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SIGNAL CORPS
REPAIR STANDARD

NO. REP-1287
ISSUE NO. 2

Amendment no. 2, 27 September 1962

SPECIFIC STANDARD
FOR
OSCILLOSCOPE AN/USM-32

18 November 1960



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U. S. ARMY SIGNAL MATERIEL SUPPORT AGENCY
FORT MONMOUTH, NEW JERSEY

Signal Corps Repair Standard No. 1287 has been prepared under the supervision of the Maintenance Methods Division and is published for the information and guidance of all concerned. Suggestions relative to the form, contents, purpose or use of this publication should be referred to the Commanding Officer, U. S. Army Signal Materiel Support Agency, Fort Monmouth, New Jersey, Attn: Chief, Maintenance Methods Division, SIGMS-MMT.

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PREFACE

Signal Corps Repair Standards are prepared by the Maintenance Methods Division, Maintenance Engineering Department, U. S. Army Signal Materiel Support Agency, and cover various items of signal equipments which are subject to repair, test and inspection. These repair standards are documents which set forth the specific performance requirements and test standards to be applied to the individual equipments being repaired and tested.

Signal Corps Repair Standards are prepared for, and their use is mandatory by, fifth echelon Signal Repair Shops in the Continental United States, in determining the quality and acceptability of repaired signal equipments.

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SPECIFIC STANDARD
FOR
OSCILLOSCOPE AN/USM-32

I. STATEMENT COVERING APPLICABILITY

This Specific Standard covers inspection requirements to be used in determining the quality and acceptability of repaired Oscilloscope AN/USM-32.

II. APPLICABLE REFERENCES

A. Repair Standards: Applicable paragraphs of Signal Corps Repair Standard No. REP-1001, General Standards for Repaired Signal Equipment, form a part of this Standard.

B. Technical Publications: The following technical publication is applicable to this equipment:

| Title | Number | Date |
|------------------------|------------|-------------|
| Oscilloscope AN/USM-32 | TM 11-5123 | 7 Aug. 1956 |

C. Modification Work Orders: All applicable Modification Work Orders pertaining to this equipment shall be performed.

III. TEST AND ADDITIONAL EQUIPMENT

The following equipments, or suitable equivalents, will be employed in determining compliance with the requirements of this Specific Standard.

| A. <u>Test Equipment</u> | <u>Stock Number</u> | <u>Quan.</u> | <u>REP</u> |
|--------------------------------------|---------------------|--------------|------------|
| Audio Oscillator TS-382/U | 6625-192-5094 | 1 | 185 |
| Frequency Meter AN/USM-26 | 6625-692-6553 | 1 | |
| Signal Generator SG-298/U | | 1 | |
| Multimeter, Meter ME-26/U | 6625-542-6407 | 1 | |
| R.F. Signal Gen- erator AN/URM-25 | 6625-309-5381 | 1 | 1283 |
| Voltmeter, Meter ME-30/U | 6625-669-0742 | 1 | 1117 |

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| Multimeter, Meter ME-26/U | 6625-542-6407 | 1 | |
| R.F. Signal Gen- erator AN/URM-25 | 6625-309-5381 | 1 | 1283 |
| Voltmeter, Meter ME-30/U | 6625-669-0742 | 1 | 1117 |

| <u>B. Additional Equipment</u> | <u>Stock Number</u> | <u>Quan.</u> | <u>REP</u> |
|--|---------------------|--------------|------------|
| Transformer, Variable Power CN-16/U | 5950-235-2086 | 1 | |

IV. REQUIREMENTS

A. General Test Conditions: All tests shall be conducted under the following conditions:

1. Input power to the equipment shall be 115 volts ac \pm 10%, single phase, 60 cycles.
2. All tests shall be performed at normal room temperature.
3. The equipment shall have a warm-up period of 15 minutes prior to performing checks.

B. Mechanical Requirements: Figure 1

| Control | Position |
|---------------|--|
| 1. Brightness | Counterclockwise shall diminish brilliance. Clockwise shall increase brilliance. Full counterclockwise position position no trace shall be visible on the scope. |
| 2. Focus | When rotated either direction, focus shall be effected. |
| 3. Hor. Pos. | Position shall be capable of positioning trace 2-1/2 inches approx. in the horizontal plane with 2x expansion. |
| 4. Vert. Pos. | Rotation shall be capable of positioning trace 2-1/4 inches approx. in the vertical plane. |

C. Electrical Requirements:

1. Vertical Input Test Figure 2

- a. Frequency Response
OS-34/USM-32

| Control | Position |
|------------------|--|
| Vert. Direct-Amp | AMP |
| Volts per Inch | 3 |
| Vert. Gain | Clockwise, full |
| All Others | Adjust to obtain a centered trace on screen. |

The overall frequency response of the vertical channel shall be within -2 db from 10 cps to 4 mc.

(1) High Frequency Response Figure 3

AN/URM-25

| Control | Position |
|--------------|--------------|
| Freq. Ban | 300 - 950 kc |
| Select Freq. | 500 kc |

ME-30/U

Voltage Selector As required.

Adjust and maintain the signal level to give measurable deflection (i.e. one inch) on the oscilloscope.

Increase the frequency slowly until the deflection on the oscilloscope is reduced to eight-tenths (.8) of the original deflection.

This is the upper frequency limit of the vertical amplifier where the response is down approximately 2 db.

The frequency shall be 4 megacycles.

During the frequency sweep, the deflection shall rise not more than one tenth (.1) of the original deflection.

(2) Low Frequency Response Figure 2

AN/URM-25

Control

Position

Freq. Ban

300 - 950 kc

ME-30/U

Voltage Selector - As required.

Adjust and maintain the signal level to give a measureable deflection (i.e. one inch) on the oscilloscope.

Decrease the frequency slowly until the deflection on the oscilloscope is reduced to eight tenths (.8) of the original deflection.

Use the AN/URM-25 for signals above 50 kc.
Use the TS-382/U for signals below 50 kc to 20 cycles.
Use the SG-298/U for signals below 20 cycles.

The lower frequency limit of the vertical amplifier where the response is down approximately 2 db.

The frequency shall not be more than one-tenth (.1) of the original deflection.

b. Sensitivity

The sensitivity of minimum attenuation (Volts per inch at .3) and maximum gain (VERT GAIN full clockwise) shall be .1 or less volts rms per inch (.28 volts P-P) using the ME-30/U.

c. Gain Control Check

Set the VOLTS PER INCH at .3 and the VERT GAIN full clockwise position.

Apply to the VERT SIG terminal a 1000 cycle signal of amplitude for one-fourth inch vertical deflection.

Without changing the level of the signal source, switch the VOLTS PER INCH to 1. and set VERT GAIN to full clockwise position.

The deflection on the oscilloscope screen shall be greater than that originally obtained in the .3 VOLTS PER INCH to assure adequate gain control coverage.

2. Sweep

a. Sweep Range

Connect the output of Audio Oscillator TS-382/U in parallel with Frequency Meter AN/USM-26 to the VERT SIG terminal.

(1) Set the SWEEP TIME (COARSE) to 20-10 and the SWEEP TIME (FINE) to full clockwise. Adjust the output frequency (approximately 100 kc) so that a single cycle is present on the oscilloscope screen. The Frequency Meter AN/USM-26 should indicate 100 kc, which is equal to 10 microseconds.

(2) SWEEP TIME (COARSE) remains at 20-10 and the SWEEP TIME (FINE) is set to full counterclockwise. Repeat the above test. The frequency meter should indicate 50 kc which is equal to 20 microseconds.

(3) Repeat the test for each SWEEP TIME (COARSE) position and at full clockwise and full counterclockwise position of SWEEP TIME (FINE) control. The sweep range shall be continuously variable from time duration of 10 to 200,000 microseconds (100 kc to 5 cycles per second).

b. Sweep Linearity

The sweep nonlinearity shall not exceed 10 percent for any sweep rate of 80 microseconds per inch or slower (5 cycles to 12,500 cycles). Faster sweeps shall have a nonlinearity of 20 percent or less (12.5 kc to 100 kc). The measurement of this nonlinearity shall be made by comparing the time representing any one-half inch of a 2-1/2 inch trace with the center one-half inch, when the duty cycle is 50 percent or less.

(1) Connect the output of R.F. Signal Generator AN/URM-25 to the VERT SIG terminal. Set the SWEEP TIME (COARSE) to 20-10 and SWEEP TIME (FINE) to full clockwise position. Adjust AN/URM-25 (approximately one megacycle) to produce 10 full cycles along a 2-1/2 inch sweep. Each full cycle should coincide with 1/4 inch of horizontal graticule within the above tolerance.

(2) Repeat the above using Audio Oscillator TS-382/U. Set SWEEP TIME (COARSE) to 200k - 20k and SWEEP TIME (FINE) to full counterclockwise position. Adjust TS-382/U (approximately 50 cycles) to produce 10 full cycles along a 2-1/2 inch sweep. Each full cycle should coincide with 1/4 inch of horizontal graticule within the above tolerance.

3. Trigger

a. Repetition Range: The trigger repetition range shall extend nominally from 40 to 6,000 cycles per second. The minimum range shall be from 45 to 5,500 cycles per second.

b. Amplitude: The amplitude shall be 100 volts p-p P/M 30 percent. When terminated into 5,000 ohms shunted by 1,500 micromicrofarads. The amplitude shall be 25 volts p-p, P/M 30 percent, when terminated into 75 ohms.

4. Synchronization

Synchronization shall be possible by the following sources of signals.

a. Line, of either polarity.

b. Internal from vertical amplifier of either polarity. Vertical presentation having a peak-to-peak amplitude of one half inch or more shall provide satisfactory operation.

c. Trigger, internal, of positive polarity only.

d. External, signal applied to SYNC IN terminal.

(1) Signals below 50 cycles shall trigger sweep with .8 volts p-p, when the rise time of the applied signal is equal to or less than that of a 5 cycles sine wave.

(2) Signals from 50 cycles to 200 kc shall trigger sweep with .2 volts p-p.

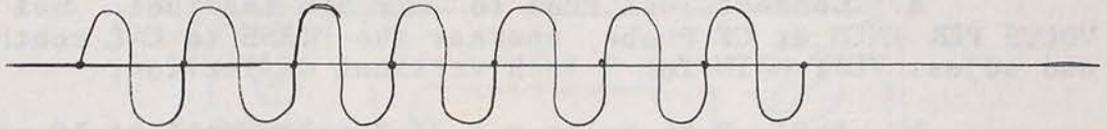
(3) Signals from 200 kc to 2 mc shall trigger sweep with .8 volts p-p.

5. Marker Generator

a. Time Intervals: The marker generator shall be capable of supplying timing markers, synchronized with the sweep to the cathode ray tube at intervals of 1, 10, 100, 1000 and 10,000 microseconds, within P/M 5 percent.

(1) Connect R.F. Signal Generator AN/URM-25 to VERT SIG terminal. Also connect Frequency Meter AN/USM-26 in parallel with the AN/URM-25 output. Set Synchronization selectro to + V. with AN/URM-25 set to approximately one megacycle. Set SWEEP TIME (COARSE) to 20-10, and adjust the SWEEP TIME (FINE) control so that 8 or 10 markers are present

on the sweep trace. Adjust the frequency control of the signal generator so that markers appear at the beginning of each full cycle. (Markers will be a blanking of the trace).



When the above condition is achieved, the electronic counter should indicate one megacycle, p/m 5 percent.

(2) Repeat the above with MARKER INTERVAL set at 10. The Frequency Meter AN/USM-26, should indicate 100 kc p/m 5 percent.

(3) Repeat the above with MARKER INTERVAL set at 100. An Audio Oscillator TS-382/U is used in place of R.F. Signal Generator AN/URM-25. The Frequency Meter AN/USM-26 should indicate 10 kc, p/m 5 percent.

(4) Repeat the above with MARKER INTERVAL set at 1 kc. The AN/USM-26 should indicate 1 kc, p/m 5 percent.

(5) Repeat the above with MARKER INTERVAL set at 10 kc. The AN/USM-26 should indicate 100 cycles per second, p/m 5 percent.

b. Output Voltage

Measured at the MARK OUT Z IN, the voltage shall be not less than:

- (1) One volt at one microsecond marker interval.
- (2) 3 volts at 10 microsecond marker interval.
- (3) 15 volts at 100 microsecond marker interval.
- (4) 20 volts at 1000 microsecond marker interval.
- (5) 25 volts at 10,000 microsecond marker interval.

6. Calibrated Voltage

a. The PRESS to CAL control shall provide 2 inches of vertical deflection near maximum clockwise position of VERT GAIN control.

b. The CAL OUT terminal shall provide .6 volts peak to peak, p/m 5 percent.

7. Test Prod (Cathode follower) MX-1609/USM-32.

a. Connect Test Prod to VERT SIG terminal. Set VOLTS PER INCH at CF Probe, operate the PRESS to CAL control and adjust VERT GAIN for 2 inch vertical deflection.

b. Apply 2.86 volts p-p (1.3 volts rms) at 10 cps, 1 mc (measure with ME-30/U) and 7 mc (measure with ME-26/U) to probe tip 2 inches vertical deflection ± 2 db (.4 inch) should be indicated on the oscilloscope screen.

8. Test Prod (Attenuator) MX-1610/USM-32

a. Connect test prod to VERT SIG terminal. Set VOLTS PER INCH at 1. Operate the PRESS to CAL control and adjust VERT GAIN for 2 inches of vertical deflection.

b. Apply 28.28 volts p-p (10 volts rms) at 1 kc to probe tip. 1.4 inch vertical deflection should be indicated on the oscilloscope screen p/m 0.1 in.

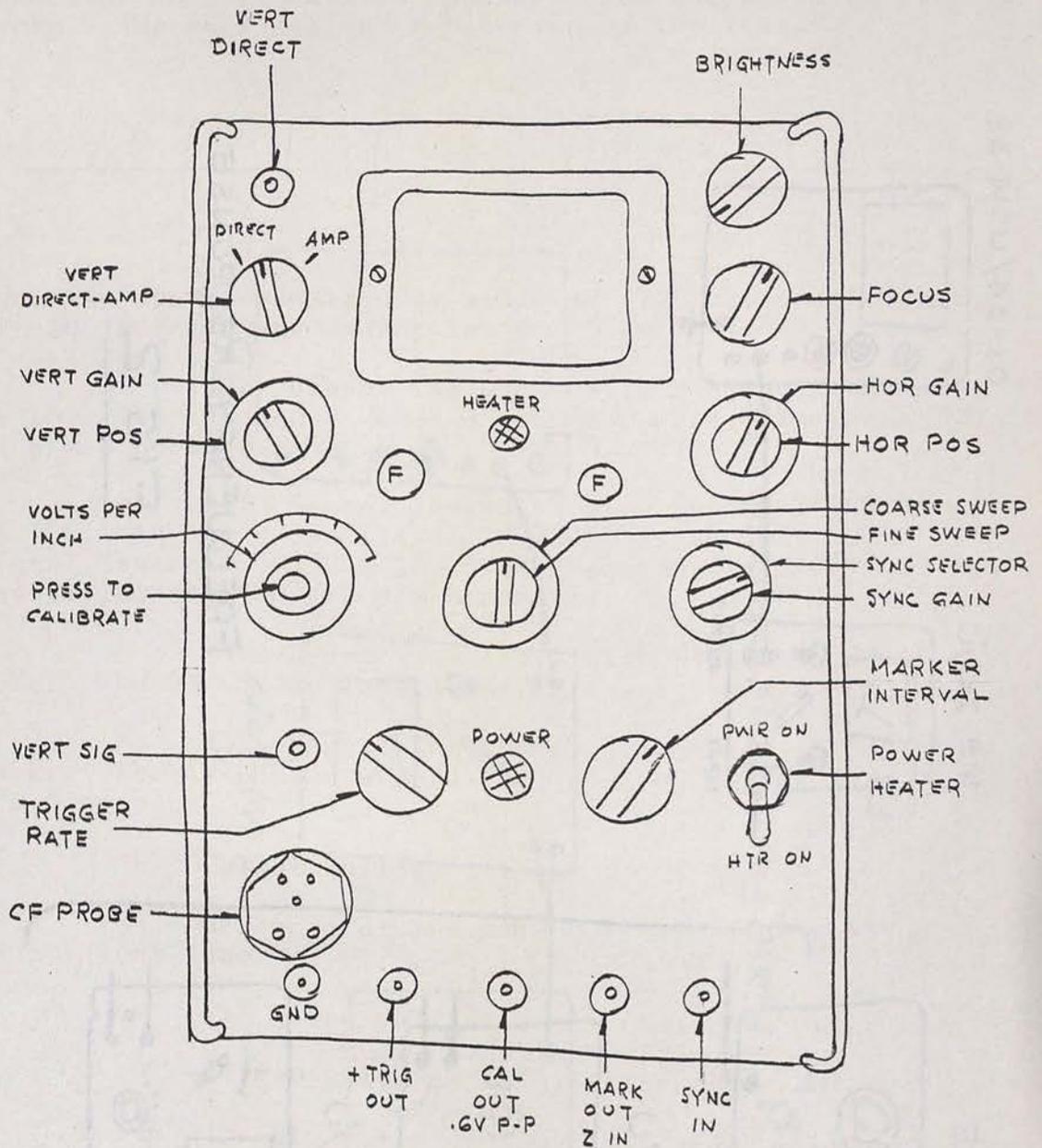
9. Test Prod (Detector) MX-1604/USM-32

a. Connect test prod to VERT terminal. Set VOLTS PER INCH at 1. Operate the PRESS To CAL control and adjust VERT GAIN for 2 inch vertical deflection.

b. Apply 10 mc signal of 2.828 volts p-p (1 volt rms) of high impedance with 50 percent modulation at 1000 cps to the probe tip. .7 inch vertical deflection should be indicated on the oscilloscope screen, p/m 25 percent.

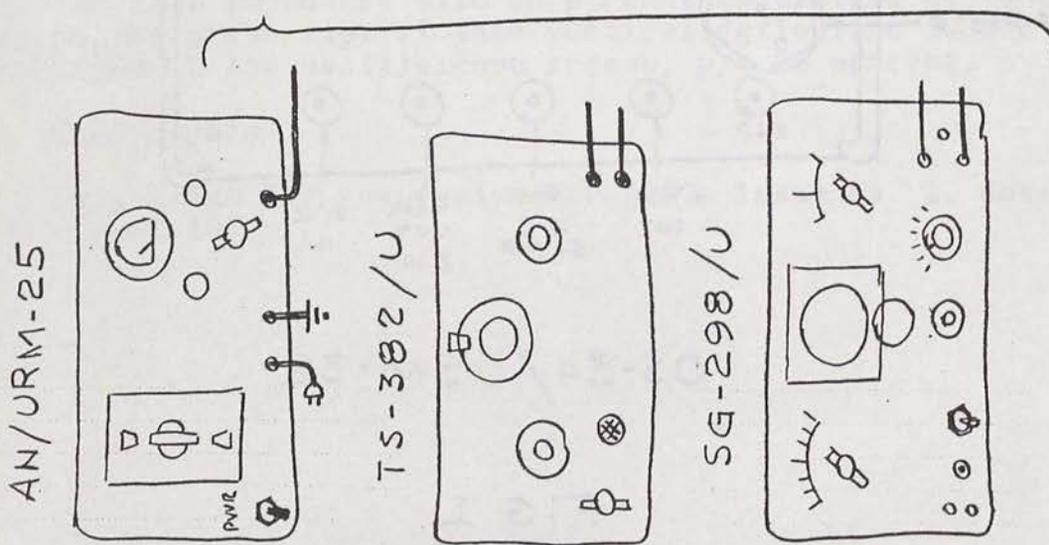
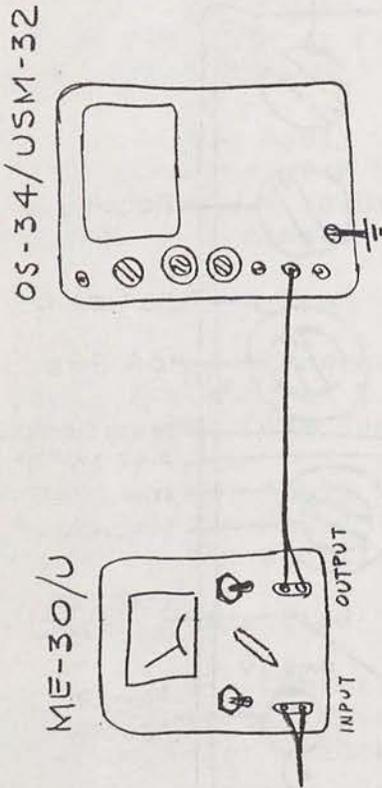
V. Supersedure

This issue REP supersedes REP-1287, Issue No. 1, dated 3 November 1959.



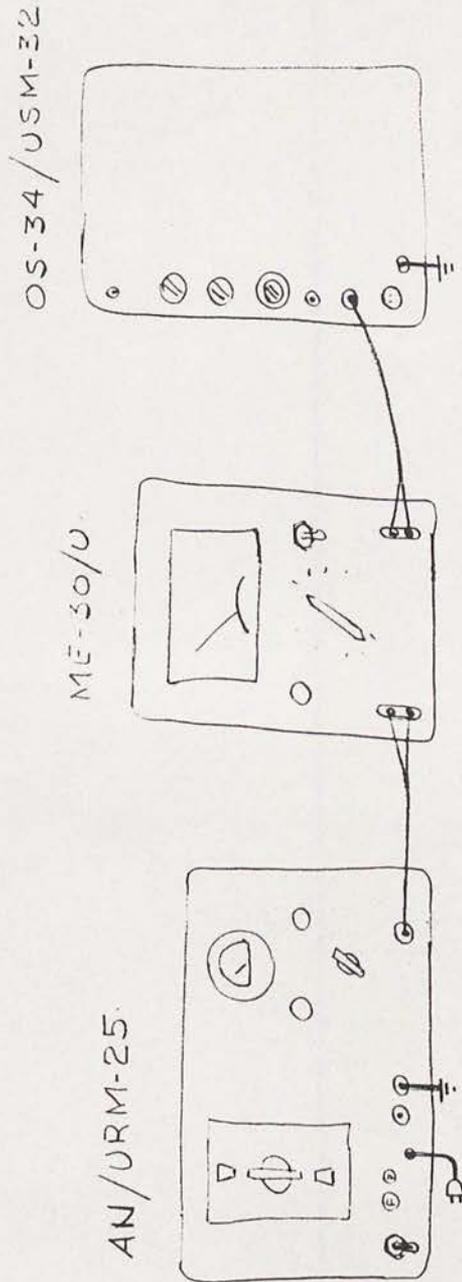
OS-34/USM-32

FIG 1



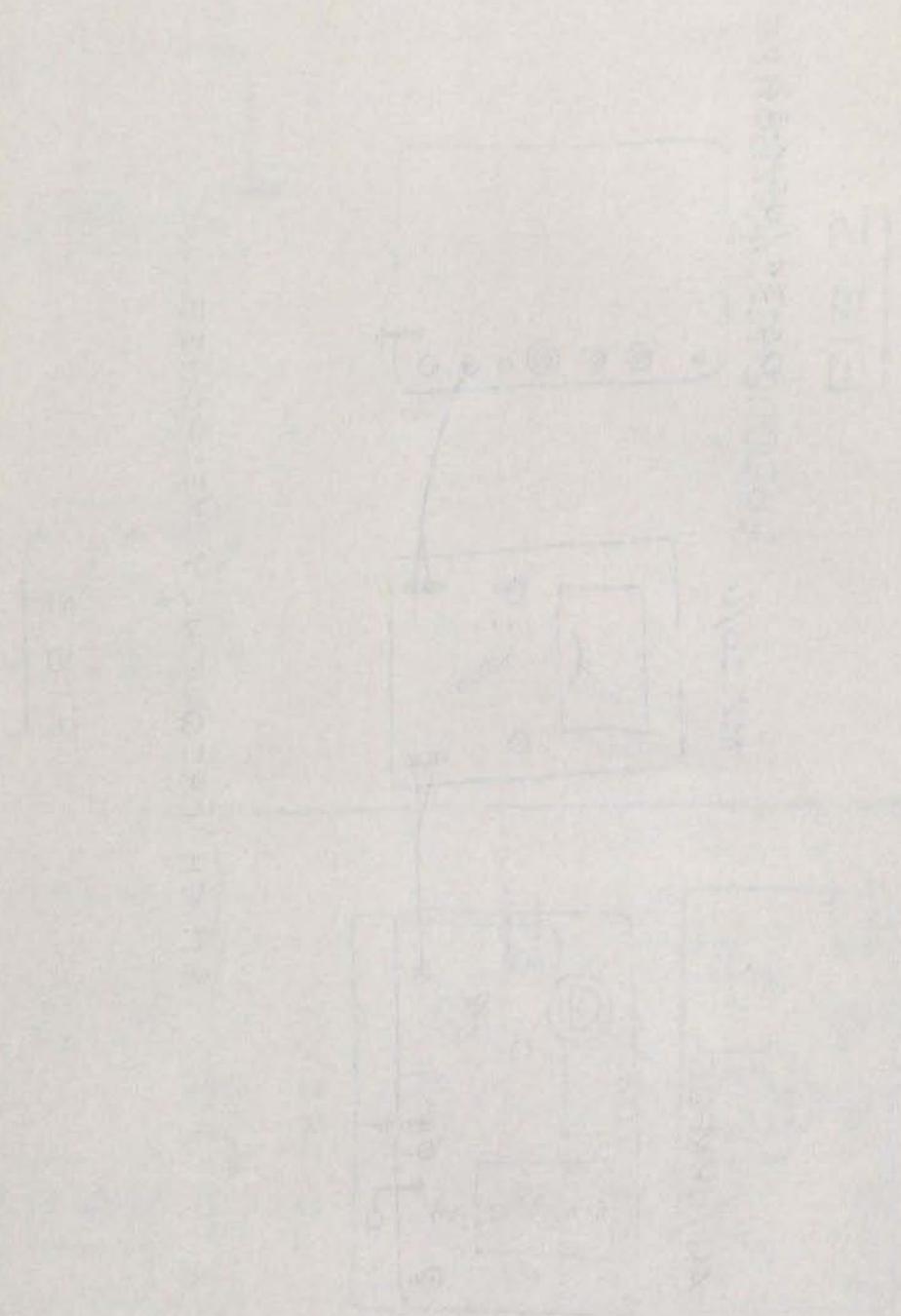
FREQUENCY RESPONSE

FIG. 2



HIGH FREQUENCY RESPONSE

FIG. 3



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1. Page 1, paragraph III.A, delete "Audio Oscillator TS-382/U, 6625-192-5094" and substitute "Audio Oscillator TS-421/U, 6625-669-0228."
2. Page 3, paragraph IV.C.1.a. Change Volts per inch "3" to read "0.3."
3. Page 4, third paragraph. Change 1st line to read "Use the AN/URM-25 for signals above 20 kc," second line "Use the TS-421/U for signals below 20 kc to 20 cycles."
4. Item 4 of Amendment 1, paragraph IV.C.1. Delete and substitute the following:

d. ATTENUATOR CHECK

Calibrate the oscilloscope by applying 0.3v p-p, 1000 cycle signal (0.106v rms) and adjust the VERT GAIN control for one inch deflection (10 divisions equal 1 inch). Without further adjustment of the VERT GAIN control, the VOLTS PER INCH attenuator shall meet the following requirements:

| <u>VOLTS PER INCH CONTROL SETTING</u> | <u>INPUT</u> | <u>MEASURE</u> |
|---|------------------------|--|
| 0.3 | 0.3v p-p (0.106v rms) | 1" deflection (calibration) |
| 1 | 1.0v p-p (0.354v rms) | 1" deflection \pm 5% (10 div \pm 0.5 div) |
| 3 | 3.0v p-p (1.06v rms) | 1" deflection \pm 5% (10 div \pm 0.5 div) |
| 10 | 10.0v p-p (3.54v rms) | 1" deflection \pm 5% (10 div \pm 0.5 div) |
| 30 | 30.0v p-p (10.6v rms) | 1" deflection \pm 5% (10 div \pm 0.5 div) |
| 100 | 100.0v p-p (35.4v rms) | 1" deflection \pm 5% (10 div \pm 0.5 div) |

5. Page 5, paragraph IV.C.2.a. Change to read "output of the appropriate generator or oscillator in parallel"

6. Page 5, paragraph IV.C.2.b(2). Change to read "TS-421/U" vice "TS-382/U" (in two (2) places).

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7. Page 7, paragraph IV.C.5.a.(3). Change to read "TS-421/U" vice "TS-382/U."

8. Page 8, paragraph IV.C.7.a. and b. Delete and substitute:

Calibrate the oscilloscope by applying 0.212v rms (0.6v p-p) at 10 cps to VERT SIG input and adjusting the VERT GAIN control for 2" deflection (20 divisions). Set the selector switch to CF PROBE position and feed 0.212v rms to the probe. The loss in the probe shall not exceed 35% (a decrease in vertical deflection of not more than seven (7) divisions from the 20 divisor reference). Repeat the calibration procedure and probe-loss check at 1mc and at 4mc.

9. Page 8, paragraph IV.C.8. heading. Add "20:1 and MX-1610A/USM-32 (10:1)."

10. Page 8, paragraph IV.C.8.b., line 2. After "probe tip" add "of plain model test prod, or 14.14v p-p (5.0v rms) to probe tip of "A" model test prod."

11. Page 10, figure 2. Change "TS-382/U" to read "TS-421/U."