HEWLETT-
PACKARD

8591E

1. 10 MHz Reference Output Accuracy

The settability is measured by changing the setting of the digital-to-analog converter (DAC) which controls the frequency of the timebase. The frequency difference per DAC step is calculated and compared to the specification.

The related adjustment for this performance test is the "10 MHz Frequency Reference Adjustment."

If the spectrum analyzer is equipped with Option 004, Precision Frequency Reference, perform "10 MHz Reference Output Accuracy for Option 004," instead.

Equipment Required

Microwave frequency counter
Frequency standard
Cable, BNC, 122 cm (48 in) (2 required)

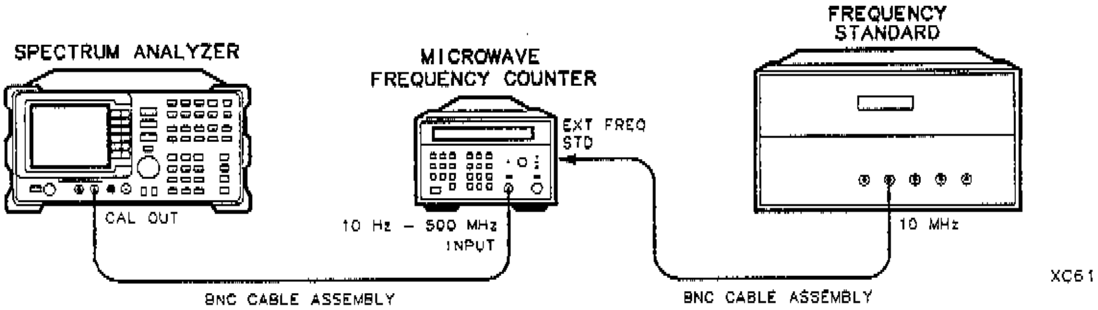

Figure 1-1. 10 MHz Reference Test Setup

Procedure

The test results will be invalid if REF UNLK is displayed at any time during this test. REF UNLK will be displayed if the internal reference oscillator is unlocked to the 10 MHz reference. a REF UNLK might occur if there is a hardware failure or if the jumper between 10 MHz REF OUTPUT and EXT REF IN on the rear panel is removed.

1. Connect the equipment as shown in Figure 1-1.
2. Set the frequency counter controls as follows:

   SAMPLE RATE .... Midrange
   50 Ω/1 Ω SWITCH .... 50 Ω
   10 Hz-500 MHz/500 MHz-26.5 GHz SWITCH .... 10 Hz-500 MHz
   FREQUENCY STANDARD (Rear panel) .... EXTERNAL

3. Wait for the frequency counter reading to stabilize. Record the frequency counter reading in the 10 MHz Reference Accuracy Worksheet as Counter Reading 1.
4. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) −37 (Hz)
   (CAL) More 1 of 4 More 2 of 4 VERIFY TIMEBASE

5. Record the number in the active function block of the spectrum analyzer in the 10 MHz Reference Accuracy Worksheet as the Timebase DAC Setting.
6. Add one to the Timebase DAC Setting recorded in step 5, then enter this number using the DATA keys on the spectrum analyzer. For example, if the timebase DAC setting is 105, press 1,0,6 (Hz).
7. Wait for the frequency counter reading to stabilize. Record the frequency counter reading in the 10 MHz Reference Accuracy Worksheet as Counter Reading 2.
8. Subtract one from the Timebase DAC Setting recorded in step 5, then enter this number using the DATA keys on the spectrum analyzer. For example, if the timebase DAC setting is 105, press 1, 0, 4, (Hz).
9. Wait for the frequency counter reading to stabilize. Record the frequency counter reading in the 10 MHz Reference Accuracy Worksheet as Counter Reading 3.

10 MHz Reference Accuracy Worksheet

Description	Measurement
Counter Reading 1	________ Hz
Timebase DAC Setting	________
Counter Reading 2	________ Hz
Counter Reading 3	________ Hz

10. Calculate the frequency settability by performing the following steps:
    - Calculate the frequency difference between Counter Reading 2 and Counter Reading 1.
    - Calculate the frequency difference between Counter Reading 3 and Counter Reading 1.
    - Divide the difference with the greatest absolute value by two and record the value as TR Entry 1-1 of the performance verification test record. The settability should be less than ±150 Hz.
    - Press (PRESET) on the spectrum analyzer. The timebase DAC will be reset automatically to the value recorded in step 5.

2. 10 MHz Reference Output Accuracy for Option 004

This test measures the warmup characteristics of the 10 MHz reference oscillator. The ability of the 10 MHz oscillator to meet its warmup characteristics gives a high level of confidence that it will also meet its yearly aging specification.

A frequency counter is connected to the 10 MHz REF OUTPUT. After the spectrum analyzer has been allowed to cool for at least 60 minutes, the spectrum analyzer is powered on. A frequency measurement is made five minutes after power is applied and the frequency is recorded. Another frequency measurement is made 25 minutes later (30 minutes after power is applied) and the frequency is recorded. A final frequency measurement is made 60 minutes after power is applied. The difference between each of the first two frequency measurements and the last frequency measurement is calculated and recorded.

The related adjustment for this procedure is "10 MHz Reference Adjustment for Option 004."

If the spectrum analyzer is *not* equipped with Option 004, Precision Frequency Reference, perform "10 MHz Reference Output Accuracy," instead.

Equipment Required

Frequency counter
Frequency standard
Cable, BNC, 122 cm (48 in) *(two required)*

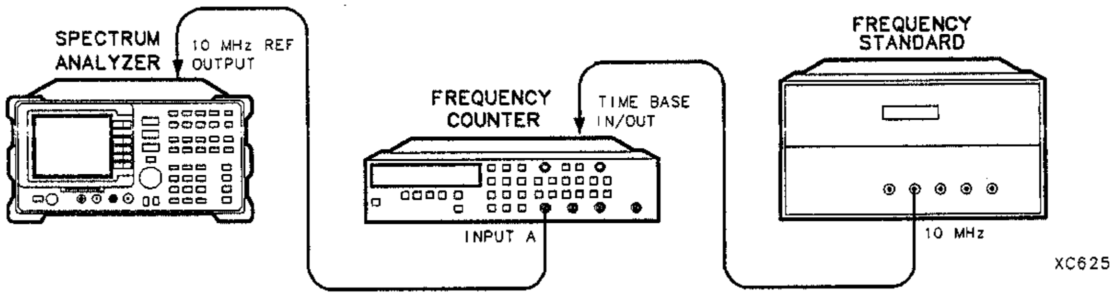

Figure 1-2. 10 MHz Reference Accuracy Test Setup, Option 004

2. 10 MHz Reference Output Accuracy for Option 004

Procedure

The spectrum analyzer must have been allowed to sit with the power off for at least 60 minutes before performing this procedure. This adequately simulates a cold start. A cold start is defined as the spectrum analyzer being powered on after being off for at least 60 minutes.

1. Allow the spectrum analyzer to sit with the power off for at least 60 minutes before proceeding. Connect the equipment as shown in Figure 1-2.
2. Set the spectrum analyzer LINE switch on. Record the Power On Time below.

   Power On Time ________

3. Set the frequency counter controls as follows:

   FUNCTION/DATA .... FREQ A
   INPUT A
   X10 ATTN .... OFF
   AC .... OFF
   50 Ω Z .... OFF
   AUTO TRIG .... ON
   100 kHz FILTER A .... OFF

4. On the frequency counter select a 10 second gate time by pressing (GATE TIME) 10 (GATE TIME). Offset the displayed frequency by −10.0 MHz by pressing (MATH), (SELECT/ENTER), (CHS/EEX) 10 (CHS/EEX) 6 (SELECT/ENTER), (SELECT ENTER). The frequency counter should now display the difference between the INPUT A signal and 10.0 MHz with 0.001 Hz resolution.
5. Proceed with the next step 5 minutes after the Power On Time noted in step 2.
6. Wait at least two periods for the frequency counter to settle. Record the frequency counter reading in the 10 MHz Reference Accuracy Worksheet as Counter Reading 1 with 0.001 Hz resolution.
7. Proceed with the next step 15 minutes after the Power On Time noted in step 2.
8. Record the frequency counter reading in the 10 MHz Reference Accuracy Worksheet as Counter Reading 2 with 0.001 Hz resolution.
9. Proceed with the next step 60 minutes after the Power On Time noted in step 2.
10. Wait at least two periods for the frequency counter to settle. Record the frequency counter reading in the 10 MHz Reference Accuracy Worksheet as Counter Reading 3 with 0.001 Hz resolution.

10 MHz Reference Accuracy Worksheet

Description	Measurement
Counter Reading 1	____________Hz
Counter Reading 2	____________Hz
Counter Reading 3	____________Hz

11. Calculate the 5 Minute Warmup Error by subtracting Reading 3 from Reading 1 and dividing the result by 10 MHz.

    5 Minute Warmup Error = $(Reading\ 1 - Reading\ 3) / (10.0 \times 10^6)$

12. Record the results as TR Entry 2-1 of the performance verification test record.
13. Calculate the 30 Minute Warmup Error by subtracting Reading 3 from Reading 2 and dividing the result by 10 MHz.

    30 Minute Warmup Error = $(Reading\ 2 - Reading\ 3) / (10.0 \times 10^6)$

14. Record the results as TR Entry 2-2 of the performance verification test record.

3. Frequency Readout and Marker Count Accuracy

The frequency readout accuracy of the spectrum analyzer is tested with an input signal of known frequency. By using the same frequency standard for the spectrum analyzer and the synthesized sweeper, the frequency reference error is eliminated.

The related adjustment for this performance test is the "Sampler Match Adjustment."

Equipment Required

Synthesized sweeper
Adapter, Type N (f) to APC 3.5 (m)
Adapter, APC 3.5 (f) to APC 3.5 (f)
Cable, Type N, 183 cm (72 in)
Cable, BNC, 122 cm (48 in)

Additional Equipment for Option 001

Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

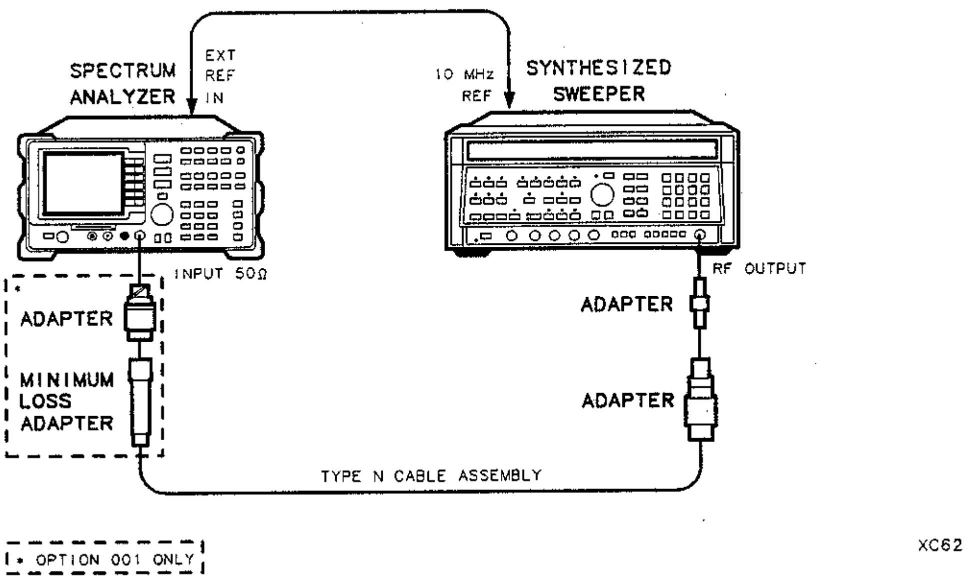

Figure 1-3. Frequency Readout Accuracy Test Setup

Procedure

This performance test consists of two parts:

Part 1: Frequency Readout Accuracy
Part 2: Marker Count Accuracy

Perform "Part 1: Frequency Readout Accuracy" before "Part 2: Marker Count Accuracy."

Part 1: Frequency Readout Accuracy

1. Connect the equipment as shown in Figure 1-3. Remember to connect the 10 MHz REF OUT of the synthesized sweeper to the EXT REF IN of the spectrum analyzer.
2. Perform the following steps to set up the equipment:
   - Press INSTRUMENT PRESET on the synthesized sweeper, then set the controls as follows:

     CW .... 1.5 GHz
     POWER LEVEL .... −10 dBm
   - Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

     (FREQUENCY) 1.5 (GHz)
     (SPAN) 20 (MHz)
3. Press (PEAK SEARCH) on the spectrum analyzer to measure the frequency readout accuracy.
4. Record the MKR frequency reading in the performance verification test record. The reading should be within the limits shown in Table 1-5.
5. Change to the next spectrum analyzer span setting listed in Table 1-5.
6. Repeat steps 3 through 5 for each spectrum analyzer span setting listed in Table 1-5.

If you are testing a spectrum analyzer equipped with Option 130 continue with step 7.

"Part 1: Frequency Readout Accuracy" is now complete for all other spectrum analyzers. Continue with "Part 2: Marker Count Accuracy."

Table 1-5. Frequency Readout Accuracy

Spectrum Analyzer	MKR Reading		
Span (MHz)	Min. (MHz)	TR Entry (Actual)	Max. (MHz)
20	1.49918	3-1	1.50082
10	1.49958	3-2	1.50042
1	1.499968	3-3	1.500032

Additional Steps for Option 130

7. Set the spectrum analyzer by pressing the following keys:

   (BW) RES BW AUTO MAN 300 (Hz)
   (SPAN) 20 (kHz)

8. Press (PEAK SEARCH) on the spectrum analyzer.
9. Record the MKR frequency reading as TR Entry 3-4 of the performance verification test record. The reading should be within the limits of 1.49999924 GHz and 1.50000076 GHz.

"Part 1: Frequency Readout Accuracy" is now complete for the option 130. Continue with "Part 2: Marker Count Accuracy."

Part 2: Marker Count Accuracy

Perform "Part 1: Frequency Readout Accuracy" before performing this procedure.

1. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer to measure the marker count accuracy by pressing the following keys:

   (FREQUENCY) 1.5 (GHz)
   (SPAN) 20 (MHz)
   (BW) RES BW AUTO MAN 300 (kHz)
   (MKR FCTN) MK COUNT ON OFF (ON)
   More 1 of 2
   CNT RES AUTO MAN 100 (Hz)

2. Press (PEAK SEARCH), then wait for a count be taken (it may take several seconds).
3. Record the CNTR frequency reading as TR Entry 3-5 of the performance verification test record. The reading should be within the limits of 1.4999989 GHz and 1.5000011 GHz.
4. Change the spectrum analyzer settings by pressing the following keys:

   (SPAN) 1 (MHz)
   (MKR FCTN) MK COUNT ON OFF (ON)
   More 1 of 2
   CNT RES AUTO MAN 10 (Hz)

5. Press (PEAK SEARCH), then wait for a count be taken (it may take several seconds).
6. Record the CNTR frequency reading as TR Entry 3-6 of the performance verification test record. The reading should be within the limits of 1.49999989 GHz and 1.50000011 GHz.

If you are testing a spectrum analyzer equipped with Option 130 continue with step 7.

Performance test "2. Frequency Readout Accuracy and Marker Count Accuracy" is now complete for all other spectrum analyzers.

Additional Steps for Option 130

7. Set the spectrum analyzer by pressing the following keys:

   (BW) RES BW AUTO MAN 300 (Hz)
   (SPAN) 20 (kHz)

8. Press (PEAK SEARCH) on the spectrum analyzer.
9. Record the MKR frequency reading as TR Entry 3-7 of the performance verification test record. The reading should be within the limits of 1.49999989 GHz and 1.50000011 GHz.

Performance test "2. Frequency Readout Accuracy and Marker Count Accuracy" is now complete for spectrum analyzers equipped with Option 130.

4. Noise Sidebands

A 500 MHz CW signal is applied to the input of the spectrum analyzer. The marker functions are used to measure the amplitude of the carrier and the noise level 10 kHz, 20 kHz, and 30 kHz above and below the carrier. The difference between these two measurements is compared to specification after the result is normalized to 1 Hz.

There are no related adjustment procedures for this performance test.

Equipment Required

Signal generator
Cable, Type N, 183 cm (72 in)

Additional Equipment for Option 001

Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

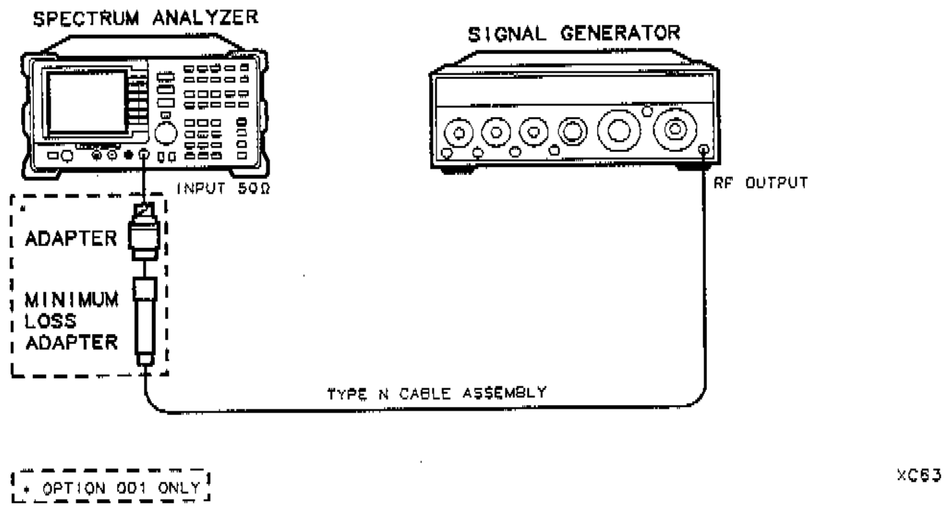

Figure 1-4. Noise Sidebands Test Setup

Procedure

This performance test consists of three parts:

Part 1: Noise Sideband Suppression at 10 kHz
Part 2: Noise Sideband Suppression at 20 kHz
Part 3: Noise Sideband Suppression at 30 kHz

Perform part 1 before performing part 2 or part 3 of this procedure.

A worksheet is provided at the end of this procedure for calculating the noise sideband suppression.

Part 1: Noise Sideband Suppression at 10 kHz

1. Perform the following steps to set up the equipment:
   - Set the signal generator controls as follows:

     FREQUENCY .... 500 MHz
     OUTPUT LEVEL .... 0 dBm
     AM .... OFF
     FM .... OFF
     COUNTER .... INT
     RF .... ON

   - Connect the equipment as shown in Figure 1-4.
   - Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

     (FREQUENCY) 500 (MHz)
     (SPAN) 10 (MHz)

2. Press the following spectrum analyzer keys to measure the carrier amplitude.

   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)
   (SPAN) 200 (kHz)
   (BW) 1 (kHz)
   VID BW AUTO MAN 30 (Hz)
   (MKR FCTN) MK TRACK ON OFF (OFF)
   (SGL SWP)
   (PEAK SEARCH)

   Record the MKR amplitude reading in the Noise Sideband Worksheet as the Carrier Amplitude.

3. Press the following spectrum analyzer keys to measure the noise sideband level at +10 kHz:

   MARKER Δ 10 (kHz)
   (MKR) MARKER NORMAL

   Record the MKR amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at +10 kHz.

4. **Noise Sidebands**

4. Press the following spectrum analyzer keys to measure the noise sideband level at −10 kHz:

   (PEAK SEARCH)
   MARKER Δ −10 (kHz)
   (MKR) MARKER NORMAL

   Record the MKR amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at −10 kHz.

5. Record the more positive value, either Noise Sideband Level at +10 kHz or Noise Sideband Level at −10 kHz from the Noise Sideband Worksheet as the Maximum Noise Sideband Level.

6. Subtract the Carrier Amplitude from the Maximum Noise Sideband Level at 10 kHz using the equation below.

   Noise Sideband Suppression = Maximum Noise Sideband Level − Carrier Amplitude

7. Record the Noise Sideband Suppression at 10 kHz in the performance verification test record as TR Entry 4-1. The suppression should be ≤−60 dBc.

Part 2: Noise Sideband Suppression at 20 kHz

1. Press the following spectrum analyzer keys to measure the noise sideband level at +20 kHz:

   (MKR) MARKER Δ 20 (kHz)
   MARKER NORMAL

   Record the MKR amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at +20 kHz.

2. Press the following spectrum analyzer keys to measure the noise sideband level at −20 kHz:

   (PEAK SEARCH)
   MARKER Δ −20 (kHz)
   (MKR) MARKER NORMAL

   Record the MKR amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at −20 kHz.

3. Record the more positive value, either Noise Sideband Level at +20 kHz or Noise Sideband Level at −20 kHz from the Noise Sideband Worksheet as the Maximum Noise Sideband Level.

4. Subtract the Carrier Amplitude from the Maximum Noise Sideband Level at 20 kHz using the equation below.

   Noise Sideband Suppression = Maximum Noise Sideband Level − Carrier Amplitude

5. Record the Noise Sideband Suppression at 20 kHz in the performance verification test record as TR Entry 4-2. The suppression should be ≤−70 dBc.

Part 3: Noise Sideband Suppression at 30 kHz

1. Press the following spectrum analyzer keys to measure the noise sideband level at +30 kHz:

   (MKR) MARKER Δ 30 (kHz)
   MARKER NORMAL

   Record the MKR amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at +30 kHz.

2. Press the following spectrum analyzer keys to measure the noise sideband level at −30 kHz:

   (PEAK SEARCH)
   MARKER Δ −30 (kHz)
   (MKR) MARKER NORMAL

   Record the MKR amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at −30 kHz.

3. Record the more positive value, either Noise Sideband Level at +30 kHz or Noise Sideband Level at −30 kHz from the Noise Sideband Worksheet as the Maximum Noise Sideband Level.

4. Subtract the Carrier Amplitude from the Maximum Noise Sideband Level at 30 kHz using the equation below.

   Noise Sideband Suppression = Maximum Noise Sideband Level − Carrier Amplitude

5. Record the Noise Sideband Suppression at 30 kHz in the performance verification test record as TR Entry 4-3. The suppression should be ≤−75 dBc.

Noise Sideband Worksheet

Description	Measurement
Carrier Amplitude	______dBm *or* dBmv
Noise Sideband Level at +10 kHz	______dBm *or* dBmv
Noise Sideband Level at −10 kHz	______dBm *or* dBmv
Maximum Noise Sideband Level at ±10 kHz	______dBm *or* dBmv
Noise Sideband Level at +20 kHz	______dBm *or* dBmv
Noise Sideband Level at −20 kHz	______dBm *or* dBmv
Maximum Noise Sideband Level at ±20 kHz	______dBm *or* dBmv
Noise Sideband Level at +30 kHz	______dBm *or* dBmv
Noise Sideband Level at −30 kHz	______dBm *or* dBmv
Maximum Noise Sideband Level at ±30 kHz	______dBm *or* dBmv

Note that the resolution bandwidth is normalized to 1 Hz as follows:

1 Hz noise-power = (noise-power in dBc) - (10 x log(RBW))

For example, −60 dBc in a 1 kHz resolution bandwidth is normalized to −90 dBc/Hz.

5. System Related Sidebands

A 500 MHz CW signal is applied to the input of the spectrum analyzer. The marker functions are used to measure the amplitude of the carrier and the amplitude of any system related sidebands 30 kHz above and below the carrier. System related sidebands are any internally generated line related, power supply related or local oscillator related sidebands.

There are no related adjustment procedures for this performance test.

Equipment Required

Signal generator
Cable, Type N, 183 cm (72 in)

Additional Equipment for Option 001

Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

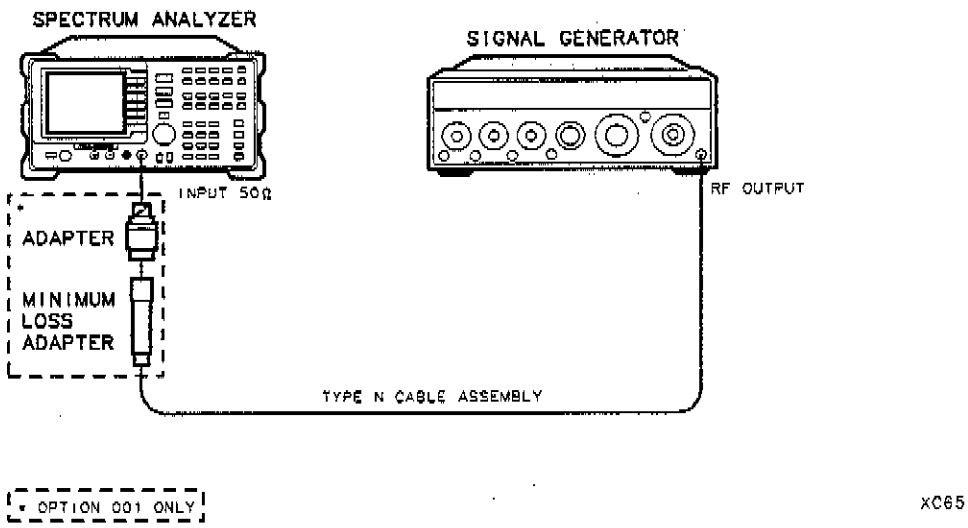

Figure 1-5. System Related Sidebands Test Setup

Procedure

1. Perform the following steps to set up the equipment:
   - Set the signal generator controls as follows:

     FREQUENCY .... 500 MHz
     OUTPUT LEVEL .... 0 dBm
     AM .... OFF
     FM .... OFF
     COUNTER .... INT
     RF .... ON

   - Connect the equipment as shown in Figure 1-5.
   - Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

     (FREQUENCY) 500 (MHz)
     (SPAN) 10 (MHz)

2. Set the spectrum analyzer to measure the system related sideband above the signal by performing the following steps:
   - Press the following keys:

     (PEAK SEARCH)
     (MKR FCTN) MK TRACK ON OFF (ON)
     (SPAN) 200 (kHz)
     (BW) 1 (kHz)
     VID BW AUTO MAN 30 (Hz)

     Allow the spectrum analyzer to stabilize for approximately 1 minute. Then press the following keys:

     (MKR FCTN) MK TRACK ON OFF (OFF)
     (FREQUENCY) CF STEP AUTO MAN 130 (kHz)

   - Press (SGL SWP) and wait for the completion of the sweep. Press (PEAK SEARCH), then MARKER Δ.
   - Press the following spectrum analyzer keys:

     (FREQUENCY)
     (⇑) (step-up key)

3. Measure the system related sideband above the signal by pressing (SGL SWP) on the spectrum analyzer. Wait for the completion of a new sweep, then press (PEAK SEARCH).
4. Record the Marker-Δ Amplitude as TR Entry 5-1 of the performance verification test record.

   The system related sideband above the signal should be <-65 dB.

5. System Related Sidebands

5. Set the spectrum analyzer to measure the system related sideband below the signal by pressing the following spectrum analyzer keys:

   (⇓) (step-down key)
   (⇓) (step-down key)

6. Measure the system related sideband below the signal by pressing (SGL SWP). Wait for the completion of a new sweep, then press (PEAK SEARCH).

   Record the Marker-Δ Amplitude as TR Entry 5-2 of the performance verification test record.

   The system related sideband below the signal should be <-65 dB.

6. Frequency Span Readout Accuracy

For testing each frequency span, two synthesized sources are used to provide two precisely-spaced signals. The spectrum analyzer marker functions are used to measure this frequency difference and the marker reading is compared to the specification.

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesized Sweeper
Synthesizer/Level Generator
Signal Generator
Power Splitter
Adapter, Type N (m) to Type N (m)
Adapter, Type N (f) to APC 3.5 (f)
Cable, Type N, 183 cm (72 in)
Cable, Type N, 152 cm (60 in)

Additional Equipment for Option 001

Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

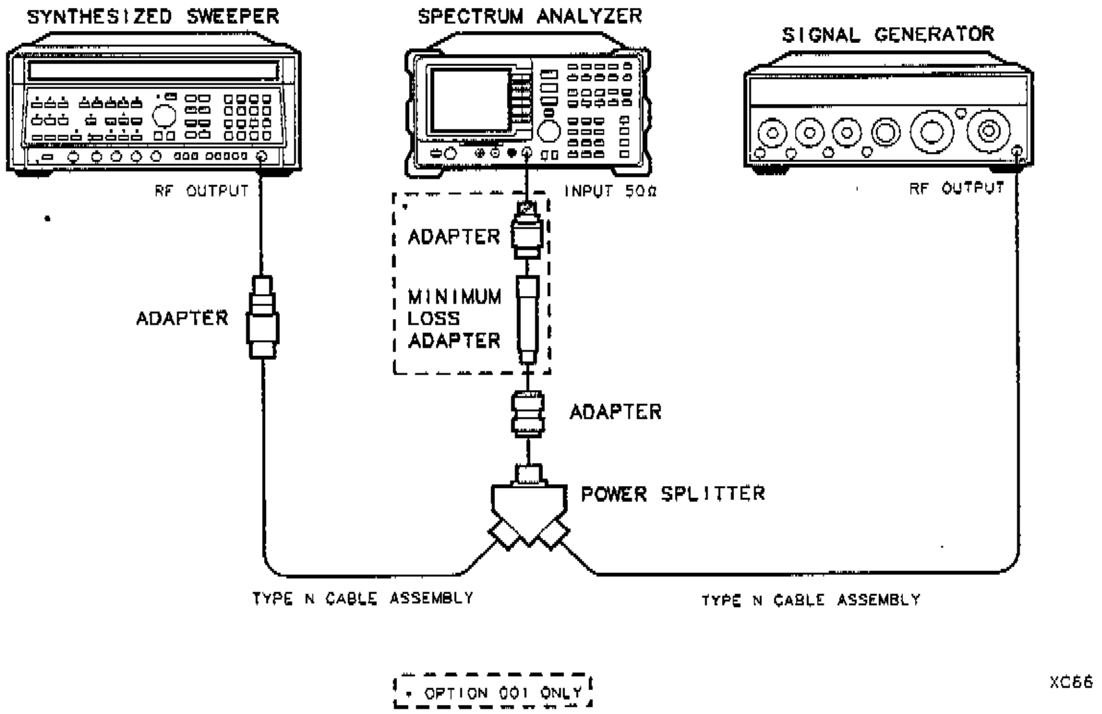

Figure 1-6. 1800 MHz Frequency Span Readout Accuracy Test Setup

6. **Frequency Span Readout Accuracy**

Procedure

This performance test consists of two parts:

Part 1: 1800 MHz Frequency Span Readout Accuracy
Part 2: 10.1 MHz to 10 kHz Frequency Span Readout Accuracy

Perform "Part 1: 1800 MHz Frequency Span Readout Accuracy" before "Part 2: 10.1 MHz to 10 kHz Frequency Span Readout Accuracy."

Part 1: 1800 MHz Frequency Span Readout Accuracy

See 8593E
Freq 900 MHz
SPAN 1800 MHz
1-29

1. Connect the equipment as shown in Figure 1-6. Note that the Power Splitter is used as a combiner.
2. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish.
3. Press INSTRUMENT PRESET on the synthesized sweeper and set the controls as follows:

   CW .... 1700 MHz
   POWER LEVEL .... −5 dBm

4. On the signal generator, set the controls as follows:

   FREQUENCY (LOCKED MODE) .... 200 MHz
   CW OUTPUT .... 0 dBm

5. Adjust the spectrum analyzer center frequency, if necessary, to place the lower frequency on the second vertical graticule line (one division from the left-most graticule line).
6. On the spectrum analyzer, press (SGL SWP). Wait for the completion of a new sweep, then press the following keys:

   (PEAK SEARCH) MARKER Δ NEXT PEAK

   The two markers should be on the signals near the second and tenth vertical graticule lines (the first graticule line is the left-most).
7. Press MARKER Δ, then continue pressing NEXT PK RIGHT until the marker Δ is on the right-most signal (1700 MHz).
8. Record the MKR Δ frequency reading as TR Entry 6-1 of the performance verification test record.

   The MKR reading should be within the 1446 MHz and 1554 MHz.

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

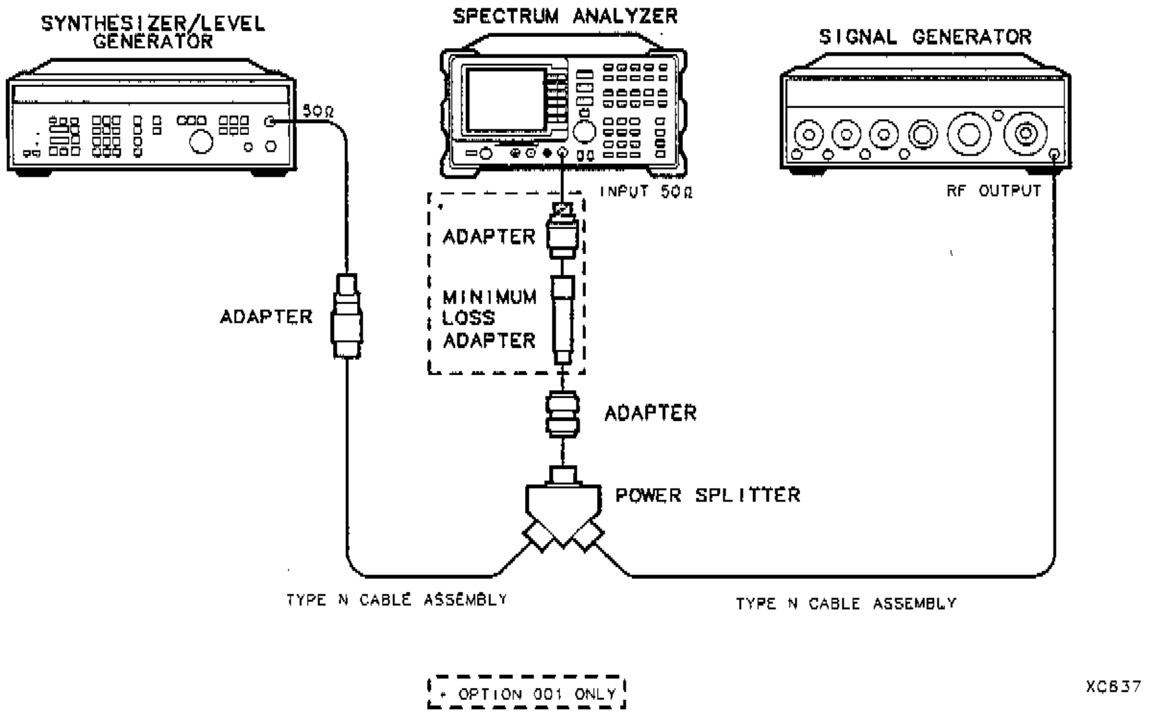

Figure 1-7. 10.1 MHz to 10 kHz Frequency Span Readout Accuracy Test Setup

Part 2: 10.1 MHz to 10 kHz Frequency Span Readout Accuracy

Perform "Part 1: 1800 MHz Frequency Span Readout Accuracy" before performing this procedure. An additional step to measure the frequency span accuracy at 1 kHz is included for spectrum analyzers equipped with Option 130.

1. Connect the equipment as shown in Figure 1-7. Note that the Power Splitter is used as a combiner.
2. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 70 (MHz)
   (SPAN) 10.1 (MHz)

3. Press INSTRUMENT PRESET on the synthesized sweeper, then set the controls as follows:

   CW .... 74 MHz
   POWER LEVEL .... −5 dBm

4. Set the synthesizer/level generator controls as follows:

   FREQUENCY .... 66 MHz
   AMPLITUDE .... 0 dBm

5. Adjust the spectrum analyzer center frequency to center the two signals on the display.
6. On the spectrum analyzer, press (SGL SWP). Wait for the completion of a new sweep, then press the following keys:

   (PEAK SEARCH) MARKER Δ NEXT PEAK

   The two markers should be on the signals near the second and tenth vertical graticule lines (the first graticule line is the left-most).

7. Record the MKR-Δ frequency reading in the performance test record as TR Entry 6-2. The MKR-Δ frequency reading should be within the limits shown.
8. Press (MKR), More 1 of 2, then MARKER ALL OFF on the spectrum analyzer.
9. Change to the next equipment settings listed in Table 1-6.
10. On the spectrum analyzer, press (SGL SWP). Wait for the completion of a new sweep, then press the following keys:

    (PEAK SEARCH) MARKER Δ NEXT PEAK

11. Record the MKR-Δ frequency reading in the performance test record.
12. Repeat steps 8 through 11 for the remaining spectrum analyzer span settings listed in Table 1-6.

If you are testing a spectrum analyzer equipped with Option 130 continue with step 13.

Performance test "6. Frequency Span Readout Accuracy" is now complete for all other spectrum analyzers.

Additional Steps for Option 130

13. Set the spectrum analyzer to measure the frequency span accuracy at 1 kHz by pressing the following keys:

    (MKR) More 1 of 2 MARKER ALL OFF
    (BW) 30 (Hz)

14. Change to the next spectrum analyzer span setting listed in Table 1-6. Be sure to set the synthesized sweeper CW and synthesizer/level generator frequencies as shown in the table.
15. On the spectrum analyzer, press (SGL SWP). Wait for the completion of a new sweep, then press the following keys:

    (PEAK SEARCH) MARKER Δ NEXT PEAK

16. Record the MKR-Δ frequency reading in the performance test record as TR Entry 6-8.

Performance test "6. Frequency Span Readout Accuracy" is now complete for the Option 130.

Table 1-6. Frequency Span Readout Accuracy

Spectrum Analyzer Span Setting	Synthesizer/Level Generator Frequency	Synthesized Sweeper Frequency	MKR-Δ Reading		
	MHz	MHz	Min.	TR Entry	Max.
10.10 MHz	66.000	74.000	7.70 MHz	6-2	8.30 MHz
10.00 MHz	66.000	74.000	7.80 MHz	6-3	8.20 MHz
100.00 kHz	69.960	70.040	78.00 kHz	6-4	82.00 kHz
99.00 kHz	69.960	70.040	78.00 kHz	6-5	82.06 kHz
10.00 kHz	69.996	70.004	7.80 kHz	6-6	8.20 kHz
1.00 kHz[1]	69.9996	70.0004	0.78 kHz	6-7	0.82 kHz
300.00 Hz[1,2]	69.99988	70.00012	225.00 Hz	-	255.00 Hz

1 For Option 130 only. See steps 13 through 16.

2 This is not a spectrum analyzer specification; however, the 300 Hz span is tested to ±5 % to keep the narrow bandwidth accuracy and residual FM measurement uncertainty at a minimum. If the 300 Hz span accuracy is >5% the additional measurement uncertainty may need to be included for the bandwidth accuracy and residual FM measurement uncertainties.

7. Residual FM

This test measures the inherent short-term instability of the spectrum analyzer LO system. With the analyzer in zero span, a stable signal is applied to the input and slope-detected on the linear portion of the IF bandwidth filter skirt. Any instability in the LO transfers to the IF signal in the mixing process. The test determines the slope of the IF filter in Hz/dB and then measures the signal amplitude variation caused by the residual FM. Multiplying these two values yields the residual FM in Hz. The narrow bandwidth options use a 300 Hz span. This span is not specified, however, it is tested in "Frequency Span Accuracy."

There are no related adjustment procedures for this performance test.

Equipment Required

Signal generator
Cable, Type N, 183 cm (72 in)

Additional Equipment for Option 001

Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

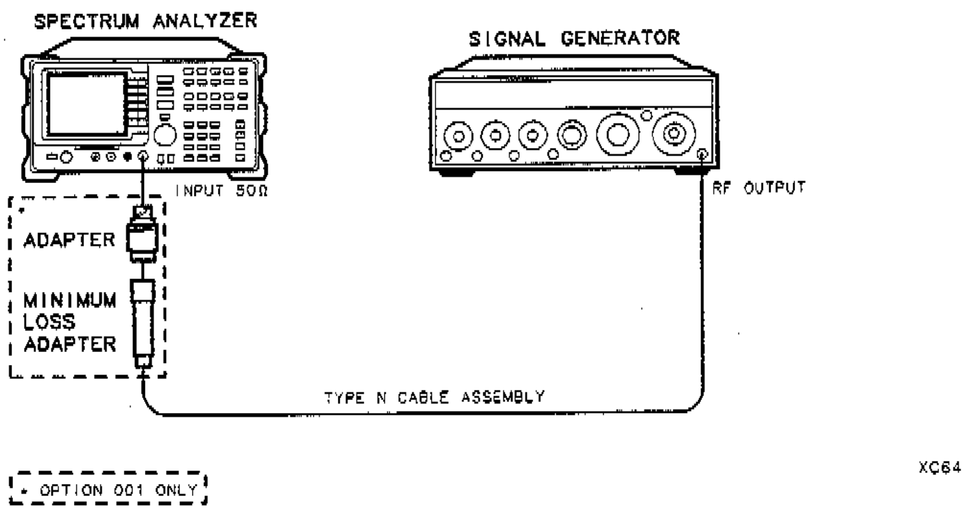

Figure 1-8. Residual FM Test Setup

Procedure

This performance test consists of two parts:

Part 1: Residual FM
Part 2: Residual FM Measurement for Option 130

Perform part 2 in addition to part 1 only if your spectrum analyzer is equipped with Option 130. All other spectrum analyzers only perform part 1.

Part 1: Residual FM

Determining the IF Filter Slope

1. Connect the equipment as shown in Figure 1-8.
2. Set the signal generator controls as follows:

   FREQUENCY .... 500 MHz
   CW OUTPUT .... −10 dBm
   CW OUTPUT *(Option 001 only)* .... −4 dBm

3. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 500 (MHz)
   (SPAN) 1 (MHz)

   Option 001 Only: Press (AMPLITUDE), More 1 of 2, Amptd Units, then dBm.

   (AMPLITUDE) −9 (dBm)
   SCALE LOG LIN (LOG) 1 (dB)
   (BW) 1 (kHz)

4. On the spectrum analyzer, press the following keys:

   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)
   (SPAN) 10 (kHz)

   Wait for the AUTO ZOOM message to disappear. Press the following spectrum analyzer keys:

   (MKR →) MARKER →REF LVL
   (MKR) MARKER 1 ON OFF (OFF)

5. On the spectrum analyzer, press the following keys:

   (SGL SWP)
   (PEAK SEARCH) MARKER Δ

   If you have difficulty achieving the ±0.1 dB setting, then make the following spectrum analyzer settings:

   (SPAN) 5 (kHz)
   (BW) VID BW AUTO MAN 30 (Hz)

6. Rotate the spectrum analyzer knob counterclockwise until the MKR-Δ amplitude reads −1 dB ±0.1 dB. Press MARKER Δ. Rotate the knob counterclockwise until the MKR-Δ amplitude reads −4 dB ±0.1 dB.
7. Divide the MKR-Δ frequency in hertz by the MKR-Δ amplitude in dB to obtain the slope of the resolution bandwidth filter. For example, if the MKR-Δ frequency is 1.08 kHz and the MKR-Δ amplitude is 3.92 dB, the slope would be equal to 275.5 Hz/dB. Record the result below:

Slope ________ Hz/ dB

Measuring the Residual FM

8. On the spectrum analyzer, press (MKR), More 1 of 2, MARKER ALL OFF, (PEAK SEARCH), then MARKER Δ. Rotate the knob counterclockwise until the MKR-Δ amplitude reads −3 dB ±0.1 dB.
9. On the spectrum analyzer, press the following keys:

   (MKR) MARKER NORMAL
   (MKR →) MARKER →CF
   (SGL SWP)
   (BW) VID BW AUTO MAN 1 (kHz)
   (SPAN) 0 (Hz)
   (SWEEP) 100 (ms)

   Press (SGL SWP).

Note The displayed trace should be about three divisions below the reference level. If it is not, press (TRIG), SWEEP CONT SGL (CONT), (FREQUENCY), and use the knob to place the displayed trace about three divisions below the reference level. Press (SGL SWP).

10. On the spectrum analyzer, press (MKR →), MORE 1 of 2, MARKER →PK-PK. Read the MKR-Δ amplitude, take its absolute value, and record the result as the Deviation.

Deviation ________ dB

11. Calculate the Residual FM by multiplying the Slope recorded in step 7 by the Deviation recorded in step 10.

    Record this value as TR Entry 7-1 of the performance verification test record. The residual FM should be less than 250 Hz.

If you are testing a spectrum analyzer equipped with Option 130 continue with "Part 2: Residual FM Measurement for Option 130." The performance test, "4. Residual FM," is now complete for all other spectrum analyzers.

Part 2: Residual FM Measurement for Option 130

The following procedure is an additional test for testing the residual FM of spectrum analyzers equipped with Option 130. Perform "Part 1: Residual FM" before performing this procedure.

Determining the IF Filter Slope

1. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 500 (MHz)
   (SPAN) 1 (MHz)

   Option 001 Only: Press (AMPLITUDE), More 1 of 3, Amptd Units, then dBm.

   (AMPLITUDE) −9 (dBm)
   SCALE LOG LIN (LOG) 1 (dB)

2. On the spectrum analyzer, press the following keys:

   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)
   (SPAN) 300 (Hz)

   Wait for the AUTO ZOOM message to disappear. Press the following spectrum analyzer keys:

   (MKR →) MARKER →REF LVL
   (MKR) MARKER 1 ON OFF (OFF)
   (BW) 30 (Hz)
   (SGL SWP)

   Wait for the completion of a new sweep.

3. On the spectrum analyzer, press (PEAK SEARCH), MARKER Δ.

4. Rotate the spectrum analyzer knob counterclockwise until the MKR-Δ amplitude reads −1 dB ±0.2 dB. Press MARKER Δ. Rotate the knob counterclockwise until the MKR-Δ amplitude reads −4 dB ±0.3 dB.

5. Divide the MKR-Δ frequency in hertz by the MKR-Δ amplitude in dB to obtain the slope of the resolution bandwidth filter. For example, if the MKR-Δ frequency is 1.08 kHz and the MKR-Δ amplitude is 3.92 dB, the slope would be equal to 275.5 Hz/dB. Record the result below:

   Slope ________ Hz/ dB

Measuring the Residual FM

6. On the spectrum analyzer, press the following keys:

   (TRIG) SWEEP CONT SGL (CONT)

   (MKR) MARKER 1 ON OFF (OFF)

   (SPAN) ZERO SPAN

   (SWEEP) SWP TIME AUTO MAN 300 (ms)

7. On the spectrum analyzer, press (FREQUENCY).
8. Rotate the spectrum analyzer knob until the displayed trace is approximately 3 divisions below the reference level, then press (SGL SWEEP).
9. On the spectrum analyzer, press (MKR →), More 1 of 2, MARKER →PK-PK. Read the MKR-Δ amplitude, take its absolute value, and record the result as the Deviation.

   Deviation ________ dB

10. Calculate the Residual FM by multiplying the Slope recorded in step 5 by the Deviation recorded in step 9.

    Record this value as TR Entry 7-2 of the performance verification test record. The residual FM should be less than 30 Hz.

The performance test, "Residual FM," is now complete.

8. Sweep Time Accuracy

This test uses a synthesizer function generator to amplitude modulate a 500 MHz CW signal from another signal generator. The spectrum analyzer demodulates this signal in zero span to display the response in the time domain. The marker delta frequency function on the spectrum analyzer is used to read out the sweep time accuracy.

If you are testing a spectrum analyzer equipped with Option 101, perform "Fast Time Domain Sweeps" in addition to this procedure.

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesizer/function generator
Signal generator
Cable, Type N, 152 cm (60 in)
Cable, BNC, 120 cm (48 in)

Additional Equipment for Option 001

Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

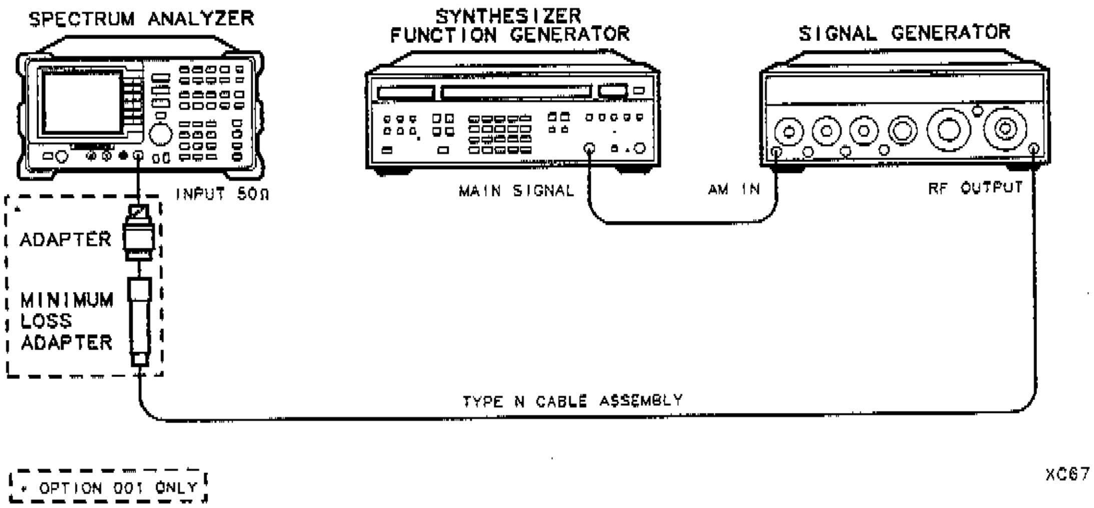

Figure 1-9. Sweep Time Accuracy Test Setup

8. Sweep Time Accuracy

Procedure

If you are testing a spectrum analyzer equipped with Option 101, perform "Fast Time Domain Sweeps," in addition to this test.

1. Set the signal generator to output a 500 MHz, −10 dBm, CW signal. Set the AM and FM controls to off.

   Option 001 Only: Set the output to −4 dBm.

2. Set the synthesizer/function generator to output a 500 Hz, +5 dBm triangle waveform signal.
3. Connect the equipment as shown in Figure 1-9.
4. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 500 (MHz)
   (SPAN) 10 (MHz)
   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)
   (SPAN) 50 (kHz)

   Wait for the AUTO ZOOM routine to finish. Press (SPAN), then ZERO SPAN.

   Press the following spectrum analyzer keys:

   (BW) 3 (MHz)
   (SWEEP) 20 (ms)
   (AMPLITUDE) SCALE LOG LIN (LIN)

   Adjust signal amplitude for a midscreen display.

5. Set the signal generator AM switch to the AC position.
6. On the spectrum analyzer, press (TRIG) then VIDEO. Adjust the video trigger so that the spectrum analyzer is sweeping.
7. Press (SGL SWP). After the completion of the sweep, press (PEAK SEARCH). If necessary, press NEXT PK LEFT until the marker is on the leftmost signal. This is the "marked signal."
8. Press (MARKER DELTA) and press NEXT PK RIGHT until the marker delta is on the eighth signal peak. Record the marker Δ reading in the performance verification test record.
9. Repeat steps 7 through 9 for the remaining sweep time settings listed in Table 1-7.

Table 1-7. Sweep Time Accuracy

Spectrum Analyzer Sweep Time Setting	Synthesizer/Function Generator Frequency	Minimum Reading	TR Entry (MKR Δ)	Maximum Reading
20 ms	500.0 Hz	15.4 ms	8-1	16.6 ms
100 ms	100.0 Hz	77.0 ms	8-2	83.0 ms
1 s	10.0 Hz	770.0 ms	8-3	830.0 ms
10 s	1.0 Hz	7.7 s	8-4	8.3 s

9. Scale Fidelity

A 50 MHz CW signal is applied to the INPUT 50 Ω of the analyzer through two step attenuators. The attenuators increase the effective amplitude range of the source. The amplitude of the source is decreased in 10 dB steps and the analyzer marker functions are used to measure the amplitude difference between steps. The source's internal attenuator is used as the reference standard. The test is performed in both log and linear amplitude scales.

The related adjustment for this performance test is "Log and Linear Amplitude Adjustment."

Equipment Required

Synthesizer/level generator
Attenuator, 1 dB step
Attenuator, 10 dB step
Cable, BNC, 122 cm (48 in)
Cable, BNC, 20 cm (9 in)
Adapter, Type N (m) to BNC (f)
Adapter, Type BNC (m) to BNC (m)

Additional Equipment for Option 001

Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

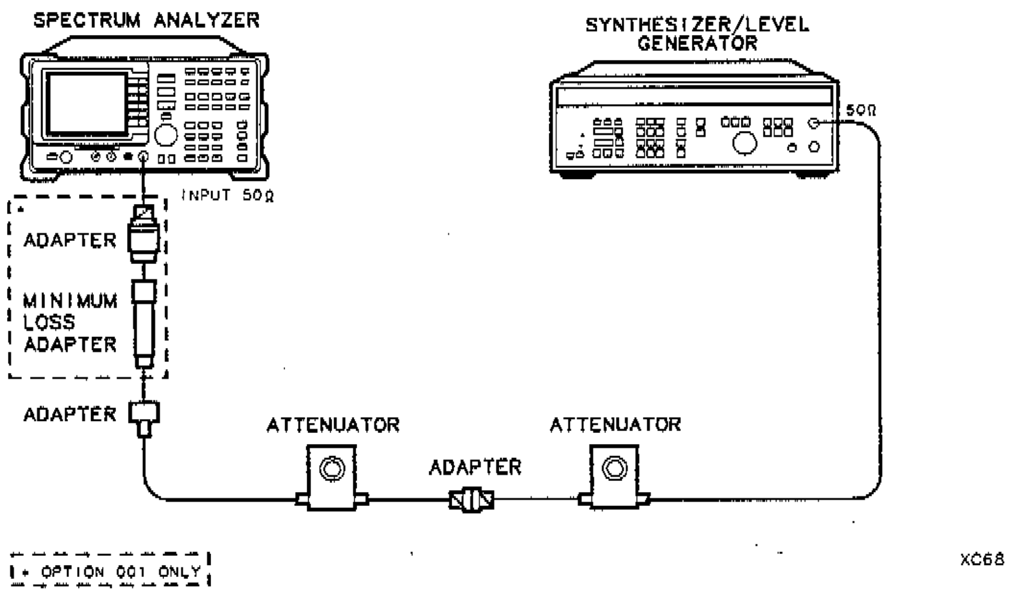

Figure 1-10. Scale Fidelity Test Setup

Procedure

Log Scale

1. Set the synthesizer/level generator controls as follows:

   FREQUENCY .... 50 MHz
   AMPLITUDE .... +10 dBm
   AMPTD INCR .... 0.05 dB
   OUTPUT .... 50 Ω

2. Connect the equipment as shown in Figure 1-10. Set the 10 dB step attenuator to 10 dB attenuation and the 1 dB step attenuator to 0 dB attenuation.

   Option 001 only: Set the attenuation of the 10 dB step attenuator to 0 dB. Connect the minimum loss pad to the INPUT 75 Ω using adapters.

3. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 50 (MHz)
   (SPAN) 10 (MHz)

   Option 001 only: Press (AMPLITUDE), More 1 of 2, Amptd Units, then dBm.

   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)
   (SPAN) 50 (kHz)

   Wait for the auto zoom routine to finish, then set the resolution bandwidth and the video bandwidth by pressing the following keys:

   (BW)
   RES BW AUTO MAN 3 (kHz)
   VID BW AUTO MAN 30 (Hz)

4. If necessary, adjust the 1 dB step attenuator attenuation until the MKR amplitude reads between 0 dBm and −1 dBm.

5. On the synthesizer/level generator, press AMPLITUDE and use the increment keys to adjust the amplitude until the spectrum analyzer MKR amplitude reads 0 dBm ±0.05 dB.

   It may be necessary to decrease the resolution of the amplitude increment of the synthesizer/level generator to 0.01 dB to obtain a MKR reading of 0 dBm ±0.05 dB.

6. On the spectrum analyzer, press (PEAK SEARCH), then MARKER Δ.

7. Set the synthesizer/level generator AMPTD INCR to 4 dB.

8. On the synthesizer/level generator, press AMPLITUDE, then increment down to step the synthesizer/level generator to the next lowest nominal amplitude listed in Table 1-8.

9. Record the Actual MKR Δ amplitude reading in the performance verification test record as indicated in Table 1-8. The MKR amplitude should be within the limits shown.

10. Repeat steps 8 through 9 for the remaining synthesizer/level generator Nominal Amplitudes listed in Table 1-8.

11. For each Actual MKR Δ reading recorded in Table 1-8, subtract the previous Actual MKR Δ reading. Add 4 dB to the number and record the result as the incremental error in the

performance verification test record as indicated in Table 1-8. The incremental error should not exceed 0.4 dB/4 dB.

Steps 12 and 13 are only for testing a spectrum analyzer equipped with Option 130. If the spectrum analyzer is *not* equipped with Option 130 continue with step 14.

Table 1-8. Cumulative and Incremental Error, Log Mode

Synthesizer/Level Generator Nominal Amplitude	dB from Ref Level (nominal)	TR Entry Cumulative Error (MKR Δ Reading)			TR Entry (Incremental Error)
		Min. (dB)	Actual (dB)	Max. (dB)	TR Entry
+10 dBm	0	0 (Ref)	0 (Ref)	0 (Ref)	0 (Ref)
+6 dBm	−4	−4.34	9-1	−3.66	9-18
+2 dBm	−8	−8.38	9-2	−7.62	9-19
−2 dBm	−22	−12.42	9-3	−11.58	9-20
−6 dBm	−16	−16.46	9-4	−15.54	9-21
−10 dBm	−20	−20.50	9-5	−19.50	9-22
−14 dBm	−24	−24.54	9-6	−23.46	9-23
−18 dBm	−28	−28.58	9-7	−27.42	9-24
−22 dBm	−32	−32.62	9-8	−31.38	9-25
−26 dBm	−36	−36.66	9-9	−35.34	9-26
−30 dBm	−40	−40.70	9-10	−39.30	9-27
−34 dBm	−44	−44.74	9-11	−43.26	9-28
−38 dBm	−48	−48.78	9-12	−47.22	9-29
−42 dBm	−52	−52.82	9-13	−51.18	9-30
−46 dBm	−56	−56.86	9-14	−55.14	9-31
−50 dBm	−60	−60.90	9-15	−59.10	9-32
−54 dBm	−64	−64.94	9-16	−63.06	N/A
−58 dBm	−68	−68.98	9-17	−67.02	N/A

Additional Steps for Option 130

12. Press the following spectrum analyzer keys:

    (BW) RES BW AUTO MAN 300 (Hz)
    (SPAN) 10 (kHz)

13. Repeat steps 4 through 11 for the narrow bandwidths. Record the results as indicated in Table 1-9.

    The scale fidelity in log mode is complete for spectrum analyzers equipped with Option 130. Continue with step 14 below.

9. Scale Fidelity

Table 1-9. Cumulative and Incremental Error, Log Mode for Option 130

Synthesizer/Level Generator Nominal Amplitude	dB from Ref Level (nominal)	TR Entry Cumulative Error (MKR Δ Reading)			TR Entry (Incremental Error)
		Min. (dB)	Actual (dB)	Max. (dB)	TR Entry
+10 dBm	0	0 (Ref)	0 (Ref)	0 (Ref)	0 (Ref)
+6 dBm	−4	−4.44	9-33	−3.56	9-50
+2 dBm	−8	−8.48	9-34	−7.52	9-51
−2 dBm	−22	−12.52	9-35	−11.48	9-52
−6 dBm	−16	−16.56	9-36	−15.44	9-53
−10 dBm	−20	−20.60	9-37	−19.40	9-54
−14 dBm	−24	−24.64	9-38	−23.36	9-55
−18 dBm	−28	−28.68	9-39	−27.32	9-56
−22 dBm	−32	−32.72	9-40	−31.28	9-57
−26 dBm	−36	−36.76	9-41	−35.24	9-58
−30 dBm	−40	−40.80	9-42	−39.20	9-59
−34 dBm	−44	−44.84	9-43	−43.16	9-60
−38 dBm	−48	−48.88	9-44	−47.12	9-61
−42 dBm	−52	−52.92	9-45	−51.08	9-62
−46 dBm	−56	−56.96	9-46	−55.04	9-63
−50 dBm	−60	−61.00	9-47	−59.00	9-64
−54 dBm	−64	−65.04	9-48	−62.96	N/A
−58 dBm	−68	−69.08	9-49	−66.92	N/A

Linear Scale

14. Set the synthesizer/level generator controls as follows:

    AMPLITUDE .... +10 dBm
    AMPTD INCR .... 0.05 dB

15. Set the 1 dB step attenuator to 0 dB attenuation.

16. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

    (AMPLITUDE) SCALE LOG LIN (LIN)

    Option 001 only: Press More 1 of 2, INPUT Z 50 Ω 75 Ω (50 Ω).

    (FREQUENCY) 50 (MHz)
    (SPAN) 10 (MHz)
    (PEAK SEARCH)
    (MKR FCTN) MK TRACK ON OFF (ON)
    (SPAN) 50 (kHz)

Wait for the auto zoom routine to finish, then set the resolution bandwidth and the video bandwidth by pressing the following keys:

(BW)
RES BW AUTO MAN 3 (kHz)
VID BW AUTO MAN 30 (Hz)

17. If necessary, adjust the 1 dB step attenuator attenuation until the MKR reads approximately 223.6 mV. It may be necessary to decrease the resolution of the amplitude increment of the synthesizer/level generator to 0.01 dB to obtain a MKR reading of 223.6 mV ± 0.4 mV.
18. On the synthesizer/level generator, press AMPLITUDE, then use the increment keys to adjust the amplitude until the spectrum analyzer MKR amplitude reads 223.6 mV ±0.4 mV.
19. On the spectrum analyzer, press (PEAK SEARCH), (MKR FCTN), MK TRACK ON OFF (OFF).
20. Set the synthesizer/level generator amplitude increment to 3 dB.
21. On the synthesizer/level generator, press AMPLITUDE, then increment down to step the synthesizer/level generator to the next lowest Nominal Amplitude listed in Table 1-10.
22. Record the MKR amplitude reading in the performance verification test record as indicated in Table 1-10. The MKR amplitude should be within the limits shown.
23. Repeat steps 21 and 22 for the remaining synthesizer/level generator Nominal Amplitudes listed in Table 1-10.

Table 1-10. Scale Fidelity, Linear Mode

Synthesizer/Level Generator Nominal Amplitude	% of Ref Level (nominal)	MKR Reading		
		Min. (mV)	TR Entry	Max. (mV)
+10 dBm	100	0 (Ref)	0 (Ref)	0 (Ref)
+7 dBm	70.7	151.59	158.02 9-65	165.01
+4 dBm	50	105.36	111.8 9-66	118.78
+1 dBm	35.48	72.63	78.74 9-67	86.05
−2 dBm	25	49.46	55.9 9-68	82.88
		49.192		62.61

Steps 24 and 25 are only for testing a spectrum analyzer equipped with Option 130. If the spectrum analyzer is *not* equipped with Option 130 continue with step 26.

Additional Steps for Option 130

24. Press the following spectrum analyzer keys:

(BW) RES BW AUTO MAN 300 (Hz)
(SPAN) 10 (kHz)

25. Repeat steps 17 through 22 for the narrow bandwidths. Record the results as indicated in Table 1-11.

The scale fidelity in linear mode is complete for spectrum analyzers equipped with Option 130. Continue with step 31 below.

9. Scale Fidelity

Table 1-11. Scale Fidelity, Linear Mode for Option 130

Synthesizer/Level Generator Nominal Amplitude	% of Ref Level (nominal)	MKR Reading		
		Min. (mV)	TR Entry	Max. (mV)
+10 dBm	100	0 (Ref)	0 (Ref)	0 (Ref)
+7 dBm	70.7	151.59	**9-69**	165.01
+4 dBm	50	105.36	**9-70**	118.78
+1 dBm	35.48	72.63	**9-71**	86.05
−2 dBm	25	49.46	**9-72**	82.88

Log to Linear Switching

26. Set the 10 dB step attenuator to 10 dB attenuation and the 1 dB step attenuator to 0 dB attenuation.

27. Set the synthesizer controls as follows:

    FREQUENCY .... 50 MHz
    AMPLITUDE .... +6 dBm

28. On the spectrum analyzer, press (PRESET), then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

    (FREQUENCY) 50 (MHz)
    (SPAN) 10 (MHz)
    (BW) 300 (kHz)

29. On the spectrum analyzer, press the following keys:

    (PEAK SEARCH)
    (MKR →) MARKER →REF LVL
    (PEAK SEARCH)

30. Record the peak marker reading in Log mode below.

    Log Mode Amplitude Reading________ dBm

31. Press (AMPLITUDE) SCALE LOG LIN (LIN) to change the scale to linear, then press More 1 of 2, Amptd Units, and dBm to set the amplitude units to dBm.

32. Press (PEAK SEARCH), then record the peak marker amplitude reading in linear mode.

    Linear Mode Amplitude Reading________ dBm

33. Subtract the Linear Mode Amplitude Reading from the Log Mode Amplitude Reading, then record this value ad the Log/Linear Error.

    Log/Linear Error________ dB

34. If the Log/Linear Error is less than 0 dB, record this value as TR Entry 9-73 in the performance verification test record. The absolute value of the reading should be less than 0.25 dB. If the Log/Linear Error is greater than 0 dB, continue with the next step.
35. On the spectrum analyzer, press the following keys:

    (MKR →) MARKER →REF LVL
    (PEAK SEARCH)

36. Record the peak marker amplitude reading in linear mode.

    Linear Mode Amplitude Reading________ dBm

37. On the spectrum analyzer, press the following keys:

    (AMPLITUDE) SCALE LOG LIN (LOG)
    (PEAK SEARCH)

38. Record the peak marker reading in Log mode below.

    Log Mode Amplitude Reading________ dBm

39. Subtract the Log Mode Amplitude Reading from the Linear Mode Amplitude Reading, then record this value ad the Linear/Log Error.

    Linear/Log Error________ dB

40. Record the Linear/Log Error as TR Entry 9-73 in the performance verification test record. The absolute value of the reading should be less than 0.25 dB.

    Steps 41 and 42 are only for testing a spectrum analyzer equipped with Option 130.

    Performance test, "Scale Fidelity" is complete for all other spectrum analyzers.

Additional Steps for Option 130

41. Press the following spectrum analyzer keys:

    (AMPLITUDE) SCALE LOG LIN (LOG)
    (BW) RES BW AUTO MAN 300 (Hz)
    (SPAN) 10 (kHz)

42. Repeat steps 29 through 39 for the narrow bandwidths. Record the results in the performance verification test record as TR Entry 9-74.

    Performance test, "Scale Fidelity" is complete for spectrum analyzers equipped with Option 130.

10. Reference Level Accuracy

A 50 MHz CW signal is applied to the INPUT 50 Ω of the spectrum analyzer through two step attenuators. The attenuators increase the effective amplitude range of the source. The amplitude of the source is decreased in 10 dB steps and the spectrum analyzer marker functions are used to measure the amplitude difference between steps. The source's internal attenuator is used as the reference standard. The test is performed in both log and linear amplitude scales.

It is only necessary to test reference levels as low as −90 dBm (with 10 dB attenuation) since lower reference levels are a function of the spectrum analyzer microprocessor manipulating the trace data. There is no error associated with the trace data manipulation.

The related adjustment for this procedure is "A12 Cal Attenuator Error Correction."

Equipment Required

Synthesizer/level generator
Attenuator, 1 dB steps
Attenuator, 10 dB steps
Cable, BNC 122 cm (48 in) *(two required)*
Adapter, Type N (m) to BNC (f)
Adapter, BNC (m) to BNC (m)

Additional Equipment for Option 001

Adapter, minimum loss
Adapter, Type N (f) to BNC (m) 75 Ω

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

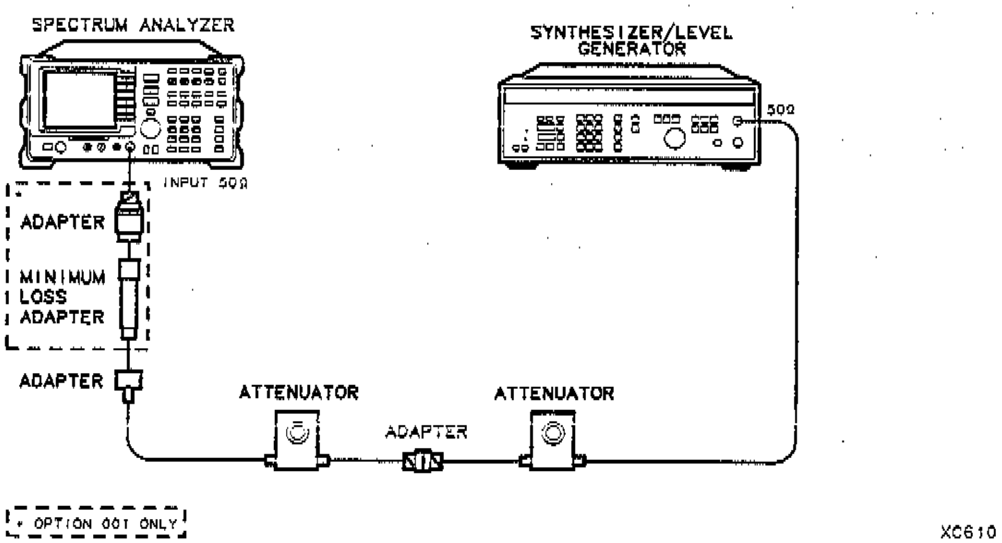

Figure 1-11. Reference Level Accuracy Test Setup

Procedure

Log Scale

1. Set the synthesizer/level generator controls as follows:

   FREQUENCY .... 50 MHz
   AMPLITUDE .... −10 dBm
   AMPTD INCR .... 10 dB
   OUTPUT .... 50 Ω

2. Connect the equipment as shown in Figure 1-11. Set the 10 dB step attenuator to 10 dB attenuation and the 1 dB step attenuator to 0 dB attenuation.

   Option 001 only: Connect the minimum loss adapter to the RF input 75 Ω, using adapters, and set the 10 dB step attenuator to 0 dB attenuation.

3. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 50 (MHz)
   (SPAN) 10 (MHz)
   (PEAK SEARCH)
   (MKR FCTN) **MK TRACK ON OFF** (ON)
   (SPAN) 50 (kHz)

   Option 001 only: Press (AMPLITUDE), **More 1 of 2**, **Amptd Units**, then **dBm**.

   (AMPLITUDE) −20 (dBm) **SCALE LOG LIN** (LOG) 1 (dB)
   (BW) 3 (kHz) **VID BW AUTO MAN** 30 (Hz)

4. Set the 1 dB step attenuator to place the signal peak one to two dB (one to two divisions) below the reference level.

5. On the spectrum analyzer, press the following keys:

   (SGL SWP)
   (PEAK SEARCH) **MARKER Δ**

6. Set the synthesizer/level generator amplitude and spectrum analyzer reference level according to Table 1-12. At each setting, press (SGL SWP) on the spectrum analyzer.

7. Record the MKR Δ amplitude reading in the performance test record as indicated in Table 1-12. The MKR Δ reading should be within the limits shown.

10. Reference Level Accuracy

Table 1-12. Reference Level Accuracy, Log Mode

Synthesizer/Level Generator Amplitude	Spectrum Analyzer Reference Level	MKR Δ Reading (dB)		
(dBm)	(dBm)	Min.	TR Entry	Max.
−10	−20	0 (Ref)	0 (Ref)	0 (Ref)
0	−10	−0.4	10-1	+0.4
+10	0	−0.5	10-2	+0.5
−20	−30	−0.4	10-3	+0.4
−30	−40	−0.5	10-4	+0.5
−40	−50	−0.8	10-5	+0.8
−50	−60	−1.0	10-6	+1.0
−60	−70	−1.1	10-7	+1.1
−70	−80	−1.2	10-8	+1.2
−80	−90	−1.3	10-9	+1.3

Linear Scale

8. Set the synthesizer/level generator amplitude to −10 dBm.
9. Set the 1 dB step attenuator to 0 dB attenuation.
10. Set the spectrum analyzer controls as follows:

    (AMPLITUDE) −20 (dBm)
    SCALE LOG LIN (LIN)
    (AMPLITUDE) More 1 of 2 Amptd Units dBm
    (SWEEP) SWEEP CONT SGL (CONT)
    (MKR) More 1 of 2 MARKER ALL OFF

11. Set the 1 dB step attenuator to place the signal peak one to two divisions below the reference level.
12. On the spectrum analyzer, press the following keys:

    (SGL SWP)
    (PEAK SEARCH) MARKER Δ
    (MKR FCTN) MK TRACK ON OFF (OFF)

13. Set the synthesizer/level generator amplitude and spectrum analyzer reference level according to Table 1-13. At each setting, press (SGL SWP) on the spectrum analyzer.
14. Record the MKR Δ amplitude reading in Table 1-13. The MKR Δ reading should be within the limits shown.

Table 1-13. Reference Level Accuracy, Linear Mode

Synthesizer/Level Generator Amplitude	Spectrum Analyzer Reference Level	MKR Δ Reading (dB)		
(dBm)	(dBm)	Min.	TR Entry	Max.
−10	−20	0 (Ref)	0 (Ref)	0 (Ref)
0	−10	−0.4	10-10	+0.4
+10	0	−0.5	10-11	+0.5
−20	−30	−0.4	10-12	+0.4
−30	−40	−0.5	10-13	+0.5
−40	−50	−0.8	10-14	+0.8
−50	−60	−1.0	10-15	+1.0
−60	−70	−1.1	10-16	+1.1
−70	−80	−1.2	10-17	+1.2
−80	−90	−1.3	10-18	+1.3

If you are testing a spectrum analyzer equipped with Option 130, continue with step 15.

Performance test "10. Reference Level Accuracy" is now complete for all other spectrum analyzers.

Additional Steps for Option 130

15. Press the following spectrum analyzer keys:

    (AMPLITUDE) −20 (dBm) SCALE LOG LIN (LOG) 1 (dB)
    (BW) RES BW AUTO MAN 300 (Hz)
    (SPAN) 10 (kHz)
    (SWEEP) SWEEP CONT SGL (CONT)

16. Set the synthesizer/level generator to −10 dBm.
17. Repeat steps 4 through 6, using Table 1-14 for the narrow resolution bandwidths.
18. Record the MKR Δ amplitude reading in the performance test record as indicated in Table 1-14. The MKR Δ reading should be within the limits shown.

10. Reference Level Accuracy

Table 1-14. Reference Level Accuracy, Log Mode for Option 130

Synthesizer/Level Generator Amplitude	Spectrum Analyzer Reference Level	MKR Δ Reading (dB)		
(dBm)	(dBm)	Min.	TR Entry	Max.
−10	−20	0 (Ref)	0 (Ref)	0 (Ref)
0	−10	−0.4	10-19	+0.4
+10	0	−0.5	10-20	+0.5
−20	−30	−0.4	10-21	+0.4
−30	−40	−0.5	10-22	+0.5
−40	−50	−0.8	10-23	+0.8
−50	−60	−1.1	10-24	+1.1
−60	−70	−1.2	10-25	+1.2
−70	−80	−1.3	10-26	+1.3
−80	−90	−1.4	10-27	+1.4

19. Repeat steps 8 through 13, using Table 1-15 for the narrow resolution bandwidths.

20. Record the MKR Δ amplitude reading in the performance test record as indicated in Table 1-15. The MKR Δ reading should be within the limits shown.

Table 1-15. Reference Level Accuracy, Linear Mode for Option 130

Synthesizer/Level Generator Amplitude	Spectrum Analyzer Reference Level	MKR Δ Reading (dB)		
(dBm)	(dBm)	Min.	TR Entry	Max.
−10	−20	0 (Ref)	0 (Ref)	0 (Ref)
0	−10	−0.4	10-28	+0.4
+10	0	−0.5	10-29	+0.5
−20	−30	−0.4	10-30	+0.4
−30	−40	−0.5	10-31	+0.5
−40	−50	−0.8	10-32	+0.8
−50	−60	−1.1	10-33	+1.1
−60	−70	−1.2	10-34	+1.2
−70	−80	−1.3	10-35	+1.3
−80	−90	−1.4	10-36	+1.4

11. Absolute Amplitude Calibration and Resolution Bandwidth Switching Uncertainties

To measure the absolute amplitude calibration uncertainty the input signal is measured after the self-cal routine is finished.

To measure the resolution bandwidth switching uncertainty an amplitude reference is taken with the resolution bandwidth set to 3 kHz using the marker-delta function. The resolution bandwidth is changed to settings between 3 MHz and 1 kHz and the amplitude variation is measured at each setting and compared to the specification. The span is changed as necessary to maintain approximately the same aspect ratio.

The related adjustment procedure for this performance test is "Crystal and LC Bandwidth Adjustment."

Equipment Required

Cable, BNC, 23 cm (9 in)
Adapter, Type N (m) to BNC (f)

Additional Equipment for Option 001

Cable, BNC, 75 Ω, 30 cm (12 in)

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

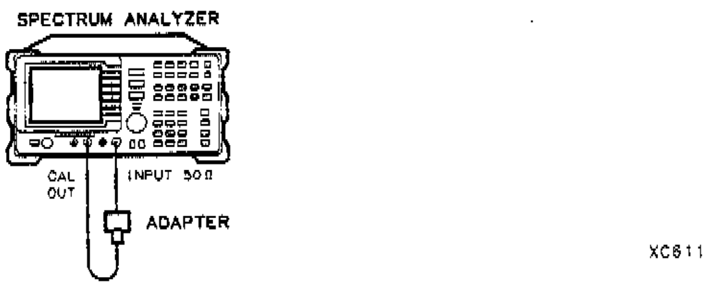

Figure 1-12. Uncertainty Test Setup

Absolute Amplitude Uncertainty

1. Connect the CAL OUT to the spectrum analyzer input using the BNC cable and adapter, as shown in Figure 1-12.

   Option 001 only: Use the 75 Ω cable and omit the adapter.

2. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer controls by pressing the following keys:

   (SPAN) 10 (MHz)
   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)
   (FREQUENCY) 300 (MHz)
   (SPAN) 50 (kHz)
   (BW) 3 (kHz)
   (VID BW AUTO MAN) 300 (Hz)

   Option 001 only: Press (AMPLITUDE), More 1 of 2, Amptd Units, then dBm.

   (AMPLITUDE) −20 (dBm)

3. Press (PEAK SEARCH), then record the marker reading in TR Entry 11-1 of the performance verification test record.

   The marker reading should be within −20.15 and −19.85 dB.

Resolution Bandwidth Switching Uncertainty

4. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer controls by pressing the following keys:

   (FREQUENCY) 300 (MHz)
   (SPAN) 10 (MHz)
   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)

   Option 001 only: Press (AMPLITUDE), More 1 of 2, Amptd Units, then dBm.

   (SPAN) 50 (kHz)
   (AMPLITUDE) −20 (dBm)
   SCALE LOG LIN (LOG) 1 (dB)
   (BW) 3 (kHz)
   VID BW AUTO MAN 1 (kHz)

5. Press (AMPLITUDE) and use the knob to adjust the reference level until the signal appears one division below the reference level, then press the following keys:

   (PEAK SEARCH) MARKER Δ
   (MKR FCTN) MK TRACK ON OFF (OFF)

6. Set the spectrum analyzer resolution bandwidth and span according to Table 1-16.

7. Press (PEAK SEARCH), then record the MKR Δ TRK amplitude reading in the performance verification test record as indicated in Table 1-16.

   The amplitude reading should be within the limits shown.

11. Absolute Amplitude Calibration and Resolution Bandwidth Switching Uncertainties

To measure the absolute amplitude calibration uncertainty the input signal is measured after the self-cal routine is finished.

To measure the resolution bandwidth switching uncertainty an amplitude reference is taken with the resolution bandwidth set to 3 kHz using the marker-delta function. The resolution bandwidth is changed to settings between 3 MHz and 1 kHz and the amplitude variation is measured at each setting and compared to the specification. The span is changed as necessary to maintain approximately the same aspect ratio.

The related adjustment procedure for this performance test is "Crystal and LC Bandwidth Adjustment."

Equipment Required

Cable, BNC, 23 cm (9 in)
Adapter, Type N (m) to BNC (f)

Additional Equipment for Option 001

Cable, BNC, 75 Ω, 30 cm (12 in)

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

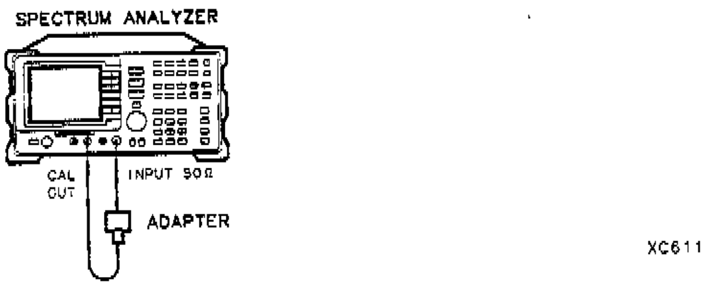

Figure 1-12. Uncertainty Test Setup

Absolute Amplitude Uncertainty

1. Connect the CAL OUT to the spectrum analyzer input using the BNC cable and adapter, as shown in Figure 1-12.

   Option 001 only: Use the 75 Ω cable and omit the adapter.

2. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer controls by pressing the following keys:

   (SPAN) 10 (MHz)
   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)
   (FREQUENCY) 300 (MHz)
   (SPAN) 50 (kHz)
   (BW) 3 (kHz)
   (VID BW AUTO MAN) 300 (Hz)

   Option 001 only: Press (AMPLITUDE), More 1 of 2, Amptd Units, then dBm.

   (AMPLITUDE) −20 (dBm)

3. Press (PEAK SEARCH), then record the marker reading in TR Entry 11-1 of the performance verification test record.

   The marker reading should be within −20.15 and −19.85 dB.

Resolution Bandwidth Switching Uncertainty

4. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer controls by pressing the following keys:

   (FREQUENCY) 300 (MHz)
   (SPAN) 10 (MHz)
   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)

   Option 001 only: Press (AMPLITUDE), More 1 of 2, Amptd Units, then dBm.

   (SPAN) 50 (kHz)
   (AMPLITUDE) −20 (dBm)
   SCALE LOG LIN (LOG) 1 (dB)
   (BW) 3 (kHz)
   VID BW AUTO MAN 1 (kHz)

5. Press (AMPLITUDE) and use the knob to adjust the reference level until the signal appears one division below the reference level, then press the following keys:

   (PEAK SEARCH) MARKER Δ
   (MKR FCTN) MK TRACK ON OFF (OFF)

6. Set the spectrum analyzer resolution bandwidth and span according to Table 1-16.

7. Press (PEAK SEARCH), then record the MKR Δ TRK amplitude reading in the performance verification test record as indicated in Table 1-16.

   The amplitude reading should be within the limits shown.

8. Repeat steps 6 through 7 for each of the remaining resolution bandwidth and span settings listed in Table 1-16.

Table 1-16. Resolution Bandwidth Switching Uncertainty

Spectrum Analyzer		MKR Δ TRK Amplitude Reading		
RES BW Setting	SPAN Setting	Min. (dB)	TR Entry	Max. (dB)
3 kHz	50 kHz	0 (Ref)	0 (Ref)	0 (Ref)
1 kHz	50 kHz	−0.5	11-2	+0.5
9 kHz	50 kHz	−0.4	11-3	+0.4
10 kHz	50 kHz	−0.4	11-4	+0.4
30 kHz	500 kHz	−0.4	11-5	+0.4
100 kHz	500 kHz	−0.4	11-6	+0.4
120 kHz	500 kHz	−0.4	11-7	+0.4
300 kHz	5 MHz	−0.4	11-8	+0.4
1 MHz	10 MHz	−0.4	11-9	+0.4
3 MHz	10 MHz	−0.4	11-10	+0.4

If you are testing a spectrum analyzer equipped with Option 130, continue with step 9.

Performance test "11. Resolution Bandwidth Switching Uncertainty" is now complete for all other spectrum analyzers.

Additional Steps for Option 130

9. Press the following spectrum analyzer keys:

   (SPAN) 50 (kHz)
   (BW) 3 (kHz)
   (PEAK SEARCH) MARKER Δ
   (MKR FCTN) MK TRACK ON OFF (ON)

10. Set the resolution bandwidth and span according to Table 1-17.
11. Press (PEAK SEARCH), then record the MKR Δ TRK amplitude reading in the performance verification test record as indicated in Table 1-16.

    The amplitude reading should be within the limits shown.
12. Repeat steps 10 through 11 for each of the remaining resolution bandwidth and span settings listed in Table 1-16.

11. Absolute Amplitude Calibration and Resolution Bandwidth Switching Uncertainties

Table 1-17.
Resolution Bandwidth Switching Uncertainty for Option 130

Spectrum Analyzer		MKR Δ TRK Amplitude Reading		
RES BW Setting	**SPAN Setting**	**Min. (dB)**	**TR Entry**	**Max. (dB)**
3 kHz	50 kHz	0 (Ref)	0 (Ref)	0 (Ref)
300 Hz	1 kHz	−0.6	11-11	+0.6
200 Hz	1 kHz	−0.6	11-12	+0.6
100 Hz	1 kHz	−0.6	11-13	−0.5
30 Hz	1 kHz	−0.6	11-14	+0.6

Note that it is normal for the 200 Hz resolution bandwidth shape to have a dip in the center of the response.

12. Resolution Bandwidth Accuracy

The output of a synthesizer/level generator is connected to the input of the spectrum analyzer. Measurements are performed in zero span to reduce the measurement uncertainty.

The frequency of the synthesizer/level generator is set to the center of the bandwidth-filter response. The synthesizer output is then reduced in amplitude by either 3 dB or 6 dB to determine the reference point. A marker reference is set and the synthesizer output is increased to its previous level.

The frequency of the synthesizer is reduced then recorded when the resulting marker amplitude matches the previously set marker reference. The synthesizer frequency is increased so that it is tuned on the opposite point on the skirt of the filter response. The frequency is once again recorded and the difference between the two frequencies is compared to the specification.

The related adjustments for this performance test are:

CAL AMPTD and CAL FREQ Self-Cal Routines
Crystal and LC Filter Adjustments

Equipment Required

Synthesizer/level generator
Cable, BNC, 122 cm (48 in)
Adapter, Type N (m) to BNC (f)

Additional Equipment for Option 001

Cable, BNC (75 Ω), 122 cm (48 in)

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

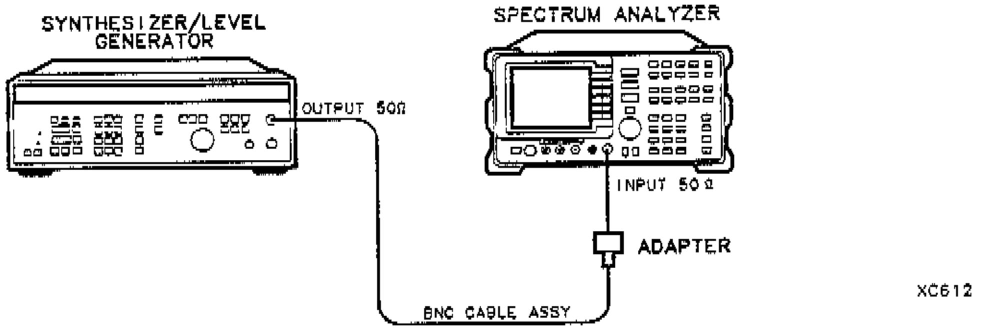

Figure 1-13. Resolution Bandwidth Accuracy Test Setup

12. Resolution Bandwidth Accuracy

Procedure

1. Connect the equipment as shown in Figure 1-13

   Option 001: Connect the 75 Ω cable to the OUTPUT 75 Ω connector of the synthesizer/level generator.

3 dB Bandwidths

2. Set the synthesizer/level generator controls as follows:

   *Option 001:*Set the 50 Ω/75 Ω switch to 75 Ω

   AMPLITUDE .... 0 dBm
   AMPTD INCR .... 3 dB
   FREQUENCY .... 50 MHz

3. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 50 (MHz)
   (SPAN) ZERO SPAN
   (BW) 3 (MHz)
   VID BW AUTO MAN 30 (Hz)
   (AMPLITUDE) SCALE LOG LIN (LOG) 1 (dB)

4. On the synthesizer/level generator set MANUAL TUNE ON/OFF to ON.
5. On the spectrum analyzer press (MKR).
6. Adjust the frequency of the synthesizer/level generator for a maximum marker reading.

   It will be necessary to adjust the MANUAL TUNE DIGIT resolution on the synthesizer/level generator for the best compromise between tuning speed and resolution.

7. On the synthesizer/level generator, press AMPLITUDE and INCR (⇓) (step-down key).
8. Press (MARKER Δ) on the spectrum analyzer.
9. On the synthesizer/level generator, press INCR (⇑) (step-up key).
10. On the synthesizer/level generator, press FREQUENCY. Lower the frequency of the synthesizer/level generator by adjusting the knob until the marker delta amplitude is 0.0 ± 0.05 dB.
11. Record the synthesizer/level generator frequency readout in column 1 of Table 1-18.
12. Using the synthesizer/level generator knob, raise the frequency so that the marker-delta amplitude is maximum. Continue increasing the frequency until the marker reads 0.0 ± 0.05 dB.
13. Record the synthesizer/level generator frequency readout in column 2 of Table 1-18.
14. Adjust the synthesizer/level generator frequency for maximum amplitude.
15. Repeat steps 5 through 14 for each of the RES BW settings listed in Table 1-18.
16. Subtract the Synthesizer Lower Frequency from the Synthesizer Upper Frequency. Record the difference as the Resolution Bandwidth Accuracy, in the performance verification test record as indicated in Table 1-18.

    RES BW Accuracy = Upper Frequency − Lower Frequency

Table 1-18. 3 dB Resolution Bandwidth Accuracy

Spectrum Analyzer RES BW	Column 1 Synthesizer Lower Frequency	Column 2 Synthesizer Upper Frequency	TR Entry (Resolution Bandwidth Accuracy)
3 MHz	__________	__________	12-1
1 MHz	__________	__________	12-2
300 kHz	__________	__________	12-3
100 kHz	__________	__________	12-4
30 kHz	__________	__________	12-5
10 kHz	__________	__________	12-6
3 kHz	__________	__________	12-7
1 kHz	__________	__________	12-8

6 dB EMI Bandwidths

17. Set the synthesizer/level generator AMPTD INCR to 6 dB.
18. On the spectrum analyzer, press the following keys:

    (BW) 9 kHz EMI BW
    (MKR)

19. On the synthesizer/level generator, press FREQUENCY. Adjust the frequency for a maximum marker reading.
20. On the synthesizer/level generator, press AMPLITUDE and INCR (⇩) (step-down key).
21. Press (MARKER DELTA) on the spectrum analyzer.
22. On the synthesizer/level generator, press INCR (⇧) (step-up key).
23. On the synthesizer/level generator, press FREQUENCY. Lower the frequency of the synthesizer/level generator by adjusting the knob until the marker-delta amplitude is 0.0 ± 0.05 dB.
24. Record the synthesizer/level generator frequency readout in column 1 of Table 1-19.
25. Using the synthesizer/level generator knob, increase the frequency so that the marker-delta amplitude is maximum. Continue increasing the frequency until the marker reads 0.0 ± 0.05 dB.
26. Record the synthesizer/level generator frequency readout in column 2 of Table 1-19.
27. Adjust the synthesizer/level generator frequency for maximum marker amplitude.
28. Repeat steps 18 through 26 for the 120 kHz EMI RES BW.
29. Subtract the Synthesizer Lower Frequency from the Synthesizer Upper Frequency. Record the difference as the Resolution Bandwidth Accuracy, in the performance verification test record as indicated in Table 1-19.

    RES BW Accuracy = Upper Frequency − Lower Frequency

12. Resolution Bandwidth Accuracy

Table 1-19. EMI Resolution Bandwidth Accuracy

Spectrum Analyzer RES BW	Column 1 Synthesizer Lower Frequency	Column 2 Synthesizer Upper Frequency	TR Entry (Resolution Bandwidth Accuracy)
9 kHz	________	________	12-9
120 kHz	________	________	12-10

If you are testing a spectrum analyzer equipped with Option 130, continue with step 30.

Performance test "Resolution Bandwidth Accuracy" is now complete for all other spectrum analyzers.

Additional Steps for Option 130

30. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

    (FREQUENCY) 50 (MHz)
    (SPAN) 1 (MHz)
    (PEAK SEARCH)
    (MKR FCTN) MK TRACK ON OFF (ON)
    (SPAN) 1 (kHz)

    Wait for the auto zoom routine to finish, then press the following keys:

    (MKR) MARKER 1 ON OFF (OFF)
    (MEAS/USER) N dB PTS ON OFF 3 (dB)
    (AMPLITUDE) SCALE LOG LIN (LOG) 1 (dB)
    (BW) 300 (Hz)

31. Set the spectrum analyzer resolution bandwidth and span according to Table 1-20.
32. Press (SGL SWP). Record the −3 dB POINTS: readout in the performance verification test record as indicated in Table 1-20.
33. Repeat steps 31 through 32 for each of the Resolution Bandwidth settings listed in Table 1-20.

Table 1-20. Resolution Bandwidth Accuracy for Option 130

Resolution Bandwidth	Frequency Span	TR Entry (−3 dB Readout)
300 Hz	1 kHz	12-11
100 Hz	1 kHz	12-12
30 Hz	300 Hz	12-13

6 dB EMI 200 Hz Bandwidths

It is normal for the 200 Hz resolution bandwidth shape to have a dip in the center of the response.

34. Press the following spectrum analyzer keys:

    (MEAS/USER) N dB PTS ON OFF 6 (dB)
    (BW) 200 (Hz)

35. Press (SGL SWP). Record the −6 dB POINTS: readout in the performance verification test record as TR Entry 12-14.

13. Calibrator Amplitude Accuracy

This test measures the accuracy of the spectrum analyzer CAL OUT signal. The first part of the test characterizes the insertion loss of a Low Pass Filter (LPF) and 10 dB Attenuator. The harmonics of the CAL OUT signal are suppressed with the LPF before the amplitude accuracy is measured using a power meter.

Calibrator Frequency is not included in this procedure because it is a function of the Frequency Reference (CAL OUT Frequency = 300 MHz ±(300 MHz × Frequency Reference)). Perform the Frequency Reference Accuracy test to verify the CAL OUT frequency.

The related adjustment for this performance test is the "Calibrator Amplitude Adjustment."

Equipment Required

Synthesized sweeper
Measuring receiver *(used as a power meter)*
Power meter
Power sensor, low power with a 50 MHz reference attenuator
Power sensor, 100 kHz to 1800 MHz
Power splitter
10 dB Attenuator, Type N (m to f), dc-12.4 GHz
Filter, low pass
Cable, Type N, 152 cm (60 in)
APC 3.5 (f) to Type N (f)
Adapter, Type N (f) to BNC (m) *(two required)*
Adapter, Type N (m) to BNC (f)

Additional Equipment for Option 001

Adapter, minimum loss
Adapter, mechanical, 75 Ω to 50 Ω
Adapter, Type N (f) 75 Ω to BNC (m) 75 Ω

Procedure

This performance test consists of two parts:

Part 1: LPF, Attenuator and Adapter Insertion Loss Characterization
Part 2: Calibrator Amplitude Accuracy

Perform "Part 1: LPF, Attenuator and Adapter Insertion Loss Characterization" before "Part 2: Calibrator Amplitude Accuracy."

A worksheet is provided at the end of this procedure for calculating the corrected insertion loss and the calibrator amplitude accuracy.

Part 1: LPF, Attenuator and Adapter Insertion Loss Characterization

1. Zero and calibrate the measuring receiver and 100 kHz to 1800 MHz power sensor in LOG mode as described in the measuring receiver operation manual.

Caution Do not attempt to calibrate the low-power power sensor without the reference attenuator or damage to the low-power power sensor will occur.

2. Zero and calibrate the power meter and low-power power sensor, as described in the power meter operation manual.
3. Press INSTRUMENT PRESET on the synthesized sweeper, then set the controls as follows:

CW .... 300 MHz
POWER LEVEL .... −15 dBm

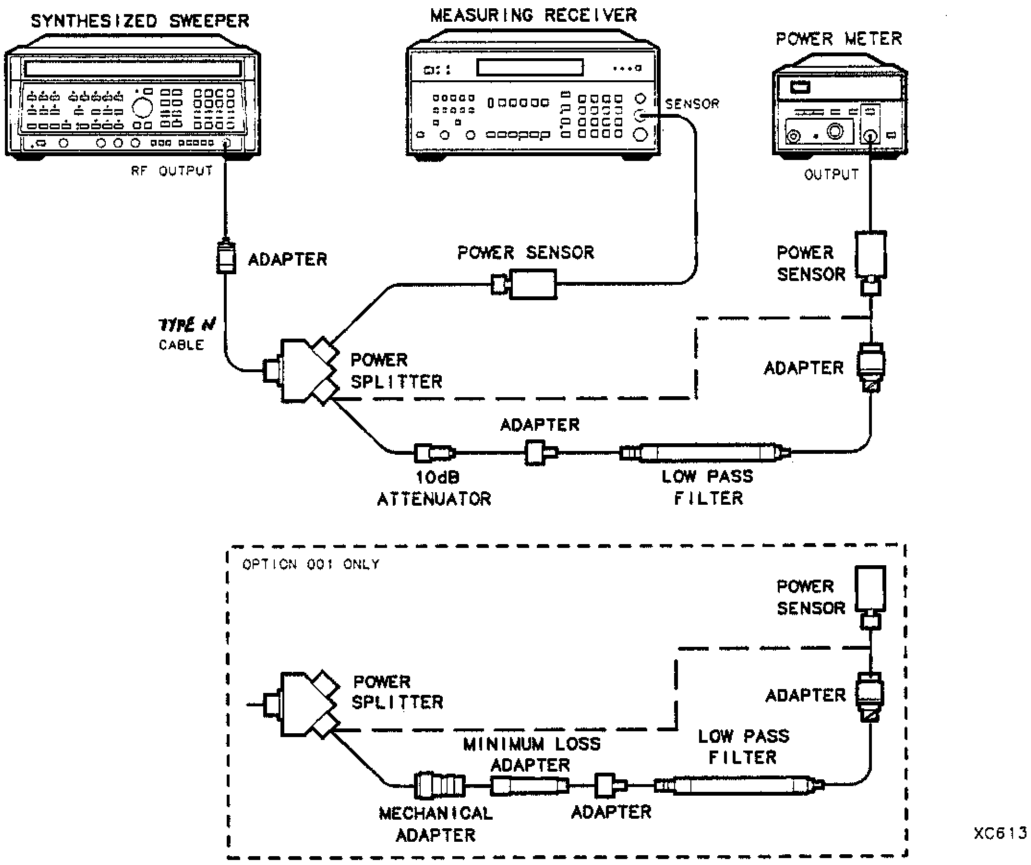

Figure 1-14. LPF Characterization

4. Connect the equipment as shown in Figure 1-14. Connect the low-power power sensor directly to the power splitter (bypass the LPF, attenuator, and adapters). Wait for the power sensor to settle before proceeding with the next step.
5. On the measuring receiver, press RATIO mode. The power indication should be 0 dB.
6. On the power meter, press the dB REF mode key. The power indication should be 0 dB.
7. Connect the LPF, attenuator and adapters as shown in Figure 1-14.
8. Record the measuring receiver reading in dB in the worksheet as the Mismatch Error. This is the relative error due to mismatch.
9. Record the power meter reading in dB in the worksheet as the Uncorrected Insertion Loss. This is the relative uncorrected insertion loss of the LPF, attenuator and adapters.
10. Subtract the Mismatch Error (step 8) from the Uncorrected Insertion Loss (step 9). This is the corrected insertion loss. Record this value in the worksheet as the Corrected Insertion Loss.

    Example: If the Mismatch Error is +0.3 dB and the Uncorrected Insertion Loss is −10.2 dB, subtract the mismatch error from the insertion loss to yield a corrected reading of −10.5 dB.

Part 2: Calibrator Amplitude Accuracy

Perform "Part 1: LPF, Attenuator and Adapter Insertion Loss Characterization" before performing this procedure.

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

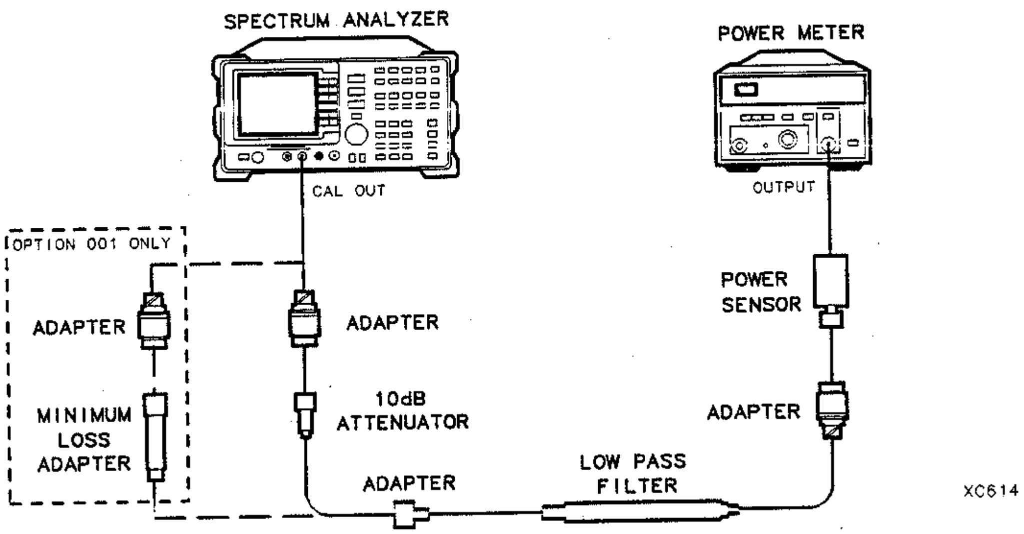

Figure 1-15. Calibrator Amplitude Accuracy Test Setup

1. Connect the equipment as shown in Figure 1-15. The spectrum analyzer should be positioned so that the setup of the adapters, LPF and attenuator do not bind. It may be necessary to support the center of gravity of the devices.
2. On the power meter, press the dBm mode key. Record the Power Meter Reading in dBm in the worksheet as the Power Meter Reading.
3. Subtract the Corrected Insertion Loss (step 10) from the Power Meter Reading (step 12).

   CAL OUT Power = Power Meter Reading − Corrected Insertion Loss

   Example: If the Corrected Insertion Loss is −10.0 dB, and the measuring receiver reading is −30 dB, then (−30 dB) − (−10.0 dB) = −20 dB

4. Record this value as TR Entry 13-1 of the performance verification test record as the CAL OUT power. The CAL OUT should be −20 dBm ±0.4 dB.

   Option 001 only: The CAL OUT power measured on 75 Ω instruments will be the same as 50 Ω instruments. To convert from dBm to dBmV use the following equation, then record this value as TR Entry 13-2 of the performance verification test record.

   dBmV = dBm + 48.75 dB

   Example: −20 + 48.75 = 28.75 dBmV

Calibrator Amplitude Accuracy Worksheet

Description	Measurement
Mismatch Error	____________dB
Uncorrected Insertion Loss	____________dB
Corrected Insertion Loss	____________dB
Counter Reading 3	____________Hz
Power Meter Reading	____________dBm

14. Frequency Response

The output of the synthesized sweeper is fed through a power splitter to a power sensor and the spectrum analyzer. The synthesized sweeper's power level is adjusted at 300 MHz to place the displayed signal at the spectrum analyzer center horizontal graticule line. The measuring receiver, used as a power meter, is placed in RATIO mode. At each new sweeper frequency and spectrum analyzer center frequency setting, the sweeper's power level is adjusted to place the signal at the center horizontal graticule line. The measuring receiver displays the inverse of the frequency response relative to 300 MHz (CAL OUT frequency).

The related adjustment for this performance test is "Frequency Response Error Correction."

Testing the flatness of spectrum analyzers equipped with Option 001, INPUT 75 Ω, is accomplished by first performing a system flatness characterization.

Equipment Required

Synthesized sweeper
Measuring receiver *(used as a power meter)*
Synthesizer/level generator
Power sensor, 100 kHz to 1800 MHz
Power splitter
Adapter, Type N (f) to APC 3.5 (f)
Adapter, Type N (m) to Type N (m)
Cable, BNC, 122 cm (48 in)
Cable, Type N, 183 cm (72 in)

Additional Equipment for Option 001

Power meter
Power sensor, 1 MHz to 2 GHz
Cable, BNC, 120 cm (48 in) 75 Ω
Adapter, Type N (f) 75 Ω to Type N (m) 50 Ω
Adapter Type N (m) to BNC (m), 75 Ω

Caution

Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

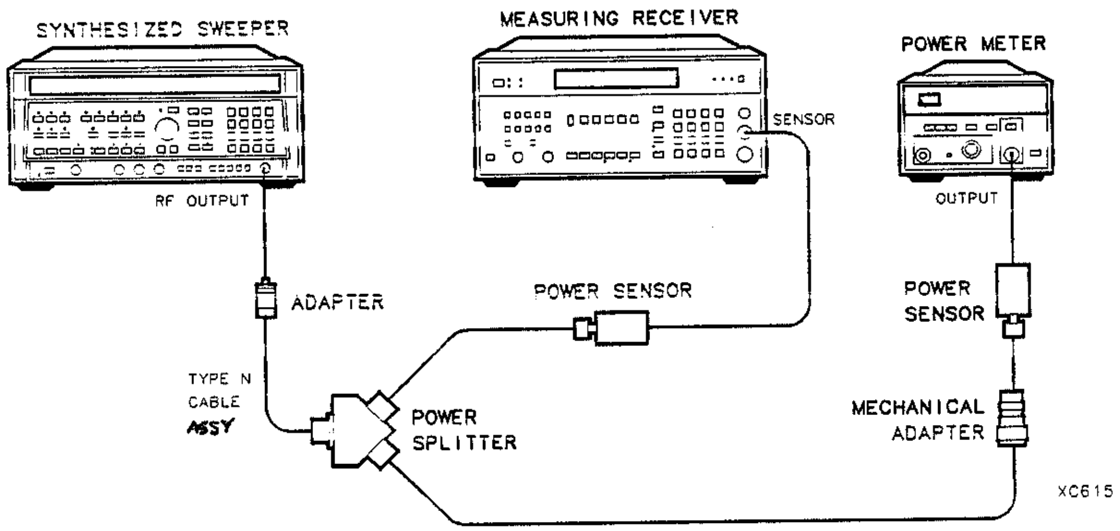

Figure 1-16. System Characterization Test Setup for Option 001

Procedure for System Characterization for Option 001

The following procedure is only for spectrum analyzers equipped with Option 001. If your spectrum analyzer is *not* equipped with Option 001 proceed with step 1 of "Frequency Response ≥50 MHz."

1. Zero and calibrate the measuring receiver and 100 kHz to 1800 MHz power sensor as described in the measuring receiver operation manual.
2. Zero and calibrate the power meter and 1 MHz to 2 GHz power sensor as described in the power meter operation manual.
3. Press instrument preset on the synthesized sweeper, then set the controls as follows:

   CW .... 50 MHz
   FREQ STEP .... 50 MHz
   POWER LEVEL .... 5 dBm

4. Connect the equipment as shown in Figure 1-16.
5. Adjust the synthesized sweeper power level for a 0 dBm reading on the measuring receiver.
6. Record the power meter reading in column 4 of Table 1-21, taking into account the Cal Factors of both the 100 kHz to 4.2 GHz power sensor and the 1 MHz to 2 GHz power sensor.

7. On the synthesized sweeper, press CW, and ⇑ (step-up key), to step through the remaining frequencies listed in Table 1-21.

   At each new frequency repeat steps 5 and 6, entering each power sensor's Cal Factor into the respective power meter.

   System characterization is now complete for spectrum analyzers equipped with Option 001. Continue with step 1 of the "Frequency Response ≥50 MHz" below.

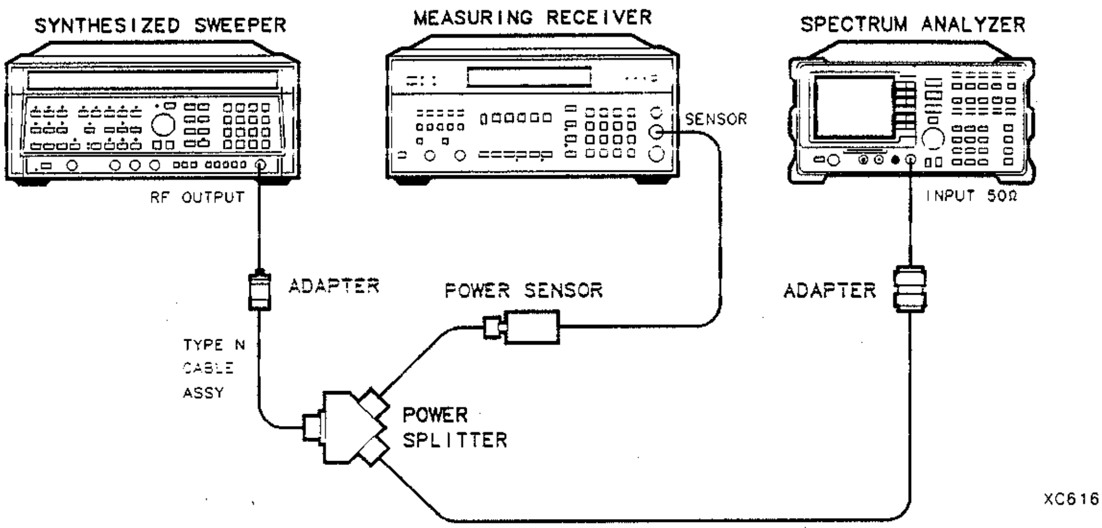

Figure 1-17. Frequency Response Test Setup, ≥50 MHz

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

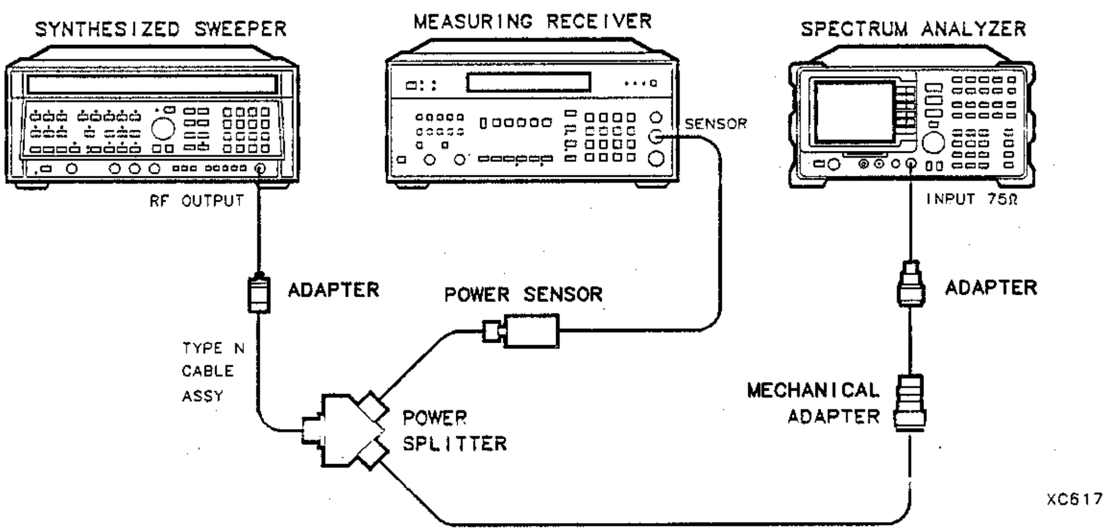

Figure 1-18. Frequency Response Test Setup, ≥50 MHz, for Option 001

Frequency Response, ≥50 MHz

If your spectrum analyzer is equipped with Option 001 perform "Procedure for System Characterization for Option 001" before proceeding with this procedure.

1. Zero and calibrate the measuring receiver and 100 kHz to 1800 MHz power sensor in log mode as described in the measuring receiver operation manual.
2. Connect the equipment as shown in Figure 1-17.

   Option 001 only: Refer to Figure 1-18.
3. Press INSTRUMENT PRESET on the synthesized sweeper. Set the synthesized sweeper controls as follows:

   CW .... 300 MHz
   FREQ STEP .... 50 MHz
   POWER LEVEL .... −8 dBm
4. On the spectrum analyzer, press (PRESET) and wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 300 (MHz)
   CF STEP AUTO MAN 50 (MHz)
   (SPAN) 5 (MHz)

   (Option 001 only: Press (AMPLITUDE), More 1 of 2, Amptd Units, then dBm).

   (AMPLITUDE) −10 (dBm)
   SCALE LOG LIN (LOG) 1 (dB)
   (BW) 1 (MHz)
   VID BW AUTO MAN 3 (kHz)
   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)
5. Adjust the synthesized sweeper power level for a MKR-TRK amplitude reading of −14 dBm ±0.05 dB.
6. Set the sensor Cal Factor on the measuring receiver, then press RATIO.
7. Set the synthesized sweeper CW to 50 MHz.
8. Press (FREQUENCY) 50 (MHz) on the spectrum analyzer.
9. Adjust the synthesized sweeper power level for a spectrum analyzer MKR-TRK amplitude reading of −14 dBm ±0.05 dB.
10. Set the sensor Cal Factor on the measuring receiver, then record the negative of the power ratio displayed on the measuring receiver in column 2 of Table 1-21 as the Error Relative to 300 MHz at 50 MHz.
11. Set the synthesized sweeper CW to 100 MHz.
12. Press (FREQUENCY) 100 (MHz) on the spectrum analyzer.
13. Adjust the synthesized sweeper power level for a spectrum analyzer MKR-TRK amplitude reading of −14 dBm ±0.05 dB.
14. Set the sensor Cal Factor on the measuring receiver, then record the negative of the power ratio displayed on the measuring receiver in column 2 of Table 1-21 as the Error Relative to 300 MHz at 100 MHz.

14. **Frequency Response**

15. On the synthesized sweeper, press CW, and (⇑) (step-up key), then on the spectrum analyzer, press (FREQUENCY), and (⇑) (step-up key).
16. Record the negative of the power ratio displayed on the measuring receiver in column 2 of Table 1-21.
17. Repeat steps 15 through 16 for each new frequency, entering the power sensor Cal Factor into the measuring receiver for each frequency setting as indicated in Table 1-21.

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

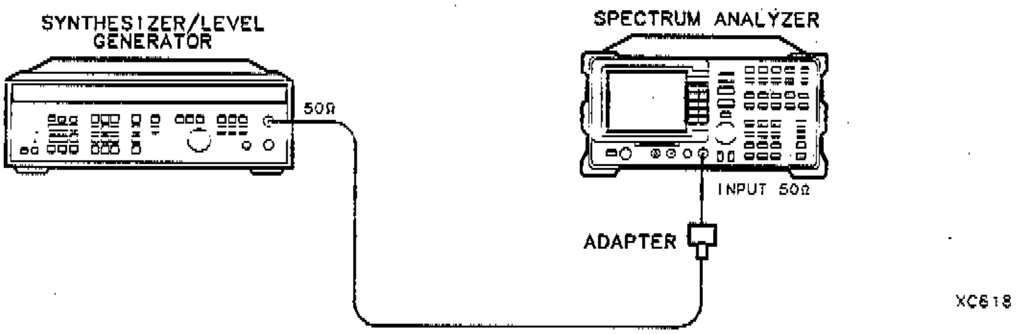

Figure 1-19. Frequency Response Test Setup, <50 MHz

Frequency Response, ≤50 MHz

18. Using a cable, connect the frequency synthesizer directly to the INPUT 50 Ω. Refer to Figure 1-19.

    Option 001 only: Using a 75 Ω cable, connect the frequency synthesizer from the 75 Ω OUTPUT to the INPUT 75 Ω. Set the frequency synthesizer 50–75 Ω switch to the 75 Ω position.

    Set the frequency synthesizer controls as follows:

    FREQUENCY .... 50 MHz
    AMPLITUDE .... −15 dBm
    AMPTD INCR .... 0.05 dB

19. On the spectrum analyzer, press the following keys:

    (FREQUENCY) 50 (MHz)
    (SPAN) 10 (MHz)
    (BW) 3 (kHz) VID BW AUTO MAN 10 (kHz)
    (PEAK SEARCH)
    (MKR FCTN) MK TRACK ON OFF (ON)
    (SPAN) 100 (kHz)

    Wait for the AUTO ZOOM routine to finish.

20. Adjust the frequency synthesizer amplitude until the MKR-TRK reads −14 dBm. This corresponds to the amplitude at 50 MHz recorded in step 11. Record the frequency synthesizer amplitude in column 2 of Table 1-22 for Frequency Synthesizer Amplitude at 50 MHz.

21. On the spectrum analyzer, press (PEAK SEARCH), MARKER Δ.
22. Set the spectrum analyzer and the frequency synthesizer to the next frequency settings listed in Table 1-22.
23. At each frequency, adjust the frequency synthesizer amplitude for a MKR-Δ-TRK amplitude reading of 0.00 ±0.05 dB.
24. Record the frequency synthesizer amplitude setting in column 2 of Table 1-22 as the frequency synthesizer amplitude.

    Option 001 only: Do not test below 1 MHz.
25. Repeat steps 22 through 24 for each frequency setting listed in Table 1-22.
26. For each of the frequencies in Table 1-22, subtract the Frequency Synthesizer Amplitude (column 2) from the Frequency Synthesizer Amplitude at 50 MHz recorded in step 19. Record the result as the Response Relative to 50 MHz (column 3) of Table 1-22.
27. Add to each of the Response Relative to 50 MHz entries in Table 1-22 the Error Relative to 300 MHz at 50 MHz recorded in step 11. Record the results as the Response Relative to 300 MHz (column 4) in Table 1-22.

    Option 001 only: Starting with the error at 50 MHz, subtract column 4 (System Error) from column 2 (Error Relative to 300 MHz) and record the result in column 5 as the Corrected Error.

Test Results

Perform the following steps to verify the frequency response of the spectrum analyzer.

1. Enter the most positive number from Table 1-22, column 4: ________ dB
2. Enter the most positive number from Table 1-21, column 2: ________ dB
   (*Option 001 only:* Use column 5)
3. Record the more positive of numbers from steps 1 and 2 in TR Entry 14-1 of the performance verification test record.
4. Enter the most negative number from Table 1-22, column 4: ________ dB
5. Enter the most negative number from Table 1-21, column 2: ________ dB
   (*Option 001 only:* Use column 5)
6. Record the more negative of numbers from steps 4 and 5 in TR Entry 14-2 of the performance verification test record.
7. Subtract the results of step 6 from the results of step 3. Record this value in TR Entry 14-3 of the performance verification test record.

   The result should be less than 2.0 dB.

   The absolute values in steps 3 and 6 should be less than 1.5 dB.

14. Frequency Response

Table 1-21. Frequency Response Errors Worksheet

Column 1 Spectrum Analyzer Frequency (MHz)	Column 2 Error Relative to 300 MHz (dB)	Column 3 CAL FACTOR Frequency (GHz)	Column 4 System Error (*Option 001 only*) (dB)	Column 5 Corrected Error (*Option 001 only*) (dB)
50	______	0.03	______	______
100	______	0.1	______	______
150	______	0.1	______	______
200	______	0.3	______	______
250	______	0.3	______	______
300 (Ref)	______	0.3	______	______
350	______	0.3	______	______
400	______	0.3	______	______
450	______	0.3	______	______
500	______	0.3	______	______
550	______	1.0	______	______
600	______	1.0	______	______
650	______	1.0	______	______
700	______	1.0	______	______
750	______	1.0	______	______
800	______	1.0	______	______
850	______	1.0	______	______
900	______	1.0	______	______
950	______	1.0	______	______
1000	______	1.0	______	______
1050	______	1.0	______	______
1100	______	1.0	______	______
1150	______	1.0	______	______
1200	______	1.0	______	______
1250	______	1.0	______	______
1300	______	1.0	______	______
1350	______	1.0	______	______
1400	______	1.0	______	______

Table 1-21. Frequency Response Errors Worksheet (continued)

Column 1 Spectrum Analyzer Frequency (MHz)	Column 2 Error Relative to 300 MHz (dB)	Column 3 CAL FACTOR Frequency (GHz)	Column 4 System Error (*Option 001 only*) (dB)	Column 5 Corrected Error (*Option 001 only*) (dB)
1450	______	1.0	______	______
1500	______	1.0	______	______
1550	______	2.0	______	______
1600	______	2.0	______	______
1650	______	2.0	______	______
1700	______	2.0	______	______
1750	______	2.0	______	______
1800	______	2.0	______	______

Table 1-22. Frequency Response, ≤50 MHz Worksheet

Column 1 Spectrum Analyzer Frequency	Column 2 Frequency Synthesizer Amplitude (dBm)	Column 3 Response Relative to 50 MHz	Column 4 Response Relative to 300 MHz
50 MHz	______	0 (Ref)	______
20 MHz	______	______	______
10 MHz	______	______	______
5 MHz	______	______	______
1 MHz	______	______	______
200 kHz	______	______	______
50 kHz	______	______	______
9 kHz	______	______	______

15. Other Input Related Spurious Responses

A synthesized source and the spectrum analyzer are set to the same frequency and the amplitude of the source is set to −20 dBm. A marker-amplitude reference is set on the spectrum analyzer. The source is then tuned to several different frequencies where image responses could occur. At each source frequency, the source amplitude is set to −20 dBm and the amplitude of the response, if any, is measured using the spectrum analyzer marker function. The marker-amplitude difference is then compared to the specification.

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesized sweeper
Measuring receiver *(used as a Power meter)*
Power sensor, 100 kHz to 1800 MHz
Adapter, Type N (f) to APC 3.5 (f)
Adapter, Type N (f) to Type N (f)
Cable, Type N, 183 cm (72 in)

Additional Equipment for Option 001

Power sensor, 75 Ω
Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω
Adapter, Type N (f) to Type N (f), 75 Ω

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

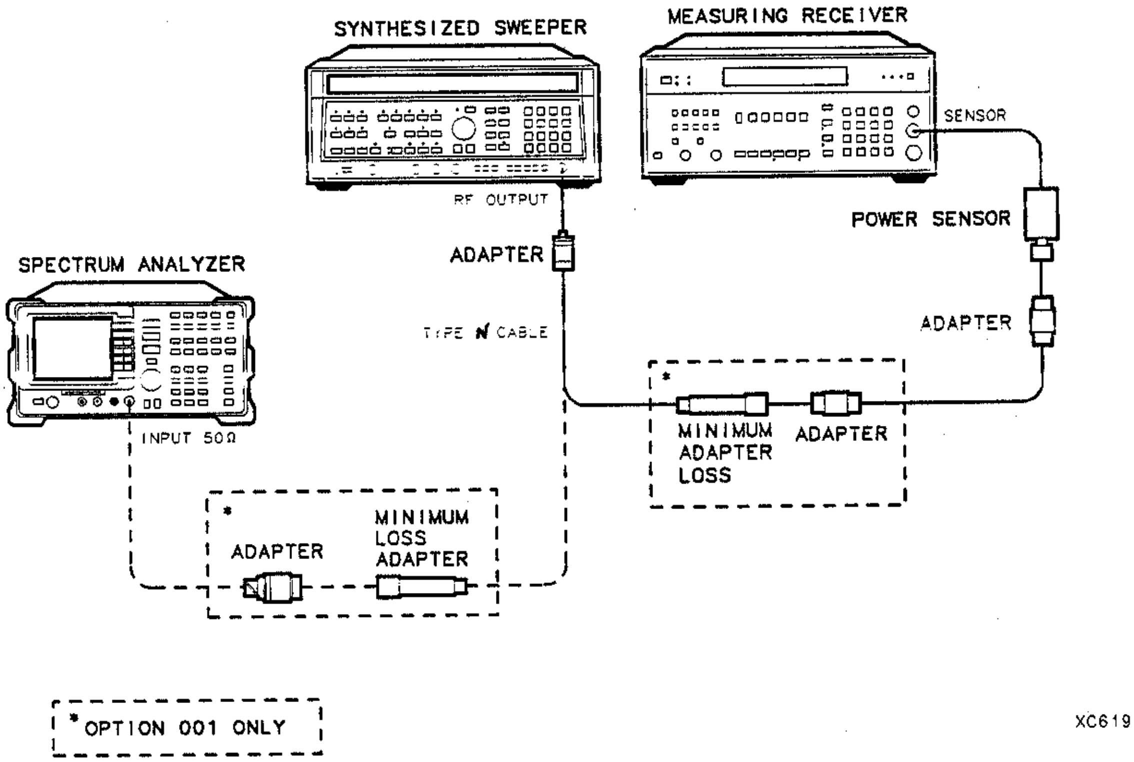

Figure 1-20. Other Input Related Spurious Responses Test Setup

Procedure

1. Zero and calibrate the measuring receiver and 100 kHz to 1800 MHz power sensor in log mode (power reads out in dBm), as described in the measuring receiver operation manual. Enter the power sensor's 542.8 MHz Cal Factor into the measuring receiver.

   Option 001 only: Use 75 Ω power sensor.

2. Press INSTRUMENT PRESET on the synthesized sweeper and set the controls as follows:

   CW .... 542.8 MHz
   POWER LEVEL .... −20 dBm
   Option 001 only: POWER LEVEL .... −14.3 dBm

3. Connect the equipment as shown in Figure 1-20. Connect the output of the synthesizer to the 100 kHz to 1800 MHz power sensor using adapters.

   Option 001 only: Use the minimum loss adapter and 75 Ω adapter to connect to the 75 Ω power sensor.

4. Adjust the synthesized sweeper power level for a −20 dBm ±0.1 dB reading on the measuring receiver.
5. On the synthesized sweeper, press SAVE 1.
6. Enter the power sensor's Cal Factor for 1142.8 MHz into the measuring receiver.

7. Set the CW frequency on the synthesized sweeper to 1142.8 MHz.
8. Adjust the synthesized sweeper power level for a −20 dBm ±0.1 dB reading on the measuring receiver.
9. On the synthesized sweeper, press SAVE 2.
10. Enter the power sensor's Cal Factor for 500 MHz into the measuring receiver.
11. Set the CW frequency on the synthesized sweeper to 500 MHz.
12. Adjust the synthesized sweeper power level for a −20 dBm ±0.1 dB reading on the measuring receiver.
13. Connect the synthesized sweeper to the RF INPUT of the spectrum analyzer using the appropriate cable and adapters.

    Option 001 only: Use the minimum loss adapter and 75 Ω adapter as shown in Figure 1-20.
14. On the spectrum analyzer, press (PRESET), then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

    (FREQUENCY) 500 (MHz)
    (SPAN) 10 (MHz)

    Option 001 only: Press (AMPLITUDE), More 1 of 2, Amptd Units, then dBm.

    (AMPLITUDE) −10 (dBm)
15. On the spectrum analyzer, press the following keys:

    (PEAK SEARCH)
    (MKR FCTN) MK TRACK ON OFF (ON)
    (SPAN) 200 (kHz)

    Wait for the AUTO ZOOM message to disappear. Press the following spectrum analyzer keys:

    (PEAK SEARCH)
    (MKR →) MARKER →REF LVL
    (MKR FCTN) MK TRACK ON OFF (OFF)
    (PEAK SEARCH) MARKER Δ
    (AMPLITUDE) (⇩) (step-down key).
    (SGL SWP)
16. For each of the frequencies listed in Table 1-23, do the following:
    a. Set the synthesized sweeper to the listed CW frequency by pressing RECALL 1 for a CW frequency of 542.8 MHz or RECALL 2 for a CW frequency of 1142.8 MHz.
    b. Press (SGL SWP) and wait for the completion of a new sweep.
    c. On the spectrum analyzer, press (PEAK SEARCH) and record the marker-delta amplitude reading in Table 1-23 as the Actual MKR Δ Amplitude.

    The Actual MKR Δ Amplitude should be less than the Maximum MKR Δ Amplitude listed in the table below.

    Note that the Maximum MKR Δ Amplitude is 10 dB more positive than the specification. This is due to the 10 dB change in reference level made in step 15.

Table 1-23. Image Responses

Synthesized Sweeper CW Frequency	Actual MKR Δ Amplitude (dBc)	Maximum MKR Δ Amplitude (dBc)
542.8 MHz	________	−55
1142.8 MHz	________	−55

17. Record the Maximum MKR Δ Amplitude from Table 1-23 in the performance verification test record as TR Entry 15-1.

16. Spurious Response

This test is performed in two parts. Part 1 measures second harmonic distortion; part 2 measures third order intermodulation distortion.

To test second harmonic distortion, a 50 MHz low pass filter is used to filter the source output, ensuring that harmonics read by the spectrum analyzer are internally generated and not coming from the source. To measure the distortion products, the power at the mixer is set 25 dB higher than specified. New test limits have been developed based on this higher power.

With −45 dBm at the input mixer and the distortion products suppressed by 70 dBc, the equivalent Second Order Intercept (SOI) is +25 dBm (−45 dBm + 70 dBc). Therefore, with −20 dBm at the mixer, and the distortion products suppressed by 45 dBc, the equivalent SOI is also +25 dBm (−20 dBm + 45 dBc).

For third order intermodulation distortion, two signals are combined in a directional bridge (for isolation) and are applied to the spectrum analyzer input. The power level of the two signals is 8 dB higher than specified, so the distortion products should be suppressed by 16 dB less than specified. In this manner, the equivalent third order intercept (TOI) is measured.

With two −30 dBm signals at the input mixer and the distortion products suppressed by 70 dBc, the equivalent TOI is +5 dBm (−30 dBm + 70 dBc/2). However, if two −22 dBm signals are present at the input mixer and the distortion products are suppressed by 54 dBc, the equivalent TOI is also +5 dBm (−22 dBm + 54 dBc/2).

Performing the test with a higher power level maintains the measurement integrity while reducing both test time and the dependency upon the source's noise sideband performance.

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesizer/level generator
Synthesized sweeper
Measuring receiver *(used as a power meter)*
Power sensor, 100 kHz to 1800 MHz
50 MHz low pass filter
Directional bridge
Cable, BNC, 120 cm (48 in) *(two required)*
Adapter, Type N (f) to APC 3.5 (f)
Adapter, Type N (f) to BNC (m)
Adapter, Type N (m) to BNC (f)
Adapter, Type N (m) to BNC (m)

Additional Equipment for Option 001

Power sensor, 75 Ω
Adapter, mechanical, 75 Ω to 50 Ω
Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω
Adapter, BNC (m) to BNC (m)

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

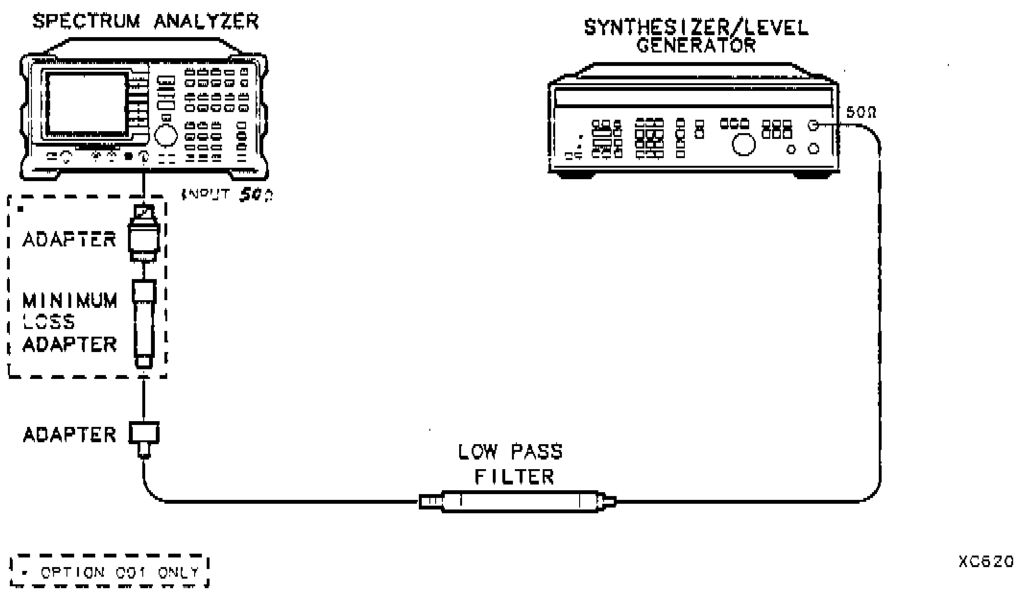

Figure 1-21. Second Harmonic Distortion Test Setup, 30 MHz

Procedure

This performance test consists of two parts:

Part 1: Second Harmonic Distortion, 30 MHz
Part 2: Third Order Intermodulation Distortion, 50 MHz

Perform "Part 1: Second Harmonic Distortion, 30 MHz" before "Part 2: Third Order Intermodulation Distortion, 50 MHz."

Part 1: Second Harmonic Distortion, 30 MHz

1. Set the synthesizer level generator controls as follows:

   FREQUENCY .... 30 MHz
   AMPLITUDE .... −10 dBm
   AMPLITUDE (*Option 001 only:*) .... −4.3 dBm

2. Connect the equipment as shown in Figure 1-21.

   Option 001 only: Connect the minimum loss adapter between the LPF and INPUT 75 Ω.

3. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 30 (MHz)
   (SPAN) 10 (MHz)

   Option 001 only: Press (AMPLITUDE), `More 1 of 2`, `Amptd Units`, then `dBm`.

   (AMPLITUDE) −10 (dBm)
   (PEAK SEARCH)
   (MKR FCTN) `MK TRACK ON OFF` (ON)
   (SPAN) 1 (MHz)

4. Wait for the `AUTO ZOOM` message to disappear, then press the following spectrum analyzer keys:

   (MKR FCTN) `MK TRACK ON OFF` (OFF)
   (BW) 30 (kHz)

5. Adjust the synthesizer level generator amplitude to place the peak of the signal at the reference level (−10 dBm).

6. Set the spectrum analyzer control as follows:

   (BW) 1 (kHz)
   `VID BW AUTO MAN` 100 (Hz)

7. Wait for two sweeps to finish, then press the following spectrum analyzer keys:

   (PEAK SEARCH)
   (MKR →) `MKR→CF STEP`
   (MKR) `MARKER Δ`
   (FREQUENCY).

8. Press the (⇑), (step-up key) on the spectrum analyzer to step to the second harmonic (at 60 MHz). Press (PEAK SEARCH). Record the MKR Δ Amplitude reading in the performance verification test record as TR Entry 16-1.

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

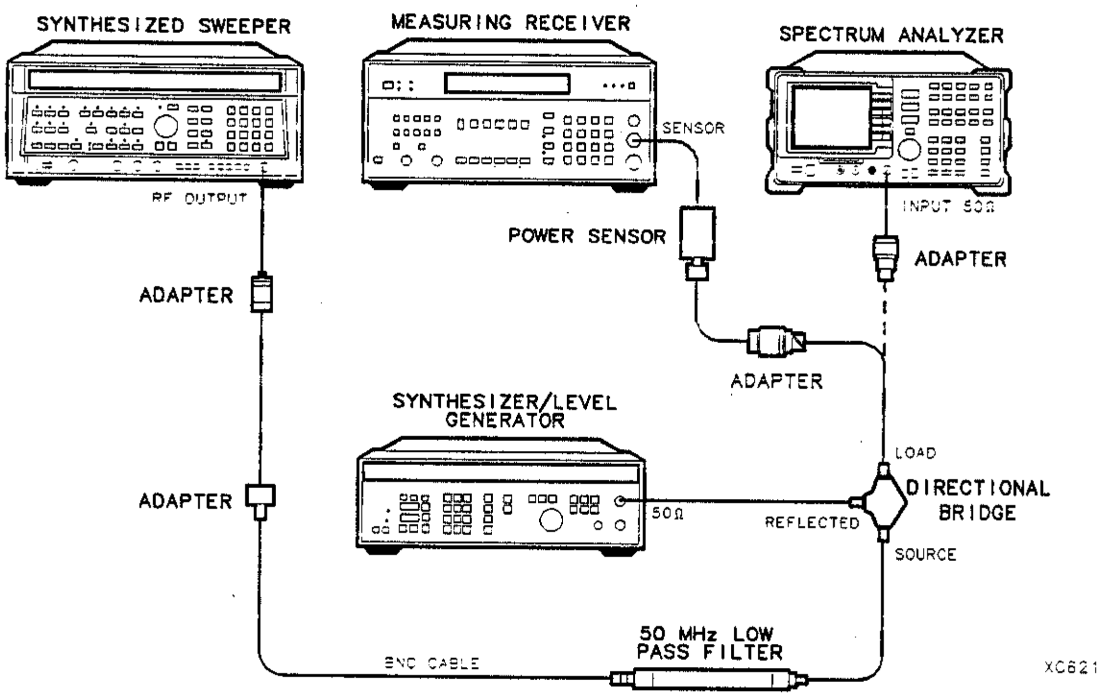

Figure 1-22. Third Order Intermodulation Distortion Test Setup

Part 2: Third Order Intermodulation Distortion, 50 MHz

1. Zero and calibrate the measuring receiver and 100 kHz to 1800 MHz power sensor in log mode (power reads out in dBm), as described in the measuring receiver operation manual. Enter the power sensor's 50 MHz Cal Factor into the measuring receiver.

   Option 001 only: Use a 75 Ω power sensor.

2. Connect the equipment as shown in Figure 1-22 with the output of the directional bridge connected to the 100 kHz to 4.2 GHZ power sensor.

   Option 001 only: Use the 75 Ω power sensor with a Type N (f) to BNC (m) 75 Ω adapter and use a BNC (m) to BNC (m) 75 Ω adapter in place of the 50 Ω adapter.

   The power measured at the output of the 50 Ω directional bridge by the 75 Ω power sensor, is the equivalent power "seen" by the 75 Ω spectrum analyzer.

3. Press INSTRUMENT PRESET on the synthesized sweeper. Set the synthesized sweeper controls as follows:

   POWER LEVEL .... −6 dBm
   CW .... 50 MHz
   RF .... OFF

4. Set the synthesizer/level generator controls as follows:

   FREQUENCY .... 50.050 MHz
   AMPLITUDE .... −6 dBm
   50 Ω/75 Ω switch .... 75 Ω (no RF output)

5. On the spectrum analyzer, press (PRESET), then wait until the preset routine is finished. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 50 (MHz)
   (SPAN) 10 (MHz)

   Option 001 only: Press (AMPLITUDE), `More 1 of 2`, `Amptd Units`, then `dBm`.

   (AMPLITUDE) −10 (dBm)
   (PEAK SEARCH) `More 1 of 2` `PEAK EXCURSN` 3 (dB)
   (DISPLAY) `More 1 of 2` `THRESHLD ON OFF` (ON) 90 (−dBm)

6. On the synthesized sweeper, set RF on. Adjust the power level until the measuring receiver reads −12 dBm ±0.05 dB.

7. Disconnect the 100 kHz to 4.2 GHZ power sensor from the directional bridge. Connect the directional bridge directly to the spectrum analyzer RF INPUT using an adapter (do not use a cable).

   Option 001 only: Use a 75 Ω adapter, BNC (m) to BNC (m).

8. On the spectrum analyzer, press the following keys:

   (PEAK SEARCH)
   (MKR FCTN) `MK TRACK ON OFF` (ON)
   (SPAN) 200 (kHz)

   Wait for the `AUTO ZOOM` message to disappear, then press the following spectrum analyzer keys:

   (MKR FCTN) `MK TRACK ON OFF` (OFF)
   (PEAK SEARCH)
   (MKR →) `MARKER →REF LVL`

9. On the synthesized level generator, set the 50 Ω/75 Ω switch to the 50 Ω position (RF on). Adjust the amplitude until the two signals are displayed at the same amplitude.

10. If necessary, adjust the spectrum analyzer center frequency until the two signals are centered on the display, the set the spectrum analyzer by pressing the following keys:

    (BW) 3 (kHz)
    `VID BW AUTO MAN` 300 (Hz)

11. Press (PEAK SEARCH), (DISPLAY), `DSP LINE ON OFF` (ON). Set the display line to a value 54 dB below the current reference level setting.

    The third order intermodulation distortion products should appear 50 kHz below the lower frequency signal and 50 kHz above the higher frequency signal. Their amplitude should be less than the display line.

12. If the distortion products can be seen, proceed as follows:

    a. On the spectrum analyzer, press (PEAK SEARCH), `MARKER Δ`.
    b. Repeatedly press `NEXT PEAK` until the active marker is on the highest distortion product.
    c. Record the MKR Δ amplitude reading as TR Entry 16-2. The MKR Δ reading should be less than −54 dBc.

13. If the distortion products cannot be seen, proceed as follows:
    a. On both the synthesized sweeper and the synthesized level generator, increase the POWER LEVEL by 5 dB. Distortion products should now be visible at this higher power level.
    b. On the spectrum analyzer, press (PEAK SEARCH), MARKER Δ.
    c. Repeatedly press NEXT PEAK until the active marker is on the highest distortion products.
    d. On both the synthesized sweeper and the synthesizer level generator, reduce the power level by 5 dB and wait for the completion of a new sweep.
    e. Record the MKR Δ amplitude reading as TR Entry 16-2 of the performance verification test record. The MKR Δ reading should be less than −54 dBc.

17. Gain Compression

Gain compression is measured by applying two signals, separated by 3 MHz. First, the test places a −20 dBm signal at the input of the spectrum analyzer (the spectrum analyzer reference level is also set to −20 dBm). Then, a 0 dBm signal is applied to the spectrum analyzer, overdriving its input. The decrease in the first signal's amplitude (gain compression) caused by the second signal is the measured gain compression.

For spectrum analyzers equipped with Option 130 the signals are separated by 10 kHz, then the first signal is kept 10 dB below the reference level.

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesized sweeper
Synthesizer/level generator
Measuring receiver *(used as a power meter)*
Power sensor, 100 kHz to 1800 MHz
Directional bridge
Cable, BNC, 120 cm (48 in) *(two required)*
Adapter, Type N (f) to BNC (m)
Adapter, Type N (m) to BNC (m)
Adapter, Type N (f) to APC 3.5 (f)
Adapter, Type N (m) to BNC (f)

Additional Equipment for Option 001

Power sensor, 75 Ω
Adapter, Type N (f) to BNC (m), 75 Ω
Adapter, Type BNC (m) to BNC (m), 75 Ω

Caution

Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

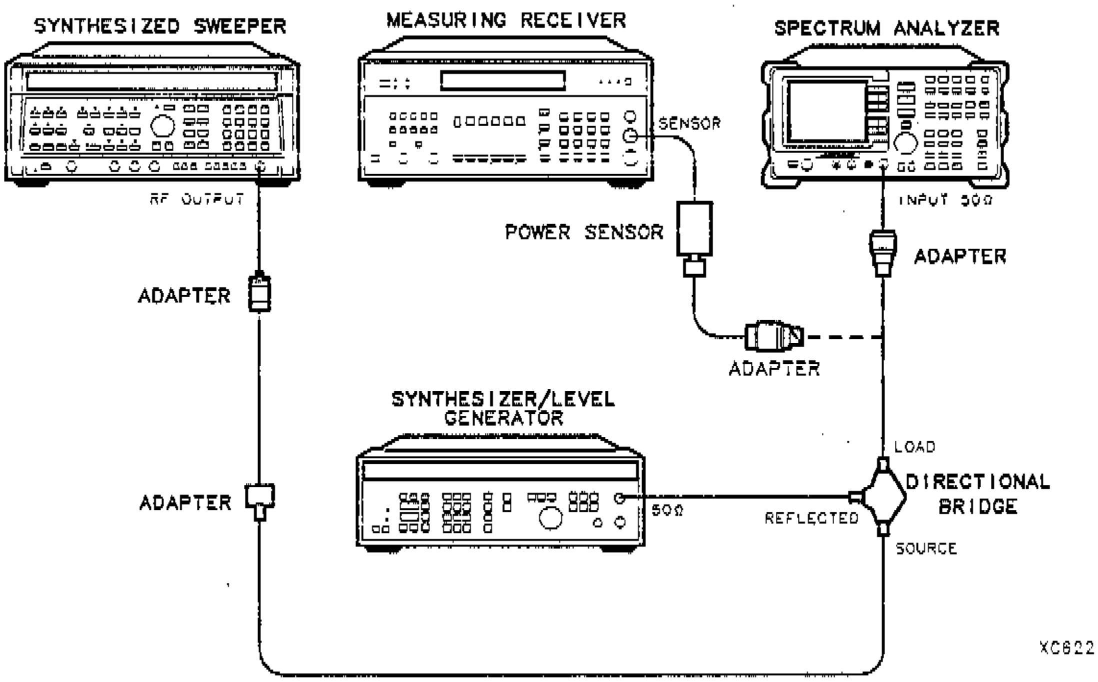

Figure 1-23. Gain Compression Test Setup

Procedure

1. Zero and calibrate the measuring receiver and 100 kHz to 1800 MHz power sensor combination in log mode (power reads out in dBm) as described in the measuring receiver operation manual. Enter the power sensor's 50 MHz Cal Factor into the measuring receiver.

   Option 001 only: Calibrate the 75 Ω power sensor.

2. Connect the equipment as shown in Figure 1-23, with the load of the directional bridge connected to the power sensor.

   Option 001 only: Use the 75 Ω power sensor with a Type N (f) to BNC (m) 75 Ω adapter and a BNC (m) to BNC (m) adapter. The power measured at the output of the 50 Ω directional bridge by the 75 Ω power sensor, is the equivalent power "seen" by the 75 Ω spectrum analyzer.

3. Press INSTRUMENT PRESET on the synthesized sweeper, then set the controls as follows:

   CW .... 53 MHz
   POWER LEVEL .... 6 dBm

4. Set the synthesized/level generator controls as follows:

   CW .... 50 MHz
   AMPLITUDE .... −14 dBm
   50 Ω/75 Ω SWITCH .... 75 Ω (no RF output)

5. On the spectrum analyzer, press (PRESET), then wait for the preset routine to finish. Press the spectrum analyzer keys as follows:

   (FREQUENCY) 50 (MHz)
   (SPAN) 20 (MHz)

   Option 001: Press (AMPLITUDE), More 1 of 2, Amptd Units, then dBm.

   (AMPLITUDE) −20 (dBm)
   SCALE LOG LIN (LOG) 1 (dB)
   (BW) 300 (kHz)

6. On the synthesized sweeper, adjust the power level for a 0 dBm reading on the measuring receiver. Set RF to off.
7. On the synthesizer/level generator, set the 50 Ω/75 Ω switch to 50 Ω.

   Note that the power level applied to the spectrum analyzer input is 10 dB greater than the specification to account for the 10 dB attenuation setting. A power level of 0 dBm at the spectrum analyzer input yields −10 dBm at the input mixer.

8. Disconnect the power sensor from the directional bridge and connect the directional bridge to the INPUT 50 Ω connector of the spectrum analyzer using an adapter. Do not use a cable.

   Option 001 only: Use a 75 Ω adapter, BNC (m) to BNC (m).

9. On the spectrum analyzer, press the following keys:

   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)
   (SPAN) 10 (MHz)

   Wait for the AUTO ZOOM routine to finish.

10. On the synthesizer/level generator, adjust the amplitude to place the signal 1 dB below the spectrum analyzer reference level.
11. On the spectrum analyzer, press (PEAK SEARCH), then MARKER Δ.
12. On the synthesized sweeper, set RF to ON.
13. On the spectrum analyzer, press (PEAK SEARCH), then NEXT PEAK.

    The active marker should be on the lower amplitude signal and not on the signal that is off the top of the screen. If it is not on the lower amplitude signal, reposition the marker to this peak using the spectrum analyzer knob.

14. Read the MKR Δ amplitude and record in the performance verification test record as TR Entry 17-1. The absolute value of this amplitude should be less than 0.5 dB.

    If you are testing a spectrum analyzer equipped with Option 130 continue with step 15.

    Performance test "Gain Compression" is now complete for all other spectrum analyzers.

Additional Steps for Option 130

15. Connect the equipment as shown in Figure 1-23.
16. Press INSTRUMENT PRESET on the synthesized sweeper, then set the controls as follows:

    CW .... 50.010 MHz
    POWER LEVEL .... 6 dBm

17. Set the synthesized/level generator controls as follows:

    FREQUENCY .... 50 MHz
    AMPLITUDE .... −14 dBm
    50 Ω/75 Ω SWITCH .... 75 Ω (no RF output)

18. On the synthesized sweeper, adjust the power level for a 0 dBm reading on the measuring receiver. Set RF to OFF.
19. On the synthesizer/level generator, set the 50 Ω/75 Ω switch to 50 Ω.
20. Disconnect the power sensor from the directional bridge and connect the directional bridge to the INPUT 50 Ω connector of the spectrum analyzer using an adapter. Do not use a cable.

    Option 001 only: Use a 75 Ω adapter, BNC (m) to BNC (m).

21. On the spectrum analyzer, press (PRESET), then wait for the preset routine to finish. Press the spectrum analyzer keys as follows:

    (FREQUENCY) 50 (MHz)
    (SPAN) 10 (MHz)

    Option 001: Press (AMPLITUDE), More 1 of 2, Amptd Units, then dBm.

    (AMPLITUDE) −10 (dBm)
    (PEAK SEARCH)
    (MKR FCTN) MK TRACK ON OFF (ON)
    (SPAN) 2 (kHz)

    Wait for the auto zoom routine to finish.

22. On the synthesizer/level generator, adjust the amplitude to place the signal 10 dB below the spectrum analyzer reference level.
23. On the spectrum analyzer, press (SGL SWP), then wait for the completion of a new sweep. Press (PEAK SEARCH), then MARKER Δ.
24. On the synthesized sweeper, set RF to ON.
25. On the spectrum analyzer, press (SGL SWP), then wait for the completion of a new sweep. Press (PEAK SEARCH), MARKER Δ.
26. Read the MKR Δ amplitude and record in the performance verification test record as TR Entry 17-2.

18. Displayed Average Noise Level

This performance test measures the displayed average noise level within the frequency range specified. The spectrum analyzer input is terminated in 50 Ω.

The LO feedthrough is used as a frequency reference for these measurements. The test tunes the spectrum analyzer frequency across the band, uses the marker to locate the frequency with the highest response, and then reads the average noise in zero span.

To reduce measurement uncertainty due to input attenuator switching and resolution bandwidth switching, a reference level offset is added. The CAL OUT signal is used as the amplitude reference for determining the amount of offset required. The offset is removed at the end of the test by pressing instrument preset.

The related adjustment for this procedure is "Frequency Response Adjustment."

If the spectrum analyzer is equipped with Option 130, narrow bandwidth, perform "Displayed Average Noise Level for Option 130," instead.

Equipment Required

Termination, 50 Ω
Cable, BNC, 23 cm (9 in)
Adapter, Type N (m) to BNC (f)

Additional Equipment for Option 001

Cable, BNC 75 Ω, 30 cm (12 in)
Termination, 75 Ω, Type N (m)
Adapter, Type N (f) to BNC (m) 75 Ω

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

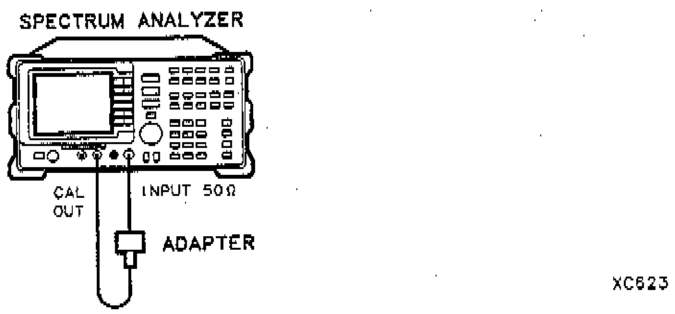

Figure 1-24. Displayed Average Noise Level Test Setup

Procedure

1. Connect a cable from the CAL OUT to the INPUT 50 Ω of the spectrum analyzer as shown in Figure 1-24.

   Option 001 only: Use a 75 Ω cable and omit the adapter.

2. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 300 (MHz)
   (SPAN) 10 (MHz)
   (AMPLITUDE) −20 (dBm)

   Option 001 only: Press (AMPLITUDE) +28.75 (dBmV).

   ATTEN AUTO MAN 0 (dB)

3. Press the following spectrum analyzer keys:

   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)
   (SPAN) 100 (kHz)

   Wait for the AUTO ZOOM message to disappear, then press the following keys:

   (BW) VID BW AUTO MAN 30 (Hz)
   (MKR FCTN) MK TRACK ON OFF (OFF)

4. Press (SGL SWP), then wait for the completion of a new sweep. Press the following spectrum analyzer keys:

   (PEAK SEARCH)
   (AMPLITUDE) More 1 of 3 REF LVL OFFSET

   Subtract the MKR amplitude reading from −20 dBm and enter the result as the REF LVL OFFSET. For example, if the marker reads −20.21 dBm, enter +0.21 dB (−20 dBm − (−20.21 dBm) = +0.21 dB). *Example for Option 001:* If the marker reads 26.4 dBmV, enter +2.35 dBmV (28.75 dBmV − 26.4 dBmV = 2.35 dBmV).

   REF LVL OFFSET ________ dB

   Option 001: REF LVL OFFSET ________ dBmV

5. Disconnect the cable from the INPUT 50 Ω connector of the spectrum analyzer. Connect the 50 Ω termination to the spectrum analyzer INPUT 50 Ω connector.

   Option 001 only: Use the 75 Ω termination.

400 kHz

If testing a spectrum analyzer equipped with Option 001, omit steps 6 through 10, then proceed to step 10 ("1 MHz").

6. Press the following spectrum analyzer keys:

   (BW) VID BW AUTO MAN (AUTO)
   (FREQUENCY) 0 (Hz)
   (SPAN) 10 (MHz)
   (AMPLITUDE) −10 (dBm)
   (TRIG) SWEEP CONT SGL (CONT)

7. Press the following spectrum analyzer keys:

   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)
   (SPAN) 800 (kHz)

   Wait for the AUTO ZOOM message to disappear, then press the following spectrum analyzer keys:

   (MKR FCTN) MK TRACK ON OFF (OFF)
   (BW) 3 (kHz)

8. Press (FREQUENCY) and adjust the center frequency until the LO feedthrough peak is on the leftmost graticule line. Set the spectrum analyzer by pressing the following keys:

   (SPAN) 50 (kHz)
   (AMPLITUDE) −50 (dBm)
   (BW) 1 (kHz)
   VID BW AUTO MAN 30 (Hz)
   (SWEEP) 5 (sec)
   (TRACE) More 1 of 3 DETECTOR PK SP NG (SP)
   (SGL SWP)

   Wait for the completion of a new sweep.

9. Press the following spectrum analyzer keys:

   (DISPLAY) DSP LINE ON OFF (ON)

   Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses (refer to the Residual Responses verification test for any suspect residuals).

10. Record the display line amplitude setting as TR Entry 18-1 of the performance verification test record as the noise level at 400 kHz. The average noise level should be less than the specified limit.

1 MHz

11. Set the spectrum analyzer by pressing the following keys:

    (AUTO COUPLE) RES BW AUTO MAN (AUTO)
    VID BW AUTO MAN (AUTO)
    (FREQUENCY) 0 (Hz)
    (SPAN) 10 (MHz)
    (AMPLITUDE) −10 (dBm)

    Option 001 only: (AMPLITUDE) +35 (dBmV)

    (TRIG) SWEEP CONT SGL (CONT)

12. Press the following spectrum analyzer keys:

    (PEAK SEARCH)
    (MKR FCTN) MK TRACK ON OFF (ON)
    (MKR →) MARKER →REF LVL
    (SPAN) 2 (MHz)

    Wait for the AUTO ZOOM message to disappear, then press (MKR FCTN) and MK TRACK ON OFF (OFF).

13. Press (FREQUENCY) and adjust the center frequency until the LO feedthrough peak is on the leftmost graticule line, then press the following spectrum analyzer keys:

    (SPAN) 50 (kHz)
    (AMPLITUDE) −50 (dBm)

14. *Option 001 only:* Press (AMPLITUDE) −1.2 (dBmV).

    (BW) VID BW AUTO MAN 30 (Hz)
    (SGL SWP)

    Wait for the completion of a new sweep.

15. Press the following spectrum analyzer keys:

    (DISPLAY) DSP LINE ON OFF (ON)

    Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses (refer to the Residual Responses verification test for any suspect residuals).

16. Record the display line amplitude setting as TR Entry 18-2 of the performance verification test record as the noise level at 1 MHz. The average noise level should be less than the specified limit.

1 MHz to 1.5 GHz

17. Press the following spectrum analyzer keys:

    (FREQUENCY) START FREQ 1 (MHz)
    STOP FREQ 1.5 (GHz)
    (BW) 1 (MHz)
    VID BW AUTO MAN 10 (kHz)
    (TRIG) SWEEP CONT SGL (CONT)

18. Press (FREQUENCY) and adjust the center frequency setting, if necessary, to place the LO feedthrough just off-screen to the left.
19. Press the following spectrum analyzer keys:

    (SGL SWP)
    (TRACE) CLEAR WRITE A
    More 1 of 3 VID AVG ON OFF (ON) 10 (Hz)

    Wait until AVG 10 is displayed to the left of the graticule (the spectrum analyzer will take ten sweeps, then stop).
20. Press (PEAK SEARCH) and record the MKR frequency as the Measurement Frequency in Table 1-24 for 1 MHz to 1.5 GHz.
21. Press the following spectrum analyzer keys:

    (TRACE) More 1 of 3 VID AVG ON OFF (OFF)
    (AUTO COUPLE) RES BW AUTO MAN (AUTO)
    VID BW AUTO MAN (AUTO)
    (SPAN) 50 (kHz)
    (FREQUENCY)

22. Set the center frequency to the Measurement Frequency recorded in Table 1-24 for 1 MHz to 1.5 GHz.
23. Press the following spectrum analyzer keys:

    (BW) 1 (kHz)
    VID BW AUTO MAN 30 (Hz)
    (SGL SWP).

    Wait for the sweep to finish.
24. Press the following spectrum analyzer keys:

    (DISPLAY) DSP LINE ON OFF (ON)

    Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses (refer to the Residual Responses verification test for any suspect residuals).
25. Record the display line amplitude setting as TR Entry 18-3 of the performance verification test record. The average noise level should be less than the specified limit.

1.5 GHz to 1.8 GHz

26. Press the following spectrum analyzer keys:

    (AUTO COUPLE) RES BW AUTO MAN (AUTO)
    VID BW AUTO MAN (AUTO)
    (SPAN) 10 (MHz)
    (AMPLITUDE) −50 (dBm)

    Option 001 only: Press (AMPLITUDE) −1.2 (dBmV).

    (TRIG) SWEEP CONT SGL (CONT)
    (FREQUENCY) START FREQ 1.5 (GHz)
    STOP FREQ 1.8 (GHz)

27. Repeat steps 18 through 23 above for frequencies from 1.5 GHz to 1.8 GHz.

    If the Displayed Average Noise at 1.8 GHz is at or out of specification, it is recommended that a known frequency source be used as a frequency marker. This ensures that testing is within 1.8 GHz.

28. Record the display line amplitude setting as TR Entry 18-4 of the performance verification test record. The average noise level should be less than the specified limit.

Table 1-24. Displayed Average Noise Level

Frequency Range	Measurement Frequency	TR Entry (Displayed Average Noise Level)	Specification
400 kHz	400 kHz	18-1	−115 dBm
1 MHz	1 MHz	18-2	−115 dBm (*Option 001 only:* <−63 dBmV)
1 MHz to 1.5 GHz	________	18-3	−115 dBm (*Option 001 only:* <−63 dBmV)
1.5 GHz to 1.8 GHz	________	18-4	−113 dBm (*Option 001 only:* <−61 dBmV)

19. Displayed Average Noise Level for Option 130

This performance test measures the displayed average noise level within the frequency range specified. The spectrum analyzer input is terminated in 50 Ω.

The LO feedthrough is used as a frequency reference for these measurements. The test tunes the spectrum analyzer frequency across the band, uses the marker to locate the frequency with the highest response, and then reads the average noise in zero span.

To reduce measurement uncertainty due to input attenuator switching and resolution bandwidth switching, a reference level offset is added. The CAL OUT signal is used as the amplitude reference for determining the amount of offset required. The offset is removed at the end of the test by pressing instrument preset.

The related adjustment for this procedure is "Frequency Response Adjustment."

If the spectrum analyzer is *not* equipped with Option 130, narrow bandwidth, perform verification test, "Displayed Average Noise Level," instead.

Equipment Required

Termination, 50 Ω
Cable, BNC, 23 cm (9 in)
Adapter, Type N (m) to BNC (f)

Additional Equipment for Option 001

Cable, BNC 75 Ω, 30 cm (12 in)
Termination, 75 Ω, Type N (m)
Adapter, Type N (f) to BNC (m) 75 Ω

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

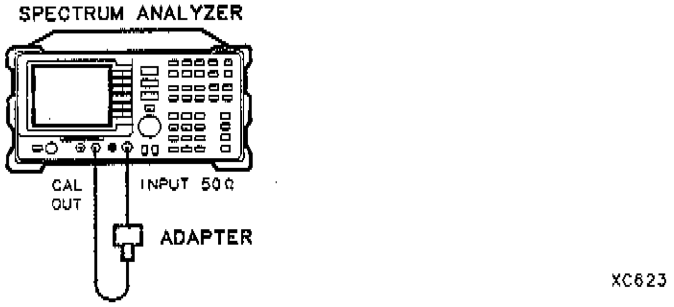

Figure 1-25. Displayed Average Noise Level Test Setup for Option 130

Procedure

1. Connect a cable from the CAL OUT to the INPUT 50 Ω of the spectrum analyzer as shown in Figure 1-25.

   Option 001 only: Use a 75 Ω cable and omit the adapter.

2. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 300 (MHz)
   (SPAN) 10 (MHz)
   (AMPLITUDE) −20 (dBm)

   Option 001 only: Press (AMPLITUDE) +28.75 (dBmV).

   ATTEN AUTO MAN 0 (dB)

3. Press the following spectrum analyzer keys:

   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)
   (SPAN) 10 (kHz)

   Wait for the AUTO ZOOM message to disappear, then press the following keys:

   (BW) 300 (Hz) VID BW AUTO MAN 30 (Hz)
   (MKR FCTN) MK TRACK ON OFF (OFF)

4. Press (SGL SWP), then wait for the completion of a new sweep. Press the following spectrum analyzer keys:

   (PEAK SEARCH)
   (AMPLITUDE) More 1 of 3 REF LVL OFFSET

   Subtract the MKR amplitude reading from −20 dBm and enter the result as the REF LVL OFFSET. For example, if the marker reads −20.21 dBm, enter +0.21 dB (−20 dBm − (−20.21 dBm) = +0.21 dB). *Example for Option 001:* If the marker reads 26.4 dBmV, enter +2.35 dBmV (28.75 dBmV − 26.4 dBmV = 2.35 dBmV).

   REF LVL OFFSET ________ dB

   Option 001: REF LVL OFFSET ________ dBmV

5. Disconnect the cable from the INPUT 50 Ω connector of the spectrum analyzer. Connect the 50 Ω termination to the spectrum analyzer INPUT 50 Ω connector.

   Option 001 only: Use the 75 Ω termination.

19. Displayed Average Noise Level for Option 130

400 kHz

If testing a spectrum analyzer equipped with Option 001, omit steps 6 through 9, then proceed to step 10 ("1 MHz").

6. Press the following spectrum analyzer keys:

   (FREQUENCY) 400 (kHz)
   (SPAN) 20 (kHz)
   (AMPLITUDE) −70 (dBm)
   (TRIG) SWEEP CONT SGL (CONT)

7. Press the following spectrum analyzer keys:

   (BW) 30 (Hz)
   (TRACE) More 1 of 3 DETECTOR PK SP NG (SP)
   (SGL SWP)

   Wait for the completion of a new sweep.

8. Press the following spectrum analyzer keys:

   (DISPLAY) DSP LINE ON OFF (ON)

   Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses (refer to the Residual Responses verification test for any suspect residuals).

9. Record the display line amplitude setting as TR Entry 19-1 of the performance verification test record as the noise level at 400 kHz. The average noise level should be less than the specified limit.

1 MHz

10. Press the following spectrum analyzer keys:

    (FREQUENCY) 1 (MHz)
    (SGL SWP)

    Wait for the completion of a new sweep.

11. Press the following spectrum analyzer keys:

    (DISPLAY) DSP LINE ON OFF (ON)

    Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses (refer to the Residual Responses verification test for any suspect residuals).

12. Record the display line amplitude setting as TR Entry 19-2 of the performance verification test record as the noise level at 1 MHz. The average noise level should be less than the specified limit.

1 MHz to 1.5 GHz

13. Press the following spectrum analyzer keys:

    (FREQUENCY) START FREQ 1 (MHz)
    STOP FREQ 1.5 (GHz)
    (BW) 1 (MHz)
    VID BW AUTO MAN 10 (kHz)
    (TRIG) SWEEP CONT SGL (CONT)

14. Press (FREQUENCY) and adjust the center frequency setting, if necessary, to place the LO feedthrough just off-screen to the left.

15. Press the following spectrum analyzer keys:

    (SGL SWP)
    (TRACE) CLEAR WRITE A
    More 1 of 3 VID AVG ON OFF (ON) 10 (Hz)

    Wait until AVG 10 is displayed to the left of the graticule (the spectrum analyzer will take ten sweeps, then stop).

16. Press (PEAK SEARCH) and record the MKR frequency as the Measurement Frequency in Table 1-25 for 1 MHz to 1.5 GHz.

17. Press the following spectrum analyzer keys:

    (TRACE) More 1 of 3
    VID AVG ON OFF (OFF)
    DETECTOR PK SP NG (SP)
    (AUTO COUPLE) RES BW AUTO MAN (AUTO)
    VID BW AUTO MAN (AUTO)
    (SPAN) 20 (kHz)
    (FREQUENCY)

18. Set the center frequency to the Measurement Frequency recorded in Table 1-25 for 1 MHz to 1.5 GHz.

19. Press the following spectrum analyzer keys:

    (BW) 30 (Hz)
    VID BW AUTO MAN 30 (Hz)
    (SGL SWP).

    Wait for the sweep to finish.

20. Press the following spectrum analyzer keys:

    (DISPLAY) DSP LINE ON OFF (ON)

    Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses (refer to the Residual Responses verification test for any suspect residuals).

21. Record the display line amplitude setting as TR Entry 19-3 of the performance verification test record. The average noise level should be less than the specified limit.

1.5 GHz to 1.8 GHz

22. Press the following spectrum analyzer keys:

    (AUTO COUPLE) RES BW AUTO MAN (AUTO)
    VID BW AUTO MAN (AUTO)
    (SPAN) 10 (MHz)
    (TRIG) SWEEP CONT SGL (CONT)
    (FREQUENCY) START FREQ 1.5 (GHz)
    STOP FREQ 1.8 (GHz)

23. Repeat steps 15 through 20 above for frequencies from 1.5 GHz to 1.8 GHz.

    If the Displayed Average Noise at 1.8 GHz is at or out of specification, it is recommended that a known frequency source be used as a frequency marker. This ensures that testing is within 1.8 GHz.

24. Record the display line amplitude setting as TR Entry 19-4 of the performance verification test record. The average noise level should be less than the specified limit.

Table 1-25. Displayed Average Noise Level

Frequency Range	Measurement Frequency	TR Entry (Displayed Average Noise Level)
400 kHz	400 kHz	19-1
1 MHz	1 MHz	19-2
1 MHz to 1.5 GHz	________	19-3
1.5 GHz to 1.8 GHz	________	19-4

20. Residual Responses

The spectrum analyzer input is terminated and the spectrum analyzer is swept from 150 kHz to 1 MHz. Then the spectrum analyzer is swept in 10 MHz spans throughout the 1 MHz to 1.8 GHz range. Any responses above the specification are noted.

If the spectrum analyzer is equipped with Option 130, narrow bandwidth, perform "Residual Responses for Option 130," instead.

There are no related adjustment procedures for this performance test.

Equipment Required

Termination, 50 Ω

Additional Equipment for Option 001

Termination, 75 Ω, Type N (m)
Adapter, Type N (f) to BNC (m), 75 Ω

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

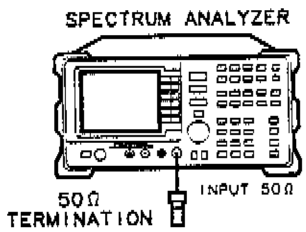

Figure 1-26. Residual Response Test Setup

Procedure

150 kHz to 1 MHz

1. Connect the termination to the spectrum analyzer input as shown in Figure 1-26.

   Option 001 only: Use the adapter to connect the 75 Ω termination, and proceed with step 5.

2. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Press the following spectrum analyzer keys:

   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)
   (SPAN) 1 (MHz)

   Wait for the AUTO ZOOM message to disappear, then press (MKR FCTN) MK TRACK ON OFF (OFF).

3. Press (FREQUENCY), then adjust the center frequency until the LO feedthrough peak is on the leftmost vertical graticule line. Set the spectrum analyzer by pressing the following keys:

   (PEAK SEARCH)
   (MKR) MARKER Δ 150 (kHz)
   MARKER NORMAL
   (AMPLITUDE) −60 (dBm)

   Option 001 only: Press (AMPLITUDE) −11.25 (dBmV).

   ATTEN AUTO MAN 0 (dB)
   (BW) 3 (kHz)
   VID BW AUTO MAN 1 (kHz)
   (DISPLAY) DSP LINE ON OFF −90 (dBm)

   Option 001 only: (DISPLAY) DSP LINE ON OFF −38 (dBmV).

4. Press (SGL SWP) and wait for a new sweep to finish. Look for any residual responses at or above the display line.

   If a residual is suspected, press (SGL SWP) again. A residual response will persist on successive sweeps, but a noise peak will not. Note the frequency and amplitude of any residual responses above the display line and to the right of the marker in Table 1-26.

1 MHz to 1.8 GHz

5. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Press the following keys:

   (FREQUENCY) 5 (MHz)
   (SPAN) 10 (MHz)
   (AMPLITUDE) −60 (dBm)

   Option 001 only: Press (AMPLITUDE) −11.25 (dBmV).

   ATTEN AUTO MAN 0 (dB)

6. Press (FREQUENCY), then adjust the center frequency until the LO feedthrough (the "signal" near the left of the screen) is just off the leftmost vertical graticule line. Press the following spectrum analyzer keys:

   (FREQUENCY) CF STEP AUTO MAN 9.8 (MHz)
   (BW) 10 (kHz)
   VID BW AUTO MAN 3 (kHz)
   (DISPLAY) DSP LINE ON OFF (ON) −90 (dBm)

   Option 001 only: Press (DISPLAY) DSP LINE ON OFF (ON) −38 (dBmV).

7. Press (SGL SWP) and wait for a new sweep to finish. Look for any residual responses at or above the display line. If a residual is suspected, press (SGL SWP) again. A residual response will persist on successive sweeps, but a noise peak will not. Note the frequency and amplitude of any residual responses above the display line in Table 1-26.
8. Press (FREQUENCY), (⇑) (step-up key), to step to the next frequency and repeat step 7.
9. Repeat step 8 until the range from 1 MHz to 1.8 GHz has been checked. (This requires 183 additional frequency steps.) The test for this band requires about 10 minutes to complete if no residuals are found.

   If there are any residuals at or near the frequency specification limits (1 MHz or 1.8 GHz), it is recommended that a known frequency source be used as a frequency marker. This will ensure that testing is done at or below the specification limits.
10. Record the highest residual from Table 1-26 as TR Entry 20-1 in the performance verification test record. If no residuals are found, then record "N/A" in the performance verification test record.

Table 1-26. Residual Responses above Display Line Worksheet

Frequency (MHz)	Amplitude (dBm)
________	________
________	________
________	________
________	________
________	________

21. Residual Responses for Option 130

The spectrum analyzer input is terminated and the spectrum analyzer is swept from 150 kHz to 1 MHz. Then the spectrum analyzer is swept in 10 MHz spans throughout the 1 MHz to 1.8 GHz range. Any responses above the specification are noted.

If the spectrum analyzer is *not* equipped with Option 130, narrow bandwidth, perform "Residual Responses," instead.

There are no related adjustment procedures for this performance test.

Equipment

Termination, 50 Ω

Additional Equipment for Option 001

Termination, 75 Ω, Type N (m)
Adapter, Type N (f) to BNC (m), 75 Ω

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

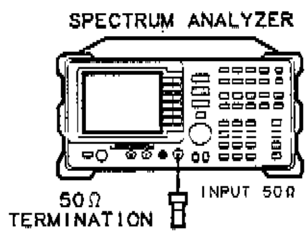

Figure 1-27. Residual Response Test Setup

Procedure

150 kHz to 1 MHz

1. Connect the termination to the spectrum analyzer input as shown in Figure 1-27.

   Option 001 only: Use the adapter to connect the 75 Ω termination, and proceed with step 3.

2. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Press the following spectrum analyzer keys:

   (FREQUENCY)
   START FREQ 150 (kHz)
   STOP FREQ 1 (MHz)
   (AMPLITUDE) −60 (dBm) ATTN 0 Hz
   (BW) 300 (Hz)
   (DISPLAY) DISPLAY LINE ON OFF −90 (dBm)

3. Press (SGL SWP) and wait for a new sweep to finish. Look for any residual responses at or above the display line.

   If a residual is suspected, press (SGL SWP) again. A residual response will persist on successive sweeps, but a noise peak will not. Note the frequency and amplitude of any residual responses above the display line and to the right of the marker in Table 1-27.

1 MHz to 1.8 GHz

4. Connect the 300 MHz CAL OUT to the RF INPUT as shown in Figure 1-27
5. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Press the following keys:

   (FREQUENCY) 300 (MHz)
   (SPAN) 10 (MHz)
   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)
   (SPAN) 1 (kHz)

   Wait for the AUTO ZOOM message to disappear, then press
6. Press the following spectrum analyzer keys:

   (BW) 300 (Hz)
   (SWEEP) 1 (sec)
   (AMPLITUDE) −20 (dBm)
   ATTN AUTO MAN 0 (dB)
7. Press the following spectrum analyzer keys:

   (SGL SWP)
   (PEAK SEARCH) MARKER Δ
   (SPAN) 10 (MHz)
   (SGL SWP)
   (PEAK SEARCH)
8. Record the marker-Δ reading below as the MEAS UNCAL Amplitude Error.

   MEAS UNCAL Amplitude Error ________ dB

9. Remove the cable from the spectrum analyzer input.
10. Reconnect the termination to the spectrum analyzer input as shown in Figure 1-27.
11. Press the following spectrum analyzer keys:

    (FREQUENCY) 5 (MHz)
    (AMPLITUDE) −60 (dBm)

    Option 001 only: Press (AMPLITUDE) −11.25 (dBmV).

    (TRIG) SWEEP CONT SGL (CONT)
12. Press (FREQUENCY), then adjust the center frequency until the LO feedthrough (the "signal" near the left of the screen) is just off the leftmost vertical graticule line. Press the following spectrum analyzer keys:

    (FREQUENCY) CF STEP AUTO MAN 9.8 (MHz)
    (DISPLAY) DSP LINE ON OFF −90 (dBm)

21. **Residual Responses for Option 130**

Add −90 dBm to the MEAS UNCAL Amplitude Error (recorded in step 8), then set the display line to this value.

For example, if the amplitude error in step 8 is −19.5 dB, add −90 dBm to this value for a result of −109.5 dBm. Enter −109.5 dBm as the display line value.

Option 001 only: Set the display line to −38 dBmV + the MEAS UNCAL Amplitude Error (recorded in step 8).

13. Press (SGL SWP) and wait for a new sweep to finish. Look for any residual responses at or above the display line.

    If a residual is suspected, press (SGL SWP) again. A residual response will persist on successive sweeps, but a noise peak will not. Note the frequency and amplitude of any residual responses above the display line and to the right of the marker in Table 1-27.

14. Press (FREQUENCY), then (⇑) (step-up key) to step to the next frequency and repeat step 13.
15. Repeat 14 until the range from 1 MHz to 1.8 GHz has been checked. (This requires 183 additional steps.)

Table 1-27.
Residual Responses above Display Line Worksheet for Option 130

Frequency (MHz)	Amplitude (dBm)
______	______
______	______
______	______
______	______
______	______

Confirming Residuals

16. Set the spectrum analyzer center frequency to a residual frequency recorded in Table 1-27, the press the following keys:

    (PRESET)
    (AMPLITUDE) −60 (dBm) ATTN 0 Hz
    (SPAN) 20 (kHz)
    (SGL SWP)
    (DISPLAY) DISPLAY LINE ON OFF −90 (dBm)

    Option 001 only: Press (DISPLAY) DISPLAY LINE ON OFF −38 (dBmV)

17. Press (SGL SWP) and wait for a new sweep to finish. Look for any residual responses at or above the display line.

    If a residual is suspected, press (SGL SWP) again. A residual response will persist on successive sweeps, but a noise peak will not. Note the frequency and amplitude of any residual responses above the display line and to the right of the marker in Table 1-28.

18. Repeat steps 16 through 17 for all residuals recorded in Table 1-27.

19. Record the highest residual from Table 1-28 as TR Entry 21-1 in the performance verification test record. If no residuals are found, then record "N/A" in the performance verification test record.

Table 1-28. Confirmed Residual Responses above Display Line for Option 130

Frequency (MHz)	Amplitude (dBm)
________	________
________	________
________	________
________	________
________	________

22. Fast Time Domain Sweeps

This procedure is only for spectrum analyzers equipped with Option 101.

The CAL OUT signal is used to compare the amplitude level of a normal sweep time (20 ms) to a fast sweep time (18 ms) using the marker delta function.

A synthesizer/level generator is used to amplitude modulate a 500 MHz, CW signal from another signal generator. The spectrum analyzer demodulates this signal in zero span to display the response in the time domain. The marker delta frequency function on the spectrum analyzer is used to read out the sweep time.

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesizer/level generator
Signal generator
Cable, BNC, 122 cm (48 in)
Cable, BNC, 23 cm (9 in)
Cable, Type N, 152 cm (60 in)
Adapter, Type N (m) to BNC (f)

Additional Equipment for Option 001

Cable, BNC, 75 Ω, 30 cm (12 in)
Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

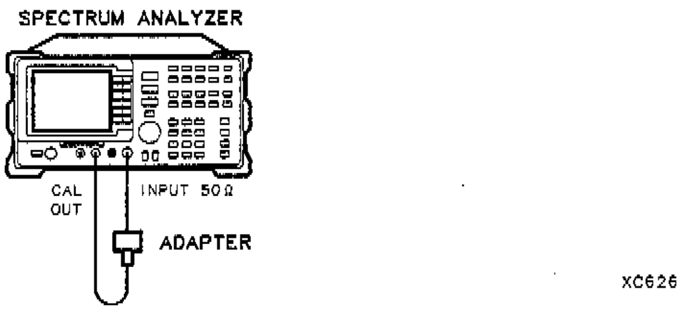

Figure 1-28. Fast Sweep Time Amplitude Test Setup

Procedure

Fast Sweep Time Amplitude Accuracy

1. Connect the equipment as shown in Figure 1-28.

   Option 001 only: Use the 75 Ω cable and omit the adapter.

2. On the spectrum analyzer, press (PRESET), then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 300 (MHz)
   (SPAN) 0 (Hz)
   (SWEEP) 20 (ms)
   (AMPLITUDE) SCALE LOG/LIN (LIN)
   REF LVL 25 (mV)

   Option 001 only: Press REF LVL 30 (mV).

   (MKR FCTN) MK NOISE ON OFF (ON)
   (SGL SWP)
   (MKR) MARKER Δ

3. Set the sweep time to 18 ms. Press (SGL SWP) and read the MKR Δ amplitude. Record the marker-Δ reading as TR Entry 22-1 of the performance verification test record. The amplitude should be within 1.007X and 0.993X.

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

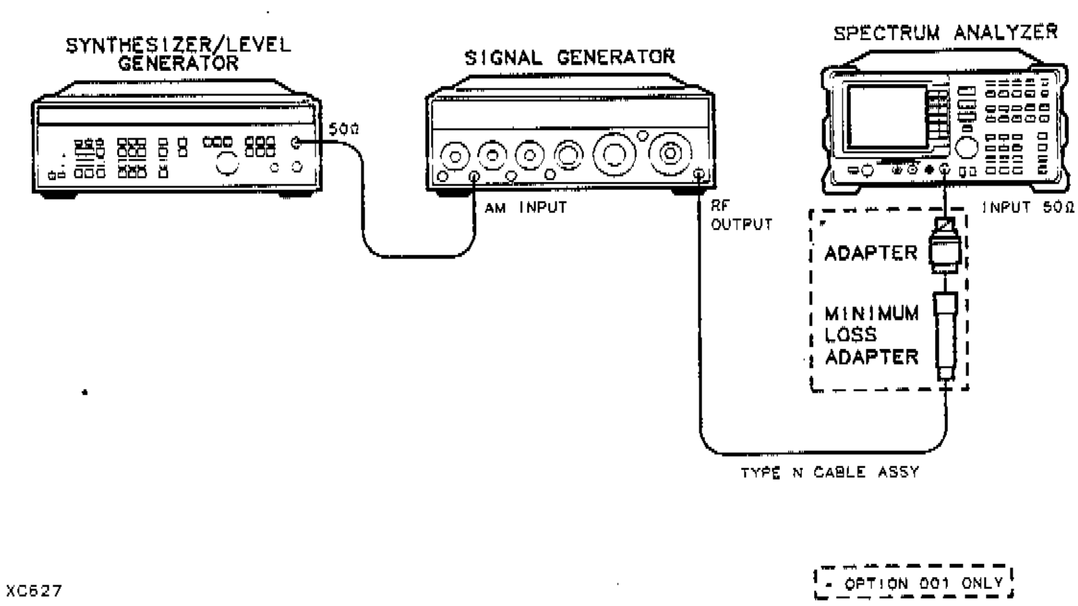

Figure 1-29. Fast Sweep Time Test Setup, Option 101

Fast Sweep Time Accuracy

4. Connect the equipment as shown in Figure 1-29.
5. Set the signal generator to output a 300 MHz, −4 dBm, CW signal. Set the AM and FM controls to OFF.

   Option 001 only: Set the output to +2 dBm.
6. Set the synthesizer/level generator to output a 556 Hz, +5 dBm, signal.
7. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Press the following spectrum analyzer keys:

   (FREQUENCY) 300 (MHz)
   (SPAN) ZERO SPAN
   (AMPLITUDE) SCALE LOG LIN (LIN)
8. Set the signal generator AM switch to the AC position. If necessary, adjust the output amplitude of the signal generator to position the top of the modulated waveform approximately one division below top screen.
9. Set the spectrum analyzer controls by pressing the following keys:

   (TRIG) VIDEO
   (SWEEP) 18 (ms)
10. Press the following spectrum analyzer keys:

    (SGL SWP)
    (PEAK SEARCH)

    If necessary, press NEXT PEAK or NEXT PK LEFT until the marker is on the leftmost complete signal peak. This is the "marked signal."
11. Press MARKER Δ, MARKER Δ, then press NEXT PK RIGHT until the marker Δ is on the eighth signal.
12. Record the MKR Δ frequency reading in the performance test record as shown in Table 1-29. The MKR reading should be within the limits shown.
13. Repeat steps 10 through 12 for the remaining sweep time settings listed in Table 1-29.

Table 1-29. Fast Sweep Time Accuracy

Spectrum Analyzer Sweep Time	Synthesizer Function Generator Frequency	Minimum Reading	TR Entry (MKR Δ)	Maximum Reading
18 ms	556 Hz	14.04 ms	22-1	14.76 ms
10 ms	1 kHz	7.8 ms	22-2	8.2 ms
1.0 ms	10 kHz	780 μs	22-3	820 ms
100 μs	100 kHz	78 μs	22-4	82 μs
20 μs	500 kHz	15.6 μs	22-5	16.4 μs

23. Absolute Amplitude, Vernier, and Power Sweep Accuracy

This procedure is only for spectrum analyzers equipped with Option 010 or 011.

The tracking generator output is connected to the spectrum analyzer input and the tracking is adjusted at 300 MHz for a maximum signal level. A calibrated power sensor is then connected to the tracking generator output to measure the power level at 300 MHz.

The measuring receiver is set for RATIO mode so that future power level readings are in dB relative to the power level at −20 dBm (*Option 011 only:* +28.8 dBmV). The output power level setting is decreased in 1 dB steps and the power level is measured at each step. The difference between the ideal and actual power levels is calculated at each step.

Since a power sweep is accomplished by stepping through the vernier settings, the peak-to-peak variation of the vernier accuracy is equal to the power sweep accuracy.

The related adjustment for this procedure is "Modulator Gain and Offset Adjustment."

Equipment Required

Measuring receiver
Power sensor, 100 kHz to 1800 MHz
Cable, Type N, 62 cm (24 in)

Additional Equipment for Option 011

Power sensor, 75 Ω
Cable, BNC, 75 Ω
Adapter, Type N (f) to BNC (m), 75 Ω
Adapter, mechanical, Type N, 50 Ω (m) to 75 Ω (f)

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 011 or damage to the input connector will occur.

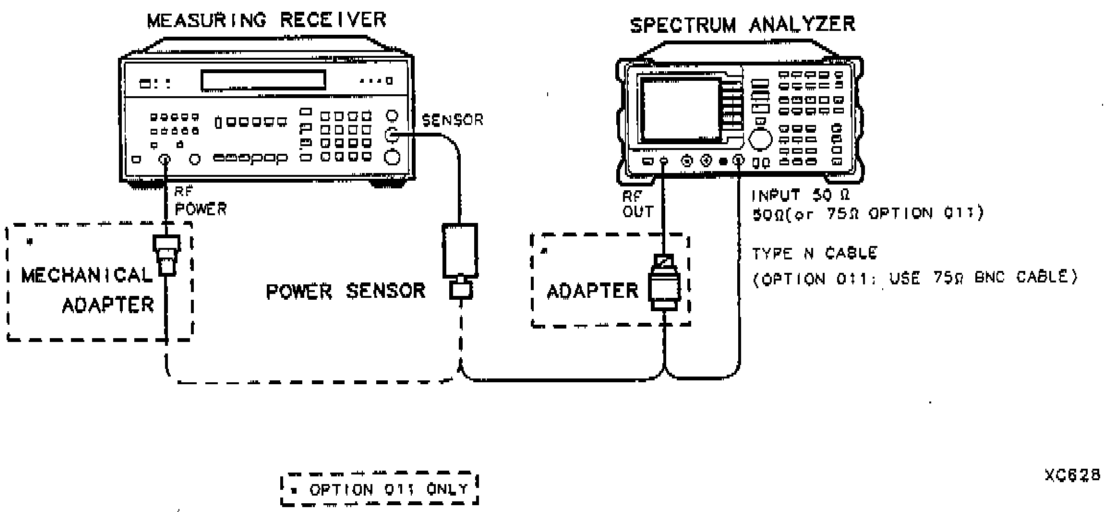

Figure 1-30. Absolute Amplitude, Vernier, and Power Sweep Accuracy Test Setup

Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 1-30.

   Option 011 only: Connect the BNC cable between the RF OUT 75 Ω and INPUT 75 Ω connectors on the spectrum analyzer.

2. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 300 (MHz)
   (SPAN) ZERO SPAN
   (MKR)
   (AUX CTRL) Track Gen
   SRC PWR ON OFF (ON) 5 (-dBm)

   Option 011 only: Press (AUX CTRL), Track Gen, SRC PWR ON OFF (ON), 42 (+dBm).

3. On the spectrum analyzer, press TRACKING PEAK. Wait for the PEAKING message to disappear.

4. Zero and calibrate the measuring receiver and 100 kHz to 1800 MHz power sensor in log mode (power reads out in dBm), as described in the measuring receiver operation manual. Enter the power sensor's 300 MHz Cal Factor into the measuring receiver.

5. Disconnect the Type N cable from the RF OUT 50 Ω and connect the 100 kHz to 1800 MHz power sensor to the RF OUT 50 Ω as shown in Figure 1-30.

   Option 011 only: Disconnect the BNC cable from the RF OUT 75 Ω and connect the 75 Ω power sensor to the RF OUT 75 Ω using an adapter.

6. On the spectrum analyzer, press 20 (-dBm), (SGL SWP).

   Option 011 only: Press 28.76 (+dBm) (+28.76 dBmV), (SGL SWP). Press (AUX CTRL), Track Gen, SRC ATN MAN AUTO (MAN).

7. Subtract −20 dBm from the power level displayed on the measuring receiver and record the result as TR Entry 23-1 of the performance verification test record as the Absolute Amplitude Accuracy.

8. On the spectrum analyzer, press (AUX CTRL), Track Gen, SRC ATN MAN AUTO (MAN), 0 (+dBm) (SRC PWR) 10 (-dBm).
   Option 011 only: Press +38.76 (+dBm) (+38.76 dBmV).

9. Press RATIO on the measuring receiver. Power levels now readout in dB relative to the power level just measured at the −10 dBm output power level setting.

   Option 011 only: Press +38.76 (dBm) (+28.8 dBmV) output power level setting.

10. Set the SRC POWER to the settings indicated in Table 1-30. At each setting, record the power level displayed on the measuring receiver in Table 1-30.

11. Calculate the absolute vernier accuracy by subtracting the SRC POWER setting and 20 dB from the Measured Power Level for each SRC POWER setting in Table 1-30.

    Vernier Accuracy = Measured Power Level − SRC POWER − 10 dB

    Option 011 only: Calculate the vernier accuracy by subtracting the SRC POWER setting from the Measured Power Level, adding 38.76 dB to each SRC POWER setting in Table 1-30.

Vernier Accuracy = Measured Power Level − SRC POWER + 38.76 dB

12. Locate the most positive and most negative absolute vernier accuracy values for SRC POWER levels greater than −10 dBm recorded in Table 1-30 and record in the performance verification test record the Positive Vernier Accuracy as TR Entry 23-2 and the Negative Vernier Accuracy as TR Entry 23-3.

    Option 011 only: For SRC POWER levels greater than and equal to +33.76 dBmV.

    Positive Vernier Accuracy ______________dB

    Negative Vernier Accuracy ______________dB

13. Locate the most positive and most negative Absolute Vernier Accuracy values for all SRC POWER levels in Table 1-30 and record below.

    Positive Power Sweep Accuracy ______________dB

    Negative Power Sweep Accuracy ______________dB

14. Calculate the power sweep accuracy by subtracting the Negative Power Sweep Accuracy recorded in the previous step from the Positive Power Sweep Accuracy recorded in the previous step. Record this value as TR Entry 23-4 of the performance verification test record as the Power Sweep Accuracy.

    Power Sweep Accuracy = Positive Power Sweep Accuracy − Negative Power Sweep Accuracy

Table 1-30. Vernier Accuracy Worksheet

SRC POWER Setting		Measured Power Level	Vernier Accuracy	Measurement Uncertainty
Opt 011, dBmV	Opt 010, dBm	(dB)	(dB)	(dB)
+38.76	−10	0 (Ref)	0 (Ref)	0
+39.76	−9	______	______	±0.033
+40.76	−8	______	______	±0.033
+41.76	−7	______	______	±0.033
+42.76	−6	______	______	±0.033
+37.76	−5	______	______	±0.033
+36.76	−4	______	______	±0.033
+35.76	−3	______	______	±0.033
+34.76	−2	______	______	±0.033
+33.76	−1	______	______	±0.033
+32.76	−15	______	______	±0.033
+31.76	−14	______	______	±0.033
+30.76	−13	______	______	±0.033
+29.76	−12	______	______	±0.033
+28.76	−11	______	______	±0.033

24. Tracking Generator Level Flatness

This procedure is only for spectrum analyzers equipped with Option 010 or 011.

The tracking generator output is connected to the spectrum analyzer input and the tracking is adjusted at 300 MHz for a maximum signal level. A calibrated power sensor is then connected to the tracking generator output to measure the power level at 300 MHz. The measuring receiver is set for RATIO mode so that future power level readings are in dB relative to the power level at 300 MHz.

The tracking generator is then stepped to several frequencies throughout its range. The output power difference relative to the power level at 300 MHz is measured at each frequency and recorded.

The related adjustment for this procedure is "Modulator Gain and Offset Adjustment."

Equipment Required

Measuring receiver
Power sensor, 100 kHz to 1800 MHz
Cable, Type N, 62 cm (24 in)

Additional Equipment for Option 011

Power sensor, 75 Ω
Cable, BNC, 75 Ω
Adapter, Type N (f) to BNC (m), 75 Ω
Adapter, mechanical, Type N, 50 Ω (m) to 75 Ω (f)

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 011 or damage to the input connector will occur.

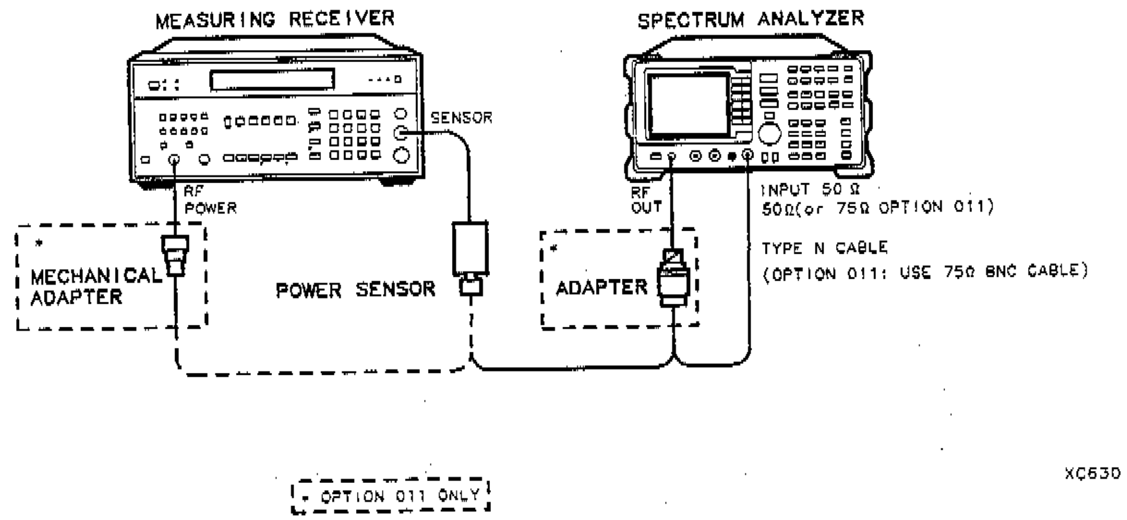

Figure 1-31. Tracking Generator Level Flatness Test Setup

Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 1-31.

   Option 011 only: Connect the BNC cable between the RF OUT 75 Ω and INPUT 75 Ω connectors on the spectrum analyzer.

2. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 300 (MHz)
   CF STEP AUTO MAN 100 (MHz)
   (SPAN) ZERO SPAN

3. On the spectrum analyzer, press (MKR), (AUX CTRL), Track Gen, SRC PWR ON OFF (ON), and enter 5 (−dBm).

   Option 011 only: Press 42 (+dBm) (+42 dBmV).

4. On the spectrum analyzer, press TRACKING PEAK. Wait for the PEAKING message to disappear.

5. Zero and calibrate the measuring receiver and 100 kHz to 1800 MHz power sensor in log mode (power reads out in dBm), as described in the measuring receiver operation manual. Enter the power sensor's 300 MHz Cal Factor into the measuring receiver.

6. Disconnect the Type N cable from the RF OUT 50 Ω and connect the 100 kHz to 4.2 GHz power sensor to the RF OUT 50 Ω.

   Option 011 only: Disconnect the BNC cable from the RF OUT 75 Ω and connect the 75 Ω power sensor to the RF OUT 75 Ω using an adapter.

7. On the spectrum analyzer, press 11 (−dBm), (SGL SWP).

   Option 011 only: Press 31.8 (+dBm) (+31.76 dBmV).

8. Press RATIO on the measuring receiver. The measuring receiver readout is now in power levels relative to the power level at 300 MHz.

9. Set the spectrum analyzer center frequency to 100 kHz. Press (SGL SWP).

   Option 011 only: Set the spectrum analyzer center frequency to 1 MHz. Press (SGL SWP).

10. Enter the appropriate power sensor Cal Factor into the measuring receiver as indicated in Table 1-31.

11. Record the power level displayed on the measuring receiver as the Level Flatness in Table 1-31.

12. Repeat steps 9 through 11 to measure the flatness at each center frequency setting listed in Table 1-31. The (⇧) (step-up key) may be used to tune to center frequencies above 100 MHz.

    Spectrum analyzers equipped with Option 011 should be tested only at frequencies of 1 MHz to 1.8 GHz.

24. Tracking Generator Level Flatness

Table 1-31. Tracking Generator Level Flatness Worksheet

Center Freq	Level Flatness (dB)	Cal Factor (MHz)	Measurement Uncertainty Option 010	Measurement Uncertainty Option 011
100 kHz*	______	0.1	+0.42/−0.45	N/A
300 kHz*	______	0.3	+0.28/−0.28	N/A
500 kHz*	______	0.3	+0.28/−0.28	N/A
1 MHz	______	1	+0.28/−0.28	+0.18/−0.39
2 MHz	______	3	+0.28/−0.28	+0.18/−0.39
5 MHz	______	3	+0.28/−0.28	+0.18/−0.39
10 MHz	______	10	+0.24/−0.24	+0.18/−0.39
20 MHz	______	30	+0.24/−0.24	+0.18/−0.39
50 MHz	______	50	+0.24/−0.24	+0.18/−0.39
100 MHz	______	100	+0.24/−0.24	+0.18/−0.39
200 MHz	______	300	+0.24/−0.24	+0.18/−0.39
300 MHz	0 (Ref)	300	0 (Ref)	0 (Ref)
400 MHz	______	300	+0.24/−0.24	+0.18/−0.39
500 MHz	______	300	+0.24/−0.24	+0.18/−0.39
600 MHz	______	300	+0.24/−0.24	+0.18/−0.39
700 MHz	______	1000	+0.24/−0.24	+0.18/−0.39
800 MHz	______	1000	+0.24/−0.24	+0.18/−0.39
900 MHz	______	1000	+0.24/−0.24	+0.18/−0.39
1000 MHz	______	1000	+0.24/−0.24	+0.18/−0.39
1100 MHz	______	1000	+0.24/−0.24	+0.18/−0.39
1200 MHz	______	1000	+0.24/−0.24	+0.18/−0.39
1300 MHz	______	1000	+0.24/−0.24	+0.18/−0.39
1400 MHz	______	1000	+0.24/−0.24	+0.18/−0.39
1500 MHz	______	2000	+0.24/−0.24	+0.18/−0.39
1600 MHz	______	2000	+0.24/−0.24	+0.18/−0.39
1700 MHz	______	2000	+0.24/−0.24	+0.18/−0.39
1800 MHz	______	2000	+0.24/−0.24	+0.18/−0.39

* These frequencies are tested on spectrum analyzers equipped with Option 010 only.

13. Locate the most positive Level Flatness reading in Table 1-31 for the frequency ranges listed in Table 1-32 and record as the Maximum Flatness in the performance verification test record as shown in Table 1-32.

Table 1-32. Maximum Flatness

Description	TR Entry (Maximum Flatness)
For Option 010	
100 kHz	24-1
300 kHz to 5 MHz	24-2
10 MHz to 1800 MHz	24-3
For Option 011	
1 MHz to 1800 MHz	24-1

14. Locate the most negative Level Flatness reading in Table 1-31 for the frequency ranges listed in Table 1-33 and record as the Minimum Flatness in the performance verification test record as shown in Table 1-33.

Table 1-33. Minimum Flatness

Description	TR Entry (Minimum Flatness)
For Option 010	
100 kHz	24-4
300 kHz to 5 MHz	24-5
10 MHz to 1800 MHz	24-6
For Option 011	
1 MHz to 1800 MHz	24-2

15. Press (PRESET) on the spectrum analyzer.

25. Harmonic Spurious Outputs

This procedure is only for spectrum analyzers equipped with Option 010 or 011.

The tracking generator output is connected to the spectrum analyzer input and the tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator output is then connected to the input of a microwave spectrum analyzer. The tracking generator is tuned to several different frequencies and the amplitude of the second and third harmonics relative to the fundamental are measured at each frequency.

There are no related adjustment procedures for this performance test.

Equipment Required

Spectrum analyzer, microwave
Cable, Type N, 62 cm (24 in)
Cable, BNC, 23 cm (9 in)
Adapter, Type N (m) to BNC (f)

Additional Equipment for Option 011

Adapter, minimum loss
Cable, BNC, 75 Ω
Adapter, Type N (f) to BNC (m), 75 Ω

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 011 or damage to the input connector will occur.

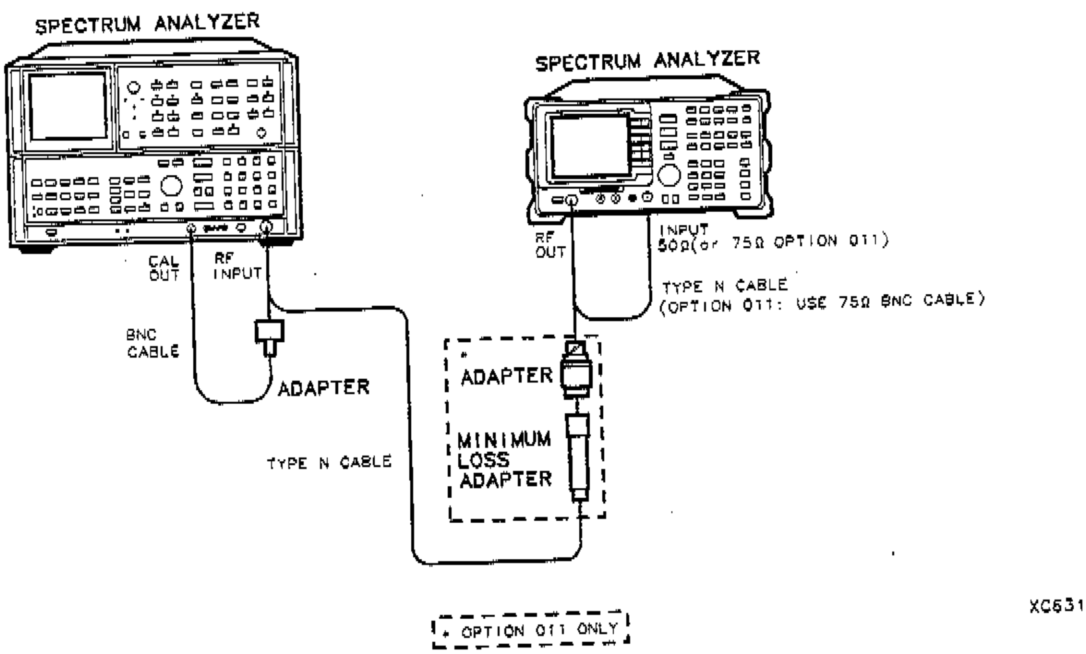

Figure 1-32. Harmonic Spurious Outputs Test Setup

Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 1-32.

   Option 011 only: Connect the 75 Ω BNC cable between the RF OUT 75 Ω and INPUT 75 Ω connectors on the spectrum analyzer.

2. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 300 (MHz)
   (SPAN) ZERO SPAN
   (MKR)
   (AUX CTRL) Track Gen
   SRC PWR ON OFF (ON) 5 (−dBm)

   Option 011 only: Press (AUX CTRL), Track Gen, SRC PWR ON OFF, then enter 42 (+dBm) (+42 dBmV).

3. On the spectrum analyzer, press TRACKING PEAK. Wait for the PEAKING message to disappear, then press the following keys:

   0 (+dBm)

   Option 011 only: Press 42.8 (+dBm) (42.8 dBmV).

   (FREQUENCY) 10 (MHz)
   (SGL SWP)

   It is only necessary to perform the next step if more than two hours have elapsed since a front-panel calibration of the microwave spectrum analyzer was performed.

   The microwave spectrum analyzer should be allowed to warm up for at least 30 minutes before proceeding.

4. Perform a front-panel calibration of the microwave spectrum analyzer by performing the following steps:

   Note that the following steps are for an HP 8566A/B microwave spectrum analyzer, the steps may be different if you are using another microwave spectrum analyzer.

   - Connect a BNC cable between the CAL OUTPUT and the RF INPUT.
   - Press (2 − 22 GHz) (INSTR PRESET), (RECALL), 8. Adjust AMPTD CAL for a marker amplitude reading of −10 dBm.
   - Press (RECALL), 9. Adjust FREQ ZERO for a maximum amplitude response.

5. Connect the Type N cable from the tracking generator output to the microwave spectrum analyzer RF INPUT as shown in Figure 1-32.

   Option 011 only: Use the minimum loss adapter and Type N (f) to BNC (m) adapter.

6. Set the microwave spectrum analyzer controls as follows:

   CENTER FREQUENCY .... 10 MHz
   SPAN .... 100 kHz
   REFERENCE LEVEL .... +5 dBm
   RES BW .... 30 kHz
   LOG dB/DIV .... 10 dB

25. Harmonic Spurious Outputs

7. Set up the microwave spectrum analyzer by performing the following steps:

   Note that the following steps are for an HP 8566A/B microwave spectrum analyzer, the steps may be different if you are using another microwave spectrum analyzer.

   - Press PEAK SEARCH and SIGNAL TRACK (ON). Wait for the signal to be displayed at center screen.
   - Press PEAK SEARCH, CF STEP SIZE 10 MHz, CENTER FREQUENCY, then SIGNAL TRACK (OFF).
   - Press CENTER FREQUENCY and the step-up key to tune to the second harmonic. Press PEAK SEARCH. Record the marker amplitude reading in Table 1-34 as the 2nd Harmonic Level for the 10 MHz Tracking Generator Output Frequency.
   - Perform this step only if the Tracking Generator Output Frequency is less than 600 MHz. Press CENTER FREQUENCY and and the step-up key to tune to the third harmonic. Press PEAK SEARCH. Record the marker amplitude reading in Table 1-34 as the 3rd Harmonic Level for the 10 MHz Tracking Generator Output Frequency.
   - Press MARKER (OFF).

8. Change the microwave spectrum analyzer center frequency to the next frequency listed in Table 1-34, then repeat step 7. Note that the microwave spectrum analyzer frequency is the same as the Tracking Generator Output Frequency (*STEP SIZE = TG FREQ*).

Table 1-34. Harmonic Spurious Responses Worksheet

Tracking Generator Frequency	2nd Harmonic Level (dBc)	3rd Harmonic Level (dBc)	Measurement Uncertainty (dB)
10 MHz	______	______	+1.55/−1.80
100 MHz	______	______	+1.55/−1.80
300 MHz	______	______	+1.55/−1.80
850 MHz	______	N/A	+1.55/−1.80

9. Locate the most positive 2nd Harmonic Level in Table 1-34 and record as TR Entry 25-1 of the performance verification test record.

10. Locate the most positive 3rd Harmonic Level in Table 1-34 and record as TR Entry 25-2 of the performance verification test record.

26. Non-Harmonic Spurious Outputs

This procedure is only for spectrum analyzers equipped with Option 010 or 011.

The tracking generator output is connected to the spectrum analyzer input and the tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator output is then connected to the input of a microwave spectrum analyzer. The tracking generator is set to several different output frequencies.

For each output frequency, several sweeps are taken on the microwave spectrum analyzer over different frequency spans and the highest displayed spurious response is measured in each span. Responses at the fundamental frequency of the tracking generator output or their harmonics are ignored. The amplitude of the highest spurious response is recorded.

There are no related adjustments for this performance test.

Equipment Required

Spectrum analyzer, microwave
Cable, Type N, 62 cm (24 in)
Cable, BNC, 23 cm (9 in)
Adapter, Type N (m) to BNC (f)

Additional Equipment for Option 011:

Adapter, minimum loss
Cable, BNC, 75 Ω
Adapter, Type N (f) to BNC (m), 75 Ω

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 011 or damage to the input connector will occur.

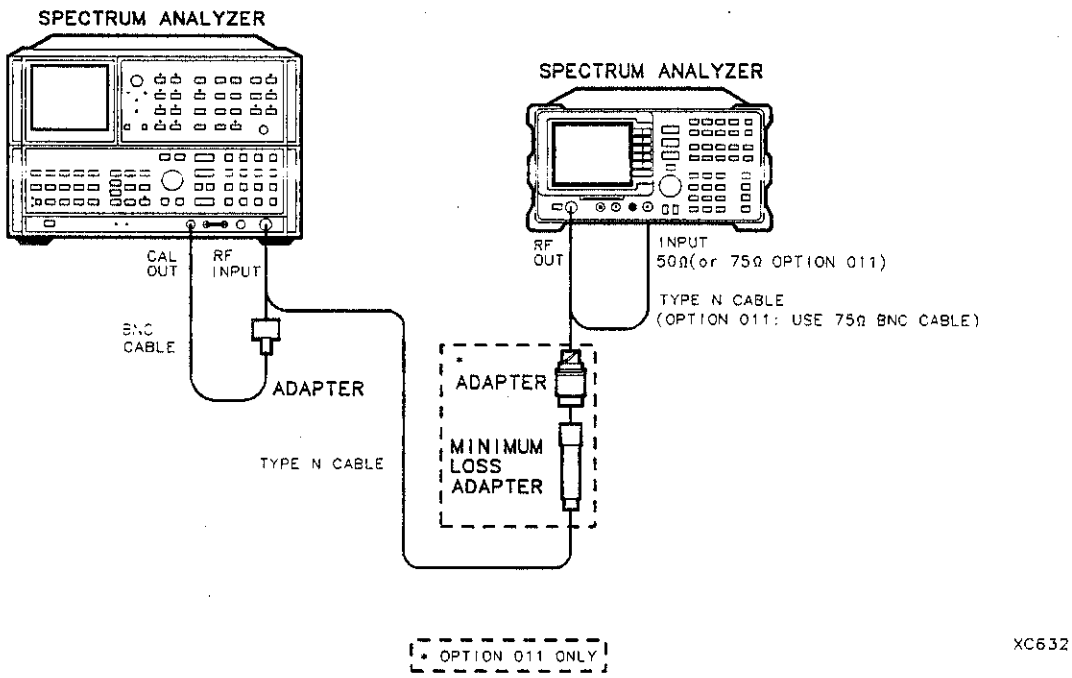

Figure 1-33. Non-Harmonic Spurious Outputs Test Setup

Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 1-33.

   Option 011 only: Connect the 75 Ω BNC cable between the RF OUT 75 Ω and INPUT 75 Ω on the spectrum analyzer.

2. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 300 (MHz)
   (SPAN) ZERO SPAN
   (BW) RES BW AUTO MAN 30 (kHz)
   (MKR)
   (AUX CTRL) Track Gen
   SRC PWR ON OFF (ON) 5 (−dBm)

   Option 011 only: Press (AUX CTRL), Track Gen, SRC PWR ON OFF (ON), then enter 42 (+dBm) (+42 dBmV).

3. On the spectrum analyzer, press TRACKING PEAK, then wait for the PEAKING message to disappear.

4. On the spectrum analyzer, press 0 (+dBm) then (SGL SWP).

   Option 011 only: Press 42.8 (+dBm) (+42.8 dBmV) then (SGL SWP).

It is only necessary to perform the next step if more than 2 hours have elapsed since a front-panel calibration of the microwave spectrum analyzer has been performed.

The microwave spectrum analyzer should be allowed to warm up for at least 30 minutes before proceeding.

5. Perform a front-panel calibration of the microwave spectrum analyzer by performing the following steps:

   Note that the following steps are for an HP 8566A/B microwave spectrum analyzer, the steps may be different if you are using another microwave spectrum analyzer.

   - Connect a BNC cable between CAL OUTPUT and RF INPUT.
   - Press (2 – 22 GHz) (INSTR PRESET), (RECALL), 8. Adjust AMPTD CAL for a marker amplitude reading of −10 dBm.
   - Press (RECALL), 9. Adjust FREQ ZERO for a maximum amplitude response.
   - Press (SHIFT), (FREQUENCY SPAN) to start the 30 second internal error correction routine.
   - Press (SHIFT), (START FREQ) to use the error correction factors just calculated.

6. Connect the Type N cable from the tracking generator output to the microwave spectrum analyzer RF INPUT as shown in Figure 1-33.

   Option 011 only: Use the minimum loss adapter and Type N (f) to BNC (m) adapter.

Measuring Fundamental Amplitudes

7. Set the spectrum analyzer center frequency to the Fundamental Frequency listed in Table 1-35.
8. Set the microwave spectrum analyzer controls as follows:

   SPAN .... 100 kHz
   REFERENCE LEVEL .... +5 dBm
   ATTEN .... 20 dB

9. Set the microwave spectrum analyzer CENTER FREQUENCY to the Fundamental Frequency listed in Table 1-35.
10. On the microwave spectrum analyzer, press PEAK SEARCH. Press MARKER →REF LVL. Wait for another sweep to finish.
11. Record the microwave spectrum analyzer marker amplitude reading in Table 1-35 as the Fundamental Amplitude.
12. Repeat steps 8 through 11 for all Fundamental Frequency settings in Table 1-35.

Table 1-35. Fundamental Response Amplitudes Worksheet

Fundamental Frequency	Fundamental Amplitude (dBm)
10 MHz	______
900 MHz	______
1.8 GHz	______

Measuring Non-Harmonic Responses

13. On the spectrum analyzer, set the center frequency to 10 MHz.
14. Set the microwave spectrum analyzer START FREQ, STOP FREQ, and RES BW as indicated in the first row of Table 1-36.
15. Press SINGLE on the microwave spectrum analyzer and wait for the sweep to finish. Press (PEAK SEARCH).
16. Verify that the marked signal is not the fundamental or a harmonic of the fundamental by performing the following steps:

    Note that the following steps are for an HP 8566A/B microwave spectrum analyzer, the steps may be different if you are using another microwave spectrum analyzer.

    a. Divide the marker frequency by the fundamental frequency (the spectrum analyzer center frequency setting). For example, if the marker frequency is 30.3 MHz and the fundamental frequency is 10 MHz, dividing 30.3 MHz by 10 MHz yields 3.03.
    b. Round the number calculated in step a the nearest whole number. In the example above, 3.03 should be rounded to 3.
    c. Multiply the fundamental frequency by the number calculated in step b. Following the example, multiplying 10 MHz by 3 yields 30 MHz.
    d. Calculate the difference between the marker frequency and the frequency calculated in step c above. Continuing the example, the difference would be 300 kHz.
    e. Due to span accuracy uncertainties in the microwave spectrum analyzer, the marker frequency might not equal the actual frequency. Given the marker frequency, check if the difference calculated in step d is within the appropriate tolerance:

       For marker frequencies <5 MHz, tolerance = ±200 kHz
       For marker frequencies <55 MHz, tolerance = ±750 kHz
       For marker frequencies >55 MHz, tolerance = ±10 MHz

    f. If the difference in step d is within the indicated tolerance, the signal in question is the fundamental signal (if the number in step b = 1) or a harmonic of the fundamental (if the number in step b >1). This response should be ignored.
17. Verify that the marked signal is a true response and not a random noise peak by pressing SINGLE to trigger a new sweep and press PEAK SEARCH. A true response will remain at the same frequency and amplitude on successive sweeps but a noise peak will not.

    If the marked signal is *not* the fundamental or a harmonic of the fundamental (see step 16) and is a true response (see step 17), proceed with step 20.
18. If the marked signal is either the fundamental or a harmonic of the fundamental (see step 16) or a noise peak (see step 17), move the marker to the next highest signal by pressing SHIFT, PEAK SEARCH. Repeat step 16.

    The following step is only performed if the marker signal is not the fundamental or harmonic of the fundamental and is a true response.

19. Calculate the difference between the amplitude of marked signal and the Fundamental Amplitude as listed in Table 1-35.

    For example, if the Fundamental Amplitude for a fundamental frequency of 10 MHz is +1.2 dBm and the marker amplitude is −40.8 dBm, the difference is −42 dBc.

    Record this difference as the Non-Harmonic Response Amplitude for the appropriate spectrum analyzer center frequency and microwave spectrum analyzer start and stop frequency settings in Table 1-36.

    Non-Harmonic Amplitude = Marker Amplitude − Fundamental Amplitude

20. If a true non-harmonic spurious response is not found, record "NOISE" as the Non-Harmonic Response Amplitude in Table 1-36 for the appropriate spectrum analyzer center frequency and microwave spectrum analyzer start and stop frequency settings.
21. Repeat steps 15 through 20 for the remaining microwave spectrum analyzer settings for start frequency, stop frequency, and resolution bandwidth; and for the spectrum analyzer center frequency setting of 10 MHz.
22. Repeat steps 14 through 21 with the spectrum analyzer center frequency set to 900 MHz.
23. Repeat steps 14 through 21 with the spectrum analyzer center frequency set to 1.8 GHz.
24. Locate in Table 1-36 the most-positive Non-Harmonic Response Amplitude. Record this amplitude as the Highest Non-Harmonic Response Amplitude in TR Entry 26-1 of the performance verification test record.

Table 1-36. Non-Harmonic Responses Worksheet

Microwave Spectrum Analyzer Settings			Non-Harmonic Response Amplitude (dBc)			Measurement Uncertainty
Start Freq (MHz)	Stop Freq (MHz)	Resolution Bandwidth	at 10 MHz Center Freq	at 900 MHz Center Freq	at 1.8 GHz Center Freq	(dB)
0.1*	5.0	10 kHz	____	____	____	+1.55/-1.80
5.0	55	100 kHz	____	____	____	+1.55/-1.80
55	1240	1 MHz	____	____	____	+1.55/-1.80
1240	1800	1 MHz	____	____	____	+1.55/-1.80

* Option 011: Set the START FREQ to 1 MHz.

27. Tracking Generator Feedthrough

This procedure is only for spectrum analyzers equipped with Option 010 or 011.

The tracking generator output is connected to the spectrum analyzer input and the tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator output is terminated and set for 0 dBm output power (maximum output power). The spectrum analyzer input is also terminated. The noise level of the spectrum analyzer is then measured at several frequencies.

There are no related adjustments for this performance test.

Equipment Required

50 Ω Termination *(two required)*
Cable, Type N, 62 cm (24 in)
Cable, BNC, 23 cm (9 in)
Cable, Type N (m) to BNC (f)

Additional Equipment for Option 011:

Termination, 75 Ω, Type N (m) *(two required)*
Cable, BNC, 75 Ω
Adapter, Type N (f) to BNC (m), 75 Ω *(two required)*

Caution Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 011 or damage to the input connector will occur.

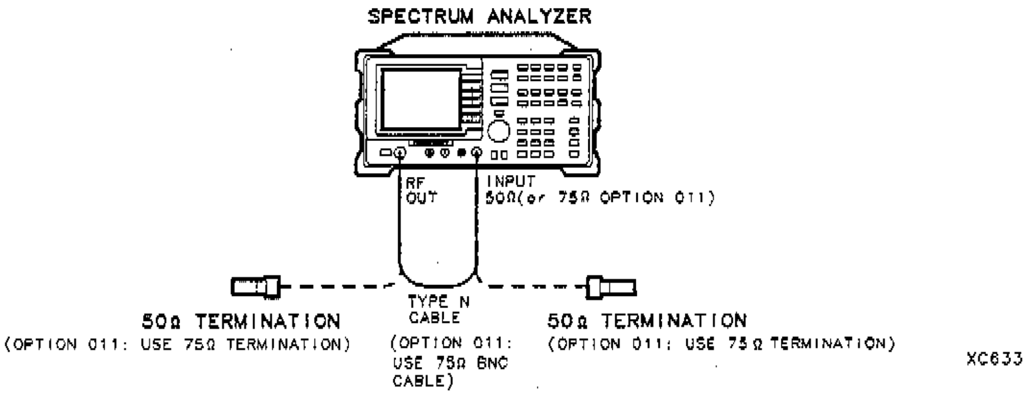

Figure 1-34. Tracking Generator Feedthrough Test Setup

Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 1-34.

   Option 011 only: Connect the 75 Ω BNC cable between the RF OUT 75 Ω and INPUT 75 Ω connectors on the spectrum analyzer.

2. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 300 (MHz)
   (SPAN) 1 (MHz)
   (BW) RES BW AUTO MAN 30 (kHz)
   (MKR)
   (AUX CTRL) Track Gen
   SRC PWR ON OFF (ON) 5 (-dBm)

   Option 011 only: Press (AUX CTRL), Track Gen, SRC PWR ON OFF, then enter 42 (+dBm) (+42 dBmV).

3. On the spectrum analyzer, press TRACKING PEAK. Wait for the PEAKING message to disappear.
4. Connect the CAL OUTPUT to the INPUT 50 Ω.

   Option 011 only: Connect the CAL OUTPUT to the INPUT 75 Ω.

5. Set the spectrum analyzer by pressing the following keys:

   (AMPLITUDE) −20 (dBm)

   Option 011 only: Press (AMPLITUDE) +28.75 (dBmV).

   ATTEN AUTO MAN 0 (dB)
   (SPAN) 10 (MHz)
   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)
   (SPAN) 100 (kHz)

   Wait for the AUTO ZOOM message to disappear, then set the spectrum analyzer as follows:

   (BW) VID BW AUTO MAN 30 (Hz)
   (MKR FCTN) MK TRACK ON OFF (OFF)

6. Press (SGL SWP), then wait for completion of a new sweep. Press the following spectrum analyzer keys:

   (PEAK SEARCH)
   (AMPLITUDE) More 1 of 3 REF LVL OFFSET (enter value)

   Subtract the MKR amplitude reading from −20 dBm, then enter the result in the spectrum analyzer as the REF LVL OFFSET. For example, if the marker reads −20.21 dBm, enter +0.21 dB.

   $-20\ dBm - (-20.21\ dBm) = +0.21\ dB$

   Example for *Option 011:*

   If the marker reads 26.4 dBmV, enter +2.35 (dB)

   $28.75\ dBmV - 26.4\ dBmV = 2.35\ dB$

27. Tracking Generator Feedthrough

7. Connect one 50 Ω termination to the spectrum analyzer INPUT 50 Ω and another to the tracking generator's RF OUT 50 Ω.

   Option 011 only: Connect one 75 Ω termination to the spectrum analyzer INPUT 75 Ω and another to the tracking generator's RF OUT 75 Ω.

8. Press (AUX CTRL), Track Gen, then SRC PWR ON OFF (OFF).

9. Set the spectrum analyzer by pressing the following keys:

   (FREQUENCY) 0 (Hz)
   (SPAN) 10 (MHz)
   (AMPLITUDE) −10 (dBm)

   Option 011 only: Press (AMPLITUDE) +38.75 (dBmV).)

   (BW) RES BW AUTO MAN 30 (kHz)

   VID BW AUTO MAN (AUTO)

   (MKR) More 1 of 2 MARKER ALL OFF

   (TRIG) SWEEP CONT SGL (CONT)

10. Press the following spectrum analyzer keys:

    (PEAK SEARCH)
    (MKR FCTN) MK TRACK ON OFF (ON)
    (MKR →) MARKER →REF LVL
    (SPAN) 2 (MHz)

    Wait for the AUTO ZOOM message to disappear, then press (MKR FCTN) MK TRACK ON OFF (OFF).

11. Press (FREQUENCY) and adjust the center frequency until the LO feedthrough peak is on the leftmost graticule line, then set the spectrum analyzer as follows:

    (SPAN) 50 (kHz)
    (AMPLITUDE) −50 (dBm)

    Option 011 only: Press (AMPLITUDE) −1.25 (dBmV).

    (BW) VID BW AUTO MAN 30 (Hz)

12. Press (AUX CTRL), Track Gen, SRC PWR ON OFF (ON), and enter 0 (+dBm).

    Option 011 only: Press (AUX CTRL), Track Gen, SRC PWR ON OFF (ON), and enter 42.8 (+dBm) (+42.8 dBmV).

13. Press (SGL SWP), then wait for completion of a new sweep. Press (DISPLAY), DSP LINE ON OFF (ON).

14. Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses. Record the display line amplitude setting in Table 1-37 as the noise level at 1 MHz.

15. Repeat steps 13 and 14 for the remaining Tracking Generator Output Frequencies (spectrum analyzer center frequency) listed in Table 1-37.
16. In Table 1-37, locate the most positive Noise Level Amplitude. Record this amplitude as TR Entry 27-1 of the performance verification test record.

Table 1-37. TG Feedthrough Worksheet

Tracking Generator Output Frequency	Noise Level Amplitude (dbm or dBmV)	Measurement Uncertainty (dB)
1 MHz	______	+1.15/−1.24
20 MHz	______	+1.15/−1.24
50 MHz	______	+1.15/−1.24
100 MHz	______	+1.15/−1.24
250 MHz	______	+1.15/−1.24
400 MHz	______	+1.15/−1.24
550 MHz	______	+1.15/−1.24
700 MHz	______	+1.15/−1.24
850 MHz	______	+1.15/−1.24
1000 MHz	______	+1.15/−1.24
1150 MHz	______	+1.15/−1.24
1300 MHz	______	+1.15/−1.24
1450 MHz	______	+1.15/−1.24
1600 MHz	______	+1.15/−1.24
1750 MHz	______	+1.15/−1.24

28. CISPR Pulse Response

This procedure is only for spectrum analyzers equipped with Option 103.

This CISPR Pulse Response measurement is made using a pulsed RF input signal rather than a pulse signal because the equipment is readily available, easily calibrated, and flexible in use. Pulsed RF setup considerations as well as the relationship between the two techniques are explained in Application Note 150-2.

The CISPR Pulse Response test measures the spectrum analyzer quasi-peak detector receiver systems's response to a pulsed RF input signal relative to that of a CW input signal and as a function of pulse repetition frequency. The output of the synthesizer/level generator is modulated by the pulse generator using the pulse modulator to yield the pulsed RF signal. The output of the pulse modulator is connected to the input of the device under test (DUT) with a BNC cable through a 3 dB attenuator. The 3 dB attenuator provides a controlled source match. Amplitude accuracy is ensured by measuring the output signal of the 3 dB attenuator using the power meter with the pulse modulator dc biased to provide a CW signal. This measured CW amplitude also corresponds to the burst amplitude of the pulsed RF input signal when the pulse modulator is appropriately driven. The system is tested, through the 9 kHz and 120 kHz EMI bandwidth filters with a pulse repetition frequency (PRF) corresponding to CISPR specifications. (Additional steps are included to test the 200 Hz EMI bandwidth filter for spectrum analyzers equipped with Option 130.) The required CW amplitude for the tests are calculated based on the device under test's impulse bandwidth, the pulse width of the pulsed RF, and the CISPR specified spectral intensity.

There are no related adjustment procedures for this performance test.

Equipment

Pulse generator
Synthesizer/level generator
Power meter
Power sensor, 100 kHz to 1800 MHz
Attenuator, 3 dB
Modulator, TeleTech
Quasi-peak detector driver
Cable, BNC, 122 cm (48 in) *(three required)*
Adapter, Type N (m) to BNC (f)
Adapter, Type N (f) to Type N (f)

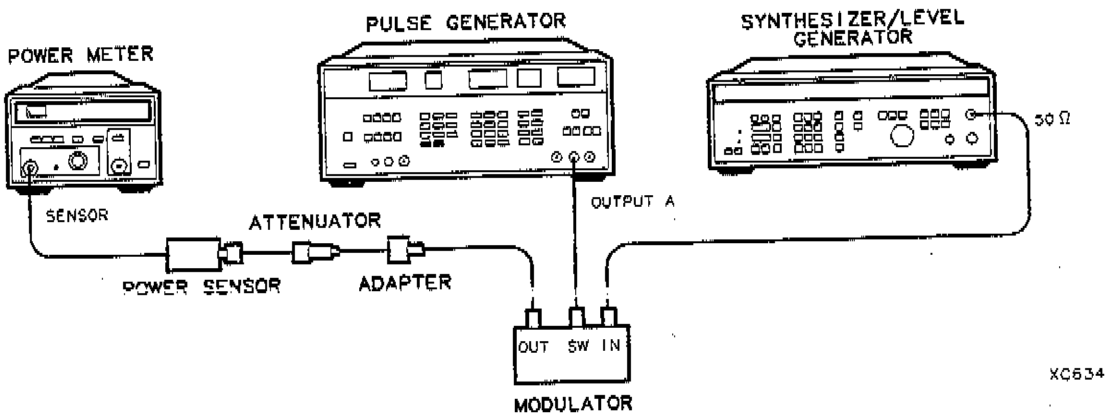

Figure 1-35. Input Amplitude Calibration Test Setup

Procedure

Be sure the quasi-peak detector driver (DLP) is installed before performing this procedure.

Input Amplitude Calibration

1. Zero and Calibrate the power meter and 100 kHz to 1800 MHz power sensor, as described in the power meter operation manual.
2. Connect the equipment as shown in Figure 1-35.
3. Press RECALL 0 on the pulse generator to preset the pulse generator. To bias the modulator on, set the pulse generator to the following settings:

   Parameters:

   LEE .... 3 ns
   TRE .... 3 ns
   HIL .... +2 V
   LOL .... +1.8 V
   DEL .... 0 ns

   Output Mode: Enabled

   Channel A .... 50 Ω
   Channel A .... NORM
4. Press STORE 1 on the pulse generator to store the settings in storage register 1.
5. Set the synthesizer/level generator to the following settings:

   FREQUENCY .... 50 MHz
   AMPLITUDE .... −3 dBm
6. Set the power meter to the following settings:

   MODE .... dBm
   CAL FACTOR .... power sensor Ref Cal Factor for 50 MHz
7. Adjust synthesizer/level generator power level for a −6.99 dBm (±0.03) reading on the power meter.
8. Record the synthesizer/level generator amplitude setting in Table 1-38 under Reference Amplitude at 50 MHz for the 200 Hz, 9 kHz and 120 kHz EMI bandwidths. Calculate the Required Amplitude for the 200 Hz, 9 kHz and 120 kHz resolution bandwidths using the following formula:

   Reference Amplitude at 50 MHz + Amplitude Offset = Required Amplitude

   Note that the reference amplitude is the same for the 9 kHz, 120 kHz, and 200 Hz filters.
9. Enter the calculated 200 Hz, 9 kHz and 120 kHz Required Amplitude values in Table 1-38.
10. On the synthesizer/level generator, press STORE 1 to store the previous setting of the synthesizer/level generator in storage register 1.

Isolation Check

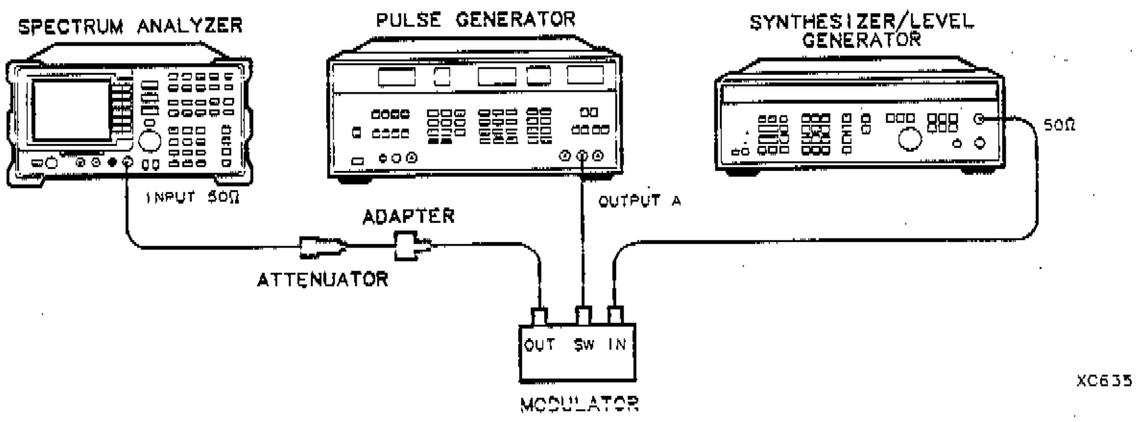

Figure 1-36. Isolation Check Test Setup

11. Connect the equipment as shown in Figure 1-36.
12. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

    (FREQUENCY) 50 (MHz)
    (SPAN) 1 (MHz)
    (PEAK SEARCH)
    (SAVE) STATE → INTRNL 1
    (MKR →) MARKER →REF LVL
    (MKR) MARKER Δ

13. Press RECALL 1 on the pulse generator. Set the pulse generator to the following settings to bias the modulator off:

    HIL .... −1.5 V
    LOL .... −1.7 V

    Use the (CHS) key to change signs of the entered value on the pulse generator.
14. Verify that the isolation of the modulator (the marker-delta reading) exceeds 70 dBc.

CW Measurement for 9 kHz EMI Bandwidth

15. Press RECALL 1 on the pulse generator.
16. Subtract 40 dB from the Reference Amplitude at 50 MHz in Table 1-38. Set the synthesizer/level generator amplitude to the calculated value by pressing (AMPLITUDE), (enter the calculated value), (−dBm).
17. Press STORE 2 on the synthesizer/level generator.
18. Press the following keys on the spectrum analyzer:

    (MKR) MARKER NORMAL

    (BW) EMI BW Menu 9 kHz EMI BW

    (AUX CTRL) Quasi Peak AUTO QP AT MKR

    A message will be displayed warning that an improper bandwidth is selected. Disregard the message and press CONTINUE.
19. Record the quasi-peak reading displayed below the signal on the spectrum analyzer screen in Table 1-39, under the Measured CW Amplitude for 9 kHz.

9 kHz Pulse RF Signal Setup

20. Press RECALL 1 on the pulse generator. Set the pulse generator to the following conditions:

PER	10 ms
WID	2.2 μs
LOL	−1.7 V

    Use the (CHS) key to change the sign of the value entered on the pulse generator.
21. Press RECALL 1 on the synthesizer/level generator. Set the synthesizer/level generator amplitude to the required amplitude value for the 9 kHz filter recorded in Table 1-38 by pressing (AMPLITUDE), (enter the Required Amplitude for 9 kHz), (−dBm).
22. Press MAN QP AT MKR on the spectrum analyzer.

    A message will be displayed warning that an improper bandwidth is selected. Disregard the message and press CONTINUE.
23. Record the marker amplitude reading in Table 1-39 as the Measured 100 Hz Amplitude for 9 kHz. Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Band B, 100 Hz Repetition Frequency.
24. Set the PERIOD to 1 ms on the pulse generator. On the spectrum analyzer, press MARKER NORM PK (so that PK is underlined), then press (SGL SWP).

    Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Band B, 1000 Hz Repetition Frequency.
25. Set the PERIOD to 50 ms on the pulse generator. Press (SGL SWP) on the spectrum analyzer.

    Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Band B, 20 Hz Repetition Frequency.
26. Set the PERIOD to 100 ms on the pulse generator. Press (SGL SWP) on the spectrum analyzer.

28. CISPR Pulse Response

Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Band B, 10 Hz Repetition Frequency.

27. Set the PERIOD to 500 ms on the pulse generator. On the spectrum analyzer, press QP X10 ON OFF so that ON is underlined, then press (SGL SWP).

    Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Band B, 2 Hz Repetition Frequency.

28. Set the PERIOD to 980 ms on the pulse generator. Press (SGL SWP) on the spectrum analyzer.

    Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Band B, 1 Hz Repetition Frequency.

29. Press TRIG on the pulse generator. Press (SGL SWP) on the spectrum analyzer. Let the spectrum analyzer sweep 3 divisions then press MAN on the pulse generator. Record the Marker reading for Isolated Pulse Measurement for Band B in Table 1-40.

Continue with "CW Measurement for 120 kHz EMI Bandwidth."

CW Measurement for 120 kHz EMI Bandwidth

30. Press RECALL 1 on the pulse generator.
31. Press RECALL 2 on the synthesizer/level generator.
32. Press (RECALL), INTRNL → STATE 1 on the spectrum analyzer.
33. On the spectrum analyzer, press the following keys:

    (MKR) MARKER NORMAL

    (AUX CTRL) Quasi Peak RETURN AUTO QP AT MKR 120 kHz EMI BW CONTINUE

34. Record the reading displayed below signal on the spectrum analyzer screen in Table 1-39 under the Measured CW Amplitude for 120 kHz.

120 kHz Pulse RF Signal Setup

35. Set the pulse generator to the following conditions:

    PER .... 10 ms
    WID .... 167 ns
    LOL .... −1.7 V

36. Press RECALL 1 on the synthesizer/level generator. Set the synthesizer/level generator amplitude to the required amplitude value for the 120 kHz filter recorded in Table 1-38 by pressing (AMPLITUDE), (enter the Required Amplitude value for the 120 kHz EMI bandwidth), (+dBm).
37. Press Quasi Peak, MAN QP AT MKR on the spectrum analyzer.
38. Record the marker reading in Table 1-39 as the Measured 100 Hz Amplitude for the 120 kHz EMI bandwidth. Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Bands C and D, 100 Hz Repetition Frequency.

39. Set PERIOD to 1 ms on the pulse generator. Press MARKER NORM PK (so that PK is underlined), (SGL SWP) on the spectrum analyzer.

    Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Bands C and D, 1000 Hz Repetition Frequency.

    Set the PERIOD to 50 ms on the pulse generator. Press QP X10 ON OFF so that ON is underlined on the spectrum analyzer. Press (SGL SWP) on the spectrum analyzer.

    Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Bands C and D, 20 Hz Repetition Frequency.

40. Set PERIOD to 100 ms on the pulse generator. Press (SGL SWP) on the spectrum analyzer.

    Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Bands C and D, 10 Hz Repetition Frequency.

41. Set the PERIOD to 500 ms on the pulse generator. Press (SGL SWP) on the spectrum analyzer.

    Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Bands C and D, 2 Hz Repetition Frequency.

42. Set PERIOD to 980 ms on the pulse generator. Press (SGL SWP) on the spectrum analyzer.

    Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Bands C and D, 1 Hz Repetition Frequency.

43. Press (TRIG) on the pulse generator. Press (SGL SWP) on the spectrum analyzer. Let the spectrum analyzer sweep three divisions then press (MAN) on the pulse generator. Record the marker reading as the Isolated Pulse for Bands C and D in Table 1-40.

Table 1-38. Input Amplitude Calibration Worksheet

EMI Bandwidth	Reference Amplitude at 50 MHz	Amplitude Offset	Required Amplitude
9 kHz		0.05	________
120 kHz		5.42	________
200 Hz		−0.40	________

Table 1-39. Quasi-Peak Detector Reference Accuracy Worksheet

EMI Bandwidth	Measured CW Amplitude	Measured Amplitude		Error	Limit
		25 Hz	100 Hz		
9 kHz	________	________	________	________	±1.5
120 kHz	________	________	________	________	±1.5
200 Hz	________	________	________	________	±1.5

44. Enter the Measured value for the Band B 100 Hz Repetition Frequency as the Reference value for all the Repetition Frequencies listed for Band B.
45. Enter the Measured value for the Bands C and D 100 Hz Repetition Frequency as the Reference value for all the Repetition Frequencies listed for Bands C and D.
46. Calculate the Amplitude Error for each of the frequencies listed in Table 1-40 using the following formula:

$$\text{Measured} - \text{Reference} = \text{Error}$$

47. Record these calculated values in the performance verification test record as indicated in Table 1-40.

If you are testing a spectrum analyzer equipped with Option 130 continue with "Additional Steps for Option 130."

Performance test "CISPR Pulse Response" is now complete for all other spectrum analyzers.

Additional Steps for Option 130

CW Measurement for 200 Hz EMI Bandwidth

48. Press RECALL 1 on the pulse generator.
49. Press RECALL 2 on the synthesizer/level generator.
50. Press (PRESET) on the spectrum, then wait for the preset routine to finish. Press the following spectrum analyzer keys:

    (RECALL) INTRNL → STATE 1
    (MKR) MARKER NORMAL
    (BW) EMI BW Menu 200 Hz EMI BW
    (AUX CTRL) Quasi Peak AUTO QP AT MKR

    A message will be displayed warning that an improper bandwidth is selected. Disregard the message and press CONTINUE.

    Note that this routine will take 1 to 2 minutes to execute.

51. Record the quasi-peak reading displayed below the signal on the spectrum analyzer screen in Table 1-39, under the Measured CW Amplitude for 200 Hz.

200 Hz Pulse RF Signal Setup

52. Press RECALL 1 on the pulse generator. Set the pulse generator to the following conditions:

    PER .... 40 ms
    WID .... 0.1 ms
    LOL .... −1.7 V

    Use the (CHS) key to change the sign of the value entered on the pulse generator.

53. Press RECALL 1 on the synthesizer/level generator. Set the synthesizer/level generator amplitude to the required amplitude value for the 200 Hz filter recorded in Table 1-38 by pressing (AMPLITUDE), (enter the Required Amplitude for 200 Hz), (−dBm).
54. Press MAN QP AT MKR on the spectrum analyzer.

A message will be displayed warning that an improper bandwidth is selected. Disregard the message and press CONTINUE.

Note that this routine will take 1 to 2 minutes to execute.

55. Record the marker amplitude reading in Table 1-39 as the Measured 100 Hz Amplitude for 200 Hz. Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Band A, 25 Hz Repetition Frequency.
56. Set the PERIOD to 10 ms on the pulse generator. On the spectrum analyzer, press MARKER NORM PK (so that PK is underlined), then (SGL SWP).

    Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Band A, 100 Hz Repetition Frequency.
57. Set the PERIOD to 16.7 ms on the pulse generator. Press (SGL SWP) on the spectrum analyzer.

    Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Band A, 60 Hz Repetition Frequency.
58. Set the PERIOD to 100 ms on the pulse generator. Press (SGL SWP) on the spectrum analyzer.

    Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Band A, 10 Hz Repetition Frequency.
59. Set the PERIOD to 200 ms on the pulse generator. Press (SGL SWP) on the spectrum analyzer.

    Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Band A, 5 Hz Repetition Frequency.
60. Set the PERIOD to 500 ms on the pulse generator. On the spectrum analyzer, press QP X10 ON OFF so that ON is underlined, then press (SGL SWP).

    Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Band A, 2 Hz Repetition Frequency.
61. Set the PERIOD to 980 ms on the pulse generator. Press (SGL SWP) on the spectrum analyzer.

    Record the marker amplitude reading in Table 1-40 as the Measured Relative Equivalent Level of Pulse for Band A, 1 Hz Repetition Frequency.
62. Press (TRIG) on the pulse generator. Press (SGL SWP) on the spectrum analyzer. Let the spectrum analyzer sweep 3 divisions then press (MAN) on the pulse generator. Record the Marker reading for Isolated Pulse Measurement for Band A in Table 1-40.

28. CISPR Pulse Response

Table 1-40. Quasi-Peak Detector Accuracy

Repetition Frequency	Relative Equivalent Level of Pulse Band B (9 kHz EMI BW)			
(Hz)	Measured (dBμV)	Reference (dBμV)	TR Entry (Error)	Limit
1000	______	______	28-1	+4.5 ±1.0
100	______	______	28-2	0 (Ref)
20	______	______	28-3	−6.5 ±1.0
10	______	______	28-4	−10.0 ±1.5
2	______	______	28-5	−20.5 ±2.0
1	______	______	28-6	−22.5 ±2.0
Isolated pulse	______	______	28-7	−23.5 ±2.0
Repetition Frequency	**Relative Equivalent Level of Pulse Bands C and D (120 kHz EMI BW)**			
(Hz)	Measured (dBμV)	Reference (dBμV)	TR Entry (Error)	Limit
1000	______	______	28-8	+8.0 ±1.0
100	______	______	28-9	0 (Ref)
20	______	______	28-10	−9.0 ±1.0
10	______	______	28-11	−14.0 ±1.5
2	______	______	28-12	−26.0 ±2.0
1	______	______	28-13	−28.5 ±2.0
Isolated pulse	______	______	28-14	−31.5 ±2.0
Repetition Frequency	**Relative Equivalent Level of Pulse Band A (200 Hz EMI BW)**			
(Hz)	Measured (dBμV)	Reference (dBμV)	TR Entry (Error)	Limit
100	______	______	28-15	+4.0 ±1.0
60	______	______	28-16	+3.0 ±1.0
25	______	______	28-17	0 (Ref)
10	______	______	28-18	−4.0 ±1.0
5	______	______	28-19	−7.5 ±1.5
2	______	______	28-20	−13.0 ±2.0
1	______	______	28-21	−17.0 ±2.0
Isolated pulse	______	______	28-22	−19.0 ±2.0

29. Gate Delay Accuracy and Gate Length Accuracy

This procedure is only for spectrum analyzers equipped with Option 105.

The method used for measuring the gate length times is determined by the length of the gate. Shorter gate-length times are measured with an oscilloscope, and longer gate-length times are measured with a counter.

For shorter gate-length times, the output signal of a pulse generator is used to trigger the gate circuitry. To measure the gate delay, Δt markers are used. There is often up to 1 μs of jitter due to the 1 μs resolution of the gate delay clock. The "define measure" feature of the oscilloscope is used to measure and calculate the average length of the gate output automatically.

For longer gate-length times, a counter is used to measure the time period from the rising edge of the gate output to its falling edge. Because the gate-length time is equivalent to the clock accuracy of the spectrum analyzer, the gate-length time is compared to the specification for clock accuracy.

There are no related adjustments for this procedure.

Equipment Required

Universal counter
Pulse/function generator
Digitizing oscilloscope
Cable, BNC, 120 cm (48 in) *(four required)*
Adapter, BNC tee (m) (f) (f) *(two required)*

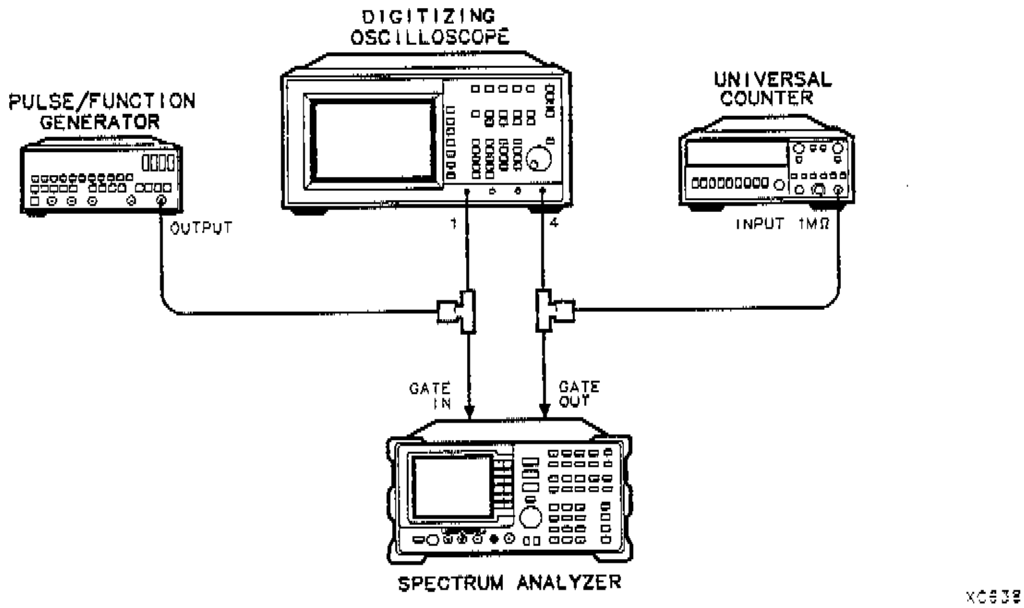

Figure 1-37. Gate Delay and Gate Length Test Setup

Procedure

To determine small gate delay and gate length (jitter-term)

1. Connect the equipment as shown in Figure 1-37.
2. Press (PRESET) on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   (SPAN) ZERO SPAN

   (SWEEP) 20 (ms) GATE ON OFF (underline ON) GATE MENU GATE DELAY 1 (μs)

   GATE LENGTH 1 (μs)

3. Activate the square wave output on the function generator.
4. Set the pulse/function generator controls as follows:

   MODE .... NORM
   FRQ .... 100 Hz
   DTY 50%
   HIL .... 2.5 V
   LOL .... 0.0 V

5. Press the following keys on the oscilloscope:

   (RECALL)
   (CLEAR)
   (DISPLAY)
     off frame axes grid .... highlight grid
     connect dots off on .... highlight on
   (TRIG)
     source 1 2 3 4 .... highlight 4
     level .... 2 V
   (TIMEBASE) .... 500 ηs/div
   (CHAN)
     CHANNEL 1 2 3 4 off on
       highlight CHANNEL 1 on
         set V/div to 1 V and offset to 2 V
       highlight CHANNEL 4 on
         set V/div to 1 V and offset to 3 V
   (DISPLAY)
     DISPLAY norm avg env .... highlight env

6. Press (CLEAR DISPLAY) on the oscilloscope. Wait for the trace to fill in, then press the following keys:

   (Δt ΔV)
   Δt markers off on .... highlight on
   stop marker .... 0 μs

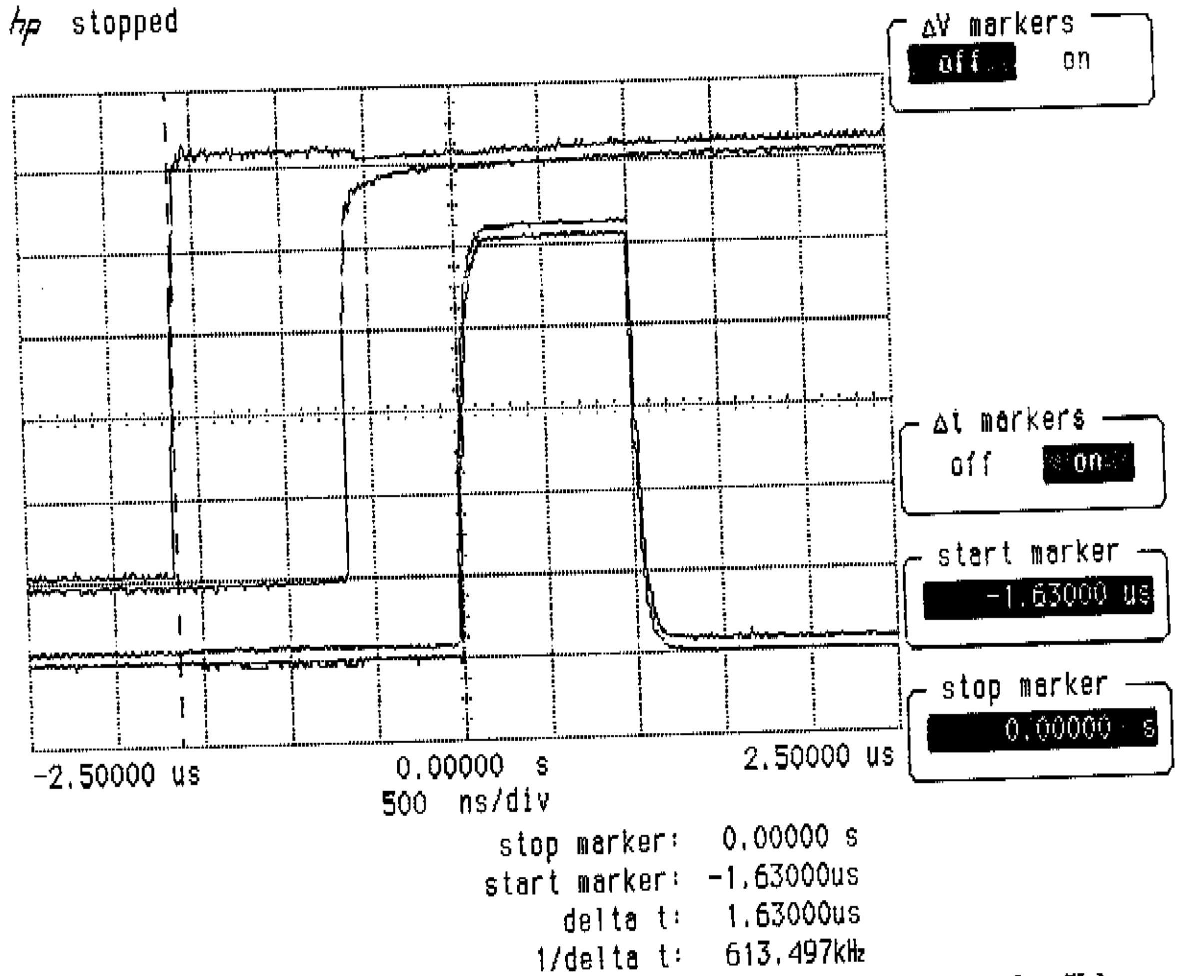

Figure 1-38. Oscilloscope Display of Minimum and Maximum Gate Delay Values

To record the minimum and maximum gate delay values

7. On the oscilloscope, press start marker. Use the knob to position the start marker on the right edge of the upper trace on the oscilloscope display. Figure 1-38 shows position for maximum gate delay.
8. Record the Δt value of the start marker reading as the MIN Gate Delay in TR Entry 29-1 of the performance verification test record. The expected value is greater than 0.0 μs, but less than 2.0 μs.
9. Use the oscilloscope knob to position the start marker on the left edge of the upper trace.
10. Record the Δt value of the start marker reading as the MAX Gate Delay in TR Entry 29-2 of the performance verification test record. The expected value is greater than 0.0 μs, but less than 2.0 μs.

To determine small gate length

11. Press the following keys on the oscilloscope:

    (BLUE) (+WIDTH) 4

    (DEFINE MEAS)

    statistics off on .... highlight ON

12. Read the average +width (4) displayed on the oscilloscope in the bottom right-hand annotation area.
13. Record this value as the 1 μs Gate Length value in TR Entry 29-3 of the performance verification test record. The 1μs gate length minimum width should be greater than 800 ηs and maximum width should be less than 1200 ηs.

To determine large gate length (clock accuracy term)

14. Press the following spectrum analyzer keys:

    (SWEEP) 150 (ms) GATE MENU GATE DELAY 10 (ms) GATE LENGTH 65 (ms)

15. Set the universal counter controls as follows:

    TI .... A → B
    GATE TIME delay .... mid-range
    CHANNEL A .... rising edge, dc couple, SENSITIVITY mode
    CHANNEL B .... falling edge, dc couple, SENSITIVITY mode
    COM A

16. Adjust LEVEL/SENS on the universal counter for best triggering.
17. Record the universal counter readout value as the 65 ms Gate Length in TR Entry 29-4 of the performance verification test record. The minimum gate length width should be greater than 64.99 ms and maximum width should be less than 65.01 ms.

30. Gate Card Insertion Loss

This procedure is only for spectrum analyzers equipped with Option 105.

Use this procedure to verify that the insertion loss for the Option 105 card is within the specifications. See the specifications in Chapter 2 for the log and linear scale additional amplitude error due to Gate-On enabled. The insertion loss is measured as follows:

1. HIGH SWEEP output on the spectrum analyzer is connected to GATE INPUT to provide a trigger signal for the gate circuitry.
2. The gate is turned off and a marker reading is taken.
3. The gate is then turned on and the synthesizer/level generator amplitude is adjusted to match the marker reading taken while the gate was off.

The difference between the two synthesizer/level generator readings is the measured insertion loss of the gate card.

Equipment Required

Synthesizer/level generator
Cable, BNC, 122 cm (48 in) *(two required)*

Additional Equipment for Option 001

Cable, BNC, 75 Ω, 120 cm (48 in)

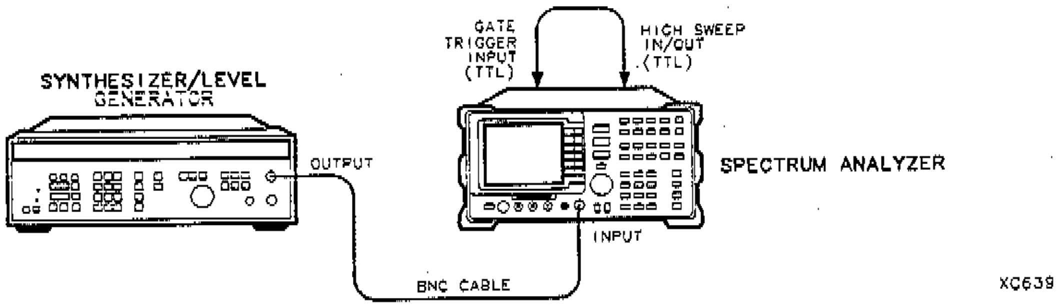

Figure 1-39. Gate Delay and Gate Length Test Setup

Procedure

To determine the card insertion loss

1. Connect the equipment as shown in Figure 1-39.

   Option 001 only: Attach the 75 Ω cable to the spectrum analyzer RF input connector rather than the 50 Ω cable.)

2. Set the synthesizer/level generator controls as follows:

   FREQUENCY .... 50 MHz
   AMPTD INCR .... 0.01 dB
   AMPLITUDE .... −5 dBm

3. On the spectrum analyzer, press (PRESET). Wait for preset to complete.

4. Press the following spectrum analyzer keys:

   (FREQUENCY) 50 (MHz)
   (SPAN) 1 (MHz)
   (BW) 100 (kHz)
   (SWEEP) 100 (ms) GATE ON OFF (underline OFF) GATE MENU GATE DELAY 20 (ms)
   GATE LENGTH 65 (ms)
   (PEAK SEARCH) MARKER DELTA
   (SWEEP) GATE ON OFF (underline ON)
   (PEAK SEARCH)

5. Use the step INCR (⇧) or (⇩) key on the synthesizer/level generator to adjust the output amplitude for a spectrum analyzer MKR Δ reading of 0.0 ±0.05 dB.

6. Record the amplitude displayed on the synthesizer/level generator as the Synthesizer/Level Generator Reading.

   Synthesizer/Level Generator Reading ______________

7. Subtract the synthesizer/level generator from the previous step from −5.0 dBm. Record the result as the Gate Card Insertion loss in TR Entry 30-1 of the performance verification test record. The insertion loss should be between −3.0 dB and +3.0 dB.

   For example, if the synthesizer/level generator reading is −4.96 dBm, then the result is −0.04 dBm as shown below:

   −5.0 dB minus the synthesizer reading is equal to the Gate Card Insertion Loss

   (−5.0) − (−4.96) = −0.04 dBm

Performance Verification Test Record

Table 1-41. Performance Verification Test Record (page 1 of 12)

Hewlett-Packard Company

Address: ______________________

____

____

Report No. ______________________

Date ______________________

(e.g. 10 SEP 1989)

Model HP 8591E

Serial No. ______________________

Options ______________________

Firmware Revision ______________________

Customer ______________________

Tested by ______________________

Ambient temperature __________ °C

Relative humidity __________ %

Power mains line frequency __________ Hz (nominal)

Test Equipment Used:

Description	Model No.	Trace No.	Cal Due Date
Synthesized Sweeper			
Synthesizer/Function Generator			
Synthesizer/Level Generator			
AM/FM Signal Generator			
Measuring Receiver			
Power Meter			
RF Power Sensor			
High-Sensitivity Power Sensor			
Pulse Generator (Option 103)			
Microwave Frequency Counter			
Universal Frequency Counter			
Frequency Standard			
Power Splitter			
Minimum Loss Adapter (Options 001 and 011 only)			
50 MHz Low Pass Filter			
50Ω Termination			
75Ω Termination (Options 001 and 011 only)			
Microwave Spectrum Analyzer (Options 010 and 011 only)			

Notes/Comments:

____

____

____

____

Performance Verification Test Record (page 2 of 12)

Hewlett-Packard Company Model HP 8591E	Report No. ______________
Serial No. ______________	Date ______________

Test Description	Results Measured Min.	Results Measured (TR Entry)	Results Measured Max.	Measurement Uncertainty
1. 10 MHz Reference Accuracy				
		Frequency Error		
Settability	−150 Hz	**(1-1)** ______	+150 Hz	$\pm 4.2 \times 10^{-9}$
2. 10 MHz Reference Accuracy for Option 004		Frequency Error		
5 Minute Warmup Error	-1×10^{-7}	**(2-1)** ______	$+1 \times 10^{-7}$	$\pm 2.004 \times 10^{-9}$
30 Minute Warmup Error	-1×10^{-8}	**(2-2)** ______	$+1 \times 10^{-8}$	$\pm 2.002 \times 10^{-9}$
3. Frequency Readout Accuracy and Marker Count Accuracy				
Frequency Readout Accuracy		Frequency (MHz)		
SPAN				
20 MHz	1.49918	**(3-1)** ______	1.50082	±1 Hz
10 MHz	1.49958	**(3-2)** ______	1.50042	±1 Hz
1 MHz	1.4999680	**(3-3)** ______	1.500032	±1 Hz
Option 130 only:				
20 kHz	1.49999924	**(3-4)** ______	1.50000076	±1 Hz
Marker Count Accuracy				
SPAN				
(CNT RES = 10 Hz) 1 MHz	1.49999989	**(3-5)** ______	1.50000011	±1 Hz
(CNT RES = 100 Hz) 20 MHz	1.4999989	**(3-6)** ______	1.5000011	±1 Hz
Option 130 only:				
20 kHz	1.49999989	**(3-7)** ______	1.50000011	±1 Hz
4. Noise Sidebands				
Suppression at 10 kHz		**(4-1)** ______	−60 dBc	±1.0 dB
Suppression at 20 kHz		**(4-2)** ______	−70 dBc	±1.0 dB
Suppression at 30 kHz		**(4-3)** ______	−75 dBc	±1.0 dB
5. System Related Sidebands				
Sideband Below Signal		**(5-1)** ______	−65 dBc	±1.0 dB
Sideband Above Signal		**(5-2)** ______	−65 dBc	±1.0 dB
6. Frequency Span Readout Accuracy				
SPAN		MKRΔ Reading		
1800 MHz	1446.00 MHz	**(6-1)** ______	1554.00 MHz	±6.37 MHz
10.10 MHz	7.70 MHz	**(6-2)** ______	8.30 MHz	±35.4 kHz
10.00 MHz	7.80 MHz	**(6-3)** ______	8.20 MHz	±3.54 kHz
100.00 kHz	78.00 kHz	**(6-4)** ______	82.00 kHz	±354 Hz
99.00 kHz	78.00 kHz	**(6-5)** ______	82.06 kHz	±354 Hz
10.00 kHz	7.80 kHz	**(6-6)** ______	8.20 kHz	±3.54 Hz
Option 130 only:				
1.00 kHz	0.78 kHz	**(6-7)** ______	0.82 kHz	±354 Hz

Performance Verification Test Record (page 3 of 12)

Hewlett-Packard Company Model HP 8591E	Report No. ______________
Serial No. ______________	Date ______________

Test Description	Results Measured Min.	Results Measured (TR Entry)	Results Measured Max.	Measurement Uncertainty
7. Residual FM		(7-1) ________	250 Hz	±45.8 Hz
Option 130 only:		(7-2) ________	30 Hz	±3.5 Hz
8. Sweep Time Accuracy				
SWEEP TIME		MKRΔ Reading		
20 ms	15.4 ms	(8-1) ________	16.6 ms	±0.057 ms
100 ms	77.0 ms	(8-2) ________	83.0 ms	±0.283 ms
1 s	770.0 ms	(8-3) ________	830.0 ms	±2.53 ms
10 s	7.7 s	(8-4) ________	8.3 s	±23.8 ms
9. Scale Fidelity				
Log Mode		Cumulative Error		
dB from Ref Level				
0	0 (Ref)	0 (Ref)	0 (Ref)	
−4	−4.34 dB	(9-1) ________	+3.66 dB	±0.06 dB
−8	−8.38 dB	(9-2) ________	−7.62 dB	±0.06 dB
−22	−12.42 dB	(9-3) ________	−11.58 dB	±0.06 dB
−16	−16.46 dB	(9-4) ________	−15.54 dB	±0.06 dB
−20	−20.50 dB	(9-5) ________	−19.50 dB	±0.06 dB
−24	−24.54 dB	(9-6) ________	−23.46 dB	±0.06 dB
−28	−28.58 dB	(9-7) ________	−27.42 dB	±0.06 dB
−32	−32.62 dB	(9-8) ________	−31.38 dB	±0.06 dB
−36	−36.66 dB	(9-9) ________	−35.34 dB	±0.06 dB
−40	−40.70 dB	(9-10) ________	−39.30 dB	±0.06 dB
−44	−44.74 dB	(9-11) ________	−43.26 dB	±0.06 dB
−48	−48.78 dB	(9-12) ________	−47.22 dB	±0.06 dB
−52	−52.82 dB	(9-13) ________	−51.18 dB	±0.06 dB
−56	−56.86 dB	(9-14) ________	−55.14 dB	±0.06 dB
−60	−60.90 dB	(9-15) ________	−59.10 dB	±0.11 dB
−64	−64.94 dB	(9-16) ________	−63.06 dB	±0.11 dB
−68	−68.98 dB	(9-17) ________	−67.02 dB	±0.11 dB

Performance Verification Test Record (page 4 of 12)

Hewlett-Packard Company Model HP 8591E	Report No. ______________
Serial No. ______________	Date ______________

Test Description	Results Measured Min.	Results Measured (TR Entry)	Results Measured Max.	Measurement Uncertainty
9. Scale Fidelity (continued)				
Log Mode		Incremental Error		
dB from Ref Level				
0	0 (Ref)	0 (Ref)	0 (Ref)	
−4	−0.4 dB	**(9-18)** ______	+0.4 dB	±0.06 dB
−8	−0.4 dB	**(9-19)** ______	+0.4 dB	±0.06 dB
−12	−0.4 dB	**(9-20)** ______	+0.4 dB	±0.06 dB
−16	−0.4 dB	**(9-21)** ______	+0.4 dB	±0.06 dB
−20	−0.4 dB	**(9-22)** ______	+0.4 dB	±0.06 dB
−24	−0.4 dB	**(9-23)** ______	+0.4 dB	±0.06 dB
−28	−0.4 dB	**(9-24)** ______	+0.4 dB	±0.06 dB
−32	−0.4 dB	**(9-25)** ______	+0.4 dB	±0.06 dB
−36	−0.4 dB	**(9-26)** ______	+0.4 dB	±0.06 dB
−40	−0.4 dB	**(9-27)** ______	+0.4 dB	±0.06 dB
−44	−0.4 dB	**(9-28)** ______	+0.4 dB	±0.06 dB
−48	−0.4 dB	**(9-29)** ______	+0.4 dB	±0.06 dB
−52	−0.4 dB	**(9-30)** ______	+0.4 dB	±0.06 dB
−56	−0.4 dB	**(9-31)** ______	+0.4 dB	±0.06 dB
−60	−0.4 dB	**(9-32)** ______	+0.4 dB	±0.11
Option 130 only:				
Log Mode		Cumulative Error		
dB from Ref Level				
0	0 (Ref)	0 (Ref)	0 (Ref)	
−4	−4.44 dB	**(9-33)** ______	+3.56 dB	±0.06 dB
−8	−8.48 dB	**(9-34)** ______	−7.52 dB	±0.06 dB
−12	−12.52 dB	**(9-35)** ______	−11.48 dB	±0.06 dB
−16	−16.56 dB	**(9-36)** ______	−15.44 dB	±0.06 dB
−20	−20.60 dB	**(9-37)** ______	−19.40 dB	±0.06 dB
−24	−24.64 dB	**(9-38)** ______	−23.36 dB	±0.06 dB
−28	−28.68 dB	**(9-39)** ______	−27.32 dB	±0.06 dB
−32	−32.72 dB	**(9-40)** ______	−31.28 dB	±0.06 dB
−36	−36.76 dB	**(9-41)** ______	−35.24 dB	±0.06 dB
−40	−40.80 dB	**(9-42)** ______	−39.20 dB	±0.06 dB
−44	−44.84 dB	**(9-43)** ______	−43.16 dB	±0.06 dB
−48	−48.88 dB	**(9-44)** ______	−47.12 dB	±0.06 dB
−52	−52.92 dB	**(9-45)** ______	−51.08 dB	±0.06 dB
−56	−56.96 dB	**(9-46)** ______	−55.04 dB	±0.06 dB
−60	−61.00 dB	**(9-47)** ______	−59.00 dB	±0.11 dB
−64	−65.04 dB	**(9-48)** ______	−62.96 dB	±0.11 dB
−68	−69.08 dB	**(9-49)** ______	−66.92 dB	±0.11 dB

Performance Verification Test Record (page 5 of 12)

Hewlett-Packard Company Model HP 8591E	Report No. ____________
Serial No. ____________	Date ____________

Test Description	Results Measured Min.	Results Measured (TR Entry)	Results Measured Max.	Measurement Uncertainty
9. Scale Fidelity (continued)				
Option 130 only:				
Log Mode		Incremental Error		
dB from Ref Level				
0	0 (Ref)	0 (Ref)	0 (Ref)	
−4	−0.4 dB	**(9-50)** ________	+0.4 dB	±0.06 dB
−8	−0.4 dB	**(9-51)** ________	+0.4 dB	±0.06 dB
−12	−0.4 dB	**(9-52)** ________	+0.4 dB	±0.06 dB
−16	−0.4 dB	**(9-53)** ________	+0.4 dB	±0.06 dB
−20	−0.4 dB	**(9-54)** ________	+0.4 dB	±0.06 dB
−24	−0.4 dB	**(9-55)** ________	+0.4 dB	±0.06 dB
−28	−0.4 dB	**(9-56)** ________	+0.4 dB	±0.06 dB
−32	−0.4 dB	**(9-57)** ________	+0.4 dB	±0.06 dB
−36	−0.4 dB	**(9-58)** ________	+0.4 dB	±0.06 dB
−40	−0.4 dB	**(9-59)** ________	+0.4 dB	±0.06 dB
−44	−0.4 dB	**(9-60)** ________	+0.4 dB	±0.06 dB
−48	−0.4 dB	**(9-61)** ________	+0.4 dB	±0.06 dB
−52	−0.4 dB	**(9-62)** ________	+0.4 dB	±0.06 dB
−56	−0.4 dB	**(9-63)** ________	+0.4 dB	±0.06 dB
−60	−0.4 dB	**(9-64)** ________	+0.4 dB	±0.11 dB
Linear Mode				
% of Ref Level				
100.00	0 (Ref)	0 (Ref)	0 (Ref)	
70.70	151.59 mV	**(9-65)** ________	165.01 mV	±1.84 mV
50.00	105.36 mV	**(9-66)** ________	118.78 mV	±1.84 mV
35.48	72.63 mV	**(9-67)** ________	86.05 mV	±1.84 mV
25.00	49.46 mV	**(9-68)** ________	82.88 mV	±1.84 mV
Option 130 only:				
% of Ref Level				
100.00	0 (Ref)	0 (Ref)	0 (Ref)	
70.70	151.59 mV	**(9-69)** ________	165.01 mV	±1.84 mV
50.00	105.36 mV	**(9-70)** ________	118.78 mV	±1.84 mV
35.48	72.63 mV	**(9-71)** ________	86.05 mV	±1.84 mV
25.00	49.46 mV	**(9-72)** ________	82.88 mV	±1.84 mV
Log-to-Linear Switching	−0.25 dB	**(9-73)** ________	+0.25 dB	±0.05 dB
Option 130 only:	−0.25 dB	**(9-74)** ________	+0.25 dB	±0.05 dB

Performance Verification Test Record (page 6 of 12)

Hewlett-Packard Company Model HP 8591E	Report No. ________________
Serial No. ________________	Date ________________

Test Description	Results Measured			Measurement
	Min.	(TR Entry)	Max.	Uncertainty
10. Reference Level Accuracy				
Log Mode				
Reference Level (dBm)				
−20	0 (Ref)	0 (Ref)	0 (Ref)	
−10	−0.40 dB	**(10-1)** ________	+0.40 dB	±0.06 dB
0	−0.50 dB	**(10-2)** ________	+0.50 dB	±0.06 dB
−30	−0.40 dB	**(10-3)** ________	+0.40 dB	±0.06 dB
−40	−0.50 dB	**(10-4)** ________	+0.50 dB	±0.08 dB
−50	−0.80 dB	**(10-5)** ________	+0.80 dB	±0.08 dB
−60	−1.00 dB	**(10-6)** ________	+1.00 dB	±0.12 dB
−70	−1.10 dB	**(10-7)** ________	+1.10 dB	±0.12 dB
−80	−1.20 dB	**(10-8)** ________	+1.20 dB	±0.12 dB
−90	−1.30 dB	**(10-9)** ________	+1.30 dB	±0.12 dB
Linear Mode				
Reference Level (dBm)				
−20	0 (Ref)	0 (Ref)	0 (Ref)	
−10	−0.40 dB	**(10-10)** ________	+0.40 dB	±0.06 dB
0	−0.50 dB	**(10-11)** ________	+0.50 dB	±0.06 dB
−30	−0.40 dB	**(10-12)** ________	+0.40 dB	±0.06 dB
−40	−0.50 dB	**(10-13)** ________	+0.50 dB	±0.08 dB
−50	−0.80 dB	**(10-14)** ________	+0.80 dB	±0.08 dB
−60	−1.00 dB	**(10-15)** ________	+1.00 dB	±0.12 dB
−70	−1.10 dB	**(10-16)** ________	+1.10 dB	±0.12 dB
−80	−1.20 dB	**(10-17)** ________	+1.20 dB	±0.12 dB
−90	−1.30 dB	**(10-18)** ________	+1.30 dB	±0.12 dB
Option 130 only:				
Log Mode				
Reference Level (dBm)				
−20	0 (Ref)	0 (Ref)	0 (Ref)	
−10	−0.40 dB	**(10-19)** ________	+0.40 dB	±0.06 dB
0	−0.50 dB	**(10-20)** ________	+0.50 dB	±0.06 dB
−30	−0.50 dB	**(10-21)** ________	+0.50 dB	±0.06 dB
−40	−0.50 dB	**(10-22)** ________	+0.50 dB	±0.08 dB
−50	−0.80 dB	**(10-23)** ________	+0.80 dB	±0.08 dB
−60	−1.20 dB	**(10-24)** ________	+1.10 dB	±0.12 dB
−70	−1.20 dB	**(10-25)** ________	+1.20 dB	±0.12 dB
−80	−1.30 dB	**(10-26)** ________	+1.30 dB	±0.12 dB
−90	−1.40 dB	**(10-27)** ________	+1.40 dB	±0.12 dB

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Hewlett-Packard Company Model HP 8591E	Report No. ____________
Serial No. ____________	Date ____________

Test Description	Results Measured			Measurement
	Min.	(TR Entry)	Max.	Uncertainty
10. Reference Level Accuracy (continued)				
Option 130 only:				
Linear Mode				
Reference Level (dBm)				
−20	0 (Ref)	0 (Ref)	0 (Ref)	
−10	−0.40 dB	**(10-28)** ________	+0.40 dB	±0.06 dB
0	−0.50 dB	(10-29) ________	+0.50 dB	±0.06 dB
−30	−0.50 dB	**(10-30)** ________	+0.50 dB	±0.06 dB
−40	−0.50 dB	**(10-31)** ________	+0.50 dB	±0.08 dB
−50	−0.80 dB	**(10-32)** ________	+0.80 dB	±0.08 dB
−60	−1.20 dB	(10-33) ________	+1.10 dB	±0.12 dB
−70	−1.20 dB	**(10-34)** ________	+1.20 dB	±0.12 dB
−80	−1.30 dB	**(10-35)** ________	+1.30 dB	±0.12 dB
−90	−1.40 dB	**(10-36)** ________	+1.40 dB	±0.12 dB
11. Absolute Amplitude **Calibration and Resolution Bandwidth Switching** Uncertainties				
Absolute Amplitude Uncertainty	−20.15 dB	**(11-1)** ________	−19.85 dB	N/A
Resolution Bandwidth Switching Uncertainty				
Resolution Bandwidth				
3 kHz	0 (Ref)	0 (Ref)	0 (Ref)	
1 kHz	−0.5 dB	**(11-2)** ________	+0.5 dB	+0.07/−0.08 dB
9 kHz	−0.4 dB	**(11-3)** ________	+0.4 dB	+0.07/−0.08 dB
10 kHz	−0.4 dB	(11-4) ________	+0.4 dB	+0.07/−0.08 dB
30 kHz	−0.4 dB	(11-5) ________	+0.4 dB	+0.07/−0.08 dB
100 kHz	−0.4 dB	(11-6) ________	+0.4 dB	+0.07/−0.08 dB
120 kHz	−0.4 dB	**(11-7)** ________	+0.4 dB	+0.07/−0.08 dB
300 kHz	−0.4 dB	**(11-8)** ________	+0.4 dB	+0.07/−0.08 dB
1 MHz	−0.4 dB	**(11-9)** ________	+0.4 dB	+0.07/−0.08 dB
3 MHz	−0.4 dB	**(11-10)** ________	+0.4 dB	+0.07/−0.08 dB
Option 130 only:				
3 kHz	0 (Ref)	0 (Ref)	0 (Ref)	
300 Hz	−0.6 dB	**(11-11)** ________	+0.6 dB	+0.07/−0.08 dB
200 Hz	−0.6 dB	**(11-12)** ________	+0.6 dB	+0.07/−0.08 dB
100 Hz	−0.6 dB	**(11-13)** ________	+0.6 dB	+0.07/−0.08 dB
30 Hz	−0.6 dB	**(11-14)** ________	+0.6 dB	+0.07/−0.08 dB

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Hewlett-Packard Company Model HP 8591E	Report No. ______
Serial No. ______	Date ______

Test Description	Results Measured			Measurement
	Min.	(TR Entry)	Max.	Uncertainty
12. Resolution Bandwidth Accuracy				
3 dB Resolution Bandwidth				
3 MHz	2.4 MHz	(12-1) ______	3.6 MHz	±138 kHz
1 MHz	0.8 MHz	(12-2) ______	1.2 MHz	±46 kHz
300 kHz	240 kHz	(12-3) ______	360 kHz	±13.8 kHz
100 kHz	80 kHz	(12-4) ______	120 kHz	±4.6 kHz
30 kHz	24 kHz	(12-5) ______	36 kHz	±1.38 kHz
10 kHz	8 kHz	(12-6) ______	12 kHz	±460 Hz
3 kHz	2.4 kHz	(12-7) ______	3.6 kHz	±138 Hz
1 kHz	0.8 kHz	(12-8) ______	1.2 kHz	±46 Hz
6 dB EMI Bandwidth				
9 kHz	7.2 kHz	(12-9) ______	10.8 kHz	±333 Hz
120 kHz	96 kHz	(12-10) ______	144 kHz	±4.44 kHz
Option 130 only:				
300 Hz	240 Hz	(12-11) ______	360 Hz	±36 Hz
100 Hz	80 Hz	(12-12) ______	120 Hz	±12 Hz
30 Hz	24 Hz	(12-13) ______	36 Hz	±3.9 Hz
200 Hz	160 Hz	(12-14) ______	240 Hz	±24 Hz
13. Calibrator Amplitude Accuracy				
	−20.4 dBm	(13-1) ______	−19.6 dBm	±0.2 dB
Option 001 only:	+28.35 dBmV	(13-2) ______	+29.15 dBmV	±0.2 dB
14. Frequency Response				
Max Positive Response		(14-1) ______	+1.5 dB	+0.32/−0.33 dB
Max Negative Response	−1.5 dB	(14-2) ______		+0.32/−0.33 dB
Peak-to-Peak Response		(14-3) ______	2.0 dB	+0.32/−0.33 dB
15. Other Input Related Spurious Responses				
542.8 MHz		(15-1) ______	−55 dBc	±1.0 dB
1142.8 MHz		(15-2) ______	−55 dBc	±1.0 dB
16. Spurious Responses				
Second Harmonic Distortion		(16-1) ______	−45 dBc	+1.86/−2.27 dB
Third Order Intermodulation Distortion		(16-2) ______	−54 dBc	+2.07/−2.42 dB
17. Gain Compression				
		(17-1) ______	0.5 dB	+0.21/−0.22 dB
Option 130 only:		(17-2) ______	0.5 dB	+0.21/−0.22 dB

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Hewlett-Packard Company Model HP 8591E	Report No. ______________
Serial No. ______________	Date ______________

Test Description	Results Measured			Measurement
	Min.	(TR Entry)	Max.	Uncertainty
18. Displayed Average Noise				
Frequency				
400 kHz		(18-1) ______	−115 dBm	+1.15/−1.25 dB
1 MHz		(18-2) ______	−115 dBm	+1.15/−1.25 dB
1 MHz to 1.5 GHz		(18-3) ______	−115 dBm	+1.15/−1.25 dB
1.5 GHz to 1.8 GHz		(18-4) ______	−113 dBm	+1.15/−1.25 dB
Option 001 only:				
Frequency				
1 MHz		(18-2) ______	−63 dBmV	+1.15/−1.25 dB
1 MHz to 1.5 GHz		(18-3) ______	−63 dBmV	+1.15/−1.25 dB
1.5 GHz to 1.8 GHz		(18-4) ______	−61 dBmV	+1.15/−1.25 dB
19. Displayed Average Noise for Option 130				
Frequency				
400 kHz		(19-1) ______	−130 dBm	+1.15/−1.25 dB
1 MHz		(19-2) ______	−130 dBm	+1.15/−1.25 dB
1 MHz to 1.5 GHz		(19-3) ______	−130 dBm	+1.15/−1.25 dB
1.5 GHz to 1.8 GHz		(19-4) ______	−128 dBm	+1.15/−1.25 dB
Option 001 only:				
Frequency				
1 MHz		(19-2) ______	−78 dBmV	+1.15/−1.25 dB
1 MHz to 1.5 GHz		(19-3) ______	−78 dBmV	+1.15/−1.25 dB
1.5 GHz to 1.8 GHz		(19-4) ______	−76 dBmV	+1.15/−1.25 dB
20. Residual Responses				
150 kHz to 1.8 GHz		(20-1) ______	−90 dBm	+1.09/−1.15 dB
Option 001 only:				
1 MHz to 1.8 GHz		(20-1) ______	−38 dBmV	+1.09/−1.15 dB
21. Residual Responses for Option 130				
150 kHz to 1.8 GHz		(21-1) ______	−90 dBm	+1.09/−1.15 dB
Option 001 only:				
1 MHz to 1.8 GHz		(21-1) ______	−38 dBmV	+1.09/−1.15 dB

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Hewlett-Packard Company Model HP 8591E	Report No. ______________
Serial No. ______________	Date ______________

Test Description	Results Measured			Measurement
	Min.	(TR Entry)	Max.	Uncertainty
22. Fast Time Domain Sweeps				
Option 101 only:				
Amplitude Resolution	0.933X	______________	1.007X	0%
SWEEP TIME				
18 ms	14.04 ms	(22-1) ______________	14.76 ms	±0.5%
10 ms	7.80 ms	(22-2) ______________	8.20 ms	±0.5%
1.0 ms	780 μs	(22-3) ______________	820 μs	±0.5%
100 μs	78 μs	(22-4) ______________	82 μs	±0.5%
20 μs	15.6 μs	(22-5) ______________	16.4 μs	±0.5%
23. Absolute Amplitude, Vernier, and Power Sweep Accuracy				
Option 010 or 011 only:				
Absolute Amplitude Accuracy	−1.0 dB	(23-1) ______________	+1.0 dB	+0.25/−0.26 dB
Positive Vernier Accuracy		(23-2) ______________	+0.75 dB	±0.033 dB
Negative Vernier Accuracy	−0.75 dB	(23-3) ______________		±0.033 dB
Power Sweep Accuracy		(23-4) ______________	1.5 dB	±0.033 dB
24. Tracking Generator Level Flatness				
Option 010 only:				
Maximum Flatness				
100 kHz		(24-1) ______________	+1.75 dB	+0.42/−0.45 dB
300 kHz to 5 MHz		(24-2) ______________	+1.75 dB	+0.28/−0.28 dB
10 MHz to 1800 MHz		(24-3) ______________	+1.75 dB	+0.24/−0.24 dB
Minimum Flatness				
100 kHz	−1.75 dB	(24-4) ______________		+0.42/−0.45 dB
300 kHz to 5 MHz	−1.75 dB	(24-5) ______________		+0.28/−0.28 dB
10 MHz to 1800 MHz	−1.75 dB	(24-6) ______________		+0.24/−0.24 dB
Option 011 only:				
Maximum Flatness				
1 MHz to 1800 MHz		(24-1) ______________	+1.75 dB	+0.18/−0.39 dB
Minimum Flatness				
1 MHz to 1800 MHz	−1.75 dB	(24-2) ______________		+0.18/−0.39 dB

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Hewlett-Packard Company Model HP 8591E	Report No. ______
Serial No. ______	Date ______

Test Description	Results Measured			Measurement Uncertainty
	Min.	(TR Entry)	Max.	
25. Harmonic Spurious Outputs				
Option 010 or 011 only:				
2nd Harmonic Level		**(25-1)** ______	−25 dBc	+1.55/−1.80 dB
3rd Harmonic Level		**(25-2)** ______	−25 dBc	+1.55/−1.80 dB
26. Non-Harmonic Spurious Outputs				
Option 010 or 011 only:				
Highest Non-Harmonic Response Amplitude		**(26-1)** ______	−30 dBc	+1.55/−1.80 dB
27. Tracking Generator Feedthrough				
Option 010 only:		(27-1) ______	−106 dBm	+1.15/−1.24 dB
Option 011 only:		(27-1) ______	−57.24 dBmV	+1.15/−1.24 dB
28. CISPR Pulse Response				
Options 103 only:	Amplitude Error			
Relative Level, 9 kHz EMI BW				
Repetition Frequency				
1000	+5.5 dB	**(28-1)** ______	+3.5 dB	±0.17 dB
100	0 (Ref)	**(28-2)** ______	0 (Ref)	0 (Ref)
20	−5.5 dB	**(28-3)** ______	−7.5 dB	±0.27 dB
10	−8.5 dB	**(28-4)** ______	−11.5 dB	±0.25 dB
2	−18.5 dB	**(28-5)** ______	−22.5 dB	±0.23 dB
1	−20.5 dB	**(28-6)** ______	−24.5 dB	±0.19 dB
Isolated Pulse	−21.5 dB	**(28-7)** ______	−25.5 dB	±0.15 dB
Relative Level, 120 kHz EMI BW				
Repetition Frequency				
1000	+9.0 dB	**(28-8)** ______	+7.0 dB	±0.17 dB
100	0 (Ref)	**(28-9)** ______	0 (Ref)	0 (Ref)
20	−8.0 dB	**(28-10)** ______	−10.0 dB	±0.18 dB
10	−12.5 dB	**(28-11)** ______	−15.5 dB	±0.18 dB
2	−24.0 dB	**(28-12)** ______	−28.0 dB	±0.18 dB
1	−26.5 dB	**(28-13)** ______	−30.5 dB	±0.18 dB
Isolated Pulse	−29.5 dB	**(28-14)** ______	−33.5 dB	±0.17 dB

Performance Verification Test Record (page 12 of 12)

Hewlett-Packard Company Model HP 8591E	Report No. ____________
Serial No. ____________	Date ____________

Test Description	Results Measured			Measurement
	Min.	(TR Entry)	Max.	Uncertainty
28. CISPR Pulse Response (continued)				
Options 103 and 130 only:		Amplitude Error		
Relative Level, Band A				
Repetition Frequency				
100	3.0 dB	(28-15) ________	+5.0 dB	±0.24 dB
60	2.0 dB	(28-16) ________	5.0 dB	±0.26 dB
25	0 (Ref)	(28-17) ________	0 (Ref)	0 (Ref)
10	−3.0 dB	(28-18) ________	−5.0 dB	±0.29 dB
5	−6.0 dB	(28-19) ________	−9.0 dB	±0.30 dB
2	−11.0 dB	(28-20) ________	−15.0 dB	±0.36 dB
1	−20.5 dB	(28-21) ________	−24.5 dB	±0.28 dB
Isolated Pulse	−21.5 dB	(28-22) ________	−25.5 dB	±0.20 dB
29. Gate Delay Accuracy and Gate Length Accuracy				
Option 105 only:				
Minimum Gate Delay	0.0 μs	(29-1) ________	2.0 μs	±0.011 μs
Maximum Gate Delay	0.0 μs	(29-2) ________	2.0 μs	±0.011 μs
1 μs Gate Length	0.8 μs	(29-3) ________	1.2 μs	±0.434 μs
65 ms Gate Length	64.99 μs	(29-4) ________	65.01 μs	±0.434 μs
30. Gate Card Insertion Loss				
Option 105 only:				
Gate Card Insertion Loss	−3.0	(30-1) ________	+3.0	±0.092 dB

2

Specifications and Characteristics

This chapter contains specifications and characteristics for the HP 8591E spectrum analyzer.

The specifications and characteristics in this chapter are listed separately. The specifications are described first, then followed by the characteristics.

General	General specifications and characteristics.
Frequency	Frequency-related specifications and characteristics.
Amplitude	Amplitude-related specifications and characteristics.
Option	Option-related specifications and characteristics.
Physical	Input, output and physical characteristics.

The distinction between specifications and characteristics is described as follows.

- Specifications describe warranted performance over the temperature range 0 °C to +55 °C (unless otherwise noted). The spectrum analyzer will meet its specifications after 2 hours of storage at a constant temperature, within the operating temperature range, 30 minutes after the spectrum analyzer is turned on and after the CAL frequency, and CAL amplitude routines have been run.
- Characteristics provide useful, but nonwarranted information about the functions and performance of the spectrum analyzer. Characteristics are specifically identified.
- Typical Performance, where listed, is not warranted, but indicates performance that most units will exhibit.
- Nominal Value indicates the expected, but not warranted, value of the parameter.

General Specifications

All specifications apply over 0 °C to +55 °C. The analyzer will meet its specifications after 2 hours of storage at a constant temperature, within the operating temperature range, 30 minutes after the analyzer is turned on and after CAL FREQ and CAL AMPTD have been run.

Temperature Range	
Operating	0 °C to +55 °C
Storage	−40 °C to +75 °C

EMI Compatibility	Conducted and radiated emission is in compliance with CISPR Pub. 11/1990 Group 1 Class A.

Audible Noise	<37.5 dBA pressure and <5.0 Bels power (ISODP7779)

Power Requirements	
ON (LINE 1)	90 to 132 V rms, 47 to 440 Hz
	198 to 264 V rms, 47 to 66 Hz
	Power consumption <500 VA; <180 W
Standby (LINE 0)	Power consumption <5 W

Frequency Specifications

Frequency Range	
50 Ω	9 kHz to 1.8 GHz
75 Ω *(Option 001)*	1 MHz to 1.8 GHz

Frequency Reference	
Aging	$\pm 2 \times 10^{-6}$/year
Settability	$\pm 0.5 \times 10^{-6}$
Temperature Stability	$\pm 5 \times 10^{-6}$

Precision Frequency Reference *(Option 004)*	
Aging	$\pm 1 \times 10^{-7}$/year
Settability	$\pm 1 \times 10^{-8}$
Temperature Stability	$\pm 1 \times 10^{-8}$

Frequency Readout Accuracy	
(Start, Stop, Center, Marker)	±(frequency readout × frequency reference error* + span accuracy + 1% of span + 20% of RBW + 100 Hz)‡

* frequency reference error = (aging rate × period of time since adjustment + initial achievable accuracy + temperature stability). See "Frequency Characteristics."
‡ See "Drift" under "Stability" in Frequency Characteristics.

Marker Count Accuracy†	
Frequency Span ≤ 10 MHz	±(marker frequency × frequency reference error* + counter resolution + 100 Hz)
Frequency Span >10 MHz	±(marker frequency × frequency reference error* + counter resolution + 1 kHz)
Counter Resolution	
Frequency Span ≤ 10 MHz	Selectable from 10 Hz to 100 kHz
Frequency Span > 10 MHz	Selectable from 100 Hz to 100 kHz

* frequency reference error = (aging rate × period of time since adjustment + initial achievable accuracy and temperature stability). See "Frequency Characteristics."
† Marker level to displayed noise level > 25 dB, RBW ≥ 300 Hz, RBW/Span ≥ 0.01. Span ≤ 300 MHz. Widen RES BW annotation is displayed when RBW < 300 Hz. Reduce SPAN annotation is displayed when RBW/Span < 0.01.

Frequency Span	
Range	0 Hz (zero span), 10 kHz to 1.8 GHz
(Option 130)	0 Hz (zero span), 1 kHz to 1.8 GHz
Resolution	Four digits
Accuracy	
Span ≤ 10 MHz	±2% of span
Span > 10 MHz	±3% of span

Frequency Specifications

Frequency Sweep Time	
Range	
	20 ms to 100 s
(Option 101)	20 μs to 100 s for span = 0 Hz
Accuracy	
20 ms to 100 s	±3%
20 μs to <20 ms *(Option 101)*	±2%
Sweep Trigger	Free Run, Single, Line, Video, External

Resolution Bandwidth	1 kHz to 3 MHz, 8 selectable resolution (3 dB) bandwidths in 1-3-10 sequence. 9 kHz and 120 kHz (6 dB) EMI bandwidths.
(Option 130)	Adds 30, 100 and 300 Hz (3 dB) bandwidths and 200 Hz (6 dB) EMI bandwidth.
Bandwidth Accuracy	
3 dB bandwidths	±20%

Stability	
Noise Sidebands	(1 kHz RBW, 30 Hz VBW and sample detector)
>10 kHz offset from CW signal	≤−90 dBc/Hz
>20 kHz offset from CW signal	≤−100 dBc/Hz
>30 kHz offset from CW signal	≤−105 dBc/Hz
Residual FM	
1 kHz RBW, 1 kHz VBW	≤250 Hz pk-pk in 100 ms
30 Hz RBW, 30 Hz VBW *(Option 130)*	≤30 Hz pk-pk in 300 ms
System-Related Sidebands	
>30 kHz offset from CW signal	≤−65 dBc

Calibrator Output Frequency	300 MHz fundamental frequency
Accuracy	Frequency reference error*

* frequency reference error = (aging rate × period of time since adjustment + initial achievable accuracy + temperature stability). See "Frequency Characteristics."

Amplitude Specifications

Amplitude specifications do not apply for Analog+ mode and negative peak detector mode except as noted in "Amplitude Characteristics."

Amplitude Range	
50 Ω	−115 dBm to +30 dBm
50 Ω *(Option 130)*	−130 dBm to +30 dBm
75 Ω	−63 dBmV to +75 dBmV
75 Ω *(Options 001 and 130)*	−78 dBmV to +75 dBmV

Maximum Safe Input Level	(Input attenuator ≥10 dB)	
	50 Ω	**75 Ω** *(Option 001)*
Average Continuous Power	+30 dBm (1 W)	+75 dBmV (0.4 W)
Peak Pulse Power	+30 dBm (1 W)	+75 dBmV (0.4 W)
dc	25 Vdc	100 Vdc

Gain Compression‡	
>10 MHz	≤0.5 dB (total power at input mixer* = −10 dBm)

* Mixer Power Level (dBm) = Input Power (dBm) − Input Attenuation (dB).
‡ (Option 130) If RBW ≤ 300 Hz, this applies only if signal separation ≥ 4 kHz and signal amplitudes ≤ Reference Level + 10 dB.

Displayed Average Noise Level	(Input terminated, 0 dB attenuation, 30 Hz VBW, sample detector)	
1 kHz RBW	**50 Ω**	**75 Ω** *(Option 001)*
400 kHz to 1 MHz	≤−115 dBm	N/A
1 MHz to 1.5 GHz	≤−115 dBm	≤−63 dBmV
1.5 GHz to 1.8 GHz	≤−113 dBm	≤−61 dBmV
30 Hz RBW *(Option 130)*		
400 kHz to 1 MHz	≤−130 dBm	N/A
1 MHz to 1.5 GHz	≤−130 dBm	≤−78 dBmV
1.5 GHz to 1.8 GHz	≤−128 dBm	≤−76 dBmV

Spurious Responses	
Second Harmonic Distortion	
5 MHz to 1.8 GHz	<−70 dBc for −45 dBm tone at input mixer.*
Third Order Intermodulation Distortion	
5 MHz to 1.8 GHz	<−70 dBc for two −30 dBm tones at input mixer* and >50 kHz separation.
Other Input Related Spurious	<−65 dBc at ≥30 kHz offset, for −20 dBm tone at input mixer ≤1.8 GHz.

* Mixer Power Level (dBm) = Input Power (dBm) − Input Attenuation (dB).

Amplitude Specifications

Residual Responses	(Input terminated and 0 dB attenuation)	
	50 Ω	**75 Ω *(Option 001)***
150 kHz to 1 MHz	<−90 dBm	N/A
1 MHz to 1.8 GHz	<−90 dBm	<−38 dBmV

Display Range	
Log Scale	0 to −70 dB from reference level is calibrated;
	0.1, 0.2, 0.5 dB/division and 1 to 20 dB/division in 1 dB steps; eight divisions displayed.
Linear Scale	eight divisions
Scale Units	dBm, dBmV, dBμV, V, and W

Marker Readout Resolution	0.05 dB for log scale
	0.05% of reference level for linear scale
Fast Sweep Times for Zero Span	
20 μs to 20 ms *(Option 101 or 301)*	
Frequency ≤ 1 GHz	0.7% of reference level for linear scale
Frequency > 1 GHz	1.0% of reference level for linear scale

Reference Level	
Range	
Log Scale	Minimum amplitude to maximum amplitude**
Linear Scale	−99 dBm to maximum amplitude**
Resolution	
Log Scale	±0.01 dB
Linear Scale	±0.12% of reference level
Accuracy	(referenced to −20 dBm reference level, 10 dB input attenuation, at a single frequency, in a fixed RBW)
0 dBm to −59.9 dBm	±(0.3 dB + .01 × dB from −20 dBm)
−60 dBm and below	
1 kHz to 3 MHz RBW	±(0.6 dB + .01 × dB from −20 dBm)
30 Hz to 300 Hz RBW *(Option 130)*	±(0.7 dB + .01 × dB from −20 dBm)

** See "Amplitude Range."

Frequency Response	(10 dB input attenuation)	
	Absolute§	**Relative Flatness†**
	±1.5 dB	±1.0 dB

† Referenced to midpoint between highest and lowest frequency response deviations.
§ Referenced to 300 MHz CAL OUT.

Calibrator Output Amplitude	
50 Ω	−20 dBm ±0.4 dB
75 Ω *(Option 001)*	+28.75 dB mV ±0.4 dB

Option Specifications

Tracking Generator Specifications (Option 010 or 011)

All specifications apply over 0 °C to +55 °C. The spectrum-analyzer/tracking-generator combination will meet its specifications after 2 hours of storage at a constant temperature within the operating temperature range, 30 minutes after the spectrum-analyzer/tracking-generator is turned on and after CAL FREQ, CAL AMPTD, CAL TRK GEN, and TRACKING PEAK have been run.

Warm-Up	30 minutes

Output Frequency	
Range	
50 Ω *(Option 010)*	100 kHz to 1.8 GHz
75 Ω *(Option 011)*	1 MHz to 1.8 GHz

Output Power Level	
Range	
50 Ω *(Option 010)*	0 to −70 dBm
75 Ω *(Option 011)*	+42.8 to −27.2 dBmV
Resolution	0.1 dB
Absolute Accuracy	±1.0 dB
	(at 300 MHz, −20 dBm, and coupled source attenuator)
	(Option 011: use +28.8 dBmV instead of −20 dBm)
Vernier	
Range	10 dB‡
Accuracy	±0.75 dB over 10 dB range
	(referenced to −20 dBm for coupled source attenuator setting)‡
	(Option 011: referenced to +28.8 dBmV instead of −20 dBm)
Output Attenuator	
Range	0 to 60 dB in 10 dB steps
‡ See the Output Accuracy table in "Option Characteristics."	

Output Power Sweep	
Range	
50 Ω *(Option 010)*	(−15 dBm to 0 dBm) − (Source Attenuator Setting)
75 Ω *(Option 011)*	(+27.8 to 42.8 dBmV) − (Source Attenuator Setting)
Resolution	0.1 dB
Accuracy (zero span)	<1.5 dB peak-to-peak

Output Flatness	
(referenced to 300 MHz, 10 dB attenuator)	±1.75 dB

Absolute Amplitude Calibration Uncertainty‡‡	±0.15 dB
‡‡ Uncertainty in the measured absolute amplitude of the CAL OUT signal at the reference settings after CAL FREQ and CAL AMPTD self-calibration. Absolute amplitude reference settings are: Reference Level −20 dBm; Input Attenuation 10 dB; Center Frequency 300 MHz; Res BW 3 kHz; Video BW 300 Hz; Scale Linear; Span 50 kHz; Sweep Time Coupled, Top Graticule (reference level), Corrections ON.	

Input Attenuator	
Range	0 to 60 dB, in 10 dB steps

Resolution Bandwidth Switching Uncertainty	(At reference level, referenced to 3 kHz RBW)
3 kHz to 3 MHz RBW	±0.4 dB
1 kHz RBW	±0.5 dB
30 Hz to 300 Hz *(Option 130)*	±0.6 dB

Linear to Log Switching	±0.25 dB at reference level

Display Scale Fidelity	
Log Maximum Cumulative	
0 to −70 dB from Reference Level	
3 kHz to 3 MHz RBW	± (0.3 dB + 0.01 × dB from reference level)
RBW ≤ 1 kHz	± (0.4 dB + 0.01 × dB from reference level)
Log Incremental Accuracy	
0 to −60 dB from Reference Level	±0.4 dB/4 dB
Linear Accuracy	±3% of reference level

Spurious Outputs	
50 Ω *(Option 010)*	(0 dBm output, 100 kHz to 1.8 GHz)
75 Ω *(Option 011)*	(+42.8 dBmV output, 1 MHz to 1.8 GHz)
Harmonic Spurs	<−25 dBc
Nonharmonic Spurs	<−30 dBc

Dynamic Range	
Tracking Generator Feedthrough	
50 Ω *(Option 010)*	<−106 dBm
75 Ω *(Option 011)*	<−57.24 dBmV

Quasi-Peak Detector Specifications (Option 103)

The Option 103 specifications and characteristics are not valid with Option 001 or 011.

The specifications for Quasi-Peak Detector (Option 103) have been based on the following:

- The spectrum analyzer displays the quasi-peak amplitude of pulsed radio frequency (RF) or continuous wave (CW) signals.
- Amplitude response conforms with Publication 16 of Comité International Spécial des Perturbations Radioélectriques (CISPR) Section 1, Clause 2.

The 200 Hz bandwidth is available only with Option 130. The 1 kHz resolution bandwidth may be used to approximate a quasi-peak measurement without Option 130. A quasi-peak measurement using the 1 kHz bandwidth will be greater than or equal to a quasi-peak measurement using a 200 Hz bandwidth.

Absolute amplitude accuracy is the sum of the pulse amplitude response relative to the reference, plus the reference pulse amplitude accuracy, plus the spectrum analyzer amplitude accuracy (calibrator output, reference level, frequency response, input attenuator, resolution bandwidth switching, linear display scale fidelity, and gain compression).

Relative Quasi-Peak Response to a CISPR Pulse (dB)	**Frequency Band**		
			(Option 130)
	120 kHz EMI BW	**9 kHz EMI BW**	**200 Hz EMI BW**
Pulse Repetition Frequency (Hz)	**0.03 to 1 GHz**	**0.15 to 30 MHz**	**10 to 150 kHz**
1000	+8.0 ± 1.0	+4.5 ± 1.0	—
100	0 dB (reference)*	0 dB (reference)*	+4.0 ± 1.0
60	—	—	+3.0 ± 1.0
25	—	—	0 dB (reference)*
20	−9.0 ± 1.0	−6.5 ± 1.0	—
10	−14.0 ± 1.5	−10.0 ± 1.5	−4.0 ± 1.0
5	—	—	−7.5 ± 1.5
2	−26.0 ± 2.0	−20.5 ± 2.0	−13.0 ± 2.0
1	−28.5 ± 2.0	−22.5 ± 2.0	−17.0 ± 2.0
Isolated Pulse	−31.5 ± 2.0	−23.5 ± 2.0	−19.0 ± 2.0

* Reference pulse amplitude accuracy relative to a 66 dBμV CW signal is <1.5 dB. CISPR reference pulse: 0.044 μVs for 0.03 to 1 GHz, 0.316 μVs for 0.15 to 30 MHz, 13.5 ± 1.5 μVs for 10 to 150 kHz *(Option 130)*.

Time Gated Spectrum Analysis Specifications (Option 105)

GATE DELAY	
Range	1 μs to 65.535 ms
Resolution	1 μs
Accuracy (From GATE TRIGGER INPUT to positive edge of GATE OUTPUT)	±(1 μs + (0.01% × GATE DELAY Readout))†
GATE LENGTH	
Range	1 μs to 65.535 ms
Resolution	1 μs
Accuracy (From positive edge to negative edge of GATE OUTPUT)	±(0.2 μs +(0.01% × GATE LENGTH Readout))
Additional Amplitude Error§	
Log Scale	±0.3 dB
Linear Scale	±0.4% of REFERENCE LEVEL

† Up to 1 μs jitter due to 1 μs resolution of gate delay clock.
§ With GATE ON enabled and triggered, CW Signal, Peak Detector Mode.

Frequency Characteristics

These are not specifications. Characteristics provide useful but nonwarranted information about instrument performance.

Frequency Reference	
Initial Achievable Accuracy	$\pm 0.5 \times 10^{-6}$
Aging	$\pm 1.0 \times 10^{-7}$/day

Precision Frequency Reference *(Option 004)*	
Aging	5×10^{-10}/day, 7-day average after being powered on for 7 days.
Warm-Up	1×10^{-8} after 30 minutes on.
Initial Achievable Accuracy	$\pm 2.2 \times 10^{-8}$ after being powered on for 24 hours.

Stability	
Drift* (after warmup at stabilized temperature)	
Frequency Span ≤10 MHz, Free Run	<2 kHz/minute of sweep time

* Because the analyzer is locked at the center frequency before each sweep, drift occurs only during the time of one sweep. For Line, Video or External trigger, additional drift occurs while waiting for the appropriate trigger signal.

Resolution Bandwidth (−3 dB)	
Range	1 kHz to 3 MHz, selectable in 1, 3 and 10 increments, and 5 MHz. Resolution bandwidths may be selected manually, or coupled to frequency span.
(Option 130)	Adds 30 Hz, 100 Hz, and 300 Hz bandwidths.
Shape	Synchronously tuned four poles. Approximately Gaussian shape.
60 dB/3 dB Bandwidth Ratio	
Resolution Bandwidth	
100 kHz to 3 MHz	15:1
30 kHz	16:1
3 kHz to 10 kHz	15:1
1 kHz	16:1
40 dB/3 dB Bandwidth Ratio *(Option 130)*	
Resolution Bandwidth	
30 Hz to 300 Hz	10:1

Frequency Characteristics

Video Bandwidth (−3 dB)	
Range	30 Hz to 1 MHz, selectable in 1, 3, 10 increments, accuracy ±30% and 3 MHz. Video bandwidths may be selected manually, or coupled to resolution bandwidth and frequency span.
(Option 130)	Adds 1, 3, and 10 Hz bandwidths.
Shape	Post detection, single pole low-pass filter used to average displayed noise.
(Option 130)	Bandwidths below 30 Hz are digital bandwidths with anti-aliasing filtering.

FFT Bandwidth Factors	FLATTOP	HANNING	UNIFORM
Noise Equivalent Bandwidth†	3.63×	1.5×	1×
3 dB Bandwidth†	3.60×	1.48×	1×
Sidelobe Height	<−90 dB	−32 dB	−13 dB
Amplitude Uncertainty	0.10 dB	1.42 dB	3.92 dB
Shape Factor (60 dB BW/3 dB BW)	2.6	9.1	>300

† Multiply entry by one-divided-by-sweep time.

Amplitude Characteristics

These are not specifications. Characteristics provide useful but nonwarranted information about instrument performance.

Log Scale Switching Uncertainty	Negligible error

Demod Tune Listen *(Option 102 or 103)*	Internal speaker, rear panel earphone jack and front-panel volume control. Adjustable squelch control mutes the audio signal to the speaker/earphone jack based on the level of the demodulated signal above 22 kHz. An uncalibrated demodulated signal is available on the AUX VIDEO OUT connector at the rear panel.

TV Trigger *(Options 101 and 102)*	Triggers sweep of the analyzer after the sync pulse of a selected line of a TV video field.
Carrier Level for Trigger	Top 60% of linear display
Compatible Formats	NTSC, PAL, SECAM
Field Selection	Even, odd, non-interlaced
Trigger Polarity	Positive, negative
Line Selection	10 to 1021

Input Attenuation Uncertainty*	
Attenuator Setting	
0 dB	±0.5 dB
10 dB	Reference
20 dB	±0.5 dB
30 dB	±0.6 dB
40 dB	±0.8 dB
50 dB	±1.0 dB
60 dB	±1.2 dB

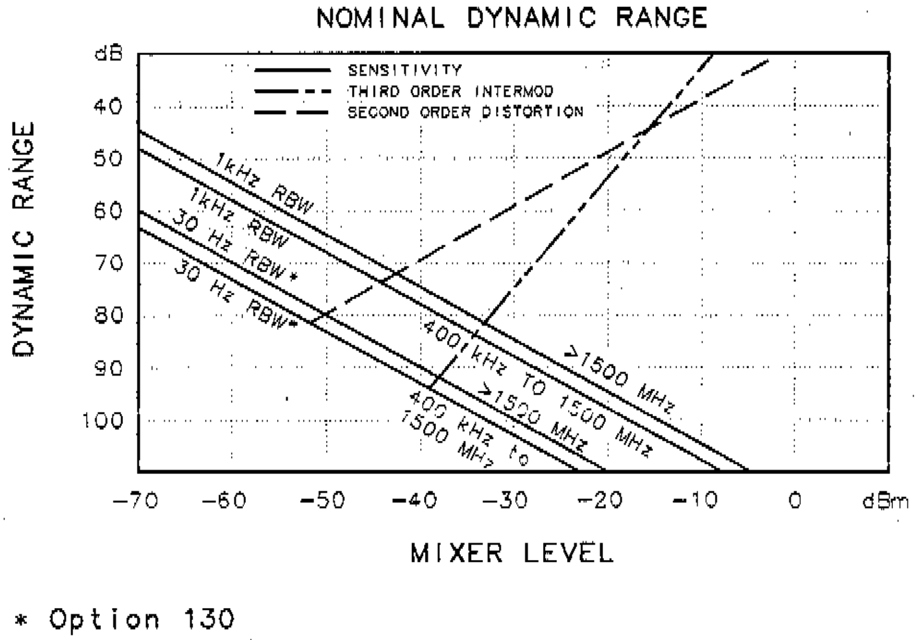
* Referenced to 10 dB input attenuator setting from 9 kHz to 1.8 GHz. See the "Specifications" table under "Frequency Response."

Input Attenuator Repeatability	
300 MHz	±0.03 dB
1.8 GHz	±1.0 dB

RF Input SWR	(Attenuator setting 10 to 60 dB) 1.35:1

Amplitude Characteristics

DYNAMIC RANGE



Dynamic Range

Analog+ Mode and Negative Peak Detector Mode (Options 101 and 301)

These modes do not utilize the full set of internal amplitude corrections. Therefore, in these modes, some analyzer amplitude specifications are reduced to characteristics. Characteristics provide useful but nonwarranted information about instrument performance.

In these modes, the following analyzer specifications remain as specifications:

Amplitude Range	**Calibrator Output**
Maximum Safe Input Level	

In these modes, the following analyzer specifications are reduced to characteristics:

Gain Compression	**Reference Level**
Displayed Average Noise Level	**Resolution Bandwidth Switching**
Spurious Responses	**Linear to Log Switching**
Residual Responses	**Display Scale Fidelity**
Display Range	**Display Scale Fidelity for Narrow Bandwidths**

Finally, the following analyzer specifications:

Marker Readout Resolution	**Frequency Response**

are replaced by the following characteristics.

Marker Readout Resolution	
(digitizing resolution)	
Log Scale	±0.31 dB
Linear Scale	
frequency ≤ 1 GHz	±0.59% of reference level
frequency > 1 GHz	±1.03% of reference level

Frequency Response in Analog+ Mode	(10 dB input attenuation, for spans $\leq$ 20 MHz)	
	Absolute§	**Relative Flatness†**
	±1.9 dB	±1.4 dB

† Referenced to midpoint between highest and lowest frequency response deviations.
§ Referenced to 300 MHz CAL OUT.

Option Characteristics

Tracking Generator Characteristics (Option 010 or 011)

Output Tracking	
Drift (usable in 10 kHz bandwidth after 30-minute warmup)	1 kHz/5 minutes

Spurious Outputs (>1.8 GHz to 4.0 GHz)	
50 Ω *(Option 010)*	
0 dBm output	
75 Ω *(Option 011)*	
+42.8 dBmV, output	
Harmonic	<−20 dBc
Nonharmonic	<−40 dBc
2121.4 MHz Feedthrough	
(Option 010)	<−45 dBm
(Option 011)	<+42.8 dBmV

RF Power-Off Residuals	
100 kHz to 1.8 GHz *(Option 010)*	<−115 dBm
1 MHz to 1.8 GHz *(Option 011)*	<−66.2 dBmV

Output Attenuator	
Repeatability	±0.2 dB

Output VSWR	
0 dB Attenuator	<2.5:1
10 dB Attenuator	<1.6:1

Dynamic Range (difference between maximum power out and tracking generator feedthrough)	
100 kHz to 1.8 GHz *(Option 010)*	>106 dB
1 MHz to 1.8 GHz *(Option 011)*	>100 dB

TRACKING GENERATOR OUTPUT ACCURACY, Option 010 (after CAL TRK GEN in auto-coupled mode)					
TG Output Power Level	Attenuator Setting	Relative Accuracy (at 300 MHz referred to −20 dBm)	Absolute Accuracy (at 300 MHz)	Relative Accuracy (referred to −20 dBm) (+0.2 dB/GHz)*	Absolute Accuracy (+0.2 dB/GHz)*
0 to −10.9 dBm	0 dB	±1.25 dB	±2.25 dB	±2.75 dB	±3.75 dB
−11 to −20.9 dBm	10 dB	±0.75 dB	±1.75 dB	±2.25 dB	±3.25 dB
−20 dBm	10 dB	0 dB Reference	±1.0 dB	±1.50 dB	±2.50 dB
−21 to −30.9 dBm	20 dB	±1.25 dB	±2.25 dB	±2.75 dB	±3.75 dB
−31 to −40.9 dBm	30 dB	±1.35 dB	±2.35 dB	±2.85 dB	±3.85 dB
−41 to −50.9 dBm	40 dB	±1.55 dB	±2.55 dB	±3.05 dB	±4.05 dB
−51 to −60.9 dBm	50 dB	±1.75 dB	±2.75 dB	±3.25 dB	±4.25 dB
−61 to −70 dBm	60 dB	±1.95 dB	±2.95 dB	±3.45 dB	±4.45 dB

* Add 0.2 dB/GHz of tuned frequency to the value in this column for complete accuracy specification relative to frequency.

Option Characteristics

TRACKING GENERATOR OUTPUT ACCURACY, Option 011 (after CAL TRK GEN in auto-coupled mode)					
TG Output Power Level	**Attenuator Setting**	**Relative Accuracy (at 300 MHz referred to +28.8 dBmV)**	**Absolute Accuracy (at 300 MHz)**	**Relative Accuracy (referred to +28.8 dBmV) (+0.2 dB/GHz)***	**Absolute Accuracy (+0.2 dB/GHz)***
+42.76 to +31.77 dBmV	0 dB	±1.25 dB	±2.25 dB	±2.75 dB	±3.75 dB
+31.76 to +21.77 dBmV	10 dB	±0.75 dB	±1.75 dB	±2.25 dB	±3.25 dB
−28.76 dBmV	10 dB	0 dB Reference	±1.0 dB	±1.50 dB	±2.50 dB
+21.76 to +11.77 dBmV	20 dB	±1.25 dB	±2.25 dB	±2.75 dB	±3.75 dB
+11.76 to +1.77 dBmV	30 dB	±1.35 dB	±2.35 dB	±2.85 dB	±3.85 dB
+1.76 to −8.23 dBmV	40 dB	±1.55 dB	±2.55 dB	±3.05 dB	±4.05 dB
−8.24 to −18.23 dBmV	50 dB	±1.75 dB	±2.75 dB	±3.25 dB	±4.25 dB
−18.24 to −27.23 dBmV	60 dB	±1.95 dB	±2.95 dB	±3.45 dB	±4.45 dB

* Add 0.2 dB/GHz of tuned frequency to the value in this column for complete accuracy specification relative to frequency.

QUASI-PEAK DETECTOR CHARACTERISTICS (Option 103)	
Quasi-Peak Measurement Range	
Displayed	70 dB
Total	115 dB

FM DEMODULATION (Option 102, 103, or 301)	
Input Level	> (−60 dBm + attenuator setting)
Signal Level	0 to −30 dB below reference level
FM Offset	
Resolution	400 Hz nominal
FM Deviation (FM GAIN)	
Resolution	1 kHz nominal
Bandwidth	FM deviation/2
FM Linearity	
(for modulating frequency < bandwidth/100)	≤ 1% of FM deviation + 290 Hz