# *TB 9-6625-2345-24

## DEPARTMENT OF THE AMY TECHNICAL BULLETIN

## CALIBRATION PROCEDURE FOR SPECTRUM ANALYZER AN/USM-620 (TEKTRONIX, MODEL 495P)

*Distribution Statement A: Approved for public release; distribution is unlimited.*

### REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also send in your comments electronically to our E-mail address: 2028@redstone.army.mil or by fax 256-842-6546/DSN 788-6546. For the World Wide Web use: https://amcom2028.redstone.army.mil. Instructions for sending an electronic 2028 can be found at the back of this manual.

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*This bulletin supersedes TB 9-6625-2345-35, dated 27 August 2003, including all changes.

## SECTION I
## IDENTIFICATION AND DESCRIPTION

**1. Test Instrument Identification.** This bulletin provides instructions for the calibration of Spectrum Analyzer, AN/USM-620 (Tektronix, Model 495P). TM 11-6625-3278-40 and TM 11-6625-3278-12 were used as the prime data sources in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

**a. Model Variations.** None.

**b. Time and Technique.** The time required for this calibration is approximately 9 hours, using the dc and low frequency and microwave technique.

**2. Forms, Records, and Reports**

**a.** Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25.

**b.** Adjustments to be reported are designated (R) at the end of the sentence in which they appear. When adjustments are in tables, the (R) follows the designated adjustment. Report only those adjustments made and designated with (R).

**3. Calibration Description**. TI parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1.  Calibration Description

| Test instrument parameters | Performance specifications |
|---|---|
| Calibrator amplitude | Range:  −20 dBm<br>Accuracy:  ± 0.3 dB |
| Calibrator frequency | Range:  100 MHz<br>Accuracy:  ±20 Hz |
| Center frequency | Range:  100 Hz to 1.8 GHz<br>Accuracy:  ±20% of Span/Div or resolution bandwidth (whichever is greater).<br>Tuning resolution: ≤ 10% of the Span/Div setting (≤ 1% of total span). |
| Frequency stability | < 50 Hz per minute after 1 hour warm up, with a span of ≤ 200 kHz |
| Frequency readout resolution | With counter, ≤ 10% of the Span/Div setting (≤ 1% of total span). |
| Span accuracy | Within ±5% of center eight divisions. |
| Resolution bandwidth | Measured at −6 dB points:<br>Accuracy: ±20% of selected bandwidth |
| Display accuracy | Range:  10 dB/Div<br>Accuracy: ±1.0 dB/10 dB to a maximum of ±2.0 dB/80 dB<br>Range:  2 dB/Div<br>Accuracy: ±0.4 dB/2 dB to a maximum of ±1.0 dB/16 dB |
| Display accuracy (linear) | ±5% of full scale |
| Display flatness<br>(Frequency response) | Range: 100 Hz to 1.8 GHz<br>Accuracy: ±1.0 dB when measured with 10 dB of attenuation |
| Spurious response | Residual: ≤ 100 dBm with input terminated into 50Ω<br>Harmonic distortion: −60 dBc for a −30 dB signal in minimum distortion mode<br>Third order intermodulation distortion: ≤ 70 dB down from two full screen signals with any frequency span in minimum distortion mode |
| Input noise sensitivity | Range: Center frequency ≥ 1 MHz<br>Bandwidth setting:<br>1 kHz resolution;     100 Hz resolution;     10 Hz resolution;<br>at least −115 dBm     at least −125 dBm     at least −131 dBm |
| Shape factor | Resolution bandwidth ≥ 100 Hz: < 7.5:1 at 60 dB and 6 dB points<br>Resolution bandwidth 10 Hz: ≤ 150 Hz wide at 60 dB points |
| Input attenuator | Range: 0 dB to 60 dB in 10 dB steps<br>Accuracy: ±0.5 dB/10 dB step, 1.0 dB maximum |
| Sweep time | Range: 20 μs/Div to 10 s/Div (10 s/Div only in auto sweep mode)<br>Accuracy: within ±5% of setting |
| Tracking generator | Frequency range: 100 kHz to 1.8 GHz<br>Output level: 0 dBm ±0.5 dB<br>Flatness: ±2.25 dB from 100 kHz to 1.8 GHz<br>Spurious outputs: 20 dBc harmonic and 40 dBc non-harmonic |

# SECTION II
# EQUIPMENT REQUIREMENTS

**4.  Equipment Required.**  Table 2 identifies the specific equipment to be used in this calibration procedure.  This equipment is issued with Secondary Transfer Calibration Standards Set AN/GSM-287 and AN/GSM-705.  Alternate items may be used by the calibrating activity.  The items selected must be verified to perform satisfactorily prior to

use and must bear evidence of current calibration.  The equipment must meet or exceed the minimum use specifications listed in table 2.  The accuracies listed in table 2 provide a four-to-one ratio between the standard and TI.  Where the four-to-one ratio cannot be met, the actual accuracy of the equipment selected is shown in parenthesis.

**5.  Accessories Required.**  The accessories required for this calibration are common usage accessories, issued as indicated in paragraph **4** above, and are not listed in this calibration procedure.  The following peculiar accessory is also required for this calibration: 50 Ω, 20 Watt dummy load.

Table 2. Minimum Specifications of Equipment Required

| Common name | Minimum use specifications | Manufacturer and model (part number) |
|---|---|---|
| FREQUENCY COUNTER | Range:  20 ms to 200 s<br>Accuracy: ± 10% | Fluke, Model PM6681/656 (PM6681/656) |
| LOW PASS FILTER | fc 125 MHz | TLC 125 |
| MEASURING RECEIVER | Frequency range:  300 MHz<br>Accuracy: ±300 Hz<br>dBm range:  -9.7 to -10.3<br>Accuracy: ±0.075 dBm | Measuring receiver system N5530S consisting of: Spectrum Analyzer Agilent, Model E4440A (E4440A), Power meter Agilent, Model E4419B (E4419B), and Sensor module Agilent, Model 504 (504) |
| OSCILLOSCOPE CALIBRATOR | Markers: 20 ns to 20 ms<br>Accuracy: ±1.25% | Fluke, Model 5820A-5C-GHZ (5820A-5C-GHZ) |
| POWER SPLITTER | Range: 20 MHz to 18 GHz | Weinschel, Model 1870A (7916839) |
| PULSE GENERATOR | Pulse: 10 ns<br>Accuracy: : ±1.25% | LeCroy, Model 9210 (9210) w/plug-ins, LeCroy, Models 9211 (9211) and 9215 (9215) (MIS 45839) |
| SIGNAL GENERATOR NO. 1 | Frequency range:  90 MHz to 1.8 GHz<br>Power range:  0 to -30 dBm<br>Accuracy: ±2 dBm | Aeroflex, Model 2023B (2023B) or (SG1207/U) |
| SIGNAL GENERATOR NO. 2 | Frequency range:  200.5 MHz<br>Power range:  0 to -10 dBm<br>Accuracy: ±2 dBm | Aeroflex, Model 2023B (2023B) or (SG-1207/U) |
| SPECTRUM ANALYZER | Frequency: 0 to 2 GHz<br>Input level: ±10 dBm<br>Display range: 60 dB | (AN/USM-677) |
| SYNTHESIZER/LEVEL GENERATOR | Frequency range:  10 kHz to 50 MHz<br>Amplitude range: -80 to +10 dBm<br>Accuracy: ±0.02 dB per 10 dB step | Hewlett-Packard, Model 3335AOPT 001-K06 (MIS-35938) |
| TIME/FREQUENCY WORKSTATION | Resolution: $1 \times 10^{-10}$ | Datrum, Model ET6000-75 (13589305) |

## SECTION III
## CALIBRATION PROCESS

**6. Preliminary Instructions**

    **a.** The instructions outlined in paragraphs **6** and **7** are preparatory to the calibration process. Personnel should become familiar with the entire bulletin before beginning the calibration.

    **b.** Items of equipment used in this procedure are referenced within the text by common name as listed in table 2.

    **c.** Unless otherwise specified, verify the result of each test and, whenever the test requirement is not met, take corrective action before continuing with the calibration. Adjustments required to calibrate the TI are included in this procedure. Additional maintenance information is contained in the manufacturer's manuals for this TI.

    **d.** Unless otherwise specified, all controls and control settings refer to TI.

**7. Equipment Setup**

### WARNING
HIGH VOLTAGE is used or exposed during the performance of this calibration. DEATH ON CONTACT may result if personnel fail to observe safety precautions. REDUCE OUTPUT(S) to minimum after each step within the performance check where applicable.

### CAUTION
Before connecting TI to power source, make sure TI is set to the power source line voltage as shown on rear of TI.

    **a.** Connect TI spectrum analyzer and TI tracking generator to 115 V ac power source.

    **b.** Depress TI spectrum analyzer **POWER** key to **ON** and set TI tracking generator switch to **ON**. Allow at least 30 minutes for TI to reach operating temperature.

**8. Calibrator Frequency**

    **a. Performance Check**

        (1) Program time/frequency workstation for 10 MHz output and connect to frequency counter **REFERENCE IN**.

        (2) Connect TI **CAL OUT** to frequency counter input **C**.

        (3) If frequency counter indication is not between 99,999,980 Hz and 100,000,020 Hz, perform **b** below.

        (4) Disconnect equipment setup.

**b. Adjustments**

(1)  Disconnect equipment setup.

(2)  Press and release TI spectrum analyzer **POWER** key to **OFF**.

(3)  Disconnect TI power cord.

(4)  Set TI spectrum analyzer on its front panel.

(5)  Loosen four screws through the back rubber feet.

(6)  Pull cover up and off.

(7)  Place TI on its top and reconnect power cord.

(8)  Connect TI **CAL OUT** to frequency counter input **C**.

(9)  Depress TI spectrum analyzer **POWER** key to **ON**.

(10) Remove the access screw from A1A37 (fig. 1) and adjust oscillator for a 100,000,000 Hz indication on frequency counter.
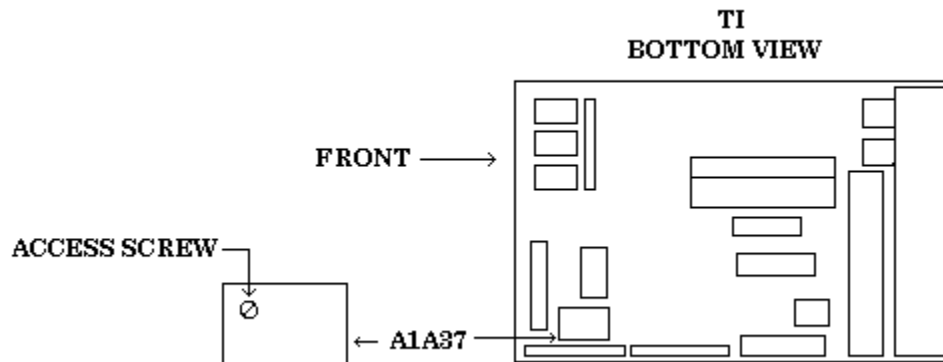
Figure 1. Cal out frequency adjustment.

(11) Disconnect TI **CAL OUT** from frequency counter input **C**.

(12) Press and release TI spectrum analyzer **POWER** key to **OFF**.

(13) Disconnect power cord.

(14) Reinstall access screw on A1A37 (fig. 1) module.

(15) Set TI spectrum analyzer on its front panel.

(16) Replace TI outer cover.

(17) Tighten four screws through back rubber feet.

(18) Place TI in its normal orientation and reconnect power cord.

(19) Depress TI spectrum analyzer **POWER** key to **ON**.

### 9. Calibrator Amplitude

#### a. Performance Check

**NOTE**

Verify that the proper CAL FACTORS are loaded for the measuring receiver power sensor module.

(1) Zero and calibrate the measuring receiver power sensor module.

(2) Connect measuring receiver power sensor module to TI **CAL OUT**.

(3) Set up measuring receiver to measure power at 100 MHz. If displayed power measurement is not between −20.3 dBm and −19.7 dBm, perform **b** below.

(4) Disconnect equipment setup.

#### b. Adjustments

(1) Disconnect equipment setup.

(2) Press and release TI spectrum analyzer **POWER** key to **OFF**.

(3) Disconnect TI power cord.

(4) Set TI spectrum analyzer on its front panel.

(5) Loosen four screws through the back rubber feet.

(6) Pull cover up and off.

(7) Place TI on its top and reconnect power cord.

(8) Connect measurement receiver power sensor module to TI **CAL OUT**.

(9) Depress TI spectrum analyzer **POWER** key to **ON**.

(10) Adjust A1A34R1041 (fig. 2) for a −20.0 ±0.3 dBm indication on measuring receiver (R).

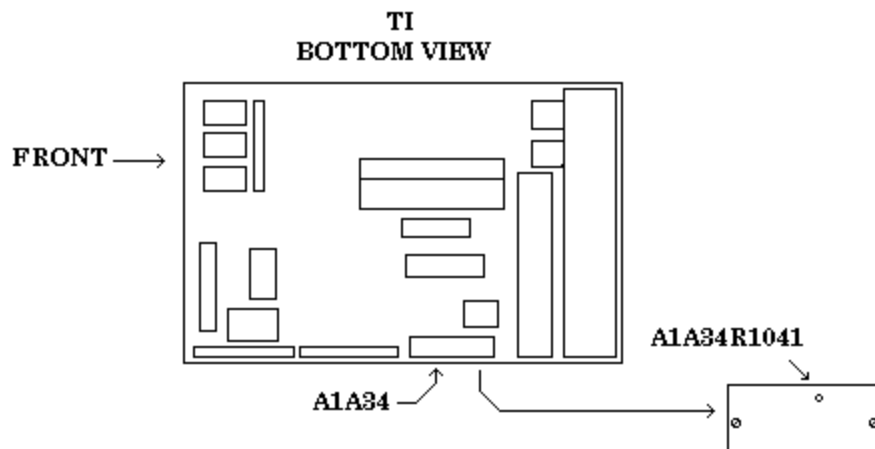

Figure 2. Cal out level adjustment.

(11) Disconnect measurement receiver power sensor module from TI **CAL OUT**.

(12) Press and release TI spectrum analyzer **POWER** key to **OFF**.

(13) Disconnect power cord.

(14) Set TI spectrum analyzer on its front panel.

(15) Replace TI outer cover.

(16) Tighten four screws through back rubber feet.

(17) Place TI in its normal orientation and reconnect power cord.

(18) Depress TI spectrum analyzer **POWER** key to **ON**.

## 10. Self Calibration

### a. Performance Check

(1) Press TI **BLUE SHIFT** then **RESET** keys.

(2) Set TI controls as listed in (a) through (d) below:

(a) **MIN RF ATTEN dB** to **0 NORM**.
(b) **PEAK AVERAGE** fully counterclockwise.
(c) **TIME/DIV** to **AUTO**.
(d) **REFERENCE LEVEL** to **–20 dBm**.

(3) Connect TI **CAL OUT** to TI **RF INPUT 50 Ω**.

(4) Press TI keys as listed in (a) through (e) below:

(a) **BLUE SHIFT**.
(b) **FREQ**, **1**, **0**, **0**, **MHz +dBX**.
(c) **BLUE SHIFT**, **SPAN/DIV**, **1**, **0**, **0**, **MHz +dBX**.
(d) **BLUE SHIFT**.
(e) **CAL**.

(5) Perform instructions as displayed on TI spectrum analyzer CRT.

(6) Upon completion of TI self calibration, disconnect TI **CAL OUT** from TI **RF INPUT 50 Ω**.

### b. Adjustments. No adjustments can be made.

## 11. Marker Frequency and Counter Accuracy

### a. Performance Check

(1) Connect signal generator No. 1 RF output to TI **RF INPUT**.

(2) Program time/frequency workstation for a 10 MHz output and connect to signal generator No. 1 external reference input (rear panel).

(3) Press TI **BLUE SHIFT** then **RESET** keys.

(4)  Set signal generator No. 1 to default setting.

(5)  Set signal generator No. 1 for an output frequency of 500 MHz at an amplitude of 0 dBm.

(6)  Press TI keys as listed in (a) through (f) below:

    (a)  **MARKER MENU**, **5**.
    (b)  **8**, **0**, **kHz –dBX**.
    (c)  **BLUE SHIFT**.
    (d)  **FREQ**, **5**, **0**, **0**, **MHz +dBX**.
    (e)  **BLUE SHIFT**.
    (f)  **SPAN/DIV**, **5**, **0**, **Hz dB**.

(7)  Press TI **SINGLE SWEEP** key twice.

(8) When sweep is completed, press TI **GREEN SHIFT** then **PEAK FIND** keys.

(9)  Marker frequency displayed on TI CRT will be within limits specified in first row of table 3.

(10)  Repeat technique of (5), (6) (c), (6) (d) then (7) and (8) above for remaining signal generator No.1 and TI settings in table 3.  Marker frequency displayed on TI CRT will be within limits specified in table 3.

Table 3.  Marker Frequency Accuracy

| Signal generator No. 1 | | Test instrument | | | |
|---|---|---|---|---|---|
| Frequency | Amplitude (dBm) | Frequency | Span/Div | Marker Freq. Display (MHz) | |
| | | | | Min | Max |
| 500      MHz | 0 | 500      MHz | 50 Hz | 499.999865 | 500.000135 |
| 1.00    GHz | 0 | 1.00   GHz | 50 Hz | 999.999756 | 1000.000235 |
| 1.5      0GHz | 0 | 1.50   GHz | 50 Hz | 1499.999665 | 1500.000335 |

(11)  Press TI keys as listed in (a) through (g) below:

    (a)  **BLUE SHIFT**.
    (b)  **FREQ**, **5**, **0**, **0**, **MHz +dBX**.
    (c)  **BLUE SHIFT**.
    (d)  **SPAN/DIV**, **1**, **MHz +dBX**.
    (e)  **COUNT** (illuminated).
    (f)  **BLUE SHIFT**.
    (g)  **COUNT RESOLN**, **1**, **Hz dB**.

(12)  Set signal generator No. 1 for an output frequency of 500 MHz at an amplitude of 0 dBm.

(13)  Press TI **SINGLE SWEEP** key twice.

(14)  Marker frequency displayed on TI CRT will be within limits specified in first row of table 4.

(15) Repeat technique of (11) (a), (11) (b) then (12) and (13) above for remaining signal generator No. 1 and TI settings in table 4. Marker frequency displayed on TI CRT will be within limits specified in table 4.

Table 4. Counter Accuracy

| Signal generator #1 | | Test instrument | | |
|---|---|---|---|---|
| Frequency | Amplitude (dBm) | Frequency | Counter Display (MHz) | |
| | | | Min | Max |
| 500     MHz | 0 | 500     MHz | 499.999888 | 500.000112 |
| 1.0   GHz | 0 | 1.0   GHz | 999.999788 | 1000.000212 |
| 1.5   GHz | 0 | 1.5   GHz | 1499.999688 | 1500.000312 |

(16) Press TI keys as listed in (a) through (f) below:

    (a) **BLUE SHIFT**.
    (b) **SPAN/DIV**, **1**, **kHz –dBX**.
    (c) **COUNT** (twice).
    (d) **SINGLE SWEEP** (twice and wait for sweep completion).
    (e) **GREEN SHIFT**.
    (f) **PEAK FIND**.

(17) Marker frequency displayed on TI CRT will be between 1499.999000 and 1500.001000.

(18) Set signal generator No. 1 to default setting.

(19) Disconnect equipment setup.

**b. Adjustments**. No adjustments can be made.

**12. Center Frequency Stability**

**a. Performance Check**

(1) Press TI keys as listed in (a) through (i) below:

    (a) **BLUE SHIFT**, **RESET**.
    (b) **BLUE SHIFT**.
    (c) **FREQ**, **1**, **0**, **0**, **MHz +dBX**.
    (d) **BLUE SHIFT**.
    (e) **SPAN/DIV**, **5**, **0**, **Hz dB**.
    (f) **VERTICAL DISPLAY 2dB/DIV**.
    (g) **BLUE SHIFT**.
    (h) **REF LEVEL**, **2**, **0**, **kHz –dBX**.
    (i) **AUTO RESOLN** (not illuminated).

(2) Set TI controls as listed in (a) and (b) below:

    (a) **TIME/DIV** to **AUTO**.
    (b) **RESOLUTION BANDWIDTH** to **100 Hz**.

(3) Connect TI **CAL OUT** to TI **RF INPUT 50Ω**.

(4) Press TI keys as listed in (a) through (g) below:

    (a) **BLUE SHIFT**.
    (b) **PULSE STRETCHER**, **6**.
    (c) **GREEN SHIFT**.
    (d) **PEAK FIND**.
    (e) **GREEN SHIFT**.
    (f) **Δ MKR**.
    (g) **SAVE A**.

(5) Wait 60 seconds, and then press TI keys as listed in (a) through (c) below:

    (a) **SINGLE SWEEP** (twice and wait for sweep completion).
    (b) **GREEN SHIFT**.
    (c) **PEAK FIND**.

(6) TI **MARKER FREQUENCY** displayed on top of CRT will be ≤ 50 Hz.

(7) Press TI **BLUE SHIFT** then **RESET** keys.

(8) Disconnect equipment setup.

  **b. Adjustments**.  No adjustments can be made.

**13. Span/Div Accuracy**

  **a. Performance Check**

(1) Connect pulse generator **OUTPUT** to TI **RF INPUT 50Ω**.

(2) Press TI keys as listed in (a) through (e) below:

    (a) **BLUE SHIFT**.
    (b) **FREQ**, **1**, **GHz**.
    (c) **BLUE SHIFT**.
    (d) **SPAN/DIV**, **1**, **0**, **0**, **MHz +dBX**.
    (e) **BLUE SHIFT**, **REF LEVEL**, **2**, **0**, **kHz –dBX**.

(3) Set pulse generator for an output pulse of 10 ns at an amplitude of 2.00 V.

(4) Use TI **CENTER/MARKER FREQUENCY** knob to align 600 MHz marker (second marker from left) to second vertical graticule line.

(5) Check alignment of markers to graticule lines over TI center eight divisions.  If alignment error exceeds ±2 minor divisions, perform **b** below.

(6) Disconnect TI **RF INPUT 50Ω** from pulse generator **OUTPUT**.

(7) Connect TI **RF INPUT 50Ω** to oscilloscope calibrator **SOURCE/MEASURE CHAN 1**.

(8) Press TI keys as listed in (a) through (f) below:

    (a) **BLUE SHIFT**.
    (b) **FREQ**, **3**, **0**, **0**, **MHz +dBX**.
    (c) **BLUE SHIFT**.

          (d)  **SPAN/DIV**, **5**, **0**, **MHz +dBX**.

          (e)  **BLUE SHIFT**.

          (f)  **REF LEVEL**, **0**, **kHz –dBX**.

   (9) Set oscilloscope calibrator for a 20 ns **MARKER** output.

  (10) Use TI **CENTER/MARKER FREQUENCY** knob to align markers on graticule lines.

  (11) Check alignment of markers to graticule lines over TI center eight divisions.  If alignment error is not within limits specified in first row of table 5, perform **b** below.

  (12) Repeat technique of (8) (a) through (d) and (9) through (11) above for remaining TI settings and oscilloscope calibrator outputs in table 5 below.  If TI alignment is not within limits specified in table 5, perform **b** below.

**NOTE**

Throughout this check use of TI **REFERENCE LEVEL** knob, to adjust TI reference level, will be required to keep trace on screen.

Table 5.  Span/Div Accuracy

| Oscilloscope calibrator | Test instrument | | |
|---|---|---|---|
| Marker output | Frequency | Span/Div | Marker alignment error (minor divisions) |
| 20  ns | 300  MHz | 50  MHz | ±2 |
| 50  ns | 100  MHz | 20  MHz | ±2 |
| 100  ns | 0  Hz | 10  MHz | ±2 |
| 200  ns | 0  Hz | 5  MHz | ±2 |
| 500  ns | 0  Hz | 2  MHz | ±2 |
| 1  µs | 0  Hz | 1  MHz | ±2 |
| 2  µs | 0  Hz | 500  kHz | ±2 |
| 5  µs | 0  Hz | 200  kHz | ±2 |
| 10  µs | 0  Hz | 100  kHz | ±2 |
| 20  µs | 0  Hz | 50  kHz | ±2 |
| 50  µs | 0  Hz | 20  kHz | ±2 |
| 100  µs | 0  Hz | 10  kHz | ±2 |
| 200  µs | 0  Hz | 5  kHz | ±2 |
| 500  µs | 0  Hz | 2  kHz | ±2 |
| 1  ms | 0  Hz | 1  kHz | ±2 |
| 2  ms | 0  Hz | 500  Hz | ±2 |
| 5  ms | 0  Hz | 200  Hz | ±2 |
| 10  ms | 0  Hz | 100  Hz | ±2 |
| 20  ms | 0  Hz | 50  Hz | ±2 |

  (13) Reduce outputs to minimum and disconnect equipment setup.

**b.  Adjustments**

   (1) Press and release TI spectrum analyzer **POWER** key to **OFF**.

   (2) Disconnect all connections made to TI spectrum analyzer.

(3)  Set TI spectrum analyzer on front panel.

(4)  Loosen four screws through back rubber feet.

(5)  Pull cover up and off.

(6)  Place TI on bottom and reconnect power cord.

(7)  Depress TI spectrum analyzer **POWER** key to **ON**.

(8)  Connect pulse generator **OUTPUT** to TI **RF INPUT 50Ω**.

(9)  Press TI keys as listed in (a) through (h) below:

    (a)  **BLUE SHIFT**.
    (b)  **RESET**.
    (c)  **BLUE SHIFT**.
    (d)  **FREQ**, **6**, **0**, **0**, **MHz +dBX**.
    (e)  **BLUE SHIFT**.
    (f)  **SPAN/DIV**, **1**, **0**, **0**, **MHz +dBX**.
    (g)  **BLUE SHIFT**.
    (h)  **REF LEVEL**, **0**, **kHz –dBX**.

(10)  Set pulse generator for a 10 ns output at an amplitude of 2.00 V.

(11)  Use TI **CENTER/MARKER FREQUENCY** knob to align second marker from left to TI second vertical graticule line.

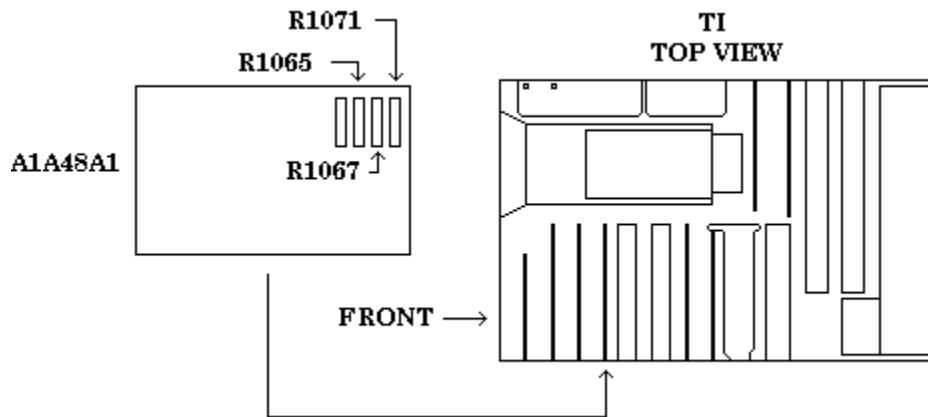(12)  Adjust A1A48A1R1065 (fig. 3) for one marker per division over center eight divisions of CRT (R).



Figure 3. Span/div adjustment.

(13)  Reduce pulse generator output to minimum and disconnect from TI RF INPUT 50Ω.

(14) Connect oscilloscope calibrator **SOURCE/MEASURE CHAN 1** to TI **RF INPUT 50Ω**.

(15) Press TI keys as listed in (a) through (d) below:

(a) **BLUE SHIFT**.
(b) **FREQ**, **5**, **0**, **MHz +dBX**.
(c) **BLUE SHIFT**.
(d) **SPAN/DIV**, **5**, **MHz +dBX**.

(16) Set oscilloscope calibrator for a 200 ns **MARKER** output.

(17) Use TI **CENTER/MARKER FREQUENCY** knob to align second marker from left to TI second vertical graticule line.

(18) Adjust A1A48A1R1071 (fig. 3) for one marker per division over center eight divisions of CRT (R).

(19) Press TI keys as listed in (a) through (d) below:

(a) **BLUE SHIFT**.
(b) **FREQ**, **2**, **0**, **0**, **kHz –dBX**.
(c) **BLUE SHIFT**.
(d) **SPAN/DIV**, **2**, **0**, **kHz –dBX**.

(20) Use TI **CENTER/MARKER FREQUENCY** knob to align second marker from left to TI second vertical graticule line.

(21) Adjust A1A48A1R1067 (fig. 3) for one marker per division over center eight divisions of CRT (R).

(22) Set oscilloscope calibrator to standby.

(23) Press TI **BLUE SHIFT** then **RESET** keys.

(24) Disconnect oscilloscope calibrator **SOURCE/MEASURE CHAN 1** from TI **RF INPUT 50Ω**.

(25) Adjust A1A72R1052 (fig. 4) dot marker over 0 Hz response as shown in example waveform in fig. 4 (R).
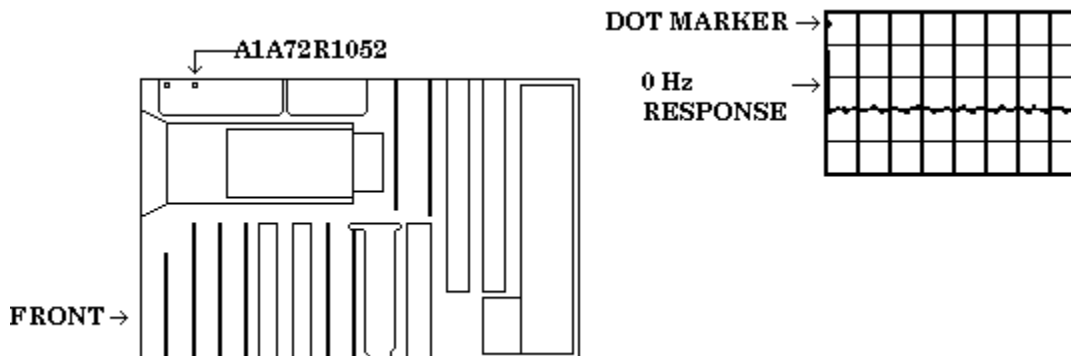


Figure 4.  0 Hz adjustment.

(26) Press and release TI spectrum analyzer **POWER** key to **OFF**.

(27) Disconnect TI power cord.

(28) Set TI spectrum analyzer on front panel.

(29) Slide outer cover onto TI.

(30) Tighten four screws through back rubber feet.

(31) Place TI in its normal orientation and reconnect power cord.

(32) Depress TI spectrum analyzer **POWER** key to **ON**.

## 14. Sweep Time Accuracy

### a.  Performance Check

(1)  Press TI **BLUE SHIFT** then **RESET** keys.

(2)  Connect equipment as shown in figure 5 below.
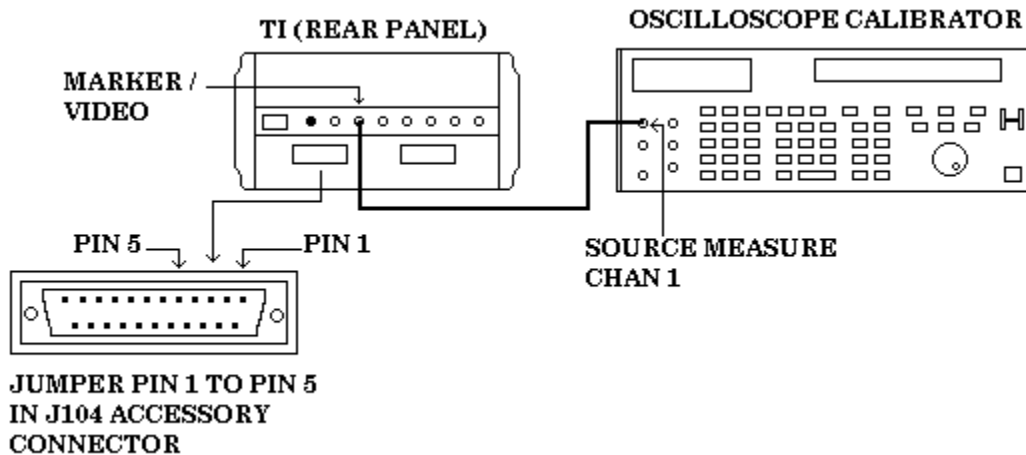


Figure 5.  Sweep time setup.

(3)  Press TI keys as listed in (a) through (d) below:
   (a)  **ZERO SPAN** (illuminated).
   (b)  **TRIGGERING INT** (illuminated).
   (c)  **VIEW A** (not illuminated).
   (d)  **VIEW B** (not illuminated).

(4)  Rotate TI **TIME/DIV** knob to **20 µs**.

(5)  Set oscilloscope calibrator for a 20 µs **MARKER** output.

### NOTE
Adjust TI intensity as necessary to view markers.

(6)  Use TI ◄► **POSITION** control to align marker on first graticule line.

   (7) Check alignment of markers to graticule lines over TI center eight divisions.  If alignment error is not within limits specified in first row of table 6, perform **b** below.

   (8) Repeat technique of (4) through (7) above for remaining oscilloscope calibrator outputs and TI settings in table 6.  If alignment error is not within limits specified in table 6, perform **b** below.

Table 6. Sweep Time Accuracy

| Oscilloscope calibrator | Test instrument | |
|---|---|---|
| Marker output | Time/div | Marker alignment error (minor divisions) |
| 20   µs | 20   µs | ±2 |
| 50   µs | 50   µs | ±2 |
| 100  µs | .1  ms | ±2 |
| 200  µs | .2  ms | ±2 |
| 500  µs | .5  ms | ±2 |
| 1  ms | 1   ms | ±2 |
| 2  ms | 2   ms | ±2 |
| 5  ms | 5   ms | ±2 |
| 10  ms | 10   ms[1] | ±2 |
| 20  ms | 20   ms[1] | ±2 |
| 50  ms | 50   ms[1] | ±2 |
| 100  ms | .1  s[1] | ±2 |
| 200  ms | .2  s[1] | ±2 |
| 500  ms | .5  s[1] | ±2 |
| 1  s | 1   s[1] | ±2 |
| 2  s | 2   s[1] | ±2 |
| 5  s | 5   s[1] | ±2 |

[1]Digital storage may be turned on (press **VIEW A** key) for sweep times slower than 5 ms per division.

   (9)  Press TI keys as listed in (a) through (d) below:

   (a)  **BLUE SHIFT**.
   (b)  **RESET**.
   (c)  **AUTO RESOLN** (not illuminated).
   (d)  **VIDEO FILTER NARROW** (illuminated).

   (10) Set TI controls as listed in (a) through (c) below:

   (a)  **RESOLUTION BANDWIDTH** to **10 Hz**.
   (b)  **PEAK AVERAGE** fully counter clockwise.
   (c)  **TIME/DIV** to **AUTO**.

   (11) Set oscilloscope calibrator for a 5s **MARKER** output.

   (12) Use TI ◄►**POSITION** control to align marker on first graticule line.  (There will be two markers per division).

   (13) Check alignment of markers to graticule lines over TI center eight divisions.  If alignment error is not within ±2 minor divisions, perform **b** below.

(14) Press TI keys as listed in (a) and (b) below:

    (a) **BLUE SHIFT**.

    (b) **SPAN/DIV**, **1**, **0**, **0**, **MHz +dBX**.

(15) Use TI ◄►**POSITION** control to realign dot to center graticule of CRT.

(16) Reduce all outputs to minimum and disconnect equipment setup.

**b. Adjustments**

  (1) Press and release TI spectrum analyzer **POWER** key to **OFF**.

  (2) Disconnect all connections made to TI spectrum analyzer.

  (3) Set TI spectrum analyzer on front panel.

  (4) Loosen four screws through back rubber feet.

  (5) Pull cover up and off.

  (6) Place TI on bottom and reconnect power cord.

  (7) Depress TI spectrum analyzer **POWER** key to **ON**.

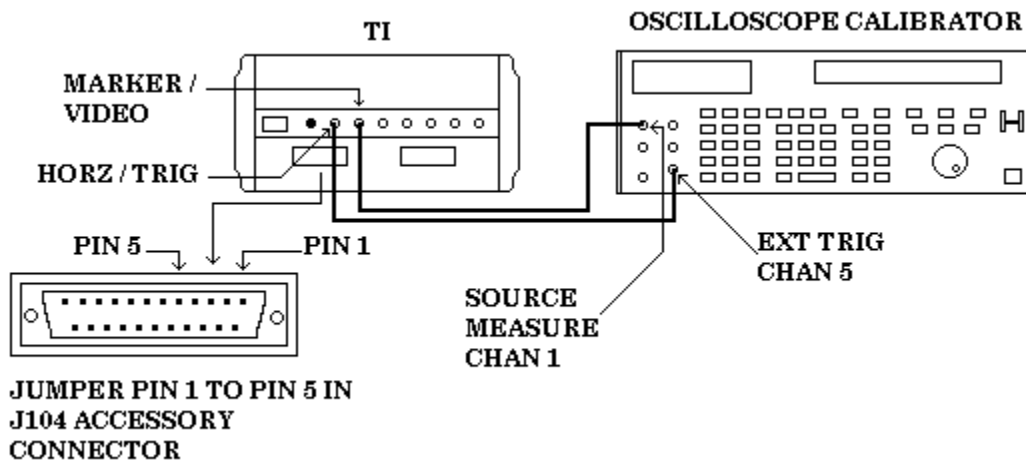  (8) Connect equipment as shown in figure 6 below.



Figure 6. Sweep time adjustment setup.

  (9) Press TI keys as listed in (a) through (g) below:

    (a) **BLUE SHIFT**.

    (b) **RESET**.

    (c) **BLUE SHIFT**.

    (d) **SPAN/DIV**, **1**, **0**, **MHz +dBX**.

    (e) **BLUE SHIFT**.

    (f) **REF LEVEL**, **2**, **0**, **kHz –dBX**.

    (g) **TRIGGERING EXT**.

  (10) Set **TIME/DIV** control to **10 ms**.

  (11) Set oscilloscope calibrator for a 10 ms **MARKER** output.

  (12) Adjust A1A72R1062 (fig. 7) for one marker per division (R).
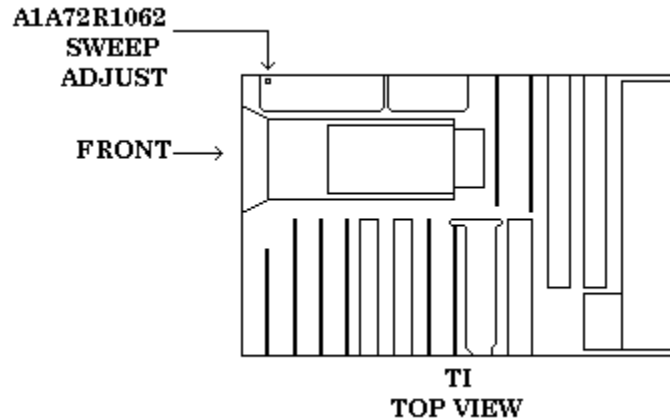


Figure 7.  Sweep adjustment.

  (13) Reduce all outputs to minimum and disconnect equipment setup.

  (14) Press and release TI spectrum analyzer **POWER** key to **OFF**.

  (15) Disconnect TI power cord.

  (16) Set TI spectrum analyzer on front panel.

  (17) Slide outer cover onto TI.

  (18) Tighten four screws through back rubber feet.

  (19) Place TI in its normal orientation and reconnect power cord.

  (20) Depress TI spectrum analyzer **POWER** key to **ON**.

**15.  Resolution BW and Shape Factor**

 **a.  Performance Check**

  (1) Connect TI **CAL OUT** to TI **RF INPUT 50Ω**.

  (2) Press TI keys as listed in (a) through (j) below:

   (a) **BLUE SHIFT**.
   (b) **RESET**.
   (c) **BLUE SHIFT**.
   (d) **FREQ**, **1**, **0**, **0**, **MHz +dBX**.
   (e) **BLUE SHIFT**.
   (f) **REF LEVEL**, **2**, **0**, **kHz –dBX**.
   (g) **BLUE SHIFT**.

(h) **SPAN DIV**, **1**, **MHz +dBX**.
(i) **VERTICAL DISPLAY 2dB/DIV**.
(j) **AUTO RESOLN** (not illuminated).

(3) Set TI controls as listed in (a) through (c) below:

(a) **RESOLUTION BANDWIDTH** to **3 MHz**.
(b) **TIME/DIV** to **AUTO**.
(c) **PEAK AVERAGE** to fully clockwise.

(4) Press TI keys as listed in (a) through (h) below:

(a) **GREEN SHIFT**.
(b) **BANDWIDTH**.
(c) **MARKER MENU**.
(d) **7**.
(e) **6**, **Hz dB**.
(f) **SINGLE SWEEP** (twice).
(g) **GREEN SHIFT**.
(h) **PEAK FIND**.

(5) Marker frequency displayed on TI CRT will be within limits specified in first row of table 7. Record displayed marker frequency indication in actual indication column of table 7 for future reference.

(6) Press TI **FREE RUN** key.

(7) Repeat technique of (2) (g), (2) (h), (3) (a) and (4) (g) through (6) above for remaining TI settings in table 7. TI will be within limits specified.

Table 7. 6dB Bandwidth

| Test Instrument | | | | |
|---|---|---|---|---|
| Span/div | Resolution bandwidth | Actual indication | Min | Max |
| 1    MHz | 3    MHz | | 2.40  MHz | 3.60        MHz |
| 200    kHz | 1    MHz | | 800        kHz | 1.20        MHz |
| 20    kHz | 100    kHz | | 80.00  kHz | 120.0        kHz |
| 2    kHz | 10    kHz | | 8.00  kHz | 12.00        kHz |
| 200    Hz | 1    kHz | | 800        Hz | 1.200        kHz |
| 20    Hz | 100    Hz | | 80        Hz | 120        Hz |

(8) Press TI keys as listed in (a) through (i) below:

(a) **FREE RUN**.
(b) **VERTICAL DISPLAY 10dB/DIV**.
(c) **MARKER MENU**.
(d) **7**.
(e) **6**, **0**, **Hz dB**.
(f) **VIDEO FILTER WIDE** (illuminated).

(g) **AUTO RESOLN** (not illuminated).
(h) **BLUE SHIFT**.
(i) **SPAN DIV**, **2**, **MHz +dBX**.

(9) Rotate TI **RESOLUTION BANDWIDTH** control to **3 MHz**.

(10) Press TI keys as listed in (a) through (c) below:

(a) **SINGLE SWEEP** (twice and wait for sweep completion).
(b) **GREEN SHIFT**.
(c) **PEAK FIND**.

(11) Record displayed marker frequency indication in first row actual indication column of table 8 for future reference.

(12) Press TI **FREE RUN** key.

(13) Repeat technique of (8) (g), (8) (h) and (9) through (12) above for remaining TI settings listed in table 8 below.

Table 8.  60dB Bandwidth

| Test instrument | | |
|---|---|---|
| Span/div | Resolution bandwidth | Actual indication |
| 2     MHz | 3     MHz | |
| 1     MHz | 3     MHz | |
| 200   kHz | 1     MHz | |
| 20    kHz | 100   kHz | |
| 2     kHz | 10    kHz | |
| 200   Hz | 1     kHz | |
| 20    Hz | 100   Hz | |

(14) Calculate shape factor for each filter using actual indication values recorded in tables 7 and 8 above in the formula below.  Shape factor calculated ratio must be <7.5:1.

Shape factor ratio = 60 dB bandwidth ÷ 6dB bandwidth

(15) Press TI keys as listed in (a) through (c) below:

(a) **FREE RUN**.
(b) **BLUE SHIFT**.
(c) **SPAN/DIV**, **5**, **0**, **Hz dB**.

(16) Rotate TI **RESOLUTION BANDWIDTH** control to **10 Hz**.

(17) Marker frequency displayed on TI CRT will be ≤ 150 Hz.

(18) Press TI keys as listed in (a) through (e) below:

(a) **MARKER MENU**.
(b) **7**.
(c) **0**, **Hz dB**.
(d) **BLUE SHIFT**.
(e) **RESET**.

(19) Disconnect equipment setup.

**b. Adjustments.** No adjustments can be made.

**16. Noise Sideband Amplitude**

**a. Performance Check**

(1) Connect TI **CAL OUT** to TI **RF INPUT 50Ω**.

(2) Press TI keys as listed in (a) through (j) below:

.      (a) **BLUE SHIFT**.
      (b) **RESET**.
      (c) **AUTO RESOLN** (not illuminated).
      (d) **BLUE SHIFT**.
      (e) **FREQ**, **1**, **0**, **0**, **MHz +dBX**.
      (f) **BLUE SHIFT**.
      (g) **SPAN/DIV**, **1**, **0**, **0**, **Hz dB**.
      (h) **BLUE SHIFT**.
      (i) **REF LEVEL**, **4**, **0**, **kHz –dBX**.
      (j) **VIDEO FILTER WIDE** (illuminated).

(3) Ensure TI **TIME/DIV** is set to **AUTO** position and **PEAK AVERAGE** control is fully clockwise.

(4) Rotate TI **RESOLUTION BANDWIDTH** control to **10 Hz.**

(5) Press TI **SINGLE SWEEP** key twice.

(6) When sweep is completed (ready light off), press TI **BLUE SHIFT** then **MKR⇒CENTER** keys.

(7) Rotate TI **CENTER/MARKER FREQUENCY** control until TI **MARKER FREQUENCY** displayed on CRT is 100.00030 MHz.

(8) While observing TI **MKR LEVEL** displayed on CRT, slowly continue to rotate **CENTER/MARKER FREQUENCY** control up to a **MARKER FREQUENCY** indication of 100.00050 MHz. Displayed **MKR LEVEL** indication will be within limits specified in first row of table 9.

(9) Rotate TI **CENTER/MARKER FREQUENCY** control until TI **MARKER FREQUENCY** displayed on CRT is 99.99970 MHz.

(10) While observing TI **MKR LEVEL** displayed on CRT, slowly continue to rotate **CENTER/MARKER FREQUENCY** control up to a **MARKER FREQUENCY** indication of 99.99950 MHz. Displayed **MKR LEVEL** indication will be within limits specified in first row of table 9.

(11) Press TI keys as listed in (a) through (c) below:

      (a) **FREE RUN**.
      (b) **BLUE SHIFT**.
      (c) **MKR OFF**.

(12) Repeat technique of (2) (f), (2) (g) and (4) through (11) above for remaining TI settings and frequencies listed in table 9. Displayed **MKR LEVEL** will be within limits specified in first row of table 9.

Table 9. Noise Sideband Amplitude

| Span/div | Resolution bandwidth | Upper frequencies (MHz) | Lower frequencies (MHz) | Mkr level limit (dBm) |
|---|---|---|---|---|
| 100 Hz | 10 Hz | 100.00030 – 100.00050 | 99.99970 – 99.99950 | ≤–90 |
| 1 kHz | 100 Hz | 100.0030 – 100.0050 | 99.9970 – 99.9950 | ≤–90 |
| 10 kHz | 1 kHz | 100.030 – 100.050 | 99.970 – 99.950 | ≤–95 |
| 100 kHz | 10 kHz | 100.30 – 100.50 | 99.70 – 99.50 | ≤–95 |
| 1 MHz | 100 kHz | 103.0 – 105.0 | 97.0 – 95.0 | ≤–95 |

(13) Disconnect equipment setup.

**b. Adjustments**. No adjustments can be made.

**17. Frequency Response**

**a. Performance Check**

(1) Press TI keys as listed in (a) through (j) below:

(a) **BLUE SHIFT**.
(b) **RESET**.
(c) **BLUE SHIFT**.
(d) **FREQ**, **1**, **0**, **0**, **kHz –dBX**.
(e) **BLUE SHIFT**.
(f) **SPAN/DIV**, **2**, **kHz –dBX**.
(g) **BLUE SHIFT**.
(h) **REF LEVEL**, **8**, **kHz –dBX**.
(i) **BLUE SHIFT**.
(j) **dB/DIV**, **1**, **Hz dB**.

(2) Connect TI **RF INPUT 50Ω** to synthesizer/level generator **OUTPUT 50Ω**.

(3) Set synthesizer/level generator for an output frequency of 100 kHz at an amplitude of –10 dBm.

(4) Press TI keys as listed in (a) through (e) below:

(a) **SINGLE SWEEP** (twice).
(b) **GREEN SHIFT**.
(c) **PEAK FIND**.
(d) **GREEN SHIFT**.
(e) **ΔMKR**.

(5) Change synthesizer/level generator output frequency to 200 kHz.

(6) Press TI keys as listed in (a) through (e) below:

(a) **BLUE SHIFT**.
(b) **FREQ**, **2**, **0**, **0**, **kHz −dBX**.
(c) **SINGLE SWEEP**.
(d) **GREEN SHIFT**.
(e) **PEAK FIND**.

(7) TI **MKR LEVEL** indication will be within limits specified in first row of table 10.

(8) Repeat technique of (5) and (6) above for remaining synthesizer/level generator frequencies and test instrument settings in table 10. TI **MKR LEVEL** indications will be within limits specified in table 10.

Table 10. Frequency Response 200 kHz to 80 MHz

| Synthesizer/level generator output frequency | Test instrument | | |
|---|---|---|---|
| | Frequency | Mkr level indication (dB) | |
| | | Min | Max |
| 200    kHz | 200    kHz | −1.0 | 1.0 |
| 300    kHz | 300    kHz | −1.0 | 1.0 |
| 400    kHz | 400    kHz | −1.0 | 1.0 |
| 500    kHz | 500    kHz | −1.0 | 1.0 |
| 600    kHz | 600    kHz | −1.0 | 1.0 |
| 700    kHz | 700    kHz | −1.0 | 1.0 |
| 800    kHz | 800    kHz | −1.0 | 1.0 |
| 900    kHz | 900    kHz | −1.0 | 1.0 |
| 1    MHz | 1    MHz | −1.0 | 1.0 |
| 10    MHz | 10    MHz | −1.0 | 1.0 |
| 20    MHz | 20    MHz | −1.0 | 1.0 |
| 30    MHz | 30    MHz | −1.0 | 1.0 |
| 40    MHz | 40    MHz | −1.0 | 1.0 |
| 50    MHz | 50    MHz | −1.0 | 1.0 |
| 60    MHz | 60    MHz | −1.0 | 1.0 |
| 70    MHz | 70    MHz | −1.0 | 1.0 |
| 80    MHz | 80    MHz | −1.0 | 1.0 |

(9) Reduce synthesizer/level generator output to minimum and disconnect synthesizer/level generator **OUTPUT 50Ω** from TI **RF INPUT 50Ω**.

(10) Zero and calibrate the measuring receiver power sensor module.

(11) Connect equipment as shown in figure 8 below.
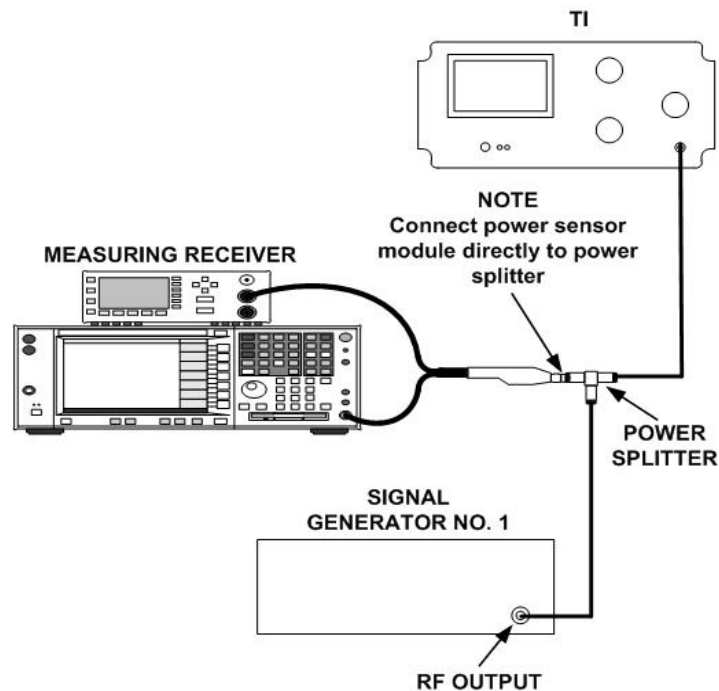
Figure 8.  Frequency response setup.

(12) Set signal generator No. 1 for an output frequency of 90 MHz at an amplitude of –5 dBm.

(13) Set measuring receiver to measure **RF POWER** in dBm at 90 MHz.

(14) Adjust signal generator No. 1 output amplitude for a measuring receiver of –10.0 ±0.1 dBm.

(15) Press TI keys as listed in (a) through (e) below:

    (a)  **BLUE SHIFT**.
    (b)  **FREQ**, **9**, **0**, **MHz +dBX**.
    (c)  **SINGLE SWEEP**.
    (d)  **GREEN SHIFT**.
    (e)  **PEAK FIND**.

(16) TI **MKR LEVEL** indication will be within limits specified in first row of table 11.

(17) Repeat technique of (13) and (16) above for remaining signal generator No. 1 frequencies and test instrument settings in table 11.  TI **MKR LEVEL** indications will be within limits specified in table 11.

Table 11.  Frequency Response 90 MHz to 1.8 GHz

| Signal generator #1 Output frequency | Test instrument | | |
|---|---|---|---|
| | Frequency | Mkr level indication (dB) | |
| | | Min | Max |
| 90  MHz | 90  MHz | −1.0 | 1.0 |
| 100  MHz | 100  MHz | −1.0 | 1.0 |
| 500  MHz | 500  MHz | −1.0 | 1.0 |
| 1.0 GHz | 1.0 GHz | −1.0 | 1.0 |
| 1.5 GHz | 1.5 GHz | −1.0 | 1.0 |
| 1.8 GHz | 1.8 GHz | −1.0 | 1.0 |

(18) Reduce all outputs to minimum and disconnect equipment setup.

**b.  Adjustments**. No adjustments can be made.

**18.  Dynamic Range and Accuracy**

**a.  Performance Check**

(1) Press TI keys as listed in (a) through (i) below:

(a) **BLUE SHIFT**.
(b) **RESET**.
(c) **BLUE SHIFT**.
(d) **FREQ**, **8**, **0**, **MHz +dBX**.
(e) **BLUE SHIFT**.
(f) **SPAN/DIV**, **2**, **kHz −dBX**.
(g) **BLUE SHIFT**.
(h) **REF LEVEL**, **1**, **0**, **MHz +dBX**.
(i) **VIDEO FILTER WIDE**.

(2) Rotate TI **PEAK AVERAGE** control fully clockwise.

(3) Connect TI **RF INPUT 50Ω** to synthesizer/level generator **OUTPUT 50Ω**.

(4) Set synthesizer/level generator for an output frequency of 80 MHz at an amplitude of +10 dBm.

(5) Adjust synthesizer/level generator output amplitude to position the displayed signal peak to TI reference level (top) graticule line.

(6) Press TI keys as listed in (a) through (f) below:

(a) **SINGLE SWEEP** (twice).
(b) **GREEN SHIFT**.
(c) **PEAK FIND**.

        (d)  **GREEN SHIFT**.

        (e)  Δ **MKR**.

        (f)  **SAVE A** (illuminated).

    (7)  Decrease synthesizer/level generator output amplitude by 10 dBm.

    (8)  Press TI **SINGLE SWEEP** key.

    (9)  TI **MKR LEVEL** indication and displayed trace will be within limits specified in first row of table 12.

    (10)  Press TI keys as listed in (a) through (i) below:

        (a)  **SAVE A** (not illuminated).

        (b)  **SINGLE SWEEP**.

        (c)  **BLUE SHIFT**.

        (d)  **MKR OFF**.

        (e)  **GREEN SHIFT**.

        (f)  **PEAK FIND**.

        (g)  **GREEN SHIFT**.

        (h)  Δ **MKR**.

        (i)  **SAVE A** (illuminated).

    (11)  Decrease synthesizer/level generator output amplitude by 10 dBm.

    (12)  Press TI **SINGLE SWEEP** key.

    (13)  TI **MKR LEVEL** indication and displayed trace will be within limits specified in second row of table 12.

    (14)  Repeat technique of (10) through (12) above for remaining synthesizer/level generator output amplitudes in table 12.  TI **MKR LEVEL** indications and displayed trace will be within limits specified in table 12.

Table 12.  Dynamic Range and Accuracy @ 10 dBm

| Synthesizer/level generator output amplitude below ref. (dBm) | Test instrument | | | |
|---|---|---|---|---|
| | Mkr level indication (dB) | | Displayed trace (dB below top graticule line) | |
| | Min | Max | Min | Max |
| −10 | −11 | −9 | −11 | −9 |
| −20 | −11 | −9 | −22 | −18 |
| −30 | −11 | −9 | −32 | −28 |
| −40 | −11 | −9 | −42 | −38 |
| −50 | −11 | −9 | −52 | −48 |
| −60 | −11 | −9 | −62 | −58 |
| −70 | −11 | −9 | −72 | −68 |
| −80 | −11 | −9 | −82 | −78 |

(15) Press TI keys as listed in (a) through (e) below:

    (a) **FREE RUN**.
    (b) **SAVE A** (not illuminated).
    (c) **BLUE SHIFT**.
    (d) **MKR OFF**.
    (e) **VERTICAL DISPLAY 2dB/DIV**.

(16) Adjust synthesizer/level generator output amplitude to position the displayed signal peak to TI reference level (top) graticule line.

(17) Press TI keys as listed in (a) through (f) below:

    (a) **SINGLE SWEEP** (twice).
    (b) **GREEN SHIFT**.
    (c) **PEAK FIND**.
    (d) **GREEN SHIFT**.
    (e) **Δ MKR**.
    (f) **SAVE A** (illuminated).

(18) Decrease synthesizer/level generator output amplitude by 2 dBm.

(19) Press TI **SINGLE SWEEP** key.

(20) TI **MKR LEVEL** indication and displayed trace will be within limits specified in first row of table 13.

(21) Press TI keys as listed in (a) through (i) below:

    (a) **SAVE A** (not illuminated).
    (b) **SINGLE SWEEP**.
    (c) **BLUE SHIFT**.
    (d) **MKR OFF**.
    (e) **GREEN SHIFT**.
    (f) **PEAK FIND**.
    (g) **GREEN SHIFT**.
    (h) **Δ MKR**.
    (i) **SAVE A** (illuminated).

(22) Decrease synthesizer/level generator output amplitude by 2 dBm.

(23) Press TI **SINGLE SWEEP** key.

(24) TI **MKR LEVEL** indication and displayed trace will be within limits specified in second row of table 13.

(25) Repeat technique of (10) through (12) above for remaining synthesizer/level generator output amplitudes in table 13. TI **MKR LEVEL** indications and displayed trace will be within limits specified in table 13.

Table 13.  Dynamic Range and Accuracy @ 2 dBm

| Synthesizer/level generator Output amplitude below ref. (dBm) | Test instrument | | | |
|---|---|---|---|---|
| | Mkr level indication (dB) | | Displayed trace (dB below top graticule line) | |
| | Min | Max | Min | Max |
| −2 | −2.4 | −1.6 | −2.4 | −1.6 |
| −4 | −2.4 | −1.6 | −4.8 | −3.2 |
| −6 | −2.4 | −1.6 | −7.0 | −5.0 |
| −8 | −2.4 | −1.6 | −9.0 | −7.0 |
| −10 | −2.4 | −1.6 | −11.0 | −9.0 |
| −12 | −2.4 | −1.6 | −13.0 | −11.0 |
| −14 | −2.4 | −1.6 | −15.0 | −13.0 |
| −16 | −2.4 | −1.6 | −17.0 | −15.0 |

(26) Press TI keys as listed in (a) through (e) below:

(a) **FREE RUN**.
(b) **SAVE A** (not illuminated).
(c) **BLUE SHIFT**.
(d) **MKR OFF**.
(e) **VERTICAL DISPLAY LIN**.

(27) Adjust synthesizer/level generator output amplitude to position the displayed signal peak to TI reference level (top) graticule line.

(28) Press TI keys as listed in (a) through (f) below:

(a) **SINGLE SWEEP** (twice).
(b) **GREEN SHIFT**.
(c) **PEAK FIND**.
(d) **GREEN SHIFT**.
(e) **Δ MKR**.
(f) **SAVE A** (illuminated).

(29) Decrease synthesizer/level generator output amplitude by 6 dBm.

(30) Press TI **SINGLE SWEEP** key.

(31) TI **MKR LEVEL** indication will be within limits specified in first row of table 14.

(32) Repeat technique of (29) and (30) above for remaining synthesizer/level generator output amplitudes in table 14.  TI **MKR LEVEL** indications and displayed trace will be within limits specified in table 14.

Table 14. Dynamic Range and Accuracy (Lin)

| Synthesizer/level generator output amplitude below ref. (dBm) | Test instrument | | | |
|---|---|---|---|---|
| | Mkr level indication (mV) | | Displayed trace (Div below top graticule line) | |
| | Min | Max | Min | Max |
| −6 | −392 | −321 | −4.4 | −3.6 |
| −12 | −581 | −450 | −6.4 | −5.6 |
| −18 | −660 | −588 | −7.4 | −6.6 |

(33) Reduce all outputs to minimum and disconnect equipment setup.

**b. Adjustments.** No adjustments can be made.

## 19. RF Attenuator Accuracy

**a. Performance Check**

(1) Connect TI **RF INPUT 50Ω** to synthesizer/level generator **OUTPUT 50Ω**.

(2) Set synthesizer/level generator for an output frequency of 50 MHz at a level of −60 dBm with 10 dB increment steps.

(3) Press TI keys as listed in (a) through (j) below:

    (a) **BLUE SHIFT**.
    (b) **RESET**.
    (c) **BLUE SHIFT**.
    (d) **FREQ**, **5**, **0**, **MHz +dBX**.
    (e) **BLUE SHIFT**.
    (f) **REF LEVEL**, **6**, **0**, **kHz −dBX**.
    (g) **VERTICAL DISPLAY 2dB/DIV**.
    (h) **BLUE SHIFT**.
    (i) **SPAN/DIV**, **5**, **0**, **0**, **Hz dB**.
    (j) **AUTO RESOLN** (not illuminated).

(4) Rotate TI **RESOLUTION BANDWIDTH** knob to **1 kHz**.

(5) Press TI keys as listed in (a) through (f) below:

    (a) **SINGLE SWEEP** (twice).
    (b) **GREEN SHIFT**.
    (c) **PEAK FIND**.
    (d) **GREEN SHIFT**.
    (e) **ΔMKR**.
    (f) **SAVE A** (illuminated).

(6) Press synthesizer/level generator **INCR ⇑** key.

(7) Rotate TI **MIN RF ATTEN dB** knob to **10**.

(8) Press TI keys as listed in (a) through (e) below:

    (a) **BLUE SHIFT**.
    (b) **REF LEVEL**, **5**, **0**, **kHz –dBX**.
    (c) **SINGLE SWEEP**.
    (d) **GREEN SHIFT**.
    (e) **PEAK FIND**.

(9) TI **MKR LEVEL** indication will be within limits specified in first row of table 15.

(10) Press TI keys as listed in (a) through (c) below:

    (a) **BLUE SHIFT**.
    (b) **MKR OFF**.
    (c) **SAVE A** (not illuminated).

(11) Repeat technique of (5) through (10) above for remaining synthesizer/level generator output amplitudes and TI settings in table 15. TI **MKR LEVEL** indications and displayed trace will be within limits specified in table 15.

Table 15. RF Attenuator Accuracy

| Synthesizer/level generator amplitude (dBm) | Test instrument | | | |
|---|---|---|---|---|
| | Ref level (dBm) | Min RF Atten (dB) | Mkr level indication (dB) | |
| | | | Min | Max |
| −60 | −60 | 0 | 9.5 | 10.5 |
| −50 | −50 | 10 | 9.5 | 10.5 |
| −40 | −40 | 20 | 9.5 | 10.5 |
| −30 | −30 | 30 | 9.5 | 10.5 |
| −20 | −20 | 40 | 9.5 | 10.5 |
| −10 | −10 | 50 | 9.5 | 10.5 |
| 0 | 0 | 60 | 9.5 | 10.5 |

(12) Rotate TI **MIN RF ATTEN dB** knob to **0 NORM** position.

(13) Set all outputs to minimum and disconnect equipment.

  **b. Adjustments**. No adjustments can be made.

## 20. IF Gain Accuracy

  **a. Performance Check**

(1) Connect TI **RF INPUT 50Ω** to synthesizer/level generator **OUTPUT 50Ω**.

(2) Set synthesizer/level generator for an output frequency of 80 MHz at a level of −22 dBm.

(3) Press TI keys as listed in (a) through (k) below:

    (a) **BLUE SHIFT**.
    (b) **RESET**.

      (c)  **BLUE SHIFT**.
      (d)  **FREQ**, **8**, **0**, **MHz +dBX**.
      (e)  **BLUE SHIFT**.
      (f)  **REF LEVEL**, **2**, **0**, **kHz –dBX**.
      (g)  **ZERO SPAN** (illuminated).
      (h)  **VIDEO FILTER NARROW** (illuminated).
      (i)  **BLUE SHIFT**.
      (j)  **dB/DIV**, **1**, **Hz dB**.
      (k)  **AUTO RESOLN** (not illuminated).

    (4)  Rotate TI **RESOLUTION BANDWIDTH** knob to **1 kHz**.

    (5)  Rotate TI **PEAK AVERAGE** knob fully clockwise.

    (6)  Adjust synthesizer/level generator amplitude to align signal two divisions below top graticule line.

    (7)  Set synthesizer/level generator for amplitude increments of 1 dB.

    (8)  Press TI keys as listed in (a) through (h) below:

      (a)  **SINGLE SWEEP** (twice).
      (b)  **GREEN SHIFT**.
      (c)  **PEAK FIND**.
      (d)  **GREEN SHIFT**.
      (e)  **ΔMKR**.
      (f)  **SAVE A** (illuminated).
      (g)  **BLUE SHIFT**.
      (h)  **REF LEVEL**, **2**, **1**, **kHz –dBX**.

    (9)  Press synthesizer/level generator **INCR⇓**.

    (10)  Press TI **SINGLE SWEEP** key.

    (11)  TI **MKR LEVEL** indication will be within limits specified in first row of table 16 ΔMKR indication column.

    (12)  Press TI **GREEN SHIFT** key, then **ΔMKR** key.

    (13)  TI **MKR LEVEL** indication will be within limits specified in first row of table 16 ΔMKR below ref column.

    (14)  Press TI keys as listed in (a) through (c) below:

      (a)  **BLUE SHIFT**.
      (b)  **MKR OFF**.
      (c)  **SAVE A** (not illuminated).

    (15)  Repeat technique of (8) through (14) above for remaining TI settings in table 16. TI **MKR LEVEL** indications will be within limits specified in table 16 ΔMKR indication and ΔMKR below ref columns.

Table 16.  IF gain accuracy @ 1 dB steps

| Ref level setting (dBm) | ΔMKR indication (dBm) | | ΔMKR below ref (dBm) | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| −21 | −1.2 | −0.8 | −23.3 | −22.7 |
| −22 | −1.2 | −0.8 | −24.4 | −23.6 |
| −23 | −1.2 | −0.8 | −25.5 | −24.5 |
| −24 | −1.2 | −0.8 | −26.5 | −25.5 |
| −25 | −1.2 | −0.8 | −27.5 | −26.5 |
| −26 | −1.2 | −0.8 | −28.5 | −27.5 |
| −27 | −1.2 | −0.8 | −29.5 | −28.5 |
| −28 | −1.2 | −0.8 | −30.5 | −29.5 |
| −29 | −1.2 | −0.8 | −31.5 | −30.5 |
| −30 | −1.5 | −0.5 | −33.0 | −31.0 |

(Test instrument spans the column headers above.)

(16) Press TI keys as listed in (a) through (f) below:

    (a) **BLUE SHIFT**.
    (b) **MKR OFF**.
    (c) **SAVE A** (not illuminated).
    (d) **BLUE SHIFT**.
    (e) **REF LEVEL**, **2**, **0**, **kHz dBX**.
    (f) **FREE RUN**.

(17) Set synthesizer/level generator output amplitude to −22 dBm and amplitude increments for 10 dBm.

(18) Adjust synthesizer/level generator amplitude to align signal two divisions below top graticule line.

(19) Press TI keys as listed in (a) through (h) below:

    (a) **SINGLE SWEEP** (twice).
    (b) **GREEN SHIFT**.
    (c) **PEAK FIND**.
    (d) **GREEN SHIFT**.
    (e) **ΔMKR**.
    (f) **SAVE A** (illuminated).
    (g) **BLUE SHIFT**.
    (h) **REF LEVEL**, **3**, **0**, **kHz −dBX**.

(20) Press synthesizer/level generator **INCR⇓**.

(21) Press TI **SINGLE SWEEP** key.

(22) TI **MKR LEVEL** indication will be within limits specified in first row of table 17 ΔMKR indication column.

(23) Press TI **GREEN SHIFT** key, then **ΔMKR** key.

(24) TI **MKR LEVEL** indication will be within limits specified in first row of table 17 ΔMKR below ref column.

(25) Press TI keys as listed in (a) through (c) below:

    (a) **BLUE SHIFT**.
    (b) **MKR OFF**.
    (c) **SAVE A** (not illuminated).

(26) Repeat technique of (19) through (26) above for remaining TI settings in table 17. TI **MKR LEVEL** indications will be within limits specified in table 17 ΔMKR indication and ΔMKR below ref columns.

Table 17.  IF Gain Accuracy @ 10 dB Steps

| Ref level setting (dBm) | ΔMKR indication (dBm) | | ΔMKR below ref (dBm) | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| −30 | −11.5 | −9.5 | −33.0 | −31.0 |
| −40 | −12.0 | −8.0 | −44.0 | −40.0 |
| −50 | −12.0 | −8.0 | −54.0 | −50.0 |
| −60 | −12.0 | −8.0 | −64.0 | −60.0 |
| −70 | −12.0 | −8.0 | −74.0 | −70.0 |
| −80 | −12.0 | −8.0 | −84.0 | −80.0 |

(27) Reduce all outputs to minimum and disconnect equipment setup.

  **b. Adjustments**.  No adjustments can be made.

**21. Gain Variation**

  **a. Performance Check**

(1) Connect TI **CAL OUT** to TI **RF INPUT 50Ω**.

(2) Press TI keys as listed in (a) through (l) below:

    (a) **BLUE SHIFT**.
    (b) **RESET**.
    (c) **BLUE SHIFT**.
    (d) **FREQ**, **1**, **0**, **0**, **MHZ +dBX**.
    (e) **BLUE SHIFT**.
    (f) **SPAN/DIV**, **1**, **MHZ +dBX**.
    (g) **BLUE SHIFT**.
    (h) **REF LEVEL**, **1**, **8**, **kHz −dBX**.
    (i) **BLUE SHIFT**.
    (j) **dB/DIV**, **1**, **Hz dB**.
    (k) **VIDEO FILTER WIDE** (illuminated).
    (l) **AUTO RESOLN** (not illuminated).

(3) Rotate TI **RESOLUTION BANDWIDTH** control to **3 MHz**.

(4) Press TI keys as listed in (a) through (e) below:

    (a) **SAVE A** (illuminated).
    (b) **GREEN SHIFT**.
    (c) **PEAK FIND**.
    (d) **GREEN SHIFT**.
    (e) **ΔMKR**.

(5) Rotate TI **RESOLUTION BANDWIDTH** control to **1 MHz**.

(6) Press TI keys as listed in (a) through (d) below:

    (a) **BLUE SHIFT**.
    (b) **SPAN/DIV**, **2**, **0**, **0**, **kHz –dBX**.
    (c) **GREEN SHIFT**.
    (d) **PEAK FIND**.

(7) TI **MKR LEVEL** indication will be within limits specified in first row of table 18.

(8) Repeat technique of (5) and (6) above for remaining TI settings in table 18. TI **MKR LEVEL** indications will be within limits specified in table 18.

Table 18. Gain Variation

| Test instrument | | | |
|---|---|---|---|
| Resolution bandwidth setting | Span/div setting | MKR level indication (dB) | |
| | | Min | Max |
| 1   MHz | 200   kHz | −0.4 | 0.4 |
| 100   kHz | 20   kHz | −0.4 | 0.4 |
| 10   kHz | 2   kHz | −0.4 | 0.4 |
| 1   kHz | 200   Hz | −0.4 | 0.4 |
| 100   Hz | 20   Hz | −0.4 | 0.4 |
| 10   Hz | 10   Hz | −0.4 | 0.4 |

(9) Disconnect TI **CAL OUT** from **RF INPUT 50Ω**.

  **b. Adjustments**. No adjustments can be made.

## 22. Sensitivity and Residual Response

  **a. Performance Check**

(1) Connect 50Ω 20-watt termination to TI **RF INPUT 50Ω**.

(2) Press TI keys as listed in (a) through (f) below:

    (a) **BLUE SHIFT**.
    (b) **RESET**.
    (c) **BLUE SHIFT**.
    (d) **REF LEVEL**, **8**, **0**, **kHz –dBX**.
    (e) **VIDEO FILTER NARROW**.

        (f)   **VERTICAL DISPLAY 2dB/DIV**.

(3)  Rotate TI **TIME/DIV** knob to **1 s**.

(4)  Press TI **AUTO RESOLN** (not illuminated).

(5)  Rotate TI **RESOLUTION BANDWIDTH** knob to **3 MHz**.

(6)  Rotate TI **PEAK AVERAGE** knob fully clockwise.

(7)  Press TI **TUNE** key.  Wait for sweep completion.

(8)  Using TI **CENTER/MARKER FREQUENCY** knob, place marker on highest point of trace.

**NOTE**
Throughout this check use of TI **REFERENCE LEVEL** knob, to adjust TI reference level, will be required to keep trace on screen.

(9)  Press TI **ZERO SPAN** key.

(10)  Press TI **SINGLE SWEEP** key twice.  Wait for sweep completion.

(11)  Using TI **CENTER/MARKER FREQUENCY** knob, place marker on highest point of trace.

(12)  TI **MKR LEVEL** indication will be within limits specified in first row of table 19.

(13)  Press TI **FREE RUN** key.

(14)  Rotate TI **RESOLUTION BANDWIDTH** knob to **1 MHz**.

(15)  Adjust TI **REFERENCE LEVEL** knob (if necessary).

(16)  Press TI **SINGLE SWEEP** key twice.  Wait for sweep completion.

(17)  Using TI **CENTER/MARKER FREQUENCY** knob, place marker on highest point of trace.

(18)  TI **MKR LEVEL** indication will be within limits specified in second row of table 19. Repeat technique of (13) through (17) for remaining TI settings in table 19.

Table 19.  Sensitivity 3 MHz – 10 Hz @ 2dB/div

| Test instrument | |
|---|---|
| Resolution bandwidth setting | Marker level indication limits (dBm) |
| 3 MHz | $\leq -80$ |
| 1 MHz | $\leq -85$ |
| 100 kHz | $\leq -95$ |
| 10 kHz | $\leq -105$ |
| 1 kHz | $\leq -115$ |

(19) Press TI keys as listed in (a) through (c) below:

    (a) **FREE RUN**.
    (b) **BLUE SHIFT**.
    (c) **dB/DIV**, **5**, **Hz dB**.

(20) Rotate TI **RESOLUTION BANDWIDTH** knob to **100 Hz**.

(21) Adjust TI **REFERENCE LEVEL** knob (if necessary).

(22) Press TI **SINGLE SWEEP** key twice.  Wait for sweep completion.

(23) Using TI **CENTER/MARKER FREQUENCY** knob, place marker on highest point of trace.

(24) TI **MKR LEVEL** indication will be within limits specified in first row of table 20.

(25) Repeat technique of (19) (a) and (20) through (24) for remaining TI settings in table 20.  TI **MKR LEVEL** indication will be within limits specified in table 20.

Table 20. Sensitivity 1 MHz – 1.8 GHz @ 5dB/div

| Test instrument | |
|---|---|
| Resolution bandwidth setting | Marker level indication limits (dBm) |
| 100 Hz | ≤−125 |
| 10 Hz | ≤−131 |

(26) Press TI keys as listed in (a) through (d) below:

    (a) **FREE RUN**.
    (b) **BLUE SHIFT**.
    (c) **FREQ**, **1**, **0**, **0**, **kHz –dBX**.
    (d) **VERTICAL DISPLAY 2dB/DIV**.

(27) Rotate TI **RESOLUTION BANDWIDTH** knob to **10 kHz**.

(28) Adjust TI **REFERENCE LEVEL** knob (if necessary).

(29) Press TI **SINGLE SWEEP** key twice.  Wait for sweep completion.

(30) Using TI **CENTER/MARKER FREQUENCY** knob, place marker on highest point of trace.

(31) TI **MKR LEVEL** indication will be within limits specified in first row of table 21.

(32) Repeat technique of (26) (a) and (27) through (30) for remaining TI settings in table 21.  TI **MKR LEVEL** indication will be within limits specified in table 21.

Table 21. Sensitivity 100 kHz @ 2dB/div

| Test instrument | |
|---|---|
| Resolution bandwidth setting | Marker level indication limits (dBm) |
| 10      kHz | $\leq -85$ |
| 1      kHz | $\leq -95$ |

(33) Press TI keys as listed in (a) through (c) below:

    (a) **FREE RUN**.
    (b) **BLUE SHIFT**.
    (c) **dB/DIV**, **5**, **Hz dB**.

(34) Rotate TI **RESOLUTION BANDWIDTH** knob to **100 Hz**.

(35) Adjust TI **REFERENCE LEVEL** knob (if necessary).

(36) Press TI **SINGLE SWEEP** key twice. Wait for sweep completion.

(37) Using TI **CENTER/MARKER FREQUENCY** knob, place marker on highest point of trace.

(38) TI **MKR LEVEL** indication will be within limits specified in first row of table 22.

(39) Repeat technique of (33) (a) and (34) through (37) for remaining TI settings in table 22. TI **MKR LEVEL** indication will be within limits specified in table 22.

Table 22. Sensitivity 100kHz @ 5dB/div

| Test instrument | |
|---|---|
| Resolution bandwidth setting | Marker level indication limits (dBm) |
| 100    Hz | $\leq -105$ |
| 10    Hz | $\leq -115$ |

(40) Press TI keys as listed in (a) through (d) below:

    (a) **FREE RUN**.
    (b) **BLUE SHIFT**.
    (c) **FREQ**, **1**, **0**, **kHz –dBX**.
    (d) **VERTICAL DISPLAY 2dB/DIV**.

(41) Rotate TI **RESOLUTION BANDWIDTH** knob to **1 kHz**.

(42) Adjust TI **REFERENCE LEVEL** knob (if necessary).

(43) Press TI **SINGLE SWEEP** key twice. Wait for sweep completion.

(44) Using TI **CENTER/MARKER FREQUENCY** knob, place marker on highest point of trace.

(45) TI **MKR LEVEL** indication will be ≤ −80 dBm.

(46) Press TI keys as listed in (a) through (c) below:

    (a) **FREE RUN**.
    (b) **BLUE SHIFT**.
    (c) **dB/DIV**, **5**, **Hz dB**.

(47) Rotate TI **RESOLUTION BANDWIDTH** knob to **100 Hz**.

(48) Adjust TI **REFERENCE LEVEL** knob (if necessary).

(49) Press TI **SINGLE SWEEP** key twice. Wait for sweep completion.

(50) Using TI **CENTER/MARKER FREQUENCY** knob, place marker on highest point of trace.

(51) TI **MKR LEVEL** indication will be within limits specified in first row of table 23.

(52) Repeat technique of (46) (a) and (47) through (50) for remaining TI settings in table 23. TI **MKR LEVEL** indication will be within limits specified in table 23.

Table 23. Sensitivity 10 kHz @ 5dB/div

| Test instrument | |
|---|---|
| Resolution bandwidth setting | Marker level indication limits (dBm) |
| 100    Hz | ≤ −90 |
| 10    Hz | ≤ −100 |

(53) Press TI keys as listed in (a) through (c) below:

    (a) **FREE RUN**.
    (b) **BLUE SHIFT**.
    (c) **FREQ**, **1**, **kHz −dBX**.

(54) Rotate TI **RESOLUTION BANDWIDTH** knob to **100 Hz**.

(55) Adjust TI **REFERENCE LEVEL** knob (if necessary).

(56) Press TI **SINGLE SWEEP** key twice. Wait for sweep completion.

(57) Using TI **CENTER/MARKER FREQUENCY** knob, place marker on highest point of trace.

(58) TI **MKR LEVEL** indication will be within limits specified in first row of table 24.

(59) Repeat technique of (53) (a) and (54) through (57) for remaining TI settings in table 24. TI **MKR LEVEL** indication will be within limits specified in table 24.

Table 24.  Sensitivity 1 kHz @ 5dB/div

| Test instrument | |
|---|---|
| Resolution bandwidth setting | Marker level indication limits (dBm) |
| 100   Hz | $\leq -85$ |
| 10   Hz | $\leq -95$ |

(60) Rotate TI **TIME/DIV** knob to **AUTO**.

(61) Press TI keys as listed in (a) through (j) below:

    (a)  **BLUE SHIFT**.
    (b)  **RESET**.
    (c)  **BLUE SHIFT**.
    (d)  **FREQ**, **5**, **0**, **MHz +dBX**.
    (e)  **BLUE SHIFT**.
    (f)  **REF LEVEL**, **5**, **0**, **kHz –dBX**.
    (g)  **BLUE SHIFT**.
    (h)  **SPAN/DIV**, **1**, **0**, **MHz +dBX**.
    (i)  **VIDEO FILTER WIDE**.
    (j)  **AUTO RESOLN** (not illuminated).

(62) Rotate TI **RESOLUTION BANDWIDTH** knob to **10 kHz**.

(63) Rotate TI **PEAK AVERAGE** knob fully counterclockwise.

(64) Press TI **SINGLE SWEEP** key (twice).  Wait for sweep completion.

(65) Press TI **TUNE** key.

(66) Using TI **CENTER/MARKER FREQUENCY** knob, place marker on highest point of trace (ignore zero Hz response).

(67) TI **MKR LEVEL** indication will be within limits specified in first row of table 25.

(68) Press TI keys as listed in (a) through (c) below:

    (a)  **BLUE SHIFT**.
    (b)  **FREQ**, **1**, **5**, **0**, **MHz + dBX**.
    (c)  **SWEEP** (wait for sweep completion).

(69) Using TI **CENTER/MARKER FREQUENCY** knob, place marker on highest point of trace.

(70) TI **MKR LEVEL** indication will be within limits specified in 150 MHz row of table 25.

(71) Repeat (68) and (69) above for remaining frequencies listed in table 25.  TI **MKR LEVEL** indication will be within limits specified in table 25.

Table 25. Residual response

| Test instrument | |
| --- | --- |
| Center frequency (MHz) | Mkr level indication limit (dBm) |
| 50 | $\leq -100$ |
| 150 | $\leq -100$ |
| 250 | $\leq -100$ |
| 350 | $\leq -100$ |
| 450 | $\leq -100$ |
| 550 | $\leq -100$ |
| 650 | $\leq -100$ |
| 750 | $\leq -100$ |
| 850 | $\leq -100$ |
| 950 | $\leq -100$ |
| 1050 | $\leq -100$ |
| 1150 | $\leq -100$ |
| 1250 | $\leq -100$ |
| 1350 | $\leq -100$ |
| 1450 | $\leq -100$ |
| 1550 | $\leq -100$ |
| 1650 | $\leq -100$ |
| 1750 | $\leq -100$ |

(72) Disconnect 50Ω 20-watt termination from TI **RF INPUT 50Ω**.

**b. Adjustments**. No adjustments can be made.

**23. Harmonic and Intermodulation Distortion**

**a. Performance Check**

(1) Connect equipment as shown in figure 9 below.
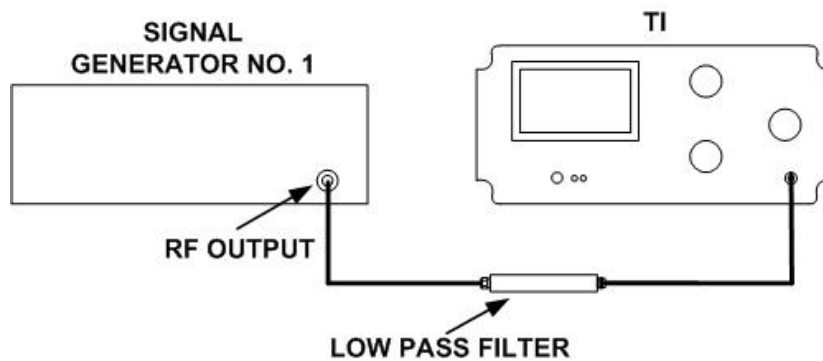


Figure 9. Harmonic distortion setup.

(2) Press TI keys as listed in (a) through (j) below:
    (a) **BLUE SHIFT**.
    (b) **RESET**.
    (c) **BLUE SHIFT**.
    (d) **FREQ**, **1**, **1**, **0**, **MHz +dBX**.

(e) **BLUE SHIFT**.
(f) **REF LEVEL**, **3**, **0**, **kHz –dBX**.
(g) **BLUE SHIFT**.
(h) **SPAN/DIV**, **5**, **0**, **0**, **kHz –dBX**.
(i) **VIDEO FILTER WIDE**.
(j) **MIN DISTORTION** (not illuminated).

(3) Rotate TI **PEAK AVERAGE** knob fully counterclockwise.

(4) Set signal generator No. 1 for an output frequency of 110 MHz at an amplitude of –30 dBm.

(5) Adjust signal generator No. 1 output amplitude to position displayed trace at TI reference level (top) graticule line.

(6) Press TI keys as listed in (a) through (g) below:

(a) **SINGLE SWEEP** (twice).
(b) **GREEN SHIFT**.
(c) **STEP SIZE**.
(d) **GREEN SHIFT**.
(e) **PEAK FIND**.
(f) **+STEP**.
(g) **SINGLE SWEEP**.

(7) TI **MKR LEVEL** indications will be within limits specified in first row of table 26.

(8) Repeat technique of (6) (f) and (6) (g) above for remaining harmonics in table 26. TI **MKR LEVEL** indications will be within limits specified in table 26.

Table 26. Harmonic Distortion

| Harmonic | MKR LEVEL indication limit (dBm) |
|---|---|
| 2nd | $\leq -90$ |
| 3rd | $\leq -90$ |

(9) Reduce all outputs to minimum.

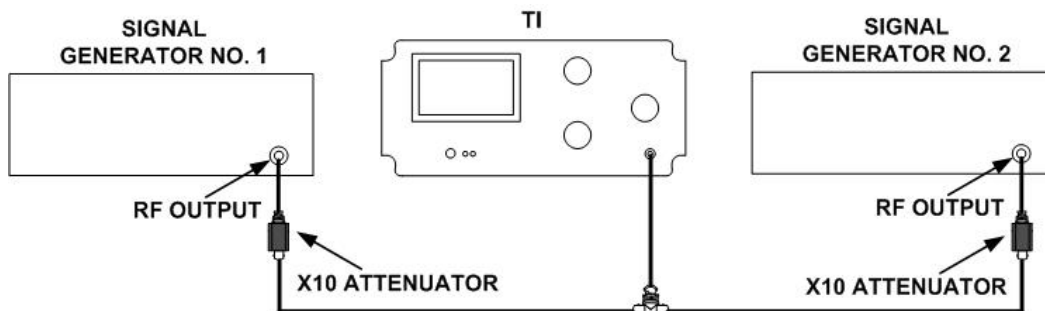(10) Connect equipment as shown in figure 10 below.



Figure 10. Third order intercept.

(11) Press TI keys as listed in (a) through (h) below:
(a) **BLUE SHIFT**.

      (b) **RESET**.
      (c) **BLUE SHIFT**.
      (d) **FREQ**, **2**, **0**, **0**, **MHz +dBX**.
      (e) **BLUE SHIFT**.
      (f) **SPAN/DIV**, **5**, **0**, **0**, **kHz –dBX**.
      (g) **BLUE SHIFT**.
      (h) **REF LEVEL**, **3**, **0**, **kHz –dBX**.

(12) Set signal generator No. 1 for an output frequency of 199.5 MHz at an amplitude of –10 dBm.

(13) Set signal generator No. 2 for an output frequency of 200.5 MHz at an amplitude of –10 dBm.

(14) Adjust signal generator No. 1 output amplitude to position its signal peak at TI top graticule line.

(15) Adjust signal generator No. 2 output amplitude to position its signal peak at TI top graticule line.

(16) Press TI **AUTO RESOLN** key (not illuminated).

(17) Rotate TI **RESOLUTION BANDWIDTH** knob to **10 kHz**.

(18) Press TI **SINGLE SWEEP** key (twice) and wait for sweep completion.

(19) Press TI keys as listed in (a) and (b) below:
      (a) **BLUE SHIFT**.
      (b) **MKR→CENTER**.

(20) Rotate TI **CENTER/MARKER FREQUENCY** knob counterclockwise until TI **MARKER FREQUENCY** indication is **198.50 MHz**. TI **MKR LEVEL** indication will be ≤ –100 dBm.

(21) Rotate TI **CENTER/MARKER FREQUENCY** knob clockwise until TI **MARKER FREQUENCY** indication is **201.50 MHz**.

(22) TI **MKR LEVEL** indication will be ≤ –100 dBm.

(23) Reduce all outputs to minimum and disconnect equipment setup.

**b. Adjustments**. No adjustments can be made.

## 24. Tracking Generator Frequency Range

**a. Performance Check**

(1) Connect TI tracking generator **RF OUT 50Ω** to TI **RF INPUT 50Ω**.

(2) Connect TI **1st LO 50Ω OUTPUT** to TI tracking generator **1st LO IN**.

(3) Connect TI **2nd LO 50Ω OUTPUT** to TI tracking generator **2nd LO IN**.

(4) Adjust TI **VAR dB** control to **0**.

(5) Set TI **OUTPUT LEVEL –dBm** to **00**.

(6) Press TI **BLUE SHIFT** then **RESET** keys.

(7)  Displayed trace must begin at left edge of TI CRT (100 kHz) and extend to right edge of TI CRT (1.8 GHz).  See example in figure 11 below.
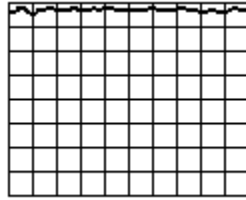


Figure 11. Frequency range.

(8)  Disconnect TI tracking generator **RF OUT 50Ω** from TI **RF INPUT 50Ω**.

**b.  Adjustments**.  No adjustments can be made.

**25.  Tracking Generator Output Level**

   **a.  Performance Check**

   (1)  Zero and calibrate the measuring receiver power sensor module.

   (2)  Connect measuring receiver power sensor module to TI **RF OUT 50Ω**.

   (3)  Press TI keys as listed in (a) through (e) below:
   - (a)  **BLUE SHIFT**.
   - (b)  **RESET**.
   - (c)  **BLUE SHIFT**.
   - (d)  **FREQ**, **1**, **0**, **0**, **MHz +dBX**.
   - (e)  **ZERO SPAN** (illuminated).

   (4)  Measure power at 100 MHz.

   (5)  Measuring receiver indication will be between –0.5 dBm and 0.5 dBm.

   (6)  Disconnect measuring receiver power sensor module from TI **RF OUT 50Ω**.

   **b.  Adjustments**.  No adjustments can be made.

**26.  Tracking Generator Flatness**

   **a.  Performance Check**

   (1)  Connect TI **RF OUT 50Ω** to **TI RF INPUT 50Ω**.

   (2)  Press TI keys as listed in (a) through (f) below:
   - (a)  **BLUE SHIFT**.
   - (b)  **RESET**.
   - (c)  **BLUE SHIFT**.
   - (d)  **REF LEVEL**, **1**, **MHz +dBX**.
   - (e)  **BLUE SHIFT**.
   - (f)  **dB/DIV**, **1**, **Hz dB**.

(3) If necessary adjust TI **REFERENCE LEVEL** knob to move trace within TI graticule area.

(4)  Press TI keys as listed in (a) through (c) below:

    (a)  **SINGLE SWEEP** (twice and wait for sweep completion).
    (b)  **GREEN SHIFT**.
    (c)  **PEAK FIND**.

(5)  Using TI **CENTER/MARKER FREQUENCY** knob, move marker to highest point on displayed trace.  (Disregard 0 Hz response)

(6)  Press TI keys as listed in (a) and (b) below:

    (a)  **GREEN SHIFT**.
    (b)  **ΔMKR**.

(7)  Using TI **CENTER/MARKER FREQUENCY** knob, move active marker to lowest point on displayed trace.

(8)  TI **MKR LEVEL** indication will be between 0 and –4.5 dB.

(9)  Disconnect TI **RF OUT 50Ω** from TI **RF INPUT 50Ω**.

  **b.  Adjustments.**  No adjustments can be made.

**27.  Tracking Generator Spurious Signals**

  **a.  Performance Checks**
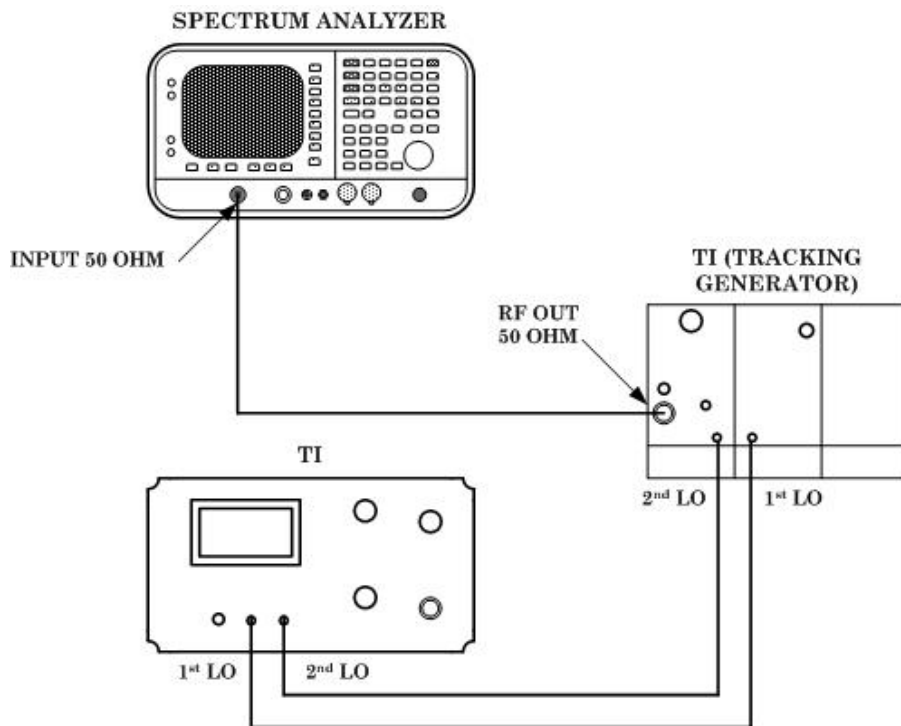
(1)  Connect equipment as shown in figure 12 below.



Figure 12.  Spurious signals setup.

(2) Adjust TI **MANUAL SCAN** knob to midrange.

(3) Press TI keys as listed in (a) through (e) below:

    (a) **BLUE SHIFT**.
    (b) **RESET**.
    (c) **BLUE SHIFT**.
    (d) **FREQ**, **1**, **0**, **0**, **MHz +dBX**.
    (e) **ZERO SPAN** (illuminated).

(4) Press spectrum analyzer keys as listed in (a) through (n) below:

    (a) **Preset**.
    (b) **FREQUENCY, Center Freq, 1, 0, 0, MHz**.
    (c) **SPAN, 2, 0, MHz**.
    (d) **BW/Avg, Res BW, 3, 0, 0, kHz**.
    (e) **Video BW, 1, 0, kHz**.
    (f) **AMPLITUDE, Ref Level, 0, dBm**.
    (g) **Scale/Div], 1, 0, dB**.
    (h) **FREQUENCY, CF Step, 1, 0, 0, MHz**.
    (i) **Center Freq**.
    (j) **Peak Search**.
    (k) **Marker Delta**.
    (l) **FREQUENCY**.
    (m) ⇑.
    (n) **Peak Search**.

(5) Spectrum analyzer **ΔMkr** indication will be within limits specified in first row of table 27.

(6) Repeat technique of (4) (m) and (n) above for remaining harmonics in table 27. Spectrum analyzer **ΔMkr** indication will be within limits specified in table 27.

Table 27.  Harmonic Amplitude

| Spectrum analyzer | |
|---|---|
| Harmonic | ΔMkr indication limit (dB) |
| 2nd | ≤ −20 |
| 3rd | ≤ −20 |
| 4th | ≤ −20 |
| 5th | ≤ −20 |
| 6th | ≤ −20 |
| 7th | ≤ −20 |
| 8th | ≤ −20 |
| 9th | ≤ −20 |
| 10th | ≤ −20 |
| 11th | ≤ −20 |
| 12th | ≤ −20 |
| 13th | ≤ −20 |
| 14th | ≤ −20 |
| 15th | ≤ −20 |
| 16th | ≤ −20 |
| 17th | ≤ −20 |
| 18th | ≤ −20 |

    (7)  Press spectrum analyzer keys as listed in (a) through (f) below:

        (a)  **FREQUENCY**, **Center Freq**, **1**, **5**, **0**, **MHz**.
        (b)  **SPAN**, **9**, **0**, **MHz**.
        (c)  **Peak Search**.
        (d)  **FREQUENCY**.
        (e)  ⇑.
        (f)  **Peak Search**.

    (8)  Spectrum analyzer **ΔMkr** indication will be $\leq -40$ dBm.

    (9)  Repeat technique of (7) (d) and (7) (f) above up to a spectrum analyzer center frequency of 1.850 GHz.  Spectrum analyzer **ΔMkr** indication will be $\leq -40$ dBm throughout.

    **b.**  **Adjustments.**  No adjustments can be made.

## 28.  Final Procedure

    **a.**  Deenergize and disconnect all equipment.

    **b.**  Annotate and affix DA label/form in accordance with TB 750-25.

By Order of the Secretary of the Army:

GEORGE W. CASEY, JR.
*General, United States Army*
*Chief of Staff*

Official:

JOYCE E. MORROW
*Administrative Assistant to the*
*Secretary of the Army*

0719037

Distribution:
  To be distributed in accordance with the initial distribution number (IDN) 344783, requirements for calibration procedure TB 9-6625-2345-24.

# Instructions for Submitting an Electronic 2028

The following format must be used if submitting an electronic 2028.  The subject line must be exactly the same and all fields must be included; however, only the following fields are mandatory:  1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From:   "Whomever" whomever@redstone.army.mil
To:        <2028@redstone.army.mil

Subject:     DA Form 2028
1.  **From**:  Joe Smith
2.  Unit:  home
3.  **Address**:  4300 Park
4.  **City**:  Hometown
5.  **St**:  MO
6.  **Zip**:  77777
7.  **Date Sent**:  19-OCT –93
8.  **Pub no:**    55-2840-229-23
9.  **Pub Title**:  TM
10. **Publication Date**:  04-JUL-85
11. Change Number:  7
12. Submitter Rank:  MSG
13.  **Submitter FName**:  Joe
14. Submitter MName:  T
15. **Submitter LName**:  Smith
16. **Submitter Phone**:  123-123-1234
17. **Problem**:  1
18. Page:  2
19. Paragraph:  3
20. Line:  4
21. NSN:  5
22. Reference:  6
23. Figure:  7
24. Table:  8
25. Item:  9
26. Total:  123
27. **Text**
This is the text for the problem below line 27.