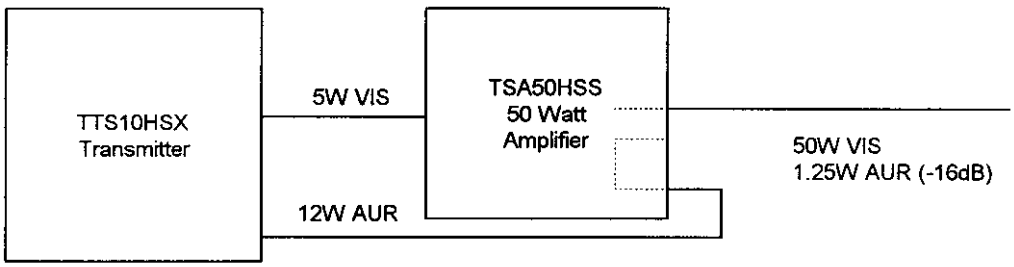
## 1.5 Certification of Data

Having performed the tests and compilation of information in this report, I certify that all statements and test results submitted for certification of the EMCEE Model TSA50HSS Amplifier are true and correct to the best of my knowledge.

Robert G. Nash
VP/Director of Engineering




TTS50HSS TRANSMITTER
Figure 1-1

# SECTION II
# TEST PROCEDURES AND DATA

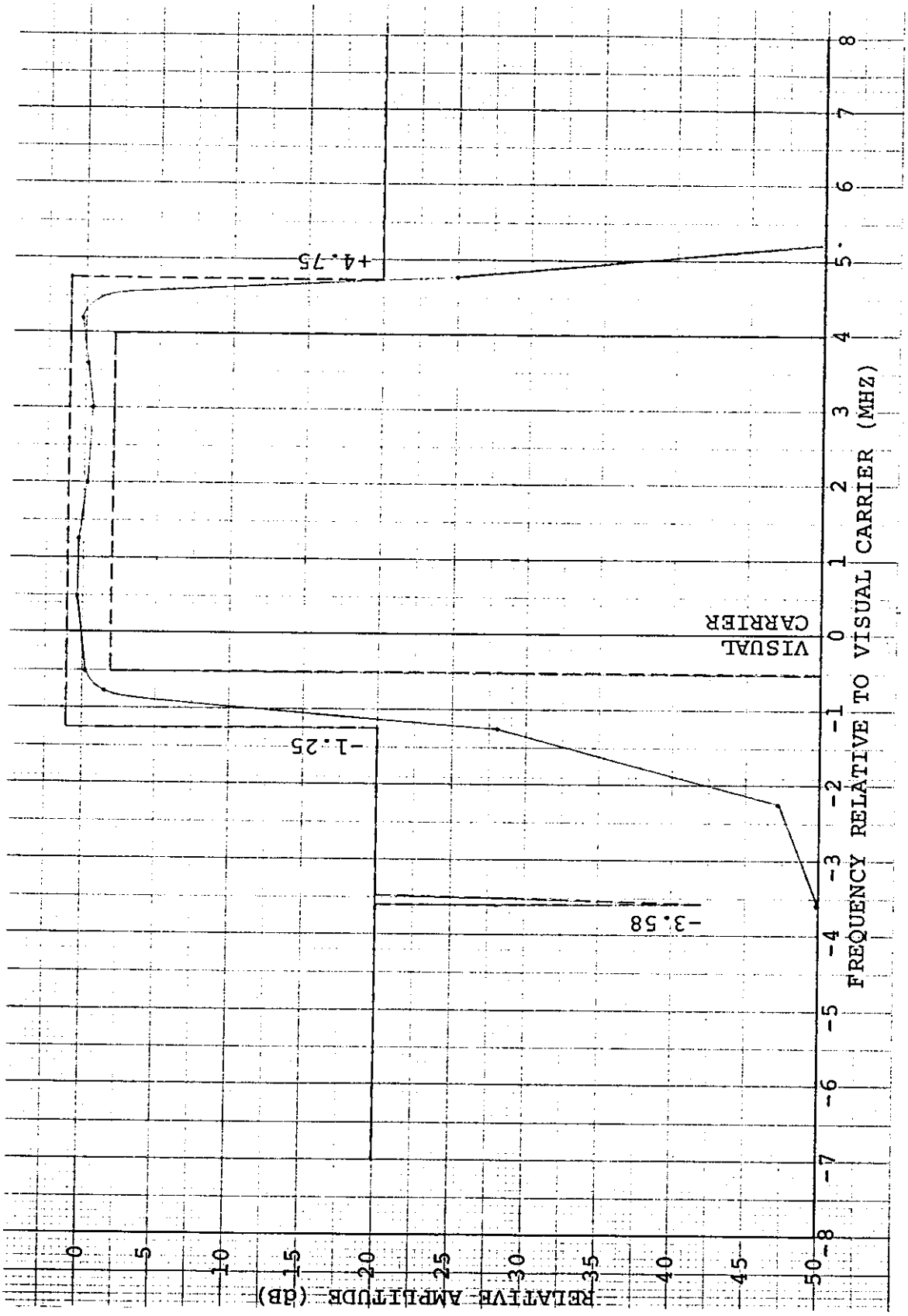
## 2.1 Frequency Response [21.908(b)/74.936(b)]

| | |
|---|---|
| Test Equipment Setup | Figure 2–1A |
| Visual Output Power | 50 watts peak sync |
| % Video Modulation | 87.5% |
| Type Video Modulation | Standard sync with a variable frequency sine wave occupying the interval between pulses. Sine-wave axis was maintained at 50% of the peak sync amplitude. Sine-wave amplitude was held constant at less than 75% of the peak output voltage. |
| Aural Output Power | 0 watts |
| Method of Measurement | Sine-wave frequency was varied through the video range. The data recorded was relative to the 200kHz sideband amplitude designated as 0dB. |

FREQUENCY RESPONSE DATA

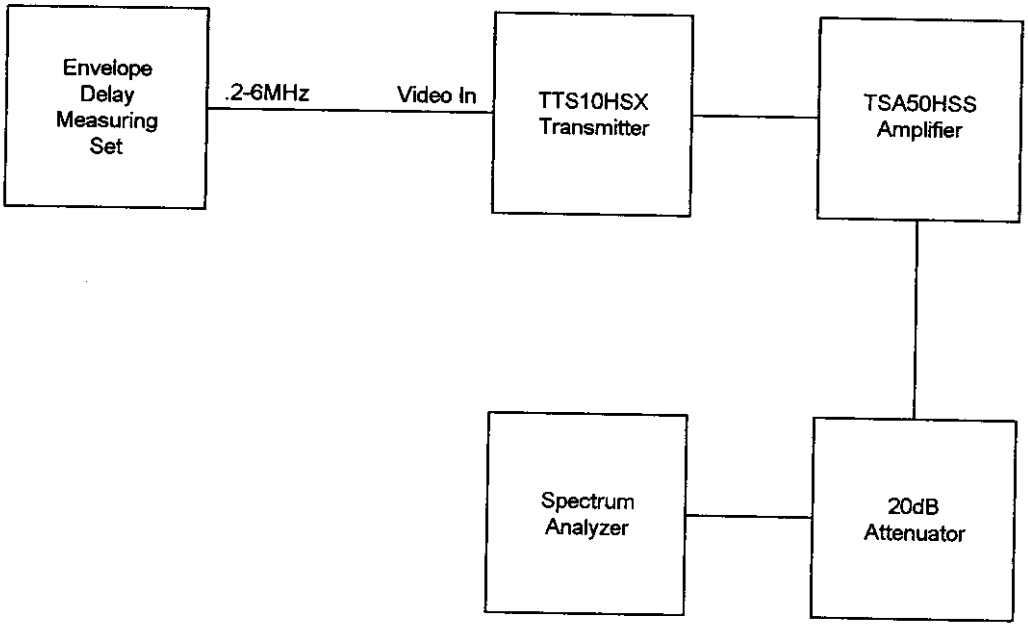
REFERENCE LEVEL: 0dB = 200kHz sideband amplitude

| OUTPUT FREQUENCY (MHz) CHANNEL E1 | SIDEBANDS | RELATIVE OUTPUT (dB) | RELATIVE TO PK VIS (dB) |
|---|---|---|---|
| 2592.50 | -4.75MHz | -60.0 | -76 |
| 2593.67 | -3.58MHz | -50.0 | -66 |
| 2595.00 | -2.25MHz | -47.0 | -63 |
| 2596.00 | -1.25MHz | -28.0 | -44 |
| 2596.50 | -750kHz | -1.5 | |
| 2596.75 | -500kHz | -0.2 | |
| 2597.25 | VISUAL CARRIER | | |
| 2597.45 | REFERENCE SIDEBAND | 0 | -16 |
| 2597.75 | +500kHz | +0.4 | |
| 2598.50 | +1.25MHz | +0.2 | |
| 2599.25 | +2.0MHz | -0.1 | |
| 2600.25 | +3.0MHz | -0.3 | |
| 2600.83 | +3.58MHz | -0.2 | |
| 2601.43 | +4.18MHz | +0.2 | |
| 2602.00 | +4.75MHz | -25.0 | -41 |
| 2602.50 | +5.25MHz | -51.0 | -67 |




AMPLITUDE VS. FREQUENCY CHARACTERISTICS

Figure 2–1



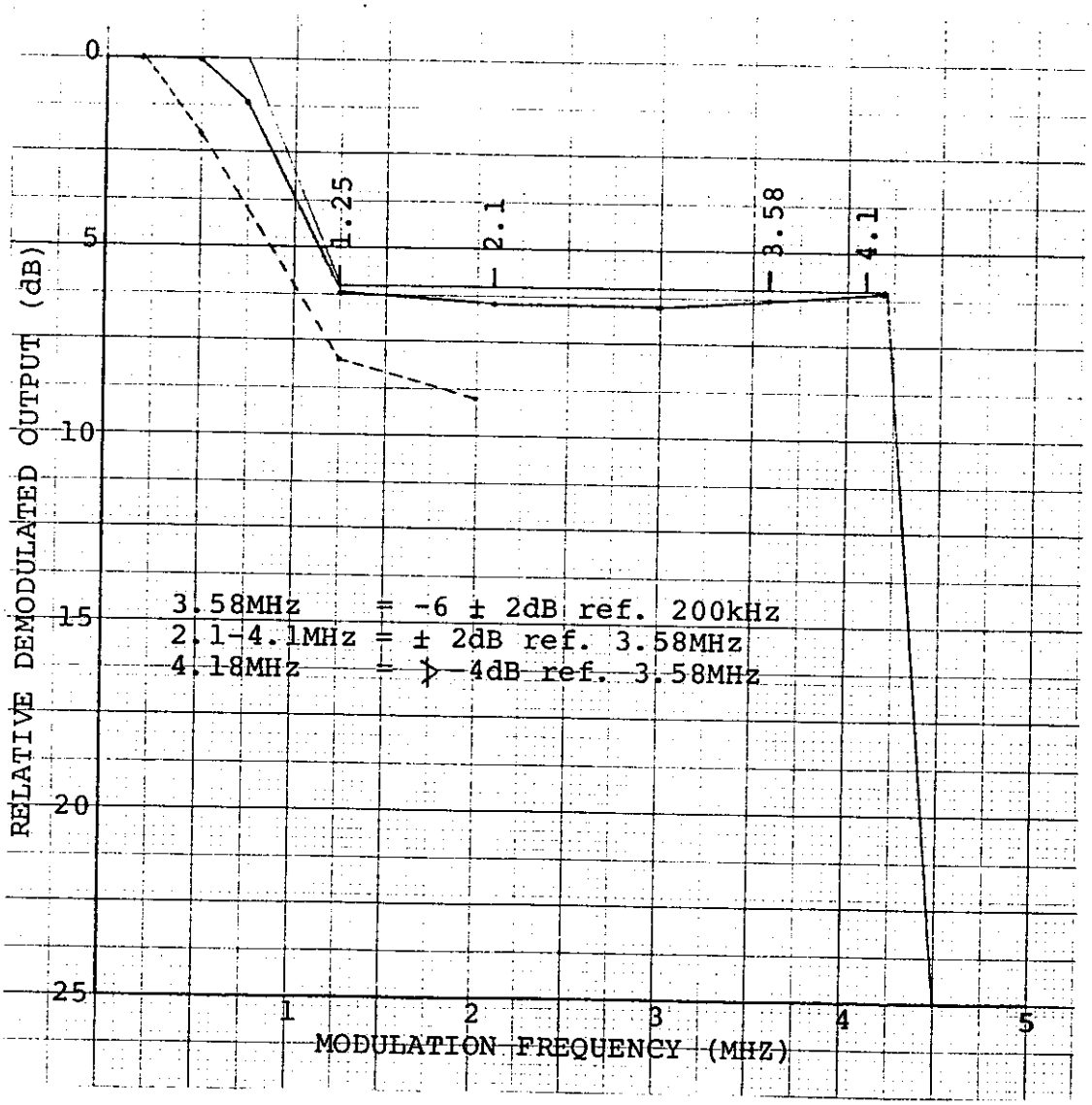

FREQUENCY RESPONSE TEST SETUP
Figure 2-1A

## 2.2 Attenuation Characteristics [73.687(a)(2)]

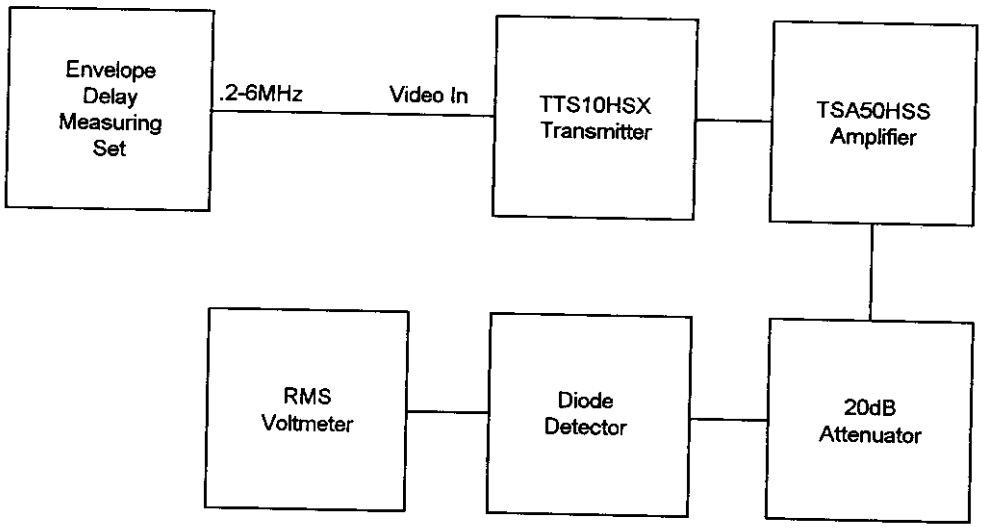
| | |
|---|---|
| Test Equipment Setup | Figure 2–2A |
| Visual Output Power | 50 watts peak |
| % Video Modulation | 87.5% |
| Type Video Modulation | Standard sync with a variable frequency sine wave occupying the interval between pulses. Sine-wave axis was maintained at 50% of the peak sync amplitude. Sine-wave amplitude was held constant at less than 75% of the peak output voltage. |
| Aural Output Power | 0 watts |
| Method of Measurement | Sine-wave frequency was varied through the video range. The data recorded was relative to the 200kHz sideband amplitude designated as 0dB. |

ATTENUATION CHARACTERISTICS DATA

| MODULATION FREQ. (MHz) | RECTIFIED OUTPUT (dB) |
|---|---|
| 0.20 | 0 |
| 0.50 | 0 |
| 0.75 | -1.2 |
| 1.25 | -6.2 |
| 2.10 | -6.4 |
| 3.00 | -6.5 |
| 3.58 | -6.3 |
| 4.18 | -6.1 |




ATTENUATION CHARACTERISTIC CURVE
Figure 2–2



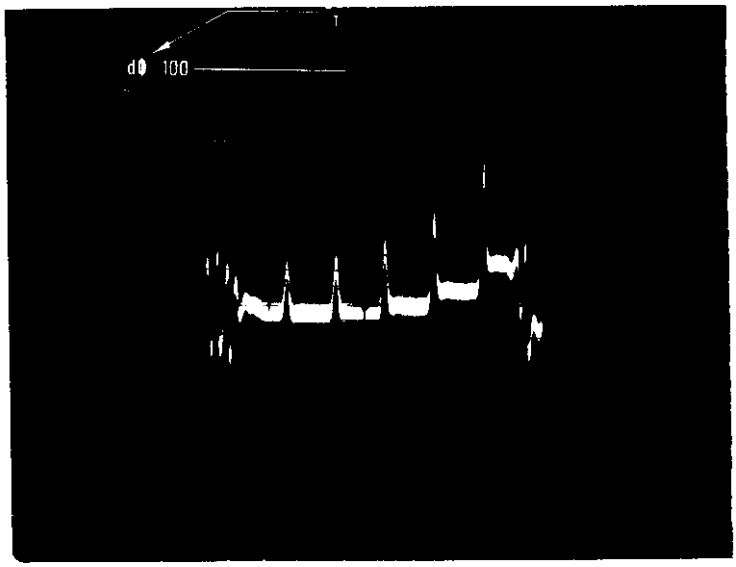

ATTENUATION CHARACTERISTICS TEST SETUP
Figure 2-2A

## 2.3 Differential Phase and Gain [73.682(a)(20)(vii)]

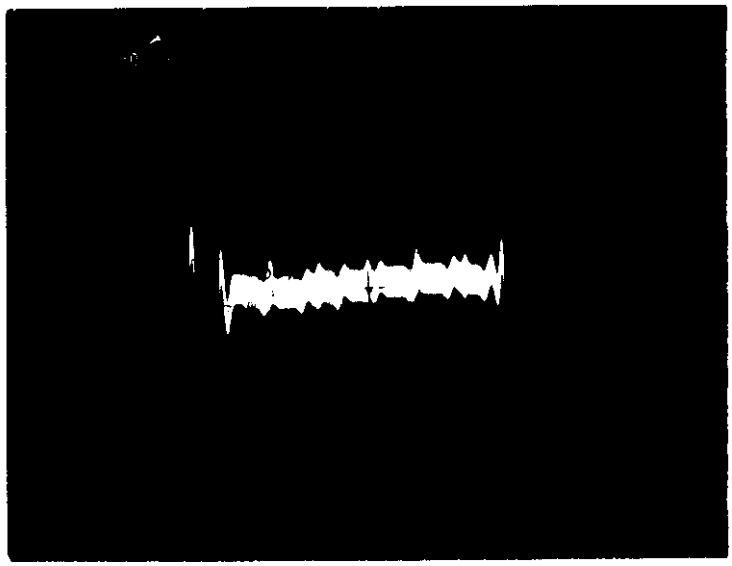
| | |
|---|---|
| Test Equipment Setup | Figure 2–3A |
| Visual Output Power | 50 watts peak |
| % Video Modulation | 87.5% |
| Type Video Modulation | Standard 5-riser stairstep modulated with 3.58MHz color subcarrier |
| Aural Output Power | 0 watts |
| % Aural Modulation | 0% |
| Method of Measurement | Data was taken from the demodulated output viewed on a waveform monitor after passing through an internal chroma filter. |

DIFFERENTIAL PHASE AND GAIN DATA

| | | |
|---|---|---|
| Differential Phase | = | 1.5° |
| Differential Gain | = | 0.5% |

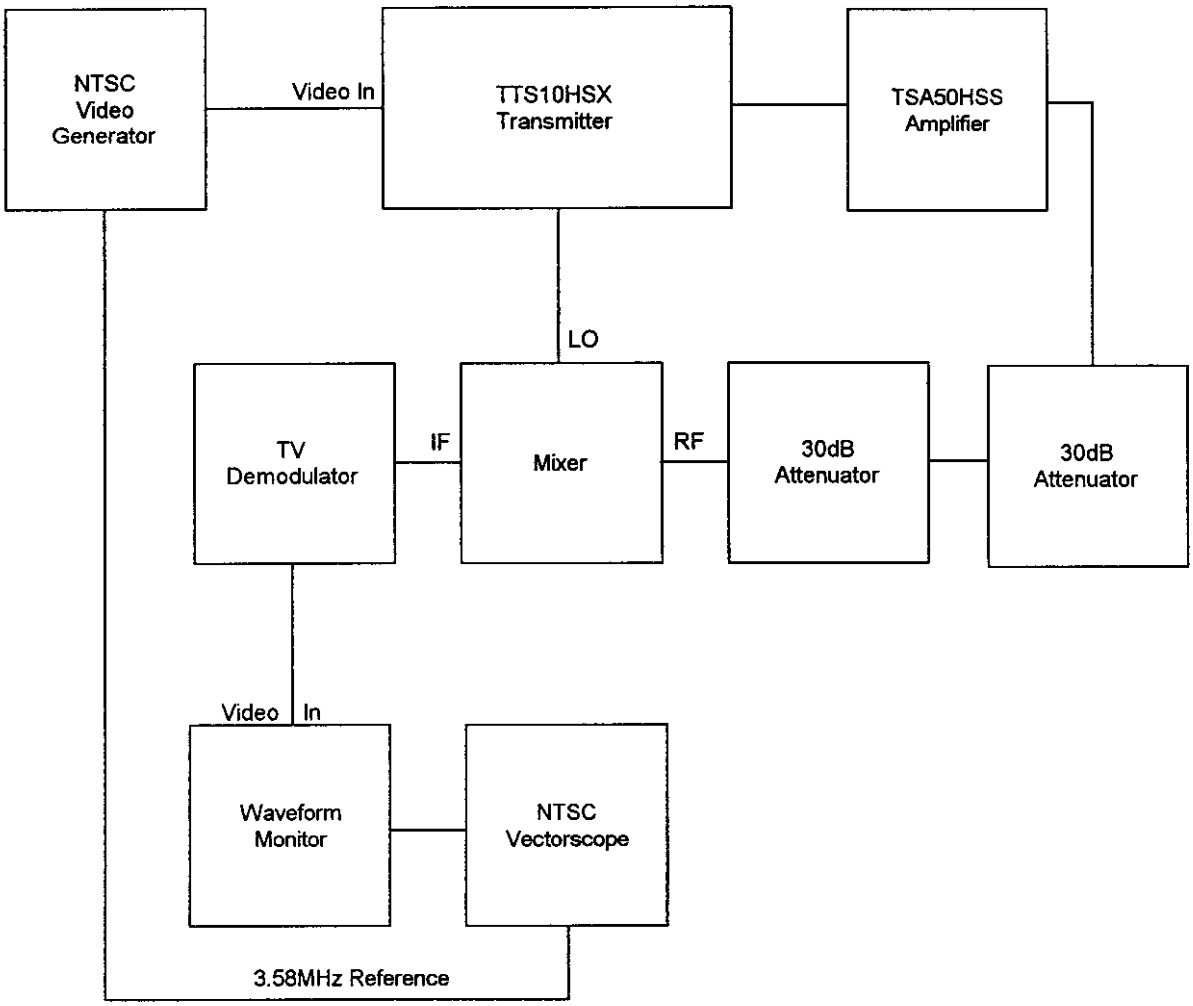



DIFFERENTIAL PHASE = 1.5°



DIFFERENTIAL GAIN = 0.5%

Figure 2–3



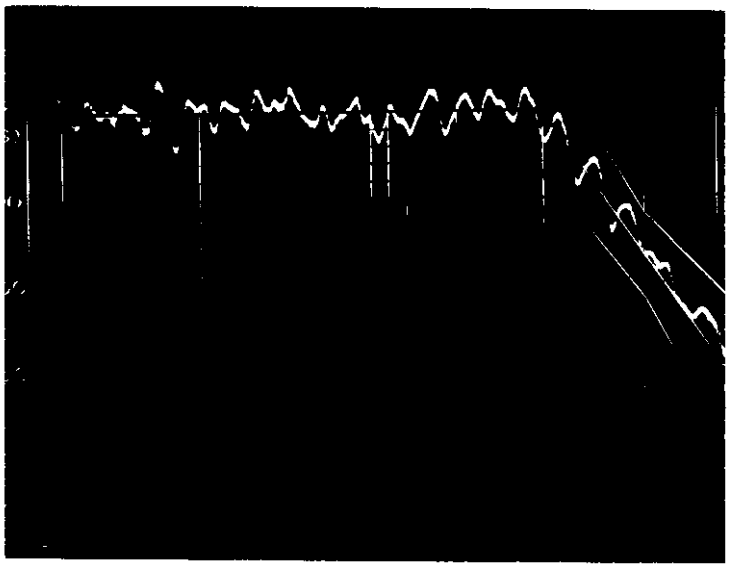

DIFFERENTIAL PHASE AND GAIN TEST SETUP
Figure 2-3A

## 2.4 Envelope Delay [73.687(a)(3)]

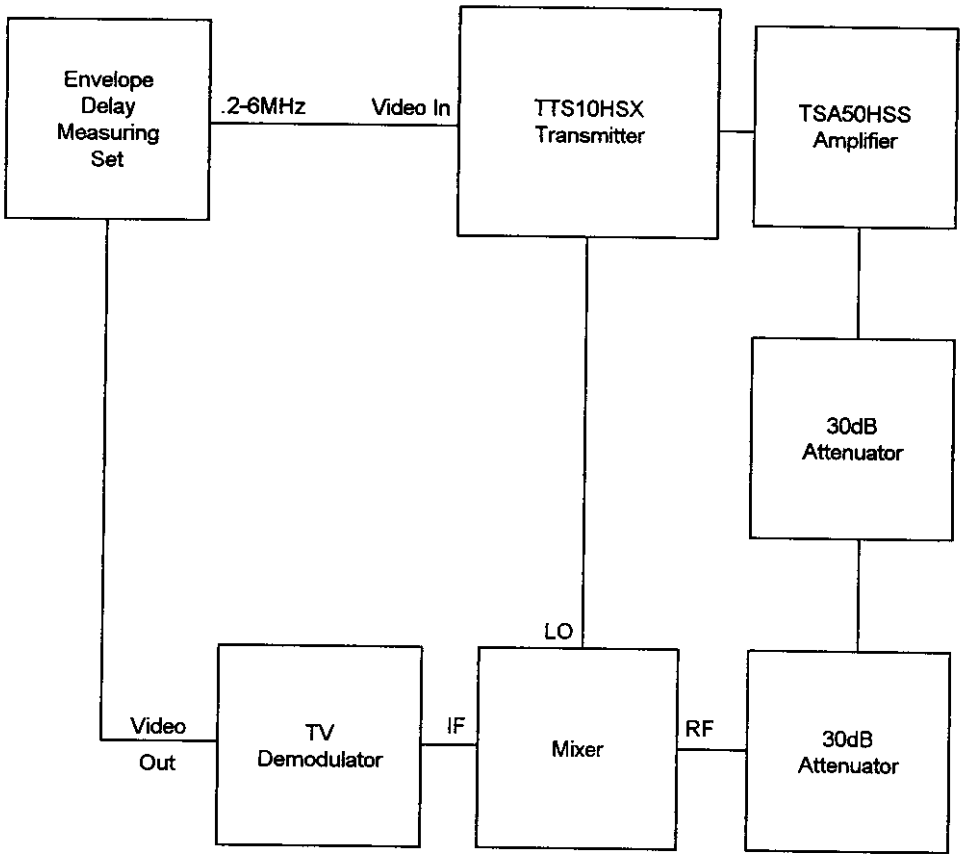
| | |
|---|---|
| Test Equipment Setup | Figure 2–4A |
| Visual Output Power | 50 watts peak |
| % Video Modulation | 87.5% |
| Type Video Modulation | A variable frequency constant amplitude sine-wave with a 200kHz reference signal provided by the envelope delay test equipment |
| Aural Output Power | 0 watts |
| Method of Measurement | The sine-wave was varied through the video range and the delay data was read from the CRT display of the Envelope Delay Measuring Set. |

ENVELOPE DELAY VERSUS FREQUENCY DATA

| FREQUENCY | ENVELOPE DELAY (ns) |
|---|---|
| 200kHz | 0 |
| 500kHz | -5 |
| 1.0MHz | +5 |
| 1.5MHz | +10 |
| 2.1MHz | 0 |
| 2.5MHz | +5 |
| 3.0MHz | -35 |
| 3.2MHz | -85 |
| 3.4MHz | -140 |
| 3.58MHz | -165 |
| 4.0MHz | -270 |
| 4.18MHz | -350 |



ENVELOPE DELAY
Figure 2–4



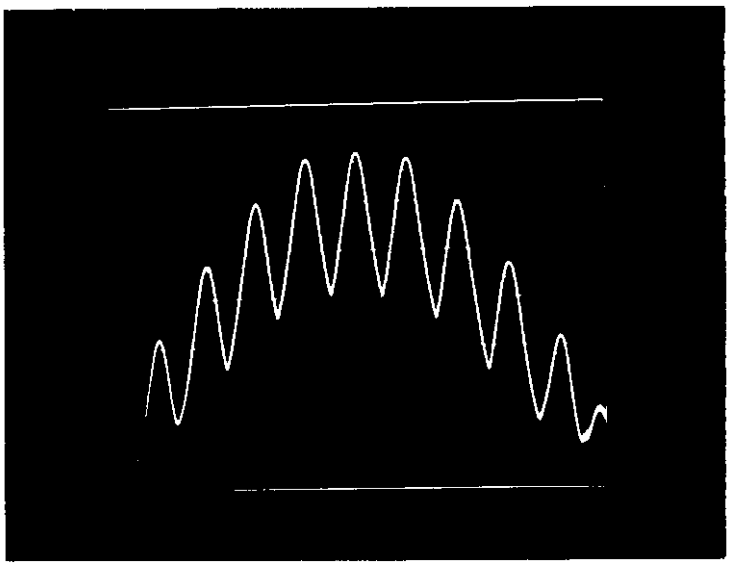

ENVELOPE DELAY TEST SETUP
Figure 2-4A

## 2.5 Aural Occupied Bandwidth [2.989(e)(6)]

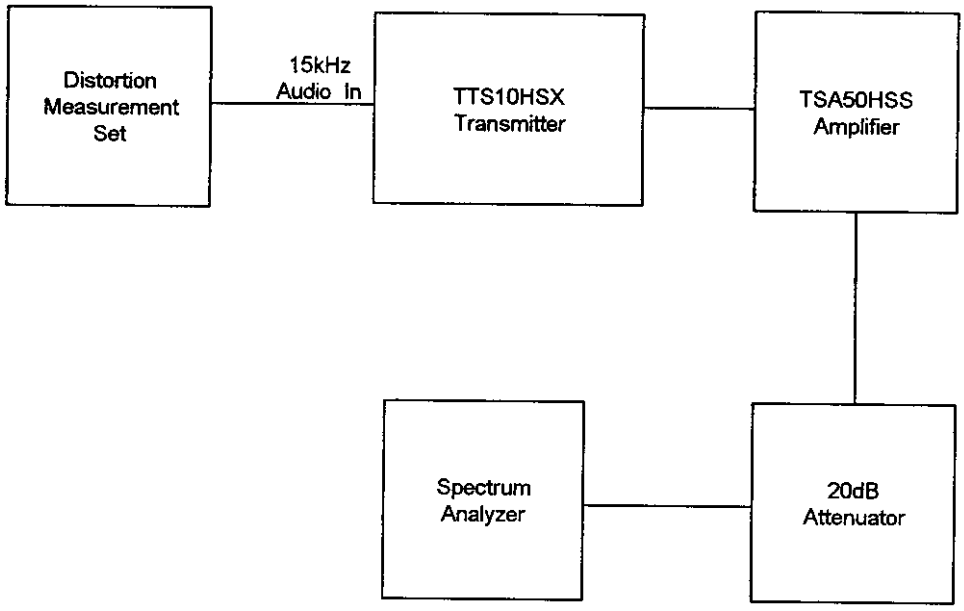
| | |
|---|---|
| Test Equipment Setup | Figure 2–5A |
| Visual Output Power | 50 watts peak |
| % Video Modulation | 0% |
| Aural Output Power | 1.25 watts average |
| % Aural Modulation | 85% (21.25kHz) |
| Aural Modulation Signal | 15kHz |
| Method of Measurement | Spectrum Analyzer was set at 3kHz resolution, 15kHz/division frequency span and 10ms/division sweep speed. Bandwidth was read at 0.5% (–23dB) of mean power. |

AURAL OCCUPIED BANDWIDTH DATA

Bandwidth ≈90kHz



AURAL OCCUPIED BANDWIDTH
Figure 2–5



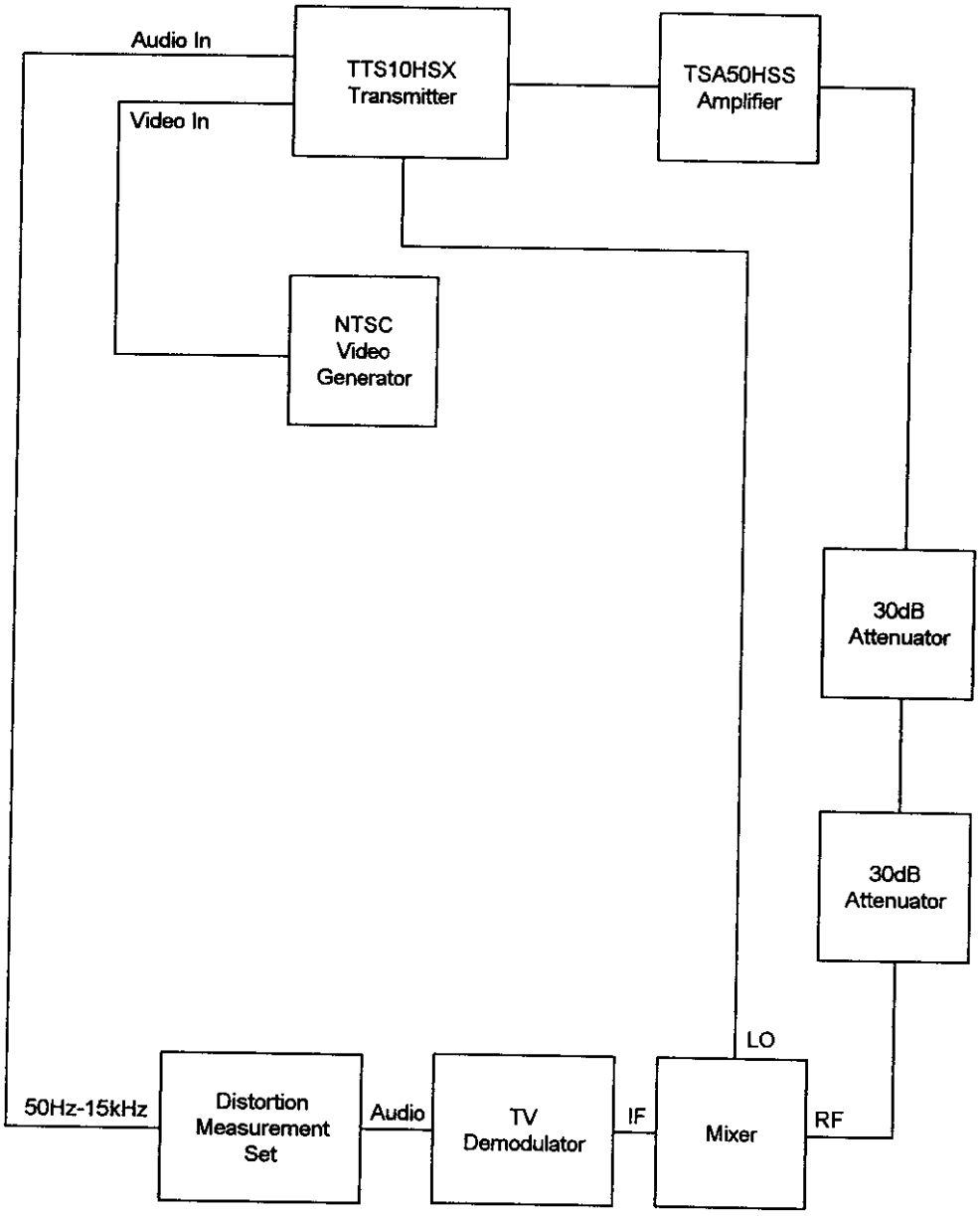

AURAL OCCUPIED BANDWIDTH TEST SETUP
Figure 2-5A

## 2.6 Aural Distortion

| | |
|---|---|
| Test Equipment Setup | Figure 2–6A |
| Visual Output Power | 50 watts peak sync |
| % Video Modulation | 87.5% |
| Type Video Modulation | Standard 10-riser stairstep |
| Aural Output Power | 1.25 watts average |
| % Aural Modulation | 100%, 50%, 25% |
| Aural Modulation Signal | Variable audio sine-wave from 50Hz to 15kHz |
| Method of Measurement | The aural modulation frequency was varied at three different % modulation levels and a distortion measurement was noted for each frequency-modulation combination. |

AURAL DISTORTION DATA

| FREQUENCY | % DISTORTION | | |
|---|---|---|---|
| Hz | 100% MOD | 50% MOD | 25% MOD |
| 50 | 0.41 | 0.44 | 0.45 |
| 100 | 0.33 | 0.35 | 0.38 |
| 400 | 0.33 | 0.30 | 0.30 |
| 1,000 | 0.25 | 0.32 | 0.35 |
| 5,000 | 0.23 | 0.29 | 0.31 |
| 7,500 | 0.21 | --- | --- |
| 10,000 | 0.26 | --- | --- |
| 15,000 | 0.34 | --- | --- |



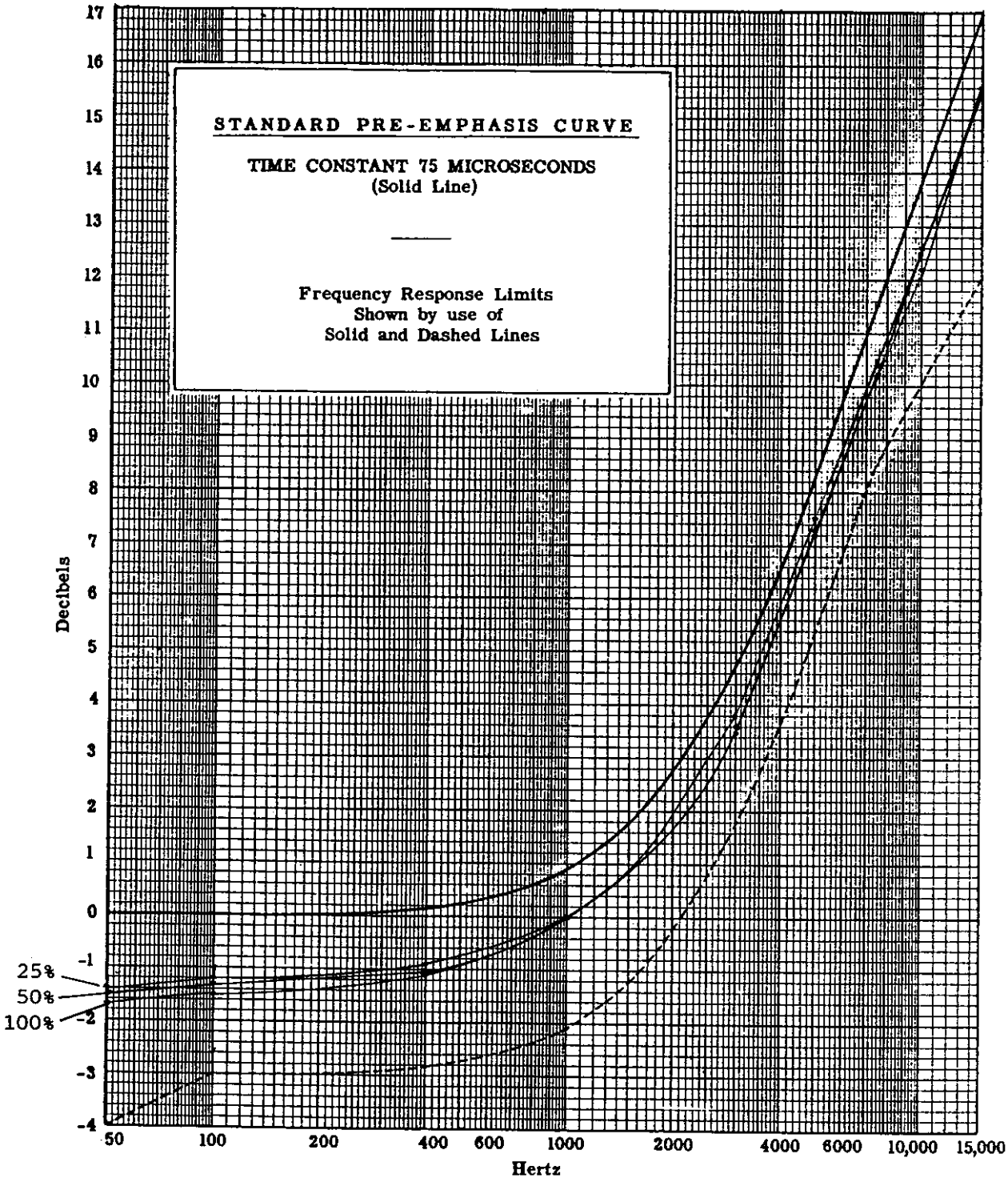

AURAL DISTORTION TEST SETUP
Figure 2-6A

## 2.7 Aural Frequency Response [73.687(b)(1)]

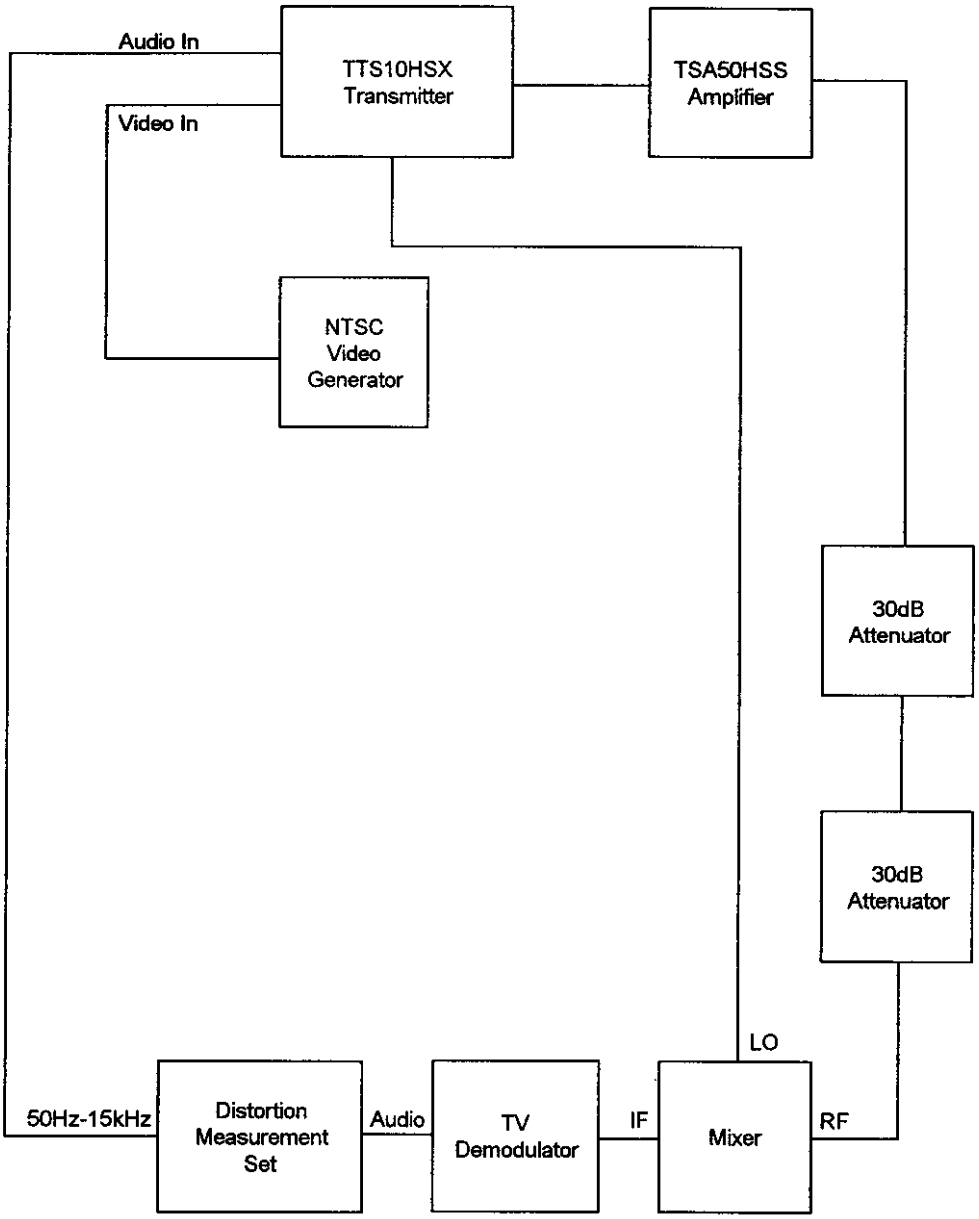
| | |
|---|---|
| Test Equipment Setup | Figure 2–7A |
| Visual Output Power | 50 watts peak sync |
| % Video Modulation | 87.5% |
| Type Video Modulation | Standard 10-riser stairstep |
| Aural Output Power | 1.25 watts average |
| % Aural Modulation | 100%, 50%, 25% |
| Aural Modulation Signal | 50 to 15,000Hz |
| Method of Measurement | The audio input was adjusted at each audio frequency to maintain a constant modulation level. Modulation input variations were plotted directly from the dB scale of the Distortion Test Set Meter. |

AURAL FREQUENCY RESPONSE DATA

| FREQUENCY | OUTPUT LEVEL RELATIVE TO 1000Hz (dB) | | |
|---|---|---|---|
| Hz | 100% MOD | 50% MOD | 25% MOD |
| 50 | -1.7 | -1.5 | -1.4 |
| 100 | -1.5 | -1.3 | -1.2 |
| 400 | -1.1 | -1.0 | -0.9 |
| 1000 | 0.0 | 0.0 | 0.0 |
| 3000 | +3.8 | +3.6 | +3.5 |
| 5000 | +7.5 | +7.3 | +7.2 |
| 7500 | +10.5 | +10.4 | +10.2 |
| 10000 | +12.6 | +12.5 | +12.3 |
| 15000 | +15.5 | +15.6 | +15.4 |




AURAL FREQUENCY RESPONSE
Figure 2–7




AURAL FREQUENCY TEST SETUP
Figure 2-7A

## 2.8 Amplitude Modulation Noise

| | |
|---|---|
| Test Equipment Setup | Figure 2–8A |
| Visual Output Power | 0 watts |
| Aural Output Power | 1.25 watts average |
| % Aural Modulation | 100% |
| Aural Modulation Signal | 400Hz |
| Method of Measurement | AC RMS and DC readings were taken to compute the signal to noise ratio shown below. An RC network was used with the RMS voltmeter to roll off noise above 15kHz. |

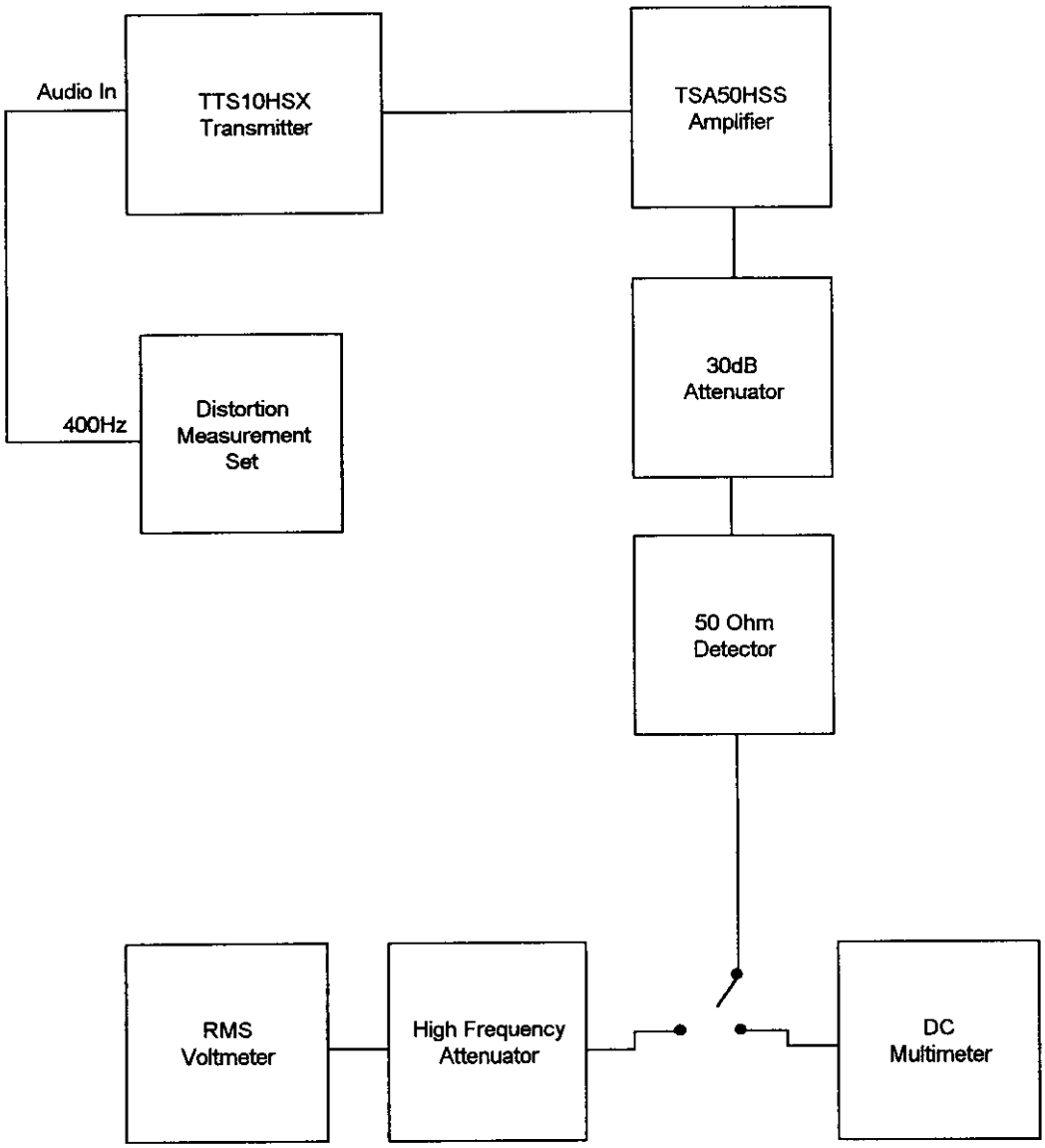
AM NOISE DATA

AC Output = 2.0mV

DC Output = 1.9V

$$\text{AM Noise} = 20 \log \frac{\text{AC Output}}{\text{DC Output}} = \frac{.0020V}{1.9V}$$

AM Noise = -59.5dB




AM NOISE TEST SETUP
Figure 2-8A

## 2.9 Frequency Modulation Noise

| | |
|---|---|
| Test Equipment Setup | Figure 2–9A |
| Visual Output Power | 0 watts |
| Aural Output Power | 1.25 watts average |
| % Aural Modulation | 100% and 0% |
| Aural Modulation Signal | 400Hz |
| Method of Measurement | With aural modulation applied, a reading was obtained from the Distortion Measurement Set RMS voltmeter. With modulation removed, a new reading was recorded. The signal to noise calculation was checked against the dB scale of the RMS voltmeter. |

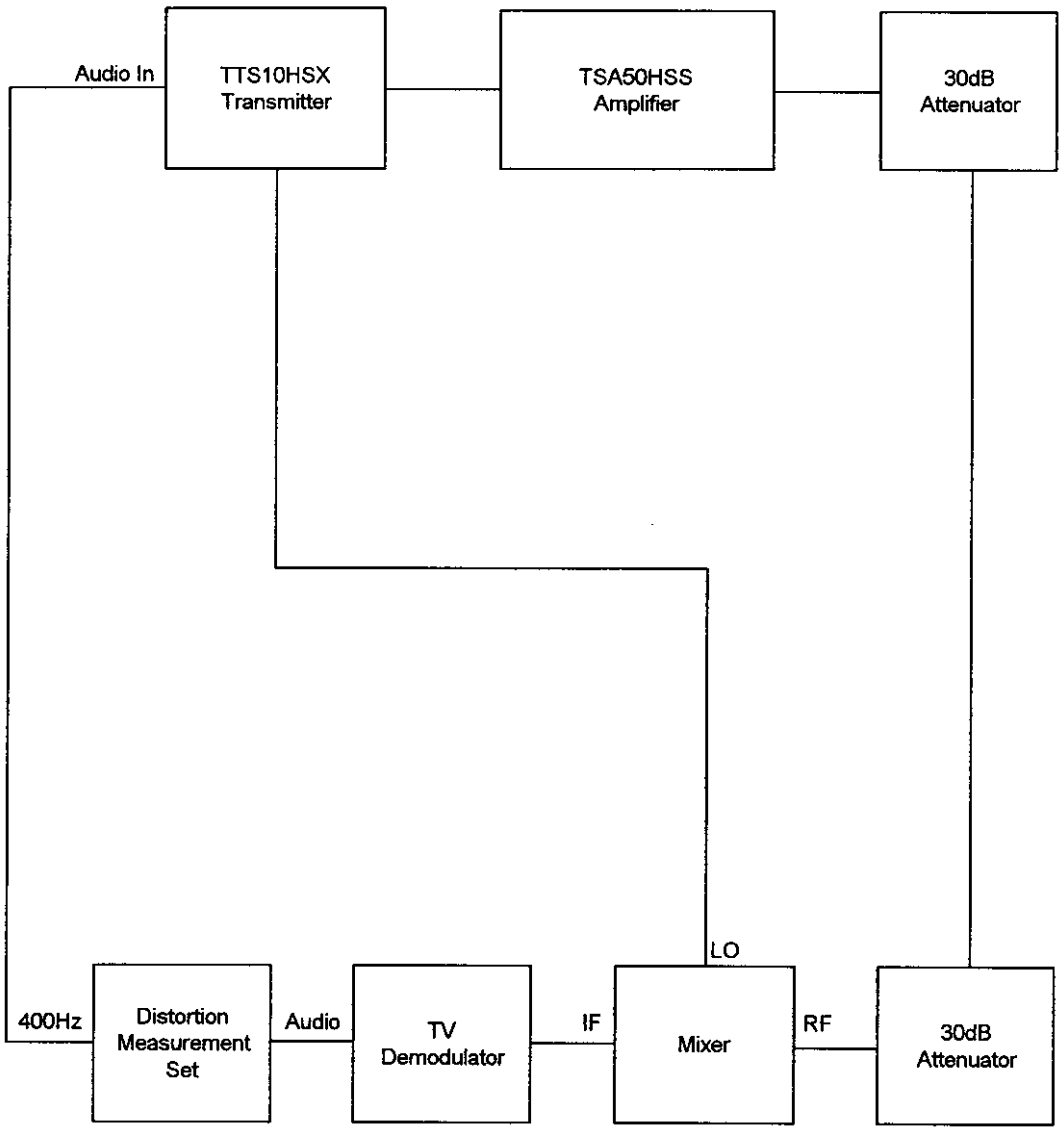
FM NOISE DATA

Detected Output w/o modulation = 1.5mV

Detected Output w/modulation = 2.5V

$$\text{FM Noise} = 20 \log \frac{\text{Output w/o modulation}}{\text{Output w/modulation}} = \frac{.0015V}{2.5V}$$

FM Noise = -64.4dB




FM NOISE TEST SETUP
Figure 2-9A

## 2.10 Antenna Terminal Radio Frequency Voltage [74.936(b)]

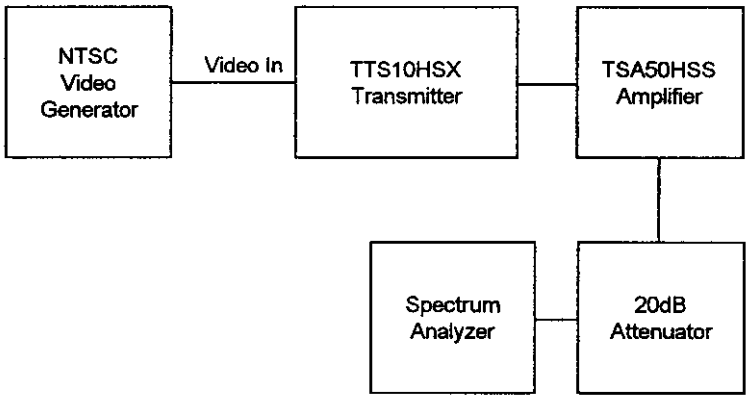
| | |
|---|---|
| Test Equipment Setup | Figure 2–10A |
| Visual Output Power | 50 watts peak sync |
| % Video Modulation | 87.5% |
| Type Video Modulation | Standard 10-riser stairstep |
| Aural Output Power | 1.25 watts average |
| % Aural Modulation | 0% |
| Method of Measurement | The spectrum analyzer display was adjusted for a zero reference level at the visual carrier using the following settings: |

| | | |
|---|---|---|
| Frequency Span/Division | – | 1MHz |
| Resolution Bandwidth | – | 30kHz |
| Time/Division | – | 10ms |
| Input Attenuation | – | 20dB |
| Reference Level | – | +3dBm |
| Video Filter | – | Off |

All emissions were checked relative to peak sync from 0 to 10.0GHz. Those emissions below -80dB were not noted.

ANTENNA TERMINAL RF VOLTAGE DATA

| FREQUENCY (MHz) | LEVEL (dB relative to peak visual) | |
|---|---|---|
| 2597.25 | 0dB | Visual Carrier |
| 2601.75 | -16dB | Aural Carrier |
| 2593.67 | -65dB | Visual Carrier -3.58MHz |
| 2592.75 | -66dB | Visual Carrier -4.5MHz |
| 2606.25 | -75dB | Aural Carrier +4.5MHz |
| 2588.25 | ---- | Visual Carrier -9.0MHz |
| 2610.75 | ---- | Aural Carrier +9.0MHz |
| 2243.00 | -68dB | Local Oscillator |
| 5194.50 | -65dB | Visual 2nd Harmonic |
| 5203.50 | -73dB | Aural 2nd Harmonic |




ANTENNA TERMINAL RF VOLTAGE TEST
Figure 2-10A

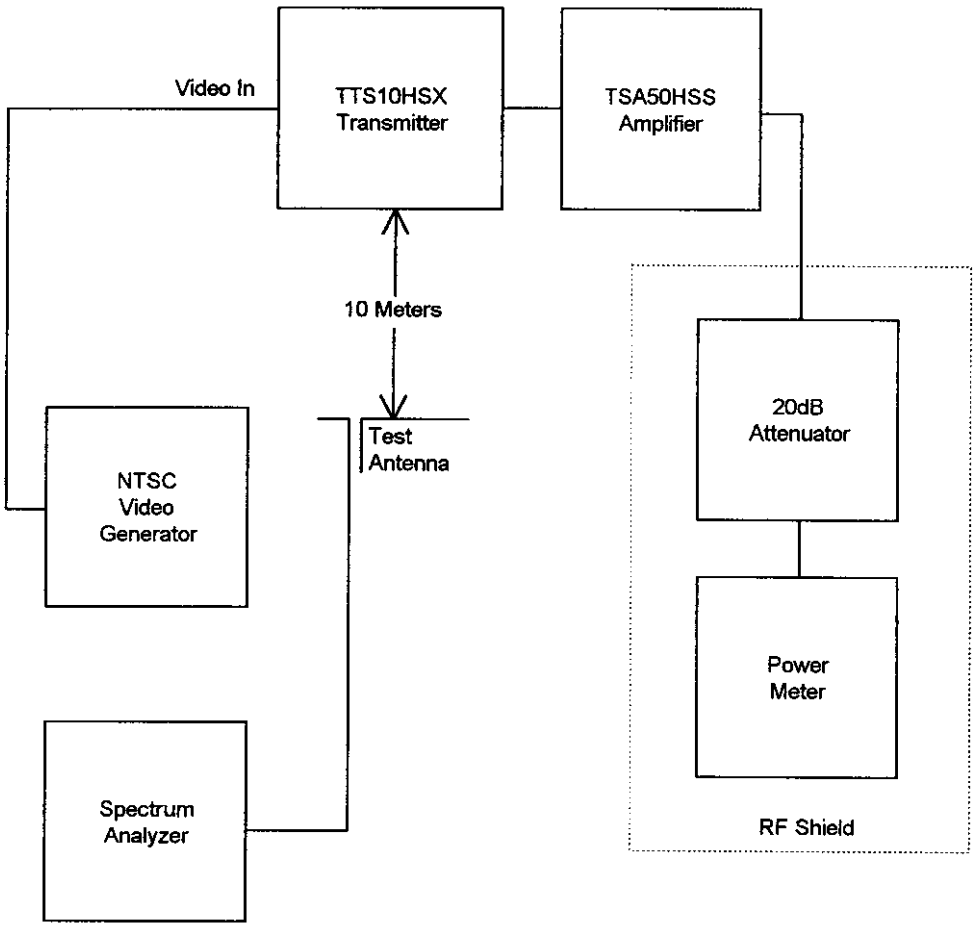
## 2.11 Spurious Radiation Field Strength [2.993]

| | |
|---|---|
| Test Equipment Setup | Figure 2–11A |
| Visual Output Power | 50 watts peak sync |
| % Video Modulation | 87.5% |
| Type Video Modulation | Standard 10-riser stairstep |
| Aural Output Power | 1.25 watts average |
| % Aural Modulation | 0% |
| Method of Measurement | The broadband receive antennas were moved horizontally and vertically around the unit to maximize receive level. Absolute power level of each spurious radiation was measured on a calibrated spectrum analyzer and converted to an equivalent field strength by finding the power density (absolute power divided by the antenna area). The relative field strength of the spurious radiation was then calculated with respect to the unit's rated output power. The field strength of the rated output was found using $\sqrt{49.2P/R}$ (P = rated output, R = distance). All emissions were assumed to be radiated from half-wave dipoles. Frequencies scanned extended from 20MHz to 10.0GHz. |

SPURIOUS RADIATION FIELD STRENGTH DATA

E Output = $\sqrt{49.2P/R} = \sqrt{(49.2)(50)}/10 = 4.96$Volts/Meter

| FREQUENCY (MHz) | | POWER MEASURED (dBm) | EQUIVALENT FIELD STRENGTH (VOLTS/METER) | RELATIVE FIELD STRENGTH (dB) |
|---|---|---|---|---|
| Visual | 2597.25 | -55 | $1.88 \times 10^{-2}$ | -48.4dB |
| Aural | 2601.75 | -70 | $3.35 \times 10^{-3}$ | -63.4dB |
| LO | 2643.00 | Not Visible | ----- | ----- |
| 2nd Harmonic | 5194.50 | Not Visible | ----- | ----- |




SPURIOUS CABINET RADIATION TEST SETUP
Figure 2-11A

## 2.12 Power Output Meter Calibration [2.985]

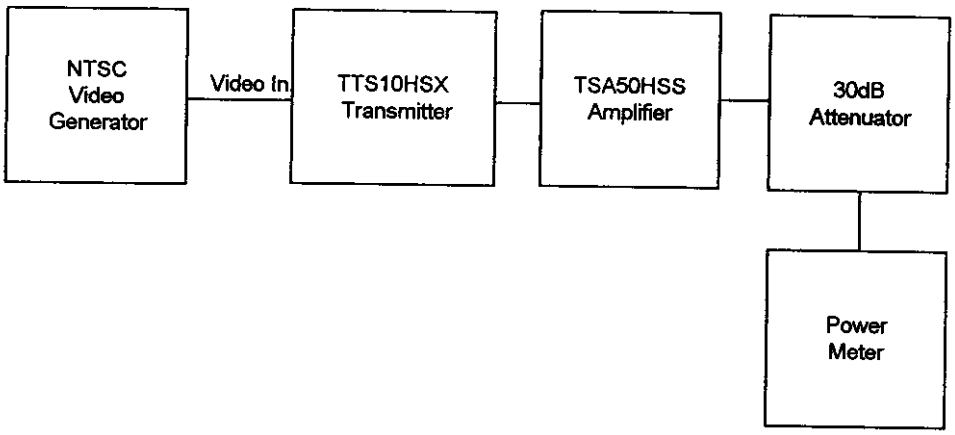
| | |
|---|---|
| Test Equipment Setup | Figure 2–12A |
| Visual Output Power | 50 watts peak sync |
| % Video Modulation | 87.5% |
| Type Video Modulation | Standard sync with blanking level set at 75% of peak sync and maintained through the interval between pulses. |
| Aural Output Power | 1.25 watts average |
| % Aural Modulation | 0% |
| Method of Measurement | The TTS10HSX transmitter VISUAL POWER ADJ was adjusted to obtain a 29.8mW average visual reading from the TSA50HSS amplifier diplexer. This power level corresponds to 50 watts peak power when using the factor of 1.68 and compensating for the output attenuation as shown: |

| [29.8mW] | x | [$10^3$] | x | [1.68] = 50W |
|---|---|---|---|---|
| meter reading | | attenuation | | power factor |

The AURAL POWER ADJ was then adjusted to obtain a 31.1mW indication on the external power meter (29.8W average visual + 1.25W average aural -30dB = 31.05mW).

The VIS control of the TSA50HSS Metering Detector, located in the power amplifier drawer, was adjusted to provide a 100% indication on the % POWER meter with the meter switch set to the VISUAL position.

The AUR control of the TTS10HSX driver Metering Detector was also adjusted for a 100% indication on the TTS10HSX % POWER meter with the meter switch set to the AURAL position. The output of the transmitter was then adjusted to produce 80% (24.8W avg) and 110% (34.2W avg) of the unit's rated output power. The readings of both % POWER meters monitoring the transmitter's output were within 2% of the external power meter indications.




POWER OUTPUT METER CALIBRATION SETUP
Figure 2-12A