TETRA SIGNAL ANALYZER
2310

Operating Manual

TETRA
SIGNAL ANALYZER

2310

100 MHz−2.4 GHz

This manual applies to instruments with software issues of 2.3 and higher.

About this manual

This manual explains how to use the 2310 TETRA Signal Analyzer.

Intended audience

Persons engaged on work requiring fast and accurate testing of TETRA (TErrestrial Trunk RAdio) modulation parameters.

It is assumed that the reader will be familiar with telecommunication terms used in modern communication systems.

Structure

Chapter 1	Main features and performance data
Chapter 2	Installation details
Chapter 3	Local operation
Chapter 4	GPIB operation with keywords and sample programs
Chapter 5	Brief technical description
Chapter 6	Instructions for acceptance testing

Document conventions

The following conventions apply throughout this manual:

RF OUTPUT	Titles marked on the instrument panel are shown in capital letters.
[TRIGGER]	Key titles are as shown on the key-caps in square brackets.
[Mobile]	Soft keys are shown in italics in square brackets.
Disable	Messages on the display are shown in italic letters.

Contents

Preface

Patent protection

The 2310 Signal Analyzer is protected by the following patents:

EP 0322139

GB 2214012

US 4870384

EP 0125790

GB 2140232

US 4609881

Precautions

WARNING	CAUTION	Note

These terms have specific meanings in this manual:

WARNING   **information to prevent personal injury.**

CAUTION   **information to prevent damage to the equipment.**

Note   **important general information.**

Hazard symbols

The meaning of hazard symbols appearing on the equipment and in the documentation is as follows:

Symbol	Description
⚠	Refer to the operating manual when this symbol is marked on the instrument. Familiarize yourself with the nature of the hazard and the actions that may have to be taken.
☠	Toxic hazard

General conditions of use

This product is designed and tested to comply with the requirements of IEC/EN61010-1 : 2001 + C1 : 2002 + C2 : 2003 'Safety requirements for electrical equipment for measurement, control and laboratory use', for Class I portable equipment and is for use in a pollution degree 2 environment. The equipment is designed to operate from an installation category II supply.

Equipment should be protected from the ingress of liquids and precipitation such as rain, snow, etc. When moving the instrument from a cold to a hot environment, it is important to allow the temperature of the instrument to stabilize before it is connected to the supply to avoid condensation forming. The equipment must only be operated within the environmental conditions specified in the Data Sheet (following Chapter 1) in the Operating/Instruction manual, otherwise the protection provided by the equipment may be impaired.

This product is not approved for use in hazardous atmospheres or medical applications. If the equipment is to be used in a safety-related application, e.g. avionics or military applications, the suitability of the product must be assessed and approved for use by a competent person.

WARNING

⚠ Electrical hazards (AC supply voltage)

This equipment conforms with IEC Safety Class I, meaning that it is provided with a protective grounding lead. To maintain this protection the supply lead must always be connected to the source of supply via a socket with a grounded contact.

Be aware that the supply filter contains capacitors that may remain charged after the equipment is disconnected from the supply. Although the stored energy is within the approved safety requirements, a slight shock may be felt if the plug pins are touched immediately after removal.

Do not remove instrument covers as this may result in personal injury. There are no user-serviceable parts inside.

Refer all servicing to qualified personnel. See list of Service Centers at rear of manual.

Fuses

Note that the internal supply fuse is in series with the live conductor of the supply lead. If connection is made to a 2-pin unpolarized supply socket, it is possible for the fuse to become transposed to the neutral conductor, in which case, parts of the equipment could remain at supply potential even after the fuse has ruptured.

WARNING

⚠ RF hazard

Do not disconnect RF cables which are carrying high levels of RF power. High voltages, which can cause RF burns, may be present at the end of the unterminated cables due to standing waves.

Switch off the transmitter or other source of RF power before disconnecting the cable from the equipment.

WARNING

⚠ Fire hazard

Make sure that only fuses of the correct rating and type are used for replacement.

If an integrally fused plug is used on the supply lead, ensure that the fuse rating is commensurate with the current requirements of this equipment. See the Data Sheet (following Chapter 1) for power requirements.

WARNING

☠ Toxic hazards

Some of the components used in this equipment may include resins and other materials which give off toxic fumes if incinerated. Take appropriate precautions, therefore, in the disposal of these items.

WARNING

☠ Beryllia

Beryllia (beryllium oxide) is used in the construction of some of the components in this equipment.

This material, when in the form of fine dust or vapor and inhaled into the lungs, can cause a respiratory disease. In its solid form, as used here, it can be handled quite safely although it is prudent to avoid handling conditions which promote dust formation by surface abrasion.

Because of this hazard, you are advised to be very careful in removing and disposing of these components. Do not put them in the general industrial or domestic waste or dispatch them by post. They should be separately and securely packed and clearly identified to show the nature of the hazard and then disposed of in a safe manner by an authorized toxic waste contractor.

WARNING

☠ Beryllium copper

Some mechanical components within this instrument are manufactured from beryllium copper. This is an alloy with a beryllium content of approximately 5%. It represents no risk in normal use.

The material should not be machined, welded or subjected to any process where heat is involved.

It must be disposed of as 'special waste'.

It must NOT be disposed of by incineration.

Précautions

WARNING	CAUTION	Note

Les termes suivants ont, dans ce manuel, des significations particulières:

WARNING   contient des informations pour éviter toute blessure au personnel.

CAUTION   contient des informations pour éviter les dommages aux équipements.

Note   contient d'importantes informations d'ordre général.

Symboles signalant un risque

La signification des symboles de danger apparaissant sur l'équipement et dans la documentation est la suivante:

Symbole   **Nature du risque**

Reportez-vous au manuel d'utilisation quand ce symbole apparaît sur l'instrument. Familiarisez-vous avec la nature du danger et la conduite à tenir.

Danger produits toxiques

Conditions générales d'utilisation

Ce produit e été conçu et testé pour être conforme aux exigences des normes CEI/EN61010-1 « exigences de sécurité des équipements électriques pour la mesure, le contrôle et l'usage en laboratoire », pour des équipements Classe I portables et pour une utilisation dans un environnement de pollution de niveau 2. Cet équipement est conçu pour fonctionner à partir d'une alimentation de catégorie II.

Cet équipement doit être protégé de l'introduction de liquides ainsi que des précipitations d'eau, de neige, etc...Lorsqu'on transporte cet instrument d'un environnement chaud vers un environnement froid, il est important de laisser l'instrument se stabiliser en température avant de le connecter à une alimentation afin d'éviter toute formation de condensation. L'appareil doit être utilisé uniquement dans le cadre des conditions d'environnement spécifiées dans la fiche technique (qui suit le chapitre 1) du manuel d'utilisation, toute autre utilisation peut endommager les systèmes de protection.

Ce produit n'est pas garanti pour fonctionner dans des atmosphères dangereuses ou pour un usage médical. Si l'équipement doit être utilisé pour des applications en relation avec la sécurité, par exemple des applications militaires ou aéronautiques, la compatibilité du produit doit être établie et approuvée par une personne compétente.

WARNING

Sécurité électrique (tension d'alimentation alternative)

Cet appareil est protégé conformément à la norme CEI de sécurité Classe I, c'est-à-dire que sa prise secteur comporte un fil de protection à la terre. Pour maintenir cette protection, le câble d'alimentation doit toujours être branché à la source d'alimentation par l'intermédiaire d'une prise comportant une borne de terre.

Notez que les filtres d'alimentation contiennent des condensateurs qui peuvent encore être chargés lorsque l'appareil est débranché. Bien que l'énergie contenue soit conforme aux exigences de sécurité, il est possible de ressentir un léger choc si l'on touche les bornes sitôt après débranchement.

Ne démontez pas le capot de l'instrument, car ceci peut provoquer des blessures. Il n'y a pas de pièces remplaçables par l'utilisateur à l'intérieur.

Faites effectuer toute réparation par du personnel qualifié. Contacter un des Centres de Maintenance Internationaux dans la liste jointe à la fin du manuel.

Fusibles

Notez que le fusible d'alimentation interne est en série avec la phase (fil brun) du cable d'alimentation. Si la prise d'alimentation comporte deux bornes non polarisées, il est possible de connecter le fusible au neutre. Dans ce cas, certaines parties de l'appareil peuvent rester à un certain potentiel même après coupure du fusible.

WARNING

⚠ Danger RF

Ne jamais debrancher un câble RF connecté à une source de puissance RF en fonctionnement. Il peut y avoir, à l'extrémité d'un câble non chargé, des tensions très importantes susceptibles de causer des brûlures graves. Toujours éteindre la source de puissance RF avant de débrancher le câble sur l'équipement.

WARNING

⚠ Risque lie au feu

Lors du remplacement des fusibles vérifiez l'exactitude de leur type et de leur valeur.

Si le câble d'alimentation comporte une prise avec fusible intégré, assurez vous que sa valeur est compatible avec les besoins en courant de l'appareil. Pour la consommation, reportez vous à la fiche technique (qui suit le chapitre 1) du manuel d'utilisation.

WARNING

☠ Danger produits toxiques

Certains composants utilisés dans cet appareil peuvent contenir des résines et d'autres matières qui dégagent des fumées toxiques lors de leur incinération. Les précautions d'usages doivent donc être prises lorsqu'on se débarrasse de ce type de composant.

WARNING

☠ Le Béryllia

Le Béryllia (oxyde de Béryllium) entre dans la composition de certains composants de cet appareil.

Cette matière peut, lorsqu'elle est inhalée sous forme de vapeur ou de fine poussière, être la cause de maladies respiratoires. Sous sa forme solide, comme c'est le cas ici, cette matière peut être manipulée sans risque, bien qu'il soit conseillé d'éviter toute manipulation pouvant entraîner la formation de poussière par abrasion de la surface.

Il est donc conseillé, pour éviter ce risque, de prendre les précautions requises pour retirer ces composants et s'en débarrasser. Ne les jetez pas avec les déchets industriels ou domestiques ou ne les envoyez pas par la poste. Il faut les emballer séparément et solidement et bien indiquer la nature du risque avant de les céder, avec précautions, à une entreprise spécialisée dans le traitement de déchets toxiques.

WARNING

☠ Bronze au béryllium

Dans cet équipement,certaines pièces mécaniques sont à base de bronze au béryllium. Il s'agit d'un alliage dans lequel le pourcentage de béryllium ne dépasse pas 5%. Il ne présente aucun danger en utilisation normale.

Toutefois, cet alliage ne doit pas être travaillé, soudé ou soumis à un processus qui implique l'utilisation d'une source de chaleur.

En cas de destruction, il sera entreposé dans un container spécial. IL ne devra pas être détruit par incinération.

Lithium

Une pile au Lithium ou un CI contenant une pile au Lithium est utilisé dans cet équipement.

Le Lithium étant une substance toxique, il ne faut en aucun cas l'écraser, l'incinérer ou le jeter avec des déchets normaux.

N'essayez pas de recharger ce type de pile. Ne court-circuitez pas ou ne forcez pas la décharge de la pile car cela pourrait causer une fuite, une surchauffe ou une explosion.

Position inclinée

Lorsque l'appareil est dans une position inclinée, il est recommandé, pour des raisons des stabilité, de ne pas y empiler d'autres appareils.

Utilisation

Cet équipement a été conçu et fabriqué par Aeroflex pour analyser le spectre de signaux RF.

La protection de l'équipement peut être altérée s'il n'est pas utilisé dans les conditions spécifiées par Aeroflex. Aeroflex n'a aucun contrôle sur l'usage de l'instrument, et ne pourra être tenu pour responsable en cas d'événement survenant suite à une utilisation différente de celle prévue.

Vorsichtsmaßnahmen

WARNING	CAUTION	Note

Diese Hinweise haben eine bestimmte Bedeutung in diesem Handbuch:

WARNING   dienen zur Vermeidung von Verletzungsrisiken.

CAUTION   dienen dem Schutz der Geräte.

Note   enthalten wichtige Informationen.

Gefahrensymbole

Die Bedeutung der Gefahrensymbole auf den Geräten und in der Dokumentation ist wie folgt:

Symbol   **Gefahrenart**

 Beziehen Sie sich auf die Bedienungsanleitung wenn das Messgerät mit diesem Symbol markiert ist. Machen Sie sich mit der Art der Gefahr und den Aktionen die getroffen werden müssen bekannt.

 Warnung vor giftigen Substanzen

Allgemeine Hinweise zur Verwendung

Dieses Produkt wurde entsprechend den Anforderungen von IEC/EN61010-1 : 2001 + C1 : 2002 + C2 : 2003 "Sicherheitsanforderungen für elektrische Ausrüstung für Meßaufgaben, Steuerung und Laborbedarf", Klasse I, transportabel zur Verwendung in einer Grad 2 verunreinigten Umgebung, entwickelt und getestet. Dieses Gerät ist für Netzversorgung Klasse II zugelassen.

Das Meßgerät sollte vor dem Eindringen von Flüssigkeiten sowie vor Regen, Schnee etc. geschützt werden. Bei Standortänderung von kalter in wärmere Umgebung sollte das Meßgerät wegen der Kondensation erst nach Anpassung an die wärmere Umgebung mit dem Netz verbunden werden. Das Gerät darf nur in Umgebungsbedingungen wie im Datenblatt (nach Kapitel 1) der Bedienungsanleitung beschrieben, betrieben werden; ansonsten wird der vom Gerät vorgesehene Schutz des Anwenders beeinträchtigt.

Dieses Produkt ist nicht für den Einsatz in gefährlicher Umgebung (z.B. Ex-Bereich) und für medizinische Anwendungen geprüft. Sollte das Gerät für den Einsatz in sicherheitsrelevanten Anwendungen wie z.B. im Flugverkehr oder bei militaerischen Anwendungen vorgesehen sein, so ist dieser von einer für diesen Bereich zuständigen Person zu beurteilen und genehmigen.

WARNING

Elektrische Schläge (Wechselspannungsversorgung)

Das Gerät entspricht IEC Sicherheitsklasse I mit einem Schutzleiter nach Erde. Das Netzkabel muß stets an eine Steckdose mit Erdkontakt angeschlossen werden.

Filterkondensatoren in der internen Spannungsversorgung können auch nach Unterbrechung der Spannungszuführung noch geladen sein. Obwohl die darin gespeicherte Energie innerhalb der Sicherheitsmargen liegt, kann ein leichter Spannungsschlag bei Berührung kurz nach der Unterbrechung erfolgen.

Öffnen Sie niemals das Gehäuse der Geräte das dies zu ernsthaften Verletzungen führen kann. Es gibt keine vom Anwender austauschbare Teile in diesem Gerät.

Lassen Sie alle Reparaturen durch qualifiziertes Personal durchführen. Eine Liste der Servicestellen finden Sie auf der Rückseite des Handbuches.

Sicherungen

Die interne Sicherung in der Spannungszuführung ist in Reihe mit der spannungsführenden Zuleitung (braun) geschaltet. Bei Verbindung mit einer zweiadrigen, nicht gepolten Steckdose kann die Sicherung in der Masseleitung liegen, so daß auch bei geschmolzener Sicherung Geräteteile immer noch auf Spannungspotential sind.

WARNING

⚠️

Hochfrequenz

Lösen Sie keine Kabel an welchen größere Pegel von Hochfrequenzleistung anliegen. An den nichtabgeschlossenen Enden von HF Kabeln können auf Grund von Stehwellen hohe Spannungen auftreten. Diese verursachen unter Umständen Verbrennungen. Schalten Sie den Sender oder die Quelle der HF-Leistung vor dem Lösen des HF-Kabels ab.

WARNING

⚠️

Feuergefahr

Es dürfen nur Ersatzsicherungen vom gleichen Typ mit den korrekten Spezifikationen entsprechend der Stromaufnahme des Gerätes verwendet werden. Siehe hierzu das Datenblatt (nach Kapitel 1).

WARNING

☠️

Warnung vor giftigen Substanzen

In einigen Bauelementen dieses Geräts können Epoxyharze oder andere Materialien enthalten sein, die im Brandfall giftige Gase erzeugen. Bei der Entsorgung müssen deshalb entsprechende Vorsichtsmaßnahmen getroffen werden.

WARNING

☠️

Beryllium Oxid

Beryllium Oxid wird in einigen Bauelementen verwendet.

Als Staub inhaliert kann Beryllium zu Schädigungen der Atemwege führen. In fester Form kann es ohne Gefahr gehandhabt werden, wobei Staubabrieb vermieden werden sollte.
Wegen dieser Gefahren dürfen diese Bauelemente nur mit der entsprechenden Vorsicht ausgebaut und entsorgt werden. Sie dürfen nicht mit Industrie oder Hausmüll vermengt oder per Post versandt werden. Sie müssen separat verpackt und entsprechend der Gefährdung markiert werden. Die Entsorgung muß über einen autorisierten Fachbetrieb erfolgen.

WARNING

☠️

Beryllium Kupfer

In diesem Gerät sind einige mechanische Komponenten aus Berylium Kupfer gefertigt. Dies ist eine Verbindung welche aus einem Berylliumanteil von ca. 5 % besteht. Bei normaler Verwendung besteht kein Gesundheitsrisiko.

Das Metall darf nicht bearbeitet, geschweißt oder sonstiger Wärmebehandlung ausgesetzt werden. Es muß als Sondermüll entsorgt werden.
Es darf nicht durch Verbrennung entsorgt werden.

WARNING

☠️

Lithium

Eine Lithium Batterie oder eine Lithium Batterie innerhalb eines IC ist in diesem Gerät eingebaut. Da Lithium ein giftiges Material ist, sollte es als Sondermüll entsorgt werden.
Diese Batterie darf auf keinen Fall geladen werden. Nicht kurzschließen, da sie dabei überhitzt werden und explodieren kann.

⚠ ## Schrägstellung

Bei Schrägstellung des Geräts sollten aus Stabilitätsgründen keine anderen Geräte darauf gestellt werden.

Eignung für Gebrauch

Dieses Gerät wurde von Aeroflex entwickelt und hergestellt um Spektrumanalyse an HF Signalen durchzuführen.

Sollte das Gerät nicht auf die von Aeroflex vorgesehene Art und Weise verwendet werden, kann die Schutzfunktion des Gerätes beeinträchtigt werden.

Aeroflex hat keinen Einfluß auf die Art der Verwendung und übernimmt keinerlei Verantwortung bei unsachgemässer Handhabung.

Precauzioni

| WARNING | CAUTION | Note |

Questi termini vengono utilizzati in questo manuale con significati specifici:

WARNING riportano informazioni atte ad evitare possibili pericoli alla persona.

CAUTION riportano informazioni per evitare possibili pericoli all'apparecchiatura.

Note riportano importanti informazioni di carattere generale.

Simboli di pericolo

Il significato del simbolo di pericolo riportato sugli strumenti e nella documentazione è il seguente:

Simbolo   **Tipo di pericolo**

Fare riferimento al manuale operativo quando questo simbolo è riportato sullo strumento. Rendervi conto della natura del pericolo e delle precauzioni che dovrete prendere.

Pericolo sostanze tossiche

Condizioni generali d'uso.

Questo prodotto è stato progettato e collaudato per rispondere ai requisiti della direttiva IEC/EN61010-1 : 2001 + C1 : 2002 + C2 : 2003 'Safety requirements for electrical equipment for measurement, control and laboratory use' per apparati di classe I portatili e per l'uso in un ambiente inquinato di grado 2. L'apparato è stato progettato per essere alimentato da un alimentatore di categoria II.

Lo strumento deve essere protetto dal possibile ingresso di liquidi quali, ad es., acqua, pioggia, neve, ecc. Qualora lo strumento venga portato da un ambiente freddo ad uno caldo, è importante lasciare che la temperatura all'interno dello strumento si stabilizzi prima di alimentarlo per evitare formazione di condense. Lo strumento deve essere utilizzato esclusivamente nelle condizioni ambientali descritte nella scheda tecnica (di seguito al capitolo 1) del manuale operativo, in caso contrario le protezioni previste nello strumento potrebbero risultare non sufficienti.

Questo prodotto non è stato approvato per essere usato in ambienti pericolosi o applicazioni medicali. Se lo strumento deve essere usato per applicazioni particolari collegate alla sicurezza (per esempio applicazioni militari o avioniche),occorre che una persona o un istituto competente ne certifichi l'uso.

WARNING

⚠ Pericoli da elettricità (alimentazione a c.c.)

Quest' apparato è provvisto del collegamento di protezione di terra e rispetta le norme di sicurezza IEC, classe I. Per mantenere questa protezione è necessario che il cavo, la spina e la presa d'alimentazione siano tutti provvisti di terra.

Il circuito d'alimentazione contiene dei filtri i cui condensatori possono restare carichi anche dopo aver rimosso l'alimentazione. Sebbene l'energia immagazzinata è entro i limiti di sicurezza, purtuttavia una leggera scossa può essere avvertita toccando i capi della spina subito dopo averla rimossa.

Non rimuovete mai le coperture perché così potreste provocare danni a voi stessi. Non vi sono all'interno parti di interesse all'utilizzatore.

Tutte gli interventi sono di competenza del personale qualificato. Vedi elenco internazionale dei Centri di Assistenza in fondo al manuale.

Fusibili

Notare che un fusibile è posto sul filo caldo (marrone) del cavo di alimentazione. Qualora l'alimentazione avvenga tramite due poli non polarizzati, è possibile che il fusibile vada a protezione del neutro per cui anche in caso di una sua rottura, l'apparato potrebbe restare sotto tensione.

WARNING

⚠ Rischio a RF

Non sconnettere cavi RF sui quali si stia trasmettendo un segnale RF ad alta potenza. Un'alta tensione, che può causare bruciature, potrebbe essere presente alla fine di cavi non terminati a causa delle onde stazionarie. Spegnere il trasmettitore od altra sorgente di segnale RF prima di disconnettere il cavo dall'apparato.

WARNING

⚠ Pericolo d'incendio

Assicurarsi che, in caso di sostituzione, vengano utilizzati solo fusibili della portata e del tipo prescritto.

Se viene usata una spina con fusibili, assicurarsi che questi siano di portata adeguata coi requisiti di alimentazione richiesti dallo strumento. Tali requisiti sono riportati nella scheda tecnica (di seguito al capitolo 1).

WARNING

☠ Pericolo sostanze tossiche

Alcuni dei componenti usati in questo strumento possono contenere resine o altri materiali che, se bruciati, possono emettere fumi tossici. Prendere quindi le opportune precauzioni nell'uso di tali parti.

WARNING

☠ Berillio

Berillio (ossido di berillio) è utilizzato nella costruzione di alcuni componenti di quest'apparato.

Questo materiale, se inalato sotto forma di polvere fine o vapore, può causare malattie respiratorie. Allo stato solido, come è usato qui, può essere maneggiato con sufficiente sicurezza anche se è prudente evitare condizioni che provochino la formazione di polveri tramite abrasioni superficiali.

A cause di questi pericoli occorre essere molto prudenti nella rimozione e nella locazione di questi componenti. Questi non devono essere gettati tra i rifiuti domestici o industriali né. vanno spediti per posta. Essi devono essere impacchettati separatamente ed in modo sicuro e devono indicare chiaramente la natura del pericolo e quindi affidate a personale autorizzato.

WARNING

☠ Rame berillio

Alcuni componenti meccanici in questo strumento sono realizzati in rame berillio. Si tratta di una lega con contenuto di berillio di circa il 5%, che non presenta alcun rischio in usi normali.

Questo materiale non deve essere lavorato, saldato o subire qualsiasi processo che coinvolge alte temperature.

Deve essere eliminato come "rifiuto speciale". Non deve essere eliminato tramite "inceneritore".

WARNING

☠ Litio

Quest 'apparato incorpora una batteria al litio o un circuito integrato contenente una batteria al litio.

Poiché il litio è una sostanza tossica, la batteria non deve essere mai né rotta, né incenerita, né gettata tra i normali rifiuti.

Questo tipo di batteria non può essere sottoposto né a ricarica né a corto-circuito o scarica forzata. Queste azioni possono provocare surriscaldamento, fuoriuscita di gas o esplosione della batteria.

WARNING

⚠ Posizionamento inclinato

Quando lo strumento è in posizione inclinata è raccomandato, per motivi di stabilità, non sovrapporre altri strumenti.

CAUTION

Caratteristiche d'uso

Questo strumento è stato progettato e prodotto da Aeroflex eseguire analisi spettrale sui segnali RF.

Se lo strumento non è utilizzato nel modo specificato da Aeroflex, le protezioni previste sullo strumento potrebbero risultare inefficaci.
Aeroflex non può avere il controllo sull'uso di questo strumento e non può essere ritenuta responsabile per eventi risultanti da un uso diverso dallo scopo prefisso.

Precauciones

WARNING	CAUTION	Note

Estos términos tienen significados específicos en este manual:

WARNING contienen información referente a prevención de daños personales.

CAUTION contienen información referente a prevención de daños en equipos.

Note contienen información general importante.

Símbolos de peligro

El significado de los símbolos de peligro en el equipo y en la documentación es el siguiente:

Símbolo   **Naturaleza del peligro**

Vea el manual de funcionamiento cuando este símbolo aparezca en el instrumento. Familiarícese con la naturaleza del riesgo y con las acciones que deban de tomarse.

Aviso de toxicidad

Condiciones generales de uso

Este producto ha sido diseñado y probado para cumplir los requerimientos de la normativa IEC/EN61010-1 : 2001 + C1 : 2002 + C2 : 2003 "Requerimientos de la normativa para equipos eléctricos de medida, control y uso en laboratorio", para equipos clase I portátiles y para uso en un ambiente con un grado de contaminación 2. El equipo ha sido diseñado para funcionar sobre una instalación de alimentación de categorías II.

Debe protegerse el equipo de la entrada de líquidos y precipitaciones como nieve, lluvia, etc. Cuando se traslada el equipo de entorno frío a un entorno caliente, es importante aguardar la estabilización el equipo para evitar la condensación. Solamente debe utilizarse el equipo bajo las condiciones ambientales especificadas en la Hoja Técnica (tras el Capítulo 1) del Manual de Instrucciones, en caso contrario la propia protección del equipo puede resultar dañada.

Este producto no ha sido aprobado para su utilización en entornos peligrosos o en aplicaciones médicas. Si se va a utilizar el equipo en una aplicación con implicaciones en cuanto a seguridad, como por ejemplo aplicaciones de aviónica o militares, es preciso que un experto competente en materia de seguridad apruebe su uso.

WARNING

Nivel peligroso de electricidad (tensión de red)

Este equipo cumple las normas IEC Seguridad Clase I, lo que significa que va provisto de un cable de protección de masa. Para mantener esta protección, el cable de alimentación de red debe de conectarse siempre a una clavija con terminal de masa.

Tenga en cuenta que el filtro de red contiene condensadores que pueden almacenar carga una vez desconectado el equipo. Aunque la energía almacenada está dentro de los requisitos de seguridad, pudiera sentirse una ligera descarga al tocar la clavija de alimentación inmediatamente después de su desconexión de red.

No retire las cubiertas del chasis del instrumento, ya que pudiera resultar dañado personalmente.

No existen partes que puedan ser reparadas en su interior.

Deje todas las tareas relativas a reparación a un servicio técnico cualificado. Vea la lista de Centros de Servicios Internacionales en la parte trasera del manual.

Fusibles

Se hace notar que el fusible de alimentación interno está enserie con el activo (marrón) del cable de alimentación a red. Si la clavija de alimentación de red cuenta con sólo dos terminales sin

polaridad, el fusible puede pasar a estar en serie con el neutro, en cuyo caso existen partes del equipo que permanecerían a tensión de red incluso después de que el fusible haya fundido.

WARNING

⚠ Riesgo de RF

No desconecte cables de RF que transporten niveles altos de potencia de RF. Es posible la presencia de altas tensiones, capaces de causar quemaduras por RF, en el extremo del cable sin terminar, debido a ondas estacionarias. Desactive el transmisor u otra fuente de potencia de RF antes de desconectar el cable de los equipos.

WARNING

⚠ Peligro de incendio

Asegúrese de utilizar sólo fusibles del tipo y valores especificados como recuesto.

Si se utiliza una clavija con fusible incorporado, asegúrese de que los valores del fusible corresponden a los requeridos por el equipo. Consulte la Hoja Técnica (tras el Capítulo 1) para comprobar los requisitos de alimentación.

WARNING

☠ Aviso de toxicidad

Alguno de los componentes utilizados en este equipo pudieran incluir resinas u otro tipo de materiales que al arder produjeran sustancias tóxicas, Por tanto, tome las debidas precauciones en la manipulación de esas piezas.

WARNING

☠ Berilio

Berilio (óxido de berilio) Este material es utilizado en la fabricación de alguno de los componentes de este equipo.

La inhalación de este material, en forma de polvo fino o vapor, entrando en los pulmones, puede ser causa de enfermedades respiratorias. En forma sólida, como se utiliza en este caso, puede manipularse con bastante seguridad, aunque se recomienda no manejarlo en aquellas condiciones que pudieran favorecer la aparición de polvo por abrasión de la superficie.

Por todo lo anterior, se recomienda tener el máximo cuidado al reemplazar o deshacerse de estos componentes, no tirándolos en basuras industriales o domésticas y no utilizar el correo para su envío. Deben, ser empaquetados de forma segura y separada, y el paquete debidamente etiquetado e identificado, señalando claramente la naturaleza del riesgo y ponerlo a disposición de un destructor autorizado de productos tóxicos.

WARNING

☠ Berilio-cobre

Algunos componentes mecánicos contenidos en este instrumento incorporan berilio-cobre en su proceso de fabricación. Se trata de una aleación con un contenido aproximado de berilio del 5%, lo que no representa ningún riesgo durante su uso normal.

El material no debe ser manipulado, soldado, ni sometido a ningún proceso que implique la aplicación de calor.

Para su eliminación debe tratarse como un "residuo especial". El material NO DEBE eliminarse mediante incineración.

GENERAL INFORMATION

Contents

2310 Data Sheet

Introduction

The 2310 is a precision RF signal analyzer which is intended for design, production and laboratory use, covering the frequency range 100 MHz to 2.4 GHz. The instrument is designed to make difficult digital radio transmitter parameter measurements with ease, speed and accuracy. It is specifically aimed at measurements defined in the TETRA standards ETS 300 394-1 and 392-2 supporting Voice and Data (V + D) transmissions, and is intended for use by those involved in the development and manufacture of TETRA mobile and base station equipment.

The 2310 includes both low-power (sensitive) and high-power DC-coupled inputs.

For TETRA radio testing with its demanding adjacent channel power requirements and TDMA characteristics, the 2310 provides a combination of low local-oscillator phase noise with high dynamic range.

All parameters can be entered from a front-panel keyboard and a rotary control can be used to adjust most settings. Microprocessor control ensures that the instrument is flexible and easy to use, and allows programming by the General Purpose Interface Bus (GPIB). The GPIB is designed to IEEE Standard 488.2. The interface allows remote control of all functions except the supply switch, and allows the instrument to be used either manually or as part of a fully-automated test system.

Specification

A full specification and performance details for this instrument are provided in the data sheet included at the end of this chapter.

TETRA analyzer

2310 architecture is based on single-stage down-conversion. The use of a local oscillator with low phase noise and a high-performance digital IF stage results in excellent phase noise and linearity. The instrument digitizes the time domain signal, then performs a Fast Fourier Transform (FFT) in order to display in the frequency domain.

Instrument configuration

A dedicated TETRA hard key configures the 2310 immediately for analysis of TETRA signals.

The 2310 can test all TETRA base stations, terminals and direct mode transmitters. The 2310 synchronizes to the training sequence that is transmitted in every TETRA burst. The training sequence gives the analyzer a time reference against which all measurements are made. Typically, the 2310 captures and analyzes one slot in each frame and captures every fifth frame. This results in a single burst being captured and displayed in 0.3 seconds. As an example, when measuring ACP due to modulation (±25 kHz), 200 bursts are measured in under 60 seconds.

TETRA measurements

When in TETRA mode, the instrument measures the following transmitter parameters, exactly according to ETSI ETS 300 394-1:

- Average transmitter output power
- Transmitter power versus time
- Adjacent channel power due to modulation
- Adjacent channel power due to switching
- Unwanted power in non-active transmit state
- Modulation accuracy
- Carrier frequency accuracy
- Linearization burst emissions
- Wideband noise emissions
- Discrete spurious noise emissions
- Intermodulation attenuation

Average transmitter power

The 2310 can measure 40 W continuously and up to 50 W with a TETRA-like burst profile. This means that all TETRA base stations and terminals can be measured directly without the need for external attenuation. The value of average transmitter power is displayed and used as the reference for other relative power measurements, such as ACP.

Transmitter power versus time

The burst profile of a TETRA burst is measured and displayed. A dynamic range of >80 dB enables the full burst profile to be seen when measured through the TETRA filter. The user can choose to view the whole burst or view the ramp-up (t1) and ramp-down (t3) periods of the burst in more detail. The burst-profile limit mask can be displayed and an automatic pass/fail indication given. A marker can be positioned on any symbol to measure the power value at each symbol point.

Adjacent channel power due to modulation

The instrument measures ACP due to modulation with >80 dB dynamic range through a TETRA filter. The results can be displayed either in tabular format or viewed as a spectrum. 'Intelligent' limits compare the measured ACP against the -60 dBc value (for channels ±1) or the -36 dBm value defined in ETS 300 394-1 as appropriate. Alternatively, user-defined limits can be set.

Adjacent channel power due to switching

The fast rise and fall times of the transmitter burst can result in spectral spreading into adjacent channels. ACP due to switching measures this spectral spreading. The measurement is made at ±25 kHz from the nominal carrier.

Unwanted power in non-active transmit state

The instrument measures the power in each of the three non-active timeslots and displays the result either in a numerical or graphical format.

Modulation/frequency accuracy

The instrument demodulates and displays the TETRA bursts. There are several display modes available (see 'Display' below). To make interpretation of the data easier on the display, data is color-coded according to function. The data within a single burst can be output via the GPIB interface.

Linearization burst emissions

The instrument captures the test-mode linearization burst and displays it, together with numerical and graphical displays of the corresponding unwanted adjacent channel power. Results are compared to the ETSI 300 394-1 limits (which are also displayed graphically), and an automatic pass/fail indication given.

Wideband noise emissions

The instrument gives numerical and graphical displays of wideband noise, at up to 20 frequencies offset more than 100 kHz from the carrier. Results are compared to the ETSI 300 394-1 limits for maximum allowable wideband noise levels (which are also displayed graphically), and an automatic pass/fail indication given. Offset frequencies can be changed, stored and removed.

Discrete spurious noise emissions

The instrument gives numerical and graphical displays of discrete spurious noise measurements, at up to 20 frequencies offset more than 100 kHz from the carrier. Results are compared to the ETSI 300 394-1 limits for maximum allowable discrete spurious noise levels (which are also displayed graphically), and an automatic pass/fail indication given. Maximum permitted wideband noise limits are taken into account when spurious noise values exceed the allowed (-36 dBm) limit, and corrected values are calculated. Offset frequencies can be changed, stored and removed.

Intermodulation attenuation

The instrument measures transmitter intermodulation attenuation – the ratio of the wanted signal to the power level of an intermodulation component – which indicates the ability of the transmitter to inhibit the generation of signals in its non-linear elements caused by the presence of the useful carrier and an interfering signal reaching the transmitter via its antenna.

Auto prescan

The instrument automatically carries out a wideband or discrete spurious noise emissions measurement over the range 110.7 MHz to 2.4 GHz and provides a graphical display of the resultant scan to aid identification of spurii and other anomalies. Limits can be shown, and markers may be used to examine the wideband noise profile.

Burst failures

The instrument displays the last 20 burst failures (if any) numerically.

Fast measurement set-up

A dedicated TETRA hard key configures the 2310 immediately for analysis of TETRA signals. The set-up process is a simple five-stage procedure:

- Define the radio type (for example, base station/terminal)
- Define the burst type (for example, normal downlink/control burst)
- Enter the transmitter frequency
- Enter nominal transmitter power
- Select the measurement

For standard measurements to ETS 300 94-1, the 2310 automatically configures itself to average the correct number of bursts and apply the TETRA filter as necessary.

The limits for each measurement as defined in the ETSI standard are stored in the 2310. Users can define their own limits for design-proving or to take into account external sources of measurement uncertainty.

FFT spectrum analyzer

The instrument can also be used to display the spectrum of any signal in the 100 MHz to 2.4 GHz band. The use of a patented A-D converter gives a dynamic range and sensitivity unmatched by any swept-tuned (superheterodyne-based) analyzer.

An optional 1 GHz active probe enables measurements to be made on a radio circuit without loading.

Main features

Operation

Selection of parameters on the screen may involve one or more of the numeric, hard or menu selection keys or the rotary control knob. Parameters may be set to specific values by numeric key entry, while values may be varied in steps using the [⇩] [⇧] keys or altered by moving the control knob.

Display

The display used is a 6.5 inch (16.5 cm) VGA TFT active-matrix color LCD having a resolution of 501 by 250 data points. An output for an external color monitor is provided on the rear panel.

The display is capable of being continuously or single-shot triggered.

Measurement display modes are as follows:

Numeric display	Displays demodulation data in the form of a table.
Spectral display	Displays the RF spectrum with a span up to 330 kHz.
Constellation diagram	Displays the modulation phase states at the symbol points.
Vector diagram	Displays the modulation phase states at the symbol points and the transitions between states.
Rotated vector	Superimposes each of the phase states onto a single point.
Demodulated data	Tabulated display of the demodulated data of a single burst.
Cartesian display	Displays vector error against time, amplitude and phase error against time, and I &Q against time

Frequency selection

Frequency selection is either made directly via the keyboard or remotely via the interfaces. Frequency resolution is 1 Hz across the band.

Level

The instrument incorporates both a low-power (sensitive) input and a high-power input. Both inputs are DC coupled.

Input circuitry is protected, by means of latching relays, against accidental application of overload power up to 0.5 W for the low-power input and 50 W for the high-power input.

Calibration

The instrument has a recommended two-year calibration interval after which it should be returned for recalibration (for Service Centers, refer to 'Addresses' section at the end of this manual).

A single key-press causes the instrument to carry out an internal self-calibration routine: this compensates for minor drifts due, for example, to temperature changes. More extensive realignment of individual circuits can be accomplished by GPIB control or from the front panel: these procedures are detailed in the maintenance manual. There are no mechanical adjustments required for realignment.

Floppy disk drive

A 3.5 inch, 1.44 MB floppy disk drive is fitted to allow software upgrades to be loaded.

Programming

A general-purpose interface bus (GPIB) interface is fitted so that all the instrument's functions are controllable via the interface bus, which is designed to IEEE Standard 488.2. The instrument can function both as talker and listener.

GPIB commands

All GPIB programming uses SCPI-like commands and is based on a MEASURE, READ, FETCH structure. This means that programs can be written quickly using high-level commands without needing to have an in-depth knowledge of the instrument. For production test programs, low-level commands are given that enable the programmer to use service requests (SRQs) to optimize programming and minimize test time.

Cost of ownership

A module exchange policy is used for the repair of major assemblies. These assemblies are fully calibrated where possible. This means that repairs can be carried out in the shortest possible time.

MIplot measurement presentation software

MIPlot measurement presentation software provides a powerful tool to enable insertion of measurement traces into standard office PC packages. The software enables the capture of trace data from the 2310 using a PC with a standard GPIB card. The traces can be inserted in word-processed documents or graphics packages using ·object linking and embedding (OLE) formatting. Once inserted in the document, the traces can be rescaled, text and markers added and colors changed.

MIPlot is an excellent tool for report generation or for presentation of results to large groups of people.

Versions and accessories

When ordering, please quote the full ordering number information.

Ordering numbers	Versions
2310	100 MHz to 2.4 GHz TETRA Signal Analyzer.
	Supplied accessories
–	AC supply lead (see 'Power cords', Chap. 2).
46882-329	Operating manual (this manual).
	Optional accessories
46882-337	Maintenance manual
46880-081	Service manual (consists of operating manual (this document) plus maintenance manual).
43139/042	RF connector cable, double-screened, 50 Ω, 1.5 m, BNC.
54311/092	Coaxial adapter N male to BNC female.
54311/095	RF connector cable, 1 m, N-type connectors.
43129/189	GPIB lead assembly, 1.5 m.
46884/293	Rack mounting kit (with slides) for rack cabinets with depths from 480 mm to 680 mm.
46884/294	Rack mounting kit (with slides) for rack cabinets with depths from 680 mm to 840 mm.
46884/931	Rack mounting kit containing front brackets only.
54112/164	Soft carrying case.
52388/900	1 GHz Active Probe.
46884/649	RS-232 cable assembly, serial port to PC control, 9-way female to 25-way D-type female, 1.5 m.
46884/650	RS-232 cable assembly, serial port to PC control, 9-way D-type female to 9-way female, 1.5 m.
46884/648	Cable assembly, serial port to printer, 9-way D-type female to 25-way male, 1.5 m.
46884/560	Cable assembly, parallel port to printer Centronics socket, 2 m.
59000/327	MIPlot measurement presentation software.

EC Declaration of Conformity

Certificate Ref. No.: DC220

The undersigned, representing:

Manufacturer:	**Aeroflex International Ltd.**
Address:	**Longacres House, Six Hills Way, Stevenage, Hertfordshire, UK SG1 2AN**

Herewith declares that the product:

Equipment Description: TETRA Signal Analyzer
Model No.   2310
Options: –

is in conformity with the following EC directive(s)
(including all applicable amendments)

Reference No.	Title:
73/23/EEC	Low Voltage Directive
89/336/EEC	EMC Directive

and that the standards and/or technical specifications referenced below have been applied:

Safety: IEC/EN61010-1 : 2001 + C1 : 2002 + C2 : 2003

EMC:
     IEC/EN 61326-1:1997 + A1 : 1998 + A2 : 2001
   RF Emission Class B, Immunity Table 1 and Performance Criterion B

Qualifying Notes:

Aeroflex Stevenage (Place)   23 December 2003 (Date)

(Signature)

Robert Trott — Director of Product Assurance

Setting new standards in TETRA transmitter analysis where speed and accuracy counts

- Accurate TETRA transmitter measurements
- Test TETRA base stations, terminals and direct mode radios
- All measurements made in accordance with ETSI, ETS300 394-1
- 80 dB instantaneous dynamic range for Adjacent Channel Power (ACP)
- Spectral displays of TETRA signals
- Modulation analysis, with vector and constellation diagrams
- Large color LCD display
- 40 W continuous power handling
- Wideband noise and discrete spurious measurements

The new world standard for mobile radio, TErrestrial Trunked RAdio (TETRA) has been defined by ETSI. TETRA is a digital trunked radio system that uses time multiplexing (TDMA) with $\pi/4$ DQPSK modulation. It is designed to offer radio users a high quality Voice and Data (V+D) network and improve upon the spectrum efficiency of older analog networks.

Having been designed specifically to make TETRA transmitter measurements with speed and accuracy, the 2310 TETRA signal analyzer is the most comprehensive TETRA transmitter tester available. TETRA networks will be used alongside existing analog networks. This places specific demands on the characteristics of the transmitter to prevent interference. A

consequence of this requirement is that transmitters need to be measured to a higher level of performance than has been necessary with analog systems.

When in the TETRA mode, the 2310 measures the following transmitter parameters, according to ETSI, ETS 300 394-1.

- Average transmitter output power
- Transmitter power vs time
- Adjacent channel power due to modulation
- Adjacent channel power due to switching
- Unwanted power in non active transmit state
- Modulation and frequency accuracy
- Wideband noise emissions
- Discrete spurious emissions

The 2310 architecture is based on a single stage down conversion. The use of a local oscillator with low phase noise and a high performance digital IF stage results in an instrument with excellent phase noise and linearity. 2310 digitizes the time domain signal and then performs a FFT in order to display in the frequency domain. This architecture gives the 2310 the capability to measure with high dynamic range and good power accuracy. The 2310 can also capture a single TETRA burst with phase and magnitude information for modulation analysis.

Average Transmitter Power

The 2310 can measure 40 W continuously and up to 50 W with a TETRA like burst profile. This means that all TETRA base stations and terminals can be measured directly without the need for external attenuation. The value of the

average transmitter power is displayed and used as the reference for other relative power measurements, such as ACP (Adjacent Channel Power).

Transmitter Power vs Time

The burst profile of a TETRA burst is measured and displayed. A dynamic range of >80 dB means that the full burst profile can be seen when measured through the TETRA filter. The user can select to view the whole burst, or to view the ramp-up (t1) and ramp-down (t3) periods of the burst in more detail. The burst profile limit mask can be displayed and automatic pass/fail indication is given.

A marker can be positioned on any symbol to measure the power value at each symbol point.
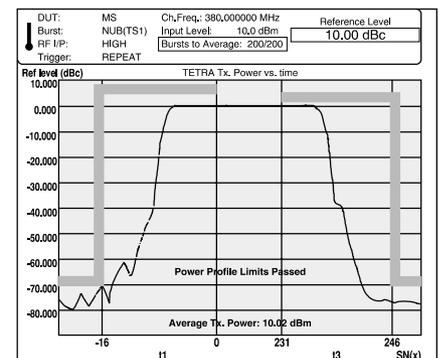
ACP due to Modulation

2310 measures ACP due to modulation with >80 dB dynamic range through the TETRA filter. The results can be displayed either in tabular format or viewed as a spectrum. Intelligent limits compare the measured ACP against the -60 dBc value (for channels ±1) or the -36 dBm value

defined in ETSI, ETS 300 394-1 as appropriate. Alternatively, it is possible to set up user defined limits.

In the tabular format the ACP in each of the ±1, ±2 and ±3 channels is displayed and a pass/fail indication given. In spectrum mode the ACP is shown with lines indicating the channel location and a numeric display of the power in each channel. ACP powers displayed are always measured through a TETRA filter. In spectrum mode the displayed trace is measured using a narrower filter. In this way, it is possible to identify if power is resulting from discrete spurious or noise.

On a production line the ACP values can be measured quickly. The spectrum display provides a powerful diagnostic tool for the investigation of ACP measurement failures.

| DUT: | MS | Ch.Freq.: 380.000000 MHz | Reference Level |
Burst:	NUB(TS1)	Input Level: 10.0 dBc	10.00 dBc
RF I/P:	HIGH	Bursts to Average: 200/200	
Trigger:	REPEAT		

Ref. Level (dBc)   TETRA Adjacent Channel Power due to Modulation

| 10.00 | -87.78 dBm | -87.93 dBm | -87.57 dBm | | -84.46 dBm | -87.94 dBm | -87.86 dBm |

| -75kHz (-3) | -50kHz (-2) | -25kHz (-1) | +25kHz (+1) | +50kHz (+2) | +75kHz (+3) |
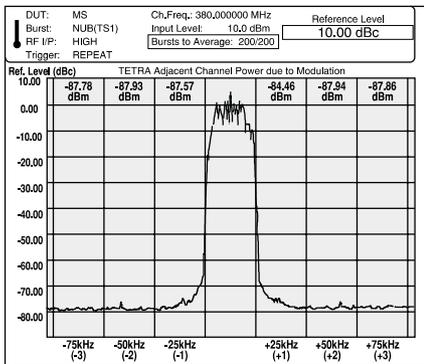
ACP due to Switching

The fast rise and fall of the transmitter burst can result in spectral spreading into adjacent channels. ACP due to switching measures this spectral spreading. The measurement is made at ±25 kHz from the nominal carrier.

Power in the Non Active Timeslots

The 2310 is capable of measuring the power in each of the three non-active timeslots.

Modulation Accuracy

DUT:	MS	Ch.Freq.: 380.000000 MHz	Bursts to Average
Burst:	NUB(TS1)	Input Level: 10.0 dBm	1
RF I/P:	HIGH	Bursts to Average: 0/1	
Trigger:	REPEAT	Burst Failures: 0	

TETRA Modulation Accuracy

| Parameter	Symbol Number	Limit	Measured Value	Pass/Fail
RMS Vector Error	-	10%	0.4%	PASS
Peak Vector Error	167	30%	1.2%	PASS
Residual Carrier Power	-	5%	0.2%	PASS
Carrier Frequency Error	-	+/-76 Hz	3 Hz	PASS
RMS Phase error	-	-	0.2 deg	-
RMS Amplitude Error	-	-	0.0%	-
Peak Phase Error	205	-	0.6 deg	-
Peak Amplitude Error	73	-	-0.7%	-

The 2310 can demodulate and display the TETRA bursts. A symbol table displays the detected bits of a TETRA burst and groups them by symbol. To make interpretation of the data easier on the 2310 display, data is color coded according to function, for example training sequence, scrambled data, guard bits.

The data within a single burst can be output via the GPIB interface.

DUT:	MS	Ch.Freq.: 380.000000 MHz	Bursts to Average
Burst:	NUB(TS1)	Input Level: 10.0 dBm	1
RF I/P:	HIGH	Bursts to Average: 0/1	
Trigger:	REPEAT	Burst Failures: 0	

TETRA Modulation Accuracy

Parameter	Symbol Number	Limit	Measured Value	Pass/Fail
RMS Vector Error	-	10%	0.4%	PASS
Peak Vector Error	167	30%	1.2%	PASS
Residual Carrier Power	-	5%	0.2%	PASS
Carrier Frequency Error	-	+/-76 Hz	3 Hz	PASS
RMS Phase error	-	-	0.2 deg	-
RMS Amplitude Error	-	-	0.0%	-
Peak Phase Error	205	-	0.6 deg	-
Peak Amplitude Error	73	-	-0.7%	-

A constellation diagram gives a display of the modulation accuracy at the symbol points. Vector error tolerance rings can be displayed at each phase state for rapid validation of modulation accuracy. Only symbols from the useful part of the burst are displayed, so for discontinuous bursts the ramp up and ramp down periods are not shown.

A vector diagram displays both the modulation phase states at the symbol points and the path trajectory between states. Again only the useful part of the burst is displayed. When setting up a digital transmitter modulator it is beneficial to be able to see the overall effect of tuning on the modulation. A special feature of 2310 called rotated vector, superimposes each of the phase states on a single point. Having selected rotated vector it is possible to view the overall effect of any changes to the modulator's characteristic.

DUT:	MS	Ch.Freq.: 380.000000 MHz	Bursts to Average
Burst:	NUB(TS1)	Input Level: 10.0 dBm	1
RF I/P:	HIGH	Bursts to Average: 1/1	
Trigger:	REPEAT	Burst Failures: 0	

TETRA Modulation Accuracy

RMS Vector Err   0.7 %
Peak Vector Err   1.4 %
Res Carr Pwr   0.9 %
Carr Freq Err   64.0 Hz

RMS Phase Err   0.2 deg
RMS Amp Err   0.0 %
Peak Phase Err   -0.6 deg
peak Amp Err   -0.7 %
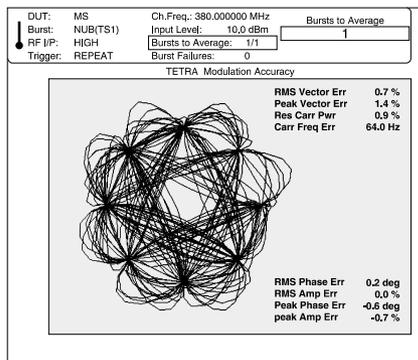
Wideband Noise

The 2310 is capable of measuring wideband noise over the frequency range 100 MHz to 2.4 GHz. Wideband noise is defined as the broadband power that is transmitted by a TETRA radio and is measured through the TETRA filter at frequency offsets greater than 100 kHz from the on-channel. The user may specify up to 20 frequency offsets. For each offset, the average power of 20 bursts is calculated and displayed.

Discrete Spurious Emissions

Discrete spurious emissions are unwanted emissions far from the carrier which occur during the transmission of a TETRA burst. The 2310 is capable of measuring the average power of a discrete signal in the frequency range 100 MHz to 1 GHz. Up to 20 measurement frequencies

may be specified by the user. For each frequency, the average power of 20 bursts is measured and displayed. When a discrete spurious signal with a level greater than the allowed limit is detected, the 2310 subtracts the maximum permitted level of wideband noise from the measured value before deciding whether the limit has been exceeded.

Auto Pre-Scan

In order to assist with the configuration of the wideband noise and discrete spurious measurements, an automatic pre-scan facility is provided. Start and stop frequencies can be specified and once the pre-scan has been performed, the user is able to view the frequency spectrum of interest. Any potential discrete spurious emission or a high level of wideband noise can be identified. By using the marker facility, the frequencies of interest can be loaded into the appropriate wideband noise or discrete spurious measurement table.

Linearization Bursts

The 2310 measures the unwanted emissions produced by a mobile or base station when an initial linearization burst is transmitted. The measurement is made in a TETRA filter at frequency offsets ±25 kHz from the on-channel. A mobile operates in the non-transmit (receive) state for four minutes prior to transmitting a linearization burst. A base station operates in test transmit mode prior to the linearization burst being transmitted.

Instrument Configuration

A dedicated TETRA hard key configures the 2310 immediately for analysis of TETRA signals.

The 2310 can test all TETRA base stations, terminals and direct mode transmitters. The 2310 synchronizes to the training sequence that is transmitted in every TETRA burst. The training sequence gives the analyzer a time reference against which all measurements are made. Typically, 2310 captures and analyzes one slot in each frame and captures every 5th frame. This results in a single burst being captured and displayed in 0.3 seconds. As an example, when measuring power burst profile, 200 bursts are measured in under 30 seconds.

Fast Measurement Set-Up

Once TETRA mode is selected, the set up process is a simple five stage procedure:

- Define the radio type (eg, Base Station/Terminal)
- Define the burst type (eg, Normal Downlink/Control Burst)
- Enter the transmitter frequency
- Enter nominal transmitter power
- Select the measurement

For measurements defined by ETSI, ETS 300 394-1 the 2310 automatically configures itself to average the correct number of bursts and apply the TETRA filter as necessary. This makes measurement set up fast and simple, ensuring that all

measurements are made correctly.

The limits for each measurement as defined by ETSI, ETS 300 394-1 are stored in the 2310. Users can define their own limits for design proving or to take into account external sources of measurement uncertainty.

GPIB code is also minimized reducing the time taken to write production test programmes.

Large Color Display

A large 6.5 in color TFT LCD displays all instrument settings and measurement results. Results are displayed either in numeric tabular format or as traces as appropriate.

A measurement information area at the top of the display clearly shows the measurement status of the instrument, including transmitter type, burst type and number of bursts to average. The main screen area shows measurement results in spectrum, power vs time or numeric data format.

Pre-Conformance Testing and Development Proving

During the design proving stages of radio development, there is a need for powerful and flexible test instruments. The 2310 measures TETRA transmitters exactly as required by ETSI, ETS 300, 394-1. However, it is designed to be flexible, giving the user the ability to define the number of bursts to average or set their own test limits.

The 2310 can be used to form the basis of a pre-conformance test system. When used with IFR's TETRA signal generator (2050T) and radio test set (2968), all the major TETRA tests can be performed. This enables extensive product evaluation to be made before submitting a radio to a full conformance test house. As a result, the radio is more likely to pass first time. Full data sheets covering the 2050T and 2968 are available from IFR.

Production Testing

In a production test environment, speed of test is paramount. The 2310 is capable of testing TETRA radios faster and more accurately than any spectrum analyzer based system. The use of a single stage downconverter followed by a digital IF stage provides the required dynamic range much faster than is possible with swept frequency systems.

It is also possible to reconfigure the measurement with a minimum of GPIB commands. Measurement results and pass /fail status can be read directly. Radios are tested more quickly and accurately with the 2310.

GPIB Control

Measurement speed in production environments is vital. Due to its dedicated hardware platform, the 2310 can be configured with the minimum of GPIB control commands. The instrument is rapidly set up to pre-determined values or sensible presets. All programming uses SCPI-like commands and is based on the MEASURE, READ, FETCH structure. This

means that programs can be written quickly using high level commands without needing to have an in-depth knowledge of the instrument. For production test programs, low level commands are given that enable the programmer to use status bits to optimize programming and minimize test time.

FFT Spectrum Analyzer

The 2310 can also be used to display the spectrum of any signal in the 100 MHz to 2.4 GHz band. The use of a patented A to D converter gives a dynamic range and sensitivity unmatched by any swept tuned (superheterodyne), based analyzer. Third order intermodulation free dynamic range is -90 dBc for two tones of -26 dBm at the input mixer. Maximum sensitivity is -150 dBm in a 1 Hz bandwidth. This delivers an instrument that is ideal for measuring unwanted intermodulation products in radio systems and measuring extremely low level spurious. Absolute amplitude accuracy is ±1 dB and so signal levels can be measured precisely. Close to carrier analysis is also possible due to the excellent phase noise and use of digital filters with good shape factor.

The in-built FFT spectrum analyzer delivers a powerful tool during the design phase of any radio system. An optional 1 GHz active probe enables the design engineer to make measurements on a radio circuit without loading.
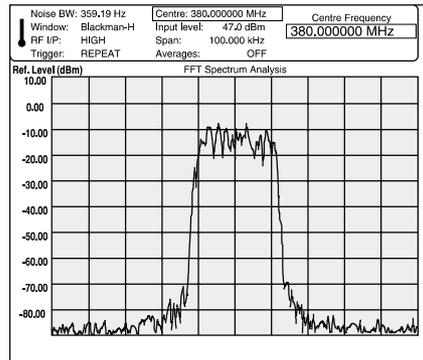
Cost Of Ownership

To minimize cost of ownership, careful consideration has been given to the design and assembly of the 2310. The recommended calibration interval is two years. A module exchange policy is used for the repair of major assemblies. These assemblies are fully calibrated. As a result, repairs can be carried out in the shortest time possible.

The use of FLASH memory and software download via the RS-232 interface or 3.5 in floppy disk drive means the 2310 can be upgraded without having to remove its covers.

Printing Made Easy

By connecting directly to the parallel printer port interface, measurement results and trace data may be sent to any parallel printer which is compatible with the HP PCL printer language PCL3 or higher (eg HP DeskJet/LaserJet)

On pressing the PRINT key, a monochrome graphical or tabular display is produced as appropriate. In addition, the hard copy produced includes current instrument configuration, time and date plus an optional user heading line which is specified under the utilities.

The output is buffered to allow the measurement process to continue whilst printing.

MIPlot Measurement Presentation Software

The MIPlot measurement presentation software provides a powerful tool to enable insertion of measurement traces into standard office PC packages. The software enables the capture of trace data from the 2310 using a PC with a standard GPIB card. The traces can be inserted into word processed documents or graphics packages using .OLE formatting. Once inserted into the document the traces can be rescaled, text and markers added and colors changed.

MIPlot is an excellent tool for report generation or for presentation of results to large groups of people.

Specification

TETRA Mode

Specifications in the TETRA mode section of this data sheet apply for frequencies from 100 MHz to 1000 MHz.
All measurements are made in accordance with the ETSI, ETS 300 394-1 specification.

Burst Types Measured - Base Station Test

NDB - Normal Down Link (cont.) using TS1 or TS2
SB - Synchronization Burst (cont.)
NDB - Normal Down Link (discont.) using TS1 or TS2
SB - Synchronization Burst (discont.)

Burst Types Measured - Mobile Test

CB - Control Uplink Burst (Half Slot discont.)
NUB - Normal Uplink Burst (discont.) TS1 or TS2

Burst Types - Direct Mode of Operation Test

DNB - Direct Mode Normal Burst (discont)
using TS1 or TS2
DSB - Direct Mode Synchronization Burst (discont)

Measurement speed

2310 captures and analyzes 1 slot in each frame, typically capturing every fifth frame.

Dynamic range

Capable of measuring a dynamic range of > 80 dB in a TETRA measurement bandwidth filter.
Input signal level for optimum dynamic range
+3 dBm to +46 dBm on the high power input.
-10 dBm to +27 dBm on the lower power input.
-20 dBm to +27 dBm on maximum sensitivity setting.

TETRA filter

2310 has an internal TETRA filter - a root Nyquist filter with a roll-off factor (α) of 0.35.

Trigger modes

Single; (user defined burst average)
Continuous; (user defined rolling average)

Average Transmitter Output Power

Average transmitter output power measured over the useful part of a burst.
2310 measures the average transmitter output power through the TETRA filter for both base station (BS) or mobile station (MS) power class transmissions.

Accuracy (for input attenuation >10 dB)

±0.5 dB (following self calibration, 100 MHz to 1 GHz, 25°C ±5°C). ±1.0 dB all other conditions.

Transmitter Power Versus Time

The 2310 measures the power profile of a TETRA burst and compares it to the power versus time mask below:
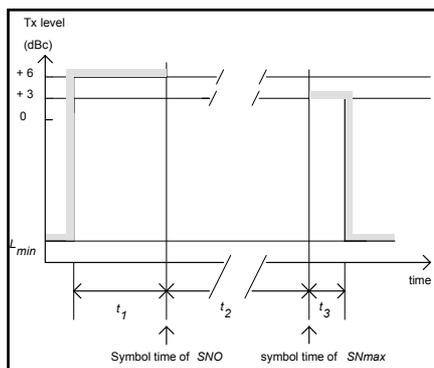
Accuracy
±0.2 dB ± residual error

Residual noise floor
<-80 dBc

Measurement Time
200 bursts measured and displayed in <30 seconds

Display Mode
Graph of power vs time for whole burst or for ramp up and ramp down periods only
Tabular result presentation

Unwanted Output Power in Non-Active Transmit State

The 2310 measures unwanted power in each of the 3 non-active timeslots following the transmitter burst through a TETRA filter.

Accuracy
±0.2 dB ± residual error

Residual noise floor
<-80 dBc

Measurement Time
200 bursts measured and displayed in
<45 seconds - 1 slot
<60 seconds - 2 slots
<70 seconds - 3 slots

Display Mode
Tabular result presentation

Adjacent Channel Power due to Modulation

The 2310 measures the average power appearing in the adjacent channels at frequency offsets of ±25 kHz, ±50 kHz and ±75 kHz from the nominal center frequency of the allocated channel.
The measurements are performed over the useful part of a burst through the TETRA filter.

Accuracy
Channel ±25 kHz   ±0.2 dB ± residual error
Channel ±50 kHz   ±0.2 dB ± residual error
Channel ±75 kHz   ±0.2 dB ± residual error

Residual noise floor
<-80 dBc

Measurement Time
For one adjacent channel; 200 bursts measured and displayed in <60 seconds
For three adjacent channels; 60 bursts measured and displayed in <115 seconds

Display Mode
Tabular result presentation
Spectrum display of adjacent channel power.

Adjacent Channel Power due to Switching Transients

The 2310 measures the adjacent channel power due to switching transients of the ramp-up (t1) and ramp-down (t3) period of a discontinuous burst. The peak power for each burst is measured. The average peak power over 200 bursts is calculated and displayed.
The measurement is performed at frequency offsets of ±25 kHz from the nominal frequency of the allocated channel through the TETRA filter.
In addition, 2310 can display the peak power of the

highest 20 bursts measured.

Accuracy
±0.2 dB ± residual error

Residual noise floor
<-70 dBc

Measurement Time
200 bursts measured and displayed in <85 seconds

Display Modes
Tabular result presentation.
Graph of power vs time for the on-channel and ± 25 kHz adjacent channels.

Modulation Accuracy

The 2310 measures the difference between the actual transmitted waveform and the ideal signal waveform.

RMS Vector Error   <0.01 (1% in any burst)
Peak Vector Error   <0.03 (3% for any symbol)
Residual Carrier Magnitude <0.01%

Measurement Time
20 bursts measured and displayed in <10 seconds

DISPLAY MODES

Constellation
Samples displayed at symbol times. Updated 3 times per second. All symbols within the t2 period are displayed.

Vector
Display of trajectory between symbol times.

Rotated Vector
Display of all symbol points super imposed onto a single symbol point.

Symbol table
The detected bits of a single TETRA burst are displayed and grouped by symbol.

Tabular result presentation
RMS Vector Error
Peak Vector Error
Residual Carrier Magnitude

Carrier Frequency Accuracy

The difference between the actual transmitted carrier frequency and its nominal value.

Accuracy
±0.01 ppm + frequency standard error

Measurement Time
20 bursts measured and displayed in <10 seconds

Display Mode
Numeric display

Wideband Noise

The 2310 measures the wideband noise level at selected frequency offsets from the on-channel. For each offset, the average power over 20 bursts is calculated and displayed. The measurement is timed to occur during the useful part of the burst (and covering at least 200 symbols in each burst) and is made through the TETRA filter. The average transmitter output power is also measured and is used as the 0 dB reference.

Accuracy
±0.2 dB ± residual noise floor error.

Offset Frequency	Residual Noise Floor (18 kHz b/w)	
	CW <=520 MHz	CW <1 GHz
100 kHz to 250 kHz	-88.0 dBc	-88.0 dBc
250 kHz to 500 kHz	-98.0 dBc	-98.0 dBc
500 kHz to frb	-100.0 dBc	-99.0 dBc
>frb	-105.0 dBc	-103.5 dBc

Where frb denotes the frequency offset corresponding to the near edge of the received band or 5 MHz whichever is greater.

Measurement Time
Average Transmitter Power (bursts to average =20) and 8 frequency offsets measured and displayed in <40 seconds.

Display modes
Tabular result presentation
Spectrum display of selected frequency offset

Adjacent Channel Power during the Initial Linearization Burst

The 2310 measures the peak power appearing in the adjacent channels during the first linearization period. The measurement is performed at frequency

offsets of ±25 kHz from the nominal center frequency of the allocated channel through the TETRA filter.

Accuracy
±0.2 dB ± residual error

Residual Noise Floor
<-70 dBc

Measurement Time
Initial linearization burst followed by 200 normal bursts (for average transmitter output power calculation) measured and displayed in <35 seconds

Display Mode
Tabular results presentation
Graphs of power vs time for on-channel and ±25 kHz adjacent channels.

FFT Spectrum Analyzer

Frequency

Frequency range
100 MHz to 2.4 GHz

Total span
10 Hz to 300 kHz in a 1, 2, 5 sequence or continuously variable.

Equivalent noise bandwidth (digital)
Window:-
5 term Blackman Harris ENBW 0.22% to 0.44% of set span
Gaussian ENBW 0.5% to 17.5% of set span.

Phase noise (at 470 MHz)
10 kHz offset   <-115 dBc/Hz
20 kHz offset   <-121 dBc/Hz
25 kHz offset   <-122 dBc/Hz
50 kHz offset   <-124 dBc/Hz

Display resolution
501 points per trace

Display update rate
5 updates/second

Amplitude

Accuracy (for input attenuation >10 dB)
±0.5 dB (following self calibration, 100 MHz to 1 GHz, 25°C ±5°C). ±1.0 dB all other conditions.

Maximum input
(See Inputs)

Dynamic range
Harmonic distortion <-70 dBc
(for a single CW signal of -20 dBm at input mixer).

Third order intermodulation free dynamic range <-85 dBc for 2 tones of -26 dBm at mixer.

Maximum sensitivity -150 dBm in 1 Hz bandwidth (low power input)

Spurious responses @ off sets <= ± 1 MHz <-80 dBc

Residual response <-110 dBm, (0 dB RF attenuation, input terminated)

Linearity ±0.01 dB per 10 dB plus Thermal Linearity Factor (TLF). Where TLF = 0.00 dB up to +30 dBm and 0.04 dB from +30 to +47 dBm per 10 dB.

Reference level setting
High power input
+50 dBm to -200 dBm in 0.001 dB steps
Low power input
+30 dBm to -200 dBm in 0.001 dB steps

Input attenuator
0 to 65 dB in 5 dB steps

Display resolution
0.01 dB to 20 dB/division in a 1, 2, 5, 10 sequence

Display units
dBm, dBµV, dBmV

Features

Display
10 x 10 graticule

Traces
Max/Min hold
Max hold
Outline
Infill

Marker Resolution
0.001 dB

2310

Averaging
User settable 1 to 200 sweeps (repeat)
User settable 1 to 20000 sweeps (single)

Markers
Frequency and level readout
2 markers
Delta marker
Peak find
Delta marker sets span
Marker sets reference level
Marker sets reference frequency
Marker to centre frequency

RF Inputs (TETRA and FFT Spectrum Analyzer Modes)

High Power Input

Maximum Input
40 W (+46 dBm) continuous
50 W (+47 dBm) 50% duty cycle
50 W continuous for 30 seconds after a minimum interval of 30 seconds with <5 W applied.

Connector
Type N (f)

Impedance
50 Ω DC coupled

Input VSWR
<1.1:1, 100 MHz to 500 MHz
<1.22:1, 500 MHz to 1 GHz
<1.43:1, >1 GHz

Low Power Input

Maximum Input
0.5 W (+27 dBm)
(overload protection to 10 W)

Connector
Type N (f)

Impedance
50 Ω DC coupled

Input VSWR (>10 dB input attenuation)
<1.22:1, <1 GHz
<1.43:1, >1 GHz

Input VSWR (no attenuation)
<1.92:1 all frequencies

Display
6.5 in VGA TFT active matrix color LCD. External VGA monitor supported via rear panel connector.

Frequency Standard

Internal OCXO
10 MHz Ageing
$\pm0.8 \times 10^{-7}$ per year after 30 days
$\pm2.5 \times 10^{-8}$ per month after 30 days
$\pm2.0 \times 10^{-8}$ per month after 60 days
$\pm1.5 \times 10^{-9}$ per day after 30 days
$\pm1.0 \times 10^{-9}$ per day after 60 days

Temperature stability
$\pm5 \times 10^{-8}$ over the temperature range 5 to 55°C

Warm up time
Output frequency within 2×10^{-7} of final frequency after switch-on at a temperature of 20°C.

Rear Panel Connectors

IF input*
10.7 MHz, BNC (f), 50 Ω
Frequency standard
Output: BNC(f), 10 MHz, 2V pk-pk into 50 Ω
Input: BNC(f), 1 MHz or 10 MHz
         Requires an input signal of 350 mV to 1.8 V RMS into 1 kΩ.

Printer interface
Parallel (Centronics compatible)
25 way D-type female

Auxiliary data I/O*
25 way D-type female

External VGA monitor
15 way compact D-type female

LO In
(SMA)

LO Out
(SMA)

RS-232
Connector is 9-way D-type (male), baud rate 300 to 9600 bits per second.

GPIB
See remote control

External Trigger*
BNC Female

Instrument Storage

Internal memory
10 non volatile instrument setting stores

3.5 in disk drive
1.44 MB floppy disk drive (MS-DOS compatible)

Remote Control

GPIB
All major functions except power supply switch control and auto pre-scan are remotely programmable.

Capabilities
Designed in accordance with IEEE488.2
Complies with the following subsets as defined in IEEE std 488.1.
SH1, AH1, T6, L4, SR1, RL1, PPO, DC1, DT1, CO, E2.

General Characteristics

Electromagnetic compatibility
Conforms with the protection requirements of EEC council directive 89/336/EEC.
Conforms with the limits specified in the following standards.
EN55011:   1991 (emissions) Class A
EN50082-1:   1992 (immunity)
EN60555-2:   1987 (mains harmonics)
CISPR 11 1990 Class A
IEC1000-4-2
IEC1000-4-3
IEC1000-4-4
IEC60555-2

Safety
Complies with IEC1010-1 EN61010-1 for class 1 portable equipment and is for use in a pollution degree 2 environment. The instrument is designed to operate from an installation category 2 supply.

Rated range of use
Full specification is met over the temperature range +5°C to +40°C (unless otherwise stated). Humidity up to 93% over specified operating range and elevation up to 3,050 m (10,000ft) (excluding 3.5 in disk drive).
3.5 in disk drive - Humidity up to 80% @ 30°C

Conditions of storage
Temperature   -40 to +70°C
Humidity   90% at +40°C
Altitude   <4,570 m

Calibration interval
Recommended 2 years.
Re-alignment can be accomplished from the front panel or by GPIB control. There are no mechanical adjustments required for re-alignment.

Power requirements
Mains frequency   47 Hz to 63 Hz
Voltage range   (100 V to 120 V and 210 V
                   240 V) ±10%
Power consumption 120 VA maximum

Dimensions
Width: 419 mm, Height: 177 mm, Depth: 488 mm.

Weight
<17 kg.

http://www.ifrinternational.com

Chapter 2
INSTALLATION

Contents

List of tables

List of figures

Initial visual inspection

After unpacking the instrument, inspect the shipping container and its cushioning material for signs of stress or damage. If damage is identified, retain the packing material for examination by the carrier in the event that a claim is made. Examine the instrument for signs of damage; do not connect the instrument to a supply when damage is present, internal electrical damage could result in shock if the instrument is turned on.

Mounting arrangements

Excessive temperatures may affect the performance of the instrument. Completely remove the plastic cover, if one is supplied over the case, and avoid standing the instrument on or close to other equipment which is hot.

CAUTION

Installation requirements

Ventilation

This instrument is forced-air-cooled by a fan mounted on the rear panel. Air must be allowed to circulate freely through the ventilator grills located on the side and underside of the instrument. Before switching on the instrument, ensure that the fan outlet on the rear panel is not restricted (i.e. clearance of at least 75 mm at the rear, 25 mm at each side, 15 mm on the underside). Failure to provide adequate clearances will increase internal temperatures and reduce the instrument reliability, so that its performance may not meet specification.

Class I power cords (3-core)

General

When the equipment has to be plugged into a Class II (ungrounded) 2-terminal socket outlet, the cable should either be fitted with a 3-pin Class I plug and used in conjunction with an adapter incorporating a ground wire, or be fitted with a Class II plug with an integral ground wire. The ground wire must be securely fastened to ground. Grounding one terminal on a 2-terminal socket will not provide adequate protection.

In the event that a molded plug has to be removed from a lead, it must be disposed of immediately. A plug with bare flexible cords is hazardous if engaged in a live socket outlet.

Power cords with the following terminations are available from Aeroflex. Please check with your local sales office for availability. This equipment is provided with a 3-wire (grounded) cordset which includes a molded IEC 320 connector for connection to the equipment. The cable must be fitted with an approved plug which, when plugged into an appropriate 3-terminal socket outlet, grounds the case of the equipment. Failure to ground the equipment may expose the operator to hazardous voltage levels. Depending upon the destination country, the color coding of the wires will differ:

Wire ended

Country	IEC 320 plug type	Aeroflex part number
Universal	Straight through	23424/158
Universal	Right angled	23424/159

	North America	Harmonized
Line (Live)	Black	Brown
Neutral	White	Blue
Ground (Earth)	Green	Green/Yellow
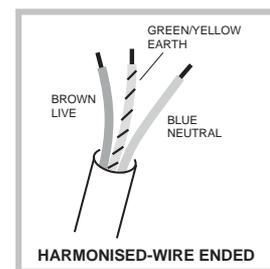
British

Country	IEC 320 plug type	Aeroflex part number
United Kingdom	Straight through	23422/001
United Kingdom	Right angled	23422/002

The UK lead is fitted with an ASTA approved molded plug to BS 1363.

A replaceable 13 A fuse to BS 1362 is contained within the plug. This fuse is only designed to protect the lead assembly. Never use the plug with the detachable fuse cover omitted or if the cover is damaged.

The fuse(s) or circuit breaker to protect the equipment is fitted at the back of the equipment.
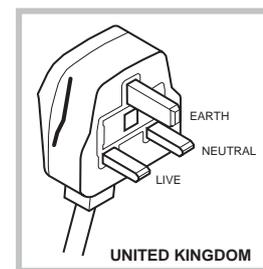
North American

Country	IEC 320 plug type	Aeroflex part number
North American	Straight through	23422/004
North American	Right angled	23422/005

The North American lead is fitted with a NEMA 5-15P (Canadian CS22.2 No 42) plug and carries approvals from UL and CSA for use in the USA and Canada.
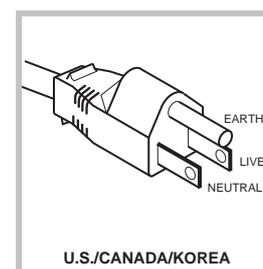
Continental Europe

Country	IEC 320 plug type	Aeroflex part number
Europe	Straight through	23422/006
Europe	Right angled	23422/007

The Continental European lead is fitted with a right angle IEC83 standard C4 plug (CEE 7/7) which allows it to be used in sockets with either a male earth pin (standard C 3b) or side earth clips (standard C 2b) the latter is commonly called the German 'Schuko' plug. In common with other Schuko style plugs, the plug is not polarized when fitted into a Schuko socket. The lead carries approvals for use in Austria, Belgium, Finland, France, Germany, Holland, Italy, Norway and Sweden. Note that this plug will not fit Italian standard CEI 23-16 outlets. The lead should not be used in Denmark given that the earth connection will not be made.
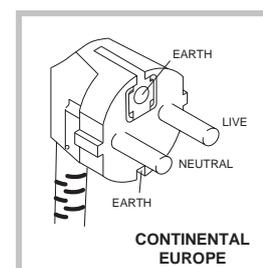
Français

Le câble d'alimentation d'Europe Continentale est muni d'un connecteur mâle à angle droit type CEI83, standard C4 (CEE 7/7), qui peut être utilisé dans une prise femelle à ergot de terre (standard C 3b) ou à clips latéraux (standard C 2b), cette dernière étant communément appelée prise "Schuko" allemande. De la même façon que les autres connecteurs de type Schuko, celui-ci n'est pas polarisé lorsqu'il s'adapte à une prise femelle Schuko. Ce câble d'alimentation est homologué en Allemagne, Autriche, Belgique, Finlande, France, Hollande, Italie, Norvège et Suède. A noter que ce connecteur n'est pas compatible avec les prises de courant italiennes au standard CEI 23-16. Ce câble ne doit pas être utilisé au Danemark à cause du défaut de connexion de masse.

Deutsch

Das kontinentaleuropäische Netzkabel ist mit einem rechtwinkeligen Stecker nach IEC83 C4 (CEE7/7) Standard versehen, welcher sowohl in Steckdosen mit Erde-Stift (Standard C 3b) oder seitlichen Erdeklemmen, im allgemeinen "Schukosteckdose" genannt, paßt. Üblicherweise ist der Schukostecker bei Verwendung in Schukosteckdosen nicht gepolt. Dieses Netzkabel besitzt Zulassung für Österreich, Belgien, Finnland, Frankreich, Deutschland, Holland, Italien, Norwegen und Schweden.

Hinweis: Dieser Schukostecker paßt nicht in die italienischen Standardsteckdosen nach CEI 23-16 Norm. Dieses Netzkabel sollte nicht in Dänemark verwendet werden, da hier keine Erdeverbindung hergestellt wird.

Español

El cable de alimentación tipo Europeo Continental dispone de una clavija C4 normalizada IEC83 (CEE 7/7) que permite su utilización tanto en bases de enchufe con toma de tierra macho (tipo C 3b) o con toma de tierra mediante contactos laterales (tipo C 2b) que, en este último caso, suele denominarse "Schuko". Al igual que cualquier otra clavija tipo Schuko, las conexiones a red no están polarizadas cuando se conectan a una base tipo Schuko. El cable lleva autorización para su uso en Austria, Bélgica, Finlandia, Francia, Alemania, Holanda, Italia, Noruega y Suecia. Observe que este cable no se adapta a la norma italiana CEI 23-16. El cable no debe utilizarse en Dinamarca en el caso de no efectuarse conexión a tierra.

Italiano

I cavi d'alimentazione per l'Europa continentale vengono forniti terminati con una spina ad angolo retto del tipo C4 secondo lo standard IEC83 (CEE 7/7) che può essere usato in prese in cui la terra può essere fornita o tramite connettore maschio (C 3b) o tramite clips laterali (C 2b), quest'ultima comunemente detta di tipo tedesca "Schuko". Questa spina, quando collegata ad una presa Schuko, non è polarizzata.

Il cavo può essere usato in Austria, Belgio, Finlandia, Francia, Germania, Olanda, Norvegia, Svezia ed Italia. E' da notare che per l'Italia questo non risponde allo standard CEI 23-16.

Questa spina non dovrebbe invece essere usata in Danimarca in quanto non realizza il collegamento di terra.

Goods-in checks

The following goods-in check verifies that the instrument is functioning correctly, but does not verify conformance to the listed specification. To verify that the instrument conforms to the specification given in Chapter 1, refer to Chapter 6, 'Acceptance testing'.

(1) Ensure that the correct fuse is fitted (accessible from the rear panel) and connect the instrument to the supply.

(2) Switch on and check that a display is present.

(3) If the instrument appears to be completely dead, carry out the following:

Check that the mains power supply line is providing power to the instrument.

Check that the mains fuses have not blown.

Connecting to supply

Ensure that the AC supply is correctly connected to the POWER SUPPLY socket. For supplies in the range 100−120 V and 210−240 V, the PSU automatically selects the appropriate range. There is no manual voltage range selection provided.

The instrument is a Safety Class 1 product and therefore must be earthed. Use the supplied power cord or an appropriate replacement. Make sure that the instrument is plugged into an outlet socket with a protective earth contact.

Disconnecting device

The detachable power cord is the instrument's disconnecting device, but if the instrument is integrated into a rack or system, an external power switch or circuit breaker may be required. Whatever the disconnecting device, make sure that you can reach it easily and that it is accessible at all times.

Fuse

For the AC voltage range of 100–240 V the fuse rating is T2AL250V. The AC fuse is a cartridge type measuring 20 mm × 5 mm.

The fuse-holder is integral with the rear panel 3-pin supply plug. For access to change the fuse, use a screwdriver to lever out the holder.

General purpose interface bus (GPIB)

The GPIB interface built into the instrument enables the signal generators to be remotely controlled to form part of an automatic measuring system.

GPIB cable connection

Connection to other equipment which has a 24-way connector to IEEE Standard 488 is made using the rear-panel GPIB socket. For this purpose, the GPIB cable assembly, available as an optional accessory, (see Chap. 1 'Accessories') may be used.

GPIB connector

The contact assignments of the GPIB cable connector are as given in the table below and shown in Fig. 2-1.

Contact	Function	Contact	Function
1	Data I/O 1	13	DataI/O 5
2	Data I/O 2	14	DataI/O 6
3	Data I/O 3	15	DataI/O 7
4	Data I/O 4	16	DataI/O 8
5	EOI	17	REN
6	DAV	18	Pair with 6
7	NRFD	19	Pair with 7
8	NDAC	20	Pair with 8
9	IFC	21	Pair with 9
10	SRQ	22	Pair with 10
11	ATN	23	Pair with 11
12	Ground shield	24	Logic ground
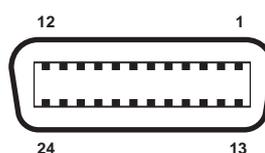
Fig. 2-1 GPIB connector contact assignments (viewed from rear panel)

IEEE to IEC conversion

An optional IEEE to IEC adapter is also available (see Chap. 1 'Optional Accessories') for interfacing with systems using a 25-way bus connector to IEC Recommendation 625. The method of use is shown in Fig. 2-2.
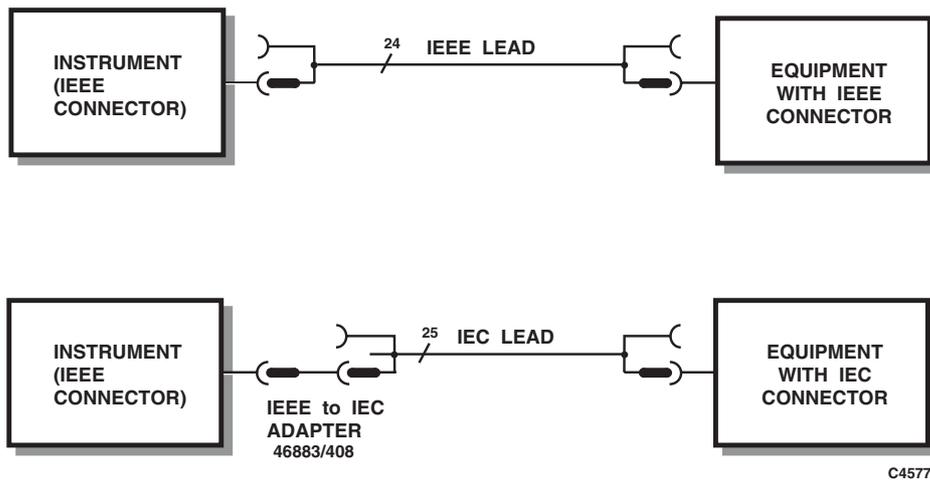
Fig. 2-2 IEEE to IEC conversion

Interface bus connection

The cables for the interface bus use special male-female connectors at both ends. This allows several connectors to be stacked one on top of another, permitting several cables to be connected to the same source and secured by a lockscrew mechanism. Too large a stack, however, may form a cantilevered structure which might cause damage and should be avoided. The piggyback arrangement permits star or linear interconnection between devices, with the restriction that the total cable length for the system must be:

(1) No greater than 20 m (65 ft).

(2) No greater than 2 m (6 ft) times the total number of devices (including the controller) connected to the bus.

RS-232 interface

The RS-232 interface built into the instrument is used to reprogram the internal flash memory.

RS-232 connector

The rear-panel male D-type RS-232 connector is shown in Fig. 2-3.
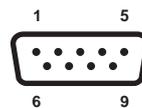
Fig. 2-3 RS-232 connector (viewed from rear panel)

The pin-outs for the 9-way RS-232 connector are shown below:

Contact		Signal
1	DCD	Data carrier detect
2	RXD	Receive data
3	TXD	Transmit data
4	DTR	Data terminal ready
5	SG	Signal ground
6	DSR	Data set ready
7	RTS	Request to send
8	CTS	Clear to send
9	RI	Ring indicator

The RS-232 interface can be connected to a personal computer's AT connector using a null-modem cable. Suitable cables are available from Aeroflex – see 'Versions and accessories' in Chap. 1. Connections to both a 9-way and a 25-way serial port on a PC are shown in Fig. 2-4 below.
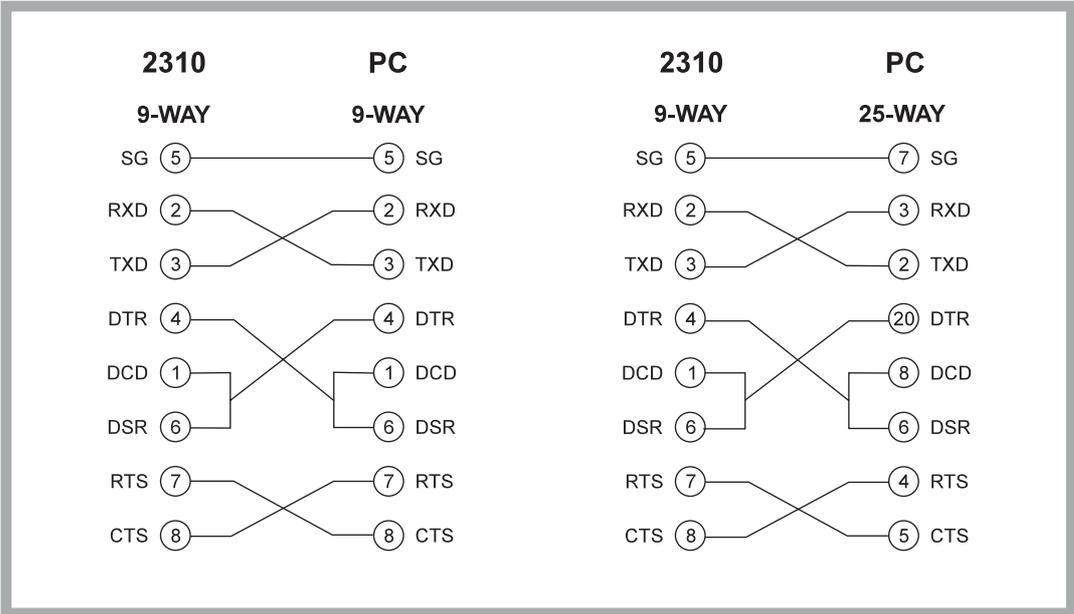
Fig. 2-4 Null modem connections

AUXILIARY I/O connector

The rear-panel 25-way female D-type AUXILIARY I/O connector is shown in Fig. 2-5. This carries modulation data inputs and power supply outputs as well as having contacts used for external control.
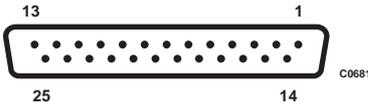
Fig. 2-5 25-way AUXILIARY I/O connector (viewed from rear panel)

Modulation data

Data for the modulator and burst control are carried on the contacts for the various formats as shown by Table 2-1.

Table 2-1 Modulation data contact assignments

DATA FORMAT	CONTACT								
	11	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Serial	Burst control	X	X	X	X	X	X	X	Data
2-bit parallel	Burst control	X	X	X	X	X	X	D0	D1
3-bit parallel	Burst control	X	X	X	X	X	D0	D1	D2
4-bit parallel	Burst control	X	X	X	X	D0	D1	D2	D3
5-bit parallel	Burst control	X	X	X	D0	D1	D2	D3	D4
6-bit parallel	Burst control	X	X	D0	D1	D2	D3	D4	D5
7-bit parallel	Burst control	X	D0	D1	D2	D3	D4	D5	D6
8-bit parallel	Burst control	D0	D1	D2	D3	D4	D5	D6	D7

where X = 'don't care' and D0 is the least significant bit

Note that in parallel data modes the data is shifted from serial to parallel internally, hence contact 21 is always the most significant data bit.

The strobes for the above data have selectable polarity and direction. For loading serial data the symbol clock is used. For loading parallel data both the symbol and bit clocks are used.

SYMBOL CLOCK I/O	contact 10
DETECTION	contact 22 – DO NOT USE
BIT CLOCK I/O	contact 23

All data and clock signals are TTL/CMOS compatible.

Auxiliary outputs

The following outputs can be used for controlling external devices:

AUX 0	contact 1
AUX 1	contact 2
AUX 2	contact 3
AUX 3	contact 4
AUX 4	contact 5
AUX 5	contact 6
AUX 6	contact 7
AUX 7	contact 8
AUX ENABLE	contact 9

Each output is CMOS compatible. The AUX ENABLE input needs to be set to a logical high to enable the outputs. Other contacts are as follows:

Contact 12	GROUND
Contact 13	not connected
Contact 24	not connected
Contact 25	not connected

PARALLEL PORT connector

The rear panel 25-way female D-type PARALLEL PORT connector is shown in Fig. 2-6 below. This is used for connection to a Centronics or parallel type printer, using HP-PCL3.
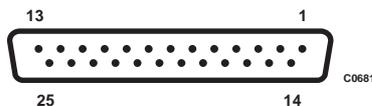
Fig. 2-6 25-way PARALLEL PORT connector (viewed from rear panel)

The functions of the socket contacts are as follows:

Contact	Function	Contact	Function
1	Strobe	10	ACK
2	Data 0	11	BUSY
3	Data 1	12	PE
4	Data 2	13	SLCT
5	Data 3	14	AUTOFD
6	Data 4	15	ERROR
7	Data 5	16	INIT
8	Data 6	17	SLCT IN
9	Data 7	18 to 25	Ground

MONITOR connector

The rear-panel 15-way female D-type MONITOR connector is shown in Fig. 2-7 below. This is used for connection to a monitor unit to duplicate the display.
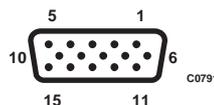
Fig. 2-7 15-way MONITOR connector (viewed from rear panel)

The functions of the socket contacts are as follows:

Contact	Function	Contact	Function
1	Video red	9	NC
2	Video green	10	NC
3	Video blue	11	No connection
4	No connection	12	No connection
5	Ground (Red)	13	HSYNC
6	Ground (Green)	14	VSYNC
7	Ground (Blue)	15	No connection

PROBE socket

Mounted on the front panel is the sub-miniature PROBE socket, which is used to provide power for an active probe such as 1 GHz Active Probe 2388 (see Chap. 1 'Versions and accessories'). The voltage outputs are shown in Fig. 2-8 below.
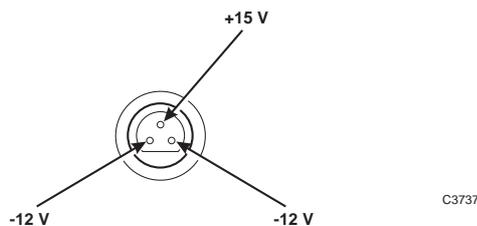
Fig. 2-8 PROBE socket showing voltage outputs (viewed from front panel)

Rack mounting

The instrument, which is normally supplied for bench mounting, may be mounted in a standard 19 inch rack (see Chap. 1 'Versions and accessories').

Battery replacement

The instrument contains a real-time clock which is powered by a lithium battery when the normal power is removed. Although battery life can extend to five years, this will depend on conditions of use; for example, battery life is reduced as the temperature is increased. To avoid loss of data it is recommended that the battery is replaced every two years.

Replace the battery as follows:

(1) Ensure that the instrument is switched on; this will provide power for the non-volatile memory while the battery is replaced. If this is not possible, the clock will continue to run for approximately 30 seconds whilst the replacement is made.

(2) Using a coin or suitable tool, unscrew the battery compartment cover at the rear of the instrument.

(3) Remove the battery, noting its orientation. Insert the replacement, then replace the battery compartment cover.

The replacement battery should be SAFT L56 or equivalent. This is a lithium 3.5 V type, rated at 1800 mAh, size AA. If a lithium battery is unobtainable an alkaline battery can be used but it will have a shorter life. A suitable battery can be obtained from Aeroflex (part number 23711/106).

Floppy disk drive

The instrument comes with a built-in 3.5 inch floppy disk drive. The drive can read from, write to, and format 3.5 inch high-density disks. Each disk can store up to 1.44 MB of data.

To insert the disk simply press it into the slot until it is retained. The disk will only go easily in one way; if force has to be used the disk is being inserted incorrectly.

To eject the disk press the button on the drive.

When the instrument is reading from or writing to a floppy disk, a light on the disk drive comes on. Do not remove a disk when the light is on as this can damage the disk and the drive.

Note that the process of formatting a disk erases all data stored on the disk.

Disk installation/loading instructions

New versions of 2310 software are supplied to you on floppy disk. Please read the instructions given on the label of the appropriate disk before inserting it into the disk drive, and then follow the instructions on the screen. You will be prompted to enter a flash download password: if you do not have this, contact an Aeroflex Ltd. Service Center (addresses are at the rear of the manual). Please be ready to quote your instrument's serial number (on the rear panel) and in particular, the Instrument ID (identification number) from the Instrument Status display in the Utilities option, as this references the instrument's unique flash download password.

Do not switch off the instrument during the loading procedure, as this may disable the boot-up software. If this should happen, you will need to return the instrument to an Aeroflex Ltd. Service Center for re-installation.

CAUTION

Routine safety testing and inspection

In the UK the 'Electricity at Work Regulations' (1989) section 4(2) places a requirement on the users of equipment to maintain it in a safe condition. The explanatory notes call for regular inspections and tests together with a need to keep records.

The following electrical tests and inspection information is provided for guidance purposes and involves the use of voltages and currents that can cause injury. It is important that these tests are only performed by competent personnel.

Prior to carrying out any inspection and tests the equipment must be disconnected from the mains supply and all external signal connections removed. All tests should include the equipment's own supply lead, all covers must be fitted and the supply switch must be in the 'ON' position.

The recommended inspection and tests fall into three categories and should be carried out in the following sequence:

1. Visual inspection
2. Earth bonding test
3. Insulation resistance test.

1. Visual inspection

A visual inspection should be carried out on a periodic basis. This interval is dependent on the operating environment, maintenance and use, and should be assessed in accordance with guidelines issued by the Health and Safety Executive (HSE). As a guide, this equipment, when used indoors in a relatively clean environment, would be classified as 'low risk' equipment and hence should be subject to safety inspections on an annual basis. If the use of the equipment is contrary to the conditions specified, you should review the safety re-test interval.

As a guide, the visual inspection should include the following where appropriate:

Check that the equipment has been installed in accordance with the instructions provided (for example, that ventilation is adequate, supply isolators are accessible, supply wiring is adequate and properly routed).

- The condition of the mains supply lead and supply connector(s).
- The correct rating and type of supply fuses.
- Security and condition of covers and handles.
- Check the presence and condition of all warning labels and markings and supplied safety information.
- Check the wiring in re-wireable plugs and appliance connectors.
- Check the cleanliness and condition of any ventilation fan filters.
- Check that the mains supply switch isolates the equipment from the supply.
- Check the supply indicator functions (if fitted).

If any defect is noted this should be rectified before proceeding with the following electrical tests.

2. Earth bonding tests

Earth bonding tests should be carried out using a 25 A (12 V maximum open circuit voltage) DC source. Tests should be limited to a maximum duration of 5 seconds and have a pass limit of 0.1 Ω after allowing for the resistance of the supply lead. Exceeding the test duration can cause damage to the equipment. The tests should be carried out between the supply earth and exposed case metalwork, no attempt should be made to perform the tests on functional earths (for example, signal carrying connector shells or screen connections) as this will result in damage to the equipment.

3. Insulation tests

A 500 V DC test should be applied between the protective earth connection and combined live and neutral supply connections with the equipment supply switch in the 'on' position. It is advisable to make the live/neutral link on the appliance tester or its connector to avoid the possibility of returning the equipment to the user with the live and neutral poles linked with an ad-hoc strap. The test voltage should be applied for 5 seconds before taking the measurement.

Aeroflex. employs reinforced insulation in the construction of its products and hence a minimum pass limit of 7 MΩ should be achieved during this test.

Where a DC power adapter is provided with the equipment, the adapter must pass the 7 MΩ test limit.

We do not recommend dielectric flash testing during routine safety tests. Most portable appliance testers use AC for the dielectric strength test which can cause damage to the supply input filter capacitors.

4. Rectification

It is recommended that the results of the above tests are recorded and checked during each repeat test. Significant differences between the previous readings and measured values should be investigated.

If any failure is detected during the above visual inspection or tests, the equipment should be disabled and the fault should be rectified by an experienced Service Engineer who is familiar with the hazards involved in carrying out such repairs.

Safety critical components should only be replaced with equivalent parts, using techniques and procedures recommended by Aeroflex.

The above information is provided for guidance only. Aeroflex. designs and constructs its products in accordance with International Safety Standards such that in normal use they represent no hazard to the operator. Aeroflex. reserves the right to amend the above information in the course of its continuing commitment to product safety.

Cleaning

Before commencing any cleaning, switch off the instrument and disconnect it from the supply. The exterior surface of the case may be cleaned using a soft cloth moistened in water. Do not use aerosol or liquid solvent cleaners.

Cleaning the LCD window

To prevent damage to the LCD window, care should be taken not to scratch the surface during use and also when cleaning. The LCD window should be cleaned by wiping a slightly damp, soft, lint-free cloth gently over the surface.

Putting into storage

If the instrument is to be put into storage, ensure that the following conditions are maintained:

Temperature range: −40 to 70°C

Humidity: Less than 90% at 40°C

Chapter 3
LOCAL OPERATION

Contents

List of tables

List of figures

contd./...

List of figures *(continued)*

Introduction

This chapter explains how to:

- Set up the signal analyzer to measure typical TETRA parameters.

- Set up the signal analyzer to perform FFT spectrum analysis.

- Use the full range of supporting utilities.

Conventions

The following conventions are used in this chapter:

PROBE	Titles marked on the instrument panel are shown in capital letters.
[TETRA]	Hard key titles are shown in square brackets.
[Input Level]	Soft key titles are shown in italics in square brackets; for example, *[Input Level]* means the soft key adjacent to the *Input Level* title box at the side of the menu.
Ref. Level	Messages appearing on the screen are shown in italics.

Front panel controls and connectors

Parameters are selected by means of hard keys, which have their function printed on them; soft keys, which do not have any notation; a numerical key pad and a rotary control, see Figs 3-1 and 3-2 below. The hard keys have functions which do not change, whereas the soft key functions are determined by the menu which is being displayed. The numerical keys are used to set parameters to specific values which can also be varied in steps by using the [⇩][⇧] keys and the rotary control.
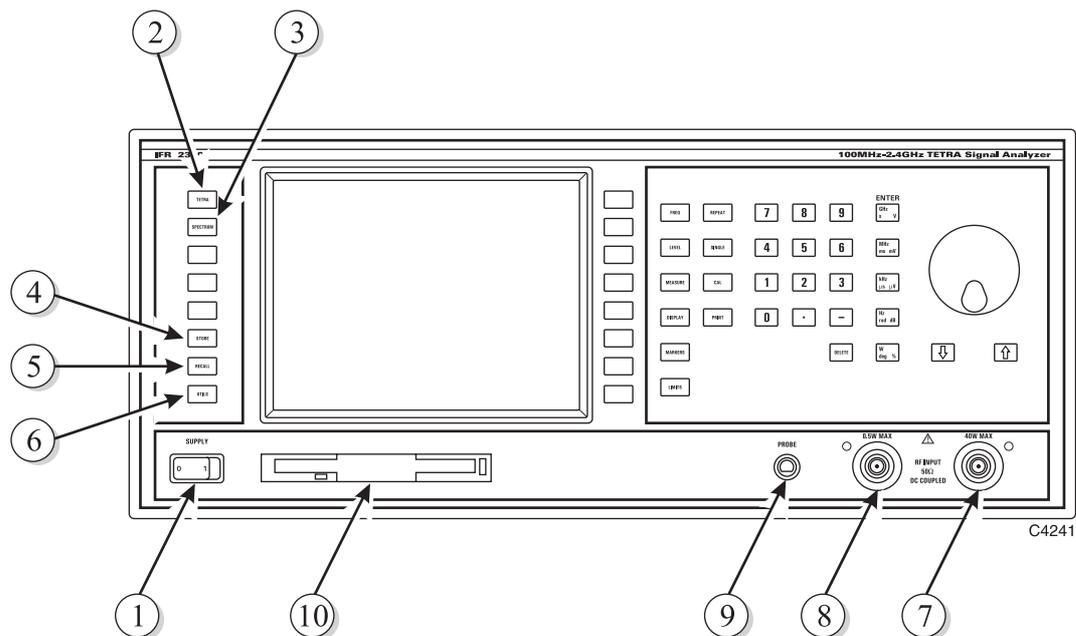
Fig. 3-1 2310 front panel – primary keys and connectors

1	SUPPLY	Switches the AC supply voltage on and off.
2	[TETRA]	Changes the operating mode to that of a TETRA signal analyzer.
3	[SPECTRUM]	Changes the operating mode to that of a narrow-band spectrum analyzer.
4	[STORE]	Enables settings and traces to be stored in NOVRAM, EEROM or floppy disk.
5	[RECALL]	Enables settings and traces to be recalled from NOVRAM, EEROM or floppy disk.
6	[UTILS]	Provides access to the utilities menus.
7	RF INPUT 40 W MAX	50 Ω type-N connector.
8	RF INPUT 0.5 W MAX	50 Ω type-N connector. Protected against the application of overload power of up to 10 W.
9	PROBE	Sub-miniature 3-pin socket providing power for 1 GHz Active Probe 2388. For contact allocation see 'PROBE socket' in Chapter 2.
10	Disk drive	Enables new software to be loaded.
11	Soft keys	Keys which change notation as the menus change.
12	[MEASURE]	Causes the measurement soft keys to be displayed.
13	[FREQ]	Causes the frequency-related soft keys to be displayed.
14	[LEVEL]	Causes the level-related soft keys to be displayed.
15	[REPEAT]	Initiates a repetitive measurement.
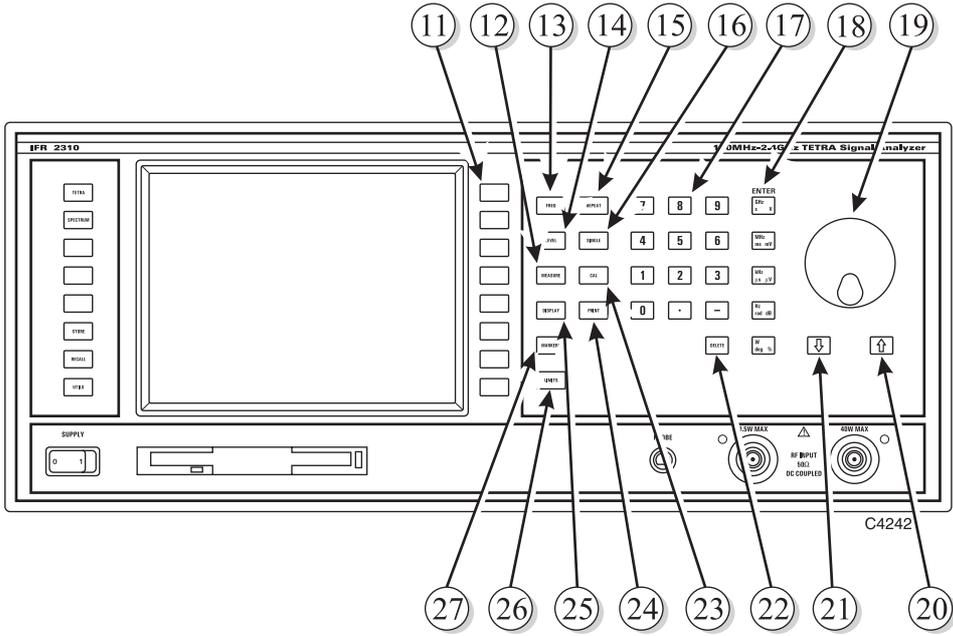
Fig. 3-2 2310 front panel – keyboard and rotary control

(16)	[SINGLE]	Initiates a single measurement.
(17)	Numerical key pad	For entering the value of a selected parameter. Minus sign and decimal point are included.
(18)	ENTER/Units keys	Determine the units of the set parameters: also used to terminate numerical and textual entries.
(19)	Rotary control	Enables the value of the selected parameter to be continuously adjusted.
(20)	[⇧]	Used to increment the value of the selected parameter by a single step. In TETRA mode with frequency selected, selects the next channel.
(21)	[⇩]	Used to decrement the value of the selected parameter by a single step. In TETRA mode with frequency selected, selects the previous channel.
(22)	[DELETE]	Used to select one of the following functions: Correct the numeric entry before the terminator is pressed Cancel hard-copy operation Remove error messages Clear a pop-up message from the display Turn display on and off.
(23)	[CAL]	Initiates an internal self-calibration routine. This optimizes measurement accuracy and cancels any temperature drift.
(24)	[PRINT]	Provides a hard copy of the data on the current measurement screen.
(25)	[DISPLAY]	Used to select the way in which measurement data is presented.
(26)	[LIMITS]	Used to specify the TETRA measure limits.
(27)	[MARKERS]	Causes the 'Markers' soft keys to be displayed.

Rear-panel connectors

The rear-panel connectors are shown in Fig. 3-3 below.
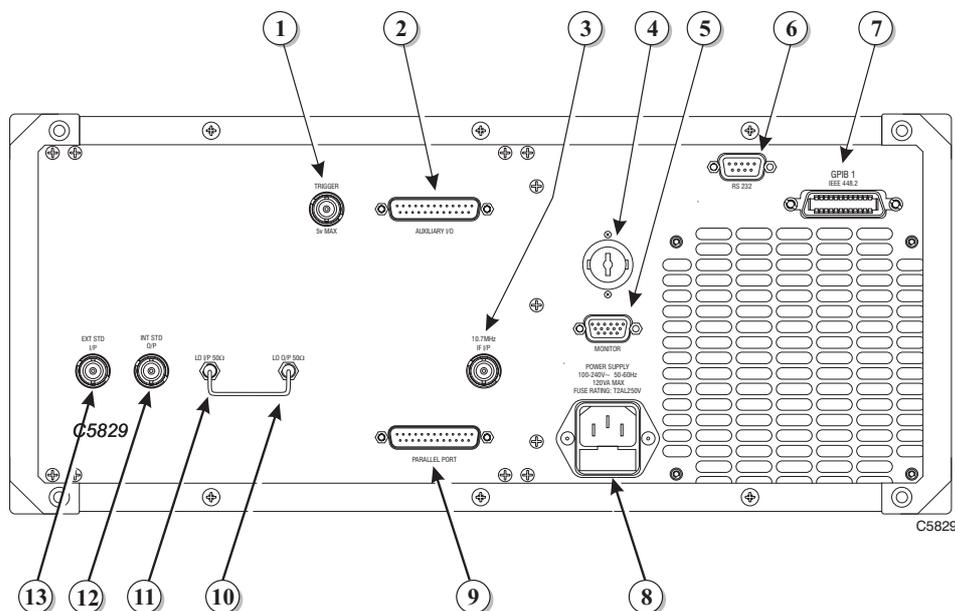
Fig. 3-3 2310 rear panel

①	TRIGGER	BNC connector used for an event trigger.
②	AUXILIARY I/O	25-way D-type connector. For contact allocation see 'Auxiliary I/O connector' in Chapter 2.
③	10.7 MHz IF I/P	The signal from an instrument under test is available at this socket at 10.7 MHz.
④	Battery holder	Houses battery for real-time clock and NOVRAM.
⑤	MONITOR	15-way D-type connector. Used for connection to a monitor unit to duplicate the display. For contact allocation see 'MONITOR connector' in Chapter 2.
⑥	RS 232	9-way RS-232 connector primarily used during software download, to reprogram the internal flash memory. For contact allocation see 'RS-232 connector' in Chapter 2.
⑦	GPIB 1	24-pin socket accepts a standard IEEE connector to allow remote control of the instrument. For contact allocation see 'GPIB connector' in Chapter 2.
⑧	POWER SUPPLY	3-pin plug integral with fuse holder. Mates with AC supply lead socket.
⑨	PARALLEL PORT	25-way D-type connector. Used for connection to a Centronics- or parallel-type printer. For contact allocation see 'PARALLEL PORT connector' in Chapter 2.
⑩	LO O/P	50 Ω SMA connector.
⑪	LO I/P	50 Ω SMA connector.
⑫	INT STD O/P	BNC connector for the output of the internal 10 MHz standard.
⑬	EXT STD I/P	BNC connector for the input of an external standard frequency of either 1 MHz or 10 MHz.

Front panel keys and soft key menus

In this manual all front-panel hard keys are shown in square brackets; for example, [TETRA]. Soft keys are shown in italics and square brackets; for example, *[Switching]*. Front-panel keys are used either to change instrument functions directly or to provide access to additional functions which are selected by soft keys.

The function currently selected becomes the active function which, in some cases, can be modified by numeric entry. A function remains active until another function key is pressed; this enables you to enter, for example, a succession of frequencies.

The positions and functions of the keys are summarized in Fig. 3-4 below.
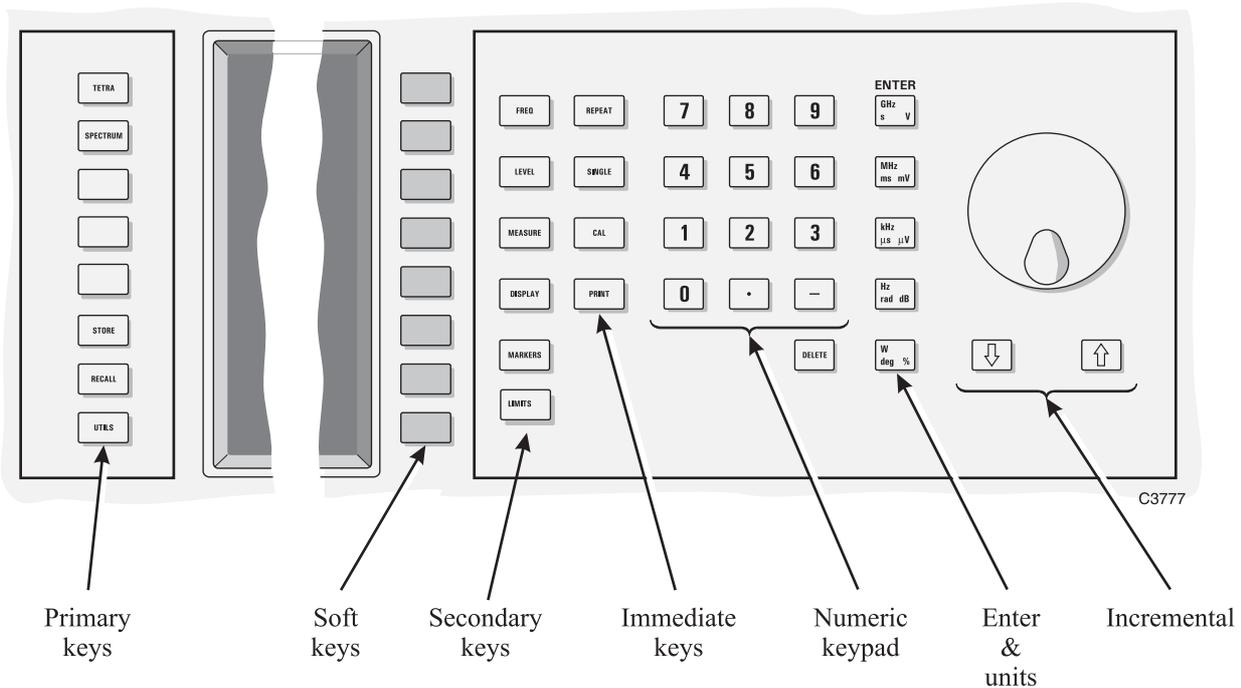
Fig. 3-4 2310 key functions

Hard keys

Primary keys – These keys change the whole screen, that is they bring up a new display as well as new soft keys.

Secondary keys – These keys change the soft key functions associated with the current screen.

Immediate keys – These keys cause an immediate action.

Soft keys

Soft-key functions are denoted by labels displayed on the screen adjacent to the keys. There are eight soft keys which are located at the right of the screen. The type of action performed by the key is indicated by the shape of the box enclosing the label as shown below:

Top of
Band Freq.

A standard rectangle indicates that selecting this soft key will immediately cause the instrument to perform the designated function, without any further interaction from the user.

Channel
Frequency

A rectangle with rounded corners indicates that after selecting this soft key the function stays selected and takes data input.

Limits
ON

A soft key showing a status LED indicates that selecting this soft key will toggle the function on or off. The LED 'lights' to show that the function is on.

Numeric
Only

Whole burst
(t1,t2,t3)

Soft keys joined by a vertical line show that they provide a 1-of-N selection.

Define
Band

A soft key having a right-edge arrow-head indicates that selecting this key will call up a new set of soft keys.

Return

A soft key having a left-edge arrow-head indicates that selecting this key will return you to your previously selected screen.

Specify
limits

A soft key which is grayed-out indicates that the function is unavailable for the selected mode.

Pressing these keys extends the menu to enable you to make additional selections.

C4465

Display

Before entering any parameters, it is useful to look at the layout of the analyzer display. It is divided into a number of fields as shown in Fig. 3-5 below.

Instrument status area

This area displays the image of a thermometer to indicate the thermal condition of the high-power input socket.

Measurement parameter status 1 area

This area shows the selection parameters. The type of device under test (DUT) is displayed together with the burst type, selected input socket and type of trigger. When in spectrum-analyzer operating mode it also displays parameters which cannot be specified by the user; for example, resolution bandwidth when a Blackman-Harris window has been selected.

Measurement parameter status 2 area

This area provides details of the current instrument configuration and is used to display data which has previously been accepted from the input entry field. It displays channel frequency, input level, number of bursts to be averaged and the selected dB per division.

Input-entry area

This area contains the input-entry field for the currently selected function.

Measurement mode and error message area

This area is used as the title area for the measurement selected. It is also used to display error messages. When an error occurs the title text is overwritten by the error message. The error message remains until the user acknowledges the error and clears it by using the [DELETE] key.

Measurement display area

Used to display the selected measurement in the numerical or graphical format specified by the user. A numeric display is automatically selected when a new measurement mode is selected and the current display format is inappropriate.

Y-axis label area

This area is used for labeling the y-axis graticule lines.

X-axis label & marker status area

This area is normally used for labeling the x-axis graticule lines. When the [MARKERS] key is pressed, the x-axis field is replaced by the marker status field.

Soft-key label area

This area can hold up to eight soft-key labels.
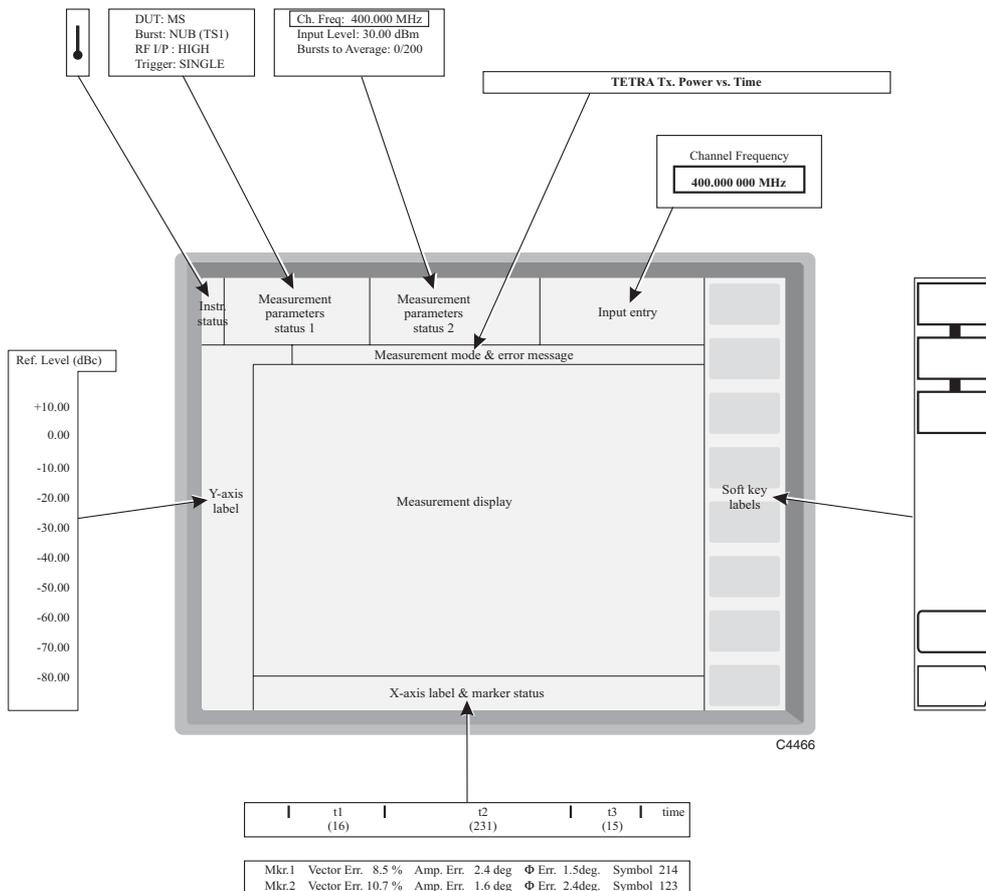
Fig. 3-5 TETRA Signal Analyzer 2310: Division of display into functional areas

Default settings

The factory default settings for TETRA operation are as follows:

Device Under Test (DUT)	MS Tx (mobile)
Burst type for analysis	NUB (TS1)
RF input selected	High power
Channel frequency	380 MHz
RF input level	+47 dBm
Number of bursts for analysis	200
TETRA measurement	RF power profile
Display type	Whole burst display (t1, t2, t3)
TETRA limits	Normal test condition limits

The factory default settings for spectrum analyzer operation are as follows:

Noise bandwidth	339.67 Hz
Window function	Blackman Harris
RF input selected	High-power
Averaging	Off
Center frequency	380 MHz
RF input level	+47 dBm
Frequency span	100 kHz
dB/div	10 dB
Current function	Center frequency

Initialization self-test

Press the supply switch to power up the 2310. The display will go through a start-up sequence in which the screen displays *INITIALISATION SELF-TEST* as shown in Fig. 3-6 below whilst a moving-bar display shows the progress of tests 1 to 31 (taking nine seconds). The screen blanks for four seconds, after which the title screen appears. This remains for approximately 20 seconds during which time the instrument initializes, and then the application screen appears.

INITIALISATION SELF-TEST

TEST 16
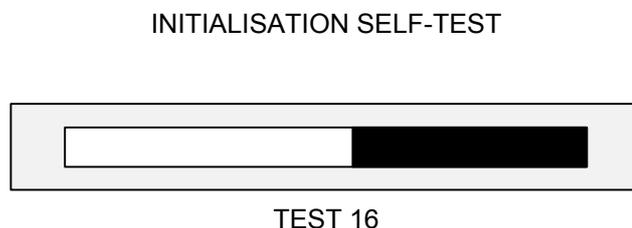
Fig. 3-6 Example of self-test in progress

Successful completion of the test gives confidence that the following CPU board peripherals are functioning:

- CPU system registers
- Xilinx FPGA boot-up
- Video BIOS
- GPIB controller communication
- Parallel port communication
- Floppy disk controller
- Real time clock
- Slow serial ports
- DRAM (SIMM)
- NOVRAM
- EEPROM
- FLASH (SIMM)

Should any faults be found, the instrument will pause to report them at the end of the self-test procedure. For fault rectification refer to the Maintenance Manual (to order see 'Versions and accessories' in Chapter 1). To continue normal operation, press the [MEASURE] key as instructed on the display.

Self-calibration

This routine optimizes measurement accuracy by making corrections for changes in operating temperature and environmental conditions. As it exercises most parts of the instrument, namely the internal power reference, input attenuator, input mixer, IF strip and measurement circuits, successful completion will give a high degree of confidence that the instrument will meet its specified RF performance.

When you press the [CAL] key an automatic calibration routine is initiated in which a 400 MHz, −10 dBm (within ±0.175 dBm) signal is switched into the signal path, where it is measured and path correction data is applied.

The adjustments performed are as follows:

- Digital IF resonator alignment
- Input attenuator
- IF amplifiers
- Digital IF gain
- IF flatness.

Whilst calibration is in progress the screen shown in Fig. 3-7 is displayed. Calibration takes approximately 35 seconds and disables the instrument during this time. This is an essential operation for you to perform whenever you require to make optimally accurate measurements.

On completion, check that no error messages are displayed.

SELF-CALIBRATION IN PROGRESS.

This calibration will take approximately 35 seconds. Please wait....

C4256
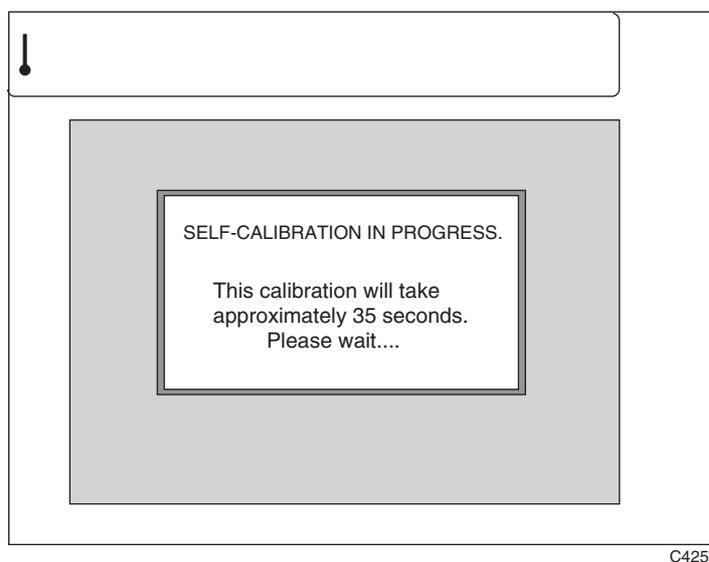
Fig. 3-7 Self-calibration screen

Printing

Pressing [PRINT] at any time outputs the results of measurements (but not of support functions such as Utilities or Limits set-up) to an external printer. The printer, which connects to the parallel port connector on the rear panel, must support HP-PCL3 or higher.

Printer output is an A4 print of all available information for the current measurement. It is not a screen dump, but an enlarged, higher-resolution version of the displayed image, together with displayed textual information plus additional relevant information that does not appear on the display. Black and white printing only is enabled. If Limits are turned on, limit lines are printed and annotated.

The *Print* Settings menu allows you to add text to the heading of all printouts. The text is preceded by the words 'Analysis by:'.

Input overload protection

WARNING

⚠ **RF hazard**

The maximum input signal level which can be applied continuously without fear of damage is 40 W to the high-power input and 0.5 W to the low-power input. However, the instrument is protected against accidental application of overload power to both these inputs by detecting the overload and disconnecting the signal input (**take care to avoid burns – see Warning in Preface**). The input switch disconnects the input path by selecting the calibration configuration after which the screen shown in Fig. 3-8 below is displayed. As instructed by the screen, remove the signal causing the overload and press *[Reset Overload]* to resume normal operation. If this key is pressed with the signal still applied, the protection circuit will operate again.
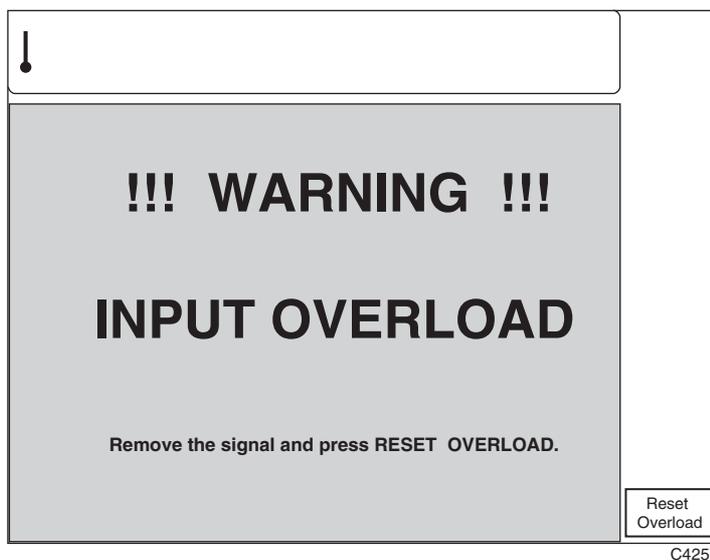
Fig. 3-8 Input overload warning screen

TETRA analyzer operation

Operation

Select the TETRA analyzer mode of operation by pressing the [TETRA] primary key. This causes a TETRA screen similar to that in Fig. 3-9 below to be displayed.

Pseudo-random burst sequence

The PRBS burst type selection, which is available for all DUT (Device Under Test) options, enables you to input signals which have no recognizable training sequence and have a pseudo-random distribution. This mode supports the T2 test signal which is used as a TETRA interferer. The T2 signal consists of a $\pi/4$ DQPSK-modulated continuous radio signal following the structure of TETRA signals, but with all modulating bits derived directly from a pseudo-random bit sequence which has a length of 511 bits (2^9-1). There is no framing format.

Burst capture

During the burst capture process, the average transmitter power label and value is replaced with a status line indicating the number of bursts captured. This provides you with an indication that the measurement is progressing correctly. If the instrument fails to detect the appropriate training sequence for the burst type selected in a two-slot period, a *NO SYNCHRONISATION FOUND* message is displayed.

DUT selection

You can specify the DUT between mobiles (MS Tx), base stations (BS Tx) and mobiles direct mode operation (DMO). The burst type soft keys displayed are dependent upon the DUT selection.

Default settings

When you change the selected DUT, a valid burst type is automatically chosen by the instrument. The factory defaults are:

MS Tx   Normal uplink burst with a TS1 training sequence.

BS Tx   Normal discontinuous downlink burst with a TS1training sequence.

DMO   Direct mode normal burst with training a TS1sequence.

Mobile station

To select the DUT as a mobile, press the *[MS Tx]* key. This causes the mobile station soft keys to be displayed at the right side of the screen as shown in Fig. 3-9 below.
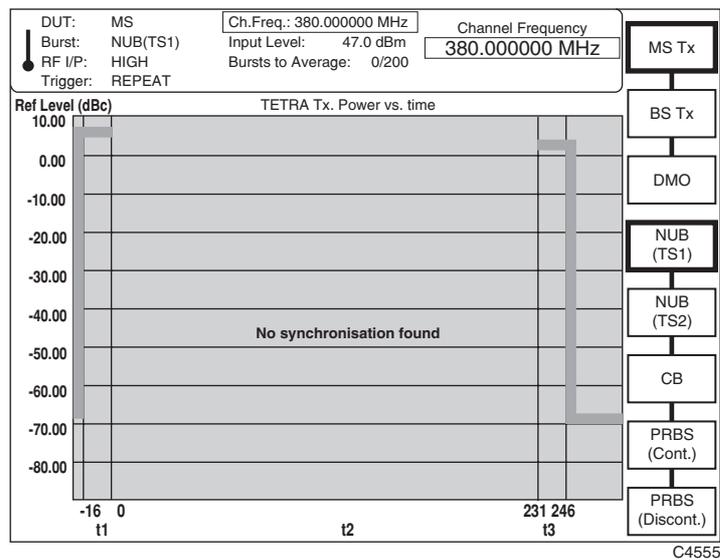
Fig. 3-9 TETRA analyzer: Selection keys displayed, MS Tx selected

(1) Select the type of burst using one of the following keys:

[NUB (TS1)] − Normal uplink burst with normal training sequence TS1.

[NUB (TS2)] − Normal uplink burst with normal training sequence TS2.

[CB] − Control uplink burst.

[PRBS (Cont.)] − Pseudo-random burst sequence (continuous data).

[PRBS (Discont.)] − Pseudo-random burst sequence (discontinuous data).

Base station

To select the DUT as a base station, press the *[BS Tx]* key. This causes the base station soft keys to be displayed at the right side of the screen as shown in Fig. 3-10 below.
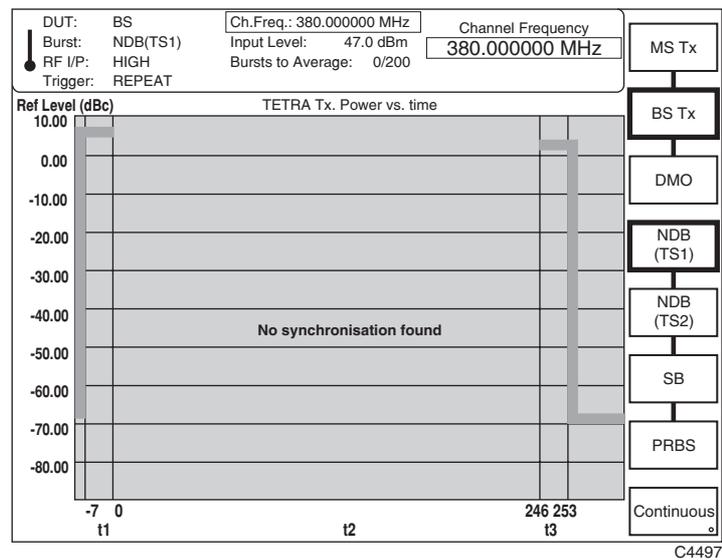
Fig. 3-10 TETRA analyzer: Selection keys displayed when BS Tx selected

(1) Select the type of burst using one of the following keys:

[NDB(TS1)] – Normal downlink burst with normal training sequence TS1.

[NDB(TS2)] – Normal downlink burst with normal training sequence TS2.

[SB] – Synchronization downlink burst.

[PRBS] – Pseudo-random burst sequence.

(2) To select continuous data, press the *[Continuous]* key.

Mobile station (direct mode)

To select direct mode operation (mobile to mobile without base station), press the *[DMO]* key. This causes the direct mode operation soft keys to be displayed at the right side of the screen as shown in Fig. 3-11 below.
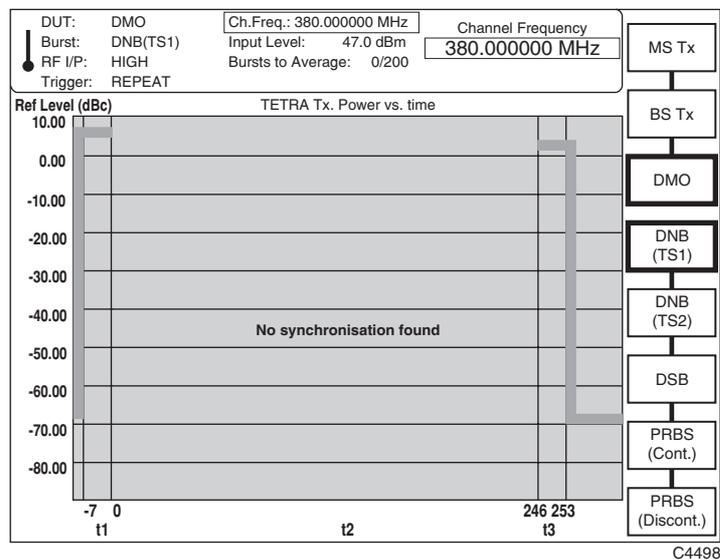
Fig. 3-11 TETRA analyzer: Selection keys displayed, DMO selected

(1)   Select the type of burst using one of the following keys:

[DNB (TS1)] − Direct mode normal burst with normal training sequence TS1.

[DNB (TS2)] − Direct mode normal burst with normal training sequence TS2.

[DSB] − Direct mode synchronization burst.

[PRBS (Cont.)] − Pseudo-random burst sequence (continuous data).

[PRBS (Discont.)] − Pseudo-random burst sequence (discontinuous data).

Frequency

To select the channel frequency or frequency standard or to define the frequency band, press the [FREQ] secondary key. This causes the frequency soft keys to be displayed at the right side of the screen as shown in Fig. 3-12 below.
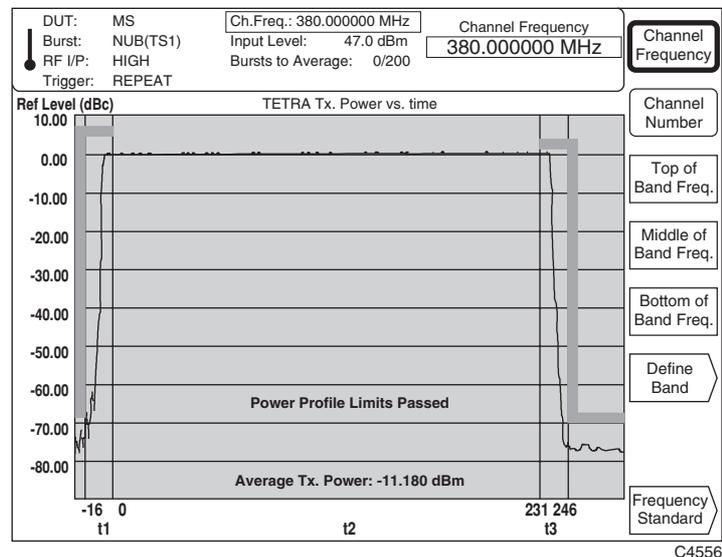
Fig. 3-12 TETRA analyzer: Selection keys displayed, FREQ selected

(1) To select a channel by defining its frequency, press *[Channel Frequency]*. This causes the current channel frequency to be displayed in the data-entry field at the top of the screen. Enter your selected channel frequency on the key pad in the range 100 MHz to 2.4 GHz, to 1 Hz resolution. Terminate using the [MHz] or [GHz] keys.

(2) To select a channel by defining its number, press *[Channel Number]*. Enter your selected channel number on the key pad in the range 0 to 400. Terminate using any [ENTER] key.

The instrument uses this value together with the start-of-band and channel spacing parameters to calculate the required frequency value.

(3) To select a channel by specifying its top-, middle- or bottom-of-band frequency (previously defined – see 'Defining the band' below), press *[Top of Band Frequency], [Middle of Band Frequency]* or *[Bottom of Band Frequency]* respectively. Pressing *[Define Band]* enables you to define each of these frequencies (see 'Defining the band' below). These keys also enable you to check the TETRA measurements at spot frequencies across the frequency band of interest.

(4) To step to the next or previous channel, press the [⇧] or [⇩] key respectively. In TETRA mode the frequency step defaults to the 25 kHz channel spacing.

(5) Pressing *[Frequency Standard]* enables you to select an internal or external frequency standard (see 'Frequency standard selection' below).

Defining the band

The *[Define Band]* key enables you to specify your TETRA frequency band and provides a faster route for setting channel frequencies. The normal measurement mode parameters are replaced with the TETRA band parameters whilst the measurement display remains unchanged. This menu enables you to specify the channel 0 frequency and the channel spacing value. These values are used to reference any future specified channel number. In addition, a frequency value in the top, middle and bottom of a particular band of interest can be specified independently of each other.

Pressing *[Define Band]* causes the TETRA band parameters to be displayed at the top of the screen together with the band-defining soft keys at the right side of the screen as shown in Fig. 3-13 below.
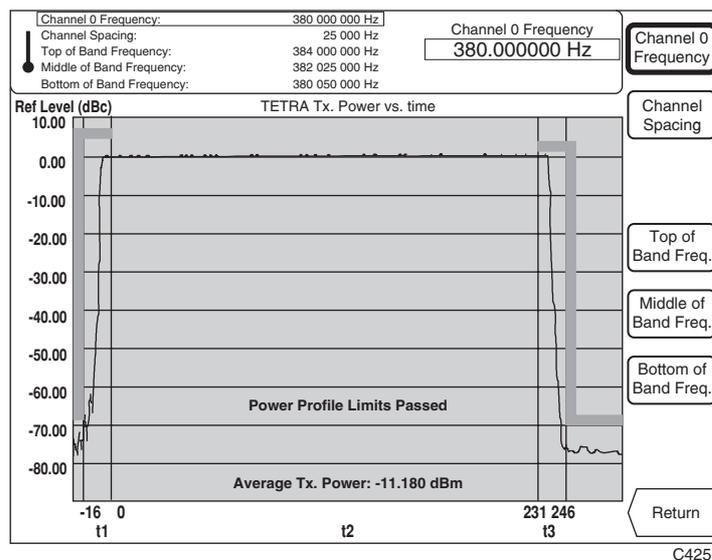
Fig. 3-13 TETRA analyzer: Selection keys displayed, Define Band selected

(1)   To define a TETRA frequency band, enter the start frequency after pressing the *[Channel 0 Frequency]* key, then enter the channel spacing after pressing the *[Channel Spacing]* key. Enter each parameter using the key pad and terminate using the appropriate units key. The instrument uses these parameters to calculate the required frequency.

(2)   To set a frequency value in the top, middle or bottom of the band press the *[Top of Band Frequency], [Middle of Band Frequency]* or *[Bottom of Band Frequency]* key respectively. Enter the frequency using the key pad and terminate using the appropriate units key.

(3)   Press *[Return]* to restore the normal measurement mode parameters and return you to your previously selected screen.

Frequency standard selection

To change the frequency standard press the *[Frequency Standard]* key. This causes the frequency standard selection soft keys to be displayed at the right side of the screen as shown in Fig. 3-14 below.
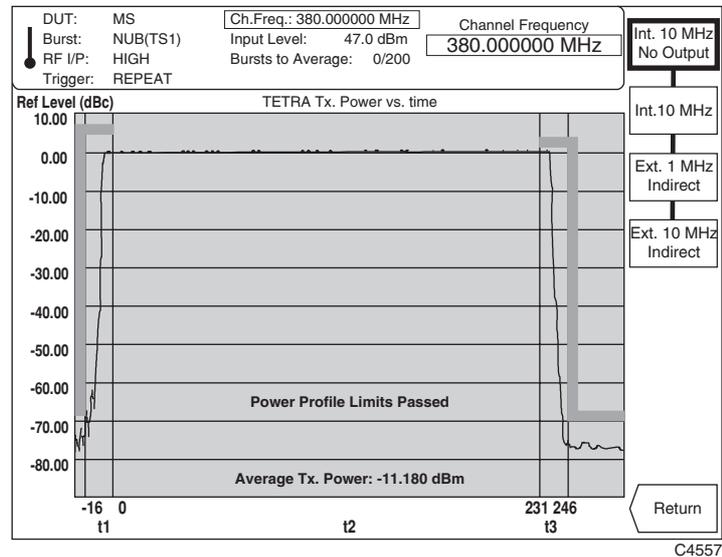
Fig. 3-14 TETRA analyzer: Selection keys displayed, Frequency Standard selected

(1)   To select the instrument's internal OCXO as the frequency standard for the instrument, press the *[Int. 10 MHz]* key. When selected, the internally generated 10 MHz standard is also available from the rear panel INT STD O/P socket. To prevent output to this socket, press instead the *[Int. 10 MHz No Output]* key.

(2)   To provide an externally generated 1 or 10 MHz standard for the instrument, connect the signal to the rear panel EXT STD I/P socket, then select between *[Ext. 1 MHz Indirect]* and *[Ext. 10 MHz Indirect]*.

When *Indirect* is selected the internal OCXO is locked to the external standard using a phase locked loop.

Your selection is automatically saved to non-volatile memory and is recalled when the instrument is switched on.

(3)   Press *[Return]* to return to the previously selected screen.

Level

The RF level entered here is used to set up the front end (input attenuator and amplifiers) of the instrument and should not be confused with the top-of-screen reference level.

To set to the nominal power level and level offset of the device under test and to choose the RF input, press the [LEVEL] secondary key. This causes the level-defining soft keys to be displayed at the right side of the screen as shown in Fig. 3-15 below. The RF level entered should accord with the nominal power of the DUT. The average transmitter power measured is compared with the input-level parameter and the selected limits.
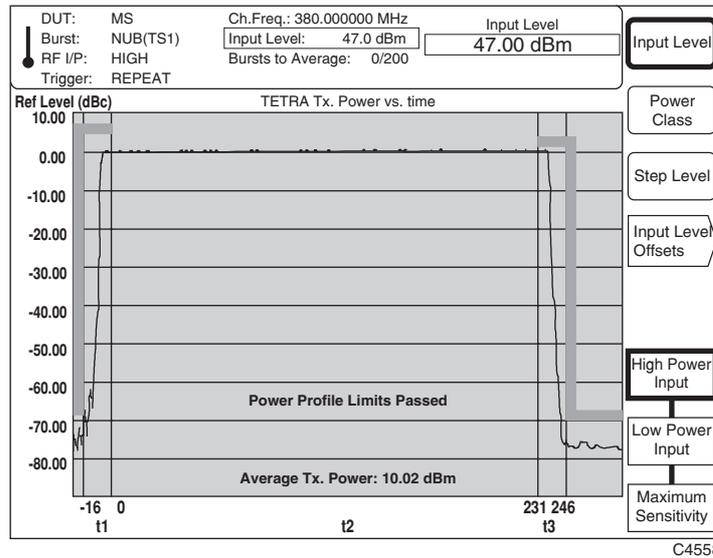
Fig. 3-15 TETRA analyzer: Selection keys displayed, LEVEL selected

(1) To set the power level as a value press *[Input Level]*, which causes the current input level to be displayed in the data entry field. Enter your input-power level on the key pad to 0.01 dB resolution. Terminate using the [dB] key.

(2) You can adjust the input level by using either the rotary control or the [⇩] [⇧] keys.

(3) To set the power level as a class, press the *[Power Class]* key. Enter the transmitter power class on the key pad in the range 1 to 10 for base stations, 1 to 4 for mobile stations, and 2 to 5 for DMO operation. Terminate using any [ENTER] key. The instrument converts the power class into dBm and displays it in the input entry area. The conversion from power class to dBm is given in Tables 3-1 to 3-3 below.

Table 3-1 Base station nominal power

Power class	Nominal power per carrier
1 (40 W)	46 dBm
2 (25 W)	44 dBm
3 (15 W)	42 dBm
4 (10 W)	40 dBm
5 (6.3 W)	38 dBm
6 (4 W)	36 dBm
7 (2.5 W)	34 dBm
8 (1.6 W)	32 dBm
9 (1 W)	30 dBm
10 (0.6 W)	28 dBm

Table 3-2 Mobile nominal power

Power class	Nominal power
1 (30 W)	45 dBm
2 (10 W)	40 dBm
3 (3 W)	35 dBm
4 (1 W)	30 dBm

Table 3-3 Direct mode mobile nominal power

Power class	Nominal power
1	Not defined
2 (10 W)	40 dBm
3 (3 W)	35 dBm
4 (1 W)	30 dBm
5 (0.3 W)	25 dBm

(4) To set the step level for a mobile station, press *[Step Level]* and enter the step level on the key pad in the range 1 to 7. Terminate using any [ENTER] key. The instrument converts the step level into dBm and displays it in the input entry area. The conversion from step level to dBm is given in Table 3-4 below.

Table 3-4 Mobile adaptive control power levels

Step level	Power
1 (30 W)	45 dBm
2 (10 W)	40 dBm
3 (3 W)	35 dBm
4 (1 W)	30 dBm
5 (0.3 W)	25 dBm
6 (0.1 W)	20 dBm
7 (0.03 W)	15 dBm

(5)   Select between high-power and low-power DC-coupled RF INPUTs using one of the following keys:

[High Power Input] − selects the 40 W RF INPUT connector which tolerates the highest-power TETRA transmitters.

[Low Power Input] − selects the 0.5 W RF INPUT connector. When selected, a 10 dB attenuator pad is inserted to protect the internal mixer. This input has a lower noise figure and allows measurements to be made on circuits and sub-assemblies before any power amplification.

[Maximum Sensitivity] − selects the 0.5 W RF INPUT with no mixer protection (0 dB attenuation).

(6)   Pressing *[Input Level Offsets]* enables you to compensate for the nominal gain or loss of an external device (see 'Level offsets selection' below).

Level offsets selection

The RF offset facility enables you to effectively display the RF power at the output of the device under test when an external device, such as an attenuator or amplifier, is connected between the DUT and the instrument. The displayed input level does not change, but the RF front-end hardware is modified to compensate for the nominal gain or loss of the external device. In addition, the facility can be used to compensate for cable loss in a test system configuration.

Pressing *[Input Level Offsets]* causes the level-offset soft keys to be displayed at the right side of the screen as shown in Fig. 3-16 below.
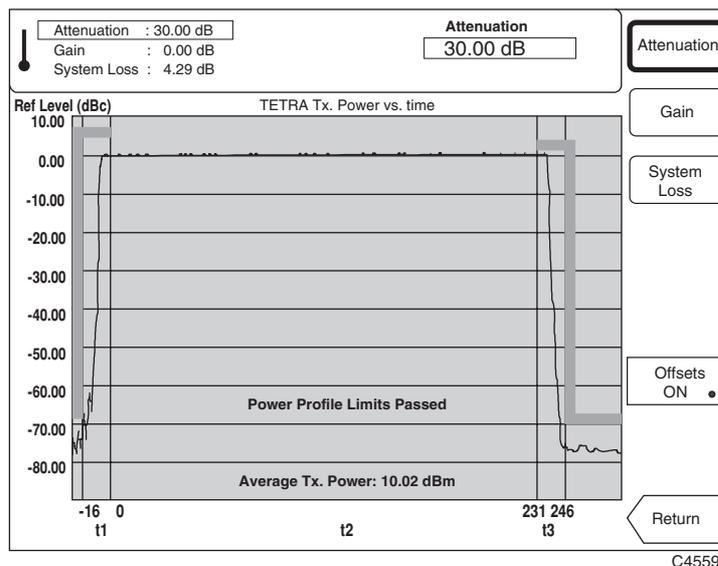
Fig. 3-16 TETRA analyzer: Selection keys displayed, Input Level Offsets selected

(1)   To enter the amount of attenuation being applied, press *[Attenuation]*, enter the value using the key pad and terminate with the *[dB]* key.

(2)   To enter the amount of gain being applied, press *[Gain]*, enter the value using the key pad and terminate with the *[dB]* key.

(3)   To compensate for power loss through cables, press the *[System Loss]* key. Enter the amount of cable loss occurring in the test configuration and terminate using the *[dB]* key.

(4)   Press *[Offsets ON]* to enable or disable the offsets. When the key's green 'LED' is lit the offsets are being applied.

The average transmitter power displayed is modified by the RF offsets as follows:

Displayed average power = Measured average power + attenuation − gain + system loss

(5)   Press *[Return]* to return to your previously selected screen.

Making TETRA measurements

To select how the instrument analyzes the input signal and to specify burst averaging, press the [MEASURE] secondary key. This causes the 'measure' soft keys to be displayed at the right side of the screen as shown in Fig. 3-17 below.
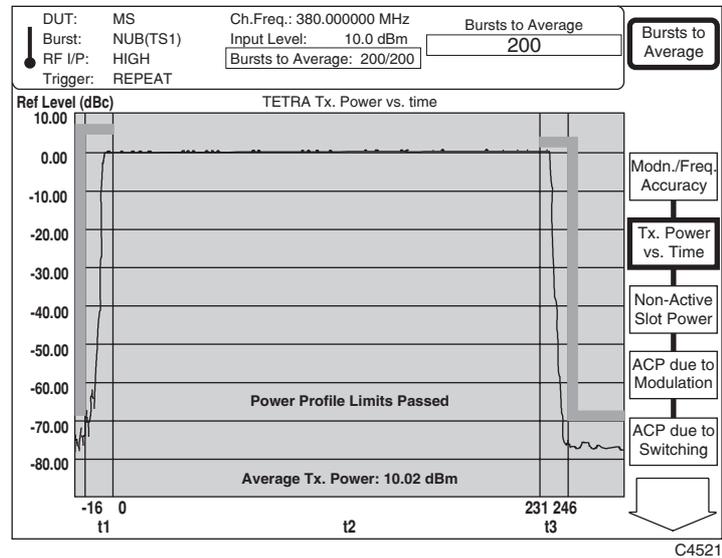
Fig. 3-17 TETRA analyzer: Selection keys displayed, MEASURE selected

Each of the TETRA measurement modes selected from this menu is explained in detail in later paragraphs. The selection soft keys and the measurement modes selected are summarized as follows:

[Modn./Freq. Accuracy] − Measures modulation and frequency accuracy.

[Tx. Power vs. Time] − Measures transmitter power versus time for burst conformance with a template (if limits are active).

[Non-Active Slot Power] − Measures unwanted power in the non-active state. This is the average power measured over non-active time slots occurring between successive bursts.

[ACP due to Modulation] − Measures adjacent channel power due to modulation. This is the average power occurring in adjacent channels during the scrambled bits of a burst, and is performed at frequency offsets of ±25 kHz, ±50 kHz and ±75 kHz.

[ACP due to Switching] − Measures adjacent channel power due to switching transients. This is the average power occurring in the adjacent channels at a frequency offset of ±25 kHz during the ramp-up and ramp-down periods of a burst.

Pressing the *[⇩]* key calls up a second display as shown in Fig. 3-18 below:
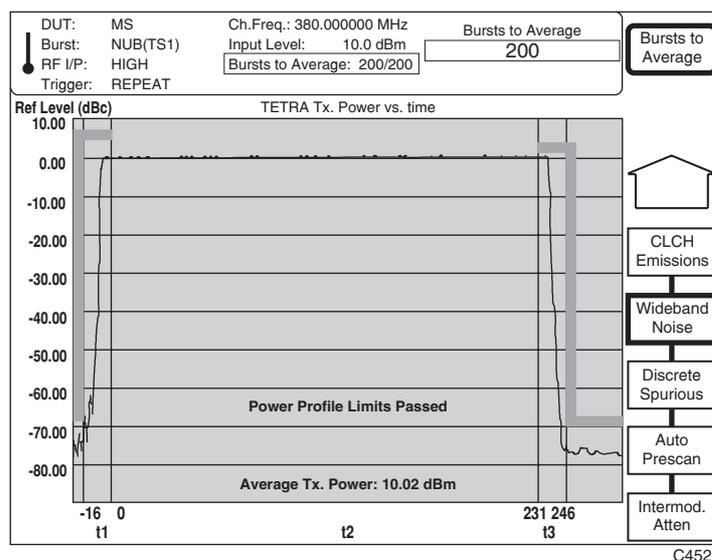
Fig. 3-18 TETRA analyzer: Selection keys displayed, [⇩] selected

[BLCH/CLCH Emissions] − Measures unwanted emissions occurring due to a base station transmitting a linearization burst on the BS linearization channel (BLCH) or a mobile station transmitting a Freq burst on the common Freq channel (CLCH). The name of the soft key changes, depending on the DUT.

[Wband. Nse. Emissions] − Measures unwanted emissions occurring at offsets greater than 100 kHz from the carrier frequency.

[Discrete Spurious] − Measures spurious noise emissions at up to 20 frequencies offset more than 100 kHz from the carrier.

[Auto Prescan] − Provides a graphical display of an automatic wideband or discrete spurious noise emissions measurement over the range 110.7 MHz to 2.4 GHz.

[Intermod. Atten] − Measures the ratio of the wanted signal to the power level of an intermodulation component and displays the result numerically.

Display

To select the display mode press the [DISPLAY] secondary key. This enables you to set the top-of-screen reference, select the trace between stored and active, and select the type of format for the display. Pressing the key causes the display soft keys to be displayed at the right side of the screen, as shown in each of the TETRA measurement procedures that follow.

Burst averaging

(1) You can specify the number of averages being applied to the measurement by pressing *[Bursts to Average]* and entering the number on the key pad in the range 1 to 200 (the instrument default is 200). Terminate using any [ENTER] key.

(2) Select the type of averaging (fixed or rolling) you require using one of the following immediate keys:

[SINGLE] − The fixed number of bursts is averaged and then the measurement process is halted. To initiate a new measurement cycle press the [SINGLE] key again.

[REPEAT] − The averaging process is updated each time a set number of bursts (determined by the update rate of the instrument) has been received. This process repeats until the specified number of bursts have been measured. The display is modified by the averaging process during successive traces.

Transmitter power versus time

Preliminary procedure

Step 1 − Set operating mode

Press the [TETRA] key.

Set up the device under test.

Select the burst type.

Step 2 − Set frequency

Set up the frequency (numeric entry, channel number or band position).

Step 3 − Set level

Enter nominal transmitter power (class number or value).

Step 4 − Select measurement

Press the [MEASURE] key.

Making the measurement

Select *[Tx. Power vs. Time],* then press the [DISPLAY] secondary key. This selects the 'transmitter power versus time' measurement mode and also causes the appropriate display soft keys to be shown at the right side of the screen as in Fig. 3-19 below.
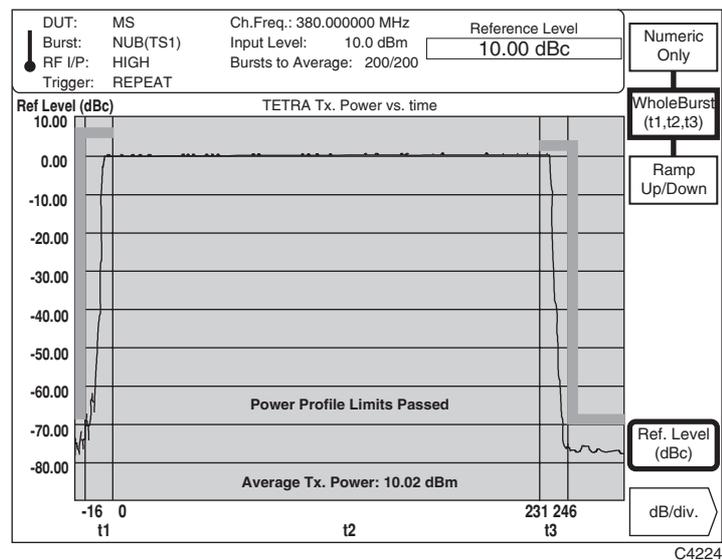
Fig. 3-19 TETRA analyzer: Whole burst display, Tx Power vs. *Time selected*

(1) To display the entire burst − the ramp-up period (t1), modulation period (t2) and ramp-down period (t3) − press the *[WholeBurst (t1,t2,t3)]* key. A display similar to that in Fig. 3-19 above is shown.

(2) To display a table of power versus time, press the *[Numeric Only]* key. This is the only valid display for continuous-burst type transmissions. A display similar to that in Fig. 3-20 below is shown.

The instrument determines which limit is applicable from the input level specified, and the appropriate dBm limits for the rise and fall periods of the power profile are displayed. If no limits are specified dashes are inserted in the *Upper Limit*, *Lower Limit* and *Pass/Fail* fields.

(3) To display just the switching periods (ramp-up period (t1) and ramp-down period (t3)), press the *[Ramp Up/Down]* key. A display similar to that in Fig. 3-21 below is shown.
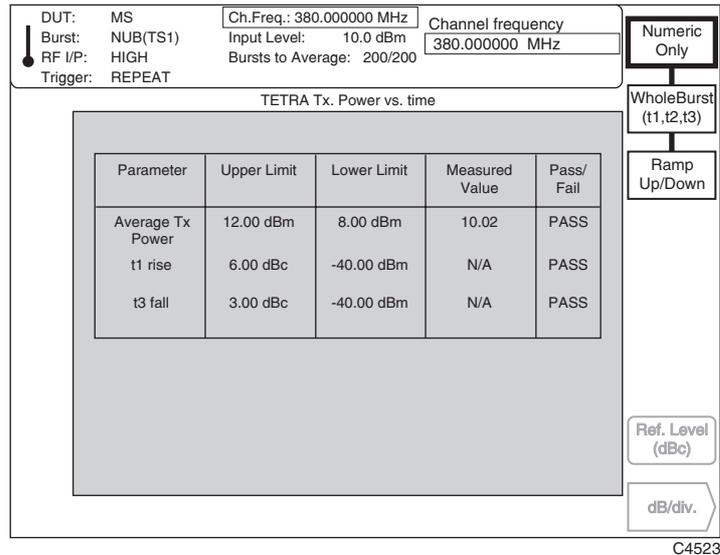
Fig. 3-20 TETRA analyzer: Numeric-only display, Tx Power vs. Time selected

(4)   You can set the top-of-screen reference level by pressing *[Ref. Level (dBc)]* and entering your selected level on the key pad to 0.01 dB resolution. *[Ref. Level (dBc)]* together with *[dB/div.]* enables you to expand or reduce the displayed transmitter level so as to look closer at a specific area of the burst. Terminate using the [dB] key. The reference level may also be adjusted using either the rotary control or [⇩] [⇧] hard keys.

(5)   You can set the dB per graticule division by pressing the *[dB/div.]* key (see 'dB/div setting') below.

Note that the power axis units reflect the limit value that the measured value was checked against (dBc or dBm).
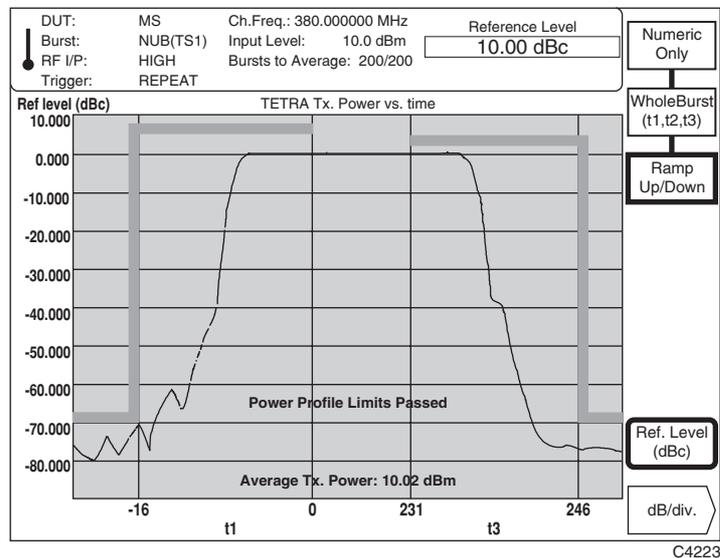
Fig. 3-21 TETRA analyzer: Ramp up/down display, Tx Power vs. Time selected

dB/div setting

To change the dB/div setting for the display graticule, press *[dB/div.]* which causes the dB/div selection soft keys to be displayed at the right side of the screen as shown in Fig. 3-22 below.
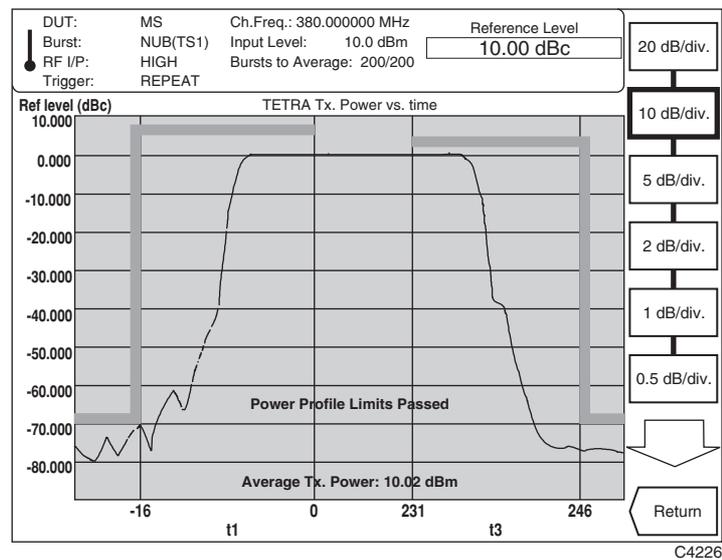
Fig. 3-22 TETRA analyzer: Display, dB/div selected

(1)   Pressing the *[⇩]* key calls up a second display which extends the menu so that you can select dB/div in the range 0.01 to 20 dB/div. The keys are marked in a 1, 2, 5 multiple sequence.

(2)   Press *[Return]* to return to the previously-selected screen.

Non-active slot power

Preliminary procedure

Step 1 − Set operating mode

Press the [TETRA] key.

Set up the device under test.

Select the burst type.

Step 2 − Set frequency

Set up the frequency (numeric entry, channel number or band position).

Step 3 − Set level

Enter nominal transmitter power (class number or value).

Step 4 − Select measurement

Press the [MEASURE] key.

Making the measurement

Select *[Non-active Slot Power]*, then press the [DISPLAY] secondary key. This selects the 'unwanted power in the non-active state' measurement mode and also causes the appropriate display soft keys to be shown at the right side of the screen as in Fig. 3-23 below.
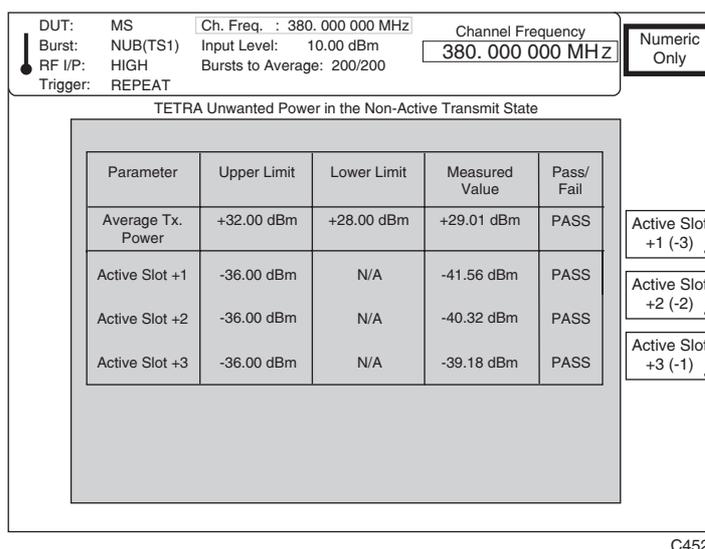
Fig. 3-23 TETRA analyzer: Numeric-only display, Non-active Slot Power selected

(1)   When *[Numeric Only]* is selected, a table of inactive slot power similar to that in Fig. 3-23 above is shown.

(2)   (2) You can specify the non-active slot to be measured by pressing the *[Active Slot +1(-3)]*, *[Active Slot +2(-2)]* or *[Active Slot +3(-1)]* key (the numbers refer to the position of the non-active slot relative to the active slot). The text in the measurement table is modified to show the selected non-active slot.

The maximum and minimum allowed values for average transmit power are calculated by the instrument from the input level (nominal power level) and the limits selected by the user. If no limits are specified, dashes are inserted in the *Upper Limit*, *Lower Limit* and *Pass/Fail* fields.

(3)   When *[Power vs. Time]* is pressed, a display similar to that in Fig. 3-24 below is shown.

In this display the vertical dashed lines represent the active and inactive slot boundaries, the horizontal dashed lines represent the limits applicable to the average transmitter power and the non-active slot power.

The x-axis is automatically scaled by the instrument depending upon the number of non-active slots requested for display. Power is displayed for both the active slot and the user-specified non-active slot.
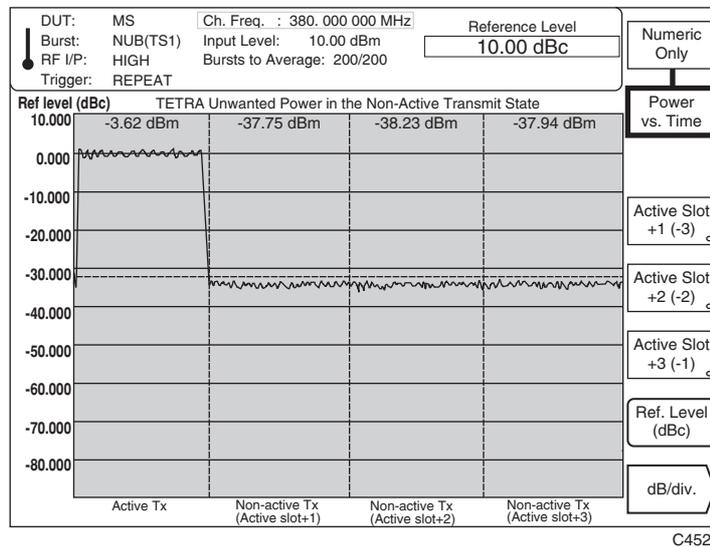
Fig. 3-24 TETRA analyzer: Power vs. time display, Non-active Slot Power selected

(4)   You can set the top-of-screen reference level by pressing *[Ref. Level (dBc)]* and entering your selected level on the key pad to 0.01 dB resolution. *[Ref. Level (dBc)]* together with *[dB/div.]* enables you to expand or reduce the displayed transmitter level so as to look closer at a specific area of the burst. Terminate using the [dB] key. The reference level may also be adjusted using either the rotary control or [⇩] [⇧] hard keys.

(5)   You can set the dB per graticule division by pressing the *[dB/div.]* key (see 'dB/div setting') below.

Note that the power axis units reflect the limit value that the measured value was checked against (dBc or dBm).

ACP due to modulation

Preliminary procedure

Step 1 – Set operating mode

Press the [TETRA] key.

Set up the device under test.

Select the burst type.

Step 2 – Set frequency

Set up the frequency (numeric entry, channel number or band position).

Step 3 – Set level

Enter nominal transmitter power (class number or value).

Step 4 – Select measurement

Press the [MEASURE] key.

Making the measurement

Select *[ACP due to Modulation]*, then press the [DISPLAY] secondary key. This selects the 'adjacent channel power due to modulation' measurement mode and also causes the appropriate display soft keys to be shown at the right side of the screen as in Fig. 3-25 below.
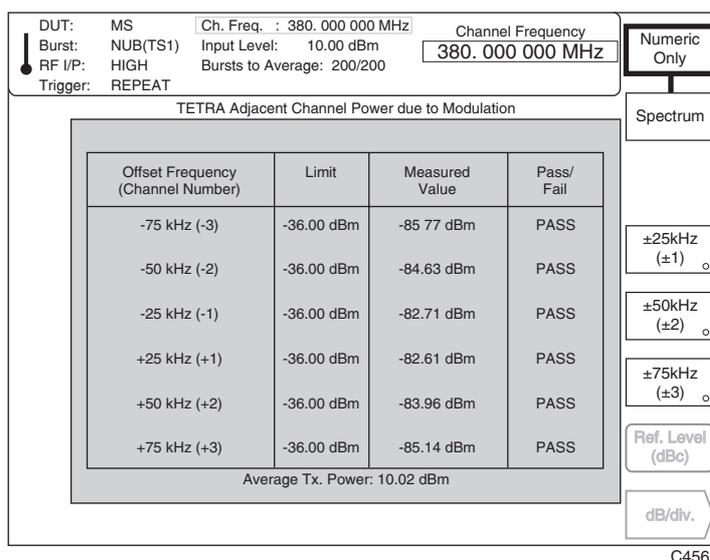
Fig. 3-25 TETRA analyzer: Numeric-only display, ACP due to Modulation selected

(1) To display a table of adjacent channel power due to modulation, press *[Numeric Only]*. A display similar to that in Fig. 3-25 above is shown. You can use the *[±25kHz (±1)]*, *[±50kHz (±2)]* and *[±75kHz (±3)]* keys to switch on and off a complete set (two lines) of offset settings and results.

If no limits are specified, dashes are inserted in the *Limit* and *Pass/Fail* display fields.

ETS 300 394-1 specifies an absolute minimum limit of −36 dBm in addition to the relative (dBc) limits. The instrument determines which limit is applicable for each channel offset. The appropriate limit for the channel offset is displayed and the measured adjacent channel power value is shown in the same unit format.

(2)   To display the RF spectrum, press the *[Spectrum]* key. This provides a graphical presentation of the numeric data as shown in Fig. 3-26 below. By switching on and off the channel offsets using the *[±25kHz (±1)]*, *[±50kHz (±2)]* and *[±75kHz (±3)]* keys the frequency band can be adjusted.
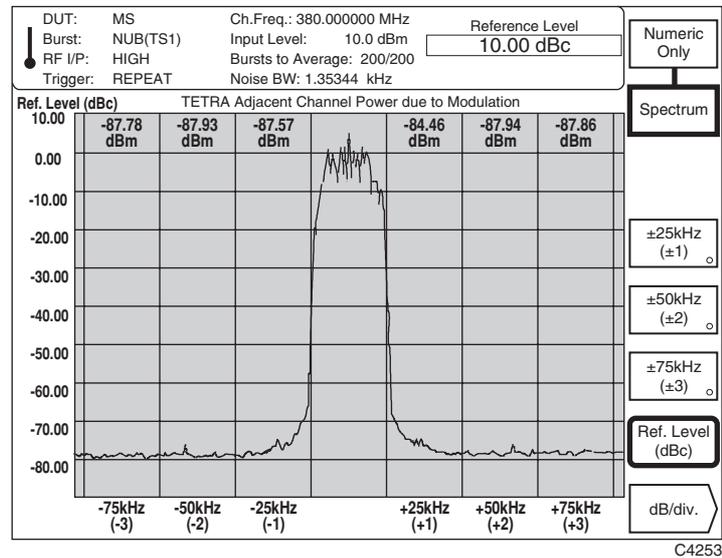
Fig. 3-26 TETRA analyzer: Spectrum display, ACP due to Modulation selected

(3)   Select *[Ref. Level (dBc)]* and enter your selected top-of-screen reference level on the key pad to 0.01 dB resolution. *[Ref. Level (dBc)]* together with *[dB/div.]* enables you to expand or reduce the displayed transmitter level so as to look closer at a specific area of the burst. Terminate using the [dB] key. The reference level may also be adjusted using either the rotary control or [⇩] [⇧] keys.

(4)   You can set the dB per graticule division by pressing the *[dB/div.]* key (see 'dB/div setting' on page 3-31).

Note: The numeric values displayed for each channel are determined from the input signal being measured through the TETRA filter in accordance with ETS 300 394-1. However, in order to achieve a graphical display of the frequency spectrum, the input signal must be measured through a noise bandwidth which is smaller than that of the TETRA filter. As a consequence, the on-channel power is not displayed at 0 dBc. The ratio between the noise bandwidth displayed and the TETRA filter bandwidth (18 kHz) can be used to determine the level difference from 0 dBc.

ACP due to switching transients

Preliminary procedure

Step 1 – Set operating mode

Press the [TETRA] key.

Set up the device under test.

Select the burst type.

Step 2 – Set frequency

Set up the frequency (numeric entry, channel number or band position).

Step 3 – Set level

Enter nominal transmitter power (class number or value).

Step 4 – Select measurement

Press the [MEASURE] key.

Making the measurement

Select *[ACP due to Switching]*, then press the [DISPLAY] secondary key. This selects the 'adjacent channel power due to switching transients' measurement mode and also causes the appropriate display soft keys to be shown at the right side of the screen as in Fig. 3-27 below.

| | | DUT: | MS | Ch. Freq. : 380. 000 000 MHz | | Channel Frequency | | Numeric Only |
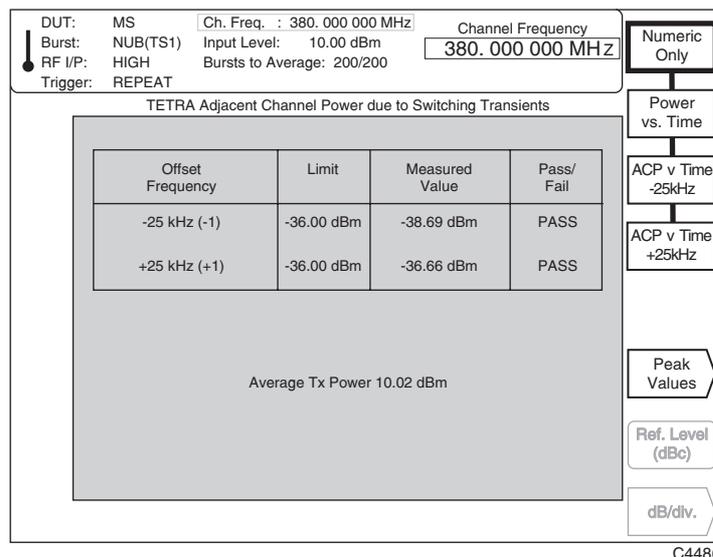
Fig. 3-27 TETRA analyzer: Numeric-only display, ACP due to Switching selected

(1) To display a table of power due to switching transients, press *[Numeric Only]*. A display similar to that in Fig. 3-27 above is shown.

If no limits are specified, dashes are inserted in the *Limit* and *Pass/Fail* display fields.

ETS 300 394-1 specifies an absolute minimum limit of −36 dBm in addition to the relative (dBc) limits. The instrument determines which limit is applicable for each channel offset. The appropriate limit for the channel offset is displayed and the measured adjacent channel power value is shown in the same unit format.

(2) To display the power profile at the center frequency, press the *[Power vs. Time]* key. This provides a graphical presentation of the numeric data as shown in Fig. 3-28 below. The ramp-up (t1) and ramp-down (t3) periods are shown, centered upon the center frequency.
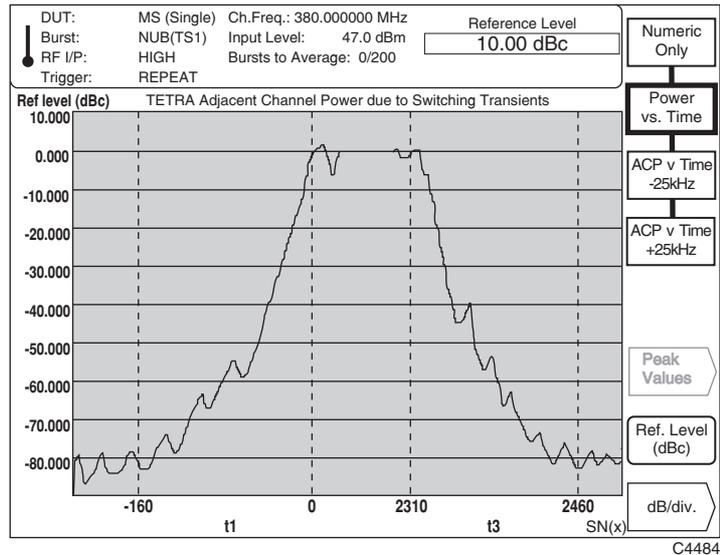
Fig. 3-28 TETRA analyzer: Power profile, ACP due to Switching selected

(3)   Select *[ACP v Time −25kHz]* to display the power profile centered upon a frequency which is offset from the center frequency by −25 kHz, as shown in Fig. 3-29 below.
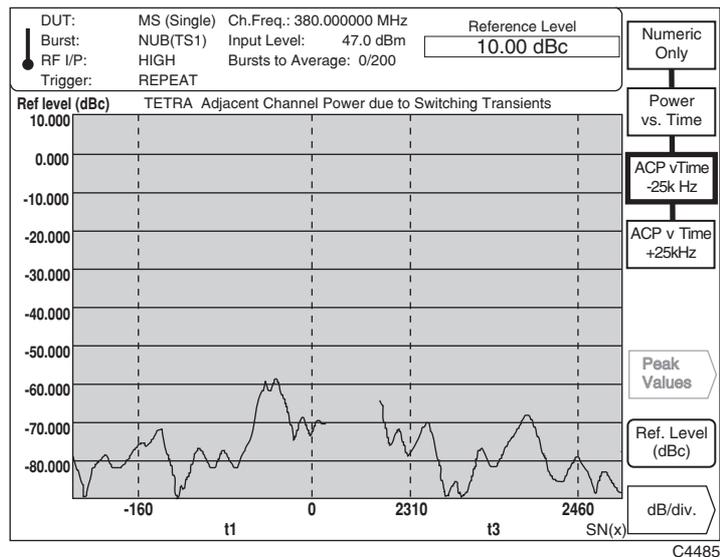
Fig. 3-29 TETRA analyzer: Power profile, ACP v Time −25 kHz selected

(4)   Similarly, select *[ACP v Time +25kHz]* to display the power profile centered upon a frequency which is offset from the center frequency by +25 kHz.

(5)   Select *[Ref. Level (dBc)]* and enter your selected top-of-screen reference level on the key pad to 0.01 dB resolution. *[Ref. Level (dBc)]* together with *[dB/div.]* enables you to expand or reduce the displayed transmitter level so as to look more closely at a specific area of the burst. Terminate using the [dB] key. The reference level may also be adjusted using either the rotary control or [⇩] [⇧] keys.

(6)   You can set the dB per graticule division by pressing the *[dB/div.]* key (see 'dB/div setting' on page 3-31).

(7)   To obtain a display of the peak power bursts press the *[Peak Values]* key (see 'Peak values' below).

Peak values

The peak power of each burst during the ramp-up (t1) and ramp-down (t3) periods is measured for the ±25 kHz channels. The process is repeated for the total number of bursts specified (default 200). The peak values are then averaged to give an overall result.

To display the top 20 peak power bursts press the *[Peak Values]* key which causes the screen shown in Fig. 3-30 to be displayed.
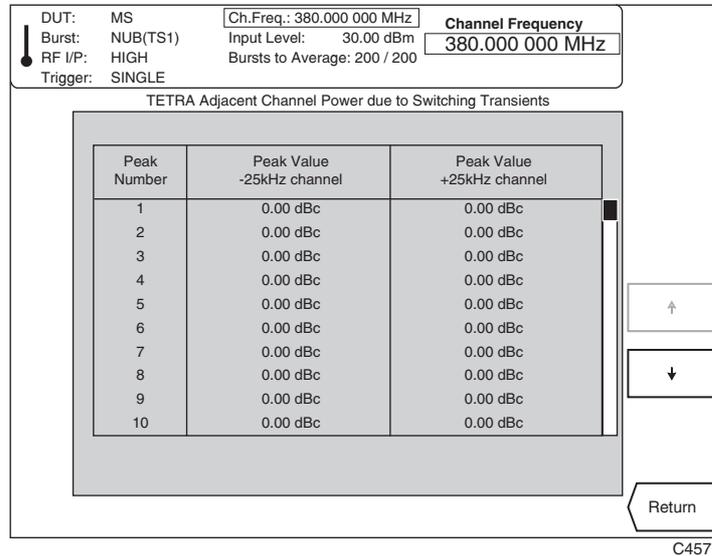
Fig. 3-30 TETRA analyzer: Display, Peak Values selected

(1)   The screen displays 10 peak power burst measurements at a time. To scroll up and down the list press the *[↑]* and *[↓]* keys.

(2)   Press *[Return]* to return to the previously selected screen.

Modulation/Frequency accuracy

Preliminary procedure

Step 1 – Set operating mode

Press the [TETRA] key.

Set up the device under test.

Select the burst type.

Step 2 – Set frequency

Set up the frequency (numeric entry, channel number or band position).

Step 3 – Set level

Enter nominal transmitter power (class number or value).

Step 4 – Select measurement

Press the [MEASURE] key.

Making the measurement

Select *[Modn./Freq. Accuracy]*, then press the [DISPLAY] secondary key. This selects the 'modulation and frequency accuracy' measurement mode and also causes the appropriate display soft keys to be shown at the right side of the screen as in Fig. 3-31 below.
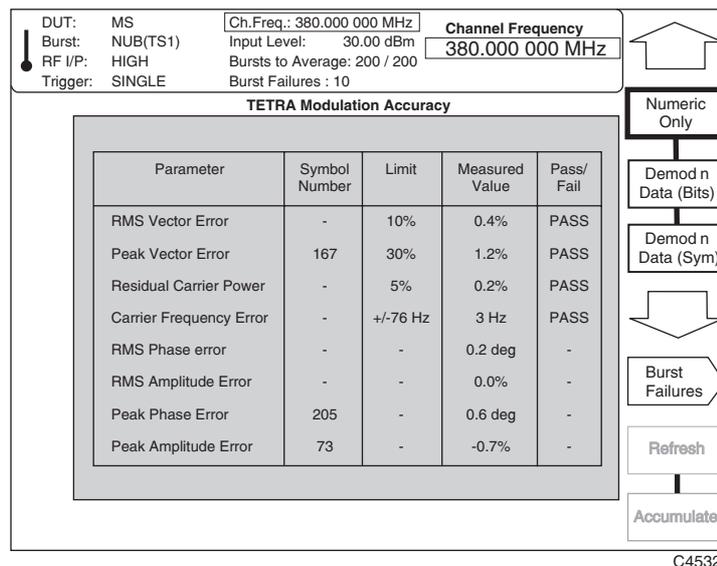
*Fig. 3-31 TETRA analyzer: Numeric-only display, Modn/Freq Accuracy selected*

(1)   Pressing *[Numeric Only]* presents a display in the form of a table as shown in Fig. 3-31 above. If no limits are specified, dashes are inserted in the *Limit* and *Pass/Fail* display fields.
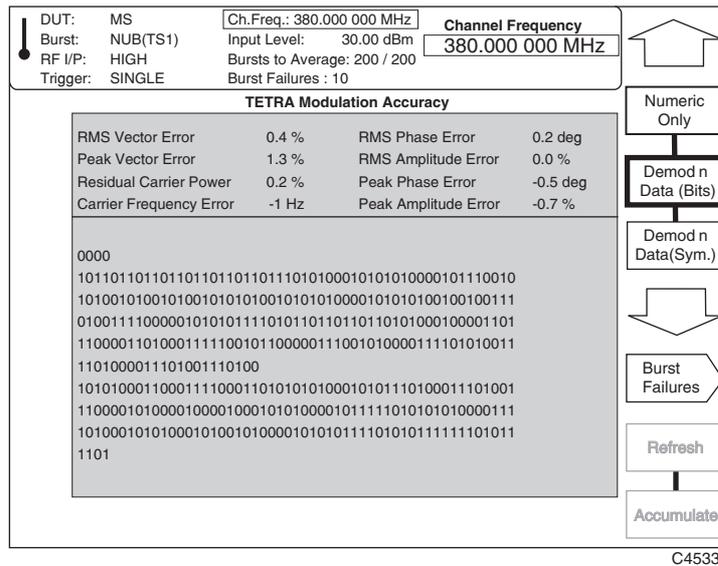
Fig. 3-32 TETRA analyzer: Demodulated data, Demod'n Data (Bits) selected

(2)   Pressing *[Demod'n Data (Bits)]* causes demodulated data from a single burst to be shown in the form of '1's and '0's as in Fig. 3-32 above.

(3)   Pressing *[Demod'n Data (Symbols)]* causes demodulated data from a single burst to be shown in symbol format as in Fig. 3-33 below.
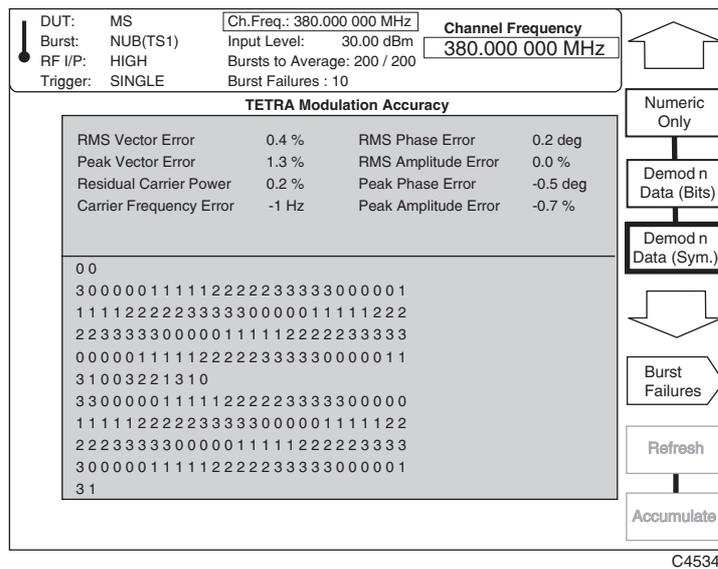
Fig. 3-33 TETRA analyzer: Demodulated data, Demod'n Data (Symbols) selected

Polar displays

Pressing *[⇩]* once causes the polar diagram selection keys to be displayed at the right side of the screen as shown in Fig. 3-34 below.

Pressing *[⇩]* a second time displays the Cartesian display selection keys, which are explained on page 3-43

Pressing *[⇩]* again returns you to the numeric displays. Pressing *[⇧]* cycles through the three sets of screens in the opposite direction.
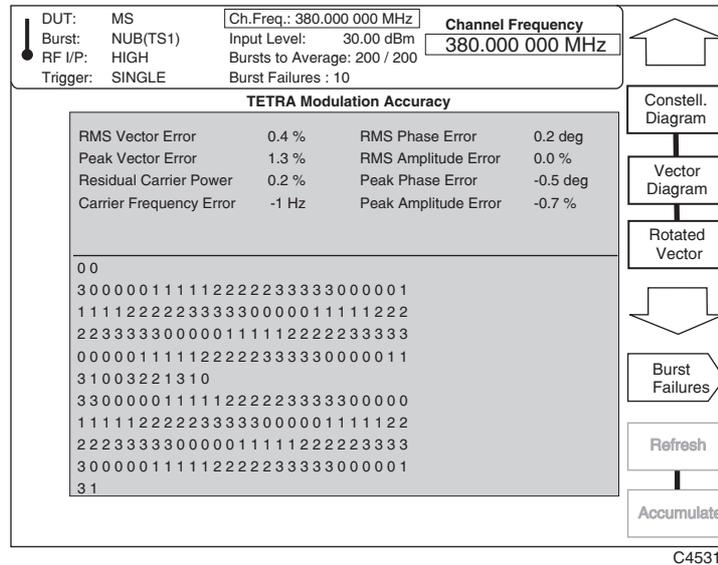
Fig. 3-34 TETRA analyzer: Polar selection, ⇩ selected

(1) Select the type of polar diagram using one of the following keys:

[Constellation Diagram] − presents a constellation display showing the phase and amplitude errors at symbol points in a TETRA burst, relative to the ideal symbol points (see Fig. 3-35 below). Displayed data is confined to the useful part of a burst. The unit circle and symbol point axes are displayed using dotted lines. When TETRA limits are enabled (see 'Specifying measurement limits' below) vector error tolerance rings are superimposed on the symbol points as seen in the diagram. The rings are filled in so that you can clearly see whether the measured symbols lie inside or outside the specified limits.

[Vector Diagram] − presents a display of the modulation at the symbol points and the vector trajectory between symbol points in a TETRA burst (see Fig. 3-36 below). Displayed data is confined to the useful part of a burst.

[Rotated Vector Diagram] − presents a display where all symbol points are rotated onto one point forming a cluster (see Fig. 3-37 below). When TETRA limits are enabled (see 'Specifying measurement limits' below) a peak vector error tolerance ring is superimposed on the symbol points as seen in the diagram. Axes values are shown for a 30% tolerance ring setting. Note that the axes are amplitude and phase. Having all the information in one cluster enables the points contributing to the vector error to be more easily observed than with the constellation or vector error diagrams.

(2) Pressing *[Refresh]* clears the current display and displays the latest measurement.

(3) Pressing *[Accumulate]* causes measured results to be displayed cumulatively. Press the key again to clear the display and recommence accumulating.
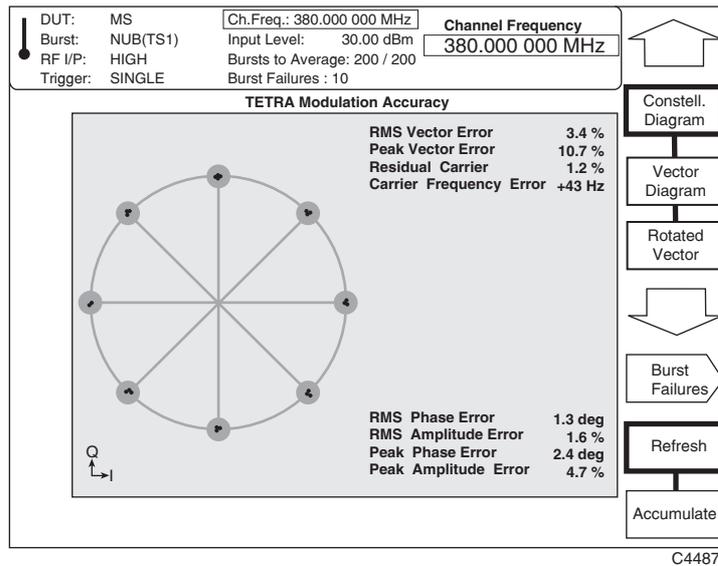
Fig. 3-35 TETRA analyzer: Polar display, Constellation Diagram selected
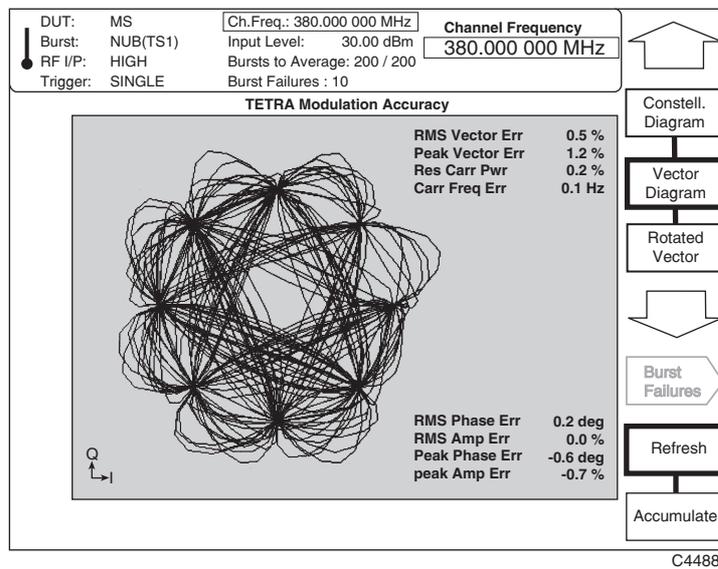
Fig. 3-36 TETRA analyzer: Polar display, Vector Diagram selected
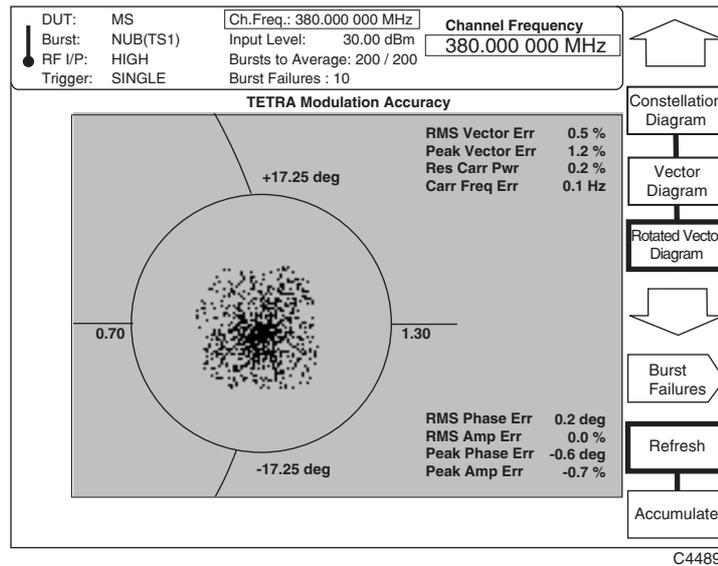
Fig. 3-37 TETRA analyzer: Polar display, Rotated Vector Diagram selected

Cartesian displays

Pressing *[⇩]* again after displaying the polar diagram selection keys causes the Cartesian display selection keys to be displayed at the right side of the screen as shown in Fig. 3-38 below.
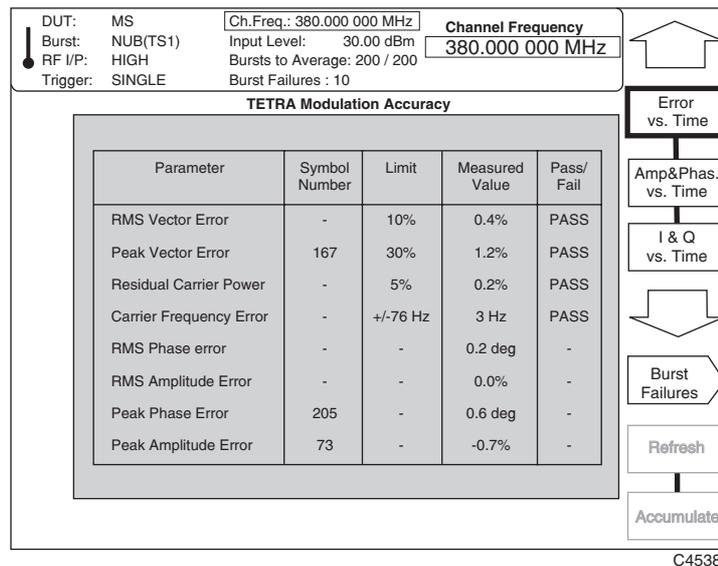
Fig. 3-38 TETRA analyzer: Cartesian display, [⇩] selected

(1) Select the type of Cartesian display diagram using one of the following keys:

[Error vs. Time] − presents a combined numeric and Cartesian display. The Cartesian display shows vector error at the symbol points against time in a TETRA burst (see Fig. 3-39 below). Displayed data is confined to the useful part of a burst, vertical dotted lines marking the boundaries of tail bits, training sequences, etc.

[Amp&Phas. vs. Time] − presents a dual-trace display of amplitude and phase error at the symbol points against time in a TETRA burst (see Fig. 3-40 below). Displayed data is confined to the useful part of a burst, vertical dotted lines marking the boundaries of tail bits, training sequences, etc.

[I & Q vs. Time] − presents a dual-trace display of the in-phase (I) and quadrature (Q) signals at the symbol points against time in a TETRA burst (see Fig. 3-41 below). Displayed data is confined to the useful part of a burst, vertical dotted lines marking the boundaries of tail bits, training sequences, etc.
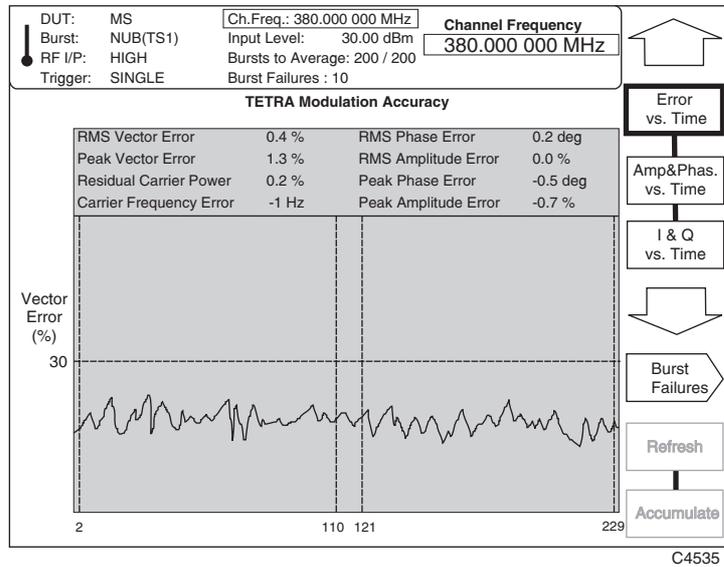
Fig. 3-39 TETRA analyzer: Cartesian display, Error vs. Time selected
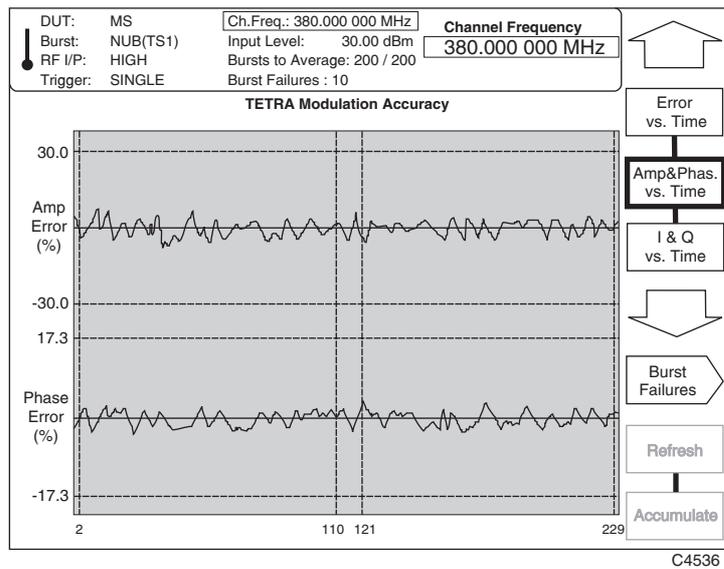
Fig. 3-40 TETRA analyzer: Cartesian display, Amp&Phase vs. Time selected
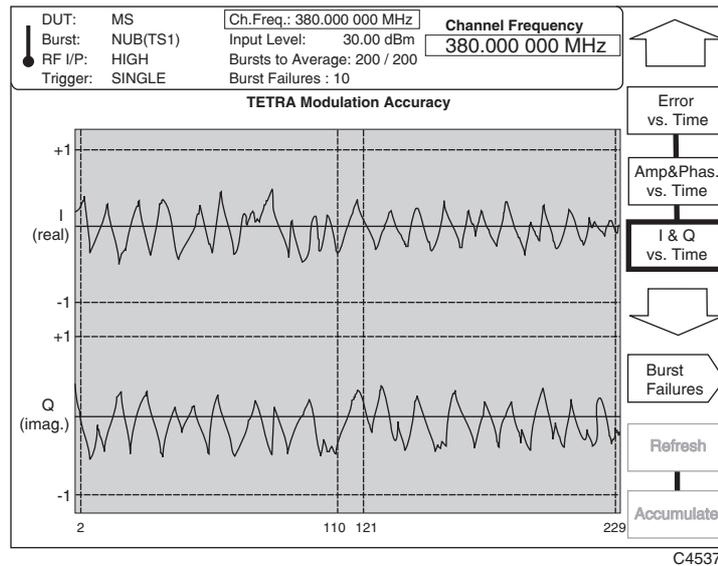
Fig. 3-41 TETRA analyzer: Cartesian display, I & Q vs. Time selected

Burst failures

To display the last 20 burst failures press the *[Burst Failures]* key (not available for Vector), which causes the screen shown in Fig. 3-42 to be displayed.
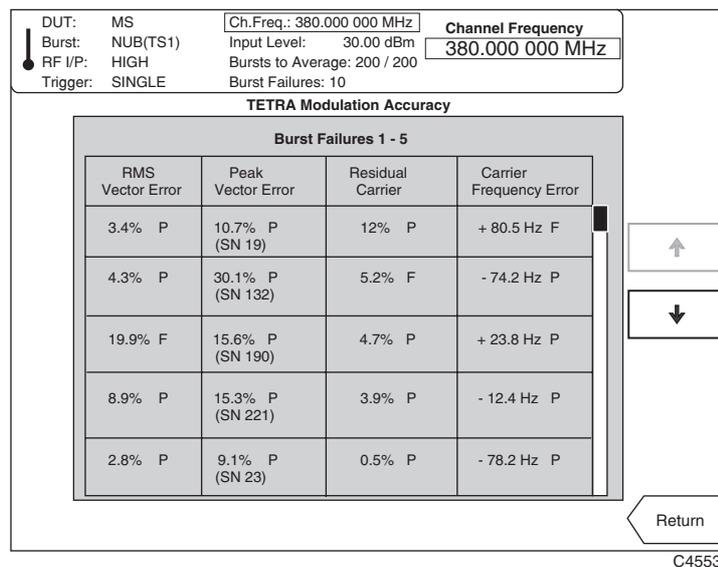
Fig. 3-42 TETRA analyzer: Display, Burst Failures selected

(1)   The screen displays a number of burst failures at a time. To scroll up and down the list press the *[↑]* and *[↓]* keys.

(2)   Press *[Return]* to return to your previously selected screen.

Specifying measurement limits

You can select a full set of measurement limit conditions. These can either be those specified in the TETRA standard (normal and extreme conditions) or as previously defined by you. Pressing the [LIMITS] key displays the TETRA limits for the DUT for all measurement modes, together with the limits soft keys displayed at the right side of the screen as shown in Fig. 3-43 below.
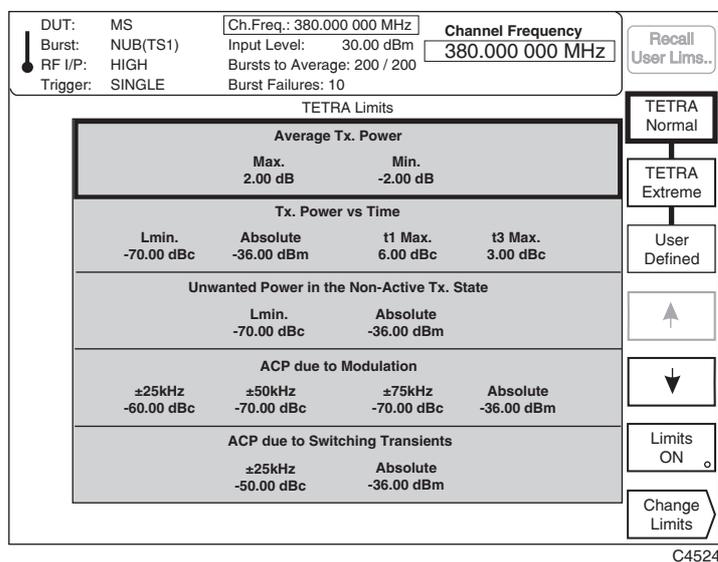
Fig. 3-43 TETRA analyzer: TETRA limits, LIMITS selected

(1) The instrument displays only the limits which are relevant to the unit under test (MS, BS, or DMO), with the currently selected measurement shown highlighted on the display.

(2) Press the *[TETRA Normal]* or *[TETRA Extreme]* key to load the limit parameters with normal or extreme test conditions as defined in the TETRA specification. The TETRA-specified limits for a device operating at its nominal power class level are given below in Table 3-5 for a base station and in Table 3-6 for a mobile station.

(3) To load a user-defined limit set from non-volatile memory, press the *[Recall User Lims.]* key. Then enter the store number (in the range 1 to 5) on the key pad and terminate with any [ENTER] key.

(4) Press *[Limits ON]* to enable or disable the displayed limits. When the key's green 'LED' is lit the limits are being applied.

(5) You can define a full set of limit conditions by pressing the *[Change Limits]* key (see 'Changing limit values' below).

Table 3-5 TETRA-specified limits for a base station

Measurement	Normal test condition limits for a BS	Extreme test condition limits for a BS
Average Tx Power	Max: +2.0 dB Min: −2.0 dB	Max: +3.0 dB Min: −4.0 dB
TX Power vs. Time	L_{min}: −40 dBc Absolute: −36 dBm t1 max +6 dB t3 max +3 dB	No extreme test condition requirement. Use normal test condition limits.
Non-active Slot Power	L_{min}: −40 dBc Absolute: −36 dBm	No extreme test condition requirement. Use normal test condition limits.
Adjacent Channel Power Due to Modulation	±25 kHz: −60 dBc ±50 kHz: −70 dBc ±75 kHz: −70 dBc Absolute: −36 dBm	±25 kHz: −50 dBc ±50 kHz: −60 dBc ±75 kHz: −60 dBc Absolute: −36 dBm
Adjacent Channel Power Due to Switching	±25 kHz: −50 dBc Absolute: −36 dBm	No extreme test condition requirement. Use normal test condition limits.
Modulation Accuracy	RMS vector error: 10% Peak vector error: 30% Residual carrier power: 5% Carrier freq accuracy: ±0.2 ppm	No extreme test condition requirement. Use normal test condition limits.
Unwanted Emissions during the CLCH	Time period: 1.000 ms PH −30.00 dBm PL −45.00 dBm	No extreme test condition requirement. Use normal test condition limits.
Wideband Noise Emissions	100−250 kHz −80.00 dBc 250−500 kHz −85.00 dBc 500 kHz−frb −90 dBc >frb −100.00 dBc Absolute (<frb) −55.00 dBm Absolute (>frb) −70.00 dBm	No extreme test condition requirement. Use normal test condition limits.

Table 3-6 TETRA-specified limits for a mobile station

Measurement	Normal test condition limits for an MS	Extreme test condition limits for an MS
Average Tx Power	Max: +2.0 dB Min: −2.0 dB	Max: +3.0 dB Min: −4.0 dB
TX Power vs. Time	L_{min}: −70 dBc Absolute: −36 dBm t1 max: +6 dB t3 max: +3 dB	No extreme test condition requirement. Use normal test condition limits.
Non-active Slot Power	L_{min}: −70 dBc Absolute: −36 dBm	No extreme test condition requirement. Use normal test condition limits.
Adjacent Channel Power Due to Modulation	±25 kHz: −60 dBc ±50 kHz: −70 dBc ±75 kHz: −70 dBc Absolute: −36 dBm	±25 kHz: −50 dBc ±50 kHz: −60 dBc ±75 kHz: −60 dBc Absolute: −36 dBm
Adjacent Channel Power Due to Switching	±25 kHz: −50 dBc Absolute: −36 dBm	No extreme test condition requirement. Use normal test condition limits.
Modulation Accuracy	RMS vector error: 10% Peak vector error: 30% Residual carrier power: 5% Carrier freq accuracy: ±0.2 ppm	No extreme test condition requirement. Use normal test condition limits.
Unwanted Emissions during the CLCH	Time period: 1.000 ms PH −30.00 dBm PL −45.00 dBm	No extreme test condition requirement. Use normal test condition limits.
Wideband Noise Emissions	MS nominal power level ≥ step level 2 (10 W): 100–250 kHz −80.00 dBc 250–500 kHz −80.00 dBc 500 kHz–frb −80 dBc >frb −80.00 dBc MS nominal power level = step level 3 (3 W): 100–250 kHz −78.00 dBc 250–500 kHz −83.00 dBc 500 kHz–frb −85 dBc >frb −100.00 dBc MS nominal power level ≤ step level 4 (1 W): 100–250 kHz −75.00 dBc 250–500 kHz −80.00 dBc 500 kHz–frb −80 dBc >frb −100.00 dBc Absolute (<frb) −55.00 dBm Absolute (>frb) −70.00 dBm	No extreme test condition requirement. Use normal test condition limits.

Changing limit values

You can modify the limit values by pressing the *[Change Limits]* key. This causes the 'change limits' soft keys to be displayed at the right side of the screen as shown in Fig. 3-44 below.

```
DUT:      MS          Ch.Freq.: 380.000000 MHz     Limit Parameter       Store Limits
Burst:    NUB(TS1)    Input Level:     47.00 dBm       2.00 dB           to Memory
RF I/P:   HIGH        Bursts to Average:   1/200
Trigger:  REPEAT
                                                                          Limit
                           TETRA Limits                                 Parameters

                        Average Tx. Power
                                                                            ←
                    Max.              Min.
                    2.00 dB          -2.00 dB
                                                                            →
                        Tx. Power vs Time

         Lmin.        Absolute        t1 Max.       t3 Max.
        -70.00 dBc   -36.00 dBm      6.00 dBc      3.00 dBc                  ↑

              Unwanted Power in the Non-Active Tx. State
                                                                            ↓
                    Lmin.             Absolute
                   -70.00 dBc        -36.00 dBm

                        ACP due to Modulation
         ±25kHz       ±50kHz          ±75kHz        Absolute
        -60.00 dBc   -70.00 dBc      -70.00 dBc    -36.00 dBm

                  ACP due to Switching Transients
                    ±25kHz            Absolute                            Return
                   -50.00 dBc        -36.00 dBm

                                                                  C4525
```

Fig. 3-44 TETRA analyzer: TETRA limits, Change Limits selected

(1)   The limit data for the currently selected measurement is positioned at the top of the screen.

(2)   Use the *[↑]* and *[↓]* soft keys to move the selection box to the appropriate set of limit parameters. Then use the *[→]* and *[←]* keys to select the required parameter.

(3)   Pressing *[Return]* returns you to your previously selected screen.

Markers

Markers in TETRA operation relate to the symbol position in the captured burst. Using the rotary control, two markers can be steered along the trace from symbol to symbol, and the appropriate parameter values are displayed for each marker. Additionally, by key control, a marker can be immediately directed to a specified peak on the display.

To select the markers function press the [MARKERS] secondary key. This causes the 'markers' soft keys appropriate to the type of measurement selected to be displayed at the right side of the screen. When transmitter power versus time is selected the display is similar to that shown in Fig. 3-45 below.
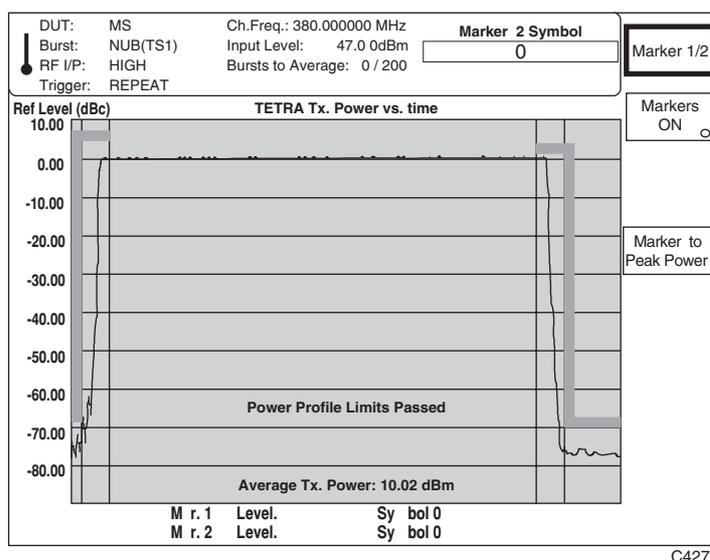
Fig. 3-45 TETRA analyzer: Selection keys displayed, MARKERS selected for a transmitter power versus time measurement

(1) Press *[Markers ON]* to toggle between enabling and disabling the markers. When ON (indicated by the key's green 'LED' being lit), the symbol position and relevant parameter values are displayed.

(2) Press *[Marker 1/2]* to toggle between selecting marker 1 and marker 2 as the active marker. The active marker number appears on the trace or symbol outlined in a box and the symbol number under the marker is shown in the input entry area at the top of the screen.

(3) Using the rotary control, move the active marker along the trace or from symbol to symbol according to the type of measurement selected. Alternatively, you can enter the symbol number using the key pad, and increment or decrement using the [⇧] or [⇩] keys.

(4) When the transmitter power versus time measurement is selected, an additional key *[Marker to Peak Power]* is displayed as shown in Fig. 3-45 above. Pressing this key moves the active marker to the position of maximum power.

(5) When modulation accuracy is selected, three additional keys *[Mkr. to Pk. Vect. Error], [Mkr. to Pk. Ampl. Error]* and *[Mkr. to Pk. Phase Error]* are displayed (see Fig. 3-46 below): these position the marker on the symbol with the peak vector, amplitude or phase error. This applies for both the polar displays and the demodulated data screens.
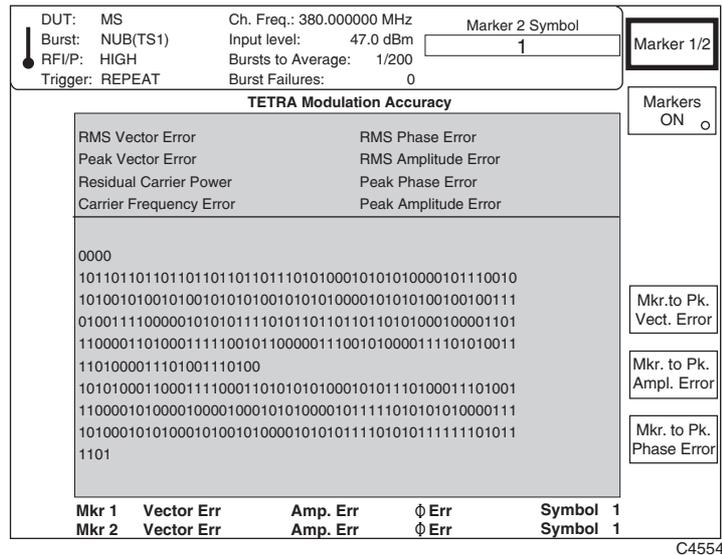
Fig. 3-46 TETRA analyzer: Selection keys displayed, MARKERS selected for a modulation accuracy measurement

(6) When auto prescan is selected, five additional soft keys are displayed (see Fig. 3-47 below). The *[Add to Spurious]* and *[Add to WB Noise]* keys insert the currently active marker frequency into the relevant (discrete spurious or wideband noise) measurement table. The *[➜]* and *[⬅]* keys display a different area of captured spectrum for investigation. The *[Marker to Peak Power]* key moves the active marker to the peak power in the part of the spectrum currently displayed; different peak powers are indicated as other parts of the spectrum are displayed.
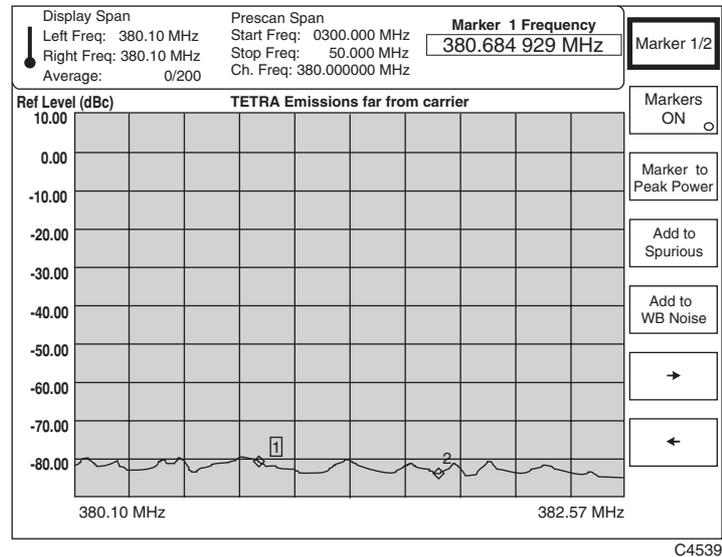
Fig. 3-47 TETRA analyzer: Selection keys displayed, MARKERS selected for an auto prescan measurement

Linearization burst emissions

Preliminary procedure

Step 1 – **Set operating mode**

Press the [TETRA] key.

Set up the device under test.

Select the burst type.

Step 2 – **Set frequency**

Set up the frequency (numeric entry, channel number or band position).

Step 3 – **Set level**

Enter nominal transmitter power (class number or value).

Step 4 – **Select measurement**

Press the [MEASURE] key.

Making the measurement

Select *[BLCH/CLCH Emissions]**, then press the [DISPLAY] secondary key. This selects the measurement mode for unwanted emissions during the BLCH/CLCH and also causes the appropriate display soft keys to be shown at the right side of the screen as in Fig. 3-48 below.

* The name of the soft key changes, depending on the device under test – *CLCH* for MS, *BLCH* for BS.
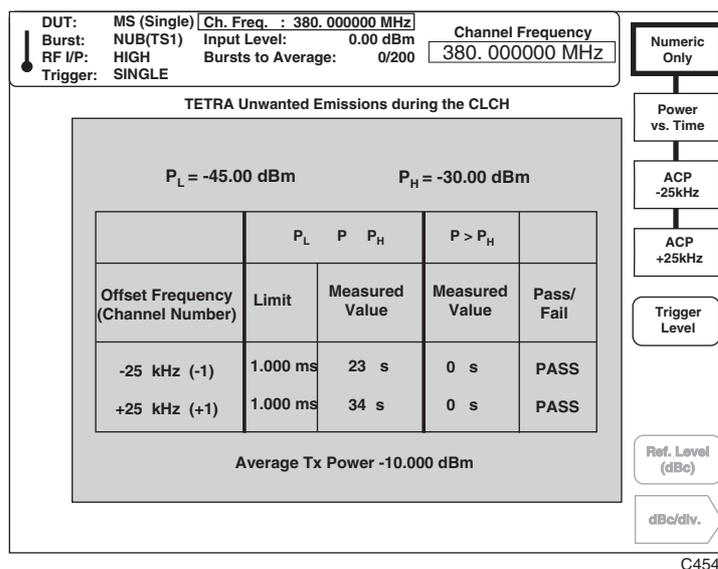
Fig. 3-48 TETRA analyzer: Numeric-only display, BLCH/CLCH Emissions selected

(1)   To display a table of unwanted emissions during the BLCH/CLCH, press *[Numeric Only]*. A display similar to that in Fig. 3-48 above is shown. Having captured the Freq burst, the instrument applies all further measurements to this particular burst.

ETS 300 394-1 specifies that the total time for which the peak power in the adjacent channel exceeds -45 dBc (P_L on the display) must not be greater than 1 ms, and that this peak power must never exceed -30 dBc (P_H on the display).

(2) To display on-channel transmitter power versus time during the Freq burst, press the *[Power vs. Time]* key. This provides a graphical representation of the numeric data, as shown in Fig. 3-49 below.

(3) Select *[Trigger Level]* and enter (using the key pad, the rotary control or [⇩] [⇧] keys), the level at which you want to begin displaying the on-channel power trace. The trigger level is shown as a red dashed line. The trigger level applies to discontinuous bursts only.
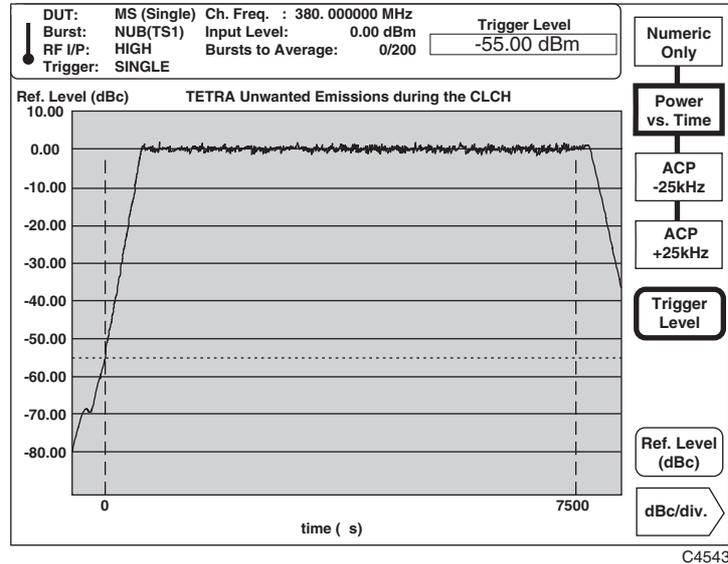
Fig. 3-49 TETRA analyzer: Spectrum display, Power vs. Time selected

(4) To display adjacent channel power versus time during the Freq burst, press either the *[ACP −25kHz]* or the *[ACP +25kHz]* key. Pressing *[ACP −25kHz]* or *[ACP +25kHz]* will display the ACP at the same instant as the last Freq burst. Press [SINGLE] to measure the Freq burst and ACP simultaneously..

The upper and lower power limits specified in ETS 300 394-1 are displayed in red as P_H and P_L, as shown in Fig. 3-50. This shows clearly the time for which the burst exceeds the lower level, and whether it exceeds the upper level.

For MS (CLCH) Freq bursts, a 7.5 ms time record is used to provide the peak adjacent power vs. time domain response; for BS (BLCH) Freq bursts, a 6.0 ms time record is used.
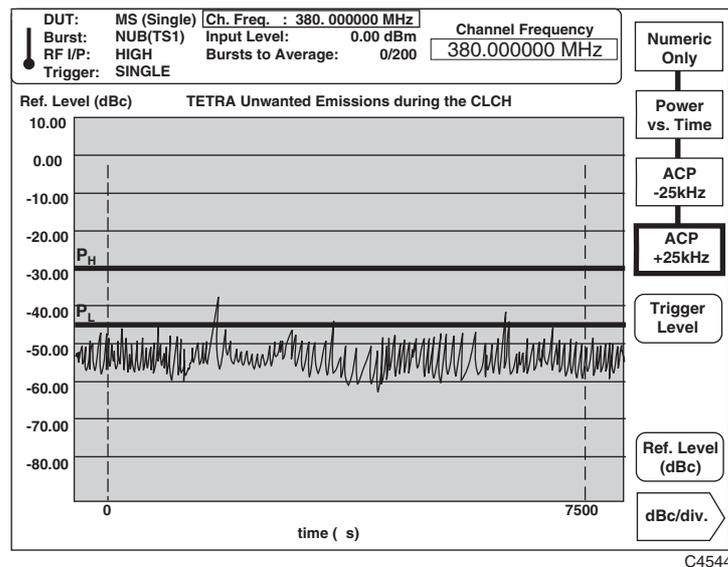
Fig. 3-50 TETRA analyzer: Spectrum display, ACP ±25 kHz selected

(5)   Select *[Ref. Level (dBc)]* and enter your selected top-of-screen reference level on the key pad to 0.01 dB resolution. *[Ref. Level (dBc)]* together with *[dB/div.]* enables you to expand or reduce the displayed signal level so as to look closer at a specific area of the burst. Terminate using the [dB] key. The reference level may also be adjusted using either the rotary control or [⇩] [⇧] keys.

(6)   You can set the dB per graticule division by pressing the *[dB/div.]* key (see 'dB/div setting' in the 'Transmitter power versus time' section).

(7)   Press *[⇧]* to return to the previously selected screen.

Note: The Freq burst occurs only when a transmitter is activated. The 2310 therefore waits for 30 seconds after the [SINGLE] key is pressed in order to allow external equipment to be activated. If no signal exceeding the trigger level appears, a 'Burst not found' message is reported after the 30 seconds pass.

Auto prescan

Preliminary procedure

Step 1 – Set operating mode

Press the [TETRA] key.

Set up the device under test.

Select the burst type.

Step 2 – Set frequency

Set up the frequency (numeric entry, channel number or band position).

Step 3 – Set level

Enter nominal transmitter power (class number or value).

Step 4 – Select measurement

Press the [MEASURE] key.

Making the measurement

Select *[Auto Prescan],* then press the [DISPLAY] secondary key. This selects the auto prescan measurement mode and also causes the appropriate display soft keys to be shown at the right side of the screen as in Fig. 3-51 below.
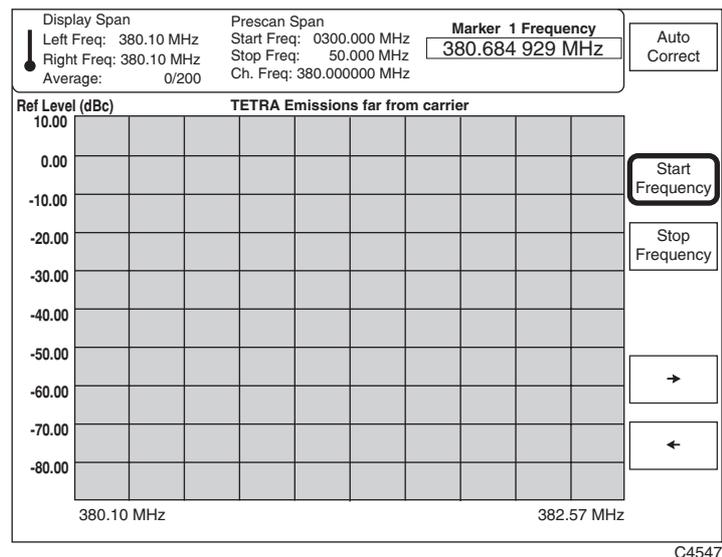
Fig. 3-51 TETRA analyzer: Spectrum display, Auto Prescan selected

(1)   Auto prescan helps the setting-up of wideband noise and discrete spurious measurements by displaying signal levels over a broad spectrum. Auto prescan is intended to assist in identifying spurii or increases in noise only, and so does not permit accurate amplitude measurements. Resolution within frb is higher than outside.

(2)   Define the beginning and end of the scan range using the *[Start Frequency]* and *[Stop Frequency]* soft keys. The start frequency must be below the center frequency, and the stop frequency above it.

Start the prescan by pressing the [SINGLE] key. After a short delay, the spectrum for the selected frequency range will be displayed, as shown in Fig. 3-52 below.
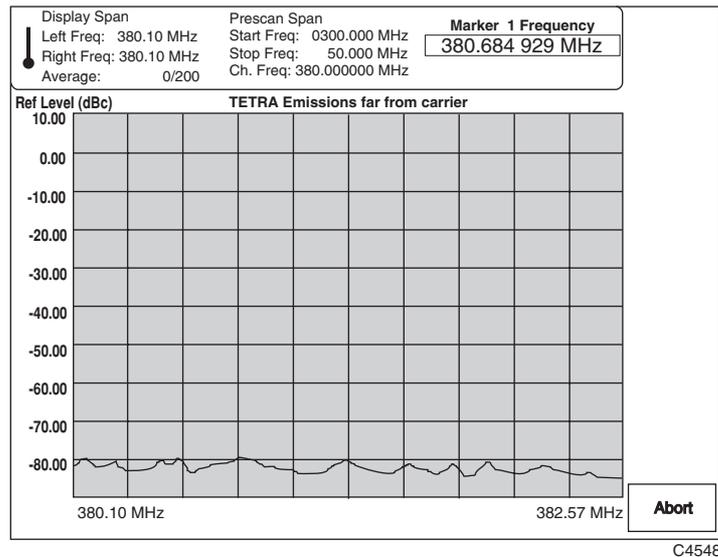
Fig. 3-52 TETRA analyzer: Auto prescan display, SINGLE pressed

(3) Whilst the measurement is taking place, other keyboard operation is disabled. The *[Abort]* key stops the measurement and returns you to the previous screen if required.

(4) The 'Left Freq' and 'Right Freq' frequencies (also repeated at the foot of the screen) show the extent of the 'window' through which you observe the captured scan. Once the measurement has finished, use the *[➡]* and *[⬅]* keys to move the window to display different areas of the captured spectrum. This technique allows high-resolution investigation.

(5) If the center frequency has been altered during another measurement, pressing the *[Auto Correct]* key automatically redefines the start and stop frequencies of the prescan so that they continue to start below, and end above, the center frequency.

(6) Using markers, you can identify and load potential discrete spurious or excessive wideband noise frequencies into the appropriate measurement tables. Refer to 'Markers' on page 3-50 for further information.

Wideband noise emissions

Preliminary procedure

Step 1 – Set operating mode

Press the [TETRA] key.

Set up the device under test.

Select the burst type.

Step 2 – Set frequency

Set up the frequency (numeric entry, channel number or band position).

Step 3 – Set level

Enter nominal transmitter power (class number or value).

Step 4 – Select measurement

Press the [MEASURE] key.

Making the measurement

Select *[Wideband Noise],* then press the [DISPLAY] secondary key. This selects the wideband noise measurement mode and also causes the appropriate display soft keys to be shown at the right side of the screen as in Fig. 3-53 below.
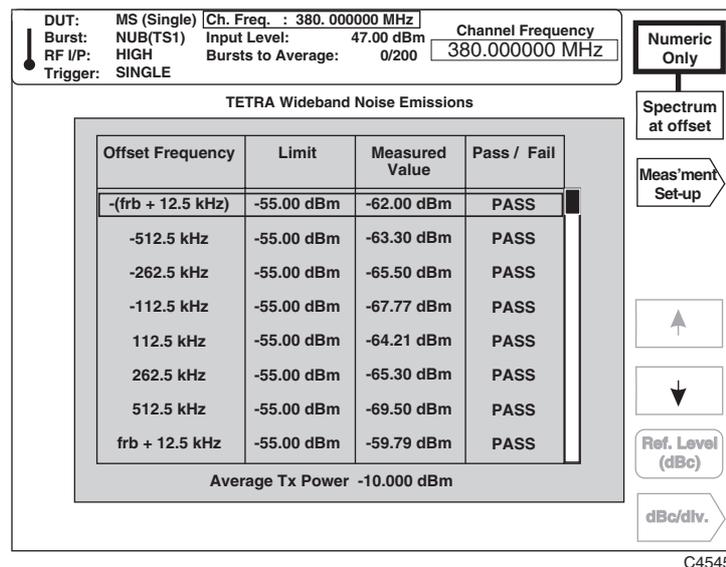
Fig. 3-53 TETRA analyzer: Numeric-only display, Wideband Noise selected

(1) To display a table of up to 20 wideband noise emissions, press *[Numeric Only]*. A display similar to that in Fig. 3-53 above is shown. These wideband emissions are modulated or unmodulated emissions occurring at offsets greater than 100 kHz from the carrier frequency. The offsets are intended to represent the center of a particular 25 kHz channel. The screen displays eight offset frequencies at a time; to scroll up and down the list press the *[↑]* and *[↓]* keys.

If no limits are specified, dashes are inserted in the *Limit* display field. frb, which represents the frequency offset corresponding to the near edge of the received band, is set at 5 MHz.

Press [SINGLE] to start a measurement and *[Abort]* to end it.

(2) ETS 300 394-1 specifies maximum allowable wideband noise levels, expressed in dBc, within particular frequency offset ranges. The instrument determines the limits appropriate to the chosen offsets and indicates (in the *Pass/Fail* column) if the measured values fall within the limits. Power is averaged over at least 20 bursts.

(3) To display the RF spectrum about the offset frequency, press the *[Spectrum at offset]* key. This provides a graphical presentation of the numeric data as shown in Fig. 3-54 below. Red markers show the power limits appropriate to the chosen offset frequencies.

Select *[Ref. Level (dBc)]* and enter your selected top-of-screen reference level on the key pad to 0.01 dB resolution. *[Ref. Level (dBc)]* together with *[dB/div.]* enables you to expand or reduce the displayed signal level so as to look more closely at a specific area. Terminate using the [dB] key. The reference level may also be adjusted using either the rotary control or [⇩] [⇧] keys.

You can set the dB per graticule division by pressing the *[dB/div.]* key (see 'dB/div setting' in the 'Transmitter power versus time' section).
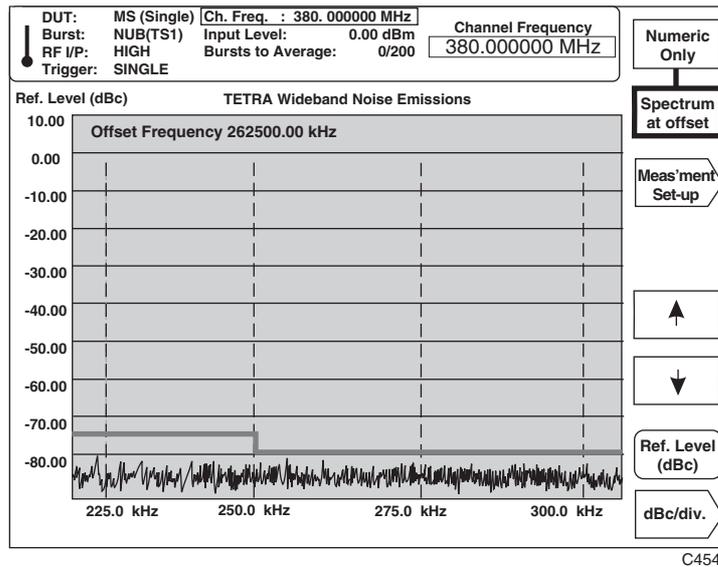
Fig. 3-54 TETRA analyzer: Spectrum display, Spectrum at offset selected

(4) Press *[Meas'ment Set-up]* to modify or remove any of the 20 offset frequencies. A display similar to that in Fig. 3-55 is shown.

Scroll up and down the list using the *[↑]* and *[↓]* keys. The currently selected frequency is shown outlined.

Delete unwanted offset frequencies using the *[Remove Offset Freq]* key.

Reinstate the last frequency removed by pressing the *[Restore Offset Freq]* key.
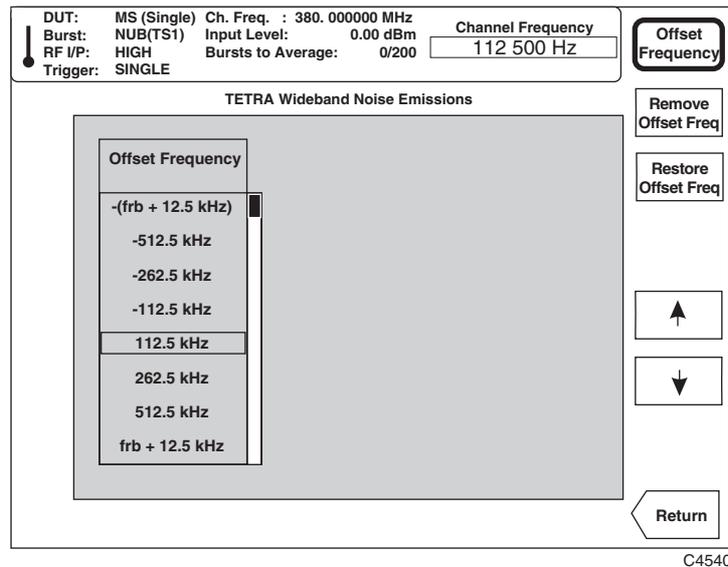
Fig. 3-55 TETRA analyzer: Display, Measurement Set-up selected

(5) To enter a new offset frequency, press the *[Offset Frequency]* key, and use the numerical key pad to set the new offset frequency (minimum offset 100 kHz), terminating the entry with the [kHz] or [MHz] hard key. The soft keys will change, as shown in Fig. 3-56.

(6) Use the *[Store Offset Freq]* key to store the new offset frequency. The instrument checks the new frequency for validity (whether it lies within the allowed range of maximum and minimum frequencies; and in the middle of a 25 kHz channel), and if valid, is saved into the table of offset frequencies. The table is adjusted so as to position new entries correctly in order of ascending frequency.
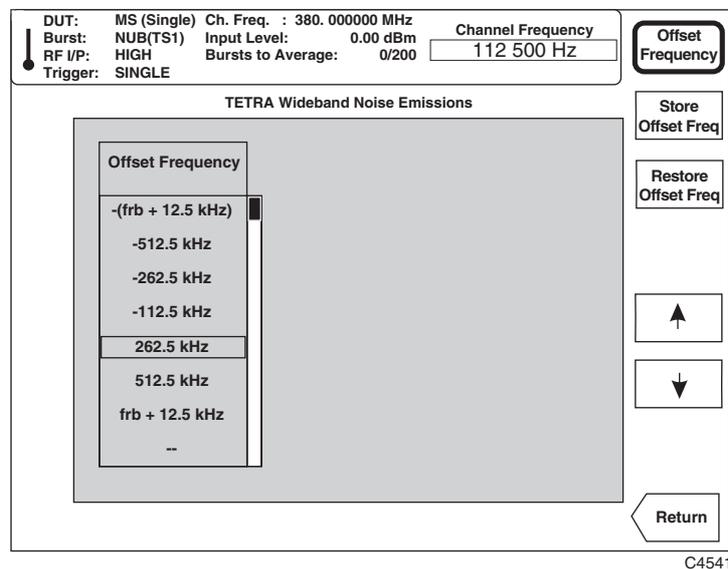
Fig. 3-56 TETRA analyzer: Display, Store Offset Frequency selected

(7) Press *[Return]* to return to the previously selected screen.

Discrete spurious noise emissions

Preliminary procedure

Step 1 – Set operating mode

Press the [TETRA] key.

Set up the device under test.

Select the burst type.

Step 2 – Set frequency

Set up the frequency (numeric entry, channel number or band position).

Step 3 – Set level

Enter nominal transmitter power (class number or value).

Step 4 – Select measurement

Press the [MEASURE] key.

Making the measurement

Select *[Discrete Spurious],* then press the [DISPLAY] secondary key. This selects the discrete spurious noise measurement mode and also causes the appropriate display soft keys to be shown at the right side of the screen as in Fig. 3-57 below.
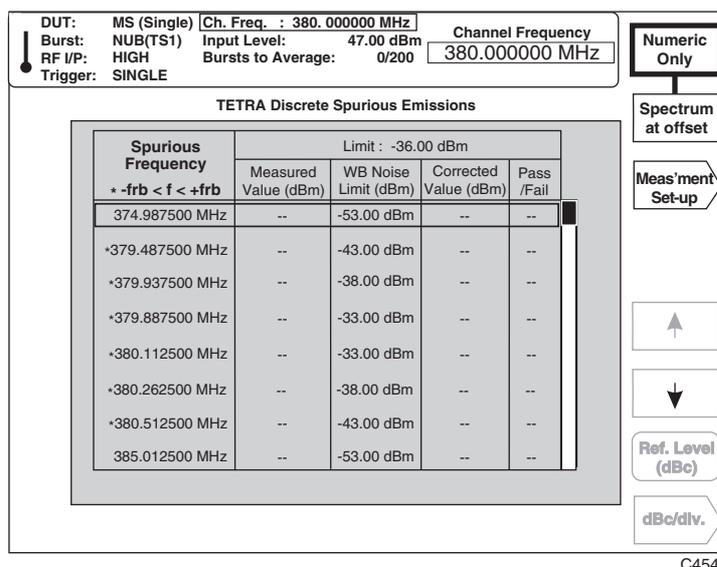
Fig. 3-57 TETRA analyzer: Numeric-only display, Discrete Spurious selected

(1) To display a table of up to 20 discrete spurious noise emission frequencies, press *[Numeric Only].* A display similar to that in Fig. 3-57 above is shown. The emissions are discrete noise emissions occurring at offsets greater than 100 kHz from the carrier frequency. The screen displays eight offset frequencies at a time; to scroll up and down the list press the *[⬆]* and *[⬇]* keys.

frb, which represents the frequency offset corresponding to the near edge of the received band, is set at 5 MHz. Frequencies which lie within frb are shown with an asterisk (*). Frequencies within frb are measured using an 18 kHz TETRA filter; frequencies outside frb are measured using a 100 kHz filter; because of this, the noise bandwidth is shown at the top of the screen, and relative power levels should not be compared directly.

If no limits are specified, dashes are inserted in the *Limit*, *WB Noise Limit (dBm)*, *Corrected Value (dBm)* and *Pass/Fail* display fields.

Press [SINGLE] to start a measurement and *[Abort]* to end it.

(2) ETS 300 394-1 specifies maximum allowable powers for discrete spurious emissions, expressed in dBc, within particular frequency offset ranges. The instrument determines the limits appropriate to the chosen offsets and indicates (in the *Pass/Fail* column) if the measured values fall within the limits. If discrete spurious noise signals exceeding −36dBm are detected, the maximum permitted wideband noise limit is taken into account to provide a corrected value. Power is averaged over at least 20 bursts.

To display the RF spectrum about a selected offset frequency, press the *[Spectrum at offset]* key. This provides a graphical presentation of the numeric data as shown in Fig. 3-58 below.
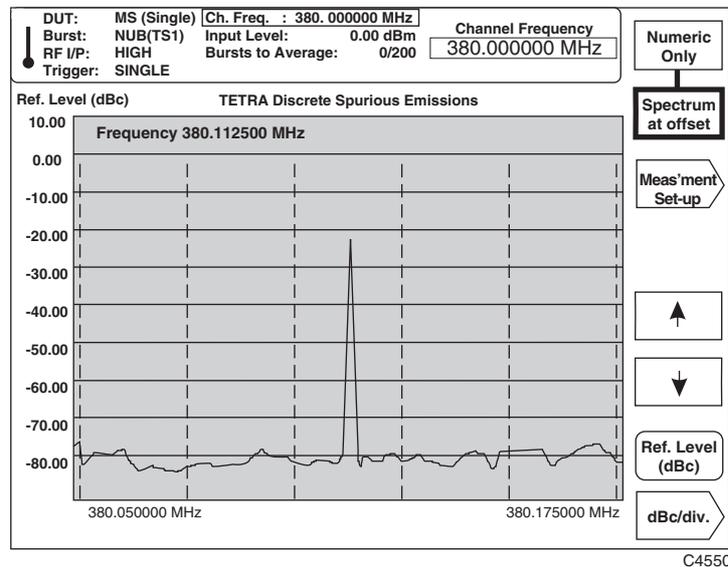
Fig. 3-58 TETRA analyzer: Spectrum display, Spectrum at offset selected

(3) kHz of frequency spectrum is displayed, with the discrete spurious frequency shown centrally on the screen. Use the *[↑]* and *[↓]* keys to display other spurious frequencies from the table − the current frequency appears at the top left corner of the screen.

(4) Select *[Ref. Level (dBc)]* and enter your selected top-of-screen reference level on the key pad to 0.01 dB resolution. *[Ref. Level (dBc)]* together with *[dB/div.]* enables you to expand or reduce the displayed signal level so as to look more closely at a specific area of the emission. Terminate using the [dB] key. The reference level may also be adjusted using either the rotary control or [⇩] [⇧] keys.

You can set the dB per graticule division by pressing the *[dB/div.]* key (see 'dB/div setting' in the 'Transmitter power versus time' section).

(5) Press *[Meas'ment Set-up]* to modify or remove any of the 20 discrete spurious noise frequencies. A display similar to that in Fig. 3-59 is shown.

Scroll up and down the list using the *[↑]* and *[↓]* keys. The currently selected frequency is shown outlined.

Delete unwanted spurious frequencies using the *[Remove Frequency]* key.

Reinstate the last frequency removed by pressing the *[Restore Frequency]* key.
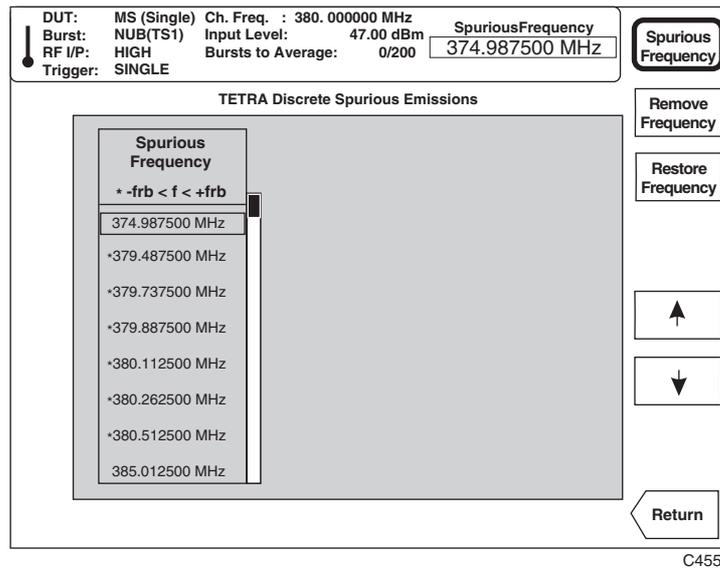
Fig. 3-59 TETRA analyzer: Display, Measurement Set-up selected

(6)   To enter a new discrete spurious frequency, press the *[Spurious Frequency]* key, and use the numerical key pad to set the new frequency, terminating the entry with the [kHz], [MHz] or [GHz] hard key. The soft keys will change, as shown in Fig. 3-60.

Use the *[Store Frequency]* key to store the new discrete spurious noise frequency. The table is adjusted so as to position new entries correctly in order of ascending frequency.
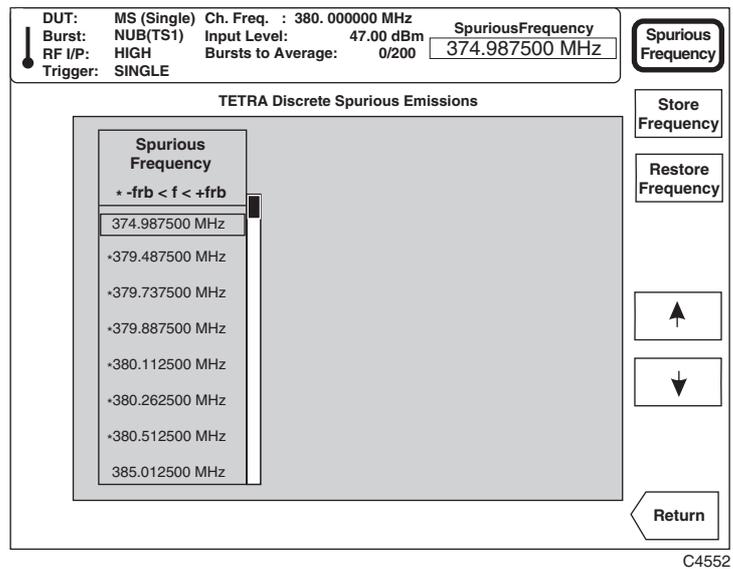
Fig. 3-60 TETRA analyzer: Display, Store Frequency selected

(7)   Press *[Return]* to return to the previously selected screen.

Intermodulation attenuation

Preliminary procedure

Step 1 – Set operating mode

Press the [TETRA] key.

Set up the device under test.

Select the burst type.

Step 2 – Set frequency

Set up the frequency (numeric entry, channel number or band position).

Step 3 – Set level

Enter nominal transmitter power (class number or value).

Step 4 – Select measurement

Press the [MEASURE] key.

Making the measurement

Select *[Intermod. Atten]*, then press the [DISPLAY] secondary key. This selects the measurement mode for intermodulation attenuation and also causes the appropriate display soft keys to be shown at the right side of the screen as in Fig. 3-61 below.
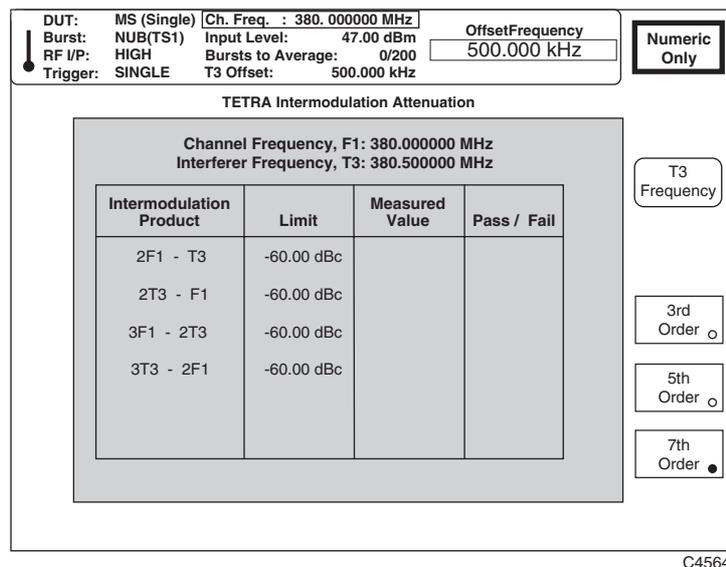
Fig. 3-61 TETRA analyzer: Numeric-only display, Intermodulation Attenuation selected

(1) Frequency T3 represents an unmodulated interfering signal which enters the transmitter via its antenna and causes intermodulation components to appear in the transmitted carrier. Fig. 3-61 above displays a table of ratios of the power level of the wanted signal to that of third-, fifth- and seventh-order intermodulation components.

Press [SINGLE] to start a measurement and *[Abort]* to end it.

ETS 300 394-1 specifies maximum allowable intermodulation attenuations for an MS, single BS, and multiple BSs (in the latter case, no interferer T3 is used). The instrument determines the limits appropriate to the chosen offsets and indicates (in the *Pass/Fail* column) if the measured values fall within the limits.

(2) Press *[3rd Order]*, *[5th Order]* and *[7th Order]* to toggle between enabling and disabling the higher-order intermodulation products. When ON (indicated by the key's green 'LED' being lit), the relevant intermodulation products and the results of the measurements are shown.

    (3)   To enter a new interferer frequency, press the *[T3 Offset]* key, and use the numerical key pad to set the new frequency, which must be offset at least 500 kHz from the carrier. Terminate the entry with the [kHz], [MHz] or [GHz] hard key.

FFT spectrum analyzer operation

Operation

For spectrum analysis the display shows a 10 x 10 graticule, with the vertical (level) axis on a logarithmic or linear scale, and the horizontal (frequency) axis on a linear scale.

To select the spectrum analyzer mode of operation, press the [SPECTRUM] primary key. This causes the spectrum analyzer screen similar to that in Fig. 3-62 below to be displayed.
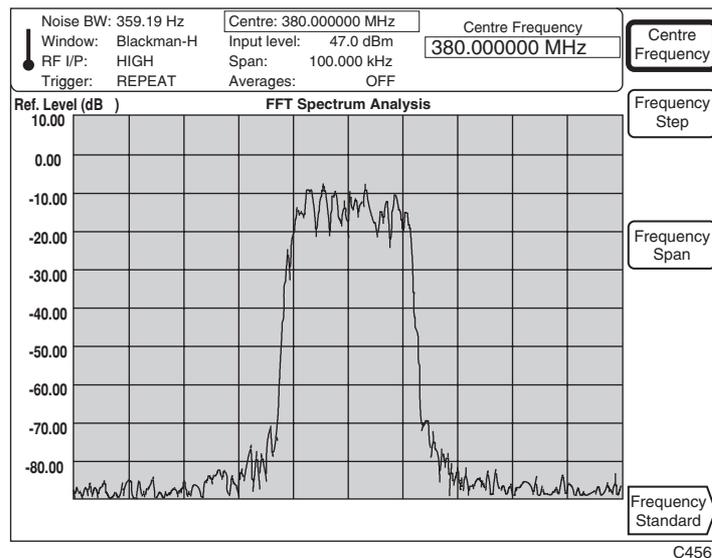
Fig. 3-62 Spectrum analyzer: Selection keys displayed, FREQ selected

Frequency

To change the center frequency or frequency span or to select the type of frequency standard, press the [FREQ] secondary key. This causes the 'frequency' soft keys to be displayed at the right side of the screen as shown in Fig. 3-62 above.

(1) To change the center frequency, press *[Centre Frequency]* which causes the current frequency to be displayed at the top of the screen. Enter your selected center frequency, in the range 100 MHz to 2.4 GHz (to 1 Hz resolution), on the key pad. Terminate using the appropriate units key.

(2) To change the increment value for the center frequency, press the *[Frequency Step]* key which causes the current step value to be displayed at the top of the screen. Enter the required step value, then terminate using the appropriate units key. When the [⇧] [⇩] keys are used, the center frequency is incremented/decremented by the specified step size. Alternatively, the center frequency can be adjusted using the rotary control. One turn of the rotary control increments/decrements the frequency by 20% of the current span setting.

(3) Select *[Frequency Span]* which causes the current frequency span to be displayed at the top of the screen. Enter your required total span on the key pad in the range 1 Hz to 330 kHz (to 1 Hz resolution). Terminate using the appropriate units key. When the [⇧] [⇩] keys are used, the frequency span is incremented/decremented in a 1, 2, 5 sequence. Alternatively, the span can be adjusted using the rotary control. One turn of the rotary control increments/decrements the frequency span by 20% of the current span setting.

(4)   Pressing *[Frequency Standard]* displays the frequency standard selection screen (see 'Frequency standard selection' below).

Frequency standard selection

To change the frequency standard press the *[Frequency Standard]* key. This causes the frequency standard selection soft keys to be displayed at the right side of the screen as shown in Fig. 3-63 below.
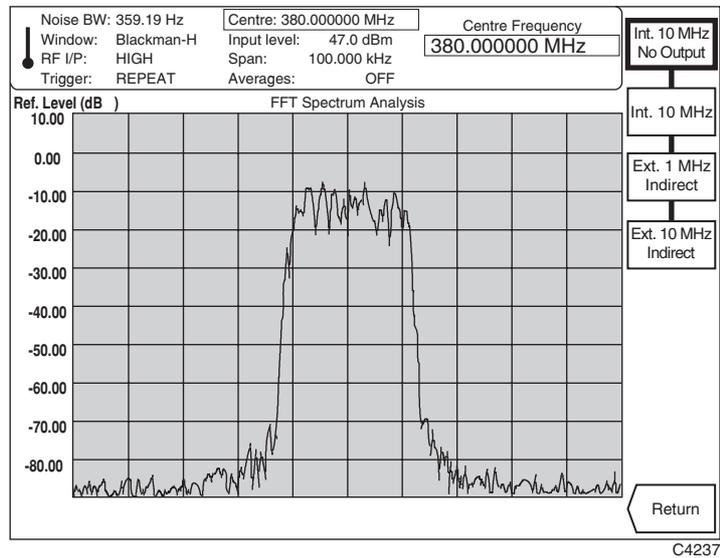
Fig. 3-63 Spectrum analyzer: Selection keys displayed, Frequency Standard selected

(1)   To select the instrument's internal standard, press the *[Int. 10 MHz]* key. When selected, the internally generated 10 MHz standard is also available from the rear panel INT STD O/P socket. To prevent output to the socket, press instead the *[Int. 10 MHz No Output]* key.

(2)   To provide an externally generated 1 or 10 MHz standard for the instrument, connect the signal to the rear panel EXT STD I/P socket, then select between *[Ext. 1 MHz Indirect]*, *[Ext. 10 MHz Indirect]* and *[Ext 10 MHz Direct]*. You should choose *Indirect* if your frequency standard accuracy is better than the internal standard, or *Direct* if your frequency standard phase noise is better than the internal standard.

(3)   Press *[Return]* to return to your previously selected screen.

Level

To control the input power level, to set the level offset of the device under test and to choose the RF input, press the [LEVEL] secondary key. This causes the 'level' soft keys to be displayed at the right side of the screen as shown in Fig. 3-64 below. Ensure that the input level is correctly set since this optimizes the input for maximum intermodulation-free dynamic range.
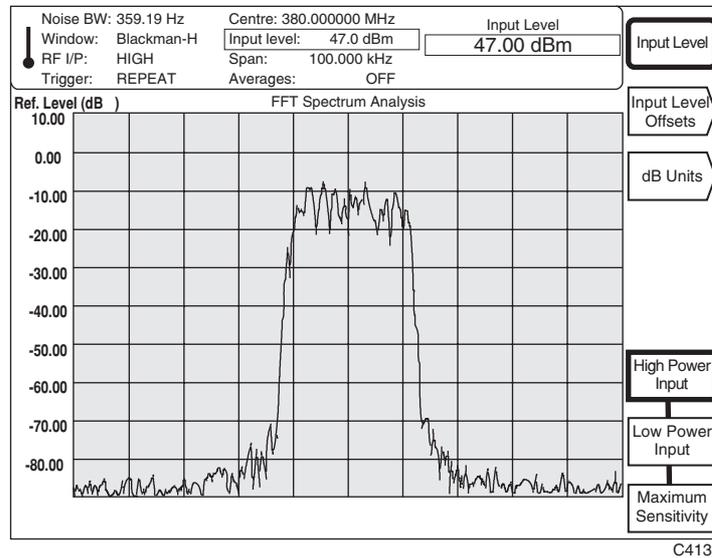
Fig. 3-64 Spectrum analyzer: Selection keys displayed, LEVEL selected

(1)   Setting the input level controls the hardware (attenuator, IF gain) settings in order that the A-to-D converter is not overloaded. To set the input level, press *[Input Level]* which causes the current input level to be displayed at the top of the screen. Enter your input signal level on the key pad in units which may be linear (µV, mV, V) or logarithmic (dB reference). Conversion between logarithmic and linear units is performed by pressing the appropriate units key (for example, to change dBm to mV press the [mV] key).

(2)   You can adjust the displayed input level by using either the rotary control or the [⇩] [⇧] keys.

(3)   Select between high-power and low-power DC-coupled RF INPUTs by pressing either the *[High Power Input]* or *[Low Power Input]* key. When the low-power input is selected a 10 dB attenuator pad is inserted to protect the internal mixer. Pressing *[Maximum Sensitivity]* selects the low-power input with no mixer protection (0 dB attenuation).

(4)   Pressing *[Input Level Offsets]* enables you to compensate for the nominal gain or loss of an external device (see 'Level offsets selection' below).

(5)   Pressing *[dB Units]* displays the 'dB units' selection keys (see 'dB units selection' below).

Level offsets selection

The RF offset facility enables you to effectively display the RF power at the output of the device under test when an external device, such as an attenuator or amplifier, is connected between the DUT and the instrument. The displayed input level does not change but the RF front-end hardware is modified to compensate for the nominal gain or loss of the external device. In addition, the facility can be used to compensate for cable loss in a test system configuration.

Pressing *[Input Level Offsets]* causes the level offset soft keys to be displayed at the right side of the screen as shown in Fig. 3-65 below.
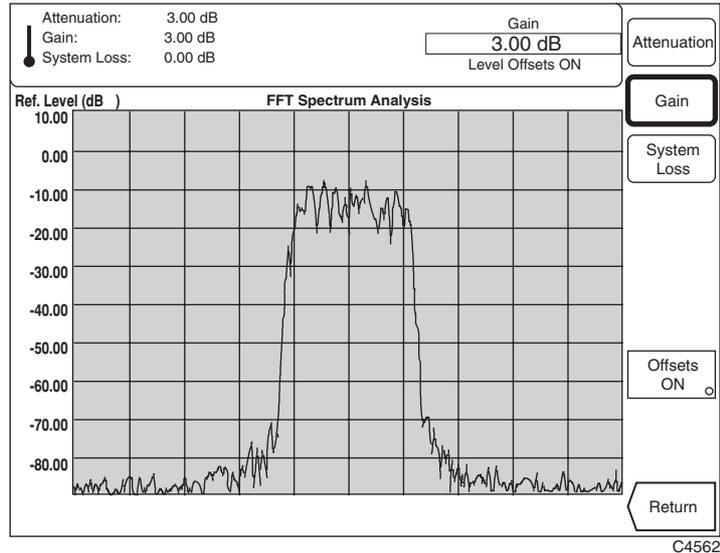
Fig. 3-65 Spectrum analyzer: Selection keys displayed, Input Level Offsets selected

(1) To enter the amount of attenuation being applied, press *[Attenuation]*, enter the value using the key pad and terminate with the [dB] key.

   When the [⇧] and [⇩] keys are used, the attenuation value is incremented/decremented in 1 dB steps for attenuator values ≥10 dB and 0.1 dB steps for attenuator values <10 dB. Alternatively, fine adjustment of the attenuation setting can be made using the rotary control. One knob click represents a change in value of 0.01 dB.

(2) To enter the amount of gain being applied press *[Gain]*, enter the value using the key pad and terminate with the [dB] key.

   When the [⇧] and [⇩] keys are used, the gain value is incremented/decremented in 1 dB steps for gain values ≥10 dB and 0.1 dB steps for gain values <10 dB. Alternatively, fine adjustment of the gain setting can be made using the rotary control. One knob click represents a change in value of 0.01 dB.

(3) To compensate for power loss through cables press the *[System Loss]* key. Enter the amount of cable loss occurring in the test configuration and terminate using the [dB] key.

(4) Press *[Offsets ON]* to enable or disable the offsets. When the key's green 'LED' is lit the offsets are being applied.

   The average transmitter power displayed is modified by the RF offsets as follows:

   Displayed average power = Measured average power + attenuation − gain + system loss.

(5) Press *[Return]* to return to your previously selected screen.

dB units selection

To select the logarithmic units press the *[dB Units]* key. This causes the dB units selection soft keys to be displayed at the right side of the screen as shown in Fig. 3-66 below.
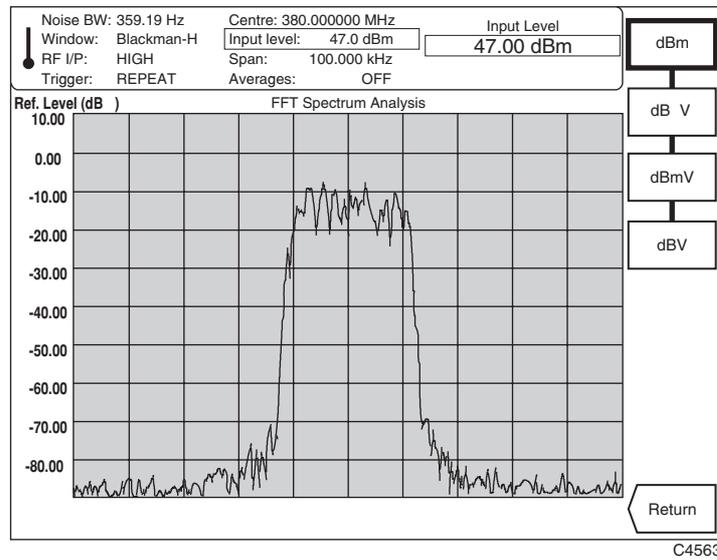
Fig. 3-66 Spectrum analyzer: Selection keys displayed, dB Units selected

(1) Choose your required logarithmic units by pressing the appropriate *[dBm], [dBmV]*, *[dBμV]* or *[dBV]* key.

(2) Press *[Return]* to return to your previously selected screen.

Measure

To select the measurement mode, press the [MEASURE] secondary key. This enables you to control the averaging process as well as to select window function. Pressing the key causes the 'measure' soft keys to be displayed at the right side of the screen as shown in Fig. 3-67 below.
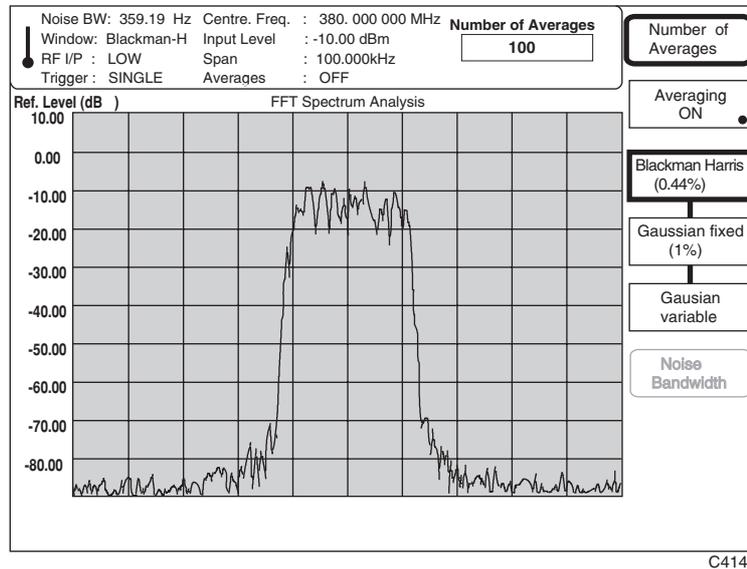
Fig. 3-67 Spectrum analyzer: Selection keys displayed, MEASURE selected

(1) You can specify the number of averages being applied to the measurement by pressing *[Number of Averages]* and entering the number on the key pad in the range 2 to 32,768 (the instrument default is 10). Terminate using any [ENTER] key.

(2) Select the type of averaging (fixed or rolling) you require using one of the following immediate keys:

[SINGLE] − The fixed number of bursts is averaged and then the measurement process is halted. The trace is updated only at the end of the averaging process. To initiate a new measurement cycle press the [SINGLE] key once again.

[REPEAT] − The displayed average is updated each time a set number of bursts (determined by the update rate of the instrument) have been received. This process is repeated until the specified number of bursts have been measured. The display is thus modified by the averaging process during successive traces.

(3) Pressing *[Averaging On]* will enable or disable the averaging process. When *On* the key's green 'LED' is lit.

(4) To select the Blackman-Harris (five-term) window function, press the *[Blackman-Harris]* key. This is usually used when a measurement requires high dynamic range. The noise bandwidth is less than or equal to 0.44% of the set span.

(5) To select the Gaussian window function, press the *[Gaussian fixed (1%)]* key. This is usually used for high amplitude accuracy measurements. The noise bandwidth is at a fixed percentage (1%) of the set span.

(6) Pressing the *[Gaussian variable]* key also selects a Gaussian window function but with the span and resolution bandwidth uncoupled. To set the noise bandwidth, press *[Noise BW]* and enter the value on the numeric key pad. Terminate using the [Hz] or [kHz] keys.

Display

To select the display mode press the [DISPLAY] secondary key. This enables you to set the top-of-screen reference, select the trace between stored and active, and select the type of format for the display. Pressing the key causes the display soft keys to be displayed at the right side of the screen as shown in Fig. 3-68 below.
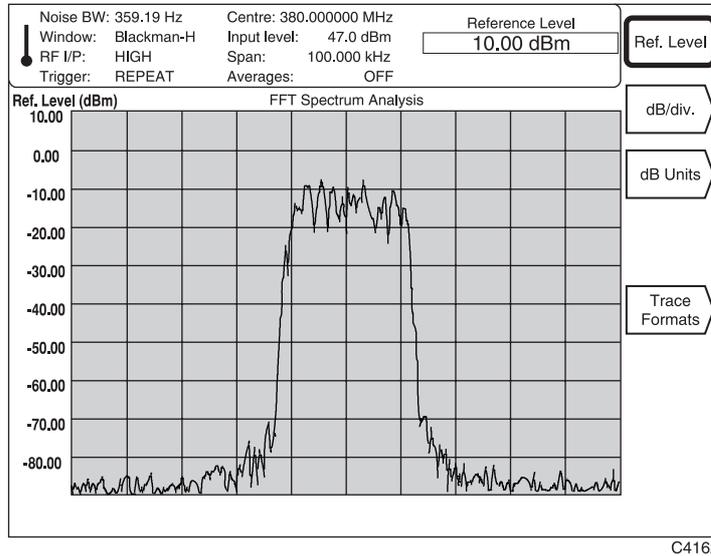
Fig. 3-68 Spectrum analyzer: Selection keys displayed, DISPLAY selected

(1)   To set the top-of-screen reference level, select *[Ref. Level]*. Enter your reference level on the key pad in units which may be linear (μV, mV, V) or logarithmic (dB reference). Conversion between logarithmic and linear units is performed by pressing the appropriate units key (for example, to change dBm to mV press the [mV] key). By specifying the top of screen in relation to the set input level, the instrument is able to analyze small signals in the presence of much larger signals without overloading the front end of the instrument. The reference level may be adjusted using either the rotary control or [⇩] [⇧] keys.

(2)   You can change the dB per graticule division by pressing the *[dB/div.]* key (see 'Setting dB/div' below).

(3)   You can change the level units by pressing *[dB Units]*. This displays the level units selection keys (see 'dB units selection' above).

(4)   Pressing *[Trace Formats]* enables you to select the type of trace as outline or infilled (see 'Trace formats' below).

dB/div setting

To change the dB/div setting for the display graticule press *[dB/div]*. This causes the dB/div selection soft keys to be displayed at the right side of the screen as shown in Fig. 3-69 below.
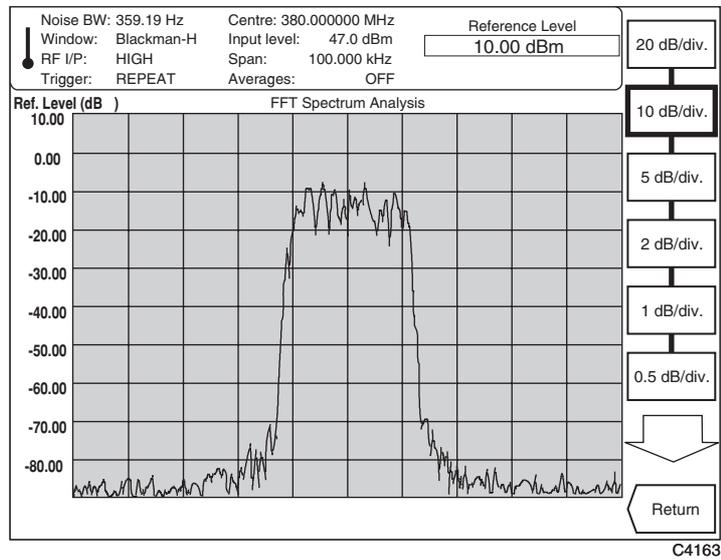
Fig. 3-69 Spectrum analyzer: Selection keys displayed, dB/div selected

(1)   Pressing the *[⇩]* key calls up a second display which extends the menu so that you can select dB/div in the range 0.01 to 20 dB/div. The keys are marked in a 1, 2, 5 multiple sequence.

(2)   Press *[Return]* to return to your previously selected screen.

Trace formats

To change the type of trace for the displayed signal press *[Trace Formats]*. This causes the trace selection soft keys to be displayed at the right side of the screen as shown in Fig. 3-70 below.

Noise BW: 359.19 Hz	Centre: 380.000000 MHz		Reference Level
Window: Blackman-H	Input level: 47.0 dBm		10.00 dBm
RF I/P: HIGH	Span: 100.000 kHz		
Trigger: REPEAT	Averages: OFF		
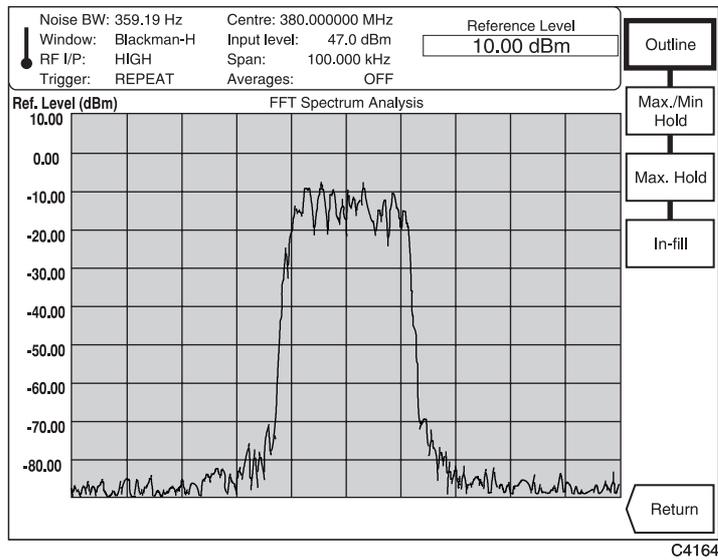
Fig. 3-70 Spectrum analyzer: Selection keys displayed, Trace Formats selected

(1) Select the type of trace using one of the following keys:

[Outline] − This is the normal trace format in which only the signal outline is displayed.

[Max./Min. Hold] − The maximum and minimum signal levels recorded at each memory location are retained for as long as this mode is selected. A shadowing effect is displayed.

[Max. Hold] − The maximum signal levels recorded at each memory location are retained for as long as this mode is selected.

[In-fill] − Either or both traces are in-filled instead of the normal outline presentation. This facility can be used to highlight the difference between the active and stored traces.

(2) Press *[Return]* to return to your last selected screen.

Markers

Using the rotary control, two markers can be independently steered across the trace providing amplitude and frequency readouts for each marker. Readouts of the difference in frequency and level between the two markers are also displayed. Additionally, by key control, a marker can be immediately directed to the peak of the largest signal on the display.

To select the markers function press the [MARKERS] secondary key. This causes the 'markers' soft keys to be displayed at the right side of the screen similar to that shown in Fig. 3-71 below.
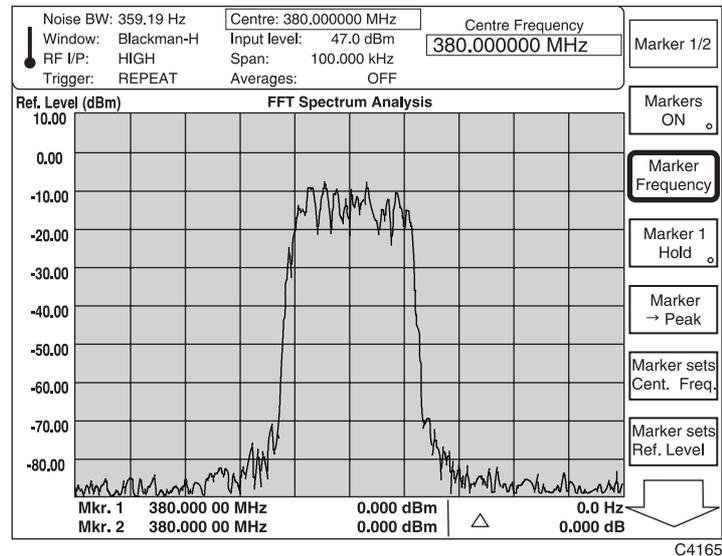
Fig. 3-71 Spectrum analyzer: Selection keys displayed, MARKERS selected

(1) Pressing *[Markers ON]* will enable or disable both markers. When *ON* (indicated by the key's green 'LED' being lit), a status table is displayed at the bottom of the screen and the marker numbers appear on the display.

(2) Pressing *[Marker 1/2]* − when enabled − toggles between selecting Marker 1 and Marker 2 as the active marker. The active marker number appears on the trace outlined in a box. Using the rotary control, you can position the active marker anywhere on the display, with the marker following the outline of the trace. The marker status table shows the frequency and level of the signal at each marker position as well as, against Δ, the absolute, unsigned, difference in both frequency and level between Marker 1 and Marker 2.

(3) To set the active marker to a specified frequency, press *[Marker Frequency]* and enter the frequency using the keypad.

(4) Pressing *[Marker 1 Hold]* locks Marker 1 to its current value, regardless of any signal change. When enabled, the key's 'LED' is lit. This function must be disabled to return to normal operation.

(5) Pressing *[Marker → Peak]* positions the active marker at the peak of the largest signal on the display.

(6) Pressing *[Marker sets Cent. Freq.]* sets the center frequency to the frequency of the active marker.

(7) Pressing *[Marker sets Ref. Level]* sets the top-of-screen reference level to the level of the active marker.

(8) Pressing the *[⤸]* key calls up a second screen (shown in Fig. 3-72) which extends the menu so that you can select the additional functions *[Markers set Span]* and *[Markers Locked]*.

(9) Pressing *[Markers set Span]* sets the frequency span to the frequency difference between Marker 1 and Marker 2.

(10) Pressing *[Markers Locked]* locks the marker spacing when the key's green 'LED' is lit. This enables ganged movement of the markers using the rotary control.

Noise BW: 359.19 Hz	Centre: 380.000000 MHz	Centre Frequency	
Window: Blackman-H	Input level: 47.0 dBm	380.000000 MHz	Marker 1/2
RF I/P: HIGH	Span: 100.000 kHz		
Trigger: REPEAT	Averages: OFF		

Mkr. 1   380.000 00 MHz   0.000 dBm   0.0 Hz
Mkr. 2   380.000 00 MHz   0.000 dBm   △   0.000 dB

C4161
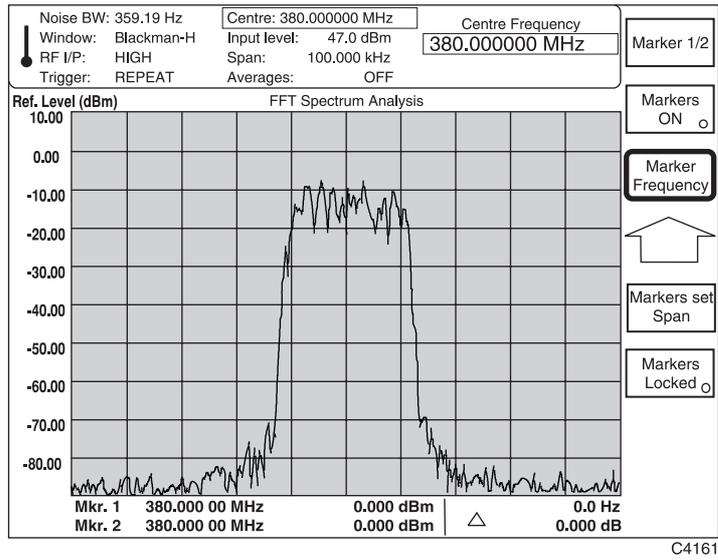
Fig. 3-72 Spectrum analyzer: Selection keys displayed, Markr. sets Parameter selected

(11) To return to the first screen press the *[⇧]* key.

Store and recall

Storing to, and recalling from, memory

The 2310 allows you to store and view up to 20 instrument configurations in named store locations. The names of stores can be edited at the time of data entry, or subsequently. You can quickly set up the instrument to replicate a stored configuration by using the memory recall function.

Selecting a store

Press the [STORE] primary key to gain access to the instrument's 'configuration storage' option. A screen similar to that in Fig. 3-73 below is displayed. This shows the status of each of the instrument's stores, numbered 1 to 20. Scroll through the table using the up/down arrow soft keys.

Against each memory number, the table provides a description of the store's contents and the date of storage. If the store contains nothing, *empty* is displayed, and two dashes appear in the 'Date Stored' column.
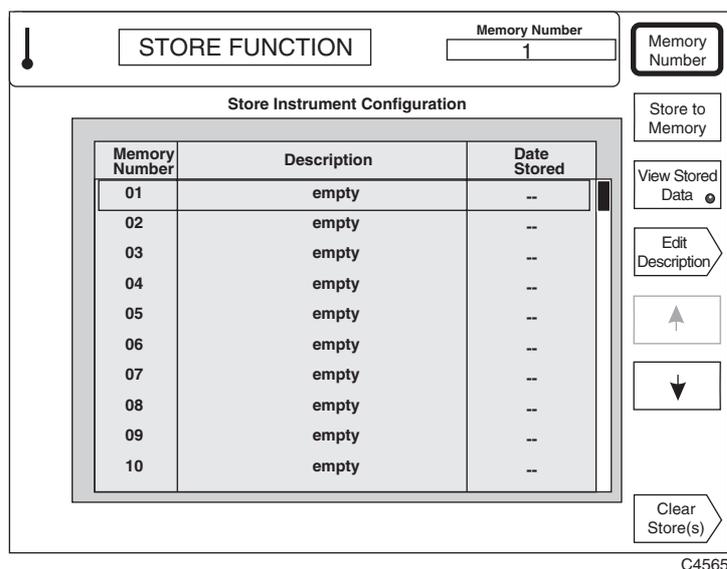
Fig. 3-73 Store instrument configuration: Top-level menu

Storing to memory

To store the current settings of the instrument, press the *[Store to Memory]* soft key. The settings are stored and the current date is added, as shown in Fig. 3-74 (the instrument's real-time clock must have been set correctly).
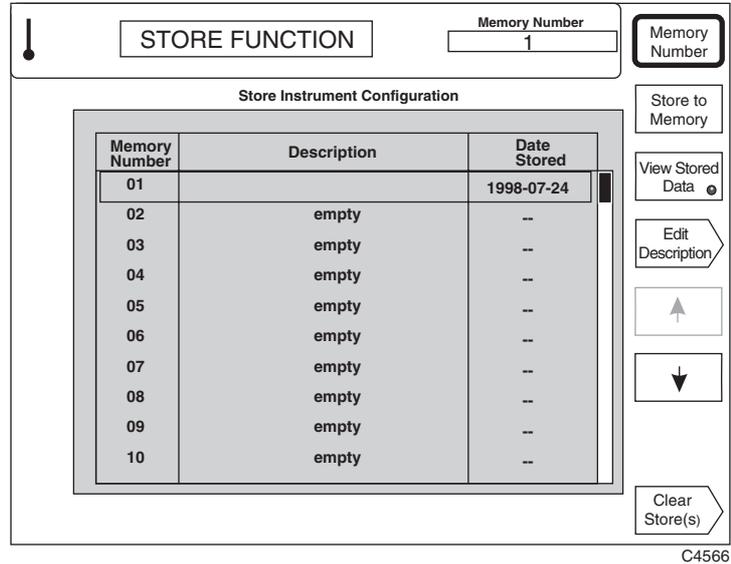
Fig. 3-74 Store instrument configuration: Storing instrument settings

Entering a store description

To enter a description for the store in which the current settings of the instrument are held, press the *[Edit Description]* soft key. An editing screen appears, as shown in Fig. 3-75. Use the rotary control to select characters from the list at the top of the screen, and enter them using the *[Insert Character]* soft key. Use the *[Insert Space]* soft key to create spaces, remove characters with the [DELETE] key, and finish by pressing any [ENTER] key.
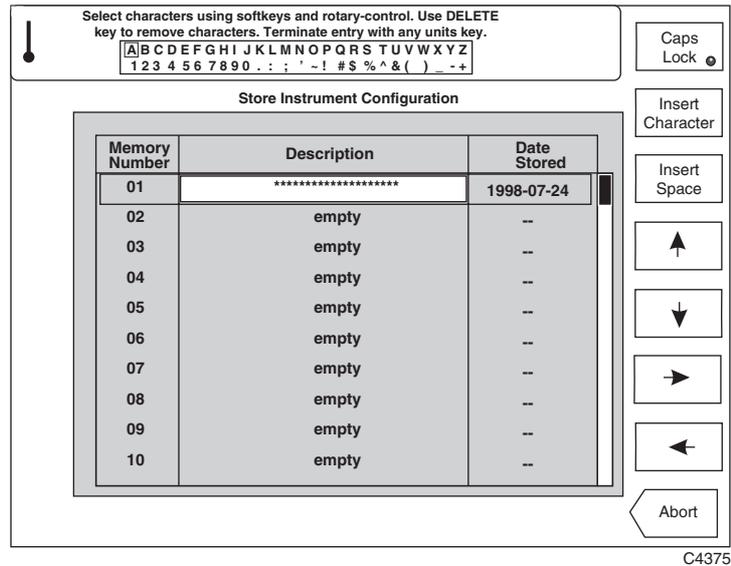
Fig. 3-75 Store instrument configuration: Description editing screen

When you press an [ENTER] key, the screen changes back to show the newly-entered description and the currently-selected memory number, as shown in Fig. 3-76.

Fig. 3-76 Store instrument configuration: Editing finished

Viewing stored settings

To view the instrument settings stored at a particular memory location, first select the location by pressing the *[Memory Number]* soft key, entering the memory location's number, and pressing any [ENTER] key. Then press the *[View Stored Data]* soft key, to display a screen similar to that shown in Fig. 3-77.

Fig. 3-77 Store instrument configuration: Viewing stored data

Editing a store description

To edit the description of the store, press the *[Edit Description]* soft key. An editing screen appears, as shown in Fig. 3-78. Use the rotary control to select characters from the list at the top of the screen, and enter them using the *[Insert Character]* soft key. Use the *[Insert Space]* soft key to create spaces, remove characters with the [DELETE] key, and finish by pressing any [ENTER] key.
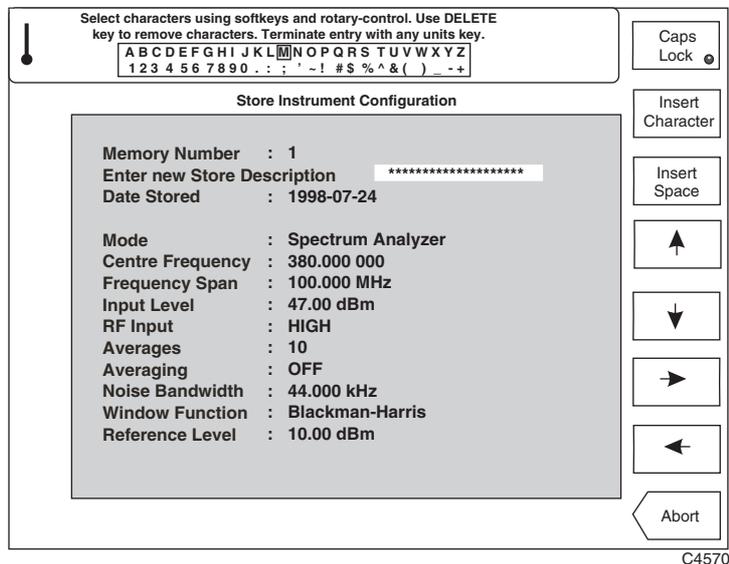
Fig. 3-78 Store instrument configuration: Editing description of store

Clearing stored configurations

It is possible to erase the contents of one or all of the stores. Press the *[Clear Stores(s)]* key, and the soft keys shown in Fig. 3-79 appear. To clear the contents of a selected store, press the *[Clear Sel'd Store]* soft key when the chosen store is displayed. To clear the contents of all the stores, press the *[Clear All Stores]* soft key.
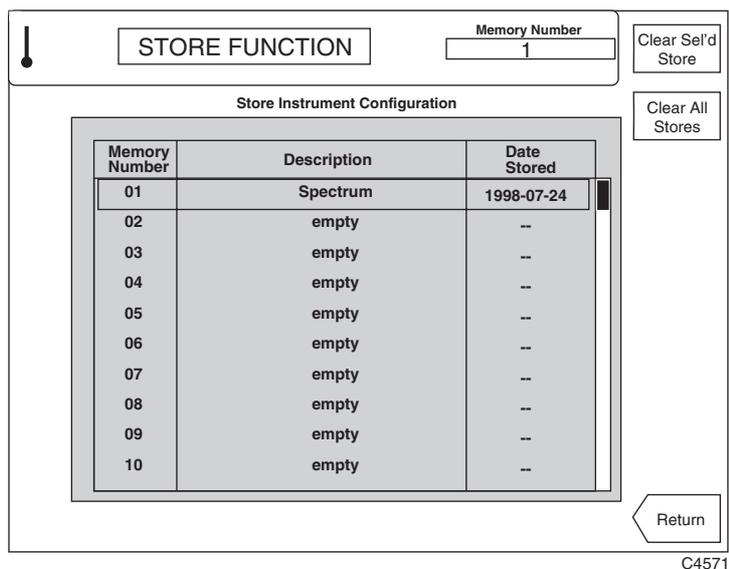
Fig. 3-79 Store instrument configuration: Clearing store contents

Pressing *[Return]* returns you to the main screen.

Recalling stored configurations

Press the [RECALL] primary key to gain access to the instrument's 'recall configuration' option. You can use this to set the instrument up quickly to replicate a previously stored configuration. A screen similar to that in Fig. 3-80 below is displayed.
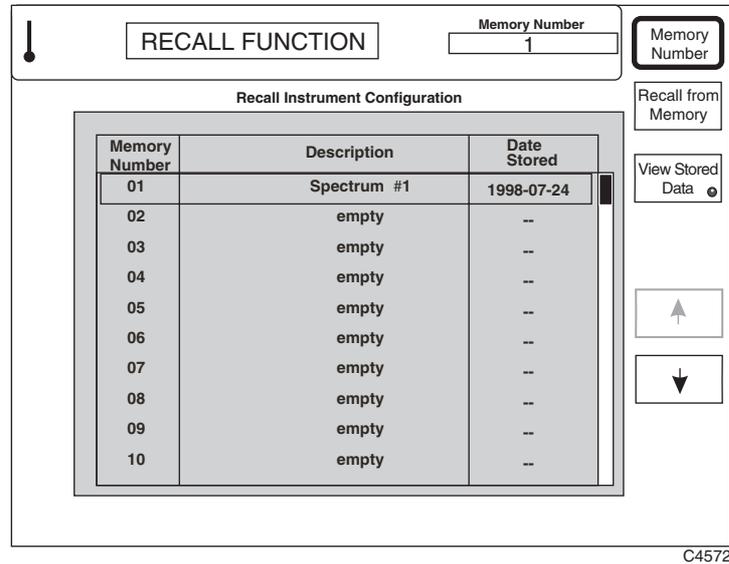
Fig. 3-80 Recall instrument configuration: Top-level menu

Viewing stored data

To look at the currently stored configurations of the instrument, select a particular store by pressing the *[Memory Number]* soft key. Press the *[View Stored Data]* soft key: a summary is given of the settings in that store, as shown in Fig. 3-81.
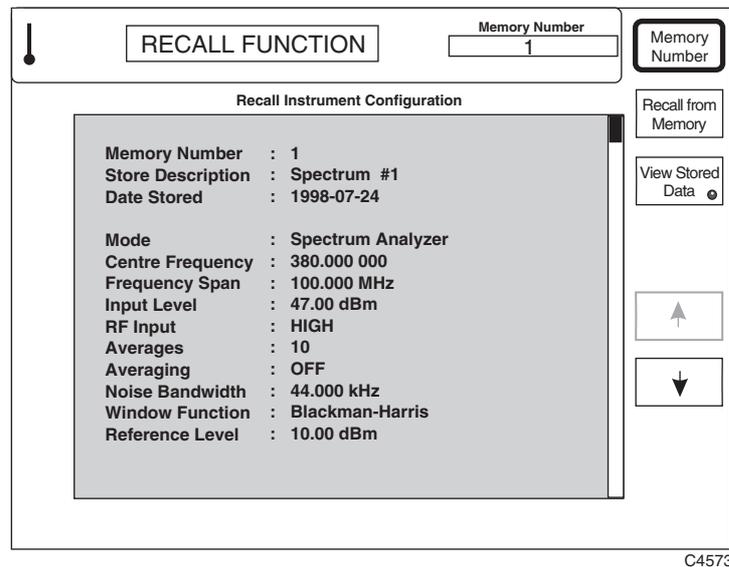
Fig. 3-81 Recall instrument configuration: Viewing instrument settings

Recalling from memory

To recall a particular configuration from memory, ensure that the chosen configuration is displayed. Press the *[Recall from Memory]* soft key; the instrument sets itself up to the displayed configuration. A message appears while this is happening, as shown in Fig. 3-82.
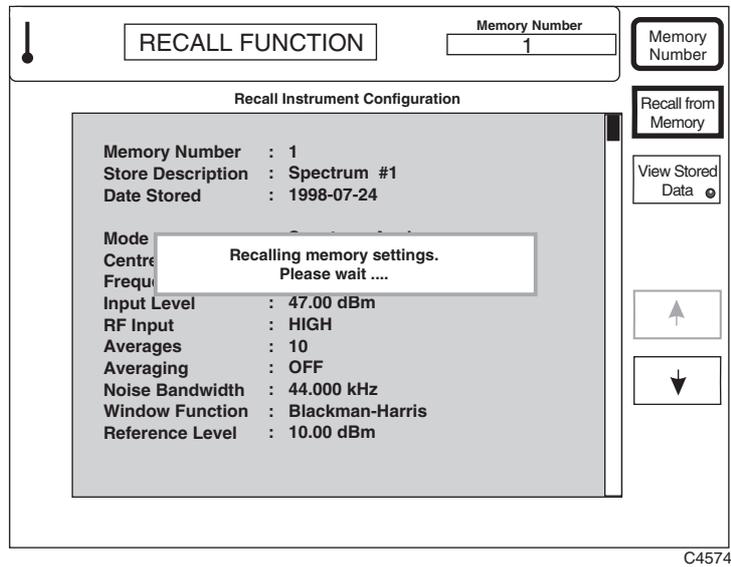
Fig. 3-82 Recall instrument configuration: Recalling a stored configuration

Utilities

Utility selection

Pressing the [UTILS] primary key gains access to the utilities options. Most of the utilities are concerned with diagnostic and maintenance functions, and their uses are therefore described in full in the maintenance manual.

Press the [UTILS] key following a power-up, and you are taken to the top-level utility access menu.

Press the [UTILS] key at any other time, and the last utility used will be recalled. A second press then takes you to the top-level utility access menu.

Utility access

This is the top-level menu which enables you to access all the other utility menus. Press the [UTILS] key (and again if necessary) until the utility access menu shown below in Fig. 3-83 is displayed.
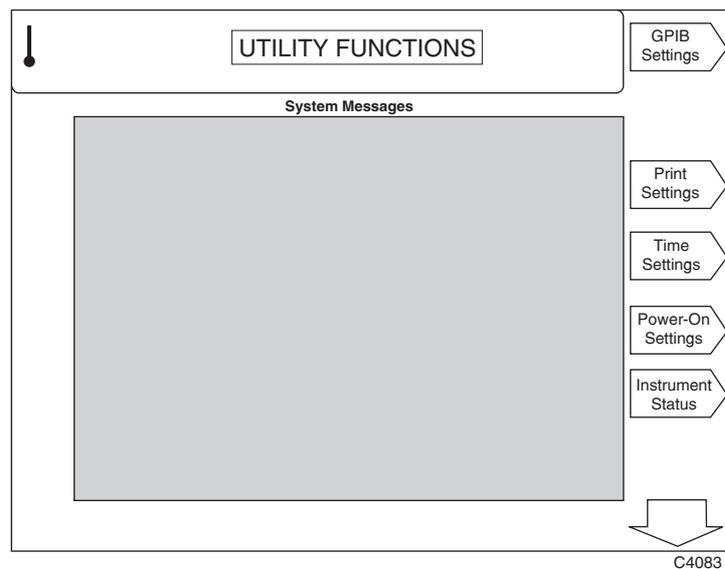
Fig. 3-83 Utilities: Utility access menu − first page

Utilities − first page

The first page of the menu is displayed together with any system messages (background error messages). Pressing *[⇩]* causes additional soft keys to be displayed on a second page.

(1) You can set up the GPIB address by pressing the *[GPIB Settings]* key (see 'GPIB settings' below).

(2) You can set the time and date by pressing the *[Time Settings]* key (see 'Time and date settings' below).

(3) You can display the instrument's status by pressing the *[Instrument Status]* key (see 'Instrument status' below).

GPIB settings

Pressing *[GPIB Settings]* causes the *GPIB Settings* menu to be displayed as shown in Fig. 3-84 below.
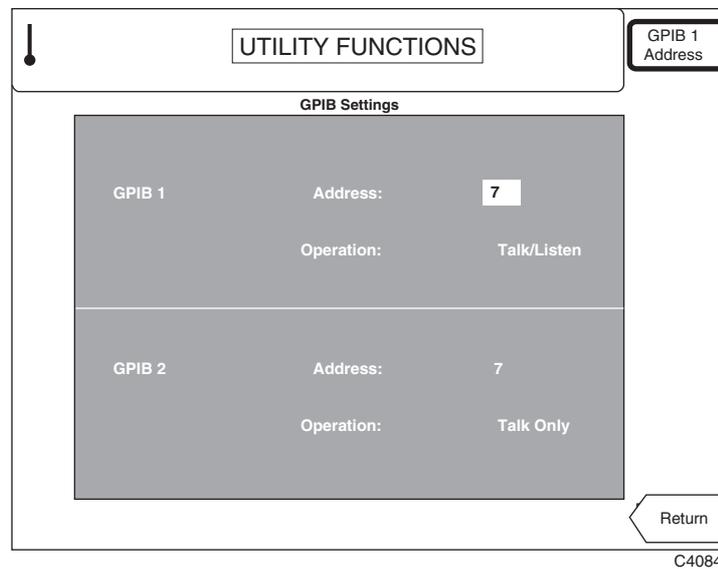
Fig. 3-84 Utilities: GPIB settings menu

(1)   Press *[GPIB 1 Address]* to enter the GPIB 1 Address which must be in the range 1 to 30. The address must be unique to the instrument.

(2)   Pressing *[Return]* returns you to the utility access menu.

Print settings

Pressing *[Print Settings]* causes the *Print Settings* menu to be displayed as shown in Fig. 3-85 below.
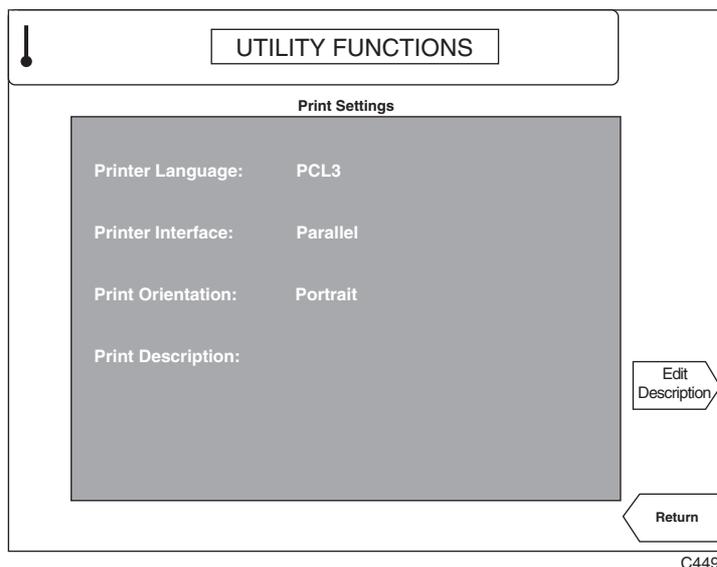
Fig. 3-85 Utilities: Print settings menu

(1)   To enter a description of the company or individual making the print, press the *[Edit Description]* soft key. An editing screen appears, as shown in Fig. 3-86. Use the rotary control to select characters from the list at the top of the screen, and enter them using the *[Insert Character]* soft key. Use the *[Insert Space]* soft key to create spaces, remove characters with the [DELETE] key, and finish by pressing any [ENTER] key. The instrument inserts the words 'Analysis by:' before the text when printing.
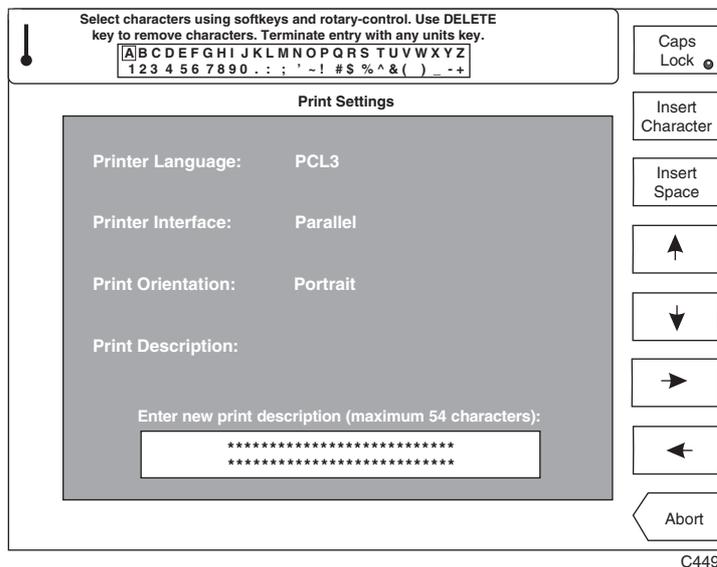
Fig. 3-86 Utilities: Print description editing screen

(2)   Pressing *[Return]* returns you to the utility access menu.

Time and date settings

Pressing *[Time Settings]* causes the *Time Settings* menu to be displayed as shown in Fig. 3-87 below.

Fig. 3-87 Utilities: Time settings menu

(1) To set the current time, press the *[Set Time]* key and enter the time in 24-hour format. Enter the time in the form HH MM; dashes are inserted automatically. Pressing any [ENTER] key starts the clock.

(2) To set the current date press the *[Set Date]* key and enter the date in the form YYYY MM DD; dashes are inserted automatically. Pressing [ENTER] causes the day to be calculated and displayed.

(3) Pressing *[Return]* returns you to the utility access menu.

Instrument status

Pressing *[Instrument Status]* causes the *Instrument Status* display to be shown as in Fig. 3-88 below. This gives important information about the instrument, including its serial and ID numbers, which you need to quote if you do not know the instrument's flash download password.
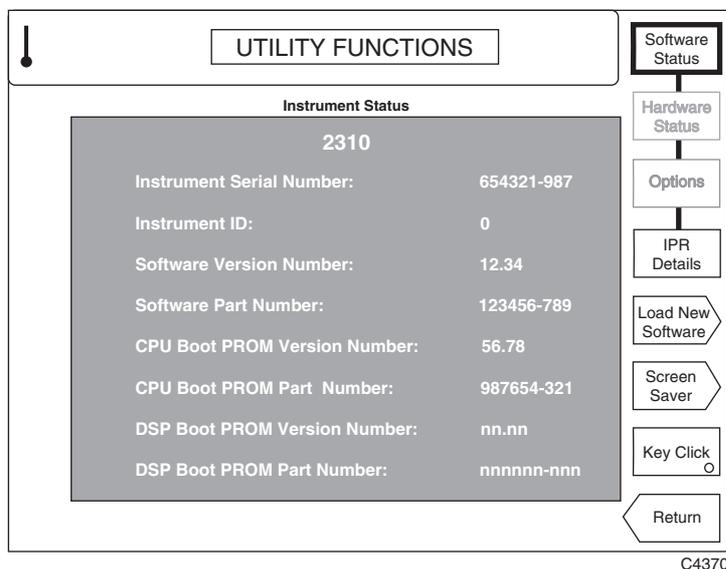
Fig. 3-88 Utilities: Instrument status

(1) To display the more important patent information press the *[IPR Details]* key. A display similar to that in Fig. 3-89 is shown.
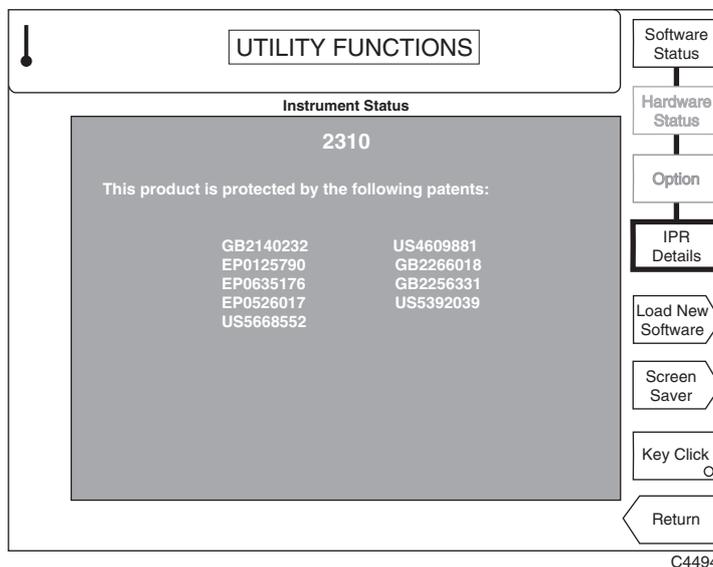
Fig. 3-89 Utilities: Patent information

(2) To install software, press *[Load New Software]*. A display similar to that in Fig. 3-90 is shown. Enter the nine-digit flash download password and then press [ENTER].

Note: If you have lost or forgotten the flash download password, contact our Customer Services department in the UK, or nearest Service Center (for address see inside rear cover). You will be asked to give the instrument's ID number (shown on the *Instrument Status* display).
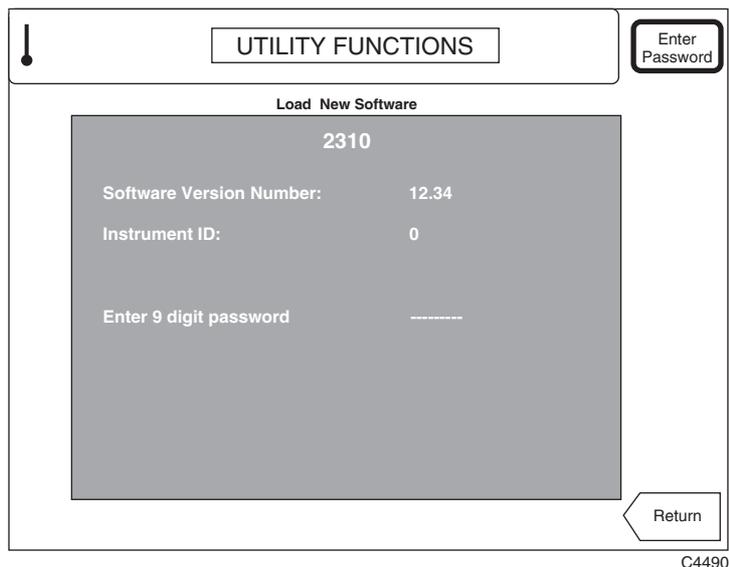
Fig. 3-90 Utilities: Load new software

The display now provides loading instructions for one or more floppy disks. Follow the instructions, or press the *[Exit]* key to end. Insert the first disk and then further disks as prompted, pressing the *[Continue]* soft key as needed. An error message is displayed if an incorrect disk is inserted.

When the disks have been read, the instrument prompts you either to load the new software into flash memory, or to exit the procedure. Press the *[Transfer to FLASH]* soft key to load the software, and when loading is finished, switch the instrument's power switch off and on again to reboot.

Caution: **Do not remove power from the instrument during the transfer to flash memory, as this can erase vital operating software.**

(3) To set up the screen saver, press the *[Screen Saver]* key. A display similar to that in Fig. 3-91 is shown.
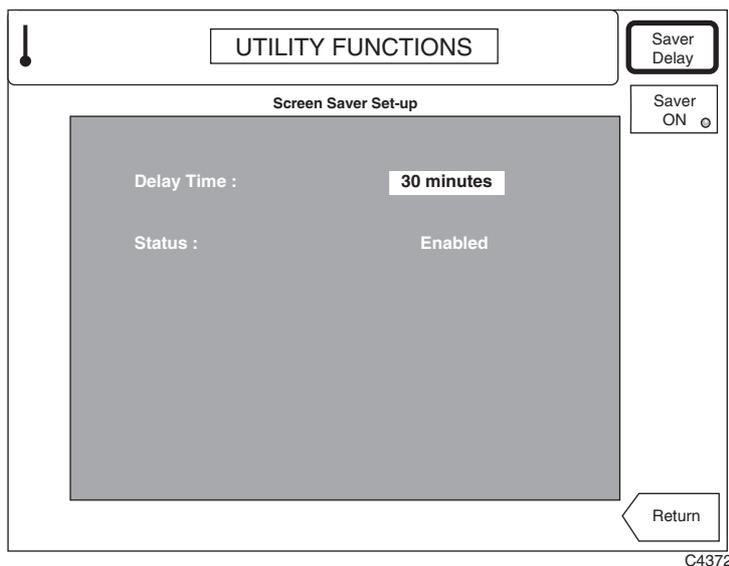
Fig. 3-91 Utilities: Screen saver set-up

(4) You can specify a time delay of between one and 30 minutes before the instrument's screen saver activates. The screen saver can be enabled or disabled using the *[Saver ON]* key: however, to maximize the life of the LCD, we recommend that the screen saver remains enabled when possible.

The screen will be blank when the screen saver is active. However, at least one of the RF INPUT LEDs remains lit to show that the instrument is active.

Press any key to reactivate the screen. That key-press is otherwise ignored by the instrument.

(5) On the instrument status screen, you can use *[Key Click]* to enable or disable a sound that is audible each time you press a key. When enabled, the key's 'LED' is lit.

(6) Pressing *[Return]* returns you to the utility access menu.

Utilities − second page

Pressing the *[⬇]* key calls up the second page of the top-level utility access menu. This extends the menu to enable access to the additional utilities shown in Fig. 3-92 below.
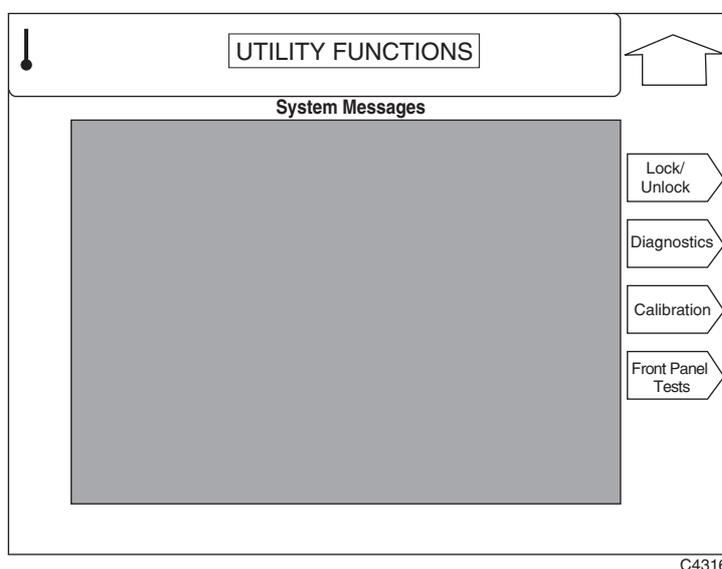
Fig. 3-92 Utilities: Utility access menu − second page

(1) You can lock or unlock the protection by pressing the *[Lock/Unlock]* key (see 'Lock/unlock' below). The operation of this menu is explained in detail in the Maintenance Manual.

(2) To select the diagnostics utilities press *[Diagnostics]*. The operation of this menu is explained in detail in the Maintenance Manual.

(3) To select the calibration utilities press *[Calibration]*. The operation of this menu is explained in detail in the Maintenance Manual.

(4) You can test for correct front panel operation by pressing the *[Front Panel Tests]* key (see 'Front panel tests' below).

(5) Pressing the *[⬆]* key returns you to the first page of the utility access menu.

Lock/unlock

With this utility you may lock the instrument to prevent unauthorized use, or unlock it to access sensitive operations such as changing memory settings, altering the instrument's calibration, and diagnostic functions. It can also be used to reset the password.

These activities are beyond the scope of this operating manual: please refer to the maintenance manual (part no. 46882-337) for further information.

Front panel tests

With this utility you can test both the functioning of the front panel controls and the operation of the display. Pressing *[Front Panel Tests]* on the utility access menu displays the front panel test screen shown in Fig. 3-93.
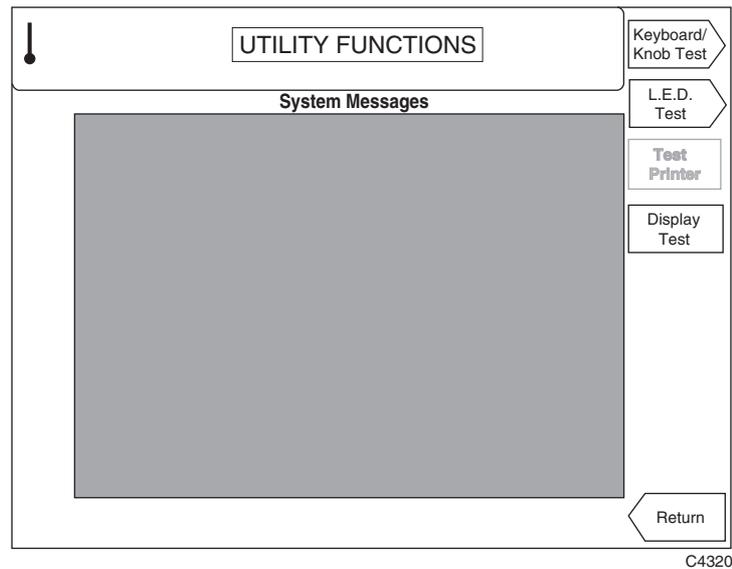
Fig. 3-93 Utilities: Front panel test screen

(1) You can test the keyboard and control knob operation by pressing the *[Keyboard/Knob Test]* key (see 'Keyboard and control knob test' below).

(2) You can test the LED operation by pressing the *[LED Test]* key (see 'Front panel LED test' below).

(3) You can test the operation of the printer by pressing the *[Test Printer]* key. A short message is output on any HP-PCL3 printer connected to the 2310's parallel port.

(4) You can test the operation of the display by pressing the *[Display Test]* key (see 'Display pixel test' below).

(5) Pressing *[Return]* returns you to the utility access menu.

Keyboard and control knob test

Pressing *[Keyboard/Knob Test]* on the front panel test menu displays the *Keyboard & Knob Test* screen similar to that shown in Fig. 3-94.
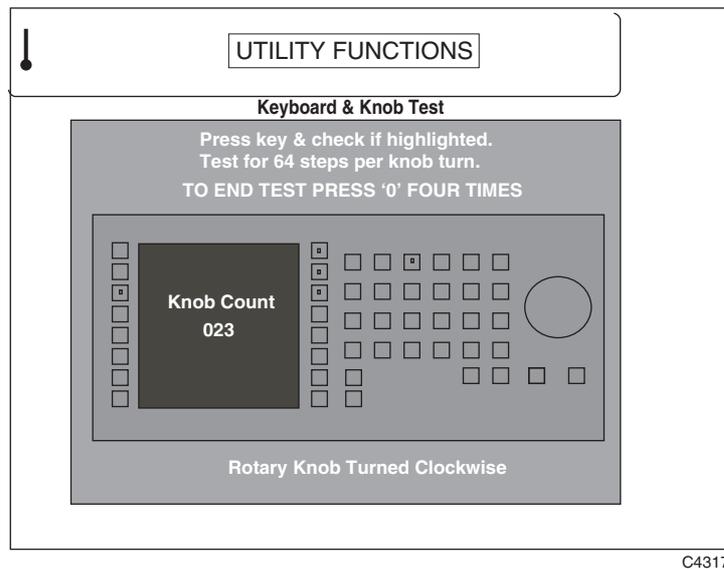
Fig. 3-94 Utilities: Keyboard and Knob Test screen

(1) Press and release each of the front panel keys (both hard and soft) in turn and check that the correct key is highlighted on the display.

(2) Turn the rotary control knob clockwise and check from the *Knob Count* shown on the screen that there are 64 steps in each complete knob turn.

(3) As instructed by the screen, press the *[0]* key four times to end the test and return to the front panel test menu.

Front panel LED test

Pressing *[L.E.D. Test]* on the front panel test menu displays the *Front Panel L.E.D. Test* screen similar to that shown in Fig. 3-95.

```
                      UTILITY FUNCTIONS

                    Front Panel L.E.D. Test

        Use SOFTKEY4 to test the front panel light- emitting diodes.

                                                        Toggle
          Each time this softkey is pressed             L.E.D.s
            they should both turn on or off.

          Both L.E.D.s should now be OFF.



                                                        Return

                                                   C4313
```
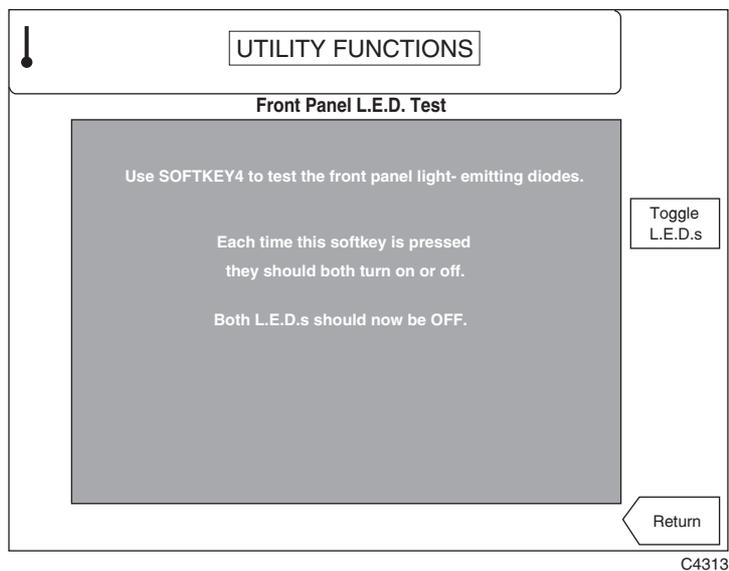
Fig. 3-95 Utilities: Front Panel LED Test screen

(1)   To test the operation of the two LEDs at the sides of the RF INPUT connectors press the *[Toggle L.E.D.s]* soft key as instructed by the screen. Both LEDs should now light up. Press again and both LEDs should now go out.

(2)   Pressing *[Return]* returns you to the front panel test menu.

Display pixel test

Pressing *[Display Test]* on the front panel test menu displays the *Display Pixel Test* screen similar to that shown in Fig. 3-96.
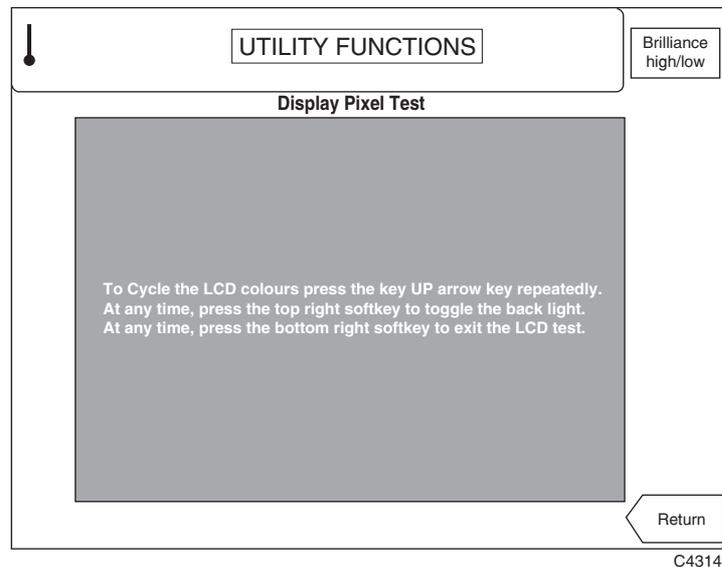
Fig. 3-96 Utilities: Display Pixel Test screen

(1)   To test the LCD colors repeatedly press the [⇧] key. Check that this causes the display to repeatedly cycle through the colors in the order red, green, blue, white, black.

(2)   To test the brilliance adjustment press the *[Brilliance high/low]* soft key. Check that repeated pressing of the key toggles the back light between high and low brilliance.

(2)   Pressing *[Return]* returns you to the front panel test menu.

Error messages

List of error messages

The following tables contain all the error messages occurring in the 2310. Negative error codes are reserved in the SCPI standard and are grouped to indicate 'generic' error conditions (for example, command errors, device-specific errors). Positive error codes indicate an error specific to 2310. An error value of zero indicates that no error has occurred.

Errors are displayed as a single line of text above the measurement display area. In order that error conditions can be monitored via the GPIB, the errors are placed into an error queue as they occur. Up to 50 error events can be retained. The queue performs a first in, first out operation. If the queue overflows, the most recent error in the queue is replaced with error

$$-350, \text{ 'Queue overflow'.}$$

Errors remain in the queue until they are read by the ERR? or :SYSTem:ERRor? query, or by the error queue being cleared by one of the following:

- power-up
- receipt of a *CLS command
- reading the last item from the queue.

In addition to the error queue entry, the appropriate bit in the Event Status Register is set.

SCPI-specific error messages

The table below contains the error code in the left column. The center column shows the associated text message. The right column provides a brief explanation as to the possible cause of the error condition.

Error code	Error text	Error explanation
0	No error	This message is output if the 2310 has no errors to report (the queue is empty).

Command error

An error number in the range −199 to −100 indicates that an IEEE 488.2 syntax error has been detected by the instrument's parser (for example, an unrecognized header). The occurrence of any error in this class causes the command error bit (bit 5) in the Event Status Register (ESR) to be set.

These errors generally occur as a result of an incorrectly-entered or invalid command. The remedy is to re-enter the command correctly. Such an error should not affect the correct operation of the instrument once the command is re-entered.

Error code	Error text	Error explanation
−100	Command error	The command is faulty or invalid. This is a generic syntax error which is only used for devices that cannot detect more specific errors.
−101	Invalid character	The command contains an invalid character e.g. '&'.
−102	Syntax error	An unrecognized command or data type was received e.g. the command contains block data which the instrument does not accept.
−103	Invalid separator	The parser was expecting a separator and encountered an illegal character e.g. a semicolon is missing after the command.
−104	Data type error	The command contains a data element different from that allowed. e.g. numeric or string data was expected but block data was encountered.
−105	GET not allowed	A Group Execute Trigger was received within a command line.
−108	Parameter not allowed	The command contains too many parameters.
−109	Missing parameter	The command contains too few parameters.
−110	Command header error	A generic error indicating that the header of the command is faulty. This error should only be used when the device cannot detect the more specific errors −111 to −119.
−111	Header separator error	The header contains an illegal separator e.g. no 'white space' followed the header.
−112	Program mnemonic too long	The header contains more than 12 characters.
−113	Undefined header	The header is syntactically correct but is not defined for the instrument.
−114	Header suffix out of range	The header contains an invalid numeric suffix e.g. TETRa2
−120	Numeric data error	A generic error indicating that the command contains a faulty numeric parameter. This error is only used when the device cannot detect the more specific errors −121 to −129.
−121	Invalid character in number	A number contains an invalid character e.g. 'A' in a decimal number or '9' in an octal number.
−123	Exponent too large	The magnitude of the exponent is greater than 32,000.
−124	Too many digits	The number includes too many digits.
−128	Numeric data not allowed	The command includes a number which is not allowed in this position.
		contd./...

Command error *(continued)*

Error code	Error text	Error explanation
−130	Suffix error	A generic error code indicating a suffix error. This error is only used when the device cannot detect the more specific errors −131 to −139.
−131	Invalid suffix	The suffix does not follow the syntax or the suffix is invalid for the instrument.
−134	Suffix too long	The suffix contains more than 12 characters.
−138	Suffix not allowed	A suffix was detected after a numeric element which does not allow suffixes.
−140	Character data error	A generic error code indicating an invalid text parameter. This error is only used when the device cannot detect more specific errors −141 to −149.
−141	Invalid character data	The text parameter either contains an invalid character or it is invalid for the command sent.
−144	Character data too long	The text parameter contains more than 12 characters.
−148	Character data not allowed	A text parameter is not allowed for the command or at the position in the command.
−150	String data error	A generic error code indicating a invalid string. This error is only used when the device cannot detect more specific errors −151 to −159.
−151	Invalid string data	A string data element was expected, but was invalid for some reason e.g. an END message was received before the terminal quote character.
−158	String data not allowed	The command contains a valid string at a position which is not permitted.
−160	Block data error	A generic error code indicating a faulty block data. This error is only used when the device cannot detect more specific errors −161 to −169.
−161	Invalid block data	A block data element was expected, but was invalid for some reason e.g. an END message was received before the block length was satisfied.
−168	Block data not allowed	The command contains valid block data at a position which is not permitted.
−170	Expression error	A generic error code indicating an invalid mathematical expression. This error is only used when the device cannot detect more specific errors −171 to −179.
−171	Invalid expression	The command contains an invalid mathematical calculation e.g. due to an illegal character.
−178	Expression data not allowed	A valid mathematical expression was encountered at an incorrect parsing level.
−180	Macro error	A generic error code indicating either an incorrect macro definition or incorrect execution of a macro. This error is only used when the device cannot detect more specific errors −181 to −189.
−181	Invalid outside macro definition	A macro parameter placeholder was encountered outside a macro definition.
−183	Invalid inside macro definition	A macro definition is syntactically incorrect.
−184	Macro parameter error	A command inside the macro definition has either the incorrect number or type of parameters.

Execution error

An error number in the range −299 to −200 indicates an error on the execution of a command (for example, the parameter value specified lies outside the range of the instrument). The occurrence of any error in this class causes the execution error bit (bit 4) in the Event Status Register (ESR) to be set.

These errors generally occur as a result of asking the instrument to carry out a command which it is incapable of performing (for example, to make a measurement outside its specification limits), or of asking the instrument to perform an invalid combination of commands. Such an error should not affect the correct operation of the instrument once the cause is removed.

Error code	Error text	Error explanation
−200	Execution error	A generic error code indicating an error on execution of the command. This error is only used when the device cannot detect more specific errors.
−201	Invalid while in local	The command is not executable while the device is in local due to a hard local control.
−202	Setting lost due to rtl	A setting associated with hard local control was lost when a Return To Local was performed.
−203	Command protected	A valid command or query could not be executed because it was password protected.
−210	Trigger error	An error occurred on triggering the device.
−211	Trigger ignored	A Group Execute Trigger or *TRG was ignored because of device timing considerations e.g. the device was not ready to respond.
−212	Arm ignored	An arming signal was ignored.
−213	Init ignored	Measurement initialization was ignored as another measurement was already in progress.
−214	Trigger deadlock	The trigger source for measurement initiation is set to GET and a subsequent measurement query is received. The measurement cannot be started until a GET is received, but the GET would cause an INTERRUPTED error.
−215	Arm deadlock	The arm source for measurement initiation is set to GET and a subsequent measurement query is received. The measurement cannot be started until a GET is received, but the GET would cause an INTERRUPTED error.
−220	Parameter error	A generic error code indicating that the command contains a faulty or invalid parameter. This error is only used when the device cannot detect more specific errors −221 to −229.
−221	Setting conflict	There is a conflict between the setting of the parameter and the instrument state.
−222	Data out of range	Valid program data was received but the parameter value lies outside the range of the instrument.
−223	Too much data	The command contains too much data for the instrument.
−224	Illegal parameter value	The parameter value is invalid.
−225	Out of memory	The instrument has insufficient memory to perform the requested operation.
−226	Lists not same length	Attempted to use LIST structure having individual LISTs of unequal length.
−230	Data corrupt or stale	The data is incomplete or invalid.
−231	Data questionable	The measurement accuracy is suspect.
		contd./...

Execution error *(continued)*

Error code	Error text	Error explanation
−232	Invalid format	
−233	Invalid version	
−240	Hardware error	A generic error code indicating that the command could not be executed due to instrument hardware problems. This error is only used when the device cannot detect more specific errors −241 to −249.
−241	Hardware missing	A valid command could not be executed because of missing hardware e.g. option not installed.
−250	Mass storage error	A generic error code indicating that a mass storage error occurred. This error is only used when the device cannot detect more specific errors −251 to −259.
−251	Missing mass data	A valid command could not be executed because of missing mass storage e.g. option not installed.
−252	Missing media	A valid command could not be executed because of missing media e.g. no floppy disk installed.
−253	Corrupt media	A valid command could not be executed because of corrupt media e.g. bad or wrongly formatted floppy disk.
−254	Media full	A valid command could not be executed because the media are full e.g. no room on the floppy disk.
−255	Directory full	A valid command could not be executed because the media directory is full.
−256	File name not found	A valid command could not be executed because the filename could not be found on the media.
−257	File name error	A valid command could not be executed because of an incorrect filename e.g. an attempt was made to copy to a duplicate filename.
−258	Media protected	A valid command could not be executed because the media were protected e.g. the write protect tab on a floppy disk was present.
−260	Expression data	A generic error code indicating that the expression contains an error. This error is only used when the device cannot detect more specific errors −261 to −269.
−261	Math error in expression	A syntactically correct expression contains a mathematical error e.g. divide by zero
−270	Macro error	A generic error code indicating that an error occurred on the execution of a macro. This error is used only when the device cannot detect more specific errors −271 to −279.
−271	Macro syntax error	The macro definition contains a syntax error.
−272	Macro execution error	The macro definition contains an error.
−273	Illegal macro label	An illegal macro label is defined in the *DMC command e.g. label is too long or is the same as a common command header.
−274	Macro parameter error	The macro definition improperly uses a macro parameter placeholder.
−275	Macro definition too long	The macro definition is too long for the instrument.
−276	Macro recursion error	The command sequence defined in a macro is trapped in a program loop.
		contd./...

Execution error *(continued)*

Error code	Error text	Error explanation
−277	Macro redefinition not allowed	The macro label defined in the *DMC command is already defined.
−278	Macro header not found	The macro label in the *GMC? Query is not defined.
−280	Program error	A generic error code indicating that a downloaded program-related execution error has occurred. This error is only used when the device cannot detect more specific errors −281 to −289.
−281	Cannot create program	The program cannot be created possibly due to insufficient memory.
−282	Illegal program name	The name of the program is invalid possibly due to redefining an existing program.
−283	Illegal variable name	The variable does not exist in the program.
−284	Program currently running	The command is not permitted while the program is running e.g. deleting a program currently in progress.
−285	Program syntax error	The downloaded program contains a syntax error.
−286	Program runtime error	
−290	Memory use error	A user request has directly or indirectly caused an error related to memory.
−291	Out of memory	
−292	Referenced name does not exist	
−293	Referenced name already exists	
−294	Incompatible type	The type of structure of a memory is inadequate.

Device-specific error

An error number in the range −399 to −300 indicates that the instrument has detected some device operation which did not properly complete (for example, due to an abnormal hardware or firmware condition). The occurrence of any error in this class causes the device-specific error bit (bit 3) in the Event Status Register (ESR) to be set.

Such an error indicates a hardware or firmware problem, either in the instrument or in connected cables or peripheral devices. If the problem is in the instrument, and you cannot resolve it, please contact your nearest Service Center.

Error code	Error text	Error explanation
−300	Device-specific error	A generic error code indicating that a device-dependent error has occurred. This error is used only when the device cannot detect more specific errors.
−310	System error	A device-specific error termed 'system error' has occurred.
−311	Memory error	An error in the instrument memory has occurred.
−312	PUD memory lost	The Protected User Data saved by the *PUD command has been lost.
−313	Calibration memory lost	Non-volatile calibration data used by the *CAL? Command has been lost.
		contd./...

Device-specific error *(continued)*

Error code	Error text	Error explanation
−314	Save/recall memory lost	Non-volatile data saved by the *SAV command has been lost.
−315	Configuration memory lost	Non-volatile configuration data saved by the instrument has been lost.
−320	Storage fault	
−321	Out of memory	An internal operation required more memory than was available.
−330	Self-test failed	
−340	Calibration failed	
−350	Queue overflow	This error code is inserted in the error queue in place of the actual error code. This code indicates that the queue is full and that an error occurred but was not recorded.
−360	Communication error	A generic error code indicating that an instrument communication error occurred. This error is used only when the device cannot detect more specific errors −261 to −269.
−361	Parity error in program message	Parity bit not correct when data received e.g. on the serial port.
−362	Framing error in program message	No stop bit detected when data received e.g. a baud rate mismatch on the serial port.
−363	Input buffer overrun	Software or hardware buffer on serial port overflows due to incorrect pacing.

Query error

An error number in the range −499 to −400 indicates that a data request error has been detected (for example, an attempt is being made to read data from the output queue when no output data is available). The occurrence of any error in this class causes the query error bit (bit 2) in the Event Status Register (ESR) to be set.

Such an error occurs as a result of requesting a reading back over the GPIB when a fault exists in the programming or execution of the command. Such an error should not affect the correct operation of the instrument once the cause is removed.

Error code	Error text	Error explanation
−400	Query error	A generic error code occurs when data is requested using a query. This error is used only when the device cannot detect more specific errors.
−410	Query INTERRUPTED	The query has been interrupted.
−420	Query UNTERMINATED	The query is incomplete.
−430	Query DEADLOCK	The query cannot be processed. Both the input and output buffers are full, so preventing the continuation of the operation.
−440	Query UNTERMINATED after indefinite response	A query is in the same command line as a query requesting an indefinite response.

Instrument-specific error messages

An positive error number ≥5000 indicates that a error condition has occurred which is specifically related to the 2310. The occurrence of any error in this class causes the device-specific error bit (bit 3) in the Event Status Register (ESR) to be set.

Such errors indicate a fault within the instrument. It may be possible to resolve this by re-calibrating the instrument (refer to the maintenance manual). If this is not possible, please contact your nearest Service Center.

Error code	Error text	Error explanation
5000	EEPROM Failure	CPU is unable to communicate with its EEPROM.
5001	EEPROM Checksum	Calibration data in EEPROM incomplete or corrupted.
5020	High Power Attenuator too Hot	Cal & control board reported input power attenuator too hot.
5021	Over Power Protection Trip	Cal & control board reported input power attenuator too high.
5022	LO Fractional-N Out of Lock	Fractional-N chip on LO board failing to lock to set frequency.
5023	LO Fractional-N Loop Low	LO board reported fractional-N frequency too low.
5024	LO Fractional-N Loop High	LO board reported fractional-N frequency too high.
5025	LO VCXO Loop Low	LO board reported voltage controlled loop too low.
5026	LO VCXO Loop High	LO board reported voltage controlled loop too high.
5027	LO Output Unleveled	LO board reported its output unleveled.
5028	LO Filter Output Low	LO board reported its voltage tune filter output too low.
5029	LO VCO Calibration Failed	VCO synthesizer calibration on LO board failed.
5030	LO VTF calibration Failed	VTF synthesizer calibration on LO board failed.
5031	Digital IF VCXO Loop High	Digital IF board reported VCO too high.
5032	Digital IF VCXO Loop Low	Digital IF board reported VCO too low.
5033	Digital IF Overload	Digital IF board reported its input signal too high.
5034	External Standard Failure	External standard at rear of instrument failed or missing.
5035	External Freq. Standard High	External standard frequency too high.
5036	External Freq. Standard Low	External standard frequency too low.
5037	DSP Communication Failure	DSP is not responding to commands from the CPU.
5038	Calibration Signal Failure	Internal calibrator signal was not available during a calibration.
5039	User Calibration expired, press CAL	Measurements unreliable, outside time-out period since cal last performed.

Chapter 4
REMOTE OPERATION

Contents

contd./...

List of tables

List of figures

Introduction

The 2310 is equipped for remote operation via the GPIB interface which conforms to IEEE 488.1 and IEEE 488.2. The interface performs instrument control with full talk and listen capability.

Before operating the instrument under GPIB control you should already be familiar with making measurements using the 2310 under local control, and with the general operation of the GPIB.

Compound headers

Compound headers allow a complex set of commands to be built up from a smaller set of basic elements in a tree structure. The elements of a compound header are separated by a colon (:). Each subsystem in this instrument is organized as a separate tree structure.

Default branches

Some elements within the compound header tree structure are enclosed within square brackets, [and]. This shows that these elements are optional and therefore may be omitted. This applies to parameters also.

Abbreviations

The elements of a compound header feature a long and a short form. Either the long or short form can be entered, other abbreviations are not permissible.

Example

        FREQuency:REFerence 380MHz

The short form is marked by upper-case letters, the long form corresponds to the complete word. Upper-case and lower-case only serve the above purpose; the 2310 itself does not make any distinction between upper-case and lower-case letters.

For a complete list of abbreviations see under 'Remote operation tables' on page 4-223.

Case

The software is not case-sensitive. Upper and lower case characters are completely interchangeable. There is no conflict between milli (m) and mega (M) as both cannot be applied to the same data.

Program data

The following program data functional elements are accepted by the test set:

        <CPD>   (also known as <CHARACTER PROGRAM DATA>)
        <NRf>   (also known as <DECIMAL NUMERIC PROGRAM DATA>)
        <STRING PROGRAM DATA>

These functional elements are defined in IEEE 488.2.

<CPD>

Character program data is used to set a parameter to one of a number of states that are best described by short alphanumeric strings.

Example:

        ON

<NRf>

Flexible numeric representation (also known as <DECIMAL NUMERIC PROGRAM DATA>) covers integer and floating point representations.

Examples:

−466	Integer value
4.91	Explicitly placed decimal point
59.5E+2	Mantissa and exponent representation

The format is known as 'flexible' because any of the three representations may be used for any type of numeric parameter.

Examples:

Where a parameter requires an integer value in the range 1 to 100, and the user needs to set its value to 42, the following values will be accepted by the 2310:

42	Integer
42.0	Floating point
4.2E1, 4200E-2	Floating point − Mantissa/exponent
41.5	Rounded up to 42
42.4	Rounded down to 42

<STRING PROGRAM DATA>

String program data consists of a number of ASCII characters enclosed in quotes. Either a pair of single ('ASCII 39') or double ("ASCII 34") quotes may be used. If the quote character chosen to mark the beginning and end of the string also appears within it, it must be doubled.

Example:

'This string contains the word "Hello"'

will be interpreted as the string

This string contains the word 'Hello'.

Response data

The following response data functional elements are generated by the 2310:

<CRD>	(also known as <CHARACTER RESPONSE DATA>)
<NR1>	
<NR2>	
<NR3>	
<STRING RESPONSE DATA>	

<CRD>

This type of response is returned when reading the value of a parameter which can take a number of discrete states. States are represented by short alphanumeric strings.

Example:

ON

<NR1>

This type of numeric response is used when returning the value of integer parameters, such as averaging number or number of measurement points.

Examples:

15
+3
−57

<NR2>

This type of numeric response includes an explicitly placed decimal point, but no exponent.

Examples:

    17.91
    −18.27
    +18.83

<NR3>

This type of numeric response includes an explicitly placed decimal point and an exponent.

Examples:

    1.756E+2
    182.8E−3

<STRING RESPONSE DATA>

This takes a similar form to <STRING PROGRAM DATA> except that the delimiting character is always a double quote ("ASCII 34").

Terminators

A **<PROGRAM MESSAGE TERMINATOR>** (as defined in IEEE 488.2) can be a newline character (ASCII 10), a newline character with the ^END message asserted at the same time, or an ^END message asserted with the final character of the <PROGRAM MESSAGE>. The terminator may be preceded by any number of 'white space' characters − any single ASCII-encoded byte in the range 0 to 9 and 11 to 32 decimal.

A **<RESPONSE MESSAGE TERMINATOR>** (as defined in IEEE 488.2) is a newline character with the ^END message asserted at the same time.

Many GPIB controllers terminate program messages with a newline character and, by default, accept newline as the response message terminator. When transferring binary data, which may contain embedded newline characters, it is necessary to ensure that the controller uses only ^END messages. Usually this means that the controller's GPIB must be set up to generate and detect ^END. Refer to the documentation supplied with the controller.

SCPI compatibility

The GPIB commands are divided into a number of subsystems. The form of these subsystems in general follows that used for the SCPI (Standard Commands for Programmable Instruments) standard. The SCPI standard employs a hierarchical model (shown in Fig. 4-1) to get the results from a measuring instrument. But note that this hierarchy is just conceptual. It is not mirrored in the GPIB tree; MEASure, READ, FETCh, INITiate and CONFigure are all subsystems at the root level.
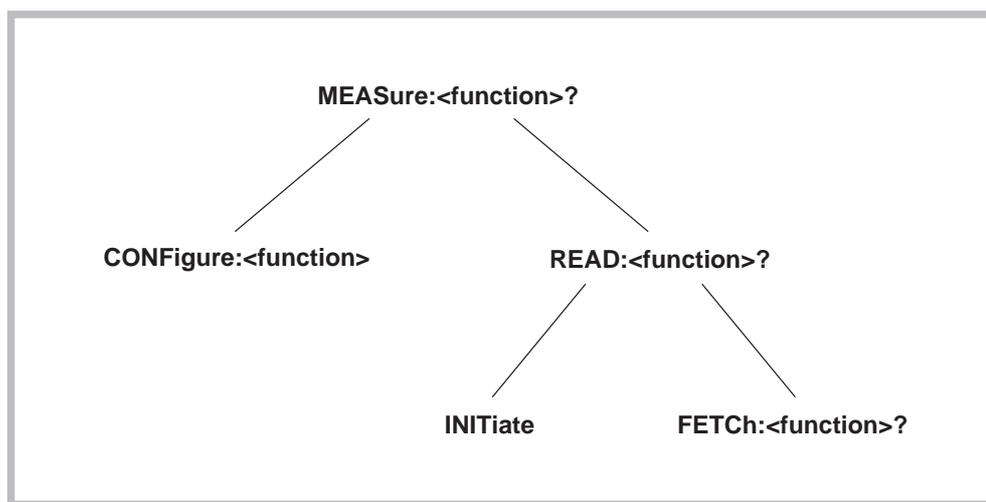
C3874

Fig. 4-1 SCPI hierarchical concept for 2310

As shown in the figure above, the GPIB uses a MEASure-READ-FETCh model. At the top level the MEASure query will always return the requested result if at all possible. The MEASure queries provide a simple way for the user to get results from the 2310 without having to have detailed knowledge of the instrument. On receipt of a MEASure the instrument will stop what it is doing, alter its configuration so as to be able to perform the measurement function requested, start the measurement process and then return the result when it is available.

A level below is the CONFigure command root to set up a measurement, and READ which initiates the configured measurement function and returns the result when available.

The two elements of READ exist as INITiate and FETCh? FETCh? allows the same results to be returned several times. More usefully, it allows different quantities calculated from the same captured data to be returned.

Query header

The position of the mnemonic elements in the query header will provide the user with the first indication of which functions may be FETChed from the same captured data. A query header would consist of three elements AA:BB:CC? Element AA is either MEASure, READ or FETCh. Element BB indicates the data capture process. Element CC defines the measurement function, that is, the calculations to be made on the data. So for given AA:BB elements, all the allowed CC elements may be FETChed from a given capture of data.

Example

```
MEAS:<TetraModulation>:<VectorError>?;:FETC:<TetraModulation>:
<CarrierLeak>?
```

All the queries return a single numeric value with the exception of trace dumps which return a set of values that represent the trace values.

Query parameters

SCPI has a number of optional parameters to the queries. These include expected value (to set the range in the most general manner) and resolution. For TETRA measurements other query parameters may be used as follows:

```
MEAS:<tetrafn>:<fn>? <frequency>, <level>, <burst type>

READ:<tetrafn>:<fn>? <burst type>

FETC:<tetrafn>:<fn>?    none
```

The top-level MEASure allows you to specify all the main characteristics of the signal to be analyzed. Below that, READ does not reconfigure the instrument, therefore frequency and level

cannot be altered; but since new data is to be captured the Burst type may be specified. The FETCh query operates on data already captured, so none of these quantities may be changed (FETCh accepts no parameters). These parameters are in addition to any other parameters demanded by the query. The parameters must be separated from the query header by a 'white space'.

Configure

The CONFigure subsystem allows the setup part of each of the defined MEASure queries to be implemented alone.

Status reporting

The instruments within a GPIB system contain a set of registers that reflect the current state of the instrument and whether a particular event has occurred. It is also sometimes necessary for an instrument to generate an alert if that condition exists or if that event has occurred.

The 2310's status registers contain information about the condition of the instrument and its measurements. Using these registers, it is possible to find out whether an error has occurred with a command, if averaging has completed for a particular measurement, if a measurement is out of limits, and other problems or conditions that may make a measurement unreliable. These registers can be used either by reading the contents directly when needed, or by configuring them to generate an interrupt signal (SRQ, service request) when the condition of interest occurs. The status system consists of seven readable registers, as shown in Fig. 4-2.
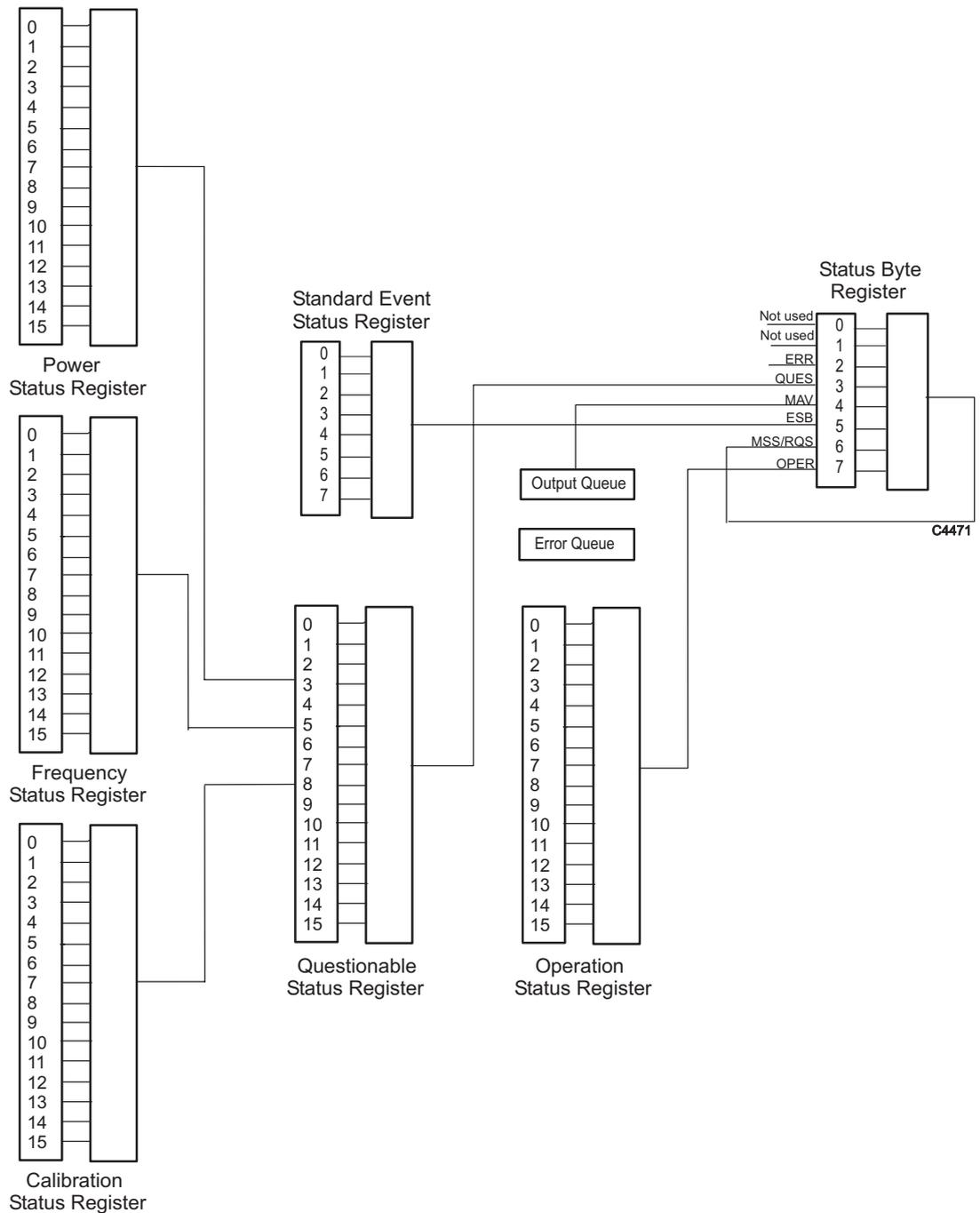
Fig. 4-2 Simplified status register structure

Status Byte Register. This is an 8-bit register that is used to represent particular conditions or events in an instrument. The Status Byte (defined by IEEE 488.1) Register is read by using the *STB? command or by serial poll. When read by serial poll, an SRQ is generated which interrupts the controller (described later). Associated with the Status Byte Register is the Service Request Enable Register, which allows control over which bits of the status byte contribute towards the generation of the SRQ signal. When read by *STB?, bit 6 of the Status Byte is known as the *master summary status* function (MSS), and is the OR function of the other seven bits of the register.

Standard Event Status Register. This 8-bit register extends the status reporting structure to cover various other events, defined by IEEE 488.2. The register is read by *ESR? The Standard Event

Status Enable Register allows control over which bits of the Standard Event Status Register affect the summary bit output (ESB). The summary bit is recorded in bit 5 of the instrument's status byte.

Operation Status Register. This is a 16-bit register, defined in SCPI, which further extends the status reporting structure by providing information about what the instrument is doing. It is read by the STATus:OPERation:CONDition? command. The summary bit output of the register is recorded in bit 7 of the status byte.

Questionable Status Register. This is another 16-bit register, also defined in SCPI, which gives information about factors affecting the quality of measurements or signal generation. It is read by the STATus:QUEStionable:CONDition? command. The summary bit output of the register is recorded in bit 3 of the status byte.

Power Status Register. This is a 16-bit register which further extends the Questionable Status Register by providing power condition information. It is read by the STATus:POWer:CONDition? command and recorded in bit 3 of the Questionable Status Register.

Frequency Status Register. This is a 16-bit register which further extends the Questionable Status Register by providing frequency condition information. It is read by the STATus:FREQuency:CONDition? command and recorded in bit 5 of the Questionable Status Register.

Calibration Status Register. This is a 16-bit register which further extends the Questionable Status Register by providing calibration condition information. It is read by the STATus:CALibration:CONDition? command and recorded in bit 8 of the Questionable Status Register.

The o*utput queue* temporarily stores responses to query commands received by the instrument until they can be read by the controller. The *error queue* temporarily stores up to 20 error messages. Each time the instrument detects an error, it places a message in the queue; each item contains an error number, defined in SCPI, and an error message. When the SYSTem:ERRor? query is sent, the message at the head of the error queue is moved to the output queue so it can be read by the controller.

The Operation and Questionable register structures consist of Condition, Event, Transition and Enable registers.

The condition registers continuously monitor the instrument's hardware and firmware status. Bits in a condition register are not latched but are updated in real time, so they represent the actual state of the instrument at all times, and are read by the above commands.

The bits of the event registers (read by STATus:OPERation:EVENt? and STATus:QUEStionable :EVENt?) are set on events. For example, the Averaging bit in the operation register only indicates if the measurement is being performed with averaging enabled, while the associated event register shows that the averaging has completed. A set of transition filters (Transition Register) control what type of change in a condition register will set the corresponding bit in the event register. The type of transition filter, negative, positive or both, is fixed for each bit. For example, the averaging bits in the Operation register structure have negative transition filters so that the bits in the event register are set when averaging is complete. When the event register bits are set they remain set, even if the corresponding condition bits change. They are reset after being read by the query commands STATus:OPERation:EVENt? and STATus:QUEStionable :EVENt?, or when the *CLS (clear status) common command is issued. Transition registers are read-write, and are unaffected by query commands or *CLS.

The ability of each bit in the event registers to affect the summary bit in the Status Byte Register can be enabled or disabled by corresponding bits in the event enable registers. These can be set and read by the commands/queries STATus:OPERation:ENABle\? and STATus:QUEStionable :ENABle\? The enabled bits are combined in a logical OR operation to produce the summary bit (summary bits are recorded in the instrument's status byte). Enable registers are cleared by *CLS.

The above status-reading commands return the decimal number equivalent of the register contents.

The events and conditions that are monitored by the 2310's status registers, and the commands for reading and writing to them, are described in more detail in 'Remote status reporting structure' below.

As already stated, two techniques are used to interact with the status reporting structure:

Direct-read method. In many cases it is adequate and convenient for the controller simply to read the appropriate registers when necessary to determine the required status information. This technique does not involve the use of SRQ and therefore does not require any interrupt handling code in the application program. The following steps are used to monitor a condition:

1. Determine which register contains the bit that monitors the condition.

2. Send the query command that reads the register.

3. Examine the bit to see if the condition has changed.

The direct-read method works well when it is not necessary to know about changes the moment they occur. A program that uses this method to detect changes in a condition as soon as possible would need to continuously read the registers at very short intervals; the SRQ method is better suited to this type of need.

Service request (SRQ) method. In the SRQ method the instrument plays a more active role, in that it tells the controller when there has been a condition change without the controller asking. The following steps are required to monitor a condition:

1. Determine which register sets and which of its bits monitors the condition.

2 Determine how that bit reports to the request service (RQS) bit of the status byte (some report directly while others may report indirectly through other register sets).

3. Send remote commands to enable the bit that monitors the condition and to enable the summary bits that report the condition to the RQS bit.

4. Enable the controller to respond to service requests.

When the condition changes, the instrument sets its RQS bit (bit 6) and the GPIB's SRQ line; the controller is informed of the change as soon as it occurs. Setting the SRQ line informs the controller that some device on the bus requires service. The GPIB program then instructs the controller to perform a serial poll; each device on the bus returns the contents of its Statue Byte Register in response to this poll. The device whose RQS bit is set to 1 is the device that requested service. After the status byte is read the RQS bit is reset to 0; the other bits are not affected.

Another reason for using SRQ is the need to detect errors in the various devices within the instrument. Since the timing of errors may not be known in advance, and it is not practical for the program to check the status of every device frequently, an interrupt handling routine can be used to detect and investigate any SRQ generated.

REMOTE STATUS REPORTING STRUCTURE

Status byte when read by *STB?
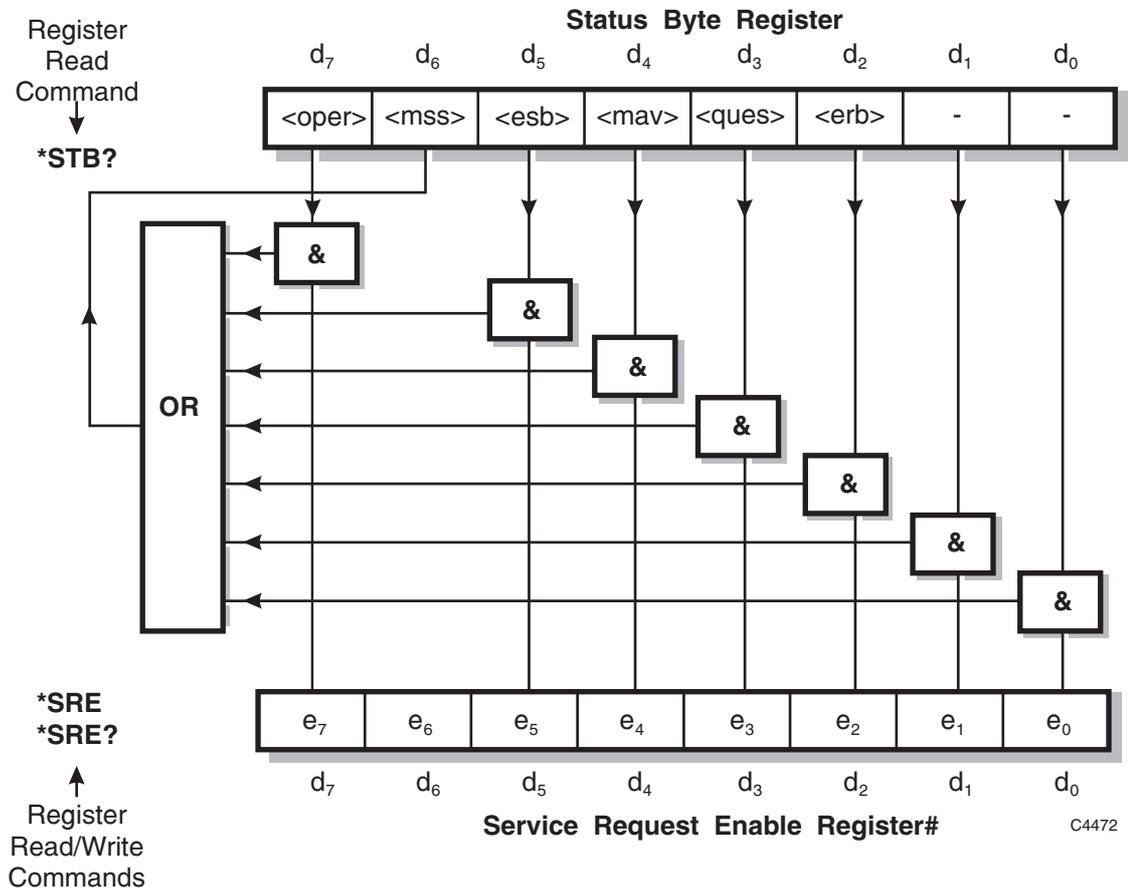
Bit 6 in this register ignores data sent by *SRE and always returns 0 in response to *SRE?

<rqs>, <esb> and <mav> are defined in IEEE 488.2.

<erb>   is as device-defined queue summary bit, indicating that the error queue is non-empty (see 'Queue flag details' on page 4-13).

<mss>   is true when (Status Byte) AND (Enable register) > 0.

<esb>   is the standard event register summary bit.

<mav>   is 'message available', indicating that the output queue is non-empty (see 'Queue flag details' on page 4-13).

<oper>   is the operation status register summary bit.

<ques>   is the questionable status register summary bit.

Note: The Status Byte Register is not cleared by the *STB? query.

Status byte when read by serial poll
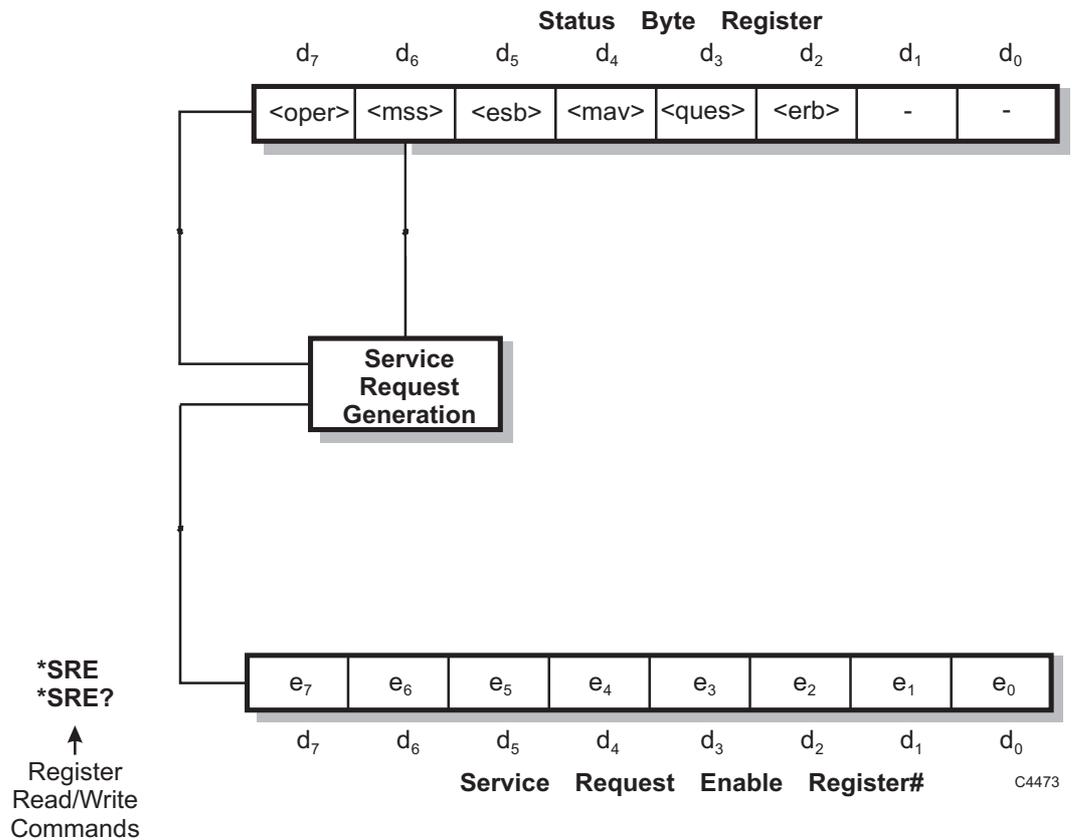
Status Byte Register

d$_7$	d$_6$	d$_5$	d$_4$	d$_3$	d$_2$	d$_1$	d$_0$
<oper>	<mss>	<esb>	<mav>	<ques>	<erb>	-	-

Service Request Generation

e$_7$	e$_6$	e$_5$	e$_4$	e$_3$	e$_2$	e$_1$	e$_0$
d$_7$	d$_6$	d$_5$	d$_4$	d$_3$	d$_2$	d$_1$	d$_0$

Service Request Enable Register#   C4473

*SRE
*SRE?

↑
Register
Read/Write
Commands

Bit 6 in this register ignores data sent by *SRE and always returns 0 in response to *SRE?

<rqs>, <esb> and <mav> are defined in IEEE 488.2.

<erb>   is as device-defined queue summary bit, indicating that the error queue is non-empty.

<rqs>   is set by request for service and is cleared by the poll.

<esb>   is the standard event register summary bit.

<mav>   is 'message available', indicating that the output queue is non-empty.

<oper>   is the operation status register summary bit.

<ques>   is the questionable status register summary bit.

<rqs> (request for service) produces an SRQ at the controller. It is set by a change to either the Status Byte or the Service Enable Register that results in a new Reason for Service. It is cleared when <mss> goes FALSE (no reason for service) or by Serial Poll.

Note: The Status Byte Register is not cleared by the *STB? query.

Queue flag details

Input from all Error Conditions

Error Queue

Response to ERROR?

8

Output Queue

Status Byte & Enable Register non-zero

From Standard Event Registers

Response Message

8

Device Dependent Error

Device Dependent Error

8

\<oper\>	\<mss\>	\<esb\>	\<mav\>	\<ques\>	\<erb\>	-	-
d_7	d_6	d_5	d_4	d_3	d_2	d_1	d_0

Status Byte Register

Data from Output Queue
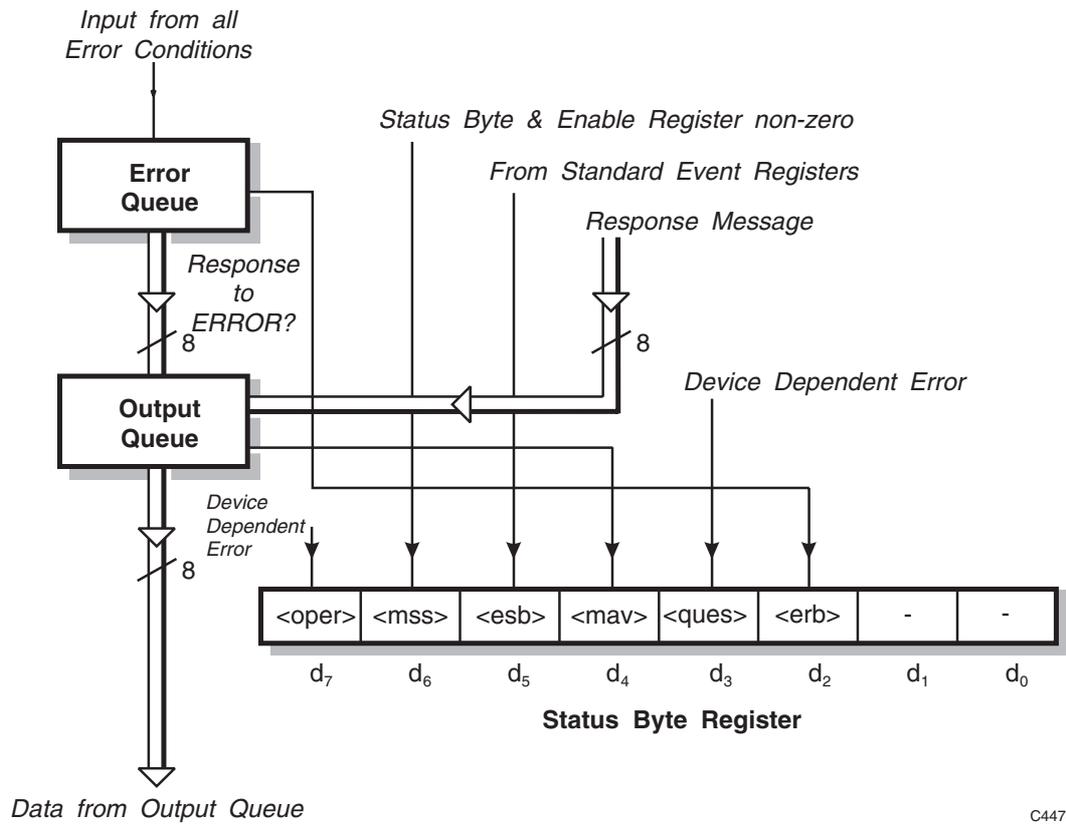
C4474

The \<mav\> status bit is set when one or more bytes are available to be read from the Output Queue.

The \<erb\> status bit is set when one or more errors are present in the Error Queue. The ERROR? query will place an NR1 response message in the Output Queue representing the error at the head of the queue. If the queue is empty, this message is 0.

Status data structure − register model

Below is a generalized model of the Register Set which funnels the monitored data into a single summary bit to set the appropriate bit in the Status Byte.

Device Status continuously monitored by Condition Register

Condition Register	d_n	d_{n-1}			d_3	d_2	d_1	d_0
Transition Filter #	d_n	d_{n-1}			d_3	d_2	d_1	d_0
Event Register	d_n	d_{n-1}			d_3	d_2	d_1	d_0

OR & & & & & &

| Event Enable Register | d_n | d_{n-1} | | | d_3 | d_2 | d_1 | d_0 |

Summary Message

C4475
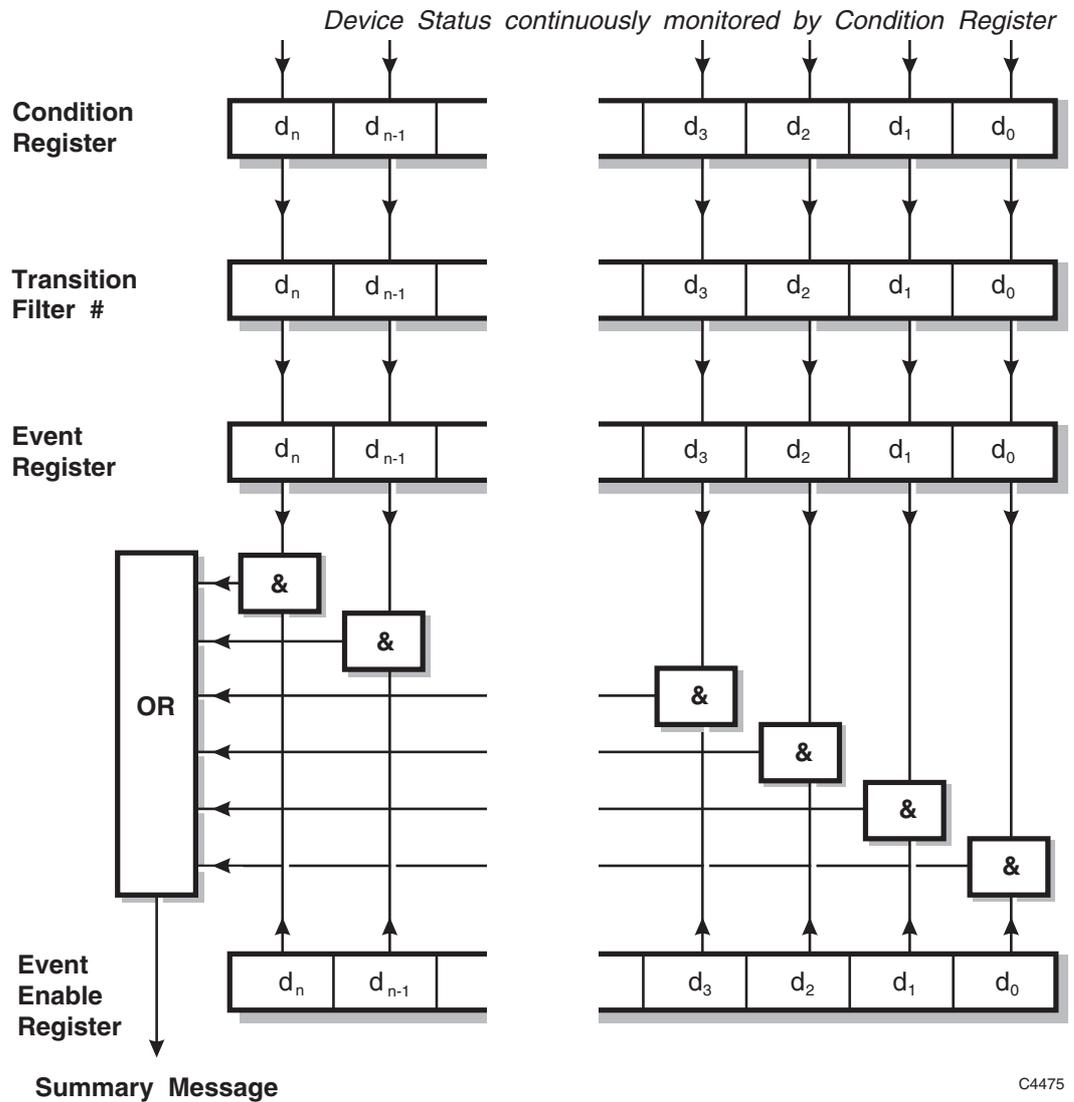
The device status is continuously monitored by the condition register. If a query to read a condition register is provided, the response represents the status of the instrument at the moment the response is generated. A condition register cannot be written to.

The transition filter determines which transition of the condition register data bits will set the corresponding bit in the event register. The condition register data bits are pre-set as either positive or negative, as described in the following pages.

The bits in an event register are 'latched'. Once set they remain set, regardless of subsequent changes in the associated condition bit until the event register is cleared by being read or by the *CLS common command. Once cleared, an event register bit will only be set again if the appropriate change in the condition bit occurs.

The event enable register may be both written to and read from. It is bitwise AND-ed with the event register and if the result is non-zero the summary message is true, otherwise the summary message is false. Enable registers are not affected by *CLS but are however clear at power-on.

Standard event registers

This register is defined by IEEE 488.2 and each bit has the meaning shown below:
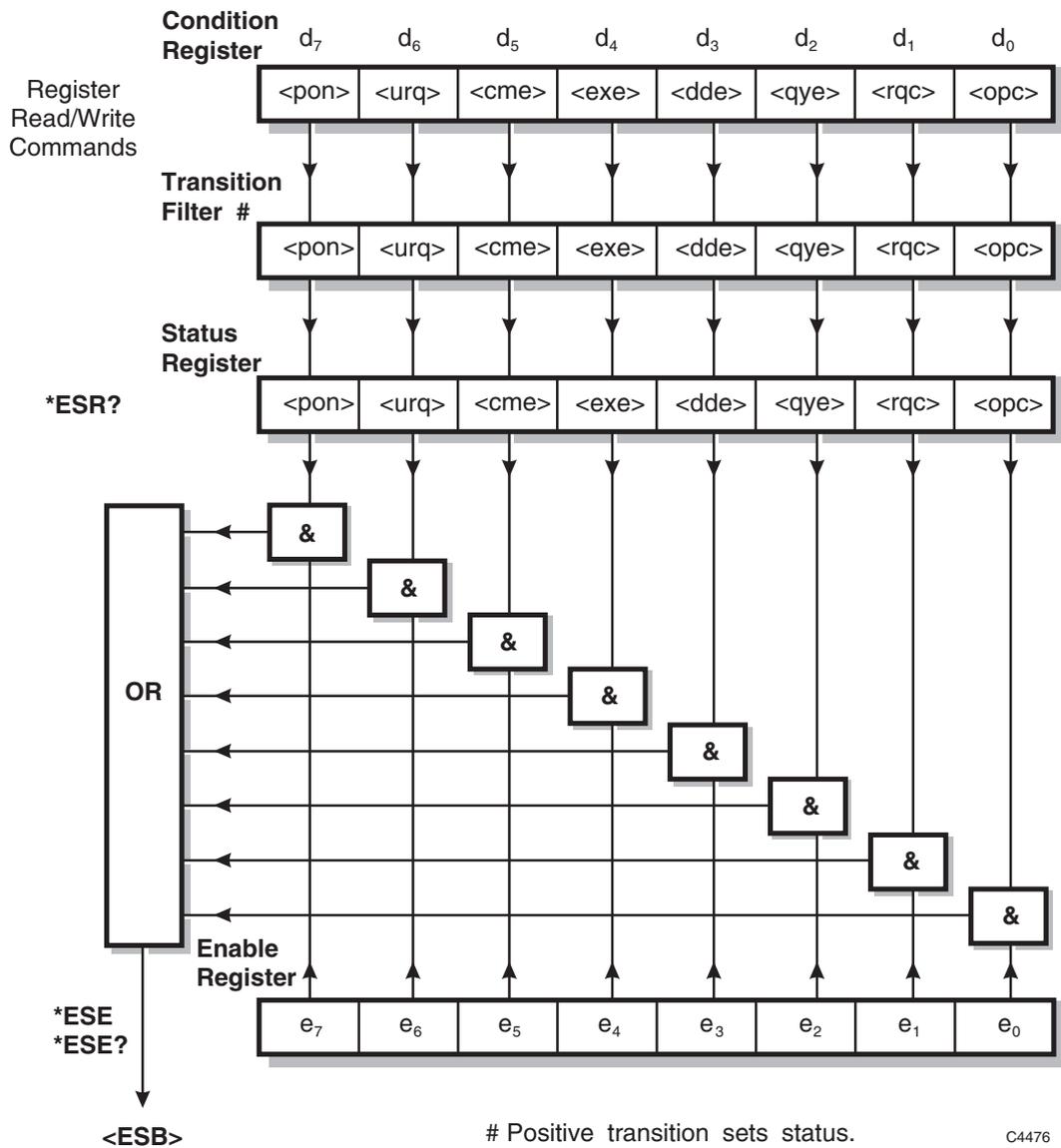
<pon>	power on
<urq>	user request – not implemented in this instrument
<cme>	command error
<exe>	execution error
<dde>	device-dependent error
<qye>	query error
<rqc>	request control – not implemented in this instrument
<opc>	operation complete – set in response to the *OPC command for synchronization.
<esb>	standard event register summary bit

Operation status condition register

This is a device-dependent register and the bits have meanings as shown in the list at the bottom of the page.

Condition Register STAT:OPER:COND?	d_{15} d_{14} ... d_3 d_2 d_1 d_0
Transition Filter #	d_{15} d_{14} ... d_3 d_2 d_1 d_0
Status Register STAT:OPER:EVEN?	d_{15} d_{14} ... d_3 d_2 d_1 d_0
Enable Register STAT:OPER:ENAB\<NRF\> STAT:OPER:ENAB?	e_{15} e_{14} ... e_3 e_2 e_1 e_0

Register Read/Write Commands

\<OPER\>
(Bit 7 of status byte register)

\# Negative transition sets status.

C4477
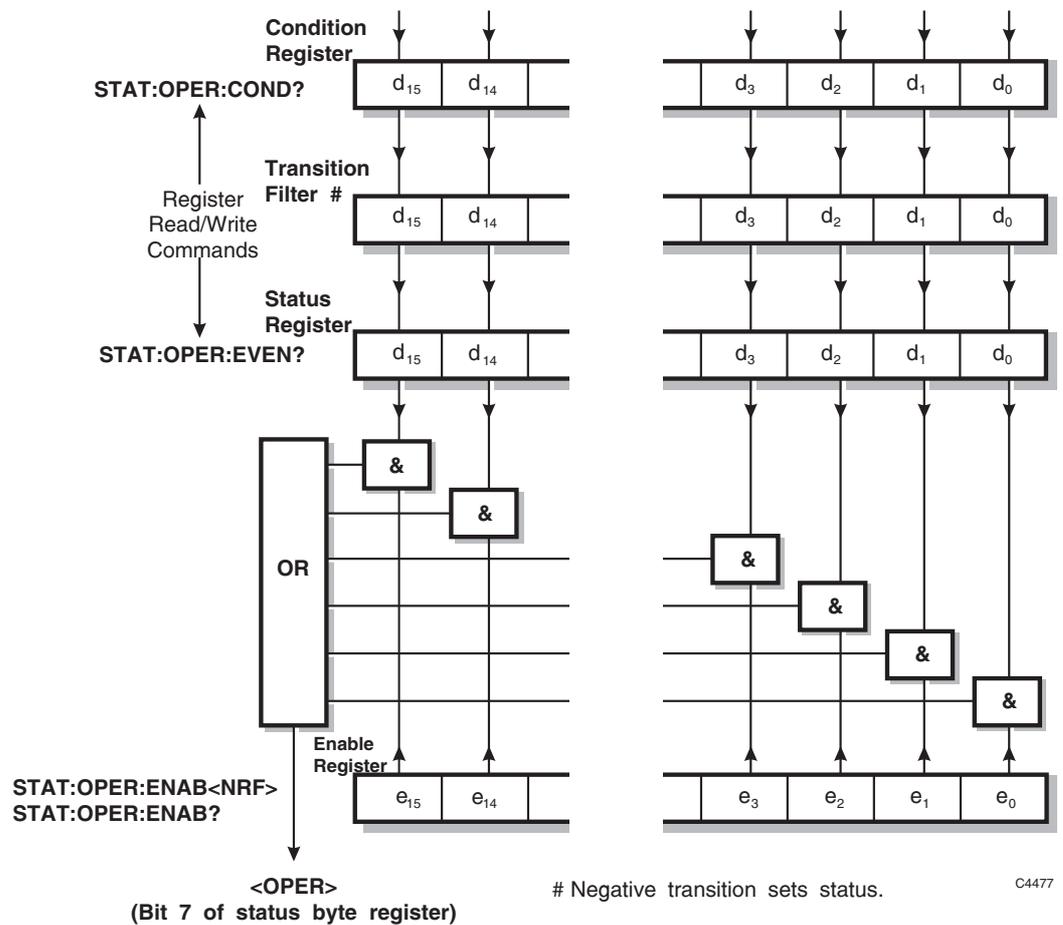
d_0	calibrating (user cal.)	d_8	–
d_1	–	d_9	–
d_2	–	d_{10}	–
d_3	–	d_{11}	printing
d_4	measuring	d_{12}	no training sequence found (–SRQ)*
d_5	–	d_{13}	–
d_6	–	d_{14}	–
d_7	–	d_{15}	–

*Refer to Table 4-1 for explanation of bit d_{12}

Questionable status condition register

This is a device-dependent register and the bits have meanings as shown in the list at the bottom of the page.
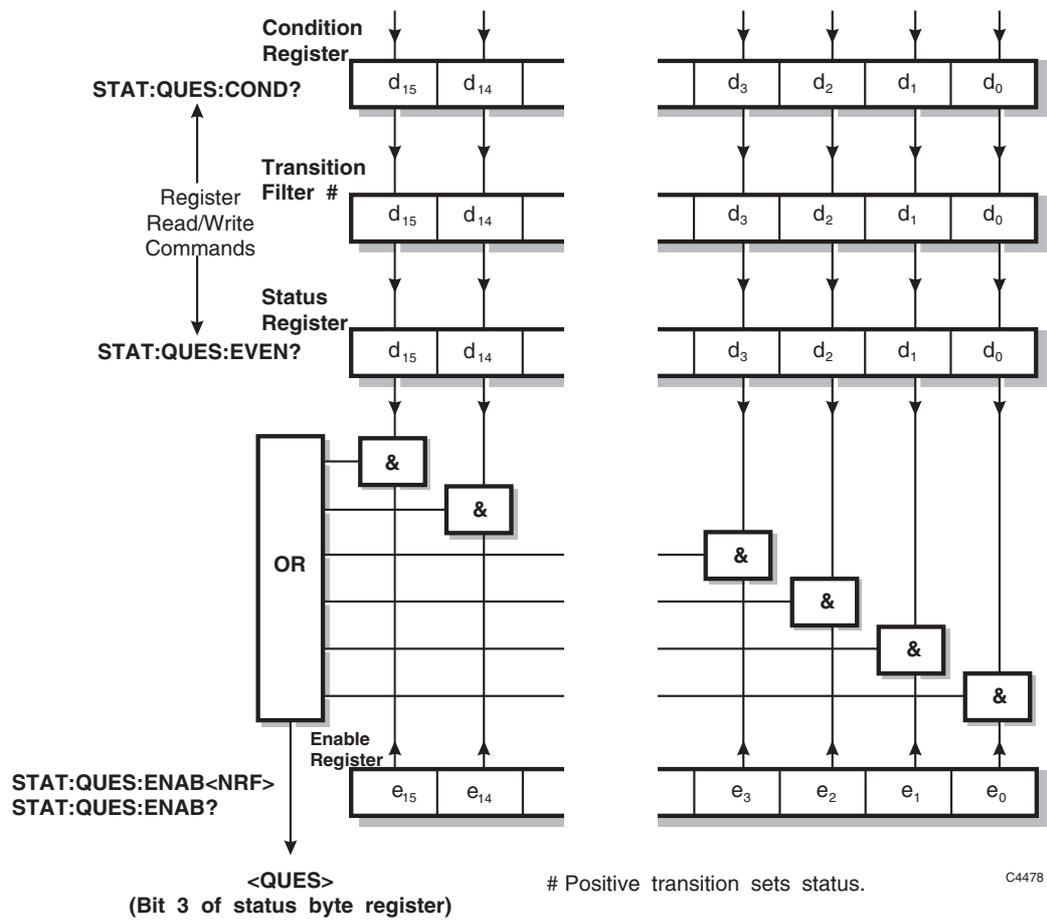
d$_0$	–	d$_8$	–
d$_1$	–	d$_9$	–
d$_2$	–	d$_{10}$	–
d$_3$	power	d$_{11}$	–
d$_4$	–	d$_{12}$	no training sequence found (+SRQ)*
d$_5$	frequency	d$_{13}$	–
d$_6$	–	d$_{14}$	–
d$_7$	modulation	d$_{15}$	–

*Refer to Table 4-1 for explanation of bit d$_{12}$

Power status condition register

This is a device-dependent register and the bits have meanings as shown in the list at the bottom of the page.

<POW>
(Bit 3 of questionable status condition register)

\# Positive transition sets status.

C4479
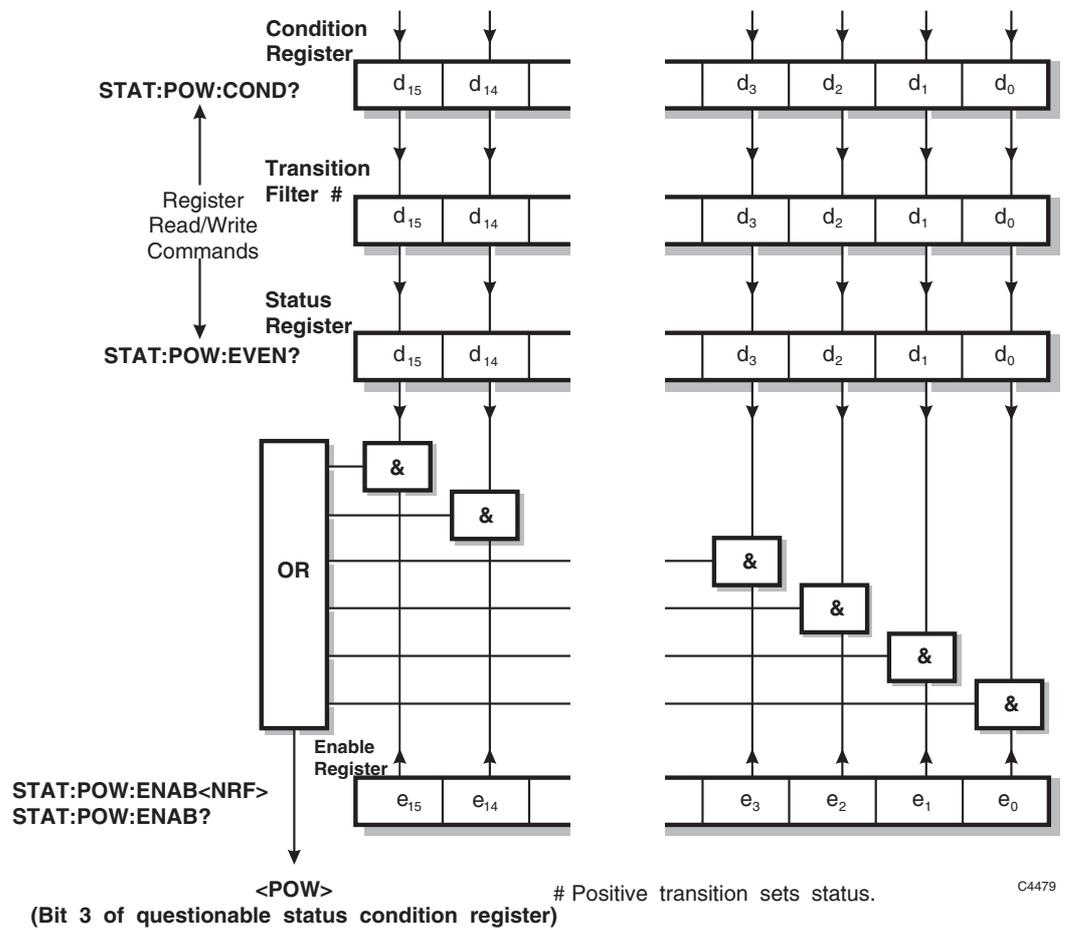
d_0	local oscillator output unleveled	d_8	–
d_1	filter unleveled	d_9	–
d_2	digital IF overload	d_{10}	–
d_3	power attenuator pad temp. high	d_{11}	–
d_4	over-power protection trip	d_{12}	–
d_5	–	d_{13}	–
d_6	–	d_{14}	–
d_7	–	d_{15}	–

Frequency status condition register

This is a device-dependent register and the bits have meanings as shown in the list at the bottom of the page.
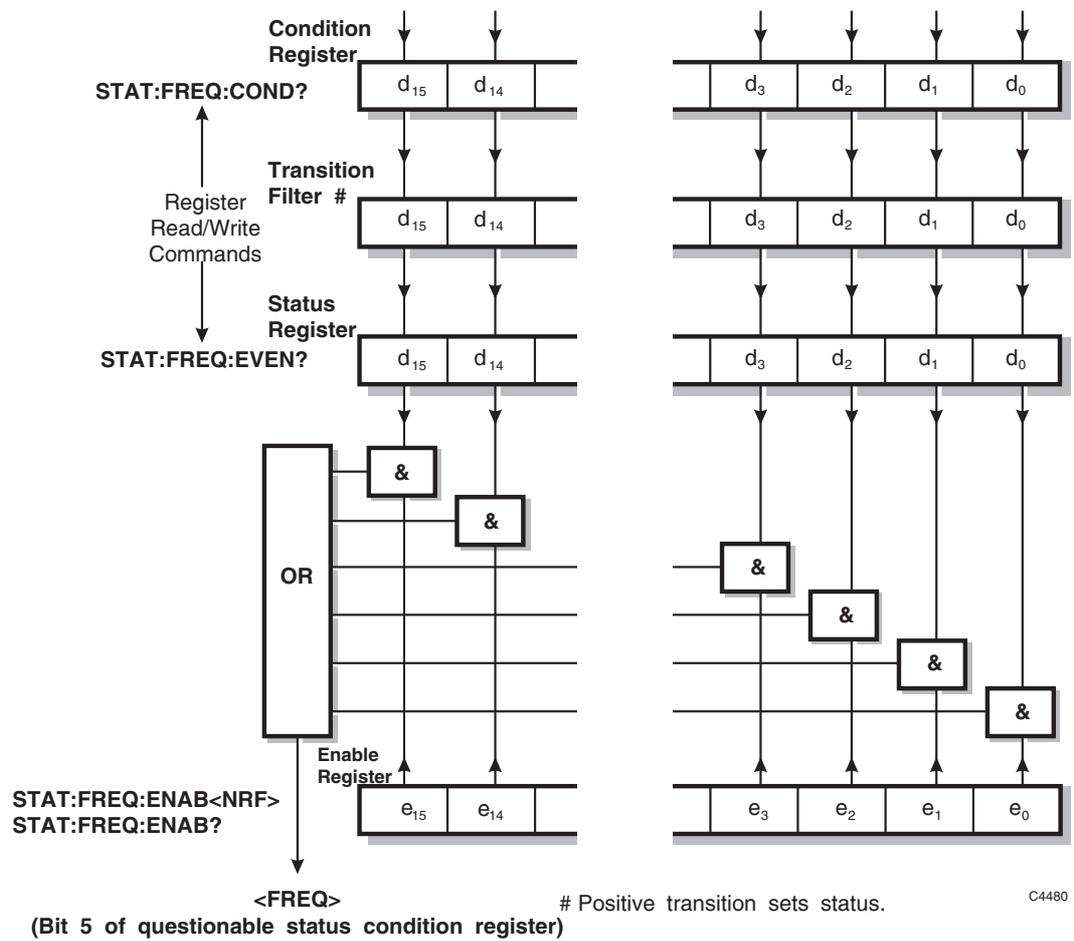
d$_0$	local oscillator fractional-N loop low	d$_8$	external standard failure (OCXO)
d$_1$	local oscillator fractional-N loop high	d$_9$	–
d$_2$	local oscillator VCXO loop low	d$_{10}$	–
d$_3$	local oscillator VCXO loop high	d$_{11}$	–
d$_4$	digital IF VCXO loop low	d$_{12}$	–
d$_5$	digital IF VCXO loop high	d$_{13}$	–
d$_6$	internal standard low	d$_{14}$	–
d$_7$	internal standard high (OCXO)	d$_{15}$	–

Calibration status condition register

This is a device-dependent register and the bits have meanings as shown in the list at the bottom of the page.

<CAL>
(Bit 8 of questionable status condition register)

Positive transition sets status.   C4481
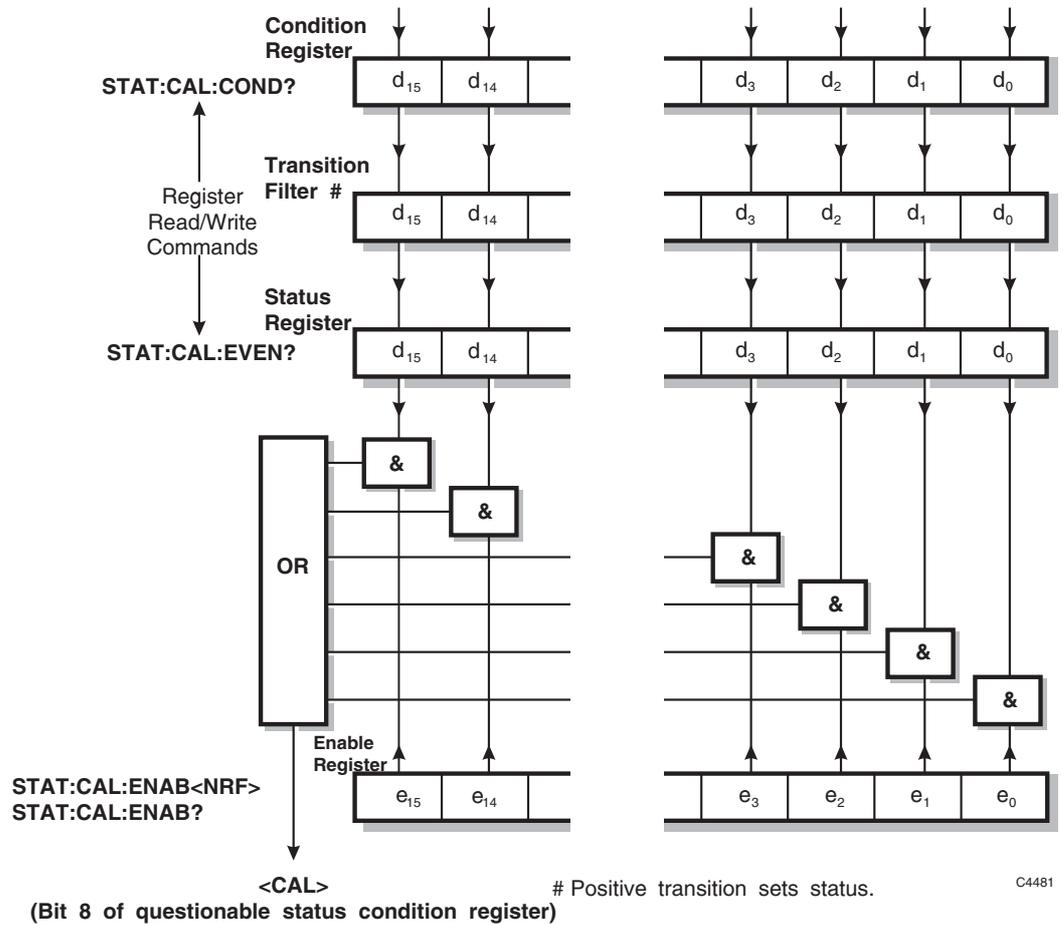
d_0	calibration failed – cal signal not found	d_8	–
d_1	user cal required	d_9	–
d_2	–	d_{10}	–
d_3	–	d_{11}	–
d_4	–	d_{12}	–
d_5	–	d_{13}	–
d_6	–	d_{14}	–
d_7	–	d_{15}	–

Table 4-1 Status registers bit identification

	POWer STAT : POW : COND?	FREQuency STAT : FREQ : COND?	CALibration STAT : CAL : COND?	QUEStionable STAT : QUES : COND?	OPERation STAT : OPER : COND?	Status byte *STB?
1	L.O. Output Unlevelled d0	L.O. Fractional-N loop Low	Calibration failed - Cal signal not found		Calibrating (user cal)	
2	Filter Unlevelled d1	L.O. Fractional-N loop High	User Cal Required			
4	Digital I.F. Overload d2	L.O. VCXO loop Low				ERR
8	Power Atten Pad Temp High d3	L.O. VCXO loop High		Power		QUES
16	Over Power Protection Trip d4	Digital I.F. VCXO loop Low			Measuring	MAV
32	d5	Digital I.F. VCXO loop High		Frequency		ESB
64	d6	Internal Standard Low				RQS/ / MSS
128	d7	Internal Standard (ocxo) High		Modulation		OPER
256	d8	External Standard (ocxo) Failure		Calibration		
512	d9					
1024	d10					
2048	d11				Printing	
4096	d12			No training +SRQ Sequence found	No training -SRQ Sequence found	
8192	d13					
16384	d14					
32768	d15					

C4277

Notes: Questionable status bits, when enabled by STAT:QUES:ENAB, allow SRQ to be generated when the specified event occurs (when the status bit is set).

Operational status bits, when enabled by STAT:OPER:ENAB, allow SRQ to be generated when the specified condition terminates (when the status bit is cleared).

The No Training Sequence status bit appears in both QUES and OPER status registers so that the user can choose to enable either (or both) in order to generate SRQ on the disappearance of Training Sequence (QUES) or on the detection of a Training Sequence (OPER). In the case of a discontinuous burst, this bit indicates that no ramp has been found.

COMMON COMMANDS SUBSYSTEM

The common commands are taken from the IEEE 488.2 standard. The commands have the same effect on different instruments. The headers of these commands consist of an asterisk (*) followed by three letters. Many common commands refer to the status reporting system.

*CLS
*ESE\?
*ESR?
*IDN?
*OPC\?
*OPT?
*RST
*SRE\?
*STB?
*TST?

*CLS

Parameters: None.

Description: Clear Status clears the Standard Event Register, the Error Queue, the Operation Event Register and the Questionable Event Register.

Example: `*CLS`

Clear the status reporting structure.

*ESE

Parameters: <NRf>
Mask.

Valid values: Mask: integer. Valid values are 0 to 255. Values outside range are rejected and an error generated.

Description: The Event Status Enable command sets the Standard Event Status Enable register to the value specified. This is an eight-bit register.

Example: `*ESE 4`

Set the Standard Event Status Enable register to 4 (00000100 in binary). This will allow Query Error messages generated by the instrument to be reported in the Event Summary Bit.

*ESE?

Parameters: None.

Response: <NR1>
Mask.

Returned values: Mask: integer. Values are in the range 0 to 255.

Description: Reads the Event Status Enable register. This is an eight-bit register. The contents of the Event Status Enable register are returned in decimal form.

Example: `*ESE?`

*ESR?

Parameters: None.

Response: <NR1>
Register contents.

Returned values: Register contents: integer. Values are in the range 0 to 255.

Description: Reads the value of the Standard Event Status register. This is an eight-bit register. The contents of the register are returned in decimal form. Subsequently the register is set to zero.

Example: `*ESR?`

*IDN?

Parameters: None.

Response: <arbitrary ASCII response data>
Manufacturer, model, serial no., software part no. and issue no.

Returned values: Manufacturer: string
Always returns 'IFR'

Model: string
This is the instrument model number in the form 231x *where:*

231x	Description
2310	TETRA Analyzer

Serial No.: string
This is in the form sssss/sss where s *is an* ASCII digit *in the range* 0 to 9.

Software Part No. and Issue No.: string
This is in the form ppppp/ppp/ii.ii where p *and* i *are* ASCII digits *in the range* 0 to 9.

Description: The Identification Query command allows information about the instrument to be read.

Example: `*IDN?`

Read information on the instrument.

*OPC

Parameters: None.

Description: The Operation Complete command sets the Operation Complete bit (bit 0) in the Standard Event Status Register when execution of the preceding operation is complete. This bit can be used to initiate a service request.

*OPC should be the final <program message unit> of the <program message>.

Example: `:CAL; *OPC`

Initiate a level calibration. The Operation Complete bit will be set in the Standard Event Status Register when the instrument has finished.

*OPC?

Parameters: None.

Response: <NR1>
Operation complete.

Returned values: Operation complete: integer. Value is 1.

Description: The Operation Complete Query returns a '1' when the preceding operation has completed.

*OPC? should be the final <query message unit> of the <program message>.

Example: `:CAL; *OPC?`

Initiate a calibration. When the instrument has finished calibrating, the value '1' will be placed in the output queue.

*OPT?

Parameters: None.

Response: <arbitrary ASCII response data>
Options.

Returned values: Options: string.

Description: Reads hardware options present. If no options are present a single '0' is returned, otherwise the response is up to six strings separated by commas.

Example: `*OPT?`

Example response: 0

*RST

Parameters:	None.
Description:	Resets the instrument to a known configuration appropriate for remote operation. Details on which parameters are not affected by preset are described elsewhere.
Example:	`*RST`

Reset instrument to known state.

*SRE

Parameters:	<NRf> Mask.
Valid values:	Mask: integer. Valid values are 0 to 255. Values outside range are rejected and an error generated.
Description:	Sets the Service Request Enable register. This is an eight-bit register.
Example:	`*SRE 32`

Sets the Service Request Enable register to 32 (0010 0000 in binary) to enable service requests when the Standard Event Status Register Summary Bit is set.

*SRE?

Parameters:	None.
Response:	<NR1> Mask.
Returned values:	Mask: integer. Values are in the range 0 to 255.
Description:	Reads the Service Request Enable register. This is an eight-bit register.
Example:	`*SRE?`

*STB?

Parameters:	None.
Response:	<NR1> Status byte.
Returned values:	Status byte: integer. Values are in the range 0 to 255.
Description:	Reads the status byte. This is an eight-bit register.
Example:	`*STB?`

*TST?

Parameters: None.

Response: <NR1>
Self test completed.

Returned values: Self test completed: integer. Value is 0.

Description: Self test query. Returns a '0' when the remote control interface and processor are operating.

Example: `*TST?`

Confirm remote control system working correctly.

ABORt SUBSYSTEM

ABORt   4-29

:ABORt

Parameters: None.

Valid values:

Description: This command aborts wideband noise, discrete spurious, auto pre-scan, diagnostic calibration/trace or intermodulation measurements if they are running.

Example: `:ABORt`

:ABORt

CALibration SUBSYSTEM

CALibrate:
    ALL\?

:CALibrate[:ALL]

Synonym for :CALibrate

Parameters: None.

Description: Sets the automatic calibration routine in progress, during which time the instrument is disabled.

Example: :CAL:ALL

Note: If *RST is issued whilst this command is executing, *RST is acknowledged immediately but its execution is delayed until after the CAL sequence finishes.

:CALibrate[:ALL]?

Synonym for :CALibrate?

Parameters: None.

Response: <int>

Returned values: 0 (after approximately 35 s).

Description: A returned 0 indicates that the calibration has completed.

Example: :CAL?

CONFigure SUBSYSTEM

The CONFigure subsystem has the following command format:

        :CONFigure:<function> <parameters>

The CONFigure commands set up the instrument in order to perform the measurement <function>. It will set some of the instrument state variables to a predetermined condition.

<function> defines the measurement operation to be used by MEASure?, READ? or FETCh? operations.

<parameters> are optional parameters which describe the essential characteristics of the measurement <function>. These parameters are the same as those specified and described in the MEASure subsystem. If parameters are omitted, they are assumed to be those currently in use. Parameters may be defaulted from the right by omitting them, or anywhere by substituting the keyword DEFault.

CONFigure:
    ACPower:
        MODulation
        SWITching
    IMOD
    LINearization
    MODulation
    NSPower
    PPROfile
    SPECtrum
    SPURious
    WBANd

:CONFigure:ACPower:MODulation

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response:

Returned values:

Description: Configures the instrument to a predefined state in order to perform TETRA
adjacent channel power due to modulation measurements.

Example: `:CONF:ACP:MOD`
`:CONF:ACP:MOD 150MHZ`
`:CONF:ACP:MOD 150E6,5DBM`
`:CONF:ACP:MOD 150E6,5DBM,NUB1`

Receipt of the CONF:ACP:MOD command will preset the instrument to the following configuration:

`:INST:SEL TETRA`	sets the basic operating mode of the instrument to TETRA analyzer.
`:INIT:CONT OFF`	sets the trigger system to idle (i.e. single).
`:TETR:AVER 200`	burst to average = 200.
`:TETR:LIM:SET NORM`	TETRA normal test limits.
`:TETR:DISP:TOP 10DBM`	top of screen (reference level) = 10 dBm.
`:TETR:DISP:VRES 10`	vertical resolution = 10 dBm/div.
`:POW:INP HIGH`	high-power input selected.
`:TETR:MEAS ACPM`	sets the TETRA measurement to ACP due to modulation.
`:TETR:ACP:MOD:DISP TAB`	tabular display format.
`:FREQ:REF    <frequency>`	sets the center frequency (if parameter specified).
`:POW:REF    <level>`	sets the input level (if parameter specified).
`:TETR:BURS   <burst type>`	sets the burst type (if parameter specified).

:CONFigure:ACPower:SWITching

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response:

Returned values:

Description: Configures the instrument to a predefined state in order to perform TETRA adjacent channel power due to switching measurements.

Example: `:CONF:ACP:SWIT`
    `:CONF:ACP:SWIT 150MHZ`
    `:CONF:ACP:SWIT 150E6,5DBM`
    `:CONF:ACP:SWIT 150E6,5DBM,NUB1`

Receipt of the CONF:ACP:SWIT command will preset the instrument to the following configuration:

`:INST:SEL TETRA`	sets the basic operating mode of the instrument to TETRA analyzer.
`:INIT:CONT OFF`	sets the trigger system to idle (i.e. single).
`:TETR:AVER 200`	burst to average = 200.
`:TETR:LIM:SET NORM`	TETRA normal test limits.
`:TETR:DISP:TOP 10DBM`	top of screen (reference level) = 10 dBm.
`:TETR:DISP:VRES 10`	vertical resolution = 10 dBm/div.
`:POW:INP HIGH`	high-power input selected.
`:TETR:MEAS ACP`	sets the TETRA measurement to ACP due to switching.
`:TETR:ACP:SWIT:DISP TAB`	tabular display format.
`:FREQ:REF    <frequency>`	sets the center frequency (if parameter specified).
`:POW:REF     <level>`	sets the input level (if parameter specified).
`:TETR:BURS   <burst type>`	sets the burst type (if parameter specified).

:CONFigure:IMOD

Parameters: [<NRf> [, <NRf> [, <NRf>]]]
[<frequency> [, <level> [, <burst type>]]]

Response:

Returned values:

Description: Configures the instrument to a predefined state in order to perform TETRA intermodulation attenuation measurements.

Example: `:CONF:IMOD`
`:CONF:IMOD 150MHZ`
`:CONF:IMOD 150E6,5DBM`
`:CONF:IMOD 150E6,5DBM,NUB1`

Receipt of the CONF:IMOD command will preset the instrument to the following configuration:

`:INIT:CONT OFF`   sets the trigger system to idle (that is, single).
`:TETR:AVER 200`   burst to average = 200.
`:TETR:LIM:SET NORM`   TETRA normal test limits.
`:POW:INP HIGH`   high-power input selected.

`:TETR:MEAS IMOD`   sets the TETRA measurement to intermodulation attenuation.

`:FREQ:CENT  <frequency>`   sets the center frequency (if parameter specified).
`:POW:REF    <level>`   sets the input level (if parameter specified).
`:TETR:BURS  <burst type>` sets the burst type (if parameter specified).

:CONFigure:LINearization

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response:

Returned values:

Description: Configures the instrument to a predefined state in order to perform TETRA linearization burst measurements.

Example: :CONF:LIN
:CONF:LIN 150MHZ
:CONF:LIN 150E6,5DBM
:CONF:LIN 150E6,5DBM,NUB1

Receipt of the CONF:LIN command will preset the instrument to the following configuration:

:TETRA:LIN:DISP NUM	sets the instrument to display linearization burst measurement as numeric results table.
:INIT:CONT OFF	sets the trigger system to idle (i.e. single).
:TETR:AVER 200	burst to average = 200.
:TETR:LIM:SET NORM	TETRA normal test limits.
:TETR:DISP:TOP 10	top of screen (reference level) = 10 dBc.
:TETR:DISP:VRES 10	vertical resolution = 10 dB/div.
:POW:INP HIGH	high-power input selected.
:TETRA:MEAS LIN	sets the TETRA measurement to linearization burst.
:FREQ:CENT <frequency>	sets the center frequency (if parameter specified).
:POW:REF <level>	sets the input level (if parameter specified).
:TETR:BURS <burst type>	sets the burst type (if parameter specified).

:CONFigure:MODulation

Parameters: [<NRf> [, <NRf> [, <NRf>]]]
[<frequency> [, <level> [, <burst type>]]]

Response:

Returned values:

Description: Configures the instrument to a predefined state in order to perform TETRA modulation accuracy measurements.

Example: `:CONF:MOD`
`:CONF:MOD 150MHZ`
`:CONF:MOD 150E6,5DBM`
`:CONF:MOD 150E6,5DBM,NUB1`

Receipt of the CONF:MOD command will preset the instrument to the following configuration:

`:INST:SEL TETRA`	sets the basic operating mode of the instrument to TETRA analyzer.
`:INIT:CONT OFF`	sets the trigger system to idle (i.e. single).
`:TETR:AVER 200`	burst to average = 200.
`:TETR:LIM:SET NORM`	TETRA normal test limits.
`:TETR:DISP:TOP 10DBM`	top of screen (reference level) = 10 dBm.
`:TETR:DISP:VRES 10`	vertical resolution = 10 dBm/div.
`:POW:INP HIGH`	high-power input selected.
`:TETR:MEAS MOD`	sets the TETRA measurement to modulation accuracy.
`:TETR:MOD:DISP TAB`	tabular display format.
`:FREQ:REF    <frequency>`	sets the center frequency (if parameter specified).
`:POW:REF    <level>`	sets the input level (if parameter specified).
`:TETR:BURS   <burst type>`	sets the burst type (if parameter specified).

:CONFigure:NSPower

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response:

Returned values:

Description: Configures the instrument to a predefined state in order to perform TETRA non-active slot power measurements.

Example: `:CONF:NSP:`
`:CONF:NSP: 150MHZ`
`:CONF:NSP: 150E6,5DBM`
`:CONF:NSP: 150E6,5DBM,NUB1`

Receipt of the CONF:NSP command will preset the instrument to the following configuration:

`:INST:SEL TETRA`	sets the basic operating mode of the instrument to TETRA analyzer.
`:INIT:CONT OFF`	sets the trigger system to idle (i.e. single).
`:TETR:AVER 200`	burst to average = 200.
`:TETR:LIM:SET NORM`	TETRA normal test limits.
`:TETR:DISP:TOP 10DBM`	top of screen (reference level) = 10 dBm.
`:TETR:DISP:VRES 10`	vertical resolution = 10 dBm/div.
`:POW:INP HIGH`	high-power input selected.
`:TETR:MEAS NSP`	sets the TETRA measurement to non-active slot power.
`:TETR:NSP:DISP TAB`	tabular display format.
`:FREQ:REF    <frequency>`	sets the center frequency (if parameter specified).
`:POW:REF    <level>`	sets the input level (if parameter specified).
`:TETR:BURS   <burst type>`	sets the burst type (if parameter specified).

:CONFigure:PPROfile

Parameters:	[<NRf> [, <NRf> [, <CPD>]]]
	[<frequency> [, <level> [, <burst type>]]]

Response:

Returned values:

Description: Configures the instrument to a predefined state in order to perform TETRA power-profile measurements.

Example:
```
:CONF:PPRO
:CONF:PPRO 150MHZ
:CONF:PPRO 150E6,5DBM
:CONF:PPRO 150E6,5DBM,NUB1
```

Receipt of the CONF:PPRO command will preset the instrument to the following configuration:

`:INST:SEL TETRA`	sets the basic operating mode of the instrument to TETRA analyzer.
`:INIT:CONT OFF`	sets the trigger system to idle (i.e. single).
`:TETR:AVER 200`	burst to average = 200.
`:TETR:LIM:SET NORM`	TETRA normal test limits.
`:TETR:DISP:TOP 10DBM`	top of screen (reference level) = 10 dBm.
`:TETR:DISP:VRES 10`	vertical resolution = 10 dBm/div.
`:POW:INP HIGH`	high-power input selected.
`:TETR:MEAS PPRO`	sets the TETRA measurement to power profile.
`:TETR:PPRO:DISP TAB`	tabular display format.
`:FREQ:REF    <frequency>`	sets the center frequency (if parameter specified).
`:POW:REF    <level>`	sets the input level (if parameter specified).
`:TETR:BURS  <burst type>`	sets the burst type (if parameter specified).

:CONFigure:SPECtrum

Parameters: [<NRf> [, <NRf> [, <NRf>]]]
[<frequency> [, <level> [, <Span>]]]

Response: <NR2>

Returned values:

Description: Configures the instrument to a predefined state in order to perform spectrum analysis measurements.

Example: :CONF:SPEC
:CONF:SPEC 150MHZ
:CONF:SPEC 150E6,5DBM
:CONF:SPEC 150E6,5DBM,10KHZ

Receipt of the CONF:SPEC command will preset the instrument to the following configuration:

:INST:SEL SPEC	sets the basic operating mode of the instrument to spectrum analyzer.
:INIT:CONT OFF	sets the trigger system to idle (i.e. single).
:SPEC:WIND BHAR	select Blackman-Harris as the window function.
:SPEC:AVER 10	number of averages = 10.
:SPEC:AVER: 1	averaging OFF.
:SPEC:DISP:TOP 10DBM	top of screen (reference level) = 10 dBm.
:SPEC:DISP:VRES 10	vertical resolution = 10 dBm/div.
:POW:INP HIGH	high-power input selected.
:FREQ:REF <frequency>	sets the center frequency (if parameter specified).
:FREQ:SPAN <Span>	sets the frequency span (if parameter specified).
:POW:REF <level>	sets the input level (if parameter specified).

:CONFigure:SPURious

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response:

Returned values:

Description: Configures the instrument to a predefined state in order to perform TETRA spurious noise measurements.

Example: `:CONF:SPUR`
`:CONF:SPUR 150MHZ`
`:CONF:SPUR 150E6,5DBM`
`:CONF:SPUR 150E6,5DBM,NUB1`

Receipt of the CONF:SPUR command will preset the instrument to the following configuration:

`:TETRA:SPUR:DISP NUM`	sets the instrument to display spurious noise measurement as numeric results table.
`:INIT:CONT OFF`	sets the trigger system to idle (i.e. single).
`:TETR:AVER 200`	burst to average = 200.
`:TETR:LIM:SET NORM`	TETRA normal test limits.
`:TETR:DISP:TOP −20`	top of screen (reference level) = −20 dBc.
`:TETR:DISP:VRES 10`	vertical resolution = 10 dB/div.
`:POW:INP HIGH`	high-power input selected.
`:TETRA:MEAS SPUR`	sets the TETRA measurement to spurious noise.
`:FREQ:CENT <frequency>`	sets the center frequency (if parameter specified).
`:POW:REF <level>`	sets the input level (if parameter specified).
`:TETR:BURS <burst type>`	sets the burst type (if parameter specified).

:CONFigure:WBANd

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response:

Returned values:

Description: Configures the instrument to a predefined state in order to perform TETRA wideband noise measurements.

Example: :CONF:WBAN
:CONF:WBAN 150MHZ
:CONF:WBAN 150E6,5DBM
:CONF:WBAN 150E6,5DBM,NUB1

Receipt of the CONF:WBAN command will preset the instrument to the following configuration:

:TETRA:WBAN:DISP NUM	sets the instrument to display wideband noise measurement as numeric results table.
:INIT:CONT OFF	sets the trigger system to idle (i.e. single).
:TETR:AVER 200	burst to average = 200.
:TETR:LIM:SET NORM	TETRA normal test limits.
:TETR:DISP:TOP −20	top of screen (reference level) = −20 dBc.
:TETR:DISP:VRES 10	vertical resolution = 10 dBm/div.
:POW:INP HIGH	high-power input selected.
:TETRA:MEAS WBAN	sets the TETRA measurement to wideband noise.
:FREQ:CENT <frequency>	sets the center frequency (if parameter specified).
:POW:REF <level>	sets the input level (if parameter specified).
:TETR:BURS <burst type>	sets the burst type (if parameter specified).

FETCh SUBSYSTEM

The FETCh subsystem has the following command format:

```
FETCh:<function>?
```

The FETCh? query is used to return the result of a measurement that has already been configured and initiated.

<function> defines the measurement operation to be used by FETCh? It is also used in the CONFigure, MEASure? and READ? subsystems.

By specifying a <function> as part of a compound header, the device will retrieve the value of the function requested derived from the data taken by the last INITiate command.

As the FETCh? query operates on data already captured for a particular measurement configuration, no parameters are specified.

The FETCh? query will return data at any time so long as the last reading is valid.

FETCh:
    ACPower:
        MODulation:
          ATPower?
          FAIL?
          POWer?
          TRACe:
              ASCii?
              BINary?
        SWITching:
          ATPower?
          FAIL?
          PEAK?
          POWer?
          TRACe:
              ASCii?
              BINary?

FETCh:
    APVT:
        AERRor?
        AERRor:
          TRACe:
              ASCii?
              BINary?
        PERRor?
        PERRor:
          TRACe:
              ASCii?
              BINary?

FETCh:
    CLUSter:
        TRACe:
          BINary?

FETCh:
    CONStellation:
        TRACe:
          BINary?

FETCh:
    IMOD:
        ATPower?
        ATTenuation?
        ATTenuation:
          FAIL?
        FAIL?
        IPOWer?
        LIMit?

FETCh:
    IQVT:
        IAMP?
        IAMP:
          TRACe:
              ASCii?
              BINary?
        QAMP?
        QAMP:
          TRACe:
              ASCii?
              BINary?

FETCh:
    LINearization:
        BETWeen?
        FAIL?
        OVER?
        TRACe:
          ASCii?
          BINary?

FETCh:
    MODulation:
        BURSt?
        BURSt:
            CLEAk?
            FAIL?
            FERRor?
            MVERror?
            PVERror?
            PVSYmbol?
        CLEAk?
        DATA?
        FAIL?
        FERRor?
        MAERror?
        MPERror?
        MVERror?
        PAERror?
        PPERror?
        PVERror?
        PASYmbol?
        PPSYmbol?
        PVSYmbol?
        TRACe:
            ASCii?
            BINary?
FETCh:
    NSPower:
        ATPower?
        FAIL?
        POWer?
        TRACe:
            ASCii?
            BINary?
FETCh:
    PPROfile:
        ATPower?
        FAIL?
        POWer?
        TRACe:
            ASCii?
            BINary?
FETCh:
    SPECtrum:
        FAIL?
        FREQ?
        LEVel?
        TRACe:
            ASCii?
            BINary?

FETCh:
    SPURious:
        ATPower?
        BANDwidth?
        CORRected?
        FAIL?
        POWer?
        POWer:
            FAIL?
        TRACe:
            ASCii?
            BINary?
FETCh:
    VECTor:
        TRACe:
            BINary?
FETCh:
    VEVT:
        TRACe:
            ASCii?
            BINary?
        VERR?
FETCh:
    WBANd:
        ATPower?
        BANDwidth?
        FAIL?
        LIMit:
            ABSolute?
            RELative?
        POWer?
        POWer:
            FAIL?
        TRACe:
            ASCii?
            BINary?

:FETCh:ACPower:MODulation:ATPower?

Parameters: None.

Response: <NR2>

Returned values: (dBm)

Description: Average transmitter power while measuring ACP due to modulation.

Example: `:FETC:ACP:MOD:ATP?`

:FETCh:ACPower:MODulation:FAIL?

Parameters: None.

Response: <NR1>

Returned values: 0 | to | 32767 – for bit significance see Table 4-3.

Description: Tests whether the measured profile fails a limit check against the current limit mask. 0 signifies a pass. Any integer denotes failure.

Example: `:FETC:ACP:MOD:FAIL?`

:FETCh:ACPower:MODulation:POWer?

Parameters: <NRf>
                <channel>

channel −3, −2, −1, +1, +2, +3 (default = −1)   x 25 kHz offset.

Response: <NR2>

Returned values: (dBc)

Description: Adjacent channel power due to modulation (in the specified channel).

Example: `:FETC:ACP:MOD:POW?   1`

:FETCh:ACPower:MODulation:TRACe:ASCii?

Parameters: None.

Response: Array of 501*<NR2>, comma separated.

Returned values:

Description: Returns the set of points representing the spectrum of the ACP due to modulation.

Example: `:FETC:ACP:MOD:TRAC:ASC?`

:FETCh:ACPower:MODulation:TRACe:BINary?

Parameters: None.

Response: Array of 501*<bin>, MS byte first. See Table 4-5.

Returned values:

Description: Returns the set of points representing the spectrum of the ACP due to modulation.

Example: `:FETC:ACP:MOD:TRAC:BIN?`

:FETCh:ACPower:SWITching:ATPower?

Parameters: None.

Response: <NR2>

Returned values: (dBm)

Description: Average transmitter power during ACP due to switching measurement.

Example: `:FETC:ACP:SWIT:ATP?`

:FETCh:ACPower:SWITching:FAIL?

Parameters: None.

Response: <NR1>

Returned values: 0 | to | 32767 − for bit significance see Table 4-3.

Description: Tests whether the measured profile fails a limit check against the current limit mask. 0 signifies a pass. Any integer denotes failure.

Example: `:FETC:ACP:SWIT:FAIL?`

:FETCh:ACPower:SWITching:PEAK?

Parameters: <NRf>
<peak no>

<peak no> is (−20, −19,...−1) for −25 kHz channel or   (1, 2,......20) for +25 kHz channel, default = 6.

Response: <NR2>

Returned values: (dBc)

Description: Returns the nth highest peak value for a particular channel offset.

Example: `:FETC:ACP:SWIT:PEAK? −10`

:FETCh:ACPower:SWITching:POWer?

Parameters:	\<NRf\> \<chan\> \<chan\> is (−1, +1) default = −1 x 25 kHz offset.
Response:	\<NR2\>
Returned values:	(dBc)
Description:	Returns the adjacent channel power due to switching of the specified channel offset.
Example:	:FETC:ACP:SWIT:POW? −1

:FETCh:ACPower:SWITching:TRACe:ASCii?

Parameters:	None.
Response:	Array of 501*\<NR2\>, comma separated.
Returned values:	(dBc)
Description:	Returns the set of points representing the spectrum of the ACP due to switching.
Example:	:FETC:ACP:SWIT:TRAC:ASC?

:FETCh:ACPower:SWITching:TRACe:BINary?

Parameters:	None.
Response:	Array of 501*\<bin\>, MS byte first. See Table 4-5.
Returned values:	(mBc)
Description:	Returns the set of points representing the spectrum of the ACP due to switching.
Example:	:FETC:ACP:SWIT:TRAC:BIN?

:FETCh:APVT:AERRor?

Parameters:	\<NRf\> \<sym_no\>
Response:	\<NR2\>
Returned values:	Amplitude error (%).
Description:	Returns the value of the amplitude error at the specified symbol.
Example:	:FETC:APVT:AERR? 20

:FETCh:APVT:AERRor:TRACe:ASCii?

Parameters: None.

Response: Array of 300*<NR2>

Returned values: (%) (ASCII)

Description: Returns the amplitude error trace data.

Example: :FETC:APVT:AERRor:TRAC:ASC?

:FETCh:APVT:AERRor:TRACe:BINary?

Parameters: None.

Response: Array of 300*<bin>

Returned values: (0.01%) 16-bit signed binary values

Description: Returns the amplitude error trace data.

Example: :FETC:APVT:AERRor:TRAC:BIN?

:FETCh:APVT:PERRor?

Parameters: <NRf>
<sym_no>

Response: <NR2>

Returned values: Phase error (deg).

Description: Returns the value of the phase error at the specified symbol.

Example: :FETC:APVT:PERR? 70

:FETCh:APVT:PERRor:TRACe:ASCii?

Parameters: None.

Response: Array of 300*<NR2>

Returned values: (deg) (ASCII)

Description: Returns the phase error trace data.

Example: :FETC:APVT:PERRor:TRAC:ASC?

:FETCh:APVT:PERRor:TRACe:BINary?

Parameters: None.

Response: Array of 300*<bin>

Returned values: (0.01 deg) 16-bit signed binary values

Description: Returns the phase error trace data.

Example: `:FETC:APVT:PERRor:TRAC:BIN?`

:FETCh:CLUSter:TRACe:BINary?

Parameters: None.

Response: <512_bin>

Returned values: <binary header> 512* 16-bit binary values. See Table 4-5.

Description: Returns the binary cluster (rotated vector) trace of 256 I,Q pairs.

Example: `:FETC:CLUS:TRAC:BIN?`

:FETCh:CONStellation:TRACe:BINary?

Parameters: None.

Response: <512_bin>

Returned values: <binary header> 512* 16-bit binary values. See Table 4-5.

Description: Returns the binary constellation trace of 256 I,Q pairs.

Example: `:FETC:CONS:TRAC:BIN?`

:FETCH:IMOD:ATPower?

Parameters: None.

Response: <NR2>

Returned values: (dBm)

Description: Returns the average on-channel transmitter power during the intermodulation attenuation measurement.

Example: `:FETCH:IMOD:ATP?`

:FETCH:IMOD:ATTenuation?

Parameters:	<NRf>
	<product no>
	<product no> is in the range 1−6, see Table 4-12.
Response:	<NR2>
Returned values:	(dBc)
Description:	Returns attenuation measurement for the specified intermodulation product.
Example:	:FETCH:IMOD:ATT? 4

:FETCH:IMOD:ATTenuation:FAIL?

Parameters:	<NRf>
	<product no>
	<product no> is in the range 1−6, see Table 4-12.
Response:	<NR1>
Returned values:	0	1
Description:	Tests whether the intermodulation attenuation meets (0) or fails to meet (1) the specification.
Example:	:FETCH:IMOD:ATT:FAIL? 1

:FETCH:IMOD:FAIL?

Parameters:	None.
Response:	<NR1>
Returned values:	0	to	32767 − for bit significance, see Table 4-3.
Description:	Returns the imod_failed flags word.
Example:	:FETCH:IMOD:FAIL?

:FETCH:IMOD:IPOWer?

Parameters: None.

Response: <NR2>

Returned values: (dBm)

Description: Returns the power measured at the interferer frequency.

Example: `:FETCH:IMOD:POW?`

:FETCH:IMOD:LIMit?

Parameters: <NRf>
                 <product no>

                 <product no> is in the range 1−6, see Table 4-12.

Response: <NR1>

Returned values: 0 | 1

Description: Returns the limit used at the product no 1 = absolute (dBm) limit. 0 = relative
                 (dBc) limit.
                 Applies to BS measurements only: MS and DMO are always relative (dBc).

Example: `:FETCH:IMOD:LIM? 1`

:FETCh:IQVT:IAMP?

Parameters: <NRf>
                 <sym_no>

Response: <NR2>

Returned values: Amplitude (normalized to 1.0000)

Description: Returns the I (real) amplitude at the specified symbol.

Example: `:FETC:IQVT:IAMP? 20`

:FETCh:IQVT:IAMP:TRACe:ASCii?

Parameters: None.

Response: Array of 300*<NR2>

Returned values: Amplitude (normalized to 1.0000)

Description: Returns the I (real) amplitude.

Example: :FETC:IQVT:IAMP:TRAC:ASC?

:FETCh:IQVT:IAMP:TRACe:BINary?

Parameters: None.

Response: Array of 300*<bin>

Returned values: (units of $\frac{1}{10000}$ normal) 16-bit signed binary values

Description: Returns the I (real) amplitude.

Example: :FETC:IQVT:IAMP:TRAC:BIN?

:FETCh:IQVT:QAMP?

Parameters: <NRf>
<sym_no>

Response: <NR2>

Returned values: Amplitude (normalized to 1.0000)

Description: Returns the Q (imaginary) amplitude at the specified symbol.

Example: :FETC:IQVT:QAMP? 20

:FETCh:IQVT:QAMP:TRACe:ASCii?

Parameters: None.

Response: Array of 300*<NR2>

Returned values: Amplitude (normalized to 1.0000)

Description: Returns the Q (imaginary) amplitude.

Example: :FETC:IQVT:QAMP:TRAC:ASC?

:FETCh:IQVT:QAMP:TRACe:BINary?

Parameters: None.

Response: Array of 300*<bin>

Returned values: (units of $\frac{1}{10000}$ normal) 16-bit signed binary values

Description: Returns the Q (imaginary) amplitude.

Example: :FETC:IQVT:QAMP:TRAC:BIN?

:FETCh:LINearization:BETWeen?

Parameters: [<NRf>]
[<chan>]

<chan> is: +1 = +25 kHz channel or −1 = −25 kHz channel (default).

Response: <NR1>

Returned values: Time in µs.

Description: Returns the total time for which the signal remains between limits in the specified channel.

Example: :FETC:LIN:BETW?

:FETCh:LINearization:FAIL?

Parameters: None.

Response: <NR1>

Returned values: See Table 4-3.

Description: Returns the failed status word.

Example: :FETC:LIN:FAIL?

:FETCh:LINearization:OVER?

Parameters: [<NRf>]
[<chan>]

<chan> is: +1 = +25 kHz channel or −1 = −25 kHz channel (default).

Response: <NR1>

Returned values: Time in µs.

Description: Returns the total time for which the −30 dBc limit is exceeded in the specified channel.

Example: :FETC:LIN:OVER? +1

:FETCh:LINearization:TRACe:ASCii?

Parameters: [<NRf>]
[<chan>]

<chan> is: +1 = +25 kHz channel, 0 = Tx channel or −1 = −25 kHz channel (default).

Response: Array of 501*<NR2>, separated by commas.

Returned values: (dBc) (ASCII)

Description: Returns 501 dBc values, taken over −500 to +8000 µs (Mobile Station and DMO), or over −500 to +6500 µs (Base Station), with respect to the trigger point of the on-channel burst.

Example: :FETC:LIN:TRAC:ASC? −1

:FETCh:LINearization:TRACe:BINary?

Parameters: [<NRf>]
[<chan>]

<chan> is: +1 = +25 kHz channel, 0 = Tx channel or −1 = −25 kHz channel (default).

Response: Array of 501*<bin>.

Returned values: (mBc, equivalent to 0.01 dBc) 16-bit signed 2's-complement binary values.

Description: Returns 501 mBc values as signed binary integers, taken over −500 to +8000 µs (Mobile Station and DMO), or over −500 to +6500 µs (Base Station), with respect to the trigger point of the on-channel burst.

Example: :FETC:LIN:TRAC:BIN? 1

:FETCH:MODulation:BURSt?

Parameters: None.

Response: <NR1>

Returned values: Number of failed bursts.

Description: Returns the total number of failed bursts in the sample.

Example: :FETCH:MOD:BURS?

:FETCh:MODulation:BURSt:CLEAk?

Parameters: <NRf>
<fail_no>

Response: <NR2>

Returned values: Residual carrier leakage (dB).

Description: Returns the residual carrier leakage value for the <fail_no> entry in the failed bursts table.

Example: :FETC:MOD:BURS:CLEA?

:FETCh:MODulation:BURS:FAIL?

Parameters: <NRf>
<fail_no>

Response: <NR1>

Returned values: 0 | to | 8− for bit significance see Table 4-3.

Description: Returns fail tokens word for the <fail_no> entry in the failed bursts table.

Example: :FETC:MOD:BURS:FAIL?

:FETCh:MODulation:BURS:FERRor?

Parameters: <NRf>
<fail_no>

Response: <NR2>

Returned values: Frequency error in Hz.

Description: Returns the frequency error value for the <fail_no> entry in the failed bursts table.

Example: :FETC:MOD:BURS:FERR?

:FETCh:MODulation:BURSt:MVERror?

Parameters: <NRf>
    <fail_no>

Response: <NR2>

Returned values: Mean vector error (%).

Description: Returns the average RMS value of vector error for the <fail_no> entry in the failed bursts table.

Example: `:FETC:MOD:BURS:MVER?`

:FETCh:MODulation:BURSt:PVERror?

Parameters: <NRf>
    <fail-no>

Response: <NR2>

Returned values: Peak vector error (%).

Description: Returns the value of the peak vector error for the <fail_no> entry in the failed bursts table.

Example: `:FETC:MOD:BURS:PVER?`

:FETCh:MODulation:BURSt:PVSYmbol?

Parameters: <NRf>
    <fail_no>

Response: <NR1>

Returned values: Symbol number.

Description: Returns the symbol number of the peak vector error for the <fail_no> entry in the failed bursts table.

Example: `:FETC:MOD:BURS:PVSY?`

:FETCh:MODulation:CLEAk?

Parameters: None.

Response: <NR2>

Returned values: Residual carrier magnitude (carrier leak) %.

Description: Returns the residual carrier error of the current burst.

Example: :FETC:MOD:CLEA?

:FETCh:MODulation:DATA?

Parameters: None.

Response: <NR1>
Data value of the specified symbol.

Returned values: 0 | 1 | 2 | 3

Description: Returns one of the above digits to signify the data symbol at the position set by the parameter.

Examples: :FETC:MOD:DATA? 69
:FETC:MOD:DATA? 69,390MHZ
:FETC:MOD:DATA? 69,390E6,40
:FETC:MOD:DATA? 69,390E6,40DBM,NUB1

:FETCh:MODulation:FAIL?

Parameters: None.

Response: <NR1>

Returned values: 0 | to | 32767 – for bit significance see Table 4-3.

Description: Tests whether the measured profile fails a limit check against the current limit mask. 0 signifies a pass. Any integer denotes failure.

Example: :FETC:MOD:FAIL?

:FETCh:MODulation:FERRor?

Parameters: None.

Response: <NR2>

Returned values: Frequency error in Hz.

Description:

Example: :FETC:MOD:FERR?

:FETCh:MODulation:MAERror?

Parameters: None.

Response: <NR2>

Returned values: Mean amplitude error (%).

Description: Returns the average RMS value of amplitude error over the symbols of the current burst.

Example: :FETC:MOD:MAER?

:FETCh:MODulation:MPERror?

Parameters: None.

Response: <NR2>

Returned values: Mean phase error (deg).

Description: Returns the average RMS value of phase error over the symbols of the current burst.

Example: :FETC:MOD:MPER?

:FETCh:MODulation:MVERror?

Parameters: None.

Response: <NR2>

Returned values: Mean vector error (%).

Description: Returns the average RMS value of vector error over the symbols of the current burst.

Example: :FETC:MOD:MVER?

:FETCh:MODulation:PAERror?

Parameters: None.

Response: <NR2>

Returned values: Peak amplitude error (%).

Description: Returns the value of the peak amplitude error of the current measurement.

Example: `:FETC:MOD:PAER?`

:FETCh:MODulation:PPERror?

Parameters: None.

Response: <NR2>

Returned values: Peak phase error (deg).

Description: Returns the value of the peak phase error of the current measurement.

Example: `:FETC:MOD:PPER?`

:FETCh:MODulation:PVERror?

Parameters: None.

Response: <NR2>

Returned values: Peak vector error (%).

Description: Returns the value of the peak vector error of the current measurement.

Example: `:FETC:MOD:PVER?`

:FETCh:MODulation:PASYmbol?

Parameters: None.

Response: <NR1>

Returned values: Symbol number.

Description: Returns the number of the symbol with the peak amplitude error.

Example: `:FETC:MOD:PASY?`

:FETCh:MODulation:PPSYmbol?

Parameters: None.

Response: <NR1>

Returned values: Symbol number.

Description: Returns the number of the symbol with the peak phase error.

Example: :FETC:MOD:PPSY?

:FETCh:MODulation:PVSYmbol?

Parameters: None.

Response: <NR1>

Returned values: Symbol number.

Description: Returns the number of the symbol with the peak vector error.

Example: :FETC:MOD:PVSY?

:FETCh:MODulation:TRACe:ASCii?

Parameters: None.

Response: Array of 255*<NR1>, comma separated.

Returned values: 0 | 1 | 2 | 3 ASCII, including symbols before and after he displayed data. Range depends on burst type.

Description: Symbol values as displayed on demodulated data screen.

Example: :FETC:MOD:TRAC:ASC?

:FETCh:MODulation:TRACe:BINary?

Parameters: None.

Response: Array of 255*<bin>. See Table 4-5.

Returned values: 0 | 1 | 2 | 3 binary, including symbols before and after the displayed data. Range depends on burst type.

Description: Symbol values as displayed on demodulated data screen.

Example: :FETC:MOD:TRAC:BIN?

:FETCh:NSPower:ATPower?

Parameters:	None.
Response:	<NR2>
Returned values:	(dBm)
Description:	Average transmitter power during non-active slot power measurement.
Example:	:FETC:NSP:ATP?

:FETCh:NSPower:FAIL?

Parameters:	None.
Response:	<NR1>
Returned values:	0	to	32767 − for bit significance see Table 4-3.
Description:	Tests whether the measured profile fails a limit check against the current limit mask. 0 signifies a pass. Any integer denotes failure.
Example:	:FETC:NSP:FAIL?

:FETCh:NSPower:POWer?

Parameters:	<NRf> <slot> <slot> = relative position of non-active slot to be measured with respect to the active slot. [−3	−2	−1	+1	+2	+3] (note: −3 ≡ +1, −2 ≡ +2, −1 ≡ +3) default = +1.
Response:	<NR2>
Returned values:	(dBc)
Description:	Non-active state power.
Example:	:FETC:NSP:POW? 1

:FETCH:NSPower:TRACe:ASCii?

Parameters: None.

Response: Array of 501*<NR2>, separated by commas.

Returned values: (dBc) (ASCII)

Description: Returns the current profile trace data as 501 dBc values. The 500 intervals are over the same slots as currently displayed.

Example: `:FETCH:NSP:TRAC:ASC?`

:FETCH:NSPower:TRACe:BINary?

Parameters: None.

Response: Array of 501*<bin>

Returned values: (mBc, equivalent to 0.01 dBc) 16-bit signed 2's-complement binary values.

Description: Returns the current profile trace data as 501 mBc values. The 500 intervals are over the same slots as currently displayed.

Example: `:FETCH:NSP:TRAC:BIN?`

:FETCh:PPROfile:ATPower?

Parameters: None.

Response: <NR2>

Returned values:

Description: Average transmitter power.

Example: `:FETC:PPRO:ATP?`

:FETCh:PPROfile:FAIL?

Parameters: None.

Response: <NR1>

Returned values: 0 | to | 32767 – for bit significance see Table 4-3.

Description: Tests whether the measured profile fails a limit check against the current limit mask. 0 signifies a pass. Any integer denotes failure.

Example: `:FETC:PPRO:FAIL?`

:FETCh:PPROfile:POWer?

Parameters: \<NRf\>
                        \<sym_no\>

                        Symbol number is in range 0 to 299 − includes ramp periods.

Response: \<NR2\> (dBc)

Returned values: The value of the power profile at a given symbol number.

Description:

Example: `:FETC:PPRO:POW? 33`

:FETCh:PPROfile:TRACe:ASCii?

Parameters: None.

Response: Array of 299*\<NR2\>, comma separated.

Returned values:

Description: Returns the set of points representing the spectrum of the power-profile trace.

Example: `:FETC:PPRO:TRAC:ASC?`

:FETCh:PPROfile:TRACe:BINary?

Parameters: None.

Response: Array of 299*\<bin\>, MS byte first. See Table 4-5.

Returned values:

Description: Returns the set of points representing the spectrum of the power-profile trace.

Example: `:FETC:PPRO:TRAC:BIN?`

:FETCh:SPECtrum:FAIL?

Parameters: None.

Response: \<NR1\>

Returned values: 0 | to | 32767 − for bit significance see Table 4-3.

Description: Tests whether was a known failure with the last spectrum FETCh. 0 signifies a pass. 1024 denotes input level overload.

Example: `:FETC:SPEC:FAIL?`

:FETCh:SPECtrum:FREQuency?

Parameters: None.

Response: <NR2>

Returned values: Frequency of the marker in Hz.

Description:

Example: `:FETC:SPEC:FREQ?`

:FETCh:SPECtrum:LEVel?

Parameters: None.

Response: <NR2>

Returned values: Level at the marker in dBm.

Description:

Example: `:FETC:SPEC:LEV?`

:FETCh:SPECtrum:TRACe:ASCii?

Parameters: None.

Response: Array of 501*<NR2>, separated by commas.

Returned values:

Description: Returns the entire trace.

Example: `:FETC:SPEC:TRAC:ASC?`

:FETCh:SPECtrum:TRACe:BINary?

Parameters: None.

Response: Array of 501*<bin>, MS byte first. See Table 4-5.

Returned values:

Description: Returns the entire trace.

Example: `:FETC:SPEC:TRAC:BIN?`

:FETCH:SPURious:ATPower?

Parameters:	None.
Response:	<NR2>
Returned values:	(dBm)
Description:	Returns average on-channel transmitter power.
Example:	:FETCH:SPUR:ATP?

:FETCH:SPURious:BANDwidth?

Parameters:	None.
Response:	<NR2>
Returned values:	(Hz)
Description:	Returns noise bandwidth.
Example:	:FETCH:SPUR:BAND?

:FETCH:SPURious:CORRected?

Parameters:	<NRf> <point no>
Response:	<NR2>
Returned values:	(dBc)
Description:	Returns power measured at the specified point, with a correction for the wideband noise limit. <point no> defaults to the current point.
Example:	:FETCH:SPUR:BAND?

:FETCH:SPURious:FAIL?

Parameters:	None.
Response:	<NR1>
Returned values:	0 | to | 32767 – for bit significance, see Table 4-3.
Description:	Returns the spur_failed flags word. In numeric-only display, the 'failed bit' is TRUE if any point has failed. In spectrum display, the 'failed' bit is TRUE if the current point has failed (after correction).
Example:	:FETCH:SPUR:FAIL?

:FETCH:SPURious:POWer?

Parameters: [<NRf>]
[<point no>]

Response: <NR2>

Returned values: (dBc)

Description: Returns the power measured at the specified point. <point no> defaults to the current point.

Examples: :FETCH:SPUR:POW?
:FETCH:SPUR:POW? 7

:FETCH:SPURious:POWer:FAIL?

Parameters: <NRf>
<point no>

Response: <NR1>

Returned values: 0 | (pass), 1 | (fail)

Description: Returns pass/fail at the specified point (after correction). <point no> defaults to the current point.

Example: :FETCH:SPUR:POW:FAIL? 8

:FETCh:SPURious:TRACe:ASCii?

Parameters: None.

Response: Array of 501*<NR2>, separated by commas.

Returned values: (dBc) (ASCII)

Description: Returns 501 dBc values, taken over a span of 125 kHz.

Example: :FETC:SPUR:TRAC:ASC?

:FETCh:SPURious:TRACe:BINary?

Parameters: None.

Response: Array of 501*<bin>.

Returned values: (mBc, equivalent to 0.01 dBc) 16-bit signed 2's-complement binary values.

Description: Returns 501 mBc values, taken over a span of 125 kHz.

Example: :FETC:SPUR:TRAC:BIN?

:FETCh:VECTor:TRACe:BINary?

Parameters: None.

Response: <3752_bin>

Returned values: <binary header> 3752* 16-bit binary values. See Table 4-5.

Description: Returns the binary vector trace of 1786 I,Q pairs.

Example: `:FETC:VECT:TRAC:BIN?`

:FETCh:VEVT:TRACe:ASCii?

Parameters: None.

Response: Array of 300*<NR2>

Returned values: Vector error trace data (%)

Description: Returns the vector error trace data.

Example: `:FETC:VEVT:TRAC:ASC?`

:FETCh:VEVT:TRACe:BINary?

Parameters: None.

Response: Array of 300*<bin>

Returned values: (0.01%) 16-bit signed binary values

Description: Returns the vector error trace data.

Example: `:FETC:VEVT:TRAC:BIN?`

:FETCh:VEVT:VERRor?

Parameters: None.

Response: <NR2>

Returned values: Vector error (%)

Description: Returns the vector error at the specified symbol.

Example: `:FETC:VEVT:VERR?`

:FETCH:WBANd:ATPower?

Parameters: None.

Response: <NR2>

Returned values: (dBm)

Description: Returns average transmitter power.

Example: :FETCH:WBAN:ATP?

:FETCH:WBANd:BANDwidth?

Parameters: None.

Response: <NR2>

Returned values: (Hz)

Description: Returns noise bandwidth.

Example: :FETCH:WBAN:BAND?

:FETCH:WBAN:FAIL?

Parameters: None.

Response: <NR1>

Returned values: 0 | to | 32767 – for bit significance, see Table 4-3.

Description: Returns the wban_failed flags word.
In numeric-only display, the 'failed bit' is TRUE if any point has failed.
In spectrum display, the 'failed' bit is TRUE if the current point has failed.

Example: :FETCH:WBAN:FAIL?

:FETCH:WBANd:LIMit:ABSolute?

Parameters: <NRf>
<point no>

Response: <NR2>

Returned values: Current limit setting (dBm).

Description: Returns the maximum absolute power limit effective for the last measurement at the specified point.

Example: :FETCH:WBAN:LIM:ABS? 1

:FETCH:WBANd:LIMit:RELative?

Parameters: <NRf>
    <point no>

Response: <NR2>

Returned values: Current limit setting (dBc).

Description: Returns the relative power limit effective for the last measurement at the specified point.

Example: `:FETCH:WBAN:LIM:REL? 7`

:FETCH:WBANd:POWer?

Parameters: [<NRf>]
    [<point no>]

Response: <NR2>

Returned values: (dBc)

Description: Returns the power measured at the specified point. <point no> defaults to the current point.

Examples: `:FETCH:WBAN:POW?`
    `:FETCH:WBAN:POW? 7`

:FETCH:WBANd:POWer:FAIL?

Parameters: <NRf>
    <point no>

Response: <NR1>

Returned values: 0 | (pass), 1 | (fail)

Description: Returns pass/fail at the specified point. <point no> defaults to the current point.

Example: `:FETCH:WBAN:POW:FAIL? 8`

:FETCH:WBANd:TRACe:ASCii?

Parameters: None.

Response: Array of 501*<nr2>, comma-separated.

Returned values: (dBc) (ASCII).

Description: Returns 501 trace points over a span of 78.75 kHz.

Example: `:FETCH:WBAN:TRAC:ASC?`

:FETCH:WBANd:TRACe:BINary?

Parameters: None.

Response: Array of 501*<bin>.

Returned values: (mBc, equivalent to 0.01 dBc) 16-bit signed 2's-complement binary values.

Description: Returns 501 trace points over a span of 78.75 kHz, centered on the specified point. Each value is returned as two bytes, MS byte first.

Example: `:FETCH:WBAN:TRAC:BIN?`

FREQuency SUBSYSTEM

The FREQUency subsystem controls the frequency characteristics of the instrument.

FREQuency:
   CENTre\?
   REFerence\?
   ROSCillator
   SPAN\?

:FREQuency:CENTre or :CENTer

Synonym for :FREQ:REF

Parameters: <NRf_fs>
The frequency to be analyzed.

Valid values: Frequency value: real
Frequency (Hz).

Description: Sets the center frequency. The actual LO frequency of the 2310 will be set
10.71 MHz higher than the value specified.

Example: `:FREQ:CENT 124E6`

Sets center frequency to 124 MHz.

:FREQuency:CENTre or :CENTer?

Synonym for :FREQ:REF?

Parameters: None.

Response: <NR2> (Hz)

Returned values: Frequency value: real.

Description: Reads the center frequency value.

Example: `:FREQ:CENT?`

`124600000`

:FREQuency:REFerence

Parameters: <NRf_fs>
                             The frequency to be analyzed.

Valid values: Frequency value: real
                             Frequency (Hz).

Description: Sets the center frequency. The actual LO frequency of the 2310 will be set
                             10.71 MHz higher than the value specified.

Example: `:FREQ:REF 124E6`

                             Sets center frequency to 124 MHz.

:FREQuency:REFerence?

Parameters: None.

Response: <NR2> (Hz)

Returned values: Frequency value: real.

Description: Reads the center frequency value.

Example: `:FREQ:REF?`

                             `124600000`

:FREQuency:ROSCillator

Parameters: <CPD>
                             Reference oscillator selection.

Valid values: INT | INT10OUT | EXT1IND | EXT10IND

Description: Selects reference oscillator between internal 10 MHz or external 1 or 10 MHz. For
                             internal, selects between enabling and disabling output from INT STD O/P socket.

                             INT   internal 10 MHz oscillator, no output.
                             INT10OUT   internal 10 MHz oscillator with 10 MHz output.
                             EXT1IND   external 1 MHz indirect via internal PLL.
                             EXT10IND   external 10 MHz indirect via internal PLL.

Example: `:FREQ:ROSC INT10OUT`

:FREQuency:SPAN

Parameters: <NRf_fs>
The frequency span to be analyzed in spectrum mode.

Valid values: Frequency value: real
Frequency (Hz).

Description: Sets the span for spectrum analyzer mode.

Example: `:FREQ:SPAN 124E3`

Sets frequency span to 124 kHz.

:FREQuency:SPAN?

Parameters: None.

Response: <NR2> (Hz)

Returned values: Frequency value: real.

Description: Reads the frequency span value.

Example: `:FREQ:SPAN?`

`124000`

HARD SUBSYSTEM

The HARD subsystem controls the printing of measurement data.

HARD:
    PLOT:
        ALL
        NAME

:HARD[:PLOT[:ALL]]

Parameters: None.

Valid values:

Description: Outputs over the parallel port connector an A4 hard print of all available information for the current measurement. If limits are turned on, limit lines are printed and annotated.

Example: `:HARD:PLOT:ALL`

:HARD:PLOT:NAME

Parameters: <STRING PROGRAM DATA>

Valid values: Up to 50 characters.

Description: Inserts a string in the heading of all printouts. The string is preceded by the words 'Analysis by:'.

Example: `:HARD:PLOT:NAME 'Our mobile unit serial 12345-67'`

INITiate SUBSYSTEM

The INITiate subsystem is used to control the initiation of a measurement process.

INITiate:
       CONTinuous\?
       IMMediate

:INITiate:CONTinuous

Parameters: <bool>

Valid values: ON | OFF | 0 | 1

Description: This command is used to select whether the trigger system is continuously initiated or not. With CONTinuous set to OFF the system remains idle until set to ON or INIT:IMMediate is received. When set to OFF, the current measurement process is aborted before returning to idle.
ON = repeat, OFF = single.

Examples:
```
INIT:CONT ON
INIT:CONT 1
```

Note: when in CONTinuous trigger mode, pressing SINGLE is equivalent to INIT:CONT 0; INIT:IMM

:INITiate:CONTinuous?

Parameters: None.

Response: <bool>

Returned values: 0 | 1

Description: Reads the current trigger initiation state.

Example: `:INIT:CONT?`

:INITiate:IMMediate

Parameters: None.

Valid values:

Description: Initiates one complete cycle and return to idle (providing CONT is OFF; if CONT is ON, this command will produce an error).

Example: `:INIT:IMM`

INSTrument SUBSYSTEM

The INSTrument subsystem selects the operating mode of the instrument.

INSTrument:
    ID?
    SELect\?

:INSTrument:ID?

Parameters: None.

Response: <NR1>

Returned values: Integer

Description: Returns the instrument's identification (ID) number (up to 10 digits maximum).

Example: INST:ID?

:INSTrument:SELect

Parameters: <CPD>
Measurement mode

Valid values: TETRA | SPECtrum

Description: Sets the basic operating mode of the instrument. When in TETRA mode, spectrum analyzer commands are still accepted and become effective when the mode is changed (and vice versa).

Calibration commands are locked out when not in calibration mode and measurement commands are not accepted whilst in calibration.

Example: INST:SEL TETRA

Sets TETRA measurement mode.

:INSTrument:SELect?

Parameters: None.

Response: <CRD>

Returned values: TETRA | SPEC

Description: Reads the current measurement mode.

Example: INST:SEL?

MEASure SUBSYSTEM

The MEASure subsystem has the following command format:

```
MEASure:<function>? <parameters>
```

The MEASure? query provides, in a single operation, a complete measurement sequence, including configuration and reading of the data. No knowledge of the instrument is required to perform the operation.

<function> defines the measurement operation to be used by MEASure? It is also used in the CONFigure, READ? and FETCh? sub-systems.

<parameters> are optional parameters which describe the essential characteristics of the measurement <function>. For example, in order for a TETRA measurement to be performed, the channel frequency, input level and burst type characteristics must be known by the instrument.

If parameters are omitted, they are assumed to be those currently in use. Parameters may be defaulted from the right by omitting them, or anywhere by substituting the keyword DEFault.

The MEASure? query is identical to performing the following command:

```
ABORt;
CONFigure:<function> <parameters>;
READ:<function>? <parameters>;
```

Note: although the MEASure? query is the most convenient and reliable method of obtaining measurement data, it is not necessarily the most efficient with respect to response time. Examples which describe the various ways of performing a measurement are given on page 4-221.

MEASure:
  ACPower:
    MODulation:
      ATPower?
      FAIL?
      POWer?
      TRACe:
        ASCii?
        BINary?
    SWITching:
      ATPower?
      FAIL?
      PEAK?
      POWer?
      TRACe:
        ASCii?
        BINary?
MEASure:
  APVT:
    AERRor?
    AERRor:
      TRACe:
        ASCii?
        BINary?
    PERRor?
    PERRor:
      TRACe:
        ASCii?
        BINary?

MEASure:
  CLUSter:
    TRACe:
      BINary?
MEASure:
  CONStellation:
    TRACe:
      BINary?
MEASure:
  IMOD:
    ATPower?
    ATTenuation?
    ATTenuation:
      FAIL?
    FAIL?
    IPOWer?
MEASure:
  IQVT:
    IAMP?
    IAMP:
      TRACe:
        ASCii?
        BINary?
    QAMP?
    QAMP:
      TRACe:
        ASCii?
        BINary?

MEASure:
    LINearization:
        BETWeen?
        FAIL?
        OVER?
        TRACe:
            ASCii?
            BINary?
MEASure:
    MODulation:
        BURSt?
        CLEAk?
        DATA?
        FAIL?
        FERRor?
        MAERror?
        MPERror?
        MVERror?
        PAERror?
        PPERror?
        PVERror?
        PASYmbol?
        PPSYmbol?
        PVSYmbol?
        TRACe:
            ASCii?
            BINary?
MEASure:
    NSPower:
        ATPower?
        FAIL?
        POWer?
        TRACe:
            ASCii?
            BINary?
MEASure:
    PPROfile:
        ATPower?
        FAIL?
        POWer?
        TRACe:
            ASCii?
            BINary?
MEASure:
    SPECtrum:
        FAIL?
        FREQ?
        LEVel?
        TRACe:
            ASCii?
            BINary?

MEASure:
    SPURious:
        ATPower?
        BANDwidth?
        CORRected?
        FAIL?
        POWer?
        POWer:
            FAIL?
        TRACe:
            ASCii?
            BINary?
MEASure:
    VECTor:
        TRACe:
            BINary?
MEASure:
    VEVT:
        TRACe:
            ASCii?
            BINary?
        VERR?
MEASure:
    WBANd:
        ATPower?
        BANDwidth?
        FAIL?
        LIMit:
            ABSolute?
            RELative?
        POWer?
        POWer:
            FAIL?
        TRACe:
            ASCii?
            BINary?

:MEASure:ACPower:MODulation:ATPower?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: (dBm)

Description: Returns the average transmitter power during adjacent channel power due to modulation measurement.

Examples: `:MEAS:ACP:MOD:ATP? 380MHZ`
`:MEAS:ACP:MOD:ATP? 380E6,−20DBM,SBC`

:MEASure:ACPower:MODulation:FAIL?

Parameters: None.

Response: <NR1>

Returned values: 0 | to | 32767 − for bit significance see Table 4-3.

Description: Tests whether the measured profile fails a limit check against the current limit mask. 0 signifies a pass. Any integer denotes failure.

Example: `:MEAS:ACP:MOD:FAIL?`

:MEASure:ACPower:MODulation:POWer?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<chan> [, <frequency> [, <level> [, <burst type>]]]]

<chan> is (−3 ,−2 ,−1, 1, 2, 3,) (default = −1)   x 25 kHz offset.

Response: <NR2>

Returned values: (dBc)

Description: Adjacent channel power due to modulation of the specified channel offset.

Examples: `:MEAS:ACP:MOD:POW?`
`:MEAS:ACP:MOD:POW? −2`
`:MEAS:ACP:MOD:POW? −2,400MHZ,15,NUB1`

:MEASure:ACPower:MODulation:TRACe:ASCii?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: Array of 501*<NR2>, separated by commas.

Returned values:

Description: Returns the set of points representing the spectrum of the ACP due to modulation.

Example: `:MEAS:ACP:MOD:TRAC:ASC? 380MHZ,−10DBM,NUB1`

:MEASure:ACPower:MODulation:TRACe:BINary?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: Array of 501*<bin>, MS byte first. See Table 4-5.

Returned values:

Description: Returns the set of points representing the spectrum of the ACP due to modulation.

Example: :MEAS:ACP:MOD:TRAC:BIN? 380MHZ,−10DBM,NUB1

:MEASure:ACPower:SWITching:ATPower?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: (dBm)

Description: Returns the average transmitter power during ACP due to switching measurement.

Example: :MEAS:ACP:SWIT:ATP?

:MEASure:ACPower:SWITching:FAIL?

Parameters: None.

Response: <NR2>

Returned values: 0 | to | 32767 − for bit significance see Table 4-3.

Description: Tests whether the measured profile fails a limit check against the current limit mask. 0 signifies a pass. Any integer denotes failure.

Example: :MEAS:ACP:SWIT:FAIL?

:MEASure:ACPower:SWITching:PEAK?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<peak no> [, <frequency> [, <level> [, <burst type>]]]]

<peak no> is (−20, −19, ..., −1) for −25 kHz channel
or (1, 2 ..., 20) for +25 kHz channel, default = 6.

Response: <NR2>

Returned values: (dBc)

Description: Returns the nth highest peak value for a particular channel offset.

Examples:
```
:MEAS:ACP:SWIT:PEAK?
:MEAS:ACP:SWIT:PEAK? −10
:MEAS:ACP:SWIT:PEAK? 5,390MHZ
:MEAS:ACP:SWIT:PEAK? 15,390E6,20
:MEAS:ACP:SWIT:PEAK? −19,390E6,20DBM,NUB1
```

:MEASure:ACPower:SWITching:POWer?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<chan> [, <frequency> [, <level> [, <burst type>]]]]

<chan> is (−1, +1) (default = −1)   x 25 kHz offset.

Response: <NR2>

Returned values: (dBc)

Description: Returns the adjacent channel power due to switching of the specified channel offset.

Examples:
```
:MEAS:ACP:SWIT:POW?
:MEAS:ACP:SWIT:POW? +1
:MEAS:ACP:SWIT:POW? +1,380MHZ
:MEAS:ACP:SWIT:POW? +1,380E6,15
:MEAS:ACP:SWIT:POW? +1,380E6,15,NUB1
```

:MEASure:ACPower:SWITching:TRACe:ASCii?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<chan> [, <frequency> [, <level> [, <burst type>]]]]

<chan> is (−1, +1) (default = −1)   x 25 kHz offset.

Response: Array of 501*<NR2>, separated by commas.

Returned values: (dBc)

Description: Returns the set of points representing the spectrum of the ACP due to switching.

Example:
```
:MEAS:ACP:SWIT:TRAC:ASC? 380MHZ,−10DBM,NUB1
```

:MEASure:ACPower:SWITching:TRACe:BINary?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<chan> [, <frequency> [, <level> [, <burst type>]]]]

<chan> is (−1, +1) (default = −1)   x 25 kHz offset.

Response: Array of 501*<bin>, MS byte first. See Table 4-5.

Returned values: (mBc)

Description: Returns the set of points representing the spectrum of the ACP due to switching.

Example: :MEAS:ACP:SWIT:TRAC:BIN? 380MHZ,−10DBM,NUB1

:MEASure:APVT:AERRor?

Parameters: <NRf> [<NRf> [, <NRf> [, <CPD>]]]
<sym_no> [<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: Amplitude error (%).

Description: Sets up to measure modulation accuracy with a display of amplitude and phase vs time. Performs the measurement for the specified center frequency, input power and burst type. Returns the value of the amplitude error at the specified symbol.

Example: :MEAS:APVT:AERR? 20

:MEASure:APVT:AERRor:TRACe:ASCii?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: Array of 300*<NR2>

Returned values: (%) (ASCII)

Description: Sets up to measure modulation accuracy with a display of amplitude and phase vs time. Performs the measurement for the specified center frequency, input power and burst type. Returns the amplitude error trace data.

Example: :MEAS:APVT:AERRor:TRAC:ASC? 380MHZ,−10DBM,NUB1

:MEASure:APVT:AERRor:TRACe:BINary?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: Array of 300*<bin>

Returned values: (0.01%) 16-bit signed binary values

Description: Sets up to measure modulation accuracy with a display of amplitude and phase vs time. Performs the measurement for the specified center frequency, input power and burst type. Returns the amplitude error trace data.

Example: :MEAS:APVT:AERRor:TRAC:BIN? 380MHZ,−10DBM,NUB1

:MEASure:APVT:PERRor?

Parameters: <NRf> [<NRf> [, <NRf> [, <CPD>]]]
<sym_no> [<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: Phase error (deg).

Description: Sets up to measure modulation accuracy with a display of amplitude and phase vs time. Performs the measurement for the specified center frequency, input power and burst type. Returns the value of the phase error at the specified symbol.

Example: :MEAS:APVT:PERR? 70

:MEASure:APVT:PERRor:TRACe:ASCii?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: Array of 300*<NR2>

Returned values: (%) (ASCII)

Description: Sets up to measure modulation accuracy with a display of amplitude and phase vs time. Performs the measurement for the specified center frequency, input power and burst type. Returns the phase error trace data.

Example: :MEAS:APVT:PERRor:TRAC:ASC? 380MHZ,−10DBM,NUB1

:MEASure:APVT:PERRor:TRACe:BINary?

Parameters:	[<NRf> [, <NRf> [, <CPD>]]] [<frequency> [, <level> [, <burst type>]]]
Response:	Array of 300*<bin>
Returned values:	(0.01%) 16-bit signed binary values
Description:	Sets up to measure modulation accuracy with a display of amplitude and phase vs time. Performs the measurement for the specified center frequency, input power and burst type. Returns the phase error trace data.
Example:	:MEAS:APVT:PERRor:TRAC:BIN? 380MHZ,−10DBM,NUB1

:MEASure:CLUSter:TRACe:BINary?

Parameters:	[<NRf> [, <NRf> [, <CPD>]]] [<frequency> [, <level> [, <burst type>]]]
Response:	<512_bin>
Returned values:	<binary header> 512* 16-bit binary values. See Table 4-5.
Description:	Configured for modulation accuracy measurement. Data is of binary cluster (rotated vector) trace in 256 I,Q pairs.
Example:	:MEAS:CLUS:TRAC:BIN? 380MHZ,−10DBM,NUB1

:MEASure:CONStellation:TRACe:BINary?

Parameters:	[<NRf> [, <NRf> [, <CPD>]]] [<frequency> [, <level> [, <burst type>]]]
Response:	<512_bin>
Returned values:	<binary header> 512* 16-bit binary values. See Table 4-5.
Description:	Configured for modulation accuracy measurement. Data is of binary constellation trace in 256 I,Q pairs.
Example:	:MEAS:CONS:TRAC:BIN? 380MHZ,−10DBM,NUB1

:MEASure:IMOD:ATPower?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: (dBm)

Description: Sets up to measure intermodulation attenuation with a numeric-only display. Performs the measurement for the specified center frequency, input power and burst type. Returns the average on-channel transmitter power during the intermodulation attenuation measurement.

Examples: :MEAS:IMOD:ATP? 400E6,10
:MEAS:IMOD:ATP? 400E6,10,NUB1

:MEASure:IMOD:ATTenuation?

Parameters: <NRf> [<NRf> [, <NRf> [, <CPD>]]]
<product no> [<frequency> [, <level> [, <burst type>]]]

<product no> is in the range 1−6, see Table 4-12.

Response: <NR2>

Returned values: (dBc or dBm) (dependent on limit used at product no − see FETC:IMOD:LIM?)

Description: Sets up to measure intermodulation attenuation with a numeric-only display. Performs the measurement for the specified product no, center frequency, input power and burst type. Returns attenuation measurement for the specified intermodulation product.

Example: :MEASure:IMOD:ATT? 2

:MEASure:IMOD:ATTenuation:FAIL?

Parameters: <NRf> [<NRf> [, <NRf> [, <CPD>]]]
<product no> [<frequency> [, <level> [, <burst type>]]]

<product no> is in the range 1−6, see Table 4-12.

Response: <NR1>

Returned values: 0 | 1

Description: Sets up to measure intermodulation attenuation with a numeric-only display. Performs the measurement for the specified product no, center frequency, input power and burst type. Tests whether the intermodulation attenuation meets (0) or fails to meet (1) the specification.

Example: :MEASure:IMOD:ATT:FAIL? 3

:MEASure:IMOD:FAIL?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR1>

Returned values: 0 | to | 32767 – for bit significance, see Table 4-3.

Description: Sets up to measure intermodulation attenuation with a numeric-only display.
Performs the measurement for the specified center frequency, input power and burst
type. Returns the imod_failed flags word.

Examples: :MEAS:IMOD:FAIL?
:MEAS:IMOD:FAIL? 400E6,10,NUB1

:MEASure:IMOD:IPOWer?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]]
[<frequency> [, <level> [, <burst type>]]]]

Response: <NR2>

Returned values: (dBm)

Description: Sets up to measure intermodulation attenuation with a numeric-only display.
Performs the measurement for the specified center frequency, input power and burst
type. Returns the power measured at the interferer frequency.

Examples: :MEAS:IMOD:POW?
:MEAS:IMOD:POW? 7
:MEAS:IMOD:POW? 7,400E6,10
:MEAS:IMOD:POW? 7,400E6,10,NUB1

:MEASure:IQVT:IAMP?

Parameters: <NRf> [<NRf> [, <NRf> [, <CPD>]]]
<sym_no> [<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: Amplitude (normalized to 1.0000)

Description: Sets up to measure modulation accuracy with a display of I & Q amplitudes vs
time. Performs the measurement for the specified center frequency, input power
and burst type. Returns the I (real) amplitude at the specified symbol.

Example: :MEAS:IQVT:IAMP? 20

:MEASure:IQVT:IAMP:TRACe:ASCii?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: Array of 300*<NR2>

Returned values: Amplitude (normalized to 1.0000)

Description: Sets up to measure modulation accuracy with a display of I & Q amplitudes vs time. Performs the measurement for the specified center frequency, input power and burst type. Returns the I (real) amplitude.

Example: :MEAS:IQVT:IAMP:TRAC:ASC?

:MEASure:IQVT:IAMP:TRACe:BINary?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: Array of 300*<bin>

Returned values: (units of $\frac{1}{10000}$ normal) 16-bit signed binary values

Description: Sets up to measure modulation accuracy with a display of I & Q amplitudes vs time. Performs the measurement for the specified center frequency, input power and burst type. Returns the I (real) amplitude.

Example: :MEAS:IQVT:IAMP:TRAC:BIN?

:MEASure:IQVT:QAMP?

Parameters: <NRf> [<NRf> [, <NRf> [, <CPD>]]]
<sym_no> [<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: Amplitude (normalized to 1.0000)

Description: Sets up to measure modulation accuracy with a display of I & Q amplitudes vs time. Performs the measurement for the specified center frequency, input power and burst type. Returns the Q (imaginary) amplitude at the specified symbol.

Example: :MEAS:IQVT:QAMP? 20

:MEASure:IQVT:QAMP:TRACe:ASCii?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: Array of 300*<NR2>

Returned values: Amplitude (normalized to 1.0000)

Description: Sets up to measure modulation accuracy with a display of I & Q amplitudes vs time. Performs the measurement for the specified center frequency, input power and burst type. Returns the Q (imaginary) amplitude.

Example: :MEAS:IQVT:QAMP:TRAC:ASC?

:MEASure:IQVT:QAMP:TRACe:BINary?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: Array of 300*<bin>

Returned values: (units of $\frac{1}{10000}$ normal) 16-bit signed binary values

Description: Sets up to measure modulation accuracy with a display of I & Q amplitudes vs time. Performs the measurement for the specified center frequency, input power and burst type. Returns the Q (imaginary) amplitude.

Example: :MEAS:IQVT:QAMP:TRAC:BIN?

:MEASure:LINearization:BETWeen?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<chan> [, <frequency> [, <level> [, <uut-type>]]]]

<chan> is +1 (+25 kHz channel) or −1 (−25 kHz channel − default).

Response: <NR1>

Returned values: Time in μs.

Description: Sets up to measure a TETRA linearization burst (CLCH emissions) with a numeric-only display. Performs the measurement and gets data for the specified channel, center frequency, input power and <uut-type>. Returns the total time for which the signal remains between limits in the specified channel.

Examples: :MEAS:LIN:BETW?
:MEAS:LIN:BETW? +1
:MEAS:LIN:BETW? −1,390E6,15,BSC

:MEASure:LINearization:FAIL?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <uut-type>]]]

<uut-type> is:
	BSC	Base Station transmit, Continuous
	BSD	Base Station transmit, Discontinuous
	DMO	Direct Mode Operation
	MS	Mobile Station transmit.

Response: <NR1>

Returned values: The failed status word − see Table 4-3.

Description: Sets up to measure a TETRA linearization burst (CLCH emissions) with a numeric-only display. Performs the measurement for the specified center frequency, input power and <uut-type>.

Examples: `:MEAS:LIN:FAIL?`
`:MEAS:LIN:FAIL? 400E6,10,BSD`

:MEASure:LINearization:OVER?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<chan> [, <frequency> [, <level> [, <uut-type>]]]]

<chan> is +1 (+25 kHz channel) or −1 (−25 kHz channel − default).

Response: <NR1>

Returned values: Time in µs.

Description: Sets up to measure a TETRA linearization burst (CLCH emissions) with a numeric-only display. Performs the measurement and gets data for the specified channel, center frequency, input power and <uut-type>. Returns the total time for which the −30 dBc limit is exceeded in the specified channel.

Examples: `:MEAS:LIN:OVER?`
`:MEAS:LIN:OVER? 1`
`:MEAS:LIN:OVER? +1,390E6,15,BSC`

:MEASure:LINearization:TRACe:ASCii?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<chan> [, <frequency> [, <level> [, <uut-type>]]]]

<chan> is +1 (+25 kHz channel), 0 (Tx channel) or −1 (−25 kHz channel −
default).

Response: Array of 501*<NR2>, separated by commas.

Returned values: (dBc) (ASCII)

Description: Sets up to measure a TETRA linearization burst (CLCH emissions) and displays
the specified channel profile. Performs the measurement and gets data for the
specified channel, center frequency, input power and <uut-type>. Returns 501 dBc
values, taken over −500 to +8000 µs (Mobile Station and DMO), or over −500 to
+6500 µs (Base Station), with respect to the trigger point of the on-channel burst.

Example: `:MEAS:LIN:TRAC:ASC? −1,380MHZ,−10,DMO`

:MEASure:LINearization:TRACe:BINary?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<chan> [, <frequency> [, <level> [, <uut-type>]]]]

<chan> is +1 (+25 kHz channel), 0 (Tx channel) or −1 (−25 kHz channel −
default).

Response: Array of 501*<bin>

Returned values: (mBc, equivalent to 0.01 dBc) 16-bit signed 2's-complement binary values.

Description: Sets up to measure a TETRA linearization burst (CLCH emissions) and displays
the specified channel profile. Performs the measurement and gets data for the
specified channel, center frequency, input power and <uut-type>. Returns 501 mBc
values as signed binary integers, taken over −500 to +8000 µs (Mobile Station and
DMO), or over −500 to +6500 µs (Base Station), with respect to the trigger point of
the on-channel burst.

Example: `:MEAS:LIN:TRAC:BIN? −1`

:MEASure:MODulation:BURSt?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<sample size> [, <frequency> [, <level> [, <burst type>]]]]

Response: <NR1>

Returned values: Number of failed bursts.

Description: Sets up to measure modulation accuracy with a single-shot, numeric-only display. Performs the measurement over the current *Bursts to Analyse* (sample size) and gets data for the specified sample size, user frequency, input power and burst type. Returns the total number of failed bursts in the sample.

Example: :MEAS:MOD:BURS? 150

:MEASure:MODulation:CLEAk?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: Residual carrier magnitude (carrier leak)%.

Description: Returns the residual carrier error of the current burst.

Examples: :MEAS:MOD:CLEA? 380E6,10DBM
:MEAS:MOD:CLEA? 380MHZ,10,SBC

:MEASure:MODulation:DATA?

Parameters: <NRf> [, <NRf> [, <NRf> [, <CPD>]]]
<sym_no> [<frequency> [, <level> [, <burst type>]]]

For symbol number range see Table 4-6.

Response: <NR1>
Data value of the specified symbol.

Returned values: 0 | 1 | 2 | 3

Description: Returns one of the above digits to signify the data symbol at the position set by the parameter.

Example: :MEAS:MOD:DATA? 69

:MEASure:MODulation:FAIL?

Parameters: None.

Response: <NR1>

Returned values: 0 | to | 32767 – for bit significance see Table 4-3.

Description: Tests whether the measured profile fails a limit check against the current limit mask. 0 signifies a pass. Any integer denotes failure.

Example: :MEAS:MOD:FAIL?

:MEASure:MODulation:FERRor?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: Frequency error in Hz.

Description: Returns the carrier frequency error of the current burst.

Example: :MEAS:MOD:FERR?

:MEASure:MODulation:MAERror?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: Mean amplitude error (%).

Description: Returns the average RMS value of amplitude error over the symbols of the current burst.

Example: :MEAS:MOD:MAER? 390E6,10,CB

:MEASure:MODulation:MPERror?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
                 [<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: Mean phase error (deg).

Description: Returns the average RMS value of phase error over the symbols of the current burst.

Examples: `:MEAS:MOD:MPER?`
              `:MEAS:MOD:MPER? 390MHZ`

:MEASure:MODulation:MVERror?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
                 [<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: Mean vector error (%).

Description: Returns the average RMS value of vector error over the symbols of the current burst.

Example: `:MEAS:MOD:MVER?`

:MEASure:MODulation:PAERror?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
                 [<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: Peak amplitude error (%).

Description: Returns the value of the peak amplitude error of the current measurement .

Examples: `:MEAS:MOD:PAER?`
              `:MEAS:MOD:PAER? 380MHZ`

:MEASure:MODulation:PPERror?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: Peak phase error (deg).

Description: Returns the value of the peak phase error of the current measurement.

Examples: :MEAS:MOD:PPER?
:MEAS:MOD:PPER? 380E6,15,NUB1

:MEASure:MODulation:PVERror?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: Peak vector error (%).

Description: Returns the value of the peak vector error of the current measurement.

Examples: :MEAS:MOD:PVER?
:MEAS:MOD:PVER? 380MHZ
:MEAS:MOD:PVER? 380E6,15DBM
:MEAS:MOD:PVER? 380E6,15,NUB1

:MEASure:MODulation:PASYmbol?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR1>

Returned values: Symbol number.

Description: Returns the number of the symbol with the peak amplitude error.

Examples: :MEAS:MOD:PASY?
:MEAS:MOD:PASY? 400MHZ

:MEASure:MODulation:PPSYmbol?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR1>

Returned values: Symbol number.

Description: Returns the number of the symbol with the peak phase error.

Examples: :MEAS:MOD:PPSY?
:MEAS:MOD:PPSY? 400E6,20DBM

:MEASure:MODulation:PVSYmbol?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR1>

Returned values: Symbol number.

Description: Returns the number of the symbol with the peak vector error.

Examples: :MEAS:MOD:PVSY?
:MEAS:MOD:PVSY? 400E6,20DBM

:MEASure:MODulation:TRACe:ASCii?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: Array of 255*<NR1>, separated by commas.

Returned values: 0 | 1 | 2 | 3 ASCII including symbols before and after the displayed data. Range depends on burst type.

Description: Symbol values as displayed on demodulated data screen.

Example: :MEAS:MOD:TRAC:ASC? 380MHZ,−10DBM,NUB1

:MEASure:MODulation:TRACe:BINary?

Parameters:	[<NRf> [, <NRf> [, <CPD>]]] [<frequency> [, <level> [, <burst type>]]]
Response:	Array of 255*<bin>. See Table 4-5.
Returned values:	0 | 1 | 2 | 3 binary including symbols before and after the displayed data. Range depends on burst type.
Description:	Symbol values as displayed on demodulated data screen.
Example:	`:MEAS:MOD:TRAC:BIN? 380MHZ,−10DBM,NUB1`

:MEASure:NSPower:ATPower?

Parameters:	[<NRf> [, <NRf> [, <CPD>]]] [<frequency> [, <level> [, <burst type>]]]
Response:	<NR2>
Returned values:	(dBm)
Description:	
Examples:	`:MEAS:NSP:ATP?` `:MEAS:NSP:ATP? 380E6,30DBM,NUB2`

:MEASure:NSPower:FAIL?

Parameters:	None.
Response:	<NR1>
Returned values:	0 | to | 32767 − for bit significance see Table 4-3.
Description:	Tests whether the measured profile fails a limit check against the current limit mask. 0 signifies a pass. Any integer denotes failure.
Example:	`:MEAS:NSP:FAIL?`

:MEASure:NSPower:POWer?

Parameters:	[<NRf> [, <NRf> [, <NRf> [, <CPD>]]]] [<slot> [, <frequency> [, <level> [, <burst type>]]]] <slot> = relative position of non-active slot to be measured with respect to the active slot. {−3, −2, −1, +1, +2, +3} (note: −3 ≡ +1, −2 ≡ +2, −1 ≡ +3) default = +1.
Response:	<NR2>
Returned values:	(dBc)
Description:	Non-active slot power.

Examples:	`:MEAS:NSP:POW?`
	`:MEAS:NSP:POW? +1`
	`:MEAS:NSP:POW? +1,400MHZ,15DBM,CB`

:MEASure:NSPower:TRACe:ASCii?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<slot> [, <frequency> [, <level> [, <burst type>]]]]

<slot> is defined by Table 4-13.

Response: Array of 501*<NR2>, separated by commas.

Returned values: (dBc) (ASCII)

Description: Sets up to measure non-active slot power with a profile display. Performs the measurement and gets data for the specified slots, center frequency, input power and burst type. Returns the current profile trace data as 501 dBc values. The 500 intervals are over the same slots as currently displayed.

Example: `:MEAS:NSP:TRAC:ASC? 3,380MHZ,−10,DMO`

:MEASure:NSPower:TRACe:BINary?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<slot> [, <frequency> [, <level> [, <burst type>]]]]

<slot> is defined by Table 4-13.

Response: Array of 501*<bin>

Returned values: (mBc, equivalent to 0.01 dBc) 16-bit signed 2's-complement binary values.

Description: Sets up to measure non-active slot power with a profile display. Performs the measurement and gets data for the specified slots, center frequency, input power and burst type. Returns the current profile trace data as 501 mBc values. The 500 intervals are over the same slots as currently displayed.

Example: `:MEAS:NSP:TRAC:BIN? 4`

:MEASure:PPROfile:ATPower?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: Returns the average transmitter power (dBm).

Description:

Examples: `:MEAS:PPRO:ATP?`
`:MEAS:PPRO:ATP? 400MHZ`

:MEASure:PPROfile:FAIL?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: 0 | to | 32767 − for bit significance see Table 4-3.

Description: Tests whether the measured profile fails a limit check against the current limit
mask. 0 signifies a pass. An integer denotes failure.

Examples: :MEAS:PPRO:FAIL?
:MEAS:PPRO:FAIL? 390MHZ
:MEAS:PPRO:FAIL? 390E6,15
:MEAS:PPRO:FAIL? 390E6,15,NUB2

:MEASure:PPROfile:POWer?

Parameters: <NRf> [, <NRf> [, <NRf> [, <CPD>]]]
<sym_no> [<frequency> [, <level> [, <burst type>]]]

For symbol number range (includes ramp periods) see Table 4-6.

Response: <NR2>

Returned values: The value of the power profile in dBc at a given symbol number.

Description:

Examples: :MEAS:PPRO:POW? 25
:MEAS:PPRO:POW? 25,400MHZ
:MEAS:PPRO:POW? 25,400E6,10
:MEAS:PPRO:POW? 25,400E6,10,NUB2

:MEASure:PPROfile:TRACe:ASCii?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: Array of 299*<NR2>, separated by commas.

Returned values:

Description: Returns the set of points representing the spectrum of the power-profile trace.

Example: :MEAS:PPRO:TRAC:ASC? 380MHZ,−10DBM,NUB1

:MEASure:PPROfile:TRACe:BINary?

Parameters:	[<NRf> [, <NRf> [, <CPD>]]] [<frequency> [, <level> [, <burst type>]]]
Response:	Array of 299*<bin>, MS byte first. See Table 4-5.
Returned values:	
Description:	Returns the set of points representing the spectrum of the power-profile trace.
Example:	`:MEAS:PPRO:TRAC:BIN? 380MHZ,−10DBM,NUB1`

:MEASure:SPECtrum:FAIL?

Parameters:	None.
Response:	<NR1>
Returned values:	0	to	32767 – for bit significance see Table 4-3.
Description:	Tests whether there was a known failure with the last spectrum MEASure. 0 signifies a pass. 1024 denotes input level overload.
Example:	`:MEAS:SPEC:FAIL?`

:MEASure:SPECtrum:FREQuency?

Parameters:	[<NRf> [, <NRf> [, <NRf>]]] [<frequency> [, <level> [, <span>]]]
Response:	<NR2>
Returned values:	Frequency of the marker in Hz, after performing a peak search on the new data.
Description:	

Examples:	`:MEAS:SPEC:FREQ?`
	`:MEAS:SPEC:FREQ? 150MHZ`
	`:MEAS:SPEC:FREQ? 150E6,5DBM`
	`:MEAS:SPEC:FREQ? 150E6,5DBM,10KHZ`

:MEASure:SPECtrum:LEVel?

Parameters: [<NRf> [, <NRf> [, <NRf>]]]
              [<frequency>[, <level> [, <span>]]]

Response: <NR2>

Returned values: Signal level of the marker in dBm, after performing a peak search on the new data.

Description:

Examples: :MEAS:SPEC:LEV?
            :MEAS:SPEC:LEV? 300MHZ

:MEASure:SPECtrum:TRACe:ASCii?

Parameters: [<NRf> [, <NRf> [, <NRf>]]]
              [<frequency> [, <level> [, <span>]]]

Response: Array of 501* <NR2>, separated by commas.

Returned values:

Description: Returns the entire trace.

Example: :MEAS:SPEC:TRAC:ASC? 380MHZ,−10DBM,200KHZ

:MEASure:SPECtrum:TRACe:BINary?

Parameters: [<NRf> [, <NRf> [, <NRf>]]]
              [<frequency> [, <level> [, <span>]]]

Response: Array of 501* <bin>, MS byte first. See Table 4-5.

Returned values:

Description: Returns the entire trace.

Example: :MEAS:SPEC:TRAC:BIN? 380MHZ,−10DBM,200KHZ

:MEASure:SPURious:ATPower?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: (dBm)

Description: Sets up to measure discrete spurious noise with a numeric-only display. Performs the measurement for the specified center frequency, input power and burst type. Returns average transmitter power.

Examples: :MEAS:SPUR:ATP?
:MEAS:SPUR:ATP? 400MHZ

:MEASure:SPURious:BANDwidth?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: (Hz)

Description: Sets up to measure discrete spurious noise with a numeric-only display. Performs the measurement for the specified center frequency, input power and burst type. Returns noise bandwidth.

Example: :MEASure:SPUR:BAND?

:MEASURE:SPURious:CORRected?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<point no> [, <frequency> [, <level> [, <burst type>]]]]

Response: <NR2>

Returned values: (dBc)

Description: Measures discrete spurious noise with a numeric-only display. Performs the measurement for the specified point number, center frequency, input power and burst type (<point no> defaults to the current point). Returns power measured at the specified point, with a correction for the wideband noise limit.

Example: :FETCH:SPUR:CORR

:MEASure:SPURious:FAIL?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR1>

Returned values: 0 | to | 32767 – for bit significance, see Table 4-3.

Description: Sets up to measure wideband noise with a numeric-only display. Performs the measurement for the specified center frequency, input power and burst type. Returns the spur_failed flags word.
The 'failed bit' is TRUE if any point has failed.

Examples: :MEAS:SPUR:FAIL? 400E6,10
:MEAS:SPUR:FAIL? 400E6,10,NUB1

:MEASure:SPURious:POWer?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<point no> [, <frequency> [, <level> [, <burst type>]]]]

Response: <NR2>

Returned values: (dBc)

Description: Sets up to measure wideband noise with a numeric-only display. Performs the measurement for the specified point number, center frequency, input power and burst type (<point no> defaults to the current point). Returns the power measured at the specified point.

Examples: :MEAS:SPUR:POW? 7,400E6,10
:MEAS:SPUR:POW? 7,400E6,10,NUB1

:MEASure:SPURious:POWer:FAIL?

Parameters: <NRf> [, <NRf> [, <NRf> [, <CPD>]]]
<point no> [, <frequency> [, <level> [, <burst type>]]]

Response: <NR1>

Returned values: 0 | (pass), 1 | (fail)

Description: Sets up to measure discrete spurious noise with a numeric-only display. Performs the measurement for the specified point number, center frequency, input power and burst type. Returns pass/fail at the specified point.

Example: :MEAS:SPUR:POW:FAIL? 7,400E6,10,NUB1

:MEASure:SPURious:TRACe:ASCii?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<point no> [, <frequency> [, <level> [, <uut-type>]]]]

Response: Array of 501*<NR2>, separated by commas

Returned values: (dBc) (ASCII)

Description: Sets up to measure discrete spurious noise with a numeric-only display (<point no>
defaults to the current point). Performs a spectrum measurement, centered on the
specified point, for the specified center frequency, input power and burst type.
Returns 501 discrete spurious dBc values, taken over a span of 125 kHz.

Example: `:MEAS:SPUR:TRAC:ASC? −1,380MHZ,−10,DMO`

:MEASure:SPURious:TRACe:BINary?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<point no> [, <frequency> [, <level> [, <uut-type>]]]]

Response: Array of 501*<bin>

Returned values: (mBc, equivalent to 0.01 dBc) 16-bit signed 2's-complement binary values.

Description: Sets up to measure discrete spurious noise with a spectrum display (<point no>
defaults to the current point). Performs a spectrum measurement, centered on the
specified point, for the specified center frequency, input power and burst type.
Returns 501 discrete spurious mBc values, taken over a span of 125 kHz.

Example: `:MEAS:SPUR:TRAC:BIN? −1`

:MEASure:VECTor:TRACe:BINary?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <3752_bin>

Returned values: <binary header> 3752* 16-bit binary values. See Table 4-5.

Description: Configured for modulation accuracy measurement. Data is of binary vector trace in
1786 I,Q pairs.

Example: `:MEAS:VECT:TRAC:BIN? 380MHZ,−10DBM,NUB1`

:MEASure:VEVT:TRACe:ASCii?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: Array of 300*<NR2>

Returned values: Vector error trace data (%)

Description: Sets up to measure modulation accuracy with a display of vector error vs time. Performs the measurement for the specified center frequency, input power and burst type. Returns the vector error trace data.

Example: `:MEAS:VEVT:TRAC:ASC?`

:MEASure:VEVT:TRACe:BINary?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: Array of 300*<bin>

Returned values: (0.01%) 16-bit signed binary values

Description: Sets up to measure modulation accuracy with a display of vector error vs time. Performs the measurement for the specified center frequency, input power and burst type. Returns the vector error trace data.

Example: `:MEAS:VEVT:TRAC:BIN?`

:MEASure:VEVT:VERRor?

Parameters: <NRf> [<NRf> [, <NRf> [, <CPD>]]]
<sym_no> [<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: Vector error (%)

Description: Sets up to measure modulation accuracy with a display of vector error vs time. Performs the measurement for the specified center frequency, input power and burst type. Returns the vector error at the specified symbol.

Example: `:MEAS:VEVT:VERR? 20`

:MEASure:WBANd:ATPower?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: (dBm)

Description: Sets up to measure wideband noise with a numeric-only display. Performs the measurement for the specified center frequency, input power and burst type. Returns average transmitter power.

Examples: :MEAS:WBAN:ATP?
:MEAS:WBAN:ATP? 400E6,10,NUB1

:MEASure:WBANd:BANDwidth?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR2>

Returned values: (Hz)

Description: Sets up to measure wideband noise with a numeric-only display. Performs the measurement for the specified center frequency, input power and burst type. Returns noise bandwidth.

Example: :MEASure:WBAN:BAND?

:MEASure:WBAN:FAIL?

Parameters: [<NRf> [, <NRf> [, <CPD>]]]
[<frequency> [, <level> [, <burst type>]]]

Response: <NR1>

Returned values: 0 | to | 32767 − for bit significance, see Table 4-3.

Description: Sets up to measure wideband noise with a numeric-only display. Performs the measurement for the specified center frequency, input power and burst type.
Returns the wban_failed flags word.
The 'failed bit' is TRUE if any point has failed.

Examples: :MEAS:WBAN:FAIL?

:MEASure:WBANd:LIMit:ABSolute?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<point no> [, <frequency> [, <level> [, <burst type>]]]]

Response: <NR2>

Returned values: Current limit setting (dBm).

Description: Sets up to measure wideband noise with a numeric-only display. Performs the measurement for the specified point number, center frequency, input power and burst type. Returns the maximum absolute power limit effective for the last measurement at the specified point.

Examples: `:MEAS:WBAN:LIM:ABS? 7`

:MEASure:WBANd:LIMit:RELative?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<point no> [, <frequency> [, <level> [,.<burst type>]]]]

Response: <NR2>

Returned values: Current limit setting (dBc).

Description: Sets up to measure wideband noise with a numeric-only display. Performs the measurement for the specified point number, center frequency, input power and burst type. Returns the relative power limit effective for the last measurement at the specified point.

Examples: `:MEAS:WBAN:LIM:REL? 7,400E6,10,NUB1`

:MEASure:WBANd:POWer?

Parameters: [<NRf> [, <NRf> [, <NRf> [, <CPD>]]]]
[<point no> [, <frequency> [, <level> [, <burst type>]]]]

Response: <NR2>

Returned values: (dBc)

Description: Sets up to measure wideband noise with a numeric-only display. Performs the measurement for the specified point number, center frequency, input power and burst type (<point no> defaults to the current point). Returns the power measured at the specified point.

Example: `:MEAS:WBAN:POW? 7,400E6,10,NUB1`

:MEASure:WBANd:POWer:FAIL?

Parameters:	[<NRf> [, <NRf> [, <NRf> [, <CPD>]]]] [<point no> [, <frequency> [, <level> [, <burst type>]]]]
Response:	<NR1>
Returned values:	0	(pass), 1	(fail)
Description:	Sets up to measure wideband noise with a numeric-only display. Performs the measurement for the specified point number, center frequency, input power and burst type. Returns pass/fail at the specified point.
Example:	`:MEAS:WBAN:POW:FAIL? 7,400E6,10,NUB1`

:MEASure:WBANd:TRACe:ASCii?

Parameters:	[<NRf> [, <NRf> [, <NRf> [, <CPD>]]]] [<point no> [, <frequency> [, <level> [, <burst type>]]]]
Response:	Array of 501*<nr2>, comma-separated.
Returned values:	(dBc) (ASCII).
Description:	Sets up to measure wideband noise with a spectrum display. Performs the measurement for the specified point number, center frequency, input power and burst type. Returns 501 trace points over a span of 78.75 kHz.
Examples:	`:MEAS:WBAN:TRAC:ASC? 6` `:MEAS:WBAN:TRAC:ASC? 6,380MHZ,-10,DMO`

:MEASure:WBANd:TRACe:BINary?

Parameters:	[<NRf> [, <NRf> [, <NRf> [, <CPD>]]]] [<point no> [, <frequency> [, <level> [, <burst type>]]]]
Response:	Array of 501*<bin>.
Returned values:	(mBc, equivalent to 0.01 dBc) 16-bit signed 2's-complement binary values.
Description:	Sets up to measure wideband noise with a spectrum display. Performs the measurement for the specified point number, center frequency, input power and burst type. Returns 501 trace points over a span of 78.75 kHz. Each value is returned as two bytes, MS byte first.
Examples:	`:MEAS:WBAN:TRAC:BIN? 6` `:MEAS:WBAN:TRAC:BIN? 6,380MHZ,-10,DMO`

POWer SUBSYSTEM

The POWer subsystem controls the configuration of the RF front-end hardware of the 2310.

POWer:
   ATTenuation?
   INPut\?
   OFFSet\?
   OFFSet:
      ATTenuation\?
      GAIN\?
      LOSS\?
   PROTection:
      RESet
      TRIPped?
   REFerence\?

:POWer:ATTenuation?

Parameters: None.

Response: <NR1>

Returned values: Attenuator setting in steps of 5 dB.

Description: Reads the current input attenuator setting.

Example: :POW:ATT?

:POWer:INPut

Parameters: <CPD>
Input selection.

Valid values: Inputs: HIGH | LOW | SENSitive

Description: Selects which of the two input sockets to use (high-power or low-power), and in the case of the low-power input, a choice of normal or low-power. This always leaves some attenuation in the path so as to ensure that the mixer is protected from overloads or maximum sensitivity which gives better results with small input signals but leaves the mixer vulnerable to some overloads.

Example: :POW:INP   HIGH

Selects high-power input.

:POWer:INPut?

Parameters: None.

Response: <CRD>

Returned values: HIGH | LOW | SENS

Description: Reads the current input selection.

Example: :POW:INP?

HIGH

:POWer:OFFSet

Parameters: <bool>

Valid values: 0 | 1

Description: Sets level offsets on or off. 0 is OFF, 1 is ON.

Example: `:POW:OFFS`

:POWer:OFFSet?

Parameters: None.

Response: <bool>

Returned values: 0 | 1

Description: Tests whether the level offsets are on or off. 0 signifies OFF, 1 signifies ON.

Example: `:POW:OFFS?`

:POWer:OFFSet:ATTenuation

Parameters: <NRf>
Input level offset.

Valid values: 0.0 to 65.0 (dB)

Description: Sets input level offset due to external attenuation.

Example: `:POW:OFFS:ATT 30`

:POWer:OFFSet:ATTenuation?

Parameters: None.

Response: <NR2>

Returned values: Input level offset (dB).

Description: Returns the current setting for input level offset due to external attenuation.

Example: `:POW:OFFS:ATT?`

:POWer:OFFSet:GAIN

Parameters: <NRf>
Input level offset.

Valid values: 0.0 to 65.0 (dB)

Description: Sets input level offset due to external gain.

Example: `:POW:OFFS:GAIN 20`

:POWer:OFFSet:GAIN?

Parameters: None.

Response: <NR2>

Returned values: Input level offset (dB).

Description: Returns the current setting for input level offset due to external gain.

Example: `:POW:OFFS:GAIN?`

:POWer:OFFSet:LOSS

Parameters: <NRf>
Input level offset.

Valid values: 0.0 to 65.0 (dB)

Description: Sets input level offset due to external system losses.

Example: `:POW:OFFS:LOSS 30`

:POWer:OFFSet:LOSS?

Parameters: None.

Response: <NR2>

Returned values: Input level offset (dB).

Description: Returns the current setting for input level offset due to external system losses.

Example: `:POW:OFFS:LOSS?`

:POWer:PROTection:RESet

Parameters: None.

Valid values:

Description: Attempts to reset the over power protection circuit.

Example: :POW:PROT:RES

Reset OPP.

:POWer:PROTection:TRIPped?

Parameters: None.

Response: <bool>

Returned values: 0 | 1

Description: Returns 1 if the over power protection has tripped, otherwise 0.

Example: :POW:PROT:TRIP?

0

:POWer:REFerence

Parameters: <NRf_os> [dBm]
The nominal input level.

Valid values: Input level.

Description: Sets the nominal input level (which is used to determine the hardware settings) in logarithmic units (dBm). Note that power class and step level are **not** supported via GPIB.

Example: :POW:REF 30.2dBm

Sets input level to 30.2 dBm.

:POWer:REFerence?

Parameters: None.

Response: <NR2>

Returned values: Input level (in dBm).

Description: Reads the current input reference level. Returns the value in dBm.

Example: :POW:REF?

30.2

READ SUBSYSTEM

The READ subsystem has the following command format

```
READ:<function>?<parameters>
```

The READ? query provides a method of performing a FETCh? operation on fresh data. Since the READ? query does not reconfigure the instrument, a common application is to use READ? in conjunction with a CONFigure command; when combined, they provide a MEASure? capability.

<function> defines the measurement operation to be used by READ? It is also used by the CONFigure, MEASure? and FETCH? subsystems.

<parameters> are optional parameters. If parameters are omitted, they are assumed to be those currently in use. Parameters may be defaulted from the right by omitting them, or anywhere by substituting the keyboard DEFault.

The READ? query is identical to performing the following commands:

```
ABORt;
INITiate:IMMediate
FETch:<function>?;<parameters>;
```

Examples which describe various method of performing the same measurement are given on page 4-221.

READ:
   ACPower:
      MODulation:
         ATPower?
         FAIL?
         POWer?
         TRACe:
            ASCii?
            BINary?
      SWITching:
         ATPower?
         FAIL?
         PEAK?
         POWer?
         TRACe:
            ASCii?
            BINary?
READ:
   APVT:
      AERRor?
      AERRor:
         TRACe:
            ASCii?
            BINary?
      PERRor?
      PERRor:
         TRACe:
            ASCii?
            BINary?

READ:
   CLUSter:
      TRACe:
         BINary?
READ:
   CONStellation:
      TRACe:
         BINary?
READ:
   IMOD:
      ATPower?
      ATTenuation?
      ATTenuation:
         FAIL?
      FAIL?
      IPOWer?
READ:
   IQVT:
      IAMP?
      IAMP:
         TRACe:
            ASCii?
            BINary?
      QAMP?
      QAMP:
         TRACe:
            ASCii?
            BINary?

READ:
    LINearization:
        BETWeen?
        FAIL?
        OVER?
        TRACe:
            ASCii?
            BINary?
READ:
    MODulation:
        BURSt?
        CLEAk?
        DATA?
        FAIL?
        FERRor?
        MAERror?
        MPERror?
        MVERror?
        PAERror?
        PPERror?
        PVERror?
        PASYmbol?
        PPSYmbol?
        PVSYmbol?
        TRACe:
            ASCii?
            BINary?
READ:
    NSPower:
            ATPower?
            FAIL?
            POWer?
            TRACe:
                ASCii?
                BINary?
READ:
    PPROfile:
        ATPower?
        FAIL?
        POWer?
        TRACe:
            ASCii?
            BINary?

READ:
    SPECtrum:
        FAIL?
        FREQ?
        LEVel?
        TRACe:
            ASCii?
            BINary?
READ:
    SPURious:
        ATPower?
        BANDwidth?
        CORRected?
        FAIL?
        POWer?
        POWer:
            FAIL?
        TRACe:
            ASCii?
            BINary?
READ:
    VECTor:
        TRACe:
            BINary?
READ:
    VEVT:
        TRACe:
            ASCii?
            BINary?
        VERR?
READ:
    WBANd:
        ATPower?
        BANDwidth?
        FAIL?
        LIMit:
            ABSolute?
            RELative?
        POWer?
        POWer:
            FAIL?
        TRACe:
            ASCii?
            BINary?

:READ:ACPower:MODulation:POWer?

Parameters:	[<NRf> [, <CPD>]]
	[<chan> [, <burst type>]]
	<chan> is (−3 , −2 , −1, 1, 2, 3) (default = −1) x 25 kHz offset.
Response:	<NR2>
Returned values:	(dBc)
Description:	Adjacent channel power due to modulation of the selected channel offset.
Examples:	`:READ:ACP:MOD:POW?`
	`:READ:ACP:MOD:POW? −2`
	`:READ:ACP:MOD:POW? 3,CB`

:READ:ACPower:MODulation:ATPower?

Parameters:	[<CPD>]
Response:	<NR2>
Returned values:	(dBm)
Description:	Average transmitter power during an adjacent channel power due to modulation measurement.
Examples:	`:READ:ACP:MOD:ATP?`
	`:READ:ACP:MOD:ATP? NUB2`

:READ:ACPower:MODulation:FAIL?

Parameters:	None.
Response:	<NR1>
Returned values:	0	to	32767 − for bit significance see Table 4-3.
Description:	Tests whether the measured profile fails a limit check against the current limit mask. 0 signifies a pass. Any integer denotes failure.
Example:	`:READ:ACP:MOD:FAIL?`

:READ:ACPower:MODulation:TRACe:ASCii?

Parameters: [<CPD>]
[<burst type>]

Response: Array of 501*<NR1>, separated by commas.

Returned values:

Description: Returns the set of points representing the spectrum of the ACP due to modulation.

Example: :READ:ACP:MOD:TRAC:ASC?

:READ:ACPower:MODulation:TRACe:BINary?

Parameters: [<CPD>]
[<burst type>]

Response: Array of 501*<bin>, MS byte first. See Table 4-5.

Returned values:

Description: Returns the set of points representing the spectrum of the ACP due to modulation.

Example: :READ:ACP:MOD:TRAC:BIN?

:READ:ACPower:SWITching:ATPower?

Parameters: [<CPD>]
[<burst type>]

Response: <NR2>

Returned values: (dBm)

Description: Average transmitter power during ACP due to switching measurement.

Examples: :READ:ACP:SWIT:ATP?
:READ:ACP:SWIT:ATP? NUB2

:READ:ACPower:SWITching:FAIL?

Parameters: None.

Response: <NR1>

Returned values: 0 | to | 32767 – for bit significance see Table 4-3.

Description: Tests whether the measured profile fails a limit check against the current limit mask. 0 signifies a pass. Any integer denotes failure.

Example: :READ:ACP:SWIT:FAIL?

:READ:ACPower:SWITching:PEAK?

Parameters: [<NRf> [, <CPD>]]
[<peak no> [, <burst type>]]

<peak no> is (−20, −19,...−1) for −25 kHz channel) or (1, 2,...20) for +25 kHz channel, default = 6.

Response: <NR2>

Returned values: (dBc)

Description: Returns the nth highest peak value for a particular channel offset.

Examples: :READ:ACP:SWIT:PEAK?
:READ:ACP:SWIT:PEAK? −10
:READ:ACP:SWIT:PEAK? −10,CB

:READ:ACPower:SWITching:POWer?

Parameters: [<NRf> [, <CPD>]]
[<chan> [, <burst type>]]

<chan> is (−1, +1) default = −1   x 25 kHz offset.

Response: <NR1>

Returned values: (dBc)

Description: Returns the adjacent channel power due to switching of the specified channel offset.

Examples: :READ:ACP:SWIT:POW?
:READ:ACP:SWIT:POW? +1
:READ:ACP:SWIT:POW? +1,CB

:READ:ACPower:SWITching:TRACe:ASCii?

Parameters: [<NRf> [, <CPD>]]
[<chan> [, <burst type>]]

<chan> is (−1, +1) default = −1   x 25 kHz offset.

Response: Array of 501*<NR1>, separated by commas.

Returned values: (dBc)

Description: Returns the set of points representing the spectrum of the ACP due to switching.

Example: :READ:ACP:SWIT:TRAC:ASC?

:READ:ACPower:SWITching:TRACe:BINary?

Parameters: [<NRf> [, <CPD>]]
[<chan> [, <burst type>]]

<chan> is (−1, +1) default = −1   x 25 kHz offset.

Response: Array of 501*<bin>, MS byte first. See Table 4-5.

Returned values: (mBc)

Description: Returns the set of points representing the spectrum of the ACP due to switching.

Example: :READ:ACP:SWIT:TRAC:BIN?

:READ:APVT:AERRor?

Parameters: <NRf> [<CPD>]
<sym_no> [<burst type>]

Response: <NR2>

Returned values: Amplitude error (%).

Description: Performs the measurement for the specified burst type. Returns the value of the amplitude error at the specified symbol.

Example: :READ:APVT:AERR? 20

:READ:APVT:AERRor:TRACe:ASCii?

Parameters: [<CPD>]
[<burst type>]

Response: Array of 300*<NR2>

Returned values: (%) (ASCII)

Description: Performs the measurement for the specified burst type. Returns the amplitude error trace data.

Example: :READ:APVT:AERRor:TRAC:ASC? NUB1

:READ:APVT:AERRor:TRACe:BINary?

Parameters: [<CPD>]
[<burst type>]

Response: Array of 300*<bin>

Returned values: (0.01%) 16-bit signed binary values

Description: Performs the measurement for the specified burst type. Returns the amplitude error trace data.

Example: :READ:APVT:AERRor:TRAC:BIN? NUB1

:READ:APVT:PERRor?

Parameters: <NRf> [<CPD>]
<sym_no> [<burst type>]

Response: <NR2>

Returned values: Phase error (deg).

Description: Performs the measurement for the specified burst type. Returns the value of the phase error at the specified symbol.

Example: :READ:APVT:PERR? 70

:READ:APVT:PERRor:TRACe:ASCii?

Parameters: [<CPD>]
[<burst type>]

Response: Array of 300*<NR2>

Returned values: (deg) (ASCII)

Description: Performs the measurement for the specified center frequency, input power and burst type. Returns the phase error trace data.

Example: :READ:APVT:PERRor:TRAC:ASC?

:READ:APVT:PERRor:TRACe:BINary?

Parameters: [<CPD>]
[<burst type>]

Response: Array of 300*<bin>

Returned values: (0.01 deg) 16-bit signed binary values

Description: Performs the measurement for the specified burst type. Returns the phase error trace data.

Example: :READ:APVT:PERRor:TRAC:BIN?

:READ:CLUSter:TRACe:BINary?

Parameters: [<CPD>]
[<burst type>]

Response: <512_bin>

Returned values: <binary header> 512* 16-bit binary values. See Table 4-5.

Description: Reads the binary cluster (rotated vector) trace of 256 I,Q pairs.

Example: :READ:CLUS:TRAC:BIN? NUB1

:READ:CONStellation:TRACe:BINary?

Parameters: [<CPD>]
[<burst type>]

Response: <512_bin>

Returned values: <binary header> 512* 16-bit binary values. See Table 4-5.

Description: Reads the binary constellation trace of 256 I,Q pairs.

Example: :READ:CONS:TRAC:BIN? NUB1

:READ:IMOD:ATPower?

Parameters: [<CPD>]
[<burst type>]

Response: <NR2>

Returned values: (dBm)

Description: Performs the measurement for the specified channel frequency. Returns the average on-channel transmitter power during the intermodulation attenuation measurement.

Examples: :READ:IMOD:ATP?
:READ:IMOD:ATP? NUB1

:READ:IMOD:ATTenuation?

Parameters: <NRf> [, <CPD>]
<product no> [, <burst type>]

<product no> is in the range 1−6, see Table 4-12.

Response: <NR2>

Returned values: (dBc)

Description: Performs the measurement for the specified channel frequency. Returns attenuation measurement for the specified intermodulation product.

Example: `:READ:IMOD:ATT? 4,NUB1`

:READ:IMOD:ATTenuation:FAIL?

Parameters: <NRf> [, <CPD>]
<product no> [, <burst type>]

<product no> is in the range 1−6, see Table 4-12.

Response: <NR1>

Returned values: 0 | 1

Description: Performs the measurement for the specified channel frequency. Tests whether the intermodulation attenuation meets (0) or fails to meet (1) the specification.

Example: `:READ:IMOD:ATT:FAIL? 3`

:READ:IMOD:FAIL?

Parameters: [<CPD>]
[<burst type>]

Response: <NR1>

Returned values: 0 | to | 32767 − for bit significance, see Table 4-3.

Description: Performs the measurement for the specified channel frequency. Returns the imod_failed flags word.

Examples: `:READ:IMOD:FAIL?`
`:READ:IMOD:FAIL? NUB1`

:READ:IMOD:IPOWer?

Parameters: [<CPD>]
[<burst type>]

Response: <NR2>

Returned values: (dBm)

Description: Performs the measurement for the specified channel frequency. Returns the power measured at the interferer frequency.

Example: :READ:IMOD:POW?

:READ:IQVT:IAMP?

Parameters: <NRf> [<CPD>]
<sym_no> [<burst type>]

Response: <NR2>

Returned values: Amplitude (normalized to 1.0000)

Description: Performs the measurement for the specified burst type. Returns the I (real) amplitude at the specified symbol.

Example: :READ:IQVT:IAMP? 20

:READ:IQVT:IAMP:TRACe:ASCii?

Parameters: [<CPD>]
[<burst type>]

Response: Array of 300*<NR2>

Returned values: Amplitude (normalized to 1.0000)

Description: Performs the measurement for the specified burst type. Returns the I (real) amplitude.

Example: :READ:IQVT:IAMP:TRAC:ASC? NUB1

:READ:IQVT:IAMP:TRACe:BINary?

Parameters: [<CPD>]
[<burst type>]

Response: Array of 300*<bin>

Returned values: (units of $\frac{1}{10000}$ normal) 16-bit signed binary values

Description: Performs the measurement for the specified burst type. Returns the I (real) amplitude.

Example: :READ:IQVT:IAMP:TRAC:BIN?

:READ:IQVT:QAMP?

Parameters: <NRf> [<CPD>]
<sym_no> [<burst type>]

Response: <NR2>

Returned values: Amplitude (normalized to 1.0000)

Description: Performs the measurement for the specified burst type. Returns the Q (imaginary) amplitude at the specified symbol.

Example: :READ:IQVT:QAMP? 20

:READ:IQVT:QAMP:TRACe:ASCii?

Parameters: [<CPD>]
[<burst type>]

Response: Array of 300*<NR2>

Returned values: Amplitude (normalized to 1.0000)

Description: Performs the measurement for the specified burst type. Returns the Q (imaginary) amplitude.

Example: :READ:IQVT:QAMP:TRAC:ASC? NUB1

:READ:IQVT:QAMP:TRACe:BINary?

Parameters: [<CPD>]
[<burst type>]

Response: Array of 300*<bin>

Returned values: (units of $\frac{1}{10000}$ normal) 16-bit signed binary values

Description: Performs the measurement for the specified burst type. Returns the Q (imaginary) amplitude.

Example: `:READ:IQVT:QAMP:TRAC:BIN?`

:READ:LINearization:BETWeen?

Parameters: [<NRf>]
[<chan>]

<chan> is: = +25 kHz channel or −1 = −25 kHz channel (default).

Response: <NR1>

Returned values: Time in µs.

Description: Measures a TETRA linearization burst with a numeric display only, getting data for the specified channel. Returns the total time for which the signal remains between limits in the specified channel.

Examples: `:READ:LIN:BETW?`
`:READ:LIN:BETW? +1`

:READ:LINearization:FAIL?

Parameters: [<CPD>]
[<uut-type>]

<uut-type> is:
BSC	Base Station transmit, Continuous
BSD	Base Station transmit, Discontinuous
DMO	Direct Mode Operation
MS	Mobile Station transmit.

Response: <NR1>

Returned values: The failed status word − see Table 4-3.

Description: Measures a TETRA linearization burst with a numeric-only display. Performs the measurement for the specified <uut-type>.

Examples: `:READ:LIN:FAIL?`
`:READ:LIN:FAIL? BSD`

:READ:LINearization:OVER?

Parameters: [<NRf>]
[<chan>]

<chan> is: +1 = +25 kHz channel or −1 = −25 kHz channel (default).

Response: <NR1>

Returned values: Time in µs.

Description: Measures a TETRA linearization burst with a numeric-only display, getting data for the specified channel. Returns the total time for which the −30 dBc limit is exceeded in the specified channel.

Examples: `:READ:LIN:OVER?`
`:READ:LIN:OVER? +1`

:READ:LINearization:TRACe:ASCii?

Parameters: [<NRf>]
[<chan>]

<chan> is: +1 = +25 kHz channel, 0 = Tx channel or −1 = −25 kHz channel (default)

Response: Array of 501*<NR2>, separated by commas.

Returned values: (dBc) (ASCII)

Description: Measures a TETRA linearization burst and displays the specified channel profile. Returns 501 dBc values, taken over −500 to +8000 µs (Mobile Station and DMO), or over −500 to +6500 µs (Base Station), with respect to the trigger point of the on-channel burst.

Example: `:READ:LIN:TRAC:ASC? −1`

:READ:LINearization:TRACe:BINary?

Parameters: [<NRf>]
[<chan>]

<chan> is: +1 = +25 kHz channel, 0 = Tx channel or −1 = −25 kHz channel (default).

Response: Array of 501*<bin>.

Returned values: (mBc, equivalent to 0.01 dBc) 16-bit signed 2's-complement binary values.

Description: Measures a TETRA linearization burst and displays the specified channel profile. Returns 501 mBc values as signed binary integers, taken over −500 to +8000 µs (Mobile Station and DMO), or over −500 to +6500 µs (Base Station), with respect to the trigger point of the on-channel burst.

Example: `:READ:LIN:TRAC:BIN?`

:READ:MODulation:BURSt?

Parameters:	[<NRf> [, <CPD>]] [<sample size> [, <burst type>]]
Response:	<NR1>
Returned values:	Number of failed bursts.
Description:	Performs the measurement over the current *Bursts to Analyse* (sample size) and gets data for the specified sample size and burst type. Returns the total number of failed bursts in the sample.
Example:	`:READ:MOD:BURS? 150,NUB1`

:READ:MODulation:CLEAk?

Parameters:	[<CPD>] [<burst type>]
Response:	<NR2>
Returned values:	Residual carrier magnitude (carrier leak) %.
Description:	Returns the residual carrier error of the current burst.
Examples:	`:READ:MOD:CLEA?` `:READ:MOD:CLEA? NUB1`

:READ:MODulation:DATA?

Parameters:	<NRf> [<CPD>] <sym_no> [<burst type>] For symbol number range see Table 4-6.
Response:	<NR1> Data value of the specified symbol.
Returned values:	0 | 1 | 2 | 3
Description:	Returns one of the above digits to signify the data symbol at the position set by the parameter.
Examples:	`:READ:MOD:DATA? 69` `:READ:MOD:DATA? 69,CB`

:READ:MODulation:FAIL?

Parameters:	None.
Response:	<NR1>
Returned values:	0	to	32767 – for bit significance see Table 4-3.
Description:	Tests whether the measured profile fails a limit check against the current limit mask. 0 signifies a pass. Any integer denotes failure.
Example:	`:READ:MOD:FAIL?`

:READ:MODulation:FERRor?

Parameters:	[<CPD>] [<burst type>]
Response:	<NR2>
Returned values:	Frequency error in Hz.
Description:	
Examples:	`:READ:MOD:FERR?` `:READ:MOD:FERR? NUB2`

:READ:MODulation:MAERror?

Parameters:	[<CPD>] [<burst type>]
Response:	<NR2>
Returned values:	Mean amplitude error (%).
Description:	Returns the average value (RMS) of amplitude error over the symbols of the current burst.
Examples:	`:READ:MOD:MAER?` `:READ:MOD:MAER? CB`

:READ:MODulation:MPERror?

Parameters: [<CPD>]
[<burst type>]

Response: <NR2>

Returned values: Mean phase error (deg).

Description: Returns the average value (RMS) of phase error over the symbols of the current burst.

Examples: `:READ:MOD:MPER?`
`:READ:MOD:MPER? CB`

:READ:MODulation:MVERror?

Parameters: [<CPD>]
[<burst type>]

Response: <NR2>

Returned values: Mean vector error (%).

Description: Returns the average value (RMS) of vector error over the symbols of the current burst.

Examples: `:READ:MOD:MVER?`
`:READ:MOD:MVER? CB`

:READ:MODulation:PAERror?

Parameters: [<CPD>]
[<burst type>]

Response: <NR2>

Returned values: Peak amplitude error (%).

Description: Returns the value of the peak amplitude error of the current measurement.

Examples: `:READ:MOD:PAER?`
`:READ:MOD:PAER? NUB1`

:READ:MODulation:PPERror?

Parameters: [<CPD>]
[<burst type>]

Response: <NR2>

Returned values: Peak phase error (deg).

Description: Returns the value of the peak phase error of the current measurement.

Examples: :READ:MOD:PPER?
:READ:MOD:PPER? NUB1

:READ:MODulation:PVERror?

Parameters: [<CPD>]
[<burst type>]

Response: <NR2>

Returned values: Peak vector error (%).

Description: Returns the value of the peak vector error of the current measurement.

Examples: :READ:MOD:PVER?
:READ:MOD:PVER? NUB1

:READ:MODulation:PASYmbol?

Parameters: [<CPD>]
[<burst type>]

Response: <NR1>

Returned values: Symbol number.

Description: Returns the number of the symbol with the peak amplitude error.

Examples: :READ:MOD:PASY?
:READ:MOD:PASY? NUB2

:READ:MODulation:PPSYmbol?

Parameters: [<CPD>]
[<burst type>]

Response: <NR1>

Returned values: Symbol number.

Description: Returns the number of the symbol with the peak phase error.

Examples: `:READ:MOD:PPSY?`
`:READ:MOD:PPSY? NUB2`

:READ:MODulation:PVSYmbol?

Parameters: [<CPD>]
[<burst type>]

Response: <NR1>

Returned values: Symbol number.

Description: Returns the number of the symbol with the peak vector error.

Examples: `:READ:MOD:PVSY?`
`:READ:MOD:PVSY? NUB2`

:READ:MODulation:TRACe:ASCii?

Parameters: [<CPD>]
[<burst type>]

Response: Array of 255*<NR1>, separated by commas.

Returned values: 0 | 1 | 2 | 3 ASCII, including symbols before and after the displayed data. Range depends on burst type.

Description: Symbol values as displayed on demodulated data screen.

Example: `:READ:MOD:TRAC:ASC?`

:READ:MODulation:TRACe:BINary?

Parameters: [<CPD>]
[<burst type>]

Response: Array of 255*<bin>. See Table 4-5.

Returned values: 0 | 1 | 2 | 3 binary, including symbols before and after the displayed data. Range depends on burst type.

Description: Symbol values as displayed on demodulated data screen.

Example: `:READ:MOD:TRAC:BIN?`

:READ:NSPower:ATPower?

Parameters:	[<CPD>] [<burst type>]
Response:	<NR2>
Returned values:	(dBm)
Description:	Average transmitter power during a non-active slot measurement.
Examples:	`:READ:NSP:ATP?` `:READ:NSP:ATP? NUB1`

:READ:NSPower:FAIL?

Parameters:	None.
Response:	<NR1>
Returned values:	0	to	32767 – for bit significance see Table 4-3.
Description:	Tests whether the measured profile fails a limit check against the current limit mask 0 signifies a pass. Any integer denotes failure.
Example:	`:READ:NSP:FAIL?`

:READ:NSPower:POWer?

Parameters:	[<NRf> [, <CPD>]] [<slot> [, <burst type>]] <slot> = relative position of inactive slot to be measured with respect to the active slot. [+3	+2	+1	−1	−2	−3] (note: −3 ≡ +1, −2 ≡ +2, −1 ≡ +3) Default = +1.
Response:	<NR2>
Returned values:	(dBc)
Description:	Non-active slot power.

Examples:	`:READ:NSP:POW?`
	`:READ:NSP:POW? 1`
	`:READ:NSP:POW? 1,NUB2`

:READ:NSPower:TRACe:ASCii?

Parameters: [<CPD>]
[<burst type>]

Response: Array of 501*<NR2>, separated by commas.

Returned values: (dBc) (ASCII)

Description: Performs a non-active slot measurement and gets data for the specified burst type.
Returns the current profile trace data as 501 dBc values. The 500 intervals are over
the same slots as currently displayed.

Example: `:READ:NSP:TRAC:ASC? DMO`

:READ:NSPower:TRACe:BINary?

Parameters: [<CPD>]
[<burst type>]

Response: Array of 501*<bin>

Returned values: (mBc, equivalent to 0.01 dBc) 16-bit signed 2's-complement binary values.

Description: Performs a non-active slot measurement and gets data for the specified burst type.
Returns the current profile trace data as 501 mBc values. The 500 intervals are
over the same slots as currently displayed.

Example: `:READ:NSP:TRAC:BIN? DMO`

:READ:PPROfile:ATPower?

Parameters: [<CPD>]
[<burst type>]

Response: <NR2>

Returned values:

Description: Average transmitter power.

Examples: `:READ:PPRO:ATP?`
`:READ:PPRO:ATP? SBC`

:READ:PPROfile:FAIL?

Parameters:	[<CPD>] [<burst type>]
Response:	<NR1>
Returned values:	0 | to | 32767 – for bit significance see Table 4-3.
Description:	Tests whether the measured profile fails a limit check against the current limit mask. 0 signifies a pass. Any integer denotes failure.
Examples:	`:READ:PPRO:FAIL?` `:READ:PPRO:FAIL? NUB1`

:READ:PPROfile:POWer?

Parameters:	<NRf> [<CPD>] <sym_no> [<burst type>] For symbol number range (includes ramp periods) see Table 4-6.
Response:	<NR2>
Returned values:	The value of the power profile at a given symbol number (dBc) referenced from the average transmitter power.
Description:	
Examples:	`:READ:PPRO:POW? 88` `:READ:PPRO:POW? 88,NUB2`

:READ:PPROfile:TRACe:ASCii?

Parameters:	[<CPD>] [<burst type>]
Response:	Array of 299*<NR2>, separated by commas.
Returned values:	
Description:	Returns the set of points representing the spectrum of the power-profile trace.
Example:	`:READ:PPRO:TRAC:ASC?`

:READ:PPROfile:TRACe:BINary?

Parameters: [<CPD>]
              [<burst type>]

Response: Array of 299*<bin>, MS byte first. See Table 4-5.

Returned values:

Description: Returns the set of points representing the spectrum of the power-profile trace.

Example: :READ:PPRO:TRAC:BIN?

:READ:SPECtrum:FAIL?

Parameters: None.

Response: <NR1>

Returned values: 0 | to | 32767 – for bit significance see Table 4-3.

Description: Tests whether was a known failure with the last spectrum READ. 0 signifies a
              pass. 1024 denotes input level overload.

Example: :READ:SPEC:FAIL?

:READ:SPECtrum:FREQuency?

Parameters: None.

Response: <NR2>

Returned values: Frequency of the marker in Hz, after performing a peak search on the new data.

Description:

Example: :READ:SPEC:FREQ?

:READ:SPECtrum:LEVel?

Parameters: None.

Response: <NR2>

Returned values: Signal level at the marker in dBm, after performing a peak search on the new data.

Description:

Example: :READ:SPEC:LEV?

:READ:SPECtrum:TRACe:ASCii?

Parameters: None.

Response: Array of 501*<NR1>, separated by commas.

Returned values:

Description: Returns the entire trace.

Example: :READ:SPEC:TRAC:ASC?

:READ:SPECtrum:TRACe:BINary?

Parameters: None.

Response: Array of 501*<bin>, MS byte first. See Table 4-5.

Returned values:

Description: Returns the entire trace.

Example: :READ:SPEC:TRAC:BIN?

:READ:SPURious:ATPower?

Parameters: [<CPD>]
[<burst type>]

Response: <NR2>

Returned values: (dBm)

Description: Measures discrete spurious noise with a numeric-only or spectrum display.
Performs the measurement for the specified burst type. Returns average transmitter power.

Examples: :READ:SPUR:ATP?
:READ:SPUR:ATP? NUB1

:READ:SPURious:BANDwidth?

Parameters: [<CPD>]
[<burst type>]

Response: <NR2>

Returned values: (Hz)

Description: Measures discrete spurious noise with a numeric-only or spectrum display.
Performs the measurement for the specified burst type. Returns noise bandwidth.

Example: :READ:SPUR:BAND? NUB1

:READ:SPURious:CORRected?

Parameters: <NRf>
     <point no>

Response: <NR2>

Returned values: (dBc)

Description: Measures discrete spurious noise with a numeric-only or spectrum display. Returns power measured at the specified point, with a correction for the wideband noise limit. <point no> defaults to the current point.

Example: `:FETCH:SPUR:BAND?`

:READ:SPURious:FAIL?

Parameters: [<CPD>]
     [<burst type>]

Response: <NR1>

Returned values: 0 | to | 32767 − for bit significance, see Table 4-3.

Description: Measures discrete spurious noise with a numeric-only or spectrum display. Performs the measurement for the specified burst type. Returns the spur_failed flags word.
In numeric-only display, the 'failed bit' is TRUE if any point has failed.
In spectrum display, the 'failed' bit is TRUE if the current point has failed (after correction).

Examples: `:READ:SPUR:FAIL?`
     `:READ:SPUR:FAIL? NUB1`

READ:SPURious:POWer?

Parameters: [<NRf>]
     [<point no>]

Response: <NR2>

Returned values: (dBc)

Description: Measures discrete spurious noise with a numeric-only or spectrum display. Returns the power measured at the specified point. <point no> defaults to the current point.

Examples: `:READ:SPUR:POW?`
     `:READ:SPUR:POW? 7`

:READ:SPURious:POWer:FAIL?

Parameters: <NRf>
<point no>

Response: <NR1>

Returned values: 0 | (pass), 1 | (fail)

Description: Measures discrete spurious noise with a numeric-only or spectrum display. Returns pass/fail at the specified point (after correction).

Example: :READ:SPUR:POW:FAIL? 8

:READ:SPURious:TRACe:ASCii?

Parameters: <NRf>
<point no>

Response: Array of 501*<NR2>, separated by commas.

Returned values: (dBc) (ASCII)

Description: Performs a spectrum measurement, centered on the specified point, and returns 501 discrete spurious dBc values, taken over a span of 125 kHz.

Example: :READ:SPUR:TRAC:ASC? −1

:READ:SPURious:TRACe:BINary?

Parameters: <NRf>
<point no>

Response: Array of 501*<bin>.

Returned values: (mBc, equivalent to 0.01 dBc) 16-bit signed 2's-complement binary values.

Description: Performs a spectrum measurement, centered on the specified point, and returns 501 discrete spurious mBc values, taken over a span of 125 kHz.

Example: :READ:SPUR:TRAC:BIN?

:READ:VECTor:TRACe:BINary?

Parameters: [<CPD>]
[<burst type>]

Response: <3752_bin>

Returned values: <binary header> 3752* 16-bit binary values. See Table 4-5.

Description: Reads the binary vector trace of 1786 I,Q pairs.

Example: :READ:VECT:TRAC:BIN? NUB1

:READ:VEVT:TRACe:ASCii?

Parameters: [<CPD>]
[<burst type>]

Response: Array of 300*<NR2>

Returned values: Vector error trace data (%)

Description: Performs the measurement for the specified burst type. Returns the vector error trace data.

Example: :READ:VEVT:TRAC:ASC? NUB1

:READ:VEVT:TRACe:BINary?

Parameters: [<CPD>]
[<burst type>]

Response: Array of 300*<bin>

Returned values: (0.01%) 16-bit signed binary values

Description: Performs the measurement for the specified burst type. Returns the vector error trace data.

Example: :READ:VEVT:TRAC:BIN?

:READ:VEVT:VERRor?

Parameters: <NRf> [<CPD>]
<sym_no> [<burst type>]

Response: <NR2>

Returned values: Vector error (%)

Description: Performs the measurement for the specified burst type. Returns the vector error at the specified symbol.

Example: :READ:VEVT:VERR? 20

:READ:WBANd:ATPower?

Parameters: [<CPD>]
[<burst type>]

Response: <NR2>

Returned values: (dBm)

Description: Measures wideband noise with a numeric-only or wideband noise spectrum display.
Performs the measurement for the specified burst type. Returns average transmitter
power.

Examples: `:READ:WBAN:ATP?`
`:READ:WBAN:ATP? NUB1`

:READ:WBANd:BANDwidth?

Parameters: [<CPD>]
[<burst type>]

Response: <NR2>

Returned values: (Hz)

Description: Measures wideband noise at the current settings with a numeric-only or wideband
noise spectrum display. Performs the measurement for the specified burst type.
Returns noise bandwidth.

Example: `:READ:WBAN:BAND? NUB1`

:READ:WBAN:FAIL?

Parameters: [<CPD>]
[<burst type>]

Response: <NR1>

Returned values: 0 | to | 32767 – for bit significance, see Table 4-3.

Description: Measures wideband noise with a numeric-only or wideband noise spectrum display.
Performs the measurement for the specified burst type. Returns the wban_failed
flags word.
In numeric-only display, the 'failed bit' is TRUE if any point has failed.
In spectrum display, the 'failed' bit is TRUE if the current point has failed.

Examples: `:READ:WBAN:FAIL?`
`:READ:WBAN:FAIL? NUB1`

:READ:WBANd:LIMit:ABSolute?

Parameters: <NRf>
<point no>

Response: <NR2>

Returned values: Current limit setting (dBm).

Description: Measures wideband noise at the current settings with a numeric-only or wideband noise spectrum display. Returns the maximum absolute power limit effective for the last measurement at the specified point.

Example: :READ:WBAN:LIM:ABS? 1

:READ:WBANd:LIMit:RELative?

Parameters: <NRf>
<point no>

Response: <NR2>

Returned values: Current limit setting (dBc).

Description: Measures wideband noise at the current settings with a numeric-only or wideband noise spectrum display. Returns the relative power limit effective for the last measurement at the specified point.

Example: :READ:WBAN:LIM:REL? 7

:READ:WBANd:POWer?

Parameters: [<NRf>]
[<point no>]

Response: <NR2>

Returned values: (dBc)

Description: Measures wideband noise at the current settings with a numeric-only or wideband noise spectrum display. Returns the power measured at the specified point. <point no> defaults to the current point.

Examples: :READ:WBAN:POW?
:READ:WBAN:POW? 7

:READ:WBANd:POWer:FAIL?

Parameters:	\<NRf\>
	\<point no\>
Response:	\<NR1\>
Returned values:	0 | (pass), 1 | (fail)
Description:	Measures wideband noise with a numeric-only or wideband noise spectrum display. Returns pass/fail at the specified point. \<point no\> defaults to the current point.
Example:	:READ:WBAN:POW:FAIL? 8

:READ:WBANd:TRACe:ASCii?

Parameters:	\<NRf\>
	\<point no\>
Response:	Array of 501*\<nr2\>, comma-separated.
Returned values:	(dBc) (ASCII).
Description:	Measures wideband noise with a spectrum display. Returns 501 trace points over a span of 78.75 kHz, centered on the specified point.
Example:	:READ:WBAN:TRAC:ASC? 6

:READ:WBANd:TRACe:BINary?

Parameters:	\<NRf\>
	\<point no\>
Response:	Array of 501*\<bin\>.
Returned values:	(mBc, equivalent to 0.01 dBc) 16-bit signed 2's-complement binary values.
Description:	Measures wideband noise with a spectrum display. Returns 501 trace points over a span of 78.75 kHz, centered on the specified point. Each value is returned as two bytes, MS byte first.
Example:	:READ:WBAN:TRAC:BIN? 6

SPECtrum SUBSYSTEM

The SPECtrum subsystem provides a suite of commands which become enabled when the Spectrum Analyzer mode of operation is chosen.

SPECtrum:
    AVERage\?
    DISPlay:
        TOP\?
        VRESolution\?
    MARKer:
        TOFReq
        TOPK
    NBANdwidth\?
    WINDow\?

:SPECtrum:AVERage

Parameters:	<NRf>
Valid values:	
Description:	Sets the number of traces to be averaged.
Example:	`:SPEC:AVER 200`

:SPECtrum:AVERage?

Parameters:	None.
Response:	<NR1>
Returned value:	Number of traces to be averaged (if averaging is enabled). Returns 1 if the averaging is OFF.
Description:	
Example:	`:SPEC:AVER?`
	`200`

:SPECtrum:DISPlay:TOP

Parameters:	<NRf_os> [dBm]
Valid values:	<noise floor> to <maximum input>
Description:	Sets the displayed top-of-screen level of the spectrum analyzer display. Does not alter the settings of the hardware determined from the <input level> (POW:REF). Used in conjunction with <vertical resolution> (SPEC:DISP:VRES) allows expansion of part of the measurement range.
Example:	`:SPEC:DISP:TOP 23dBm`
	Sets top of screen to 23 dBm.

:SPECtrum:DISPlay:TOP?

Parameters:	None.
Response:	<NR2>
Returned values:	
Description:	Reads top-of screen.
Example:	`:SPEC:DISP:TOP?`

:SPECtrum:DISPlay:VRESolution

Parameters: <NRf_os>
Vertical resolution of spectrum analyzer display.

Valid values: 0.01 dB/div to 50 dB/div
(dB)

Description: Sets the vertical resolution (in dB/div) of the spectrum analyzer display. Does not affect hardware settings.

Example: `:SPEC:DISP:VRES 0.1`

Sets vertical resolution to 0.1 dB/div.

:SPECtrum:DISPlay:VRESolution?

Parameters: None.

Response: <NR2>

Returned values: Spectrum analyzer vertical resolution in dB/div.

Description:

Example: `:SPEC:DISP:VRES?`

`0.1`

:SPECtrum:MARKer:TOFReq

Parameters: <NRf_fs>
Frequency value at which the marker is to be positioned.

Valid values:

Description: Moves the marker to the frequency specified as the parameter (in preparation for reading the level at the marker). If the frequency is outside the current span it is set to the edge of the current span.

Example: `:SPEC:MARK:TOFR  387.4795MHz`

:SPECtrum:MARKer:TOPK

Parameters: None.

Valid values:

Description: Moves the marker to the peak of the current trace, (in preparation for reading the level and/or frequency at the marker).

Example: `:SPEC:MARK:TOPK`

:SPECtrum:NBANdwidth

Parameters:	\<NRf_fs\>
	The noise bandwidth of the Gaussian filter. (Blackman-Harris is fixed.)
Valid values:	Absolute bandwidth (Hz)
Description:	Sets the bandwidth of the Gaussian filter as an absolute frequency.
Example:	:SPEC:NBAN 10
	Sets Gaussian window bandwidth to 10 Hz.

:SPECtrum:NBANdwidth?

Parameters:	None.
Response:	\<NR2\> (Hz)
Returned values:	Noise bandwidth.
Description:	Returns the current value of the filter bandwidth in Hz.
Example:	:SPEC:NBAN?

:SPECtrum:WINDow

Parameters:	\<CPD\>
Valid values:	BHARris	GAUSsian	AUTO-gaussian
Description:	Sets the windowing function used in spectrum analysis mode to Blackman-Harris or Gaussian.
	AUTO indicates Gaussian with bandwidth at 1% of span.
Example:	:SPEC:WIND BHAR
	Sets window type to Blackman-Harris.

:SPECtrum:WINDow?

Parameters:	None.
Response:	\<CRD\>
Returned values:	Window type: BHARris	GAUSsian	AUTO-gaussian
Description:	Reads window type.
Example:	:SPEC:WIND?

STATus SUBSYSTEM

STATus:
    CALibration:
        CONDition?
        ENABle\?
        EVENt?
    FREQuency:
        CONDition?
        ENABle\?
        EVENt?
    OPERation:
        CONDition?
        ENABle\?
        EVENt?
    POWer:
        CONDition?
        ENABle\?
        EVENt?
    QUEStionable:
        CONDition?
        ENABle\?
        EVENt?

:STATus:CALibration:CONDition?

Parameters:	None.
Response:	<NR1> Calibration status register contents.
Returned values:	0 = Calibration successful. 1 = Calibration failed − calibration signal not found.
Description:	Reads the contents of the Calibration Status Register.
Example:	:STAT:CAL:COND?

:STATus:CALibration:ENABle

Parameters:	<NRf> Mask
Valid values:	0 = Disable calibration failed enable bit. 1 = Enable calibration failed enable bit.
Description:	Sets the enable mask which allows true conditions in the Calibration Status Event Register to be reported in the summary bit. If a bit is 1 in the enable register and its associated event bit makes a transition to true, a positive transition will occur in the associated summary bit.
Example:	:STAT:CAL:ENAB

:STATus:CALibration:ENABle?

Parameters:	[<NRf>] [Mask]
Response:	<NR1> Mask
Returned values:	
Description:	Reads the enable mask for the Calibration Status Register.
Example:	:STAT:CAL:ENAB?

:STATus:CALibration:EVENt?

Parameters:	None.
Response:	<NR1> Event register contents.
Returned values:	0 = Calibration successful. 1 = Calibration failed − calibration signal not found.
Description:	Reads the contents of the event register associated with the Calibration Status Register.
Example:	`:STAT:CAL:EVEN?`
	Determine what caused the event.

:STATus:FREQuency:CONDition?

Parameters:	None.
Response:	<NR1> Frequency status register contents.
Returned values:	0 = Calibration successful. Otherwise integer value, for decode see Table 4-1.
Description:	Reads the contents of the Frequency Status Register.
Example response:	`:STAT:FREQ:COND?`
	`320 (External Standard Failure + External Standard Low)`

:STATus:FREQuency:ENABle

Parameters: <NRf>
                      Mask

Valid values: For integer value decode see Table 4-1.

Description: Sets the enable mask which allows true conditions in the Frequency Status Event Register to be reported in the summary bit. If a bit is 1 in the enable register and its associated event bit makes a transition to true, a positive transition will occur in the associated summary bit.

Example: :STAT:FREQ:ENAB

:STATus:FREQuency:ENABle?

Parameters: [<NRf>]
                      [Mask]

Response: <NR1>
                      Mask

Returned values:

Description: Reads the enable mask for the Frequency Status Register.

Example: :STAT:FREQ:ENAB?

:STATus:FREQuency:EVENt?

Parameters: None.

Response: <NR1>
                      Event register contents.

Returned values: 0 = Calibration successful. Otherwise integer value, for decode see Table 4-1.

Description: Reads the contents of the event register associated with the Frequency Status Register.

Example: :STAT:FREQ:EVEN?

Determine what caused the event.

:STATus:OPERation:CONDition?

Parameters: None.

Response: <NR1>
Operation status register contents.

Returned values: 0 = Calibration successful. Otherwise integer value, for decode see Table 4-1.

Description: Reads the contents of the Operation Status Register.

Example: `:STAT:OPER:COND?`

:STATus:OPERation:ENABle

Parameters: <NRf>
Mask

Valid values: For integer value decode see Table 4-1.

Description: Sets the enable mask which allows true conditions in the Operation Status Event
Register to be reported in the summary bit. If a bit is 1 in the enable register and its
associated event bit makes a transition to true, a positive transition will occur in the
associated summary bit.

Example: `:STAT:OPER:ENAB 32`

Program the status register with the mask value 32.

:STATus:OPERation:ENABle?

Parameters: [<NRf>]
[Mask]

Response: <NR1>
Mask

Returned values:

Description: Reads the enable mask for the Operation Status Register.

Example: `:STAT:OPER:ENAB?`

:STATus:OPERation:EVENt?

Parameters: None.

Response: <NR1>
Event register contents.

Returned values: 0 = Calibration successful. Otherwise integer value, for decode see Table 4-1.

Description: Reads the contents of the event register associated with the Operation Status Register.

Example: `:STAT:OPER?`

Determine what caused the event.

:STATus:POWer:CONDition?

Parameters: None.

Response: <NR1>
Questionable status register contents.

Returned values: 0 = Calibration successful. Otherwise integer value, for decode see Table 4-1.

Description: Reads the contents of the Power Status Register.

Example: `:STAT:POW:COND?`

:STATus:POWer:ENABle

Parameters: \<NRf\>
Mask

Valid values: For integer value decode see Table 4-1.

Description: Sets the enable mask which allows true conditions in the Power Status Event Register to be reported in the summary bit. If a bit is 1 in the enable register and its associated event bit makes a transition to true, a positive transition will occur in the associated summary bit.

Example: `:STAT:POW:ENAB`

:STATus:POWer:ENABle?

Parameters: [\<NRf\>]
[Mask]

Response: \<NR1\>
Mask

Returned values:

Description: Reads the enable mask for the Power Status Register.

Example: `:STAT:POW:ENAB?`

:STATus:POWer:EVENt?

Parameters: None.

Response: \<NR1\>
Event register contents.

Returned values: 0 = Calibration successful. Otherwise integer value, for decode see Table 4-1.

Description: Reads the contents of the event register associated with the Power Status Register.

Example: `:STAT:POW:EVEN?`

Determine what caused the event.

:STATus:QUEStionable:CONDition?

Parameters: None.

Response: <NR1>
Questionable status register contents.

Returned values: 0 = Calibration successful. Otherwise integer value, for decode see Table 4-1.

Description: Reads the contents of the Questionable Status Register.

Example: :STAT:QUES:CON?

:STATus:QUEStionable:ENABle

Parameters: <NRf>
Mask

Valid values: For integer value decode see Table 4-1

Description: Sets the enable mask which allows true conditions in the Questionable Status Event
Register to be reported in the summary bit. If a bit is 1 in the enable register and its
associated event bit makes a transition to true, a positive transition will occur in the
associated summary bit.

Example: :STAT:QUES:ENAB 8

Program the status register with the mask value 8.

:STATus:QUEStionable:ENABle?

Parameters: [<NRf>]
[Mask]

Response: <NR1>
Mask

Returned values:

Description: Reads the enable mask for the Questionable Status Register.

Example: :STAT:QUES:ENAB?

:STATus:QUEStionable:EVENt?

Parameters: None.

Response: <NR1>
Event register contents.

Returned values: 0 = Calibration successful. Otherwise integer value, for decode see Table 4-1.

Description: Reads the contents of the event register associated with the Questionable Status Register.

Example: `:STAT:QUES:EVEN?`

Determine what caused the event.

SYSTem SUBSYSTEM

SYSTem:
    DATE\?
    ERRor?
    HOURs\?
    PRESet
    SETTing:
        ERASe
        RECall
        SAVE\?
    TIME\?
    TOTal?

:SYSTem:DATE

Parameters: <NRf>, <NRf>, <NRf>
<year>, <month>, <day>

Valid values: Year: integer.
Month: integer. Valid values are 1 to 12. Values outside range are rejected and an error generated.
Day: integer. Valid values are 1 to 31. Values outside range are rejected and an error generated.

Description: Sets the date of the real-time clock. The year must be entered in full.

Example: :SYST:DATE 1999,8,20

Sets the date to 20th August 1999.

:SYSTem:DATE?

Parameters: None.

Response: <NR1>, <NR1>, <NR1>
<year>, <month>, <day>

Returned values: Year: integer.
Month: integer. Values are in the range 1 to 12.
Day: integer. Values are in the range 1 to 31.

Description: Reads the date of the real-time clock.

Example: :SYST:DATE?

:SYSTem:ERRor?

Parameters: None.

Response: <NR1>,<string response data>
Error number, error message string.

Returned values: Error number: integer.
Error message string: string. Variable length string.

Description: Reads the SCPI 1990.0 error number and error message from the head of the error queue.

Example: :SYST:ERR?

Example response: -112,'Program mnemonic too long'

:ERRor?

	Synonym for :SYST:ERR?
Parameters:	None.
Response:	<NR1>,<string response data> Error number, error message string.
Returned values:	Error number: integer. Error message string: string. Variable length string.
Description:	Reads the SCPI 1990.0 error number and error message from the head of the error queue.
Example:	`:ERR?`
Example response:	`-112,'Program mnemonic too long'`

:SYSTem:HOURs

Parameters:	None.
Valid values:	
Description:	Resets the elapsed-time counter to zero.
Example:	`:SYST:HOUR`

:SYSTem:HOURs?

Parameters:	None.
Response:	<NR2>
Returned values:	Operating (power-on) time (hrs).
Description:	Returns the operating time elapsed since the counter was last reset. The time is incremented every 15 minutes (0.25 hrs).

Example:	`:SYST:HOUR?`
	
	`152.25`

:SYSTem:PRESet

Synonym for :*RST

Parameters: None.

Description: Places the instrument in its default state. See details on which parameters are not affected by preset. This preset state is optimized for manual operation.

See also *RST common commands.

Example: `:SYST:PRES`

Presets the instrument.

:SYSTem:SETTing:ERASe

Parameters: <NR1>
<stor_no>

Valid values: 1 to 20

Description: Erases the instrument settings in the selected store.

Example: `:SYST:SETT:ERAS 12`

:SYSTem:SETTing:RECall

Parameters: <NR1>
<stor_no>

Valid values: 1 to 20

Description: Recalls the current settings of the instrument in the selected store.

Example: `:SYST:SETT:REC 4`

:SYSTem:SETTing:SAVE

Parameters: `<NRf>, <NRf>`
                                     `<stor_no>, <name>`

Valid values: Store number: 1 to 20; name: up to 20 characters, or none

Description: Saves the current settings of the instrument to the selected store, and names the store with the character string entered.

Example: `:SYST:SETT:SAVE 4,CURRENT`

:SYSTem:SETTing:SAVE?

Parameters: `<NR1>`
                                     `<store_no>`

Response: `<string>`

Returned values: Store name.

Description: Returns the name of the current store.

Example: `:SYST:SETT:SAVE?`

:SYSTem:TIME

Parameters: <NRf>, <NRf>, <NRf>
                <hours>, <minutes>, <seconds>

Valid values: Hours: integer. Valid values are 0 to 23. Values outside range are rejected and an error generated.
                Minutes: integer. Valid values are 0 to 59. Values outside range are rejected and an error generated.
                Seconds: integer. Valid values are 0 to 59. Values outside range are rejected and an error generated.

Description: Sets the time of the real-time clock. The time is in 24-hour format.

Example: `:SYST:TIME 14,30,0`

Sets the time to 2:30 pm.

:SYSTem:TIME?

Parameters: None.

Response: <NR1>, <NR1>, <NR1>
                <hours>, <minutes>, <seconds>

Returned values: Hours: integer. Values are in the range 0 to 23.
                Minutes: integer. Values are in the range 0 to 59.
                Seconds: integer. Values are in the range 0 to 59.

Description: Reads the time of the real-time clock.

Example: `:SYST:TIME?`

:SYSTem:TOTal?

Parameters: None.

Response: <NR2>

Returned values: Total operating (power-on) time (hrs).

Description: Returns the total operating time elapsed since the instrument was new. This counter is never reset. The time is incremented every 15 minutes (0.25 hrs).

Example: `:SYST:TOT?`

                `1192.75`

:SYSTem:TIME

TETRa SUBSYSTEM

The TETRa subsystem provides a suite of commands which become enabled when the TETRA mode of operation is chosen.

TETRa:
    ACPower:
        MODulation:
            CHANnel?
            DISPlay\?
                TOP\?
                VRESolution\?
            NBANdwidth?
        SWITching:
            DISPlay\?
                TOP\?
                VRESolution\?

TETRa:
    AVERage\?

TETRa:
    BURSt\?

TETRa:
    BURSt:
        LENGth?
        MODulation?
        PPROfile

TETRa:
    DISPlay:
        TOP\?
        VRESolution\?

TETRa:
    IMOD:
        ABORt
        OFFSet\?
        ORDer\?

TETRa:
    LIMits:
        ACPModulation:
            ABSolute\?
            K25\?
            K50\?
            K75\?
        ACPSwitching:
            ABSolute\?
            K25\?
        ATPower:
            MAXimum\?
            MINimum\?
        IMOD:
            BSA\?
            BSR\?
            MS\?
        LINearization:
            HIGHer\?
            LOWer\?
            TIME\?
        MODulation:
            CLEAk\?
            FERRor\?
            MVERror\?
            PVERror\?
        NSPower:
            ABSolute\?
            LMIN\?
        PPROfile:
            ABSolute\?
            LMIN\?
            T1MX\?
            T3MX\?
        SAVE
        SET\?
        SPURious\?
        STATe\?
        WBANd:
            XXXx\?

TETRa:
    LINearization:
        DISPlay\?
        DISPlay:
            TOP\?
            VRESolution\?
        MARKer:
            POWer?
            TIME
            TOPK\?
        TRIGger\?
TETRa:
    MEASurement\?
TETRa:
    MODulation:
        DISPlay\?
        MARK:
            AMPlitude\?
            PHASe\?
            SYMbol\?
            VECTor\?
TETRa:
    NSPower:
        DISPlay\?
        DISPlay:
            TOP\?
            VRESolution\?
        SLOT\?
TETRa:
    PPRofile:
        DISPlay\?
            TOP\?
            VRESolution\?
        MARKer:
            TOPK?
TETRa:
    SPURious:
        ABORt
        DISPlay\?
        DISPlay:
            POINt\?
            TOP\?
            VRESolution\?
        EDIT:
            FREQuency?
            INSert
            POINts?
            REMove

TETRa:
    WBANd:
        ABORt
        DISPlay\?
        DISPlay:
            POINt\?
            TOP\?
            VRESolution\?
        EDIT:
            INSert
            OFFSet?
            POINts?
            REMove

:TETRa:ACPower:MODulation:CHANnel?

Parameters: None.

Response: <NR1>

Returned values: See Table 4-7

Description: Returns the nominal span in terms of active channels.

Example: `:TETR:ACP:MOD:CHAN?`

:TETRa:ACPower:MODulation:DISPlay

Parameters: <CPD>
TETRA ACP due to modulation display formats.

Valid values: NUM | SPEC

Description: Sets the display format to be used when TETRA adjacent channel power due to modulation measurements are being performed.

NUM   NUMeric only
SPEC   SPECtrum (due to modulation)

Example: `:TETR:ACP:MOD:DISP NUM`

Sets TETRA adjacent channel power due to modulation display to numeric only.

:TETRa:ACPower:MODulation:DISPlay?

Parameters: None.

Response: <CRD>

Returned values: NUM | SPEC

Description: Reads current TETRA ACP due to modulation measurement display format.

Example: `:TETR:ACP:MOD:DISP?`

:TETRa:ACPower:MODulation:DISPlay:TOP

Synonym for :TETRa:DISPlay:TOP

Parameters: <NRf_os>

Valid values: <noise floor> to <maximum input> (dBc)

Description: Sets the displayed top-of-screen level of the adjacent channel power due to modulation display. Does not alter the settings of the hardware determined from the <input level> (POW:REF). Used in conjunction with <vertical resolution> (TETR:DISP:VRES), allows expansion of part of the measurement range.

Example: `:TETR:ACP:MOD:DISP:TOP 23dBm`

Sets top of screen to 23 dBm.

:TETRa:ACPower:MODulation:DISPlay:TOP?

Synonym for :TETRa:DISPlay:TOP?

Parameters: None.

Response: <NR2>

Returned values: Top-of screen level (dBc)

Description: Returns the displayed top-of screen level for the ACP due to modulation display.

Example: `:TETR:ACP:MOD:DISP:TOP?`

:TETRa:ACPower:MODulation:DISPlay:VRESolution

Synonym for :TETRa:DISPlay:VRESolution

Parameters: <NRf_os>
Vertical resolution of TETRA analyzer display

Valid values: 0.01 dB/div to 50 dB/div.
(dB)

Description: Sets the vertical resolution (in dB/div) of the adjacent power due to modulation display. Does not affect hardware settings.

Example: `:TETR:ACP:MOD:DISP:VRES 0.1`

Sets vertical resolution to 0.1 dB/div.

:TETRa:ACPower:MODulation:DISPlay:VRESolution?

Synonym for :TETRa:DISPlay:VRESolution?

Parameters: None.

Response: <NR2>

Returned values: Vertical resolution in dB/div.

Description: Reads the vertical resolution of the ACP due to modulation display.

Example: `:TETR:ACP:MOD:DISP:VRES?`

`0.1`

:TETRa:ACPower:MODulation:NBANdwidth?

Parameters: None.

Response: <NR2> (Hz)

Returned values: Noise bandwidth.

Description: Returns the current noise bandwidth setting for the adjacent channel power measurement.

Example: `:TETR:ACP:MOD:NBAN?`

`1353.44`

:TETRa:ACPower:SWITching:DISPlay

Parameters: <CPD>

TETRA ACP due to switching display formats.

Valid values: NUM | PROFile | PM25 | PP25

Description: Sets the display format to be used when TETRA adjacent channel power due to switching measurements are being performed.

NUM   NUMeric only
PROF   On-channel power-vs-time profile
PM25   −25 kHz channel power-vs-time
PP25   +25 kHz channel power-vs-time.

Example: :TETR:ACP:SWIT:DISP NUM

Sets TETRA adjacent channel power due to switching display to numeric-only.

:TETRa:ACPower:SWITching:DISPlay?

Parameters: None.

Response: <CRD>

Returned values: NUM | PROF | PM25 | PP25

Description: Reads current TETRA ACP due to switching measurement display format.

Example: :TETR:ACP:SWIT:DISP?

:TETRa:ACPower:SWITching:DISPlay:TOP

Synonym for :TETRa:DISPlay:TOP

Parameters: <NRf_os>

Valid values: <noise floor> to <maximum input> (dBc)

Description: Sets the displayed top-of-screen level of the adjacent power due to switching display. Does not alter the settings of the hardware determined from the <input level> (POW:REF). Used in conjunction with <vertical resolution> (TETR:DISP:VRES), allows expansion of part of the measurement range.

Example: `:TETR:ACP:SWIT:DISP:TOP 23dBm`

Sets top of screen to 23 dBm.

:TETRa:ACPower:SWITching:DISPlay:TOP?

Synonym for :TETRa:DISPlay:TOP?

Parameters: None.

Response: <NR2>

Returned values: Top-of screen level (dB)

Description: Reads the displayed top-of screen level of the ACP due to switching display.

Example: `:TETR:ACP:SWIT:DISP:TOP?`

:TETRa:ACPower:SWITching:DISPlay:VRESolution

Synonym for :TETRa:DISPlay:VRESolution

Parameters: <NRf_os>
Vertical resolution of TETRA analyzer display

Valid values: 0.01 dB/div to 50 dB/div.
(dB)

Description: Sets the vertical resolution (in dB/div) of the adjacent channel power due to switching display. Does not affect hardware settings.

Example: `:TETR:ACP:SWIT:DISP:VRES 0.1`

Sets vertical resolution to 0.1 dB/div.

:TETRa:ACPower:SWITching:DISPlay:VRESolution?

Synonym for :TETRa:DISPlay:VRESolution?

Parameters: None.

Response: <NR2>

Returned values: Vertical resolution in dB/div.

Description: Reads the vertical resolution of the ACP due to switching display.

Example: `:TETR:ACP:SWIT:DISP:VRES?`

`0.1`

:TETRa:AVERage

Parameters: <NRf>

Valid values: 1 to 200

Description: Sets the number of bursts over which most TETRA measurements are made.

Example: `:TETR:AVER 100`

Sets TETRA averages to 100 bursts.

:TETRa:AVERage?

Parameters: None.

Response: <NR1>

Returned values: 1 to 200

Description: Reads current TETRA averaging selection.

Example: `:TETR:AVER?`

:TETRa:BURSt

Parameters: <CPD>
Specific TETRA burst types.

Valid values: CB | NUB1 | NUB2 | NDB1C | NDB1D | NDB2C | NDB2D | SBC | SBD | DNB1 | DNB2 | DSB | PRUD | PRDC | PRDD | PRDMD

Description: Sets which TETRA burst type is to be analyzed. This list includes the bursts for all types of units (base station, mobile, DMO etc.). An exception is the linearization burst which is not included. This is treated as a distinct measurement which still needs a type to be specified for the subsequent bursts used to establish a 0 dB reference.

CB	Control uplink Burst
NUB1	Normal Uplink Burst (with TS1)
NUB2	Normal Uplink Burst (with TS2)
NDB1C	Normal Downlink Burst (TS1, Continuous)
NDB1D	Normal Downlink Burst (TS1, Discontinuous)
NDB2C	Normal Downlink Burst (TS2, Continuous)
NDB2D	Normal Downlink Burst (TS2, Discontinuous)
SBC	Synchronization downlink Burst (Continuous)
SBD	Synchronization downlink Burst (Discontinuous)
DNB1	Direct mode Normal Burst (with TS1)
DNB2	Direct mode Normal Burst (with TS2)
DSB	Direct mode Synchronization Burst
PRUD	Pseudo-Random Uplink Discontinuous
PRDC	Pseudo-Random Downlink Continuous
PRDD	Pseudo-Random Downlink Discontinuous
PRDMD	Pseudo-Random Direct Mode Discontinuous

Example: `:TETR:BURS NUB1`
Sets type of burst to be analyzed to normal uplink burst with TS1.

:TETRa:BURSt?

Parameters: None.

Response: <CPD>

Returned values: CB | NUB1 | NUB2 | NDB1C | NDB1D | NDB2C | NDB2D | SBC | SBD | DNB1 | DNB2 | DSB | PRUD | PRDC | PRDD | PRDMD

Description: Reads current TETRA burst type.

Example: `:TETR:BURS?`

:TETRa:BURSt:LENGth?

Parameters: None.

Response: <NR1>

Returned values: 103 to 255

Description: Returns length of current burst type as number of modulation symbols. See Table 4-6.

Example: :TETR:BURS:LENG?

:TETRa:BURSt:MODulation?

Parameters: None.

Response: <NR1>

Returned values: 0 to 16

Description: Returns preamble length in modulation accuracy data as symbol periods before Sn(0). See Table 4-6.

Example: :TETR:BURS:MOD?

:TETRa:BURSt:PPROfile?

Parameters: None.

Response: <NR1>

Returned values: 5 to 21

Description: Returns preamble length in power-profile points as symbol periods before Sn(0). See Table 4-6.

Example: :TETR:BURS:PPRO?

:TETRa:DISPlay:TOP

Parameters: <NRf_os>

Valid values: <noise floor> to <maximum input>

Description: Sets the displayed top-of-screen level of the TETRA analyzer display. Does not alter the settings of the hardware determined from the <input level> (POW:REF). Used in conjunction with <vertical resolution> (TETR:DISP:VRES), allows expansion of part of the measurement range.

Example: `:TETR:DISP:TOP 23dBm`

Sets top of screen to 23 dBm.

:TETRa:DISPlay:TOP?

Parameters: None.

Response: <NR2>

Returned values: Topof-screen level (dBc)

Description: Returns the top-of-screen level of the TETRA analyzer display.

Example: `:TETR:DISP:TOP?`

:TETRa:DISPlay:VRESolution

Parameters: <NRf_os>
                 Vertical resolution of TETRA analyzer display

Valid values: 0.01 dB/div to 50 dB/div.F

Description: Sets the vertical resolution (in dB/div) of the TETRA analyzer display. Does not affect hardware settings.

Example: `:TETR:DISP:VRES 0.1`

Sets vertical resolution to 0.1 dB/div.

:TETRa:DISPlay:VRESolution?

Parameters: None.

Response: <NR2>

Returned values: TETRA analyzer vertical resolution in dB/div.

Description: Reads the vertical resolution.

Example: `:TETR:DISP:VRES?`

                 `0.1`

:TETRa:IMOD:ABORt

Parameters: None.

Valid values:

Description: This command aborts an intermodulation attenuation measurement which is in progress following an INIT:IMMediate command or [SINGLE] key-press. It would normally be used if the signal is lost during an attempted intermodulation attenuation measurement.

Notes:
This command will not abort the measurement if the intermodulation attenuation measurement was started with a MEASure:IMOD:xxxx? or READ:IMOD:xxxx? command.

The alternative command ABORt will abort wideband noise, discrete spurious, auto pre-scan, diagnostic calibration/trace or intermodulation measurements if they are running.

Example: `:TETR:IMOD:ABORt`

:TETRa:IMOD:OFFSet

Parameters: <NRf>
<freq>

Valid values: (Hz)

Description: Sets the interferer frequency offset from the channel frequency. Default is 500 kHz.

Example: `:TETR:IMOD:OFFSet 30E+4`

:TETRa:IMOD:OFFSet?

Parameters: None.

Response: <NR2> (Hz)

Returned values: Interferer frequency offset.

Description: Returns the current offset of the interferer signal from the channel frequency.

Example: `:TETR:IMOD:OFFSet?`

:TETRa:IMOD:ORDer

Parameters: <NRf>
<code>

Valid values: 0–7

Description: Selects products for the intermodulation attenuation measurement and display. See Table 4-11.

Example: :TETR:IMOD:ORDer 3

:TETRa:IMOD:ORDer?

Parameters: None.

Response: <NR1>

Returned values: 0–7

Description: Returns the code which defines products used for the intermodulation attenuation measurement and display. See Table 4-11.

Example: :TETR:IMOD:ORDer?

:TETRa:LIMits:ACPModulation:ABSolute

Parameters: <NRf>

Valid values: (dBm)

Description: Sets maximum absolute power limit for the non-active periods. Applied to the ACP due to modulation measurement. Replaces default limit whilst instrument remains switched on.

Example: :TETR:LIM:ACPM:ABS −36

:TETRa:LIMits:ACPModulation:ABSolute?

Parameters: None.

Response: <NRf> (dBm)

Returned values: Current limit setting.

Description: Returns maximum absolute power limit for the non-active periods for the ACP due to modulation measurement.

Example: :TETR:LIM:ACPM:ABS? −36

:TETRa:LIMits:ACPModulation:K25

Parameters: <NRf>

Valid values: (dBc)

Description: Sets maximum power limit relative to carrier for the non-active ±25 kHz channels. Applied to the ACP due to modulation measurement. Replaces default limit whilst instrument remains switched on.

Example: `:TETR:LIM:ACPM:K25 −60`

:TETRa:LIMits:ACPModulation:K25?

Parameters: None.

Response: <NRf> (dBc)

Returned values: Current limit setting.

Description: Returns maximum power limit relative to carrier for the non-active ±25 kHz channels for the ACP due to switching measurement.

Example: `:TETR:LIM:ACPM:K25? −60`

:TETRa:LIMits:ACPModulation:K50

Parameters: <NRf>

Valid values: (dBc)

Description: Sets maximum power limit relative to carrier for the non-active ±50 kHz channels. Applied to the ACP due to modulation measurement. Replaces default limit whilst instrument remains switched on.

Example: `:TETR:LIM:ACPM:K50 −70`

:TETRa:LIMits:ACPModulation:K50?

Parameters: None.

Response: <NRf> (dBc)

Returned values: Current limit setting.

Description: Returns maximum power limit relative to carrier for the non-active ±50 kHz channels for the ACP due to switching measurement.

Example: `:TETR:LIM:ACPM:K50? −70`

:TETRa:LIMits:ACPModulation:K75

Parameters: <NRf>

Valid values: (dBc)

Description: Sets maximum power limit relative to carrier for the non-active ±75 kHz channels. Applied to the ACP due to modulation measurement. Replaces default limit whilst instrument remains switched on.

Example: `:TETR:LIM:ACPM:K75 −70`

:TETRa:LIMits:ACPModulation:K75?

Parameters: None.

Response: <NRf> (dBc)

Returned values: Current limit setting.

Description: Returns maximum power limit relative to carrier for the non-active ±75 kHz channels for the ACP due to switching measurement.

Example: `:TETR:LIM:ACPM:K75? −70`

:TETRa:LIMits:ACPSwitching:ABSolute

Parameters: <NRf>

Valid values: (dBm)

Description: Sets maximum absolute power limit for the non-active periods. Applied to the ACP due to switching measurement. Replaces default limit whilst instrument remains switched on.

Example: `:TETR:LIM:ACPS:ABS −36`

:TETRa:LIMits:ACPSwitching:ABSolute?

Parameters: None.

Response: <NRf> (dBm)

Returned values: Current limit setting.

Description: Returns maximum absolute power limit for the non-active periods for the ACP due to switching measurement.

Example: `:TETR:LIM:ACPS:ABS? −36`

:TETRa:LIMits:ACPSwitching:K25

Parameters: <NRf>

Valid values: (dBc)

Description: Sets maximum power limit relative to carrier for the non-active ±25 kHz channels. Applied to the ACP due to switching measurement. Replaces default limit whilst instrument remains switched on.

Example: `:TETR:LIM:ACPS:K25 −50`

:TETRa:LIMits:ACPSwitching:K25?

Parameters: None.

Response: <NRf> (dBc)

Returned values: Current limit setting.

Description: Returns maximum power limit relative to carrier for the non-active ±25 kHz channels for the ACP due to switching measurement.

Example: `:TETR:LIM:ACPS:K25? −50`

:TETRa:LIMits:ATPower:MAXimum

Parameters: <NRf>

Valid values: (dB)

Description: Sets a limit with respect to input level for maximum average Tx power. Applied to all TETRA measurements. Replaces default limit whilst instrument remains switched on.

Example: `:TETR:LIM:ATP:MAX 2`

:TETRa:LIMits:ATPower:MAXimum?

Parameters: None.

Response: <NRf> (dB)

Returned values: Current limit setting.

Description: Returns current limit with respect to input level for maximum average Tx power.

Example: `:TETR:LIM:ATP:MAX? 2`

:TETRa:LIMits:ATPower:MINimum

Parameters: <NRf>

Valid values: (dB)

Description: Sets a limit with respect to input level for minimum average Tx power. Applied to all TETRA measurements. Replaces default limit whilst instrument remains switched on.

Example: `:TETR:LIM:ATP:MIN −2`

:TETRa:LIMits:ATPower:MINimum?

Parameters: None.

Response: <NRf> (dBm)

Returned values: Current limit setting.

Description: Returns current limit with respect to input level for minimum average Tx power.

Example: `:TETR:LIM:ATP:MIN? −2`

:TETRa:LIMits:IMOD:BSA

Parameters: <NRf_os>
    <level>

Valid values: (dBm)

Description: Sets the absolute intermodulation attenuation limit to the specified value for BS with average Tx power <+34 dBm. Default is −36 dBm.

Example: `:TETR:LIM:IMOD:BSA −40`

:TETRa:LIMits:IMOD:BSA?

Parameters: None.

Response: <NRf>

Returned values: Imod limit (dBc)

Description: Returns the current value for the absolute intermodulation attenuation limit for BS with average Tx power <+34 dBm.

Example: `:TETR:LIM:IMOD:BSA?`

:TETRa:LIMits:IMOD:BSR

Parameters: <NRf_os>
<level>

Valid values: (dBc)

Description: Sets the relative intermodulation attenuation limit to the specified value for BS with average Tx power >+34 dBm. Default is −70 dBc.

Example: `:TETR:LIM:IMOD:BSR −60`

:TETRa:LIMits:IMOD:BSR?

Parameters: None.

Response: <NRf>

Returned values: Imod limit (dBc)

Description: Returns the current value for the relative intermodulation attenuation limit for BS with average Tx power >+34 dBm.

Example: `:TETR:LIM:IMOD:BSR?`

:TETRa:LIMits:IMOD:MS

Parameters: <NRf_os>
<level>

Valid values: (dBc)

Description: Sets the intermodulation attenuation limit to the specified value for MS and DMO. Default is −60 dBc.

Example: `:TETR:LIM:IMOD:MS −50`

:TETRa:LIMits:IMOD:MS?

Parameters: None.

Response: <NRf>

Returned values: Imod limit (dBc)

Description: Returns the current value for the intermodulation attenuation limit for MS and DMO.

Example: `:TETR:LIM:IMOD:MS?`

:TETRa:LIMits:LINearization:HIGHer

Parameters: <NRf>

Valid values: (dBc)

Description: Sets user high (max) limit for adjacent channel power during a linearization burst. The TETRA standard is −30 dBc.

Example: `:TETR:LIM:LIN:HIGH −30`

:TETRa:LIMits:LINearization:HIGHer?

Parameters: None.

Response: <NRf> (dBc)

Returned values: Adjacent channel power maximum limit.

Description: Returns current high (max) limit for adjacent channel power during a linearization burst.

Example: `:TETR:LIM:LIN:HIGH?`

:TETRa:LIMits:LINearization:LOWer

Parameters: <NRf>

Valid values: (dBc)

Description: Sets user low limit for adjacent channel power during a linearization burst. The TETRA standard is −45 dBc.

Example: `:TETR:LIM:LIN:LOW −45`

:TETRa:LIMits:LINearization:LOWer?

Parameters: None.

Response: <NRf> (dBc)

Returned values: Adjacent channel power low limit.

Description: Returns current low limit for adjacent channel power during a linearization burst.

Example: `:TETR:LIM:LIN:LOW?`

:TETRa:LIMits:LINearization:TIME

Parameters: <NRf>
                 <time>

Valid values: (s)

Description: Sets fail total time user limit for adjacent channels between limits during a linearization burst. The TETRA standard is 0.001 s.

Example: :TETR:LIM:LIN:TIME 0.001

:TETRa:LIMits:LINearization:TIME?

Parameters: None.

Response: <NRf>

Returned values: Time in seconds.

Description: Returns current fail total time limit for adjacent channels during a linearization burst.

Example: :TETR:LIM:LIN:TIME?

:TETRa:LIMits:MODulation:CLEAk

Parameters: <NRf>

Valid values: (%)

Description: Sets maximum limit for residual carrier power (carrier leakage). Applied to the modulation accuracy measurement. Replaces default limit whilst instrument remains switched on.

Example: :TETR:LIM:MOD:CLEA 5

:TETRa:LIMits:MODulation:CLEAk?

Parameters: None.

Response: <NRf> (%)

Returned values: Current limit setting.

Description: Returns maximum limit for residual carrier power (carrier leakage).

Example: :TETR:LIM:MOD:CLEA? 5

:TETRa:LIMits:MODulation:FERRor

Parameters: <NRf>

Valid values: (ppm)

Description: Sets maximum limit for frequency error. Applied to the modulation accuracy measurement. Replaces default limit whilst instrument remains switched on.

Example: `:TETR:LIM:MOD:FERR 0.2`

:TETRa:LIMits:MODulation:FERRor?

Parameters: None.

Response: <NRf> (ppm)

Returned values: Current limit setting.

Description: Returns maximum limit for frequency error for the modulation accuracy measurement.

Example: `:TETR:LIM:MOD:FERR? 0.2`

:TETRa:LIMits:MODulation:MVERror

Parameters: <NRf>

Valid values: (%)

Description: Sets maximum limit for RMS (mean) vector error. Applied to the modulation accuracy measurement. Replaces default limit whilst instrument remains switched on.

Example: `:TETR:LIM:MOD:MVER 10`

:TETRa:LIMits:MODulation:MVERror?

Parameters: None.

Response: <NRf> (%)

Returned values: Current limit setting.

Description: Returns maximum limit for RMS (mean) vector error for the modulation accuracy measurement.

Example: `:TETR:LIM:MOD:MVER? 10`

:TETRa:LIMits:MODulation:PVERror

Parameters: <NRf>

Valid values: (%)

Description: Sets maximum limit for peak vector error. Applied to the modulation accuracy measurement. Replaces default limit whilst instrument remains switched on.

Example: `:TETR:LIM:MOD:PVER  30`

:TETRa:LIMits:MODulation:PVERror?

Parameters: None.

Response: <NRf> (%)

Returned values: Current limit setting.

Description: Returns maximum limit for peak vector error for the modulation accuracy measurement.

Example: `:TETR:LIM:MOD:PVER? 30`

:TETRa:LIMits:NSPower:ABSolute

Parameters: <NRf>

Valid values: (dBm)

Description: Sets maximum absolute power limit for the non-active periods. Applied to the non-active Tx state (power-profile) measurement. Replaces default limit whilst instrument remains switched on.

Example: `:TETR:LIM:NSP:ABS −36`

:TETRa:LIMits:NSPower:ABSolute?

Parameters: None.

Response: <NRf> (dBm)

Returned values: Current limit setting.

Description: Returns maximum absolute power limit for the non-active periods for the non-active Tx state measurement.

Example: `:TETR:LIM:NSP:ABS? −36`

:TETRa:LIMits:NSPower:LMINimum

Parameters: <NRf>

Valid values: (dBc)

Description: Sets maximum power limit relative to carrier for the non-active slots. Applied to the ACP due to modulation measurement. Replaces default limit whilst instrument remains switched on.

Example: :TETR:LIM:NSP:LMIN −70

:TETRa:LIMits:NSPower:LMINimum?

Parameters: None.

Response: <NRf> (dBc)

Returned values: Current limit setting.

Description: Returns maximum power limit relative to carrier for the non-active slots for the ACP due to modulation measurement.

Example: :TETR:LIM:NSP:LMIN? −70

:TETRa:LIMits:PPROfile:ABSolute

Parameters: <NRf>

Valid values: (dBm)

Description: Sets maximum absolute power limit for the non-active periods. Applied to the Tx power vs time (power-profile) measurement. Replaces default limit whilst instrument remains switched on.

Example: :TETR:LIM:PPRO:ABS −36

:TETRa:LIMits:PPROfile:ABSolute?

Parameters: None.

Response: <NRf> (dBm)

Returned values: Current limit setting

Description: Returns maximum absolute power limit for the non-active periods for the Tx power vs time measurement.

Example: :TETR:LIM:PPRO:ABS? −36

:TETRa:LIMits:PPROfile:LMIN

Parameters: <NRf>

Valid values: (dBc)

Description: Sets maximum power limit relative to carrier for the non-active periods. Applied to the Tx power vs time (power-profile) measurement. Replaces default limit whilst instrument remains switched on.

Example: `:TETR:LIM:PPRO:LMIN –70`

:TETRa:LIMits:PPROfile:LMIN?

Parameters: None.

Response: <NRf> (dBc)

Returned values: Current limit setting.

Description: Returns maximum power limit relative to carrier for the non-active periods for the Tx power vs time measurement.

Example: `:TETR:LIM:PPRO:LMIN? –70`

:TETRa:LIMits:PPROfile:T1MX

Parameters: <NRf>

Valid values: (dB)

Description: Sets maximum power limit for the ramp-up (t1 overshoot) period. Applied to the Tx power vs time (power-profile) measurement. Replaces default limit whilst instrument remains switched on.

Example: `:TETR:LIM:PPRO:T1MX 6`

:TETRa:LIMits:PPROfile:T1MX?

Parameters: None.

Response: <NRf> (dB)

Returned values: Current limit setting.

Description: Returns maximum power limit for the ramp-up period for the Tx power vs time measurement.

Example: `:TETR:LIM:PPRO:T1MX? 6`

:TETRa:LIMits:PPROfile:T3MX

Parameters: \<NRf\>

Valid values: (dB)

Description: Sets maximum power limit for the ramp-up (t3 overshoot) period. Applied to the Tx power vs time (power-profile) measurement. Replaces default limit whilst instrument remains switched on.

Example: `:TETR:LIM:PPRO:T3MX 3`

:TETRa:LIMits:PPROfile:T3MX?

Parameters: None.

Response: \<NRf\> (dB)

Returned values: Current limit setting.

Description: Returns maximum power limit for the ramp-up period for the Tx power vs time measurement.

Example: `:TETR:LIM:PPRO:T3MX? 3`

:TETRa:LIMits:SAVE

Parameters: \<NRf\>
                       \<set_no\>

Valid values: 1 to 5

Description: Saves the current power-profile limits in force to the specified USERn limits store.

Example: `:TETR:LIM SAVE 3`

:TETRa:LIMits:SET

Parameters: <CPD>
               <limit_id>

Valid values: NORMal | EXTReme | USER1 | USER2 | USER3 | USER4 | USER5

Description: Selects which set of power-profile limits to apply to the instrument.

Example: :TETR:LIM:SET NORM

:TETRa:LIMits:SET?

Parameters: None.

Response: <CRD>

Returned values: NORM | EXTR | USER1 | USER2 | USER3 | USER4 | USER5

Description: Returns the currently selected set of power-profile limits.

Example: :TETR:LIM:SET?

:TETRa:LIMits:SPURious

Parameters: <NRf>

Valid values: (dBm)

Description: Sets limit for discrete spurious noise tests. Defaults to −36 dBm.

Example: :TETR:LIM:SPUR 10

:TETRa:LIMits:SPURious?

Parameters: None.

Response: <NR2>

Returned values: Noise limit (dBm).

Description: Returns current limit for discrete spurious noise tests.

Example: :TETR:LIM:SPUR?

:TETRa:LIMits:STATe

Parameters: <bool>

Valid values: 0 | 1

Description: Displays TETRA limits results for pass or fail. 1 is ON, 0 is OFF.
When ON, displays PASS or FAIL. When OFF, displays '−'.
Values returned by xxFAIL query commands are not affected.

Example: :TETR:LIM:STAT

:TETRa:LIMits:STATe?

Parameters: None.

Response: <bool>

Returned values: 0 | 1

Description: Tests whether the measured profile fails a limit check against the current limit
mask. 0 signifies a pass. 1 denotes failure.

Example: :TETR:LIM:STAT?

:TETRa:LIMits:WBANd:XXXx

Parameters: <NRf>
                      <dBx>

Valid values: (dBm or dBc)

Description: Sets limits for wideband noise tests. Absolute limits are dBm, relative limits are
dBc. XXXx specifies limit type − see Tables 4-8, 4-9 and 4-10.

Example: :TETR:LIM:WBAN:XXXx 10

:TETRa:LIMits:WBANd:XXXx?

Parameters: None.

Response: <NRf>

Returned values: Noise limit (dBm/dBc).

Description: Returns limits for wideband noise tests. Absolute limits are dBm, relative limits are
dBc. XXXx specifies limit type − see Tables 4-8, 4-9 and 4-10.

Example: :TETR:LIM:WBAN:XXXx?

:TETRa:LINearization:DISPlay

Parameters: <CPD>
                  <disp>
                  displayed channel profile.

Valid values: NUMeric | PROFile | PP25 | PM25

Description: Changes the displayed channel profile but leaves the marker at the same time position, so that wanted and unwanted emissions can be compared.

NUMeric	Display numeric results only
PROFile	Display on-channel power-vs-time profile
PP25	Display +25 kHz channel power vs time
PM25	Display −25 kHz channel power vs time.

Example: `:TETR:LIN:DISP NUM`

:TETRa:LINearization:DISPlay?

Parameters: None.

Response: <CRD>

Returned values: NUM | PROF | PP25 | PM25

Description: Returns the currently-selected display.

Example: `:TETR:LIN:DISP?`

:TETRa:LINearization:DISPlay:TOP

Synonym for :TETR:DISP:TOP

Parameters: <NRf>

Valid values: (dBc)

Description: Sets the displayed top-of-screen level for the linearization-burst spectrum display.

Example: `:TETR:LIN:DISP:TOP 10`

:TETRa:LINearization:DISPlay:TOP?

Synonym for :TETR:DISP:TOP?

Parameters: None.

Response: <NR2>

Returned values: Top-of-screen value (dBc).

Description: Returns the displayed top-of-screen level for the linearization-burst spectrum display.

Example: `:TETR:LIN:DISP:TOP?`

:TETRa:LINearization:DISPlay:VRES

Synonym for :TETR:DISP:VRES

Parameters: <NRf>

Valid values: (dB)

Description: Sets the vertical resolution for the linearization-burst spectrum display.

Example: :TETR:LIN:DISP:VRES 10

:TETRa:LINearization:DISPlay:VRES?

Synonym for :TETR:DISP:VRES?

Parameters: None.

Response: <NR2> (dB)

Returned values: Vertical resolution setting.

Description: Returns the current setting of vertical resolution for the linearization-burst spectrum display.

Example: :TETR:LIN:DISP:VRES?

:TETRa:LINearization:MARKer:POWer?

Parameters: None.

Response: <NR2>

Returned values: Power (dBc)

Description: Returns the power at marker 1 with respect to the on-channel burst average power.

Example: :TETR:LIN:MARK:POW?

:TETRa:LINearization:MARKer:TIME

Parameters: <NRf>
              <time>

Valid values: (μs)

Description: Turns on the marker display and sets marker 1 at the specified time with respect to the start of the on-channel burst.

Example: :TETR:LIN:MARK:TIME 50

:TETRa:LINearization:MARKer:TOPK

Parameters: None.

Valid values: None.

Description: Turns on the marker display and sets marker 1 to the peak of the currently displayed profile.

Example: `:TETR:LIN:MARK:TOPK`

:TETRa:LINearization:MARKer:TOPK?

Parameters: None.

Response: <NR1>

Returned values: Time (µs).

Description: Turns on the marker display and sets marker 1 to the peak of the currently displayed profile. Returns the time at marker 1 with respect to the start of the on-channel burst.

Example: `:TETR:LIN:MARK:TOPK?`

:TETRa:LINearization:TRIGger

Parameters: <NRf>

Valid values: (dBm)

Description: Sets trigger level at which the linearization burst capture commences.

Example: `:TETR:LIN:TRIG –60`

:TETRa:LINearization:TRIGger?

Parameters: None.

Response: <NR2>

Returned values: Trigger level.

Description: Returns the trigger level at which the linearization burst commences.

Example: `:TETR:LIN:TRIG?`

:TETRa:MEASurement

Parameters: <CPD>
Specific TETRA measurements.

Valid values: ACPM | ACPS | IMOD | LIN | MOD | NSP | PPRO | SPUR | WBAN

Description: Sets the TETRA measurement. Note that a MEAS? query will also set this function according to the second element of the query header. If the instrument is not in TETRA measurement mode, the specified measurement type will be entered when next switching to TETRA.

    ACPM   Adjacent Channel Power due to Modulation
    ACPS   Adjacent Channel Power due to Switching
    IMOD   Intermodulation attenuation
    LIN   Linearization
    MOD   Modulation
    NSP   Non-active Slot Power
    PPRO   Power Profile
    SPUR   Spurious noise
    WBAN Wideband noise

Example: `:TETR:MEAS PPRO`

Sets TETRA measurement to power profile.

:TETRa:MEASurement?

Parameters: None.

Response: <CRD>

Returned values: ACPM | ACPS | IMOD | LIN | MOD | NSP | PPRO | SPUR | WBAN

Description: Reads current TETRA measurement. If the instrument is not in TETRA measurement mode, it returns the type of measurement type that was in use when last in TETRA mode and which will be entered when next switching to TETRA.

Example: `:TETR:MEAS?`

:TETRa:MODulation:DISPlay

Parameters: <CPD>
TETRA modulation display formats.

Valid values: APVT | CLUS | CONS | DDBI | DDSY | IQVT | NUM | VECT | VEVT

Description: Sets the display format to be used when TETRA modulation measurements are being performed.

APVT   Amplitude and Phase Vs Time
CLUS   CLUSter – Rotated vector diagram
CONS   CONStellation diagram
DDBI   Demodulated Data BIts
DDSY   Demodulated Data SYmbols
IQVT   I & Q amplitudes Vs Time
NUM   NUMeric only
VECT   VECTor diagram
VEVT   Vector Error Vs Time

Example: :TETR:MOD:DISP VECT

Sets TETRA modulation display to vector diagram.

:TETRa:MODulation:DISPlay?

Parameters: None.

Response: <CRD>

Returned values: APVT | CLUS | CONS | DDBI | DDSY | IQVT | NUM | VECT | VEVT

Description: Reads current TETRA modulation measurement display format.

Example: :TETR:MOD:DISP?

:TETRa:MODulation:MARK:AMPlitude

Parameters: None.

Valid values:

Description: Moves marker 1 to the symbol with peak amplitude error.

Example: :TETR:MOD:MARK:AMP

:TETRa:MODulation:MARK:AMPlitude?

Parameters: None.

Response: <NR1>

Returned values: <sym_no>

Description: Returns the symbol number of marker 1.

Example: :TETR:MOD:MARK:AMP?

:TETRa:MODulation:MARK:PHASe

Parameters: None.

Valid values:

Description: Moves marker 1 to the symbol with peak phase error.

Example: `:TETR:MOD:MARK:PHAS`

:TETRa:MODulation:MARK: PHASe?

Parameters: None.

Response: <NR1>

Returned values: <sym_no>

Description: Returns the symbol number of marker 1.

Example: `:TETR:MOD:MARK:AMP?`

:TETRa:MODulation:MARK:SYMbol

Parameters: <NRf>
<sym_no>

Valid values: 0 to 299

Description: Moves marker 1 to the specified symbol.

Example: `:TETR:MOD:MARK:SYM 120`

:TETRa:MODulation:MARK: SYMbol?

Parameters: None.

Response: <NR1>

Returned values: <sym_no>

Description: Returns the symbol number of marker 1.

Example: `:TETR:MOD:MARK:SYM?`

:TETRa:MODulation:MARK:VECTor

Parameters: None.

Valid values:

Description: Moves marker 1 to the symbol with peak vector error.

Example: :TETR:MOD:MARK:VECT

:TETRa:MODulation:MARK: VECTor?

Parameters: None.

Response: <NR1>

Returned values: <sym_no>

Description: Returns the symbol number of marker 1.

Example: :TETR:MOD:MARK:VECT?

:TETRa:NSPower:DISPlay

Parameters: <CPD>
<disp> Displayed channel profile.

Valid values: NUMeric | PROFile

Description: Sets the display type to be used for non-active slot power measurement.

NUMeric   Display numeric results only
PROFile   Display on-channel power-vs-time profile.

Example: :TETR:NSP:DISP NUM

:TETRa:NSPower:DISPlay?

Parameters: None.

Response: <CRD>

Returned values: NUM | PROF

Description: Returns the currently-selected display for non-active slot power.

Example: :TETR:NSP:DISP?

:TETRa:NSPower:DISPlay:TOP

Synonym for :TETR:DISP:TOP

Parameters: <NRf_os>

Valid values: (dBc)

Description: Sets the displayed top-of-screen level for the non-active slot power-profile display. Does not alter the settings of the hardware determined from the <input level> (POW:REF). Used in conjunction with <vertical resolution> (TETR:NSP:DISP:VRES), allows expansion of part of the measurement range.

Example: `:TETR:NSP:DISP:TOP 10dBc`

:TETRa:NSPower:DISPlay:TOP?

Synonym for :TETR:DISP:TOP?

Parameters: None.

Response: <NR2>

Returned values: Top-of-screen value (dBc).

Description: Returns the top-of-screen level for the non-active slot power-profile display.

Example: `:TETR:NSP:DISP:TOP?`

:TETRa:NSPower:DISPlay:VRESolution

Synonym for :TETR:DISP:VRES

Parameters: <NRf_os>
Vertical resolution of non-active slot power-profile display.

Valid values: 0.01 dB/div to 50 dB/div.
(dB)

Description: Sets the vertical resolution (in dB/div) of the non-active slot power-profile display. Does not affect hardware settings.

Example: `:TETR:NSP:DISP:VRES 0.1`

Sets vertical resolution to 0.1 dB/div.

:TETRa:NSPower:DISPlay:VRESolution?

Synonym for :TETR:DISP:VRES?

Parameters: None.

Response: <NR2>

Returned values: Vertical resolution in dB/div.

Description: Returns the vertical resolution of the non-active slot power profile display.

Example: `:TETR:NSP:DISP:VRES?`

`0.1`

:TETRa:NSPower:SLOT

Parameters: <NRf>
              <code>

Valid values: 1 to 7

Description: Selects which slots are displayed in the non-active slot power-profile display. See Table 4-13.

Example: :TETR:NSP:SLOT 3

:TETRa:NSPower:SLOT?

Parameters: None.

Response: <NR1>

Returned values: 1 to 7

Description: Returns the code for slots displayed in the non-active slot power-profile display. See Table 4-13.

Example: :TETR:NSP:SLOT?

              3

:TETRa:PPROfile:DISPlay

Parameters: <CPD>
                                               TETRA power-profile display formats.

Valid values: NUM | T123 | T13

Description: Sets the display format to be used when TETRA power-profile measurements are being performed.

                                      NUM   NUMeric only
                                      T123   Whole slot t1 & t2 & t3 displayed graphically
                                      T13   Ramp-up (t1) & ramp-down (t3) periods displayed graphically

Example: `:TETR:PPR:DISP NUM`

Sets TETRA power-profile display to numeric-only.

:TETRa:PPROfile:DISPlay?

Parameters: None.

Response: <CRD>

Returned values: NUM | T123 | T13

Description: Reads current TETRA power-profile display format.

Example: `:TETR:PPRO:DISP?`

:TETRa:PPROfile:DISPlay:TOP

Synonym for :TETR:DISP:TOP

Parameters: <NRf_os>

Valid values: <noise floor> to <maximum input> (dBc)

Description: Sets the displayed top-of-screen level of the power profile display. Does not alter the settings of the hardware determined from the <input level> (POW:REF). Used in conjunction with <vertical resolution> (TETR:DISP:VRES), allows expansion of part of the measurement range.

Example: :TETR:PPRO:DISP:TOP 23dBm

Sets top of screen to 23 dBm.

:TETRa:PPROfile:DISPlay:TOP?

Synonym for :TETR:DISP:TOP?

Parameters: None.

Response: <NR2>

Returned values: Top-of screen value (dBc).

Description: Returns the displayed top-of screen level of the power profile display.

Example: :TETR:PPRO:DISP:TOP?

:TETRa:PPROfile:DISPlay:VRESolution

Synonym for :TETR:DISP:VRES

Parameters: <NRf_os>
Vertical resolution of TETRA analyzer display

Valid values: 0.01 dB/div to 50 dB/div.
(dB)

Description: Sets the vertical resolution (in dB/div) of the power profile display. Does not affect hardware settings.

Example: `:TETR:PPRO:DISP:VRES 0.1`

Sets vertical resolution to 0.1 dB/div.

:TETRa:PPROfile:DISPlay:VRESolution?

Synonym for :TETR:DISP:VRES?

Parameters: None.

Response: <NR2>

Returned values: Vertical resolution in dB/div.

Description: Reads the vertical resolution of the power profile display.

Example: `:TETR:PPRO:DISP:VRES?`

`0.1`

:TETRa:PPROfile:MARKer:TOPK?

Parameters: None.

Response: <NR1>

Returned values: <sym_no>

Description: Moves the marker to the symbol with the peak power of the current power-profile trace (in preparation for reading the level at the marker).

Example: `:TETR:PPRO:MARK:TOPK? 32`
`:FETC:PPRO:POW? 32 0.2`

:TETRa:SPURious:ABORt

Parameters: None.

Valid values:

Description: This command aborts a discrete spurious noise measurement which is in progress following an INIT:IMMediate command or [SINGLE] key-press. It would normally be used if the signal is lost during an attempted discrete spurious noise measurement.

Notes:
This command will not abort the measurement if the discrete spurious noise measurement was started with a MEASure:SPURious:xxxx? or READ:SPURious:xxxx? command.

The alternative command ABORt will abort wideband noise, discrete spurious, auto pre-scan, diagnostic calibration/trace or intermodulation measurements if they are running.

Example: `:TETR:SPUR:ABORt`

:TETRa:SPURious:DISPlay

Parameters: <CPD>
Displayed channel profile.

Valid values: NUMeric | SPECtrum

Description: Changes the display type to be used for discrete spurious noise measurement.

NUMeric   Display numeric results only
SPECtrum Display spectrum.

Example: `:TETR:SPUR:DISP SPEC`

:TETRa:SPURious:DISPlay?

Parameters: None.

Response: <CRD>

Returned values: NUM | SPEC

Description: Returns the current selected display.

Example: `:TETR:SPUR:DISP?`

:TETRa:SPURious:DISPlay:POINt

Parameters: \<NRf\>
                         \<point no\>

Valid values: 1 to 20

Description: Selects the specified point. The point is highlighted on the numeric display and forms the center frequency on the spectrum display.

Example: :TETR:SPUR:POIN 11

:TETRa:SPURious:DISPlay:POINt?

Parameters: None.

Response: \<NR1\>

Returned values: 1 to 20

Description: Returns the currently selected point.

Example: :TETR:SPUR:POIN?

:TETRa:SPURious:DISPlay:TOP

Synonym for :TETR:DISP:TOP

Parameters: \<NRf_os\>

Valid values: (dBc)

Description: Sets the displayed top-of-screen level for the discrete spurious noise spectrum display. CONF:SPUR sets −20 dBc.

Example: :TETR:SPUR:DISP:TOP 10

:TETRa:SPURious:DISPlay:TOP?

Synonym for :TETR:DISP:TOP?

Parameters: None.

Response: \<NR2\> (dBc)

Returned values: Top-of-screen value.

Description: Returns the displayed top-of-screen level for the discrete spurious noise spectrum display.

Example: :TETR:SPUR:DISP:TOP?

:TETRa:SPURious:DISPlay:VRESolution

Synonym for :TETR:DISP:VRES

Parameters: <NRf>
    <dB/div>

Valid values: (dB)

Description: Sets the vertical resolution for the discrete spurious noise spectrum display.
    CONF:SPUR sets 10 dB.

Example: `:TETR:SPUR:DISP:VRES 10`

:TETRa:SPURious:DISPlay:VRES?

Synonym for :TETR:DISP:VRES?

Parameters: None.

Response: <NR2> (dB)

Returned values: Vertical resolution setting.

Description: Returns the current setting of vertical resolution for the discrete spurious noise
    spectrum display.

Example: `:TETR:SPUR:DISP:VRES?`

:TETRa:SPURious:EDIT:FREQuency?

Parameters: <NRf>
    <point no>

Response: <NR2>

Returned values: Frequency (Hz)

Description: Returns the frequency of the specified point. <point no> defaults to the current
    point.

Example: `:TETR:SPUR:EDIT:FREQ?`

:TETRa:SPURious:EDIT:INSert

Parameters: <NRf>
                   <freq>

Valid values: 100 kHz to 10 MHz, positive and negative values.

Description: Defines a spurious frequency (which must be at least ±100 kHz from the current channel frequency) and adds it to the table (if the table is not full). The specified frequency is automatically inserted at the correct position in the array of points.

Example: :TETR:SPUR:EDIT:INS −26.25E+4

:TETRa:SPURious:EDIT:POINts?

Parameters: None.

Response: <NR1>

Returned values: 1 to 20

Description: Returns the number of points currently defined in the discrete spurious noise measurement.

Example: :TETR:SPUR:EDIT:POIN?

:TETRa:SPURious:EDIT:REMove

Parameters: <NRf>
                   <point no>

Valid values: 1 to 20

Description: Removes the specified point from the table of discrete spurious noise frequencies: point numbers above this move down by one. The last remaining point cannot be removed.

Example: :TETR:SPUR:EDIT:REMove 11

:TETRa:WBANd:ABORt

Parameters: None.

Valid values:

Description: This command aborts a wideband noise measurement which is in progress following an INIT:IMMediate command or [SINGLE] key-press. It would normally be used if the signal is lost during an attempted wideband noise measurement.

Notes:
This command will not abort the measurement if the wideband noise measurement was started with a MEASure:WBANd:xxxx? or READ:WBANd:xxxx? command.

The alternative command ABORt will abort wideband noise, discrete spurious, auto pre-scan, diagnostic calibration/trace or intermodulation measurements if they are running.

Example: `:TETR:WBAN:ABORt`

:TETRa:WBANd:DISPlay

Parameters: <CPD>
Displayed channel profile.

Valid values: NUMeric | SPECtrum

Description: Changes the display type to be used for wideband noise measurement.

NUMeric   Display numeric results only
SPECtrum   Display spectrum.

Example: `:TETR:WBAN:DISP SPEC`

:TETRa:WBANd:DISPlay?

Parameters: None.

Response: <CRD>

Returned values: NUM | SPEC

Description: Returns the currently-selected display.

Example: `:TETR:WBAN:DISP?`

:TETRa:WBANd:DISPlay:POINt

Parameters:	<NRf>
	<point no>
Valid values:	1 to 20
Description:	Selects the specified point. The point is highlighted on the numeric display and forms the center frequency on the spectrum display.
Example:	:TETR:WBAN:POIN 11

:TETRa:WBANd:DISPlay:POINt?

Parameters:	None.
Response:	<NR1>
Returned values:	1 to 20
Description:	Returns the currently selected point.
Example:	:TETR:WBAN:POIN?

:TETRa:WBANd:DISPlay:TOP

Synonym for :TETR:DISP:TOP

Parameters:	<NRf>
Valid values:	(dBc)
Description:	Sets the displayed top-of-screen level for the wideband-noise spectrum display.
Example:	:TETR:WBAN:DISP:TOP 10

:TETRa:WBANd:DISPlay:TOP?

Synonym for :TETR:DISP:TOP?

Parameters:	None.
Response:	<NR2>
Returned values:	Top-of-screen value (dBc).
Description:	Returns the displayed top-of-screen level for the wideband-noise spectrum display.
Example:	:TETR:WBAN:DISP:TOP?

:TETRa:WBANd:DISPlay:VRESolution

Synonym for :TETR:DISP:VRES

Parameters: <NRf>
                                                         <dB/div>

Valid values: (dB)

Description: Sets the vertical resolution for the wideband-noise spectrum display.

Example: `:TETR:WBAN:DISP:VRES 10`

:TETRa:WBANd:DISPlay:VRESolution?

Synonym for :TETR:DISP:VRES?

Parameters: None.

Response: <NR2> (dB)

Returned values: Vertical resolution setting.

Description: Returns the current setting of vertical resolution for the wideband-noise spectrum display.

Example: `:TETR:WBAN:DISP:VRES?`

:TETRa:WBANd:EDIT:INSert

Parameters: <NRf>
                                                       <Freq>

Valid values: 100 kHz to 10 MHz, positive and negative values.

Description: Defines a frequency offset relative to the channel center and adds it to the table (if the table is not full). The specified offset frequency, in Hz, is rounded to a multiple of 12.5 kHz and is automatically inserted at the correct position in the array of points.

Example: `:TETR:WBAN:EDIT:INS −26.25E+4`

:TETRa:WBANd:EDIT:OFFSet?

Parameters: <NRf>
                                                <point no>

Response: <NR2>

Returned values: Offset frequency (Hz).

Description: Returns the offset frequency of the specified point.

Example: `:TETR:WBAN:EDIT:OFFS?`

:TETRa:WBANd:EDIT:POINts?

Parameters: None.

Response: <NR1>

Returned values: 1 to 20.

Description: Returns the number of points currently defined in the wideband noise measurement.

Example: `:TETR:WBAN:EDIT:POIN?`

:TETRa:WBANd:EDIT:REMove

Parameters: <NRf>
                                                 <point no>

Valid values: 1 to 20.

Description: Removes the specified point from the table of offset frequencies: point numbers above this move down by one. The last remaining point cannot be removed.

Example: `:TETR:WBAN:EDIT:REMove 11`

Examples of using the MEASure, CONFigure, READ and FETCh concept

The examples below make an equivalent measurement of modulation accuracy − RMS Vector Error, Peak Vector Error, Residual Carrier Magnitude and Frequency Error − for a TETRA mobile transmitting a Normal Uplink Burst (with a training sequence, TS1) at a nominal channel frequency of 380 MHz and a power level of 32 dBm.

Using MEASure and FETCh

```
:MEAS:MOD:MVER? 380MHZ, 32DBM, NUB1;:FETC:MOD:PVER?;CLEA?;FERR?
```

The response would be of the format `0.09,0.22,1.02,43.4`

As previously stated, MEASure queries provide a simple method of taking measurements. They are easy to use and will always return a result if the applied signal corresponds to the specified parameters. Used on their own, MEASure queries are not an efficient way of performing a series of different measurements as each MEASure query initiates the capture of new data.

The MEASure queries have been provided with optional parameters which describe the essential characteristics of the TETRA signal to be measured. The user may prefer to use the normal commands to set up measurement conditions and to use MEASure query without parameters.

for example, the command sequence

```
:FREQ:REF 380MHZ
:POW:REF 32DBM
:TETR:BURS NUB1
:MEAS:MOD:PVER?
```

performs the same operation as

```
:MEAS:MOD:PVER? 380MHZ,32DBM,NUB1
```

There are cases when the parameters are not required. If a subsequent measurement is made on the same signal it is not necessary to re-state the parameters.

for example:
```
:MEAS:MOD:PVER? 380MHZ,32DBM,NUB1
:MEAS:PPRO:FAIL?
```

The second measurement (Power Profile) is performed on the signal described by the parameters of the initial modulation accuracy measurement.

The MEASure query also sets some of the instrument settings to pre-determined values. These are intended to perform either essential or sensible defaults. The setting can be accomplished without taking a measurement by using the CONFigure commands, which take the same optional parameters as the MEASure queries.

Using CONFigure plus READ and FETCh

```
:CONF:MOD 380MHZ,32DBM,NUB1
:READ:MOD:MVER?:FETCH:MOD:PVER?;CLEA?;FERR?

0.09,0.22,1.02,43.54
```

Sometimes the settings changed by the CONFigure command may not be appropriate. The general approach would be to use normal commands to set up the instrument as required and then to use READ and/or FETCh to perform the measurements. If the difference from the default setting is minor then a useful technique would be to first CONFigure the instrument for the measurement, then change the unwanted setting using the appropriate command, and finally to use READ to make the measurement and return the result.

for example:
```
:CONF:MOD 380MHZ,32DBM,NUB1
:POW:INP LOW
:READ:MOD:PVER?
```

This is equivalent to performing a MEASure query. However, the low-power input is used instead of the default high power.

Using CONFigure and FETCh

```
:CONF:MOD 380MHZ,32DBM,NUB1
:INIT:IMM
:FETC:MOD:MVER?;PVER?;CLEA?;FERR?
```

```
0.09,0.22,1.02,43.54
```

Using commands plus READ and FETCh

```
:INST:SEL TETRA
:INIT:CONT:OFF
:TETR:MEAS MOD
:FREQ:REF:380MHZ
:POW:INP HIGH;REF 32DBM
```

```
0.09,0.22,1.02,43.54
```

Using commands and FETCh

```
:INST:SEL TETRA
:INIT:CONT:OFF
:TETR:MEAS MOD
:FREQ:REF:380MHZ
:POW:INP HIGH;REF 32DBM
:INIT:IMM
:FETC:MOD:MVER?;:FETC:MOD:PVER?;CLEA?;FERR?
```

```
0.09,0.22,1.02,43.54
```

MEASure vs READ vs FETCh

In the previous group of examples the selection of MEASure, READ or FETCh is largely a matter of choice. However, there are circumstances when the use of the correct query is essential. For example, in order to read back a number of level points of a particular power profile, the FETCh query must be used − after the initial profile measurement has been made − in order for further data from the same profile to be retrieved.

for example:
```
:MEAS:PPRO:POW? 10
:FETC:PPRO:POW? 11;POW? 12;POW? 13:POW? 14;POW? 15
```

Six adjacent points of the same power profile are read back. The use of READ or MEASure would not produce the intended result since new power-profile data would be captured for each query.

By contrast, in order to monitor the time variation of a particular quantity, READ should be used. MEASure would work but it is not required since the instrument configuration remains the same. FETCh is not suitable for this application as no new capture process would be performed and as a consequence, the same result would be returned.

for example:
```
:MEAS:MOD:MVER?
:READ:MOD:MVER?
:READ:MOD:MVER?
```

etc...

The above sequence of queries would measure the RMS vector error and subsequently perform new readings to monitor its variation with time.

Remote operation tables

GPIB abbreviations and codes

Abbreviations and codes used in this chapter are summarized in this table.

Table 4-2 GPIB abbreviations and codes

Abbreviation	Full	Standard format
bin	16-bit binary, as 2 bytes MS byte first	
bin8	8-bit binary, single return byte	
16-bit	an integer returning the sum of several binary weighted Boolean flags	`<NR1>`
bool	Boolean, accepts [0|1], or [ON|OFF] – returns [0|1]	`[0|1]`
burst	<burst-type>	`<CPD>`
chan_no	adjacent channel	`[−1|1] = −25kHz | +25kHz`
CPD	character program data – a mnemonic used as a command parameter: for example, <burst-type>	`[<string>|<string>|...]`
CRD	character response data – as CPD but returned from the instrument.	`<string>`
dBc	Decibel with respect to carrier (Average Tx Power)	
dBm	Decibel with respect to 1 mW reference	
deg	degrees of phase angle	
fail_no	failing burst 1 = most recent. Max 20 saved.	
fls	[<frequency(Hz)>[,<level(dB)>[,<span(Hz)>]]]	`<NRf>[,<NRf>[,<NRf>]]`
flb	[<frequency(Hz)>[,<level(dB)>[,<burst-type>]]]	`<NRf>[,<NRf>[,<CPD>]]`
h,m	<hour(24)>,<minute>	`<NR1>,<NR1>`
hh-mm	time: for example, '14–35'	`<string>`
mBc	'milliBels' that is, 0.01 dBc – see dBc. Unconventional, but used for binary trace data	
mBm	'milliBels' that is, 0.01 dBm – see dBm. Unconventional, but used for binary trace data	
nnn	integer, number of data items	
nnn_bin8	nnn binary 8-bit data bytes	`<header><byte1><byte2>...`
nnn_bin	nnn binary 16-bit data words. Each word as 2 bytes, sent MS byte first	`<header><MSB1><LSB1><MSB2><LSB2>...`
nnn_NR1	nnn integer symbol values [0|1|2|3] in ASCII, comma separated	`<NR1−1>,<NR1−2>,...`
nnn_NR2	nnn floating point values in ASCII, comma separated	`<NR2−1>,<NR2−2>,...`
nflb	<number>[,frequency>[,<level>[,<burst-type>]]]	`<NRf>[,<NRf>[,<NRf>[,<CPD>]]]`
NRf/_fs/_os	decimal integer or floating point, no suffix/with freq multiplier suffix/with optional suffix	`<NR1>|<NR2>/[<units_string>]`
NR1	decimal integer	`<NR1>`
NR2/_os	decimal floating point, no units suffix/with optional units suffix	`<NR2>/[units_string]`
n_sym	nth symbol – for example, FETC:ACP:SWIT:PEAK? –6 returns 6th highest peak power in –25 kHz channel	
op_nflb	[<number>[,frequency>[,<level>[,<burst-type>]]]]	`[<NRf>[,<NRf>[,<NRf>[,<CPD>]]]]`
op_NR1	[<integer>] (that is, optional integer parameter)	`[<NR1>]`
op_nbst	[<number>[,<burst-type>]]<number> is <sym_no> or <fail_no>	`[<NR1>[,<CPD>]]`
ppm	parts per million	
nbst	<number>[,<burst-type>] <number> is <sym_no> or <fail_no>	`<NR1>[,<CPD>]`
sd	standard deviation	
slot_no	time multiplex slot number	`[−3|−2|−1|1|2|3]  (−3 = +1)`
sym	symbol value	`[0|1|2|3]`
sym_no	Symbol number – legal range depends on command & burst_type	`(−22, +300)`
y,m,d	<year>,<month>,<day>	`<NR1>,<NR1>,<NR1>`
yyyy−mm−dd	ISO format date string: for example, '1999–12–16'	`<string>`

FAIL? command return bits

The return bits resulting from the FAIL? command query for the FETCh, MEASure and READ subsystems are shown in Table 4-3.

Table 4-3 FAIL? command return bits

Return bit		Command					
Bit	dec	F/M/R:ACP :MOD:FAIL?	F/M/R:ACP :SWIT:FAIL?	F/M/R :MOD:FAIL?	F/M/R:\NSP :FAIL?	F/M/R:PPRO :FAIL?	F/M/R:LIN :FAIL?
15	32768	0	0	0	0	0	0
14	16384	Av. Tx power	Av. Tx power	Av. Tx power fail	Av. Tx power	Av. Tx power	Av. Tx power
13	8192	No tr. seq. found	No tr. seq. found	No tr. seq. found	No tr. seq. found	No tr. seq. found	No tr. seq. found
12	4096	No carrier found	No carrier found	No carrier found	No carrier found	No carrier found	No carrier found
11	2048	No ramp found	No ramp found	No ramp found	No ramp found	No ramp found	No ramp found
10	1024	Input overload	Input overload	Input overload	Input overload	Input overload	Input overload
9	512	Data not valid	Data not valid	Data not valid	Data not valid	Data not valid	Data not valid
8	256						No burst found
7	128			Peak phase error			
6	64			RMS phase error			
5	32	−75 kHz channel		Peak ampl. error			
4	16	−50 kHz channel		RMS ampl. error			
3	8	−25 kHz channel		Frequency error			
2	4	+25 kHz channel		Residual carrier magnification	+1(−3) slot		
1	2	+50 kHz channel	−25 kHz channel	Peak vector error	+2(−2) slot	Ramp up	−25 kHz channel
0	1	+75 kHz channel	+25 kHz channel	RMS vector error	+3(−1) slot	Ramp down	+25 kHz channel

Return bit		Command				
Bit	dec	F/M/R:WBAN :FAIL?	F/M/R:SPUR :FAIL?	F/M/R:MOD :BURS:FAIL?	F/M/R:IMOD :FAIL?	F/M/R:\SPEC :FAIL?
15	32768	0	0	0	0	0
14	16384	Av. Tx power			Av. Tx power	
13	8192	No tr. seq. found			No tr. seq. found	
12	4096	No carrier found	No carrier found			
11	2048	No ramp found	No ramp found			
10	1024	Input overload	Input overload		Input overload	Input overload
9	512	Data not valid	Data not valid		Data not valid	Data not valid
8	256	No burst found	No burst found		No burst found	
7	128					
6	64					
5	32				6 4T3−3F1	
4	16				5 4F1−3T3	
3	8			Frequency error	4 3T3−2F1	
2	4			Residual carrier magnification	3 3F1−2T3	
1	2			Peak vector error	2 2T3−F1	
0	1	Failed	Failed	RMS vector error	1 2F1−T3	

Return bit value 0 = limits passed.
For failures the integer sum is returned.

Common commands

The common commands taken from the IEEE 488.2 standard are described in Table 4-4.

Table 4-4 Common commands

Command	Description	Parameter	Comments
*CLS	Clear status		no query
*ESE	Event status enable	0–255	
*ESR?	Standard event status query	0–255	query only
*IDN?	Identification query	<string>	query only
*OPC	Operation complete		
*OPT?	Option identification query		query only
*RST	Reset		no query
*SRE	Service request enable	0–255	
*STB?	Status byte query		query only
*TST?	Self test query		query only
*WAI	Wait to continue		no query

Table 4-5 BINary graphical output commands

FETC/READ/MEAS	Returned data	at points	start from	Units	Binary header
:ACP :MOD :TRAC:BIN?	501 Y-values	x-pixel	left	mB	#3501
:CLUS:TRAC:BIN?	256 IQ pairs	symbol	sym 0	pixels	#3512
:CONS:TRAC:BIN?	256 IQ pairs	symbol	sym 0	pixels	#3512
:MOD :TRAC:BIN?	255 symbols	symbol		symbols[0|1|2|3]	#3255
:PPRO:TRAC:BIN?	299 Y-values	symbol		mB	#3299
:SPEC:TRAC:BIN?	501 Y-values	x-pixel	left	mB	#3501
:VECT:TRAC:BIN?	1786 IQ pairs	sample	sym 0	pixels	#43572

Notes

Pixel output commands
`FETC/READ/MEAS:CLUS:TRAC:BIN?`
Rotated vector (cluster) diagram
Ideal symbol point is 0,0. Radius of displayed tolerance ring is 117 pixels.
Tolerance ring is set in TETRA limits function as Peak Vector Error (`TETR:LIM:MOD:PVER`).
The scope of the data is message symbols so that symbol 1 is the first leading tail symbol.
The first point sent is symbol 0 as reference point.
The number of relevant symbols depends on the current burst-type.
The real data ends with the last end tail symbol. That value is then used to pad the returned data set to the full length, 256 symbols (0 to 255).

`FETC/READ/MEAS:CONS:TRAC:BIN?`
Constellation diagram
Centre of diagram is 0,0. Radius to ideal symbol points is 117.
Nominal symbol points are (clockwise from 9 o'clock): −117,0; −83,83; 0, 117; 83,83; 117,0; 83,−83; 0,−117; −83,−83.
The scope of the data is message symbols so that symbol 1 is the first leading tail symbol.
The first point sent is symbol 0 as reference point. This is plotted arbitrarily at any of the eight possible symbol points.
The number of relevant symbols depends on the current burst-type.
The real data ends with the last end tail symbol. That value is then used to pad the returned data set to the full length, 256 symbols (0 to 255).

`FETC/READ/MEAS:VECT:TRAC:BIN?`
Vector diagram
Centre of diagram is 0,0. Radius to ideal symbol points is 117.
Nominal symbol points are (clockwise from 9 o'clock): −117,0; −83,83; 0, 117; 83,83; 117,0; 83,−83; 0,−117; −83,−83.
7 sample points for each symbol.   sample 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16...........1786
                                     symbol 0   1   2 255
The scope of the data is message symbols so that symbol 1 is the first leading tail symbol.
The first point sent is sample 0, symbol 0 as reference point. This is plotted arbitrarily at any of the eight possible symbol points.
The number of relevant symbols depends on the current burst-type.
The real data ends with the last end tail symbol. That value is then used to pad the returned data set to the full length, 1786 sample I,Q pairs.

Table 4-6 Burst types for use as sbst parameter

Mnemonic	Burst type	up/down link	cont/discont	Training sequence	sym_no range :MOD:DATA?	sym_no range :PPRO:POW?	burst_length excl. sym_no 0
NUB1	normal	uplink (ms tx)		TS1	−16, 238	−21,277	231
NUB2	normal	uplink		TS2	−16, 238	−21,277	231
CB	control	uplink			−16, 238	−21,277	103
PRUD	pseudo-random	uplink	discont		−16, 238	−21,277	231
NDB1C	normal	downlink (bs tx)	cont	TS1	1, 255	−12,286	255
NDB1D	normal	downlink	discont	TS1	−4, 250	−12,286	246
NDB2C	normal	downlink	cont	TS2	1, 255	−12,286	255
NDB2D	normal	downlink	discont	TS2	−4, 250	−12,286	246
SBC	synchronization	downlink	cont		1, 255	−12,286	255
SBD	synchronization	downlink	discont		−4, 250	−12,286	246
PRDC	pseudo-random	downlink	cont		1, 255	−5,293	255
PRDD	pseudo-random	downlink	discont		−4, 250	−12.286	246
DNB1	normal	direct mode		TS1	−16, 238	−21,277	235
DNB2	normal	direct mode		TS2	−16, 238	−21,277	235
DSB	synchronization	direct mode			−16, 238	−21,277	235
PRDMD	pseudo-random	direct mode	discont		−16, 238	−21,277	235

Notes

sym_no range for `MEAS/READ/FETC:MOD:DATA?` is also range returned by `...:MOD:TRAC:ASC/BIN?` −255 values

sym_no range for `MEAS/READ/FETC:PPRO:POW?` is also range returned by `...:PPRO:TRAC:ASC/BIN?` −299 values

Table 4-7 `TETR:ACP:MOD:CHAN?` **command decode**

Return value	Nominal chan	±25 kHz	±50 kHz	±75 kHz	Nominal span (kHz)
0	X				25
1	X	X			75
2	X		X		125
3	X	X	X		125
4	X			X	175
5	X	X		X	175
6	X		X	X	175
7	X	X	X	X	175

Note

`FETC/READ/MEAS:XXX:TRAC:BIN? returns nnn_bin or nnn_bin8.`
Format of nnn_bin and nnn_bin8 are 'Definite Length Arbitrary Block Response' to IEEE 488.2 para 8.7.9.
  #xyyybbbbb.......bbb
where:
is format identifier character '#'
x is <nonzero digit> ASCII digit character '1' to '9', the number of 'yyy' digits
yyy is a number formed from ASCII digits '0' to '9' representing the number of **bytes** of data, excluding the '#xyyy' header and any 'Response Message Terminator'
bbb.. are data bytes

With nnn_bin8 each data item is 8-bit data, represented as one byte (values are 0 to 4); so for 255_bin8, there are 255 bytes of data following the header '#3255'.

With nnn_bin8 each data item is 16-bit data, represented as two bytes MS byte first; so for 512_bin8, there are 1024 bytes of data following the header '#41024'.

Table 4-8 Wideband noise absolute limits

Frequency Offset	TETR:LIM:WBAN:XXXx		Maximum wideband noise Absolute level	
	MS		BS.(inc DMO)	
	XXXX	Normal	XXXX	Normal
<frb	AML	−55 dBm	ABL	−55 dBm
>frb	AMG	−70 dBm	ABG	−70 dBm

Normal test condition − no extreme test requirement, use normal limits.

Note: The average transmitter power measurement has specified limits related to mobile step level. It is proposed that the user-defined limits are used for this requirement.

frb = frequency offset corresponding to near edge of receive band or 5 MHz, whichever is greater.

Table 4-9 Wideband noise relative limits

Frequency Offset	TETR:LIM:WBAN:XXXx						Maximum wideband noise Relative level	
	MS Nom. Power ≤step level 4 (1 W)		MS Nom. Power = step level 3 (3 W)		MS Nom. Power ≥step level 2 (10 W)		BS (inc DMO)	
	XXXX	Normal	XXXX	Normal	XXXX	Normal	XXX	Normal
100 kHz−250 kHz	RM14	−75 dBc	RM13	−78 dBc	RM12	−80 dBc	RB1	−80 dBc
250 kHz−500 kHz	RM24	−80 dBc	RM23	−83 dBc	RM22	−85 dBc	RB2	−85 dBc
500 kHz − frb	RM54	−80 dBc	RM53	−85 dBc	RM52	−90 dBc	RB5	−90 dBc
>frb	RMG4	−100 dBc	RMG3	−100 dBc	RMG2	−100 dBc	RBG	−100 dBc

Normal test condition − no extreme test requirement, use normal limits.

frb = frequency offset corresponding to near edge of receive band or 5 MHz, whichever is greater.

Table 4-10 TETR:LIM:WBAN:XXXX command family

GPIB Command	DB_MAIN.H element name	Station	Application range		Normal
TETR:LIM:WBAN:RB1	WBN_LIM_BS_100_250	Base	100kHz−250kHz		−80 dBc
TETR:LIM:WBAN:RB2	WBN_LIM_BS_250_500	Base	250kHz−500kHz		−85 dBc
TETR:LIM:WBAN:RB5	WBN_LIM_BS_500_FRB	Base	500kHz−frb		−90 dBc
TETR:LIM:WBAN:RBG	WBN_LIM_BS_GT_FRB	Base	>frb		−100 dBc
TETR:LIM:WBAN:ABL	WBN_LIM_BS_ABS_LTE_FRB	Base	Absolute limit	<frb	−55 dBm
TETR:LIM:WBAN:ABG	WBN_LIM_BS_ABS_GT_FRB	Base	Absolute limit	≥frb	−70 dBm
TETR:LIM:WBAN:RM14	WBN_LIM_MS_100_250_LTE_4	Mobile	100kHz−250kHz	≤lev 4	−75 dBc
TETR:LIM:WBAN:RM13	WBN_LIM_MS_100_250_3	Mobile	100kHz−250kHz	lev 3	−78 dBc
TETR:LIM:WBAN:RM12	WBN_LIM_MS_100_250_GTE_2	Mobile	100kHz−250kHz	≤lev 2	−80 dBc
TETR:LIM:WBAN:RM24	WBN_LIM_MS_250_500_LTE_4	Mobile	250kHz−500kHz	≤lev 4	−80 dBc
TETR:LIM:WBAN:RM23	WBN_LIM_MS_250_500_3	Mobile	250kHz−500kHz	lev 3	−83 dBc
TETR:LIM:WBAN:RM22	WBN_LIM_MS_250_500_GTE_2	Mobile	250kHz−500kHz	≤lev 2	−85 dBc
TETR:LIM:WBAN:RM54	WBN_LIM_MS_500_FRB_LTE_4	Mobile	500kHz−frb	≤lev 4	−80 dBc
TETR:LIM:WBAN:RM53	WBN_LIM_MS_500_FRB_3	Mobile	500kHz−frb	lev 3	−85 dBc
TETR:LIM:WBAN:RM52	WBN_LIM_MS_500_FRB_GTE_2	Mobile	500kHz−frb	≤lev 2	−90 dBc
TETR:LIM:WBAN:RMG4	WBN_LIM_MS_GT_FRB_LTE_4	Mobile	>frb	≤lev 4	−100 dBc
TETR:LIM:WBAN:RMG3	WBN_LIM_MS_GT_FRB_3	Mobile	>frb	lev 3	−100 dBc
TETR:LIM:WBAN:RMG2	WBN_LIM_MS_GT_FRB_GTE_2	Mobile	>frb	≤lev 2	−100 dBc
TETR:LIM:WBAN:AML	WBN_LIM_MS_ABS_LTE_FRB	Mobile	Absolute limit	<frb	−55 dBm
TETR:LIM:WBAN:AMG	WBN_LIM_MS_ABS_GT_FRB	Mobile	Absolute limit	≥frb	−70 dBm

Table 4-11 Intermodulation attenuation products

Code	3rd order		5th order		7th order	
	Product 2F1−T3	Product 2T3−F1	Product 3F1−2T3	Product 3T3−2F1	Product 4F1−3T3	Product 4T3−3F1
0	−	−	−	−	−	−
1	√	√	−	−	−	−
2	−	−	√	√	−	−
3	√	√	√	√	−	−
4	−	−	−	−	√	√
5	√	√	−	−	√	√
6	−	−	√	√	√	√
7	√	√	√	√	√	√

F1 = channel frequency   T3 = channel frequency + offset

Note: Code 0 measures average transmit power (ATP) and interferer power (IPOW) only.

Table 4-12 Product no. for intermodulation product

	3rd order		5th order		7th order	
Product no.	1	2	3	4	5	6
Intermodulation product	2F1−T3	2T3−F1	3F1−2T3	3T3−2F1	4F1−3T3	4T3−3F1

Table 4-13 Code definition table for slots displayed in NSP display

Code	Active	+1(−3)	+2(−2)	+3(−1)
1	√	−	−	√
2	√	−	√	−
3	√	−	√	√
4	√	√	−	−
5	√	√	−	√
6	√	√	√	−
7	√	√	√	√

Chapter 5
BRIEF TECHNICAL DESCRIPTION

Introduction

The 2310 is a precision signal analyzer which covers the frequency range of 100 MHz to 2.4 GHz. It provides the dual operating modes of TETRA signal analyzer and FFT spectrum analyzer. A block diagram for the instrument is shown in Fig. 5-1.

Signal path

The instrument has both low power (0.5 W) and high power (40 W) inputs. The high power input can accept 50 W on a 50% duty cycle. This input also has a temperature sensor. The input circuits perform RF level control and feed to a mixer for down-conversion to an intermediate frequency (IF) of 10.7 MHz. The IF level control stages feed via an A-D converter to the digital signal processor (DSP).

Display

This is a 6.5 inch VGA TFT active matrix color LCD. An output for an external color monitor is provided from the MONITOR connector.

Control

The 2310 is a menu-driven instrument. Main menus are displayed by the use of hard keys, and parameters are changed by means of soft keys whose functions change as the menus change. Internal control of the instrument is achieved by a microprocessor which receives data from the various controls and sends instructions via an internal data bus to the signal processing circuits.

The instrument can also be controlled by the built-in General Purpose Interface Bus (GPIB). The interface enables the instrument to be used both as a manually operated bench mounted instrument and as part of a fully automated test system.
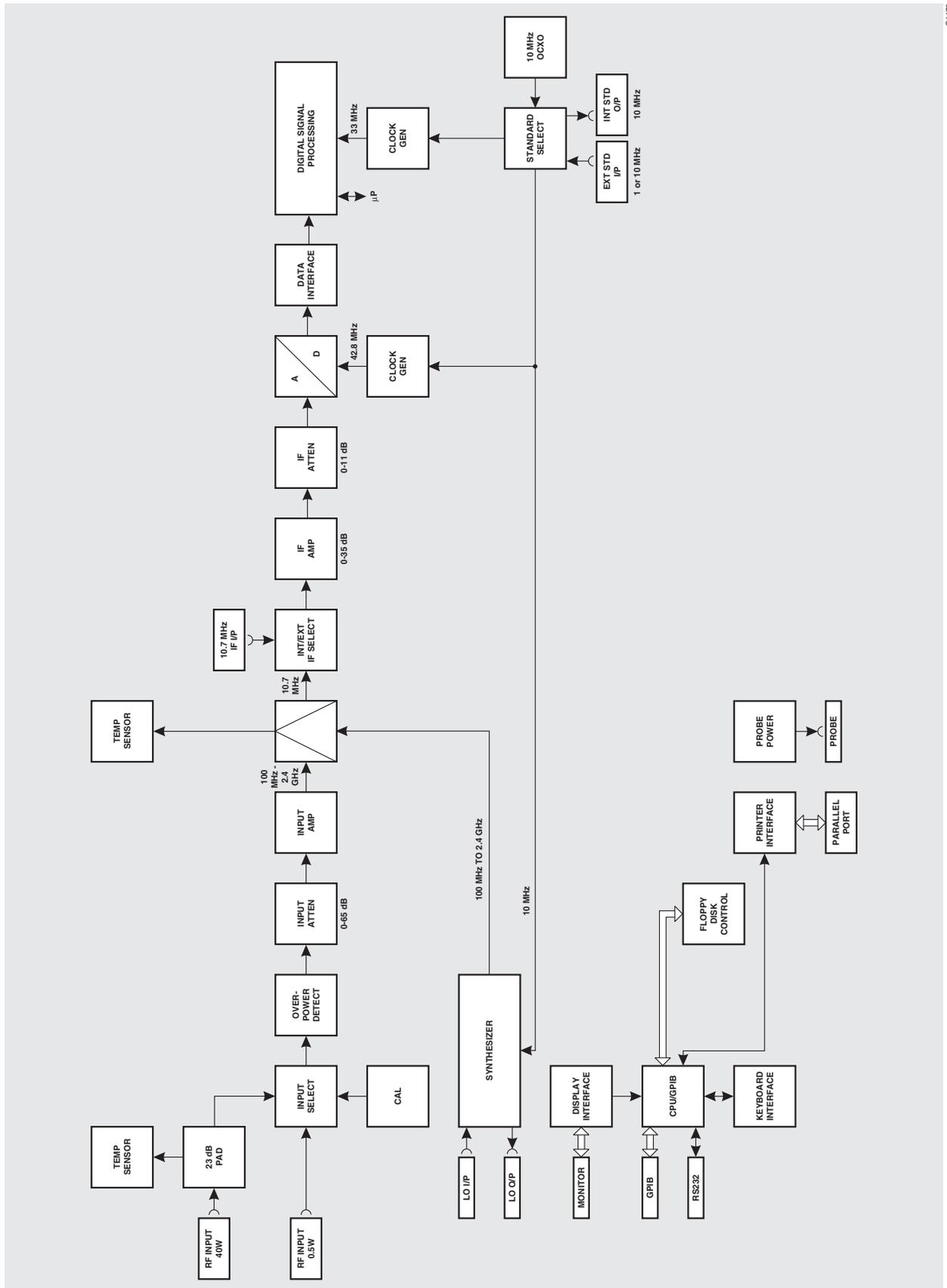
Fig. 5-1 Block schematic diagram

Chapter 6
ACCEPTANCE TESTING

The following procedure is intended as a quick and convenient method for checking the basic functionality of a new instrument. For a full test of instrument performance against the published specification, refer to the 2310 Maintenance Manual, part no. 46882-337.

Equipment required

Description	Minimum specification
Signal Generator	Any one of the IFR 2.4 GHz signal generators: 2025, 2031, 2032, 2041, 2042, 2051(T) or 2052(T)

Initialization self-test

Press the supply switch to power up the 2310. The display will go through a start-up sequence as follows:

The screen displays the following (tests 1 to 15 complete very quickly):

INITIALISATION SELF-TEST

TEST 16
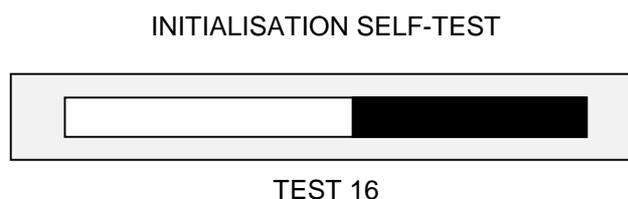
Fig. 6-1 Example of self-test in progress

After the final test, TEST 31, the screen blanks for approximately four seconds, after which the title screen appears. This remains for approximately 20 seconds while the instrument initializes, after which the application screen appears.

The bar display indicates the progress through the initialization self-test; successful completion of the test gives confidence that the following CPU board peripherals are functioning:

- CPU system registers
- Xilinx FPGA boot-up
- Video BIOS
- GPIB controller communication
- Parallel port communication
- Floppy disk controller
- Real time clock
- All serial ports
- DRAM (SIMM)
- NOVRAM
- EEPROM
- FLASH (SIMM)

Front panel tests

This procedure checks that all front panel keys, the rotary control and LEDs are functioning.

(1)   On the 2310 select:

> [UTIL]
> *[⇓]*
> *[Front Panel Tests]*
> *[Keyboard/Knob Test]*

The screen displays a diagram of the front panel. Systematically depress each of the front panel keys in turn ensuring that a dot appears in the corresponding box on the display. Rotate the rotary control clockwise through one revolution and check for a count of between 60 and 70.

Press 0 four times to exit.

(2)   On the 2310 select:

> *[L.E.D. test]*
> *[Toggle L.E.D.s]*   Press this key twice to ensure correct LED operation.
> *[Return]*
> *[Return]*

User self-calibration routine

This routine is run on an occasional basis to correct for changes in operating temperature and environmental conditions. As it exercises most parts of the instrument, namely the internal power reference, input attenuator, input mixer, IF strip and measurement circuits, successful completion will give a high degree of confidence that the instrument meets its specified RF performance. The adjustments performed are as follows:

- Digital IF resonator alignment
- Input attenuator
- IF amplifiers
- Digital IF gain
- IF flatness

Whilst calibration is in progress the screen shown in Fig. 6-2 is displayed. On completion, check that no error messages appear.


SELF-CALIBRATION IN PROGRESS.

This calibration will take
approximately 35 seconds.
Please wait....

C4256
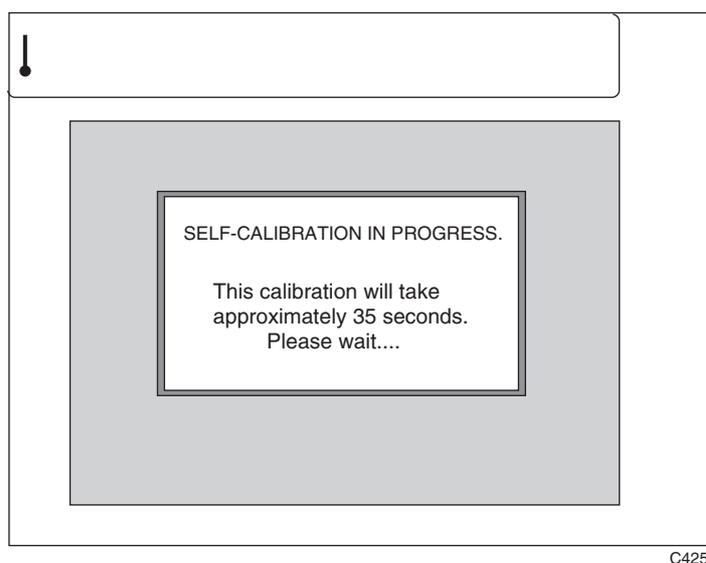
Fig. 6-2 Self-calibration screen

RF input acceptance tests

These tests ensure that an external signal applied to either RF input socket is selected and measured correctly.
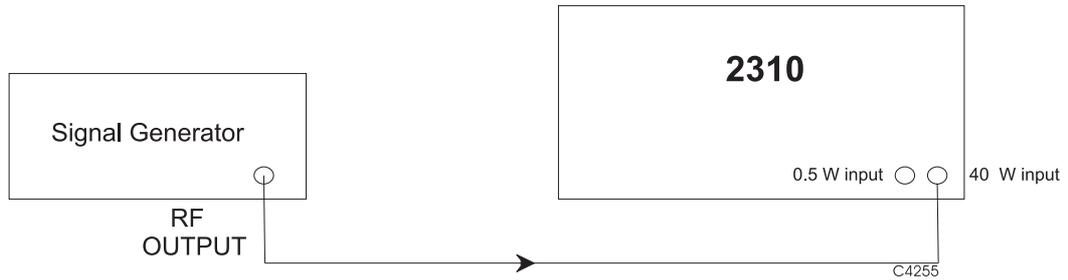
Fig. 6-3 RF input test set-up

(1)   Connect the test equipment as shown in Fig. 6-3.

(2)   On the 2310 select:

        [UTIL] *[Power On Settings] [Instrument PRESET]*
        [SPECTRUM]
        [FREQ]   2 GHz
        [Frequency Span]   10 kHz

(3)   Set the signal generator to RF level 0 dBm and carrier frequency 2 GHz.

(4)   On the 2310 select:

        [MARKERS]
        [Markers ON]
        [SINGLE]
        [Marker → Peak]

(5)   Read the Mkr. 1 frequency and level at the bottom of the display. Check that the frequency is nominally 2 GHz and the level is 0 dBm ± 2 dB.

(6)   Connect the signal generator to the 0.5 W input of the 2310.

(7)   On the 2310 select:

        [LEVEL]
        [Low Power Input]
        [Input Level]   0 dBm
        [SINGLE]
        [MARKERS]
        [Marker → Peak]

(8)   Read the Mkr. 1 frequency and level at the bottom of the display. Check that the frequency is nominally 2 GHz and the level is 0 dBm ± 2 dB.

AEROFLEX LIMITED
SOFTWARE LICENSE AND WARRANTY

This document is an Agreement between the user of this Licensed Software, the Licensee, and Aeroflex Limited ('Aeroflex'), the Licensor. By installing or commencing to use the Licensed Software you accept the terms of this Agreement. If you do not agree to the terms of this Agreement do not use the Licensed Software.

1. DEFINITIONS
The following expressions will have the meanings set out below for the purposes of this Agreement:

Add-In Application Software	Licensed Software that may be loaded separately from time to time into the Designated Equipment to improve or modify its functionality
Computer Application Software	Licensed Software supplied to run on a standard PC or workstation
Designated Equipment	means either:
	the single piece of equipment or system supplied by Aeroflex upon which the Licensed Software is installed; or
	a computer that is connected to a single piece of equipment or system supplied by Aeroflex upon which computer the Licensed Software is installed
Downloaded Software	any software downloaded from an Aeroflex web site
Embedded Software	Licensed Software that forms part of the Designated Equipment supplied by Aeroflex and without which the Equipment cannot function
License Fee	means either the fee paid or other consideration given to Aeroflex for the use of the Licensed Software on the Designated Equipment
Licensed Software	all and any programs, listings, flow charts and instructions in whole or in part including Add-in, Computer Application, Downloaded and Embedded Software supplied to work with Designated Equipment
PXI Software	Licensed Software specific to Aeroflex's 3000 Series PXI product range

2. LICENSE FEE
The Licensee shall pay the License Fee to Aeroflex in accordance with the terms of the contract between the Licensee and Aeroflex.

3. TERM
This Agreement shall be effective from the date of receipt or download (where applicable) of the Licensed Software by the Licensee and shall continue in force until terminated under the provisions of Clause 8.

4. LICENCE
4.1 The following rights and restrictions in this Article 4 apply to all Licensed Software unless otherwise expressly stated in other Articles of this Agreement.

4.2 Unless and until terminated, this License confers upon the Licensee the non-transferable and non-exclusive right to use the Licensed Software on the Designated Equipment.

4.3 The Licensee may not use the Licensed Software on other than the Designated Equipment, unless written permission is first obtained from Aeroflex and until the appropriate additional License Fee has been paid to Aeroflex.

4.4 The Licensee may not amend or alter the Licensed Software and shall have no right or license other than that stipulated herein.

4.5 Except as specifically permitted elsewhere in this Agreement the Licensee may make not more than two copies of the Licensed Software (but not the Authoring and Language Manuals) in machine-readable form for operational security and shall ensure that all such copies include Aeroflex's copyright notice, together with any features which disclose the name of the Licensed Software and the Licensee. Furthermore, the Licensee shall not permit the Licensed Software or any part to be disclosed in any form to any third party and shall maintain the Licensed Software in secure premises to prevent any unauthorized disclosure. The Licensee shall notify Aeroflex immediately if the Licensee has knowledge that any unlicensed party possesses the Licensed Software. The Licensee's obligation to maintain confidentiality shall cease when the Licensed Software and all copies have been destroyed or returned. The copyright in the Licensed Software shall remain with Aeroflex. The Licensee will permit Aeroflex at all reasonable times to audit the use of the Licensed Software.

4.6 The Licensee will not disassemble or reverse engineer the Licensed Software, nor sub-license, lease, rent or part with possession or otherwise transfer the whole or any part of the Licensed Software.

5   ADDITIONAL LICENSE RIGHTS SPECIFIC TO PXI SOFTWARE

5.1   Definitions for PXI Software

The following expressions will have the meanings set out below for the purposes of the supplementary rights granted in this Article.

PXI Drivers	All 3000 Series PXI module device drivers including embedded firmware that are installed at runtime
PXI Executable Applications	All executable applications supplied with each 3000 Series PXI module including:-
	PXI Studio
	Soft Front Panels (manual operation graphical user interfaces)
	Utilities including: RF Investigator, PXI Version Information and Self Test
PXI Spectrum Analysis Library	The spectrum analysis measurement suite library .dll software supplied with each 3000 Series PXI module
PXI Optional Application Library	Individual measurement suite available from a range of optional .dll application libraries

5.2   PXI Drivers, PXI Executable Applications and PXI Spectrum Analysis Library License Rights

Subject to the License granted in Article 4 hereof notwithstanding the limitations on number of copies in Clause 4.5 hereof, the Licensee is entitled to make and distribute as many copies of the PXI Drivers and PXI Executable Applications as necessary for use with 3000 Series PXI modules acquired by the Licensee from Aeroflex or its authorized distributor or reseller provided that the Licensee may not sell or charge a fee for the PXI Drivers and PXI Executable Applications.

5.3   PXI Optional Application Library License Rights

Subject to the License granted in Article 4 hereof notwithstanding the limitations on number of copies in Clause 4.5 hereof, the Licensee is entitled to distribute as many copies of any PXI Optional Application Library as necessary for use with 3000 Series PXI modules acquired by the Licensee from Aeroflex or its authorized distributor or reseller provided that:

5.3.1   copies of the applicable PXI Optional Application Library are used solely with 3000 Series PXI modules which the customer has purchased with the corresponding option or part number for the applicable PXI Optional Application Library; and

5.3.2   the Licensee may not sell or charge a fee for the PXI Optional Application Library.

6   WARRANTY

6.1   Aeroflex certifies that the Licensed Software supplied by Aeroflex will at the time of delivery function substantially in accordance with the applicable Software Product Descriptions, Data Sheets or Product Specifications published by Aeroflex.

6.2   The warranty period (unless an extended warranty for Embedded Software has been purchased) from date of delivery in respect of each type of Licensed Software is:

PXI Drivers	24 months
Embedded Software	12 months
Add-In Application Software	90 days
Computer Application Software	90 days
Downloaded Software	No warranty

6.3   If during the appropriate Warranty Period the Licensed Software does not conform substantially to the Software Product Descriptions, Data Sheets or Product Specifications Aeroflex will provide:

6.3.1   In the case of Embedded Software and at Aeroflex's discretion either a fix for the problem or an effective and efficient work-around.

6.3.2   In the case of Add-In Application Software and Computer Application Software and at Aeroflex's discretion replacement of the software or a fix for the problem or an effective and efficient work-around.

6.4   Aeroflex does not warrant that the operation of any Licensed Software will be uninterrupted or error free.

6.5   The above Warranty does not apply to:

6.5.1   Defects resulting from software not supplied by Aeroflex, from unauthorized modification or misuse or from operation outside of the specification.

6.5.2   Third party produced proprietary software which Aeroflex may deliver with its products, in such case the third party software license agreement including its warranty terms shall apply.

6.6   The remedies offered above are sole and exclusive remedies and to the extent permitted by applicable law are in lieu of any implied conditions, guarantees or warranties whatsoever and whether statutory or otherwise as to the Licensed Software all of which are hereby expressly excluded.

7.   INDEMNITY

7.1   Aeroflex shall defend, at its expense, any action brought against the Licensee alleging that the Licensed Software infringes any patent, registered design, trademark or copyright, and shall pay all Licensor's costs and damages finally awarded up to an aggregate equivalent to the License Fee provided the Licensee shall not have done or permitted to be done anything which may have been or become any such infringement and shall have exercised reasonable care in protecting the same failing which the Licensee shall indemnify Aeroflex against all claims costs and damages incurred and that Aeroflex is given prompt written notice of such claim and given information, reasonable assistance and sole authority to defend or settle such claim on behalf of the Licensee. In the defense or settlement of any such claim, Aeroflex may obtain for the Licensee the right to continue using the Licensed Software or replace it or modify it so that it becomes non-infringing.

7.2   Aeroflex shall not be liable if the alleged infringement:

7.2.1 is based upon the use of the Licensed Software in combination with other software not furnished by Aeroflex, or

7.2.2 is based upon the use of the Licensed Software alone or in combination with other software in equipment not functionally identical to the Designated Equipment, or

7.2.3 arises as a result of Aeroflex having followed a properly authorized design or instruction of the Licensee, or

7.2.4 arises out of the use of the Licensed Software in a country other than the one disclosed to Aeroflex as the intended country of use of the Licensed Software at the commencement of this Agreement.

7.3 Aeroflex shall not be liable to the Licensee for any loss of use or for loss of profits or of contracts arising directly or indirectly out of any such infringement of patent, registered design, trademark or copyright. Notwithstanding anything in this Agreement to the contrary, the total liability of Aeroflex and its employees, in contract, tort, or otherwise (including negligence, warranty, indemnity, and strict liability) howsoever arising out of this License shall be limited to the total amount of the License Fee and total support fees actually paid to Aeroflex by the Licensee.

8. TERMINATION

8.1 Notwithstanding anything herein to the contrary, this License shall forthwith determine if the Licensee:

8.1.1 As an individual has a Receiving Order made against him or is adjudicated bankrupt or compounds with creditors or as a corporate body, compounds with creditors or has a winding-up order made against it or

8.1.2 Parts with possession of the Designated Equipment.

8.2 This License may be terminated by notice in writing to the Licensee if the Licensee shall be in breach of any of its obligations hereunder and continue in such breach for a period of 21 days after notice thereof has been served on the Licensee.

8.3 On termination of this Agreement for any reason, Aeroflex may require the Licensee to return to Aeroflex all copies of the Licensed Software in the custody of the Licensee and the Licensee shall, at its own cost and expense, comply with such requirement within 14 days and shall, at the same time, certify to Aeroflex in writing that all copies of the Licensed Software in whatever form have been obliterated from the Designated Equipment.

9. THIRD PARTY LICENCES

9.1 The Licensed Software or part thereof may be the proprietary property of third party licensors. In such an event such third party licensors (as may be referenced on the software media, or any on screen message on start up of the software or on the order acknowledgement) and/or Aeroflex may directly enforce the terms of this Agreement and may terminate the Agreement if the Licensee is in breach of the conditions contained herein.

9.2 If any third party software supplied with the Licensed Software is supplied with, or contains or displays the third party's own license terms then the Licensee shall abide by such third party license terms (for the purpose of this Article the term "third party" shall include other companies within the Aeroflex group of companies).

10. EXPORT REGULATIONS

The Licensee undertakes that where necessary the Licensee will conform with all relevant export regulations imposed by the Governments of the United Kingdom and/or the United State of America.

11. U.S. GOVERNMENT RESTRICTED RIGHTS

The Licensed Software and documentation are provided with RESTRICTED RIGHTS. Use, duplication, or disclosure by the Government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013 or subparagraphs (c)(1) and (2) of the Commercial Computer Software-Restricted Rights at 48 CFR 52.227-19, as applicable.

12. NOTICES

Any notice to be given by the Licensee to Aeroflex shall be addressed to:

Aeroflex Limited, Longacres House, Six Hills Way, Stevenage, SG1 2AN, UK.

13. LAW AND JURISDICTION

This Agreement shall be governed by the laws of England and shall be subject to the exclusive jurisdiction of the English courts. This agreement constitutes the whole agreement between the parties and may be changed only by a written agreement signed by both parties.

© AEROFLEX LIMITED 2009

CHINA Beijing
Tel: [+86] (10) 6539 1166
Fax: [+86] (10) 6539 1778

CHINA Shanghai
Tel: [+86] (21) 5109 5128
Fax: [+86] (21) 5150 6112

FINLAND
Tel: [+358] (9) 2709 5541
Fax: [+358] (9) 804 2441

FRANCE
Tel: [+33] 1 60 79 96 00
Fax: [+33] 1 60 77 69 22

GERMANY
Tel: [+49] 8131 2926-0
Fax: [+49] 8131 2926-130

HONG KONG
Tel: [+852] 2832 7988
Fax: [+852] 2834 5364

INDIA
Tel: [+91] 80 [4] 115 4501
Fax: [+91] 80 [4] 115 4502

JAPAN
Tel: [+81] 3 3500 5591
Fax: [+81] 3 3500 5592

KOREA
Tel: [+82] (2) 3424 2719
Fax: [+82] (2) 3424 8620

SCANDINAVIA
Tel: [+45] 9614 0045
Fax: [+45] 9614 0047

SPAIN
Tel: [+34] (91) 640 11 34
Fax: [+34] (91) 640 06 40

UK Cambridge
Tel: [+44] (0) 1763 262277
Fax: [+44] (0) 1763 285353

UK Stevenage
Tel: [+44] (0) 1438 742200
Fax: [+44] (0) 1438 727601
Freephone: 0800 282388

USA
Tel: [+1] (316) 522 4981
Fax: [+1] (316) 522 1360
Toll Free: (800) 835 2352

*As we are always seeking to improve our products, the information in this document
gives only a general indication of the product capacity, performance and suitability,
none of which shall form part of any contract.
We reserve the right to make design changes without notice.*

web **www.aeroflex.com**   Email **info-test@aeroflex.com**

November 2008