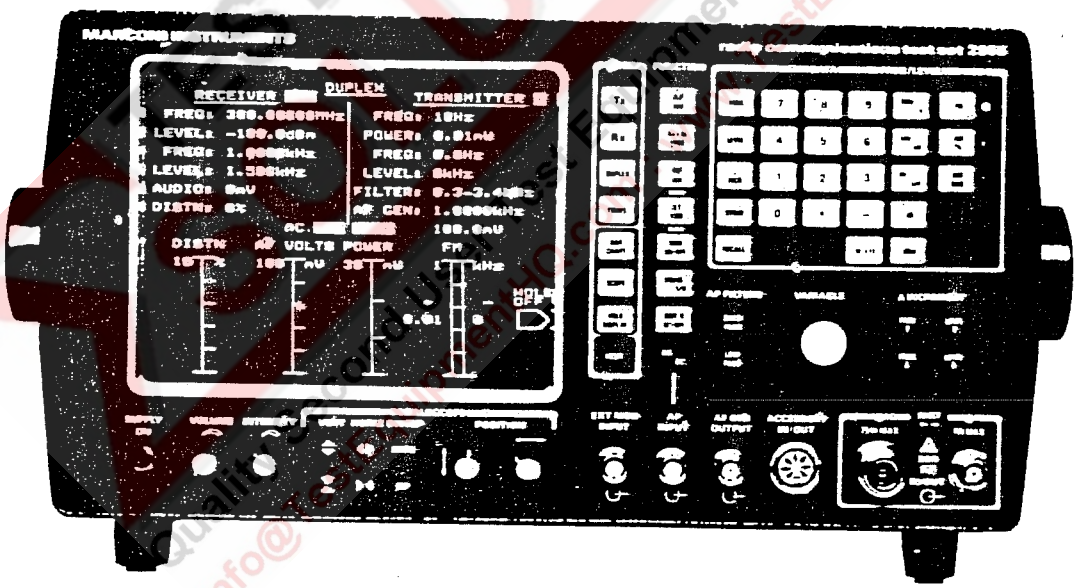
Chapter 1

GENERAL INFORMATION AND DATA

INTRODUCTION

Radio Communications Test Set type 2955 combines all the measurement facilities required for testing mobile radio transceivers in the range up to 1000 MHz. It is a compact self-contained unit designed for bench or mobile use and can be considered as a combination of eleven instruments as follows:-

RF counter
AF counter.
RF signal generator.
Modulation meter.
RF power meter.
AF generator.
AF and DC voltmeter.
Distortion meter.
S/N (signal to noise) and SINAD (S/N and distortion) meter.
Tones decoder and encoder.
Digital oscilloscope.



Push-button selection makes all the necessary interconnections for each measurement, eliminating the need for the many interconnections required when separate instruments are used. Function selection and data entries are made on a colour-coded keyboard with the operating sequence logically arranged from left to right. Instrument operation is greatly enhanced by the CRT display which provides prompts during data entry and guidance during operating sequences while also showing the instrument settings and measurement results. Analogue measurements are displayed by an oscilloscope with repetitive sweep, single shot and freeze facilities, as well as by five autoranging bar charts.

Counters Due to there being two frequency counters, simultaneous AF and RF frequency readings can be displayed. Ranges and resolutions are respectively 10 Hz to 20 kHz at 0.1 Hz and 1.5 to 1000 MHz at 1 or 10 Hz. Either an internal or an external frequency standard may be used.

Signal generator The signal generator can be amplitude, frequency, or phase modulated, internally or externally, the internal modulating signal being obtained from the AF generator. Amplitude modulation is variable up to 70% for carrier frequencies from 0.4 to 400 MHz. FM deviation can be set from 0 to 25 kHz, and ΦM deviation from 0 to 10 radians. Transmitter and receiver measurements can be made from a common N-type connector. The generator BNC socket is automatically protected against reverse power overloads.

Modulation meter Automatic frequency tuning and levelling of the modulation monitor provide accurate measurements of AM, FM and ΦM. Because of the independent tuning, modulation measurements are easily made on duplex systems. The modulation may be observed on an oscilloscope and its symmetry checked from the peak and trough values displayed on a dual bar chart. The demodulated output is available at a rear panel socket. Provision is made for audible monitoring using the built-in loudspeaker or by an external loudspeaker or headphones.

RF power meter The absorption RF power meter will measure up to 75 W continuously or up to 150 W for short periods, over a frequency range of 1.5 to 1000 MHz. Power levels may be observed on an autoranging bar chart in addition to the digital readout. The connection of the throughline power meter (available as an optional accessory) extends the capability of the instrument by enabling measurements of forward power, reverse power and VSWR to be made.

AF generator The AF generator provides a range of frequencies from 20 Hz to 20 kHz plus a fixed 1 kHz output used for distortion measurements and 2 tone test. Its audio output is available at a front panel socket and it also provides the internal AM, FM and ΦM for the signal generator. A combined 600 Ω balanced to unbalanced converter and 20 dB attenuator is available as an optional accessory.

AF voltmeter Operating in the range 20 Hz to 20 kHz, the true RMS audio frequency voltmeter has provisions for measuring AF or AF plus the DC component. Band-pass and low-pass filters may be selected. Level may be observed on an autoranged bar chart.

Distortion meter The AF distortion and signal to noise ratio meter and the associated SINAD meter operate at a frequency of 1 kHz supplied by the AF generator. The bar chart displays are autoranged at 10% and 30% for distortion and signal to noise, 18 dB and 50 dB for SINAD. The CCITT and C-message filters (available as optional accessories) enable psophometrically weighted measurements to be made.

Tones decoder and encoder For testing selective calling tone encoding and decoding equipment, the instrument is capable of receiving and generating four defined tone frequency standards plus a user-defined standard. Sub-audible tones can also be generated. Provision is made to receive a sequence of up to 12 and send a sequence of up to 11 out of 15 allocated tone frequencies. For transmitter testing, each received tone is compared with the standard frequency allocations held in memory and, if within limits, its tone number and % frequency error is displayed. For receiver testing, the tones may be generated in single step, tone burst or continuous cycle.

Modulation meter. Automatic frequency tuning and levelling of the modulation monitor provide accurate measurements of AM, FM and ΦM. Because of the independent tuning, modulation measurements can be made on duplex systems. The modulation can be observed on an oscilloscope and its symmetry checked from the peak and trough values displayed on a dual bar chart. The demodulated output is available at a rear panel socket. Provision is made for audible monitoring using the built-in loudspeaker or by an external loudspeaker or headphones.

RF power meter. The absorption RF power meter measures up to 75 W continuously or up to 150 W for short periods over a frequency range of 1.5 to 1000 MHz. The connection of the RF Directional Power Head (available as an optional accessory) extends the capability of the instrument by enabling measurements of forward power, reverse power and VSWR to be made.

AF generators. The two AF generators provide a range of frequencies from 20 Hz to 20 kHz for single-tone or two-tone testing. The audio output is available at a front panel socket and the generators also provide the internal AM, FM and ΦM for the RF signal generator. A combined 600 Ω Balanced to Unbalanced Convertor and 20 dB Attenuator is available as an optional accessory.

AF voltmeter. Operating in the range 20 Hz to 20 kHz, the true RMS voltmeter has provisions for measuring AF or AF plus the DC component. Band-pass and low-pass filters can be selected.

Distortion, S/N (signal to noise) or SINAD (signal to noise and distortion) meter. The AF distortion and noise meter operates at 1 kHz which is supplied by one of the AF generators. The bar chart displays are autoranged at 10% and 30% (for distortion), at 30 and 100 dB (for S/N) or at 18 and 50 dB (for SINAD). The Psophometric Filter Units (available as optional accessories) enable CCITT and C-message weighted measurements to be made.

Sequential tones decoder and encoder. For testing selective calling tones encoding and decoding equipment, the instrument is capable of receiving and generating five defined tone frequency standards plus a user-defined standard. Provision is made to receive and to send sequences of up to 33 tone frequencies. For transmitter testing, each received tone is compared with the standard frequency allocations which is held in memory and, if it is within the limits, its tone number and % frequency error are displayed. For receiver testing, the tones can be generated in single step, tone burst or continuous cycle. There is a revertive tones facility whereby tones are sent to a receiver and the the answering sequence is decoded.

DTMF decoder and encoder. There are similar facilities for testing DTMF encoding and decoding equipment.

DCS decoder and encoder. There are similar facilities for DCS encoding and decoding equipment.

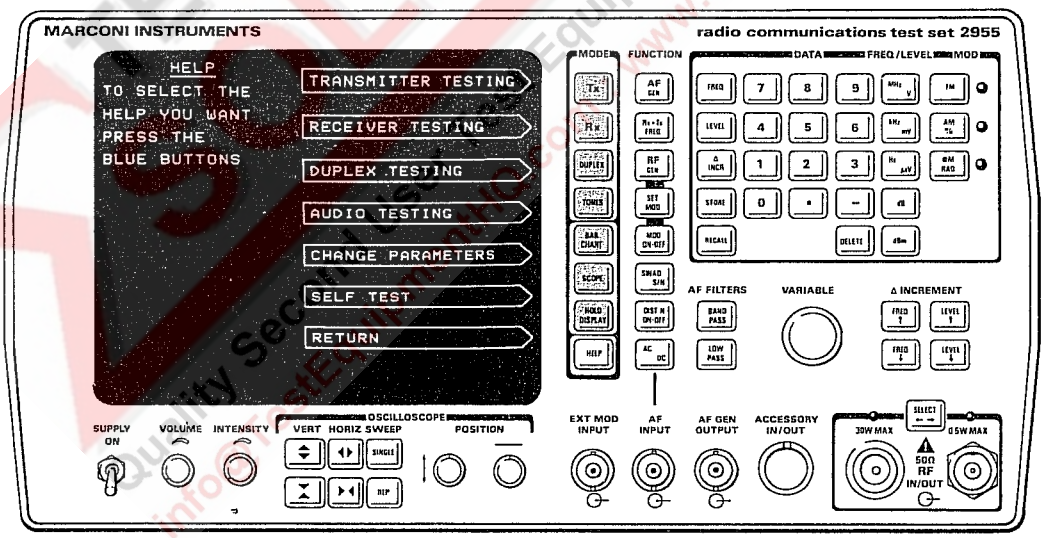
POCSAG radio pager encoder. The instrument can be used to check the response of a pager to an RF signal modulated with the pager's address and an appropriate message. Deliberate errors can be created in the outgoing signal.

GPIB interface unit. This unit allows the instrument to form part of an automatic test system. The GPIB additionally enables a display to be configured to the user's own requirements using a comprehensive character set. The GPIB also enables the 24 Column Printer (available as an optional accessory) to be used.

Marconi
Instruments

2955

RADIO COMMUNICATIONS TEST SET



Operating Manual

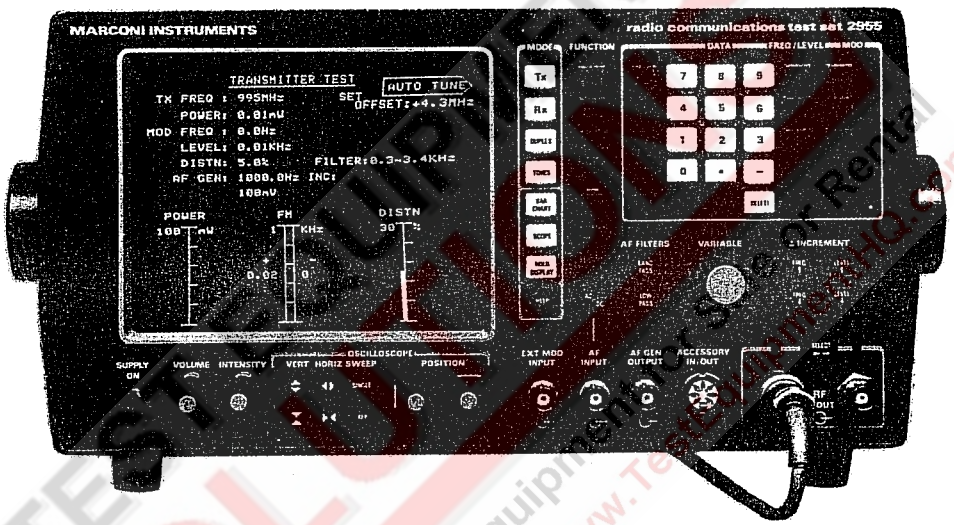
Chapter 1

GENERAL INFORMATION AND DATA

INTRODUCTION

Radio Communications Test Set type 2955 combines all the measurement facilities required for testing mobile radio transceivers in the range up to 1000 MHz. It is a compact self-contained unit designed for bench or mobile use and can be considered as a combination of eleven instruments:–

- RF counter
- AF counter
- Signal generator
- Modulation meter
- RF power meter
- AF generator
- AF and d.c. voltmeter
- AF distortion meter
- SINAD and S/N meter
- Tones encoder/decoder
- Digital oscilloscope



Push-button selection makes all the necessary interconnections for each measurement, eliminating the need for the many interconnections required when separate instruments are used. Function selection and data entries are made on a colour-coded keyboard with the operating sequence logically arranged from left to right. Instrument operation is greatly enhanced by the c.r.t. display which provides prompts during data entry and guidance during operating sequences while also showing the instrument settings and measurement results. Analogue measurements are displayed by an oscilloscope with repetitive sweep, single shot and freeze facilities, as well as by five auto-ranging bar charts.

Counters Due to there being two frequency counters, simultaneous a.f. and r.f. frequency readings can be displayed. Ranges and resolutions are respectively 10 Hz to 20 kHz at 0.1 Hz and 1.5 to 1000 MHz at 1 or 10 Hz. Either an internal or an external frequency standard may be used.

Signal generator The signal generator can be amplitude, frequency, or phase modulated, internally or externally, the internal modulating signal being obtained from the a.f. generator. Amplitude modulation is variable up to 70% for carrier or frequencies from 0.4 to 400 MHz. FM deviation can be set from 0 to 25 kHz, and ø.m. deviation from 0 to 10 radians. Transmitter and receiver measurements can be made from a common N-type connector. The generator b.n.c. socket is automatically protected against reverse power overloads.

Modulation meter Automatic frequency tuning and levelling of the modulation monitor provide accurate measurements of a.m., f.m. and ø.m. Because of the independent tuning, modulation measurements are easily made on duplex systems. The modulation may be observed on an

oscilloscope and its symmetry checked from the peak and trough values displayed on a dual bar chart. The demodulated output is available at a rear panel socket. Provision is made for audible monitoring using the built-in loudspeaker or by an external loudspeaker or headphones.

RF power meter The absorption r.f. power meter will measure up to 30 W continuously or up to 100 W for short periods, over a frequency range of 1.5 to 1000 MHz. Power levels may be observed on an autoranging bar chart in addition to the digital readout. The connection of the throughline power meter (available as an optional accessory) extends the capability of the instrument by enabling measurements of forward power, reverse power and v.s.w.r. to be made.

AF generator The a.f. generator provides a range of frequencies from 20 Hz to 20 kHz plus a fixed 1 kHz output used for distortion measurements and 2 tone tests. Its audio output is available at a front panel socket and it also provides the internal a.m., f.m. and ø.m. for the signal generator. A combined 600 Ω balanced to unbalanced converter and 20 dB attenuator is available as an optional accessory.

AF voltmeter Operating in the range 20 Hz to 20 kHz, the true r.m.s. audio frequency voltmeter has provision for measuring a.f. or a.f. plus the d.c. component. Band-pass and low-pass filters may be selected. Level may be observed on an autoranged bar chart.

Distortion meter The a.f. distortion and signal to noise ratio meter and the associated SINAD meter operate at a frequency of 1 kHz supplied by the a.f. generator. The bar chart displays are autoranged at 10% and 30% for distortion, and signal to noise, 18 dB and 50 dB for SINAD. The CCITT and C-message filters (available as optional accessories) enable psophometrically weighted measurements to be made.

Tones encoder/decoder For testing selective calling tone encoding and decoding equipment, the instrument is capable of generating and receiving four defined tone frequency standards plus a user-defined standard. Sub-audible tones can also be generated.

Provision is made to send and receive a sequence of up to 10 out of 15 allocated tone frequencies. For receiver testing, the tones may be generated in single step, tone burst or continuous cycle. For transmitter testing, each received tone is compared with the standard frequency allocations held in memory and, if within limits, its tone number and % frequency error is displayed.

GPIB option The addition of the optional GPIB (General Purpose Interface Bus) unit greatly extends the versatility of the instrument, and allows the instrument to form part of an automatic test system. The GPIB additionally enables a display to be configured to the user's own requirements using a comprehensive character set. The GPIB also enables a 24 column ticket printer option to be used.

Calibration and test Routine calibration needs have been kept to a minimum, and calibration factors stored in a non-volatile memory may be accessed with a secure access code from the front panel keys, or via the GPIB, permitting rapid recalibration.

A built-in self test facility may be called whenever required which enables faults to be identified to major module level or to groups of components.

SPECIAL FEATURES

Transmitter test

Setting:	TX key press selects test mode.
Auto-tuning:	Typically under 3 seconds to acquire and measure:– RF frequency RF power Modulation frequency and level Modulation distortion
Manual tune:	Displays positive and negative frequency offset from carrier. 3 digits and decimal point indicate most significant error.

Tones decoder: Decodes CCIR, ZVEI, DZVEI, EEA (or EIA) and user-defined menu.
Provides tone number, frequency and % error for up to 12 tones.
Tone deviation and duration may be monitored using the digital storage scope in TX test mode.

RX=TX key: Presets the r.f. signal generator frequency for receiver test mode to that shown in TX mode.

HOLD DISPLAY key: Freezes screen settings and readings, facilitating high r.f. power measurements and hard copy printout of TX, RX and DX or a.f. test screens.

Duplex test

Setting: DX key press selects test mode.

Mod. meter/sig. gen.: Independent modulation meter and r.f. signal generator allows any frequency offset for duplex radio or cross-band repeater testing.

Tones encoder: Encodes CCIR, ZVEI, DZVEI, EEA (or EIA) and user-defined menu.
User may send up to 11 tones in any standard, continuously, tone step or burst. A facility allows for tones to be extended.

Receiver test

Setting: RX key press selects test mode.
Default settings of r.f. level, mod. freq. and level reduce function test time.

Signal generator: Output level accuracy ±2 dB over entire frequency, temperature and attenuator ranges. Level units keyboard selectable either dBm or µV. Software menu allows user to switch between p.d. and e.m.f. levels.

SINAD/S/N meter: User-settable default condition allows either SINAD or S/N readings, a dedicated key is provided to toggle setting.

Tones encoder: Encodes CCIR, ZVEI, DZVEI, EEA (or EIA) and user-defined menu.
User may send up to 10 tones in any standard continuously, tone step or burst. A facility allows for tones to be extended.

PERFORMANCE DATA

RF SIGNAL GENERATOR SECTION

Output impedance: 50 Ω nominal.

VSWR: N-type <1.2:1 to 500 MHz.
<1.5:1 to 1000 MHz.
BNC <2.2:1 to 1000 MHz typical.

Frequency

Range: 0.4 MHz to 1000 MHz.

Resolution: 50 Hz up to 530 MHz.
100 Hz up to 1000 MHz.

Indication: 8 digit display.

Setting: Via keyboard entry; step change variation by increment/decrement keys and rotary control.

Accuracy: As internal standard.

Output level

Range (RX mode): −140 dBm to −20 dBm (0.0224 μV to 22.4 mV p.d.) from N-type socket.
−120 dBm to 0 dBm (0.224 μV to 224 mV p.d.) from b.n.c. output.

Two-port duplex: −40 dBm to −120 dBm (2.24 mV to 0.224 μV p.d.).

One-port duplex: −80 dBm to −140 dBm (22.35 μV to 0.0224 μV p.d.).

Resolution: 0.1 dB.

Indication: 4 digits (dBm/μV and p.d./e.m.f.).

Setting: 10 dB and 0.1 dB steps.

Accuracy: ±2 dB for levels above −127 dBm.

Spectral purity

FM on c.w.: <30 Hz to 520 MHz, <60 Hz to 1000 MHz.
(0.3 to 3.4 kHz weighted r.m.s.).
Typically:-
8 Hz up to 250 MHz,
15 Hz up to 500 MHz,
30 Hz up to 1000 MHz.

Harmonics: Harmonics are in band 0.4 to 1000 MHz only.
<−20 dBc to 1.5 MHz.
<−25 dBc 1.5 MHz to 250 MHz.
<−20 dBc 250 MHz to 1000 MHz.

Sub-harmonics: None up to 530 MHz, <−25 dBc to 1000 MHz.

Spurious signals: Carrier up to 88 MHz–
<−45 dBc below 110 MHz.
<−35 dBc above 110 MHz.
Carrier up to 1000 MHz– <−60 dBc.

S/N (typical) at 20 kHz offset: <−106 dB/Hz to 500 MHz.
<−100 dB/Hz to 1000 MHz.

RF leakage <0.5 μV p.d. generated in a 50 Ω load by a 2-turn 25 mm loop as near as 25 mm to the case of the instrument with the output set to less than −20 dBm and the output terminated in a 50 Ω sealed load.

Protection 50 W reverse power trip. Automatically resets on removal of power input from b.n.c. socket. A visual alarm warning (REMOVE RF INPUT) and an audible alarm are provided for added protection.

MODULATION SECTION

Amplitude modulation

CW range: 1.5 to 400 MHz, usable to 400 kHz.

Modulation range: 0 to 70%, usable to 85%.

Frequency range: 50 Hz to 15 kHz.

Resolution: 1%.

Indication: 2 digits.

Setting: Via keyboard entry; step change variation by increment/decrement keys and rotary control.

Accuracy:	±7% of setting ±1 digit at 1 kHz. ±10% of setting ±1 digit from 50 Hz to 5 kHz up to 60% a.m. ±15% of of setting ± digit from 50 Hz to 15 kHz up to 70% a.m.

AM external input

Input impedance:	1 MΩ in parallel with approx. 40 pF.
CW range:	1.5 to 400 MHz.
Modulation depth range:	0 to 70%, usable to 85%.
Frequency range:	50 Hz to 15 kHz.
Sensitivity:	50 Hz to 5 kHz, up to 60% a.m.:– 1.5V p-p for 30% a.m. ±10% ±1% a.m. 50 Hz to 15 kHz, up to 70% a.m.:– 1.5V p-p for 30% a.m. ±15% ±1% a.m.
AM distortion:	<2% distortion at 1 kHz with 30% a.m. in a 300 Hz to 3.4 kHz bandwidth.

Frequency modulation

CW range:	0.4 to 1000 MHz.
Deviation range:	0 to 25 kHz.
Modulation frequency range:	50 Hz to 15 kHz.
Resolution:	25 Hz (<6.25 kHz dev). 100 Hz (<25 kHz dev).
Indication:	4 digits.
Setting:	Via keyboard entry. Step change variation by increment/decrement keys and rotary control.
Accuracy:	±7% ±10 Hz (at 1 kHz). ±10% (50 Hz to 15 kHz).

FM external input

Input impedance:	1 MΩ in parallel with approx 40 pF.
CW range:	0.4 to 1000 MHz.
Deviation range:	0 to 30 kHz deviation.
Modulation frequency range:	1 Hz to 50 kHz.
Sensitivity:	1 V p-p for 5 kHz deviation ±10% at 1 kHz.
FM distortion:	<1% distortion at 1 kHz with 5 kHz deviation in a 300 Hz to 3.4 kHz bandwidth.

Phase modulation

CW range:	0.4 to 1000 MHz.
Deviation range:	0 to 10 rad.
Modulation frequency range:	300 Hz to 3.4 kHz.
Resolution:	0.02/0.03 rad, up to 6.3 rad.
Indication:	3 digits.
Setting:	Via keyboard entry. Step change variation by increment/decrement keys and rotary control.
Accuracy:	±8% at 1 kHz, ±11% from 300 Hz to 3.4 kHz.
Distortion:	<10% at 1 kHz with 5 rad measured in a 0.3 to 3.4 kHz bandwidth.

øM external input

Input impedance:	1 MΩ in parallel with approx. 40 pF.
Deviation range:	0 to 10 rad.

Frequency range:	300 Hz to 3.4 kHz.
Sensitivity:	1 V p-p for 5 rad at ±12% at 1 kHz.
øM distortion:	<2% at 1 kHz with 5 rads, measured in a 300 Hz to 3.4 kHz bandwidth.

AUDIO GENERATOR and 1kHz OSCILLATOR SECTION

Output impedance:	5 Ω nominal.
Frequency	
Range:	50 Hz to 15 kHz (usable 20 Hz to 20 kHz).
Resolution:	0.1 Hz (20 Hz to 3.25 kHz). 1 Hz (3.25 kHz to 20 kHz).
Indication:	5 digits.
Setting:	Via keyboard entry. Step change variation by increment/decrement keys and rotary control.
Accuracy:	±0.01 Hz (50 Hz to 3.25 kHz). ±0.1 Hz (3.25 kHz to 15 kHz).
Signal purity	
Distortion:	<2% up to 15 kHz.
Spurious signals:	<−26 dBc (at 9370 Hz ± 20 Hz only).
Residual noise:	<0.2 mV r.m.s. in a psophometric bandwidth.
DC offset:	<100 mV d.c.
Fixed frequency:	1 kHz.
Accuracy:	As internal standard.
Distortion:	<1%.
Residual noise:	<0.4 mV r.m.s. in a psophometric bandwidth.
DC offset:	<100 mV d.c.
2 tone setting:	Two tones are available, 1 kHz and the a.f. generator frequency setting, both at the same level.
Output level (e.m.f.)	
Range:	1 mV to 2.55 V up to 5 kHz. 1 mV to 2 V up to 15 kHz.
Accuracy:	±5% ±1 count 50 Hz to 15 kHz.
Setting:	1 mV steps (1 mV to 255 mV) 2.5 mV steps (255 mV to 635 mV). 10 mV steps (640 mV to 2.55 V).

RF COUNTER SECTION

Frequency	
Range:	1.5 to 1000 MHz.
Resolution:	1 Hz or 10 Hz to 200 MHz, 10 Hz from 200 MHz to 1000 MHz.
Input	
Impedance:	50 Ω nominal.
VSWR:	N-type <1.2:1 to 500 MHz, <1.5:1 to 1000 MHz. BNC <2:1 to 1000 MHz typical.
Sensitivity:	Input to N-type socket; 5 mW (0.5 V), TX mode selected. 20 mW (1 V), one/two port duplex. Input to b.n.c. socket; 0.05 mW (50 mV).

Update time:	100 ms for frequencies up to 200 MHz with 10 Hz resolution. 1 s with 1 Hz resolution. 400 ms for frequencies up to 1000 MHz. 10 Hz resolution only.

RF POWER METER SECTION

Input

Range:	Input to N-type socket; 50 mW to 30 W continuous, TX mode selected. 100 W for limited period, typically 2 minutes at 25°C. End of usable working period indicated by visual warning (REMOVE RF INPUT) and audible alarm.
Single port duplex:	100 mW to 30 W. Input to b.n.c. socket; 0.5 mW to 0.5 W. Electronic trip circuit prevents damage for overload inputs up to 50 W.
Frequency range:	1.5 to 1000 MHz.
Resolution:	1% of indicated bar chart range.
Indication:	2 or 3 digits and analogue display.
Setting:	Automatic ranging on scales 0 to 30, 0 to 100, 0 to 300 mW; 0 to 1, 0 to 3, 0 to 10, 0 to 30, 0 to 100 W.
Acquisition time:	300 ms for frequencies up to 200 MHz with 10 Hz resolution. 3 s with 1 Hz resolution. 1.2 s for frequencies up to 1000 MHz. 10 Hz resolution only.
Accuracy:	±10% ±1 digit up to 500 MHz. ±15% ±1 digit up to 960 MHz. ±20% ±1 digit up to 1000 MHz. ±1.25 dB ± 1 digit ≥ 5 mW over the ranges 825 – 845 MHz and 890 – 905 MHz from +15°C to +25°C.

MODULATION METER SECTION

Input

Manual tune:	Provides frequency offset indication from carrier, 3 digits and decimal point. Indicates most significant positive or negative error.
Auto tune:	Provides measurement and simultaneous display of r.f. frequency, r.f. power, modulation frequency and level.
Sensitivity:	Input to N-type socket; 5 mW (0.5 V), TX mode selected. 20 mW (1 V), single port duplex. Input to b.n.c. socket; 0.05 mW (50 mV).
Acquisition time:	Less than 3 s with 10 Hz resolution selected.
AF filters available:	Band-pass – 300 Hz to 3.4 kHz. Low-pass – 300 Hz. Low-pass – 15 kHz.

Amplitude modulation

CW range:	1.5 to 400 MHz.
Modulation depth range:	0 to 90% below 100 MHz. 0 to 80% from 100 to 400 MHz. Usable to 100% when manually tuned. Automatic ranging (bar chart), 0 to 10, 0 to 30, 0 to 100% depth.
Moduation frequency range:	50 Hz to 10 kHz (usable from 10 Hz to 15 kHz).
Resolution:	1% a.m.
Indication:	2 digits and ± peak analogue display.
Accuracy:	±6% ±1 digit at 1 kHz. ±8.5% ±1 digit from 50 Hz to 10 kHz.
Demod distortion: (300 Hz to 3.4 kHz bandwidth)	At 30% a.m. and 1 kHz mod. freq.: <2% at 21 MHz carrier and above. <5% up to 21 MHz carrier.
Residual a.m.:	<1%, 300 Hz to 3.4 kHz bandwidth.

Frequency modulation

CW range:	1.5 to 1000 MHz.
Deviation range:	0 to 25 kHz (30 kHz on scope) Automatic ranging (bar chart) 0 to 1, 0 to 3, 0 to 10, 0 to 30 kHz.
Modulation frequency range:	50 Hz to 10 kHz (typically 10 Hz to 15 kHz).
Resolution:	10 Hz up to 2.5 kHz deviation. 1% up to 25 kHz deviation.
Indication:	3 digits and ± peak analogue display.
Accuracy:	±6% ±1 digit at 1 kHz. ±8.5% ±1 digit over range 50 Hz to 10 kHz.
Demod distortion:	<2% distortion at 5 kHz deviation and 1 kHz modulation frequency in a 300 Hz to 3.4 kHz bandwidth.
Residual f.m. (300 Hz to 3.4 kHz):	<30 Hz r.m.s. (typ. 15 Hz) up to 500 MHz. <60 Hz r.m.s. (typ. 30 Hz) up to 1000 MHz. For inputs above 20 mW/0.2 mW (N/BNC).

Phase modulation

CW range:	1.5 to 1000 MHz.
Deviation range:	0 to 10 rad. Automatic ranging (bar chart), 0 to 1, 0 to 3, 0 to 10 rad.
Modulation frequency range:	300 Hz to 3.4 kHz (phase demodulation obtained using 750 µs de-emphasis).
Resolution:	1% or 0.01 rad.
Indication:	3 digits and ± peak analogue display.
Accuracy:	±6% ±1 digit at 1 kHz. ±8.5% ±1 digit from 300 Hz to 3.4 kHz.
Demod. distortion:	<2% at 5 rad and 1 kHz modulation frequency in a 300 Hz to 3.4 kHz bandwidth.

SINAD AND S/N METER SECTION

General

Frequency:	1 kHz.