# Manual Supplement

## 8593E Option E02/E04

Agilent Technologies

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# Contents

# 1 Purpose of This Manual Supplement

There are additional capabilities with the 8593E Option E02/E04. This supplement updates the *8590 D-Series and E-Series Spectrum Analyzer User's Guide*, the *8590 D-Series and E-Series Spectrum Analyzer Programmer's Guide*, and the *8590 E-Series Spectrum Analyzer Calibration Guide* with the additional capabilities.

## How to Use This Manual Supplement

This manual supplement is designed to be inserted into and used with your existing 8590 Series documentation.

Use the following instructions to insert this supplement into the following guides:

- *8590 D-Series and E-Series Spectrum Analyzer User's Guide*
- *8590 E-Series Spectrum Analyzer Calibration Guide*
- *8590 D-Series and E-Series Spectrum Analyzer Programmer's Guide*
- *8590 D-Series and E-Series Spectrum Analyzers Service Guide*

1. Place the "8593E Option E02/E04 General Information" section in the *8590 E-Series Spectrum Analyzer Calibration Guide*.
2. Place the "8593E Option E02/E04 Verification Tests" section in the *8590 E-Series Spectrum Analyzer Calibration Guide*.
3. Place the "8593E Option E02/E04 Operation" section in the *8590 D-Series and E-Series Spectrum Analyzer User's Guide*.
4. Place the "8593E Option E02/E04 Programming Commands" section in the *8590 D-Series and E-Series Spectrum Analyzer Programmer's Guide*.
5. Place the "8593E Option E02/E04 Replaceable Parts" section in the *8590 D-Series and E-Series Spectrum Analyzers Service Guide*.

# 2 8593E Option E02/E04 General Information

This section of the *8593E Option E02/E04 Manual Supplement* contains the following:

1. The Agilent Technologies Software Product License Agreement and Limited Warranty.
2. The 8593E Option E02/E04 specifications and characteristics.
3. Information about the Option E02/E04 rear-panel connectors (supplements the "Rear-Panel Overview" section in Chapter 2 of the *8590 D-Series and E-Series Spectrum Analyzer User's Guide*).
4. Information about the 8593E Option E02/E04 tracking generator functions.
5. The menus for the different modes.

**NOTE** This document is designed to supplement the information in the *8590 E-Series Spectrum Analyzer Calibration Guide* with information about the 8593E Option E02/E04. Since this manual supplement contains information specific to the 8593E Option E02/E04, we recommend that you refer to the following:

- The *8590 D-Series and E-Series Spectrum Analyzer User's Guide* for general information about the spectrum analyzer in the spectrum analyzer mode.
- The *8590 E-Series Spectrum Analyzer Calibration Guide* for specifications and characteristics and operation verification.
- The *8590 D-Series and E-Series Spectrum Analyzer Programmer's Guide* for additional programming information.
- The *8590 D-Series and E-Series Spectrum Analyzers Service Guide* for additional replacement parts information.

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# 8593E Option E02/E04 Specifications

These are in addition to the standard 8593E Specifications in Chapter 5 of *8590 E-Series Spectrum Analyzer Calibration Guide*. 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, CAL AMPTD, CAL YTF, and CAL TRK GEN have been run.

**Table 2-1. 8593E Option E02/E04 Specifications (1 of 5)**

| SPECTRUM ANALYZER | |
|---|---|
| **Frequency Specifications** | |
| Resolution Bandwidth | |
| Selectivity of 1 kHz Resolution | |
| Bandwidth setting | |
| (60 dB:6 dB Ratio) | <13:1 |
| Precision Frequency Reference | |
| Aging | ±1 x $10^{-7}$ ppm per year |
| | ±1.5 x $10^{-7}$ ppm per 2 years |
| Settability | ±1 x $10^{-8}$ ppm |
| Temperature Stability | < ± 0.01 ppm |
| **Amplitude Specifications** | |
| Spurious Responses | |
| 3-tone intermodulation distortion | Three –30 dBm tones at input mixer with 2.75 MHz separation. |
| 10 MHz to 1.5 GHz | <–70 dBc |
| 1.5 GHz to 12 GHz | <–67 dBc |
| Maximum Dynamic Range | |
| Signal to TOI distortion | 70 dB |
| –30 dBm input with 0 dB input attenuation | |

**Table 2-1. 8593E Option E02/E04 Specifications (2 of 5)**

| IF TRACKING GENERATOR<br>The following specifications apply after TRACK PEAK has been run. | |
|---|---|
| **Frequency Range** | |
| Direct | 300 kHz to 2.9 GHz |
| w/Multipath Fading Simulator | 40 MHz to 170 MHz |
| **Frequency Span Range** | |
| Direct | Zero span, 10 kHz to 2 GHz, full span |
| w/Multipath Fading Simulator | Zero span, 10 kHz to 170 MHz |
| **Frequency Accuracy** | |
| Span > 0 | ±(frequency readout x frequency reference error[b] + span accuracy + 1% of span + 20% of resolution bandwidth +2 kHz) |
| Zero Span (CW) | ±3 kHz after 15 minute warm-up |
| **Dynamic Range** | |
| Direct | >111 dB |
| **Output Level Range** | |
| Direct | –66 dBm to –1.0 dBm with 50 Ω load |
| w/Multipath Fading Simulator | –50 dBm to +10 dBm with 75 Ω load |
| Output Attenuator Range | 0 to 56 dB in 8 dB steps |
| **Output Level Resolution** | |
| Direct | 0.1 dB |
| w/Multipath Fading Simulator | 0.1 dB |
| **Output Level Vernier Accuracy** | 16 dB attenuation, referenced to –20 dBm |
| at 300 MHz, 25 °C ±10 °C | |
| Incremental | ±0.20 dB/dB |
| Cumulative | ±0.50 dB Total |
| **Output Level Absolute Accuracy** | 16 dB attenuation, referenced to –20 dBm |
| at 300 MHz, 25 °C ±10 °C | |
| Direct | ±0.75 dB referenced to 0 dBm at 300 MHz |
| w/Multipath Fading Simulator | ±2.75 dB |

b. Frequency Reference Error = (aging rate x period of time since adjustment + initial achievable accuracy + temperature stability).

### Table 2-1. 8593E Option E02/E04 Specifications (3 of 5)

| IF TRACKING GENERATOR (continued) | |
|---|---|
| **Level Flatness, Unnormalized** | |
| Referenced to 300 MHz, –20 dBm | |
| Direct | |
| 300 kHz to 10 MHz | ±3.0 dB |
| 40 MHz to 300 MHz | ±1.5 dB |
| 10 MHz to 2.9 GHz | ±2 dB |
| **Level Flatness, Normalized** | |
| At constant temperature, excluding errors due to mismatch. | |
| Direct | ±0.2 dB |
| w/Multipath Fading Simulator | ±0.05 dB per 40 MHz |
| **Output Level Stability** | |
| At constant temperature | |
| Direct | ±0.05 dB per 15 minutes |
| | ±0.1 dB per 24 hours |
| **Power Sweep Range** | (–10 dBm to –1 dBm) - (source attenuator setting) |
| **Spectral Purity (–1 dBm Output Power)** | |
| Residual FM in CW Mode | <500 Hz rms using a 50 Hz to 15 kHz post detection bandwidth |
| Residual AM in CW Mode | <–60 dBc using a 50 Hz to 15 kHz post detection bandwidth |
| Spurious Output | |
| Harmonic spurs 300 kHz to 2.9 GHz | |
| TG output: 300 kHz to ≤400 MHz | ≤–25 dBc |
| TG output: >400 MHz to 2.9 GHz | ≤–15 dBc |
| Non-harmonic spurs 300 kHz to 2.9 GHz | |
| TG output: 300 kHz to ≤400 MHz | ≤–27 dBc |
| TG output: >400 MHz to 2.9 GHz | ≤–15 dBc |
| **LO Feedthrough (–1 dBm ouput power)** | |
| 3.9217 GHz to 6.8214 GHz | <–16 dBm |
| **TG Feedthrough** | |
| 400 kHz to 2.9 GHz | <–110 dBm |
| **RF Power OFF Residuals** | |
| 300 kHz to 2.9 GHz | <–120 dBm |
| **Sweep Time Range** | 20 ms to 100 s |

### Table 2-1. 8593E Option E02/E04 Specifications (4 of 5)

| EVENT COUNTER | |
|---|---|
| **Maximum Pulse Rate** | |
| Driven from open collector | |
| TTL with 1 kΩ pull-up | 100 kHz |
| **Minimum Pulse Width** | |
| Driven from open collector | |
| TTL with 1 kΩ pull-up | 1 µs negative, 5 µs positive |
| **Maximum Input Cable Length** | 25 ft of 75 Ω cable |
| **Gate Time** | |
| Range | 10 ms to 163 s in 10 ms steps and totalize (continuous) |
| Accuracy | ±0.1% |
| **Event Counter** | |
| Counts negative-going pulses (falling edge followed by rising edge) at EVENT CNTR INPUT | |
| Maximum Number of Counts | $4 \times 10^9$ |
| Resolution | 1 count |
| **Interval Counter** | |
| Counts negative-going pulses (falling edge followed by rising edge) at INTERVAL CNTR INPUT | |
| Maximum Number of Counts | $4 \times 10^9$ |
| Resolution | 1 count |
| Counts total time that INTERVAL CNTR INPUT is low | |
| Maximum Interval Time | 163 s |
| Resolution per pulse | 2.5 ms |

## Table 2-1. 8593E Option E02/E04 Specifications (5 of 5)

| | | |
|---|---|---|
| **FLATNESS ANALYZER** when used with 8470B Detector | | |
| **Frequency Range** | 10 MHz to 18 GHz | |
| **Flatness** | ±0.05 dB per 40 MHz (normalized) does not include mismatch errors. | |
| **Input Level** | –30 to +20 dBm at diode detector. | |
| **Log Scale** | 0.1 to 1 dB/div in 0.1 dB steps, 8 divisions displayed. | |
| **Display Scale Fidelity** | | |
| Reference Level | Log Incremental Accuracy | Log Maximum Cumulative |
| dBm | dB/2 dB step | dB |
| –30 to –20.1 | 0.7 | 0.7 |
| – 20 to +15.9 | 0.4 | 0.6 |
| +16 to +20 | 0.8 | 1.2 |
| **Return Loss at Diode Detector** | | |
| 75 Ω system | | |
| 10 MHz to 2 GHz | >26 dB when used with 11852B 75 Ω to 50 Ω matching pad. | |
| 50 Ω system | | |
| 10 MHz to 4 GHz | >23 dB | |
| 4 GHz to 15 GHz | >18 dB | |
| 15 GHz to 18 GHz | >15 dB | |
| **FREQUENCY COUNTER** | | |
| **Frequency Range** | 10 MHz to 2.9 GHz (N=1)[a]<br>2.75 GHz to 6.5 GHz (N=1)<br>6.0 GHz to 12.8 GHz (N=2)<br>12.4 GHz to 19.4 GHz (N=3)<br>19.1 GHz to 22 GHz (N=4) | |
| **Sensitivity** | <–40 dBm | |
| **Frequency Measurement Accuracy** | ±(frequency readout x frequency reference error[b] + counter resolution + 100 Hz x N)[a] | |
| **Usable Counter Resolution** | 5 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz | |

b. Frequency Reference Error= (aging rate x period of time since adjusted + initial achievable accuracy + temperature stability). The frequency reference is the 8593E E02/E04 Spectrum Analyzer Frequency Reference.

a. N = LO harmonic. See “Frequency Range”.

## 8593E Option E02/E04 Characteristics

These are in addition to the standard 8593E Specifications in Chapter 2 of *8590 E-Series Spectrum Analyzer Calibration Guide.*

**Table 2-2. 8593E E02/E04 Characteristics (1 of 2)**

**NOTE** These are not specifications. Characteristics provide useful, but non-warranted, information about instrument performance.

| | |
|---|---|
| **EVENT COUNTER** | |
| **Input Level** | TTL, HCMOS, open collector TTL |
| **Maximum Pulse Rate** | |
| Driven from TTL or HCMOS | 1.6 MHz |
| **Minimum Pulse Width** | |
| Driven from TTL or HCMOS | 300 ns negative or positive |
| **Input Impedance** | |
| AC | 75 Ω |
| DC | 2 kΩ (pull-up to +5 V) |
| **Maximum Safe Input Level** | ±15 Vdc |
| **Rear Panel Connectors** | |
| EVENT CNTR INPUT | BNC female |
| INTERVAL CNTR INPUT | BNC female |
| **FLATNESS ANALYZER** | |
| **Rear Panel Connector** | |
| FLATNESS EXT DET IN | BNC female |
| **Maximum Safe Input Level** | |
| at 8470B Detector | 200 mW continuous |
| | 1 W for <1 minute |
| | 0 Vdc |
| **Maximum Safe Input Level** | |
| at rear panel connector | |
| Inner Conductor | ±15 Vdc |
| Outer Conductor | ±5 Vdc |
| **Operational Features** | “Single button” calibration (normalization) |
| | Amplitude Track |

### Table 2-2. 8593E E02/E04 Characteristics (2 of 2)

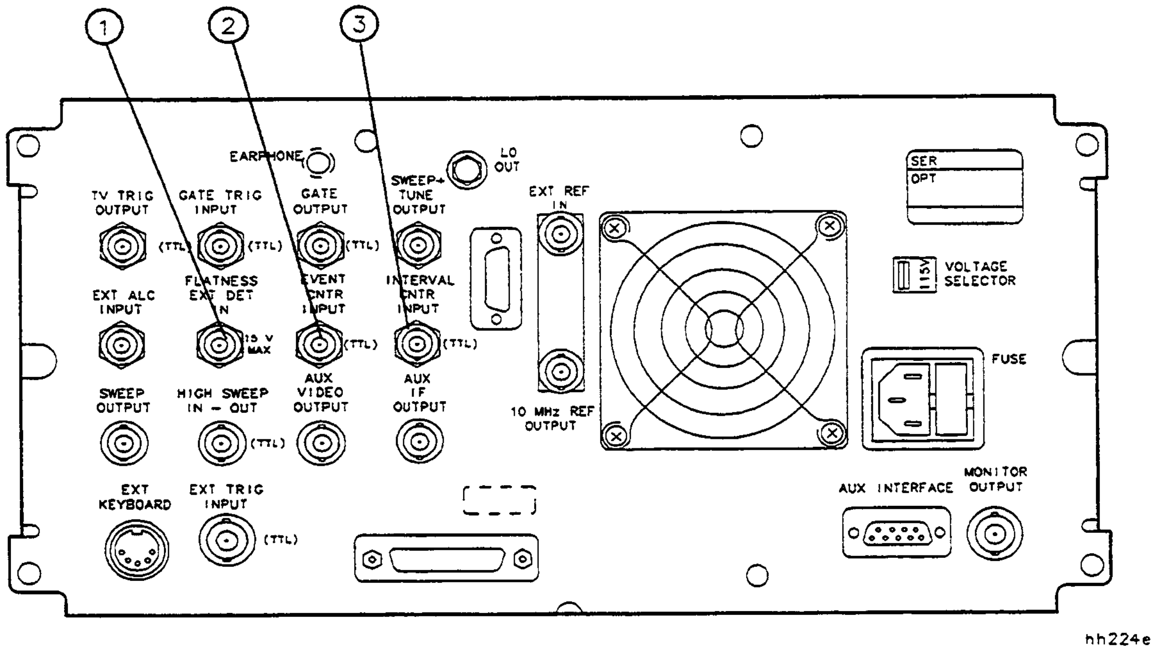
| FREQUENCY COUNTER | |
|---|---|
| **Front Panel Connector**[b] | |
| INPUT 50 Ω | Type N female |
| Input Impedance | 50 Ω |
| **IF TRACKING GENERATOR** | |
| **RF output** | |
| Connector | Type N Female |
| Impedance | 50 Ω |
| Return Loss | > –13 dB for attenuation ≥ 8 dB |
| | > –6 dB for 0 dB attenuation |
| Maximum safe reverse level without damage | +30 dBm (1 Watt), 30 Vdc |
| **SPECTRUM ANALYZER** | |
| **Precision Frequency Reference** | |
| Aging | 0.005 ppm/day, 7 day average after being turned on for 7 days |
| Warm-up | ±0.01 ppm within 15 minutes of turn-on |
| | ±0.1 ppm within 5 minutes of turn-on |
| Initial Achievable Accuracy | 1±0.022 ppm within 24 hours of turn-on |

b. Uses the INPUT 50 Ω connector of the spectrum analyzer.

# Option E02/E04 Rear-Panel Connectors

The Option E02/E04 has three rear-panel connectors in addition to those on the standard 8593E analyzer. See Figure 2-1.

**Figure 2-1. 8593E Option E02/E04 Rear-Panel Connectors**




1. **FLATNESS EXT DET IN** is used in the flatness mode. The flatness analyzer measures swept flatness (amplitude versus frequency). Flatness is analyzed with the 8470B Crystal Detector (from the Accessory Kit) connected to the FLATNESS EXT DET IN connector.

---

**CAUTION** The maximum safe input level of the FLATNESS EXT DET IN connector is ±5 Vdc at the inner connector, and ±5 Vdc at the outer connector.

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2. **EVENT CNTR INPUT (TTL)** is the input for the event counter. The event counter measures the number of negative-going pulses.

---

**CAUTION** The maximum safe input level of the EVENT CNTR INPUT and the INTERVAL CNTR INPUT is ±15 Vdc.

---

3. **INTERVAL CNTR INPUT (TTL)** is the input for the interval counter. The interval counter counts the number of negative-going pulses and also measures the accumulated time interval that the pulse is (low).

**NOTE** The LO OUTPUT connector must be terminated with a 50 Ω termination to meet frequency and amplitude specifications.

## 8593E Option E02/E04 Tracking Generator Functions

Some of the 8593E Option E02/E04 tracking generator functions are different than the 8591E Option 010 or 011 tracking generator. The following table lists the 8591E Option 010 or 011 function and compares it with the 8593E Option E02/E04 function.

| 8591E Option 010 or Option 011 Function | Corresponding 8593E Function | Comments |
|---|---|---|
| ALC MTR INT XTAL | ALC INT EXT[b] | Only internal automatic level control is available for the 8593E. External leveling control is not accessible. |
| MAN TRK ADJUST | MAN TRK ADJUST | Performs a similar function[a] |
| PWR SWP ON OFF | PWR SWP ON OFF | Performs a similar function[a] |
| SRC PWR OFFSET | SRC PWR OFFSET | Performs a similar function[a] |
| SRC PWR ON OFF | SRC PWR ON OFF | Performs a similar function[a] |
| SRC PWR STP SIZE | SRC PWR STP SIZE | Performs a similar function |
| SWP CPLG SR SA | SWP CPLG SR SA[b] | Performs a similar function |
| TRACKING PEAK | TRACKING PEAK | Performs a similar function |

b. This function is not available when using the scalar analyzer mode.

a. The 8591E Option 010 and 8593E Option E02/E04 functions are not identical because Option E02/E04 has a wider frequency range (300 kHz to 2900 MHz) than the 8591E Option 010 or 011.

## Mode Menus

The following section contains the menus for the following 8593E Option E02/E04 (also called DRTS) modes:



**NOTE** The functions of some of the front-panel keys may be changed or inaccessible while in a DRTS mode.

**Figure 2-2. Digital Radio Mask Mode Menu**

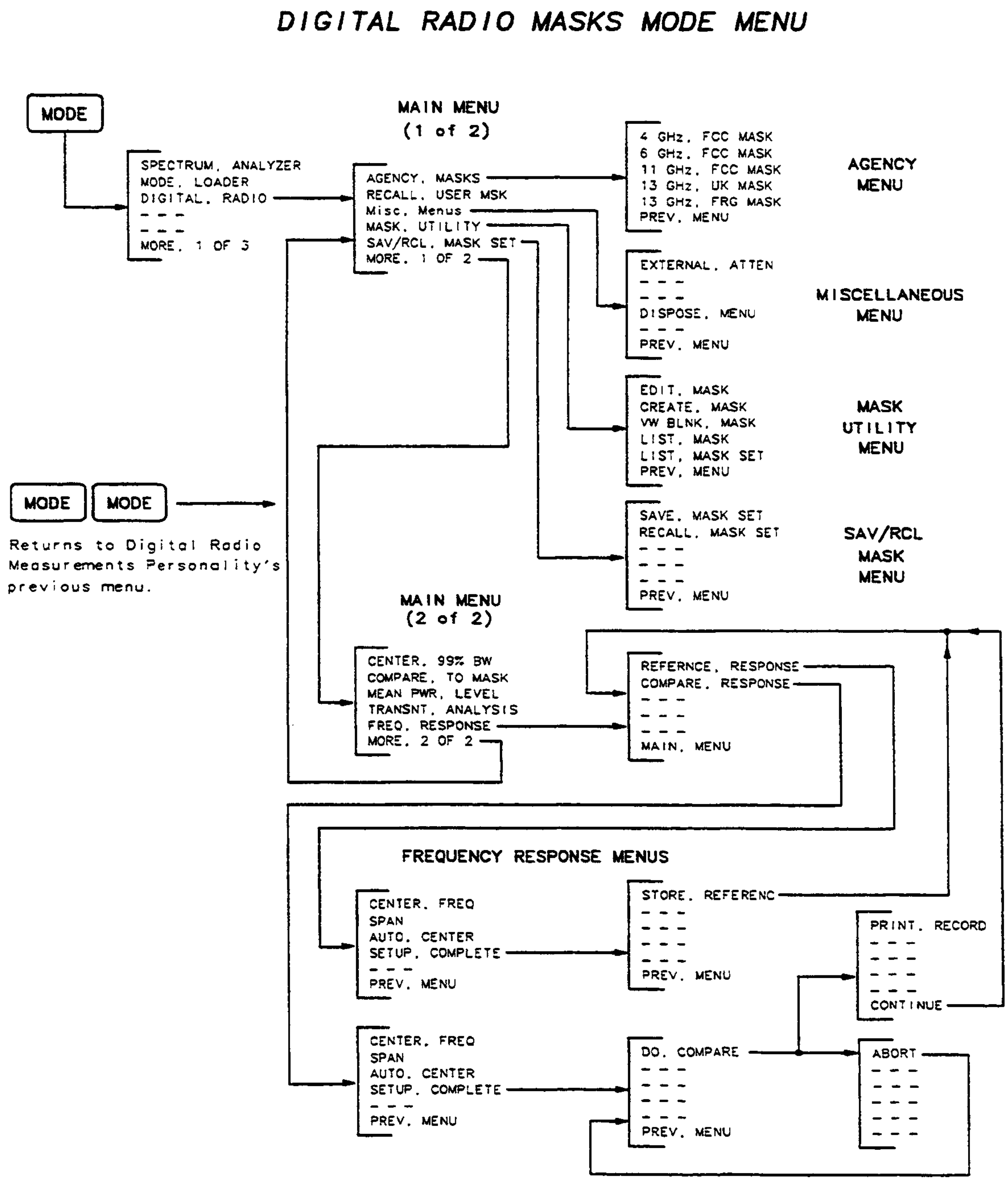
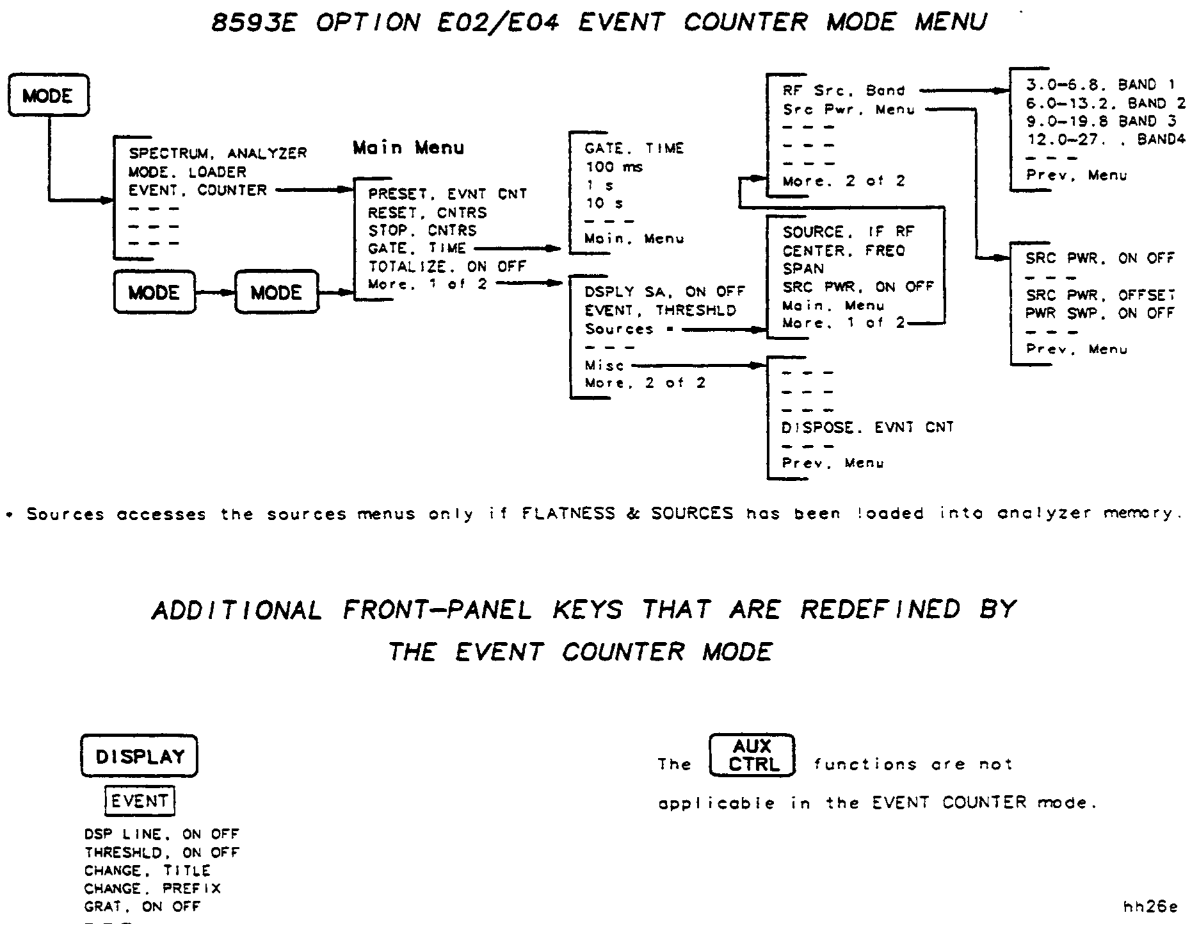


**Figure 2-3. Event Counter Mode Menu**



## Figure 2-4. Flatness & Sources Mode Menu

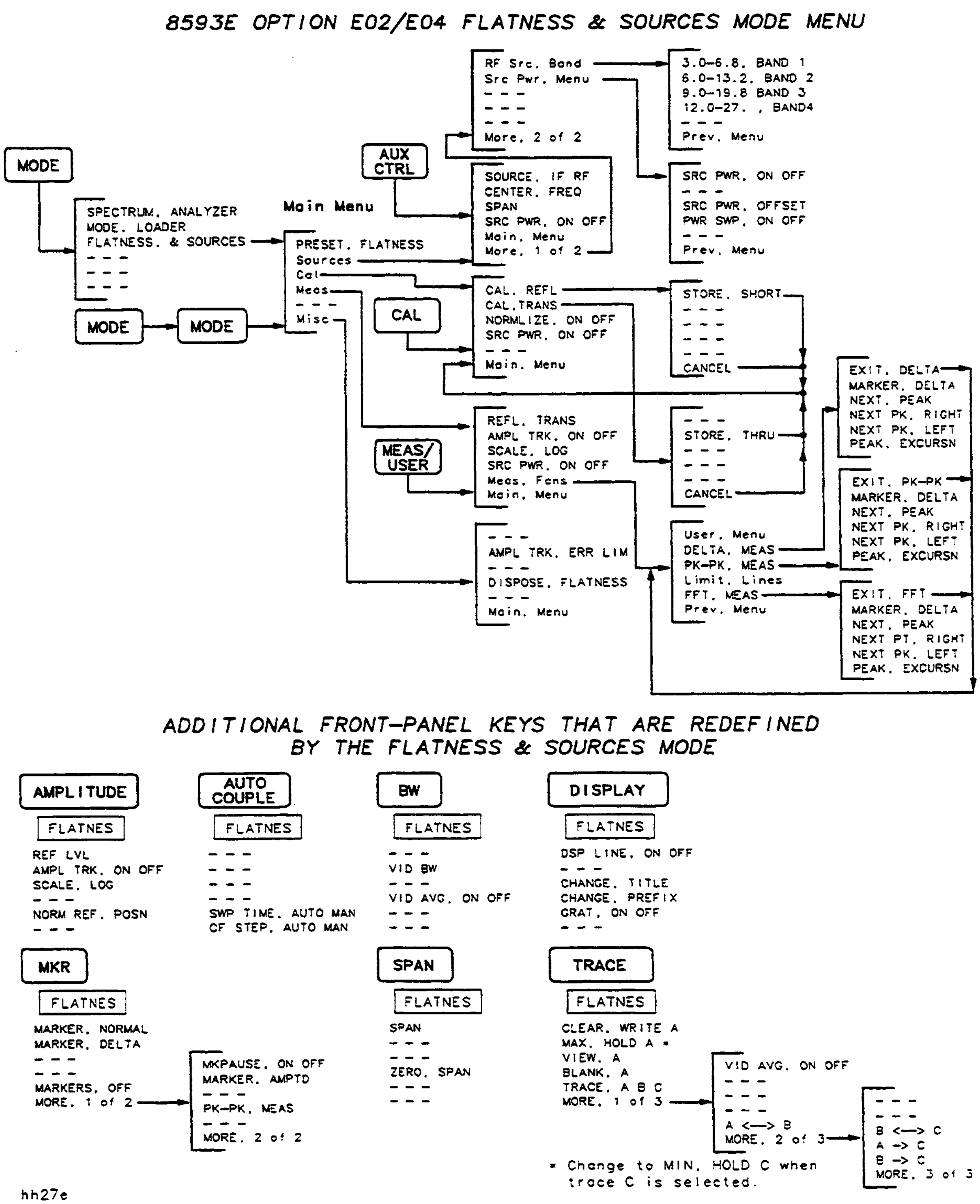


**Figure 2-5. Frequency Counter Mode Menu**

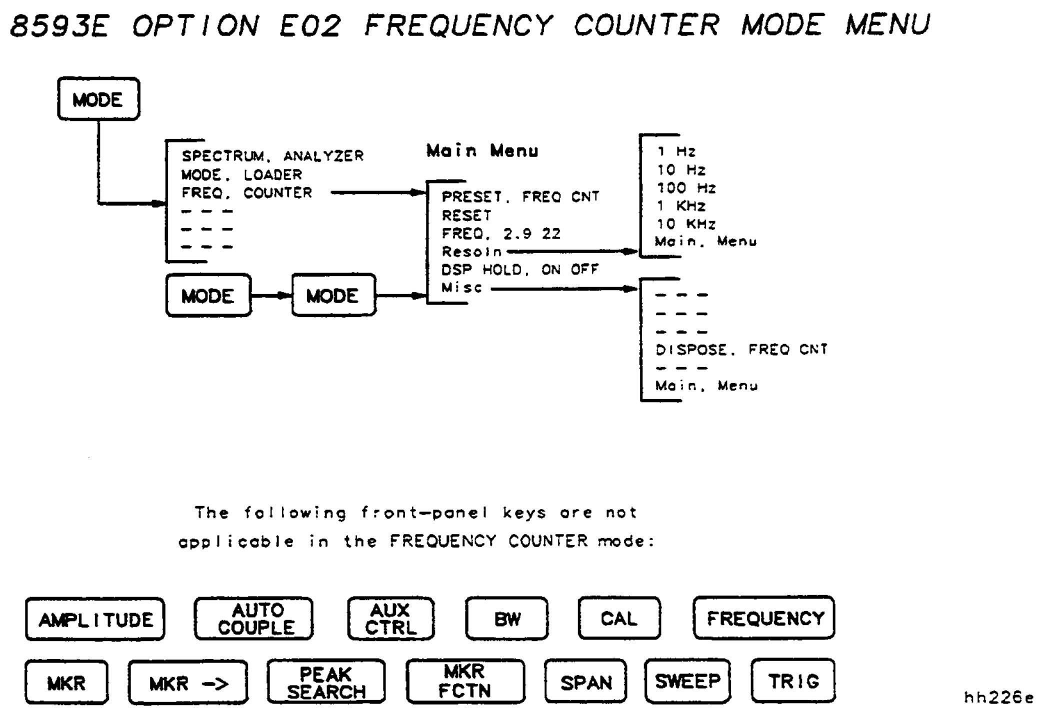


**Figure 2-6. Low Frequency Oscilloscope Mode Menu**

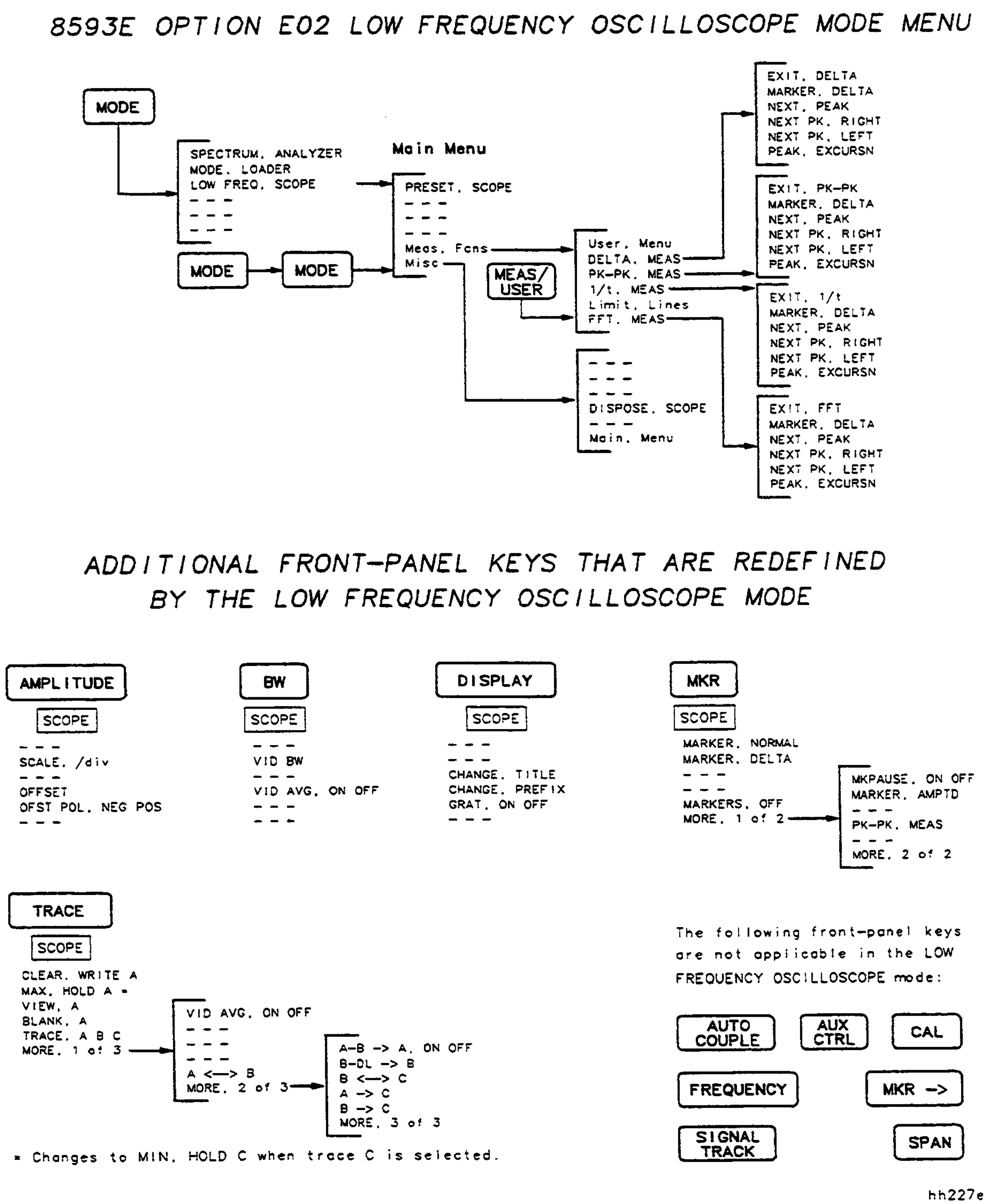
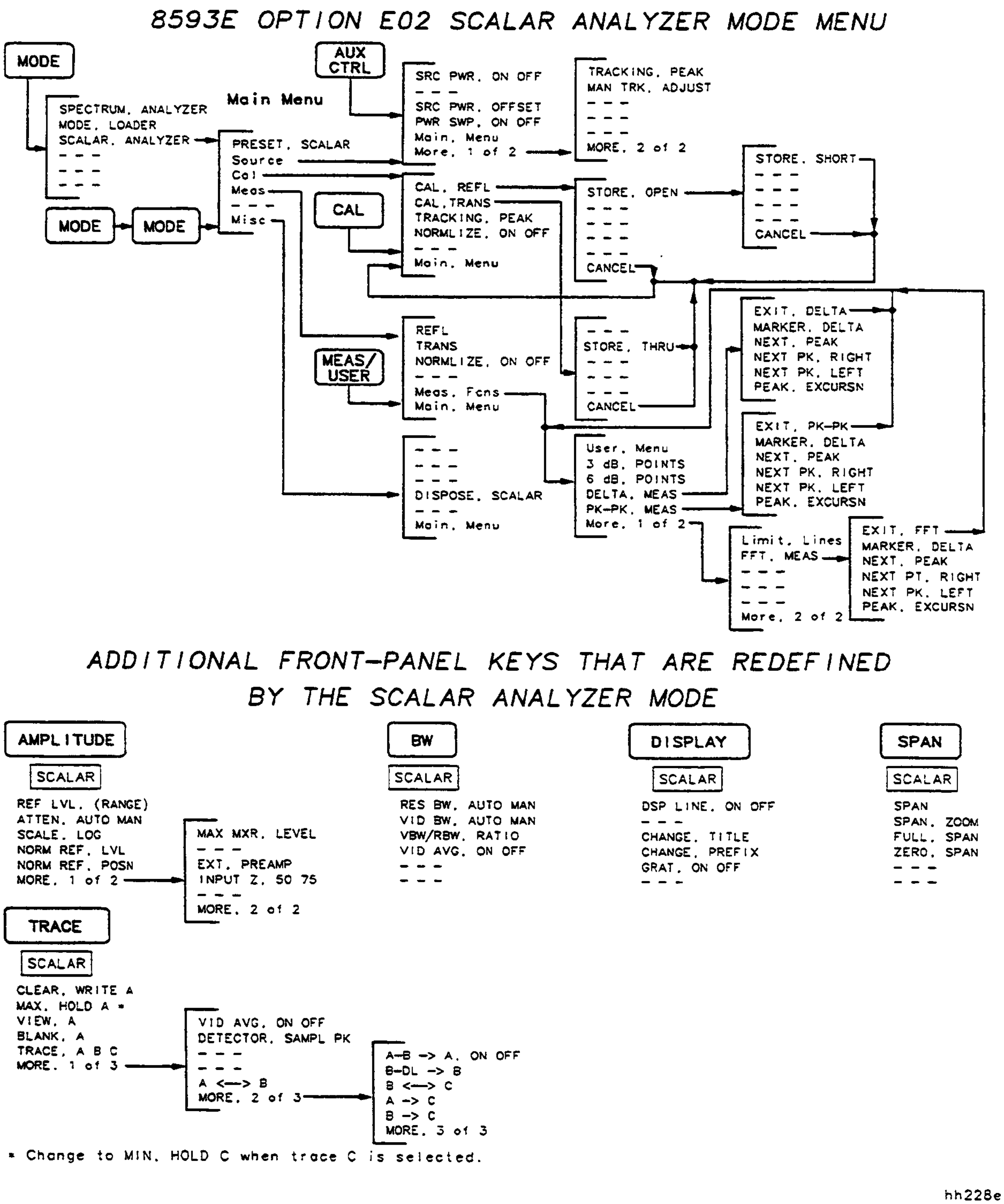


**Figure 2-7. Scalar Analyzer Mode Menu**



# 3 8593E Option E02/E04 Verification Tests

# What You'll Find in This Supplement

This supplement to the "Performance Verification Tests" chapter of the *8590 E-Series Spectrum Analyzer Calibration Guide* contains procedures which test the electrical performance of the 8593E Option E02/E04 Spectrum Analyzer.

The *8590 E-Series Spectrum Analyzer Calibration Guide* contains procedures which test the electrical performance of the IF tracking generator.

None of the test procedures involve removing the cover of the spectrum analyzer.

**NOTE** The tracking generator harmonic and non-harmonic spur specifications in this supplement supersede the specifications in the *8590 E-Series Spectrum Analyzer Calibration Guide*.

## 8593E Option E02/E04 Verification Tests

The 8593E Option E02/E04 verification tests verify that the spectrum analyzer performance is within all of the Option E02/E04 specifications. It is time consuming and requires extensive test equipment. Perform the 8593E Performance Verification tests before performing the 8593E Option E02/E04 verification tests. See Table 2-1 the "Performance Verification Tests" chapter of the *8590 E-Series Spectrum Analyzer Calibration Guide* for a complete set of 8593E Performance Verification tests. See Table 3-1 for a complete listing of the 8593E Option E02/E04 verification tests. The IF tracking generator verification tests included here are in addition to or supersede tests in the *8590 E-Series Spectrum Analyzer Calibration Guide*.

**Table 3-1 Verification Tests for the 8593E Option E02/E04**

| Test Number | Test Name |
|---|---|
| 1 | Resolution Bandwidth Selectivity |
| 2 | Three-Tone Intermodulation Distortion |
| 3 | Absolute Amplitude and Vernier Accuracy |
| 4 | Power Sweep Range |
| 5 | Tracking Generator Level and Flatness |
| 6 | Tracking Generator Frequency Accuracy |
| 7 | Harmonic Spurious Outputs |
| 8 | Non-Harmonic Spurious Outputs |
| 9 | Tracking Generator Feedthrough |
| 10 | RF Power-Off Residuals |
| 11 | Tracking Generator LO Feedthrough Amplitude |
| 12 | Residual AM and Residual FM |
| 13 | Event Counter |
| 14 | Flatness Analyzer Log Fidelity |

## Before You Start the Verification Tests

There are six things you should do before starting a verification test:

1. Switch the analyzer on and let it warm up in accordance with the General Specifications listed in Table 2-1.
2. Read the "Making Measurements" chapter of the *8590 D-Series and E-Series Spectrum Analyzer User's Guide*.
3. After the analyzer has warmed up as specified, perform the self-calibration procedure documented in "Improving Accuracy With Self- Calibration Routines" in the "Getting Started" chapter of the *8590 D-Series and E-Series Spectrum Analyzer User's Guide*. The performance of the analyzer is only specified after the analyzer calibration routines have been run and if the analyzer is autocoupled.
4. Perform the verification tests for the 8593E described in the "Calibration" chapter of the *8590 E-Series Spectrum Analyzer Calibration Guide* (prior to this supplement).
5. Read the rest of this section before you start any of the tests, and make a copy of the Performance Verification Test Record "Recording the Test Results".
6. Load the Frequency Counter, Flatness and Sources, and Event Counter modes with the following procedure.

## Loading the Frequency. Counter, Flatness and Sources, and Event

Counter Modes

1. Press **[PRESET]** on the 8593E. If **MODE LOADER** is not one of the displayed softkeys, perform *all* of the following steps. If **MODE LOADER** is displayed, perform step 2.
   a. Press **[CONFIG]**, **MORE 1 of 2**, **DISPOSE USER MEM**. The message `IF YOU ARE SURE, PRESS KEY AGAIN TO PURGE DATA` will be displayed. Press **DISPOSE USER MEM** again.
   b. Press **[RECALL]**, **INTERNAL CRD** (CRD), **CATALOG CARD**, **CATALOG ALL**.
   c. The file name "dLOADME" should be highlighted. If not, rotate the knob until "dLOADME" is highlighted. Press **LOAD FILE**.
2. Press **MODE LOADER**. Select number 1 from the menu to load the Frequency Counter, Flatness and Sources, and Event Counter modes, and press **[ENTER]**. Wait until all modes are loaded.

## Test Equipment You'll Need

Table 3-2 lists the recommended test equipment for the performance tests. Any equipment that meets the critical specifications given in the table can be substituted for the recommended model(s).

## Recording the Test Results

A test results table is provided at the end of each test procedure for your convenience in recording test results as you perform the procedure.

In addition, a complete Performance Verification Test Record, Table 3-15, has been provided at the end of this supplement. We recommend that you make a copy of the table, record the test results on the copy, and keep the copy for your calibration test record. This record could prove valuable in tracking gradual changes in test results over long periods of time.

## If the Analyzer Doesn't Meet Specifications

If the analyzer fails a test, rerun the **CAL FREQ & AMPTD** routine, press **CAL STORE**, and repeat the test. If the analyzer still fails one or more specifications, complete any remaining tests and record all test results on a copy of the test record. Then refer to the "Problems and Error Messages" chapter of the *8590 D-Series and E-Series Spectrum Analyzer User's Guide* for instructions on how to solve the problem.

## Periodically Verifying Operation

The analyzer requires periodic verification of operation. Under most conditions of use, you should test the analyzer at least once a year with either Operation Verification or the complete set of Performance Verification tests.

### Table 3-2 Recommended Test Equipment

| Instrument | Critical Specifications for Equipment Substitution | Recommended Model |
|---|---|---|
| Spectrum Analyzer | Frequency Range: 300 kHz to 7 GHz | 8566A/B |
| | Relative Amplitude Accuracy: | |
| | 300 kHz to 2.5 GHz: <±1.8 dB | |
| | 300 kHz to 2.9 GHz: <±4.0 dB | |
| | Absolute Amplitude Accuracy: | |
| | 300 kHz to 2.5 GHz: <±1.9 dB | |
| | 2.5 GHz to 2.9 GHz: <±4.1 dB | |
| | Frequency Accuracy: <±10 kHz at 7 GHz | |
| Synthesizer/ Function Generator | Frequency Range: 0.1 Hz to 20 MHz | 3325B |
| | Frequency Accuracy: <±0.02% | |
| | Maximum Output Power: >+20 dBm | |
| | Waveform: Triangle, Sine | |
| Pulse/ Function Generator | Frequency Range: 50 kHz to 100 kHz | 8116A |
| | Amplitude Range: 0 to 5V peak-to-peak | |
| | Waveforms: Square, Pulse | |
| | Duty Cycle: 10% to 90% | |
| | Burst Mode | |
| | Maximum Number of Bursts: > 1000 | |
| | Complement Mode | |
| Measuring/ Receiver | Compatible with Power Sensors | 8902A |
| | dB Relative Mode | |
| | Resolution: 0.01 dB | |
| | Power Reference Accuracy: <±1.2% | |
| | AM and FM Measurement Modes | |
| | AM Accuracy: <6.5 dB at –60 dBc. | |
| | FM Accuracy: <42.5 Hz rms | |
| Power Sensor | Frequency Range: 10 MHz to 80 MHz | 8482H |
| | Power Range: +0 dBm to +20 dBm | |
| | Maximum SWR: 1.20 (10 MHz to 80 MHz) | |
| RF Detector | Frequency Range: 10 MHz to 18 GHz | 8470B |
| | Maximum SWR: <1.2 (10 MHz to 80 MHz) | |
| | Sensitivity: >0.5mV/mW | |
| | Maximum Input: 200 mW | |
| Termination | Impedance: 50 Ω (nominal) (*2 required*) | 908A |

# 1. Resolution Bandwidth Selectivity

### Specification

1 kHz RES BW Setting, 60 dB:6 dB ratio:<13:1

### Related Adjustments

Crystal and LC Bandwidth Filter Adjustments

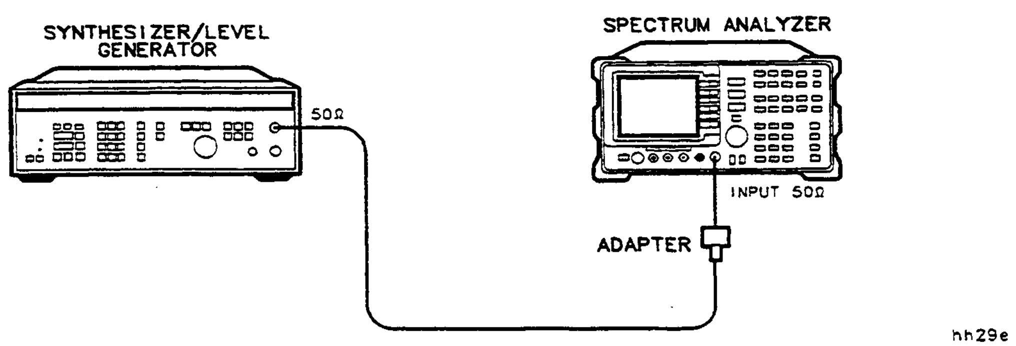
### Description

The output of a frequency-synthesizer/level-generator is applied to the input of the spectrum analyzer. The synthesizer output amplitude is reduced by 6 dB to establish an amplitude reference for the actual 6 dB point. The synthesizer is then increased by 6 dB. A sweep is taken and the markers are used to measure the 6 dB bandwidth.

The synthesizer is then turned to frequencies near the upper and lower 6 dB points and the markers are used to measure the frequency separation. The measured separation is then used to correct the measured 6 dB bandwidth for span errors.

The 60 dB bandwidth is measures in a similar manner. The ratio of the 60 dB to 6 dB bandwidth is calculated.

**Figure 3-1 Resolution Bandwidth Selectivity Test Setup**




### Equipment

Synthesizer/Level Generator .......................................... 3335A

### Adapter

BNC (f) to Type N (m)..................................................... 1250-1476

### Cable

BNC, 122 cm (48 in) ......................................................... 10503A

### Procedure

1. Connect the equipment as shown in Figure 3-1.
2. Set the 3335A controls as follows:

   FREQUENCY ........................................................ 40 MHz
   AMPLITUDE ........................................................ –2 dBm
   AMPTD INCR ....................................................... 0.5 dB

3. On the 8593E, press **[PRESET]** and set the controls as follows:

   CENTER FREQ .................................................... 40 MHz
   SPAN ................................................................. 100 kHz

**Measuring 6 dB Bandwidth**

4. On the 8593E, press **[PEAK SEARCH]**, **[MKR FCTN]**, **MK TRACK ON OFF** (ON), **[SPAN]**, 10 **[kHz]**. Wait for the `AUTO ZOOM` message to disappear.
5. Set the 8593 controls as follows:

   LOG dB/DIV ........................................................ 1 dB
   VIDEO BW .......................................................... 30 Hz

6. Press **[AMPLITUDE]** on the 3335A and use the INCR keys until the 8593E MKR amplitude is between 0 and –0.5 dBm. On the 3335A, press **[AMPTD INCR]**, 6 **[+dBm]**, **[AMPLITUDE]**, INCR **[▼]**.
7. On the 8593E, press **[MKR FCTN]**, **MKR TRACK ON OFF** (OFF), **[PEAK SEARCH]**, **MARKER DELTA**.
8. Press INCR, **[▲]** on the 3335A.
9. On the 8593E, press **[SGL SWP]**, **[MKR]**.
10. On the 8593E, rotate the knob counterclockwise until the MARKER Δ amplitude reads 0 dB ±0.25 dB. The marker should be on the left-hand skirt of the signal. If the marker cannot be set exactly to 0 dB, note weather the marker is just above or just below the actual 6 dB.
11. On the 8593E, press **MARKER DELTA**, **[PEAK SEARCH]**. Rotate the knob clockwise until the MARKER Δ amplitude reads 0 dB ±0.25 dB. The active marker should be in the right-hand skirt of the signal. If the marker was set just above the 6 dB point in step 10, set the marker just below the 6 dB point. If the marker was set just below the 6 dB point in step 10, set the marker just above the 6 dB point.
12. Record the MARKER Δ frequency as the Measured 6 dB BW below.

    Measured 6 dB BW__________Hz

13. Divide the MARKER Δ frequency by two and record as the 3335A FREQ

    3335A FREQ INCR__________Hz

14. On the 3335A, press **[FREQ INCR]** and enter the 3335A FREQ INCR recorded in step 13. Press **[FREQUENCY]**, INCR **[▼]**.

15. On the 8593E, press **[SGL SWP]**, **[PEAK SEARCH]**, **MARKER DELTA**.

16. On the 8593E, press **[FREQUENCY]**, 40 **[MHz]**, INCR **[▲]**.

17. On the 8593E, press **[SGL SWP]**, **[PEAK SEARCH]**. Record the MARKER Δ frequency as the Measured Separation.

Measured Seperation__________Hz

18. Calculate and record the Actual 6 dB BW using the following equation:

Actual 6 dB BW= (Measured 6 dB BW) $^2$/Measured Separation)

Actual 6 dB BW__________Hz

### Measuring 60 dB Bandwidth

19. Set the 3335A controls as follows:

FREQUENCY ............................................................ 40 MHz
AMPLITUDE ............................................................ –2 dBm
AMPTD INCR ............................................................ 1 dB

20. Set the 8593E controls as follows:

VIDEO BW ............................................................ AUTO
TRIG ............................................................ CONT
LOG dB/DIV ............................................................ 10 dB
SPAN ............................................................ 30 kHz

21. On the 8593E, press **[MKR]**, **MARKER NORMAL**, **[PEAK SEARCH]**.

22. Press **[AMPLITUDE]** on the 3335A and use the INCR keys until the 8593E MKR amplitude reading is between 0 and –1 dBm. On the 3335A, press **[AMPTD INCR]**, 60 **[+dBm]**, **[AMPLITUDE]**, INCR **[▼]**.

23. On the 8593E, press **[BW]**, **[VID BW AUTO MAN]** (MAN), 30, **[Hz]**. Wait for completion of a new sweep. Press **[PEAK SEARCH]**, **MARKER DELTA**.

24. Press INCR **[▲]** on the 3335A.

25. On the 8593E, press **[BW]**, **VID AVG ON OFF** (ON), 10, **[Hz]**. Wait for `AVG 10` to be displayed to the left of the graticule area. Press **[SGL SWP]** and wait for completion of a new sweep. Press **[MKR]**.

26. On the 8593E, rotate the knob counterclockwise until the MARKER Δ amplitude reads 0 dB ±0.50 dB. The marker should be on the left-hand skirt of the signal. If the marker cannot be set exactly to 0 dB, note weather the marker is just above or just below the actual 60 dB point.

27. On the 8593E, press **MARKER DELTA**, **[PEAK SEARCH]**. Rotate the knob clockwise until the MARKER Δ amplitude reads 0 dB ±0.50 dB. The active marker should be in the right-hand skirt of the signal. If the marker was set just above the 60 dB point in step 10, set the marker just below the 60 dB point. If the marker was set just below the 60 dB point in step 10, set the marker just above the 60 dB point.

28. Record the MARKER Δ frequency as the Measured 60 dB BW below.

Measured 60 dB BW__________Hz

29. Divide the MARKER Δ frequency by two and record as the 3335A FREQ INCR.

3335A FREQ INCR__________Hz

30. On the 3335A, press **[FREQ INCR]** and enter the 3335A FREQ INCR recorded in step 29. Press **[FREQUENCY]**, INCR **[▼]**.
31. On the 8593E, press **[BW]**, **VID AVG ON OFF** (OFF), **[SGL SWP]**, **[PEAK SEARCH]**, **MARKER DELTA**.
32. On the 3335A, press **[FREQUENCY]**, 40 **[MHz]**, INCR **[▲]**.
33. On the 8593E, press **[SGL SWP]**, **[PEAK SEARCH]**, Record the MARKER Δ frequency as the Measured Separation.

Measured Separation__________Hz

34. Calculate and record the Actual 60 dB BW using the following equation:

Actual 60 dB BW= (Measured 60 dB BW) $^2$/Measured Separation

Actual 60 dB BW__________Hz

35. Divide the Actual 60 dB from step 34 by the Actual 6 dB from step 18 and record the result as the 1 kHz RES BW Selectivity.

1 kHz RES BW Selectivity = Actual 60 dB BW/Actual 6 dB BW

1 kHz RES BW Selectivity__________:1

# 2. Three-Tone Intermodulation Distortion

## Specification

For three –30 dBm tones at input mixer with 2.75 MHz separation:

10 MHz to 1.5 GHz: < –70 dBc

1.5 GHz to 12 GHz: < –67 dBc

## Description

The three-tone intermodulation distortion performance is verified using a two-tone third order intermodulation distortion test. Given three test signals of frequencies Fa, Fb, and Fc, the amplitude of the Fa – Fb + Fc product (three-tone test) is 6 dB higher than the 2Fa –Fb third order product (two-tone test) (1). As a result, the third order distortion products should be –76 dBc for lower frequencies and –73 dBc for higher frequencies.

The two tones are combined in a directional coupler (for isolation) and are applied to the 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.

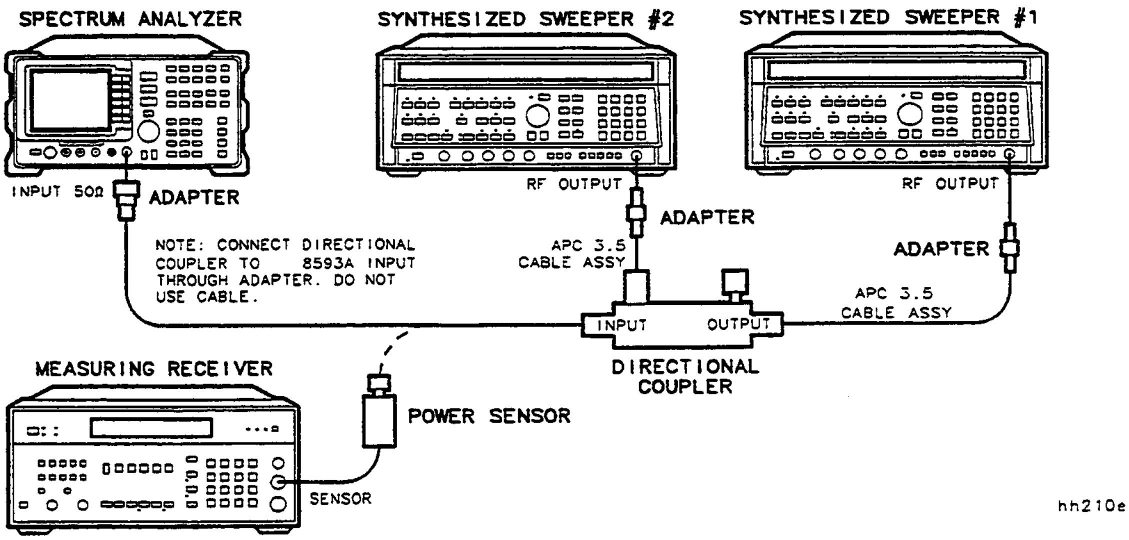
With two –30 dBm tones at the input mixer and the distortion products suppressed by 76 dBc, the equivalent TOI is +8 dBm (–30 dBm + 76 dBc/2). However, if two –22 dBm tones are present at the input mixer and the distortion products are suppressed by 60 dBc, the equivalent TOI is also +8 dBm (–22 dBm + 60 dBc/2).

Performing the test with a higher power level maintains the measurement integrity while reducing test time.

The lower frequency range performance is tested at 2 GHz, due to directional coupler frequency limitations. Testing at 2 GHz verifies the performance of the 10 MHz to 2.9 GHz range.

(1) R.C. Heidt, “Three-Tone Nonlinearity Testing-The Intermodulation Coefficient, M” Panel Session on “Nonlinearities in Microwave Devices and Systems,” in Digest 1973 IEEE G-MTT International Microwave Symposium. (Boulder, Colorado), June 4-6, 1973, p.113

**Figure 3-2 Three-Tone Intermodulation Distortion Test Setup**




## Equipment

Synthesized Sweeper (2 required) ............................. 8340A/B
Measuring Receiver (or Power Meter)....................... 8902A
Power Sensor, 50 MHz to 26.5 GHz........................... 8485A
Directional Coupler .................................................... 0955-0125

## Cable

APC 3.5 Cable, 91 cm (36 in) (2 required).................. 8120-4921

## Adapter

Type N (m) to APC 3.5 (m)........................................... 1250-1743

APC 3.5 (f) to APC 3.5 (f) ............................................. 5061-5311

## Procedure

1. Zero and calibrate the 8902A and 8485A combination in log mode (RF power readout in dBm). Enter the power sensor's 2 GHz Cal Factor into the 8902A.
2. Connect the equipment as shown in Figure 3-2 with the input of the directional coupler connected to the power sensor.

3. Press **[INSTR PRESET]** on each 8340A/B. Set each 8340A/B controls as follows:

   POWER LEVEL.......................................................... –15 dBm
   CW (8340A/B #1) ....................................................... 2.0 GHz
   CW (8340A/B #2) ....................................................... 2.00275 GHz
   RF ....................................................................... OFF

4. On the 8593E, press **[PRESET]** and wait until the preset is finished. Set the controls as follows:

   CENTER FREQ.......................................................... 2.0 GHz
   SPAN .................................................................... 1 MHz
   REF LEVEL.............................................................. –10 dBm

   Press the following analyzer keys: **[PEAK SEARCH]**, **More 1 of 2**, **PEAK EXCURSN**, 3 **[dB]**, **[DISPLAY]**, **THRESHOLD ON OFF** (ON), 90 **[-dBm]**.

5. On 8340A/B #1, set RF on. Adjust the power level until the 8902A reads –12 dBm ±0.05 dB.

6. Disconnect the power sensor from the directional coupler. Connect the directional coupler directly to the 8593E INPUT 50Ω using an adapter (do not use a cable).

7. On the 8593E, press **[PEAK SEARCH]**, **[MKR FCTN]**, **MKR TRACK ON OFF** (ON), **[SPAN]**, 200 **[kHz]**. Wait for the `AUTO ZOOM` message to disappear. Press **[MKR FCTN]**, **MKR TRACK ON OFF** (OFF), **[PEAK SEARCH]**, **[MKR ->]**, **MARKER -> REF LVL**. Press **[FREQUENCY]**, **CF STEP MAN AUTO** (MAN), 2.75 **[MHz]**, **CENTER FREQ**, **[▲]**.

8. On 8340A/B #2, set RF on. Adjust the power level until the signal is displayed at the reference level.

9. Set the 8593E controls as follows:

   RES BW ................................................................ 1 kHz
   VIDEO BW.............................................................. 100 kHz

10. On the 8593E, press **[PEAK SEARCH]**, **MARKER DELTA**, **[FREQUENCY]**, **[▲]**, **[SGL SWP]**. Wait for completion of a new sweep.

11. If a distortion product can be seen, proceed as follows:

    a. On the 8593E, press **[PEAK SEARCH]**.

    b. Record the MKR Δ amplitude reading in Table 3-3 as the Upper Product Suppression.

12. If a distortion product cannot be seen, proceed as follows:
    a. On each 8340A/B, increase the power level by 5 dB.
    b. On the 8593E, press **[SGL SWEEP]** and wait for completion of a new sweep. A distortion product should now be visible with the higher power level. Press **[PEAK SEARCH]**.
    c. On each 8340A/B, reduce the power level by 5 dB.
    d. On the 8593E, press **[SGL SWEEP]** and wait for completion of a new sweep.
    e. Record the MKR Δ amplitude reading in Table 3-3 as the Upper Product Suppression.
13. On the 8593E, press [**FREQUENCY**], **[▼]**, **[▼]**, **[▼]**, **[SGL SWP]**. Wait for completion of a new sweep.
14. If a distortion product can be seen, proceed as follows:
    a. On the 8593E, press **[PEAK SEARCH]**.
    b. Record the MKR Δ amplitude reading in Table 3-3 as the Lower Product Suppression.
15. If a distortion product cannot be seen, proceed as follows:
    a. On each 8340A/B, increase the power level by 5 dB.
    b. On the 8593E, press **[SGL SWEEP]** and wait for completion of a new sweep. A distortion product should now be visible with the higher power level. Press **[PEAK SEARCH]**.
    c. On each 8340A/B, reduce the power level by 5 dB.
    d. On the 8593E, press **[SGL SWEEP]** and wait for completion of a new sweep.
    e. Record the MKR Δ amplitude reading in Table 3-3 as the Upper Product Suppression.
16. Enter the power sensor's 2 GHz Cal Factor into the 8902A.
17. Connect the equipment as shown in Figure 3-2 with the input of the directional coupler connected to the power sensor.
18. Set each 8340A/B controls as follows:

    POWER LEVEL........................................................ –15 dBm
    CW (8340A/B #1) ...................................................... 4.0 GHz
    CW (8340A/B #2) ...................................................... 4.00275 GHz
    RF ................................................................................. OFF

19. On the 8593E, press **[PRESET]** and wait until the preset is finished. Set the controls as follows:

    CENTER FREQ........................................................ 4.0 GHz
    SPAN ....................................................................... 1 MHz
    REF LEVEL............................................................. –10 dBm

    Press the following analyzer keys: **[PEAK SEARCH]**, **PEAK EXCURSN**, 3 **[dB]**, **[DISPLAY]**, **THRESHOLD ON OFF** (ON), –90 **[+dBm]**.

20. On 8340A/B #1, set RF on. Adjust the power level until the 8902A reads –12 dBm ±0.05 dB.

21. Disconnect the power sensor from the directional coupler. Connect the directional coupler directly to the 8593E INPUT 50 Ω using an adapter (do not use a cable).

22. On the 8593E, press **[PEAK SEARCH]**, **[MKR FCTN]**, **MKR TRACK ON OFF** (ON), **[SPAN]**, 200 **[kHz]**. Wait for the `AUTO ZOOM` message to disappear. Press **[MKR FCTN]**, **MKR TRACK ON OFF** (OFF), **[PEAK SEARCH]**, **[MKR ->]**, **MARKER -> REF LVL**. Press **[FREQUENCY]**, **CF STEP MAN AUTO** (MAN), 2.75 **[MHz]**, **CENTER FREQ**, **[▲]**.

23. On 8340A/B #2, set RF on. Adjust the power level until the signal is displaced at the reference level.

24. Set the 8593E controls as follows:

    RES BW ..................................................................... 1 kHz
    VIDEO BW............................................................... 100 Hz

25. On the 8593E, press **[PEAK SEACH]**, **MARKER DELTA**, **[FREQUENCY]**, **[▲]**, **[SGL SWP]**. Wait for completion of a new sweep.

26. If a distortion product can be seen, proceed as follows:

    a. On the 8593E, press **[PEAK SEARCH]**.

    b. Record the MKR Δ amplitude reading in Table 3-3 as the Lower Product Suppression.

27. If a distortion product cannot be seen, proceed as follows:

    a. On each 8340A/B, increase the power level by 5 dB.

    b. On the 8593E, press **[SGL SWEEP]** and wait for completion of a new sweep. A distortion product should now be visible with the higher power level. Press **[PEAK SEARCH]**.

    c. On each 8340A/B, reduce the power level by 5 dB.

    d. On the 8593E, press **[SGL SWEEP]** and wait for completion of a new sweep.

    e. Record the MKR Δ amplitude reading in Table 3-3 as the Upper Product Suppression.

28. On the 8593E, press [**FREQUENCY**], **[▼]**, **[▼]**, **[▼]**, **[SGL SWP]**. Wait for completion of a new sweep.

29. If a distortion product can be seen, proceed as follows:
    a. On the 8593E, press **[PEAK SEARCH]**.
    b. Record the MKR Δ amplitude reading in Table 3-3 as the Lower Product Suppression.
30. If a distortion product cannot be seen, proceed as follows:
    a. On each 8340A/B, increase the power level by 5 dB.
    b. On the 8593E, press **[SGL SWEEP]** and wait for completion of a new sweep. A distortion product should now be visible with the higher power level. Press **[PEAK SEARCH]**.
    c. On each 8340A/B, reduce the power level by 5 dB.
    d. On the 8593E, press **[SGL SWEEP]** and wait for completion of a new sweep.
    e. Record the MKR Δ amplitude reading in Table 3-3 as the Upper Product Suppression.

**Table 3-3 Three-Tone Intermodulation Distortion**

| 8340A/B #1 Frequency (GHz) | 8340A/B #1 Frequency (GHz) | Upper Product Suppression (dB) | Lower Product Suppression (dB) | Measurement Uncertainty (dB) |
|---|---|---|---|---|
| 2.0 | 2.00275 | ____________ | ____________ | +2.07/–2.42 |
| 4.0 | 4.00275 | ____________ | ____________ | +2.07/–2.42 |

# 3. Absolute Amplitude and Vernier Accuracy

## Specification

| | |
|---|---|
| Absolute Amplitude Accuracy | <±0.75 dB (–20 dBm setting at 300 MHz, 16 dB attenuation setting) |
| Vernier Accuracy | <±0.20 dB/dB, <±0.5 dB max (referenced to –20 dBm setting at 300 MHz, 16 dB attenuation setting) |

## Related Adjustments

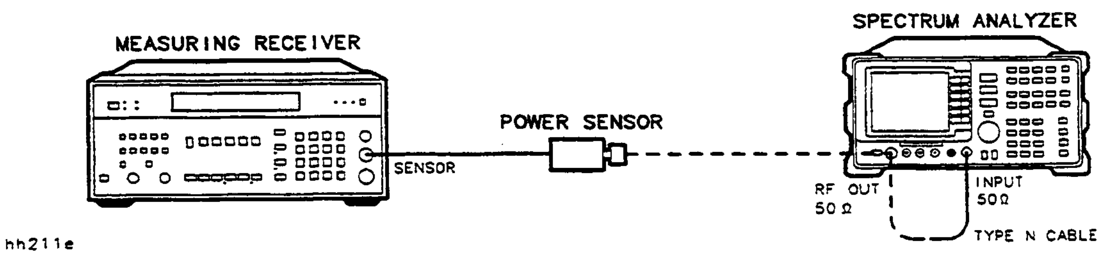
Tracking Generator Power Level Adjustments

## Description

The tracking generator output is connected to the spectrum analyzer INPUT 50 Ω 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 then set into RATIO mode so that future power level readings will be in dB relative to the power level at 300 MHz. 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. The step-to-step error is also calculated.

**Figure 3-3 Absolute Amplitude and Vernier Accuracy Test Setup**




## Equipment

Measuring Receiver .................................................... 8902A
Power Sensor ............................................................ 8482A

## Cable

Type N, 62 cm (24 in).................................................. 11500B/C

## Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 3-3.
2. Press **[PRESET]** on the spectrum analyzer and set the controls as follows:

   CENTER FREQ ........................................................ 300 MHz
   SPAN ............................................................................ 0 Hz
   RES BW ...................................................................... 30 kHz

3. On the spectrum analyzer, press **[MKR]**, **[AUX CTRL]**, **TRACK GEN**, **SRC POWER ON OFF** (ON) –5 **[dBm]**.
4. On the spectrum analyzer press **TRACKING PEAK**. Wait for the “PEAKING” message to disappear.
5. Zero and calibrate the measuring-receiver/power-sensor combination in log mode (power levels readout in dBm). Refer to the measuring receiver’s 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 power sensor to the RF OUT 50 Ω. See Figure 3-3.
7. On the spectrum analyzer, press **SRC POWER ON OFF** (ON), –20 **[dBm]**, **[SGL SWP]**.
8. Record the power level displayed on the measuring receiver below as the Absolute Amplitude Accuracy.

   Absolute Amplitude Accuracy___________dBm

   (Measurement Uncertainty: <+0.25/-0.26 dB)

9. Press RATIO on the measuring receiver. Power levels will now readout in dB relative to the power level just measured at the –20 dBm output power level setting.
10. Set the SRC POWER to the settings indicated in Table 3-4. At each setting, record the power level displayed on the measuring receiver.
11. Calculate the Absolute Vernier Accuracy by subtracting the SRC POWER setting from the Measured Power Level for each SRC POWER setting in Table 3-4.

    (Measured Power Level – SRC POWER) – 20 dB = Absolute Vernier Accuracy

12. Record the Absolute Vernier Accuracy for the –19 dBm SRC POWER setting as the corresponding Step-to-Step Accuracy.
13. Calculate the Step-to-Step Accuracy for the –20 dBm to –30 dBm SRC POWER settings by subtracting the previous Absolute Vernier Accuracy from the current Absolute Vernier Accuracy.

14. Locate the most positive and most negative Absolute Vernier Accuracy values in Table 3-4 and record below.

Positive Absolute Vernier Accuracy_______________dB

Negative Absolute Vernier Accuracy_______________dB

15. Locate the most positive and most negative Step-to-Step Accuracy values in Table 3-4 and record below.

Positive Step-to-Step Accuracy_______________dB

Negative Step-to-Step Accuracy_______________dB

**Table 3-4 Vernier Accuracy**

| SRC POWER | Measured Power Level (dB) | Absolute Vernier Accuracy (dB) | Step-to-Step Accuracy (dB) | Measurement Uncertainty (dB) |
|---|---|---|---|---|
| –20 | 0 (Ref) | 0 (Ref) | 0 (Ref) | 0 |
| –19 | ______ | ______ | ______ | ±0.033 |
| –20 | 0 (Ref) | 0 (Ref) | 0 (Ref) | ±0.033 |
| –21 | ______ | ______ | ______ | ±0.033 |
| –22 | ______ | ______ | ______ | ±0.033 |
| –23 | ______ | ______ | ______ | ±0.033 |
| –24 | ______ | ______ | ______ | ±0.033 |
| –25 | ______ | ______ | ______ | ±0.033 |
| –26 | ______ | ______ | ______ | ±0.033 |
| –27 | ______ | ______ | ______ | ±0.033 |
| –28 | ______ | ______ | ______ | ±0.033 |
| –29 | ______ | ______ | ______ | ±0.033 |
| –30 | ______ | ______ | ______ | ±0.033 |

# 4. Power Sweep Range

### Specification

Range: (–10 dBm to –1 dBm)-(source power setting)

### Related Adjustment

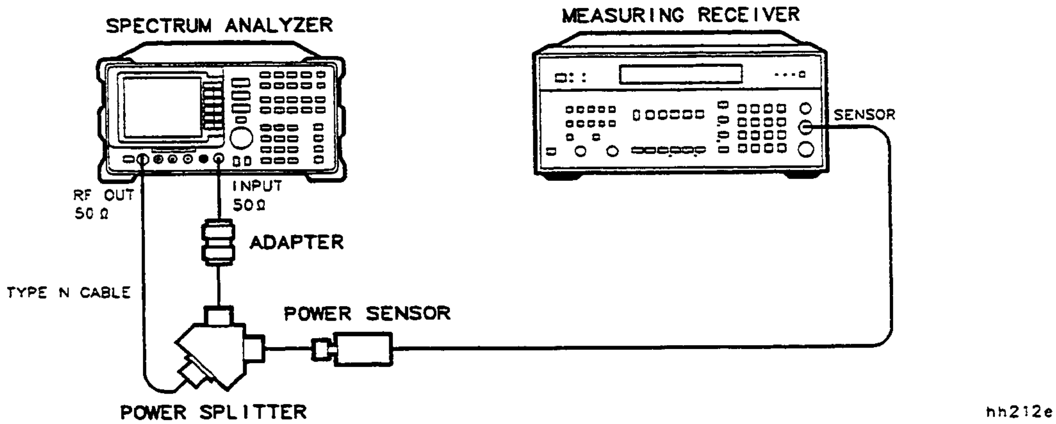
Tracking Generator Power Level Adjustments

### Description

The tracking generator output is connected to the spectrum analyzer INPUT 50 Ω through a power splitter and the tracking is adjusted at 300 MHz for a maximum signal level. The other output of the power splitter is connected to a measuring receiver. The tracking generator is set to do a power sweep from –10 dBm to –1 dBm.

The markers are used to measure the displayed amplitude at the beginning and end of the sweep. The power sweep is then turned off and the power level of the tracking generator is adjusted until the displayed amplitude is the same as at the start of the sweep. This power level is measured on the measuring receiver and recorded. The tracking generator is then adjusted until the displayed amplitude is the same as at the end of the sweep. This power level is measured and recorded. The difference between the two measured power levels is calculated and recorded.

**Figure 3-4 Power Sweep Range Test Setup**



### Equipment

Measuring Receiver .................................................... 8902A
Power Sensor .............................................................. 8482A
Power Splitter ............................................................. 11667A

#### Cable

Type N, 62 cm (24 in).................................................. 11500B/C

#### Adapter

Type N (m) to Type N (m)............................................ 1250-1475

### Procedure

1. Connect the equipment as shown in Figure 3-4. Do not connect the power sensor to the power splitter at this time.
2. Press **[PRESET]** on the spectrum analyzer and set the controls as follows:

   CENTER FREQ ......................................................... 300 MHz
   SPAN ........................................................................... 0 Hz
   RES BW ...................................................................... 30 kHz
3. On the spectrum analyzer, press **[MKR]**, **[AUX CTRL]**, **TRACK GEN**, **SRC PWR ON OFF** (ON), –5 **[dBm]**.
4. On the spectrum analyzer, press **TRACKING PEAK**. Wait for the “PEAKING” message to disappear.
5. Zero and calibrate the power-sensor/measuring-receiver in log mode (power levels read out in dBm). Refer to the measuring receiver’s operation manual. Enter the power sensor’s 300 MHz Cal Factor into the measuring receiver. Connect the power sensor to the power splitter. See Figure 3-4.
6. On the spectrum analyzer, press **SRC PWR ON OFF** (ON), 10 **[–dBm]**, **PWR SWP ON OFF** (ON), 9 **[dB]**. Press **[AMPLITUDE]**, **SCALE LOG LIN** (LOG), 2 **[dB]**, **REF LVL**. Adjust the reference level until the peak of the displayed ramp (along the far-right graticule) is one-half division down from the reference level.
7. Press **[MKR]**, **MARKER NORMAL**. Use the knob to place the marker at the far-left graticule line. The marker should read 0 picosecond. Press **MARKER DELTA**.
8. Press **[AUX CTRL]**, **TRACK GEN**, **PWR SWP ON OFF** (OFF) to set power sweep off. The Δ MKR should read 0 dB ±0.1 dB. If it does not, press **SRC PWR ON OFF** (ON) and adjust the power level until the marker reads 0 dB ±0.1 dB.
9. Record the power level displayed on the measuring receiver.

   Start Power Level_________dBm
10. Press **PWR SWP ON OFF** (ON) to set power sweep on. Wait for completion of a new sweep.
11. Press **[MKR]**, **MARKER NORMAL**. Use the knob to place the marker at the rightmost graticule line. Press **MARKER DELTA**.

12. Press **[AUX CTRL]**, **TRACK GEN**, **PWR SWP ON OFF** (OFF) to set power sweep off. Press **SRC PWR ON OFF** (ON) and adjust the SRC POWER level until the Δ MKR reads 0 dB ±0.1 dB.

---

**NOTE** Wait for completion of a new sweep after each adjustment of the SRC POWER level.

---

13. Record the power level displayed on the measuring receiver.

Stop Power Level___________dBm

14. Subtract Start Power Level (step 9) from the Stop Power Level (step 13) and record as the Power Sweep Range.

Power Sweep Range = Stop Power Level – Start Power Level

Power Sweep Range ___________dB

# 5. Tracking Generator Level Flatness

## Specification

Level Flatness, at –20 dBm output power, referenced to 300 MHz:

300 kHz to 10 MHz: ±3 dB

40 MHz to 300 MHz: ±1.5 dB

10 MHz to 2.9 GHz: ±2 dB

## Related Adjustment

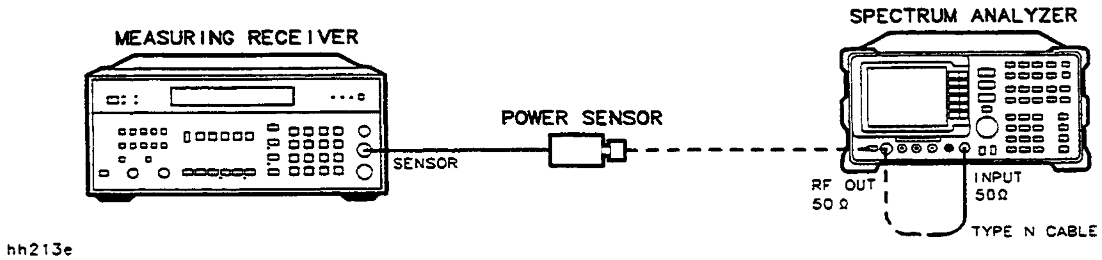
Tracking Generator Power Level Adjustments

## Description

The tracking generator output is connected to the spectrum analyzer INPUT 50 Ω 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 then set into RATIO mode so that future power level readings will be 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.

**Figure 3-5 Level Flatness Test Setup**




## Equipment

Measuring Receiver .................................................... 8902A
Power Sensor ............................................................ 8482A

## Cable

Type N, 62 cm (24 in).................................................. 11500B/C

### Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 3-5.
2. Press **[PRESET]**, **[SPAN]**, **BANDLOCK**, **0–2.9 Gz BAND 0** on the spectrum analyzer and set the controls as follows:

   CENTER FREQ ........................................................ 300 MHz
   CF STEP ................................................................. 100 MHz
   SPAN ........................................................................ 0 Hz
   RES BW ................................................................... 30 kHz

3. On the spectrum analyzer, press **[MKR]**, **[AUX CTRL]**, **TRACK GEN**, **SRC PWR ON OFF** (ON), –5 **[dB]**.
4. On the spectrum analyzer, press **TRACKING PEAK**. Wait for the “PEAKING” message to disappear.
5. Zero and calibrate the measuring-receiver/power-sensor combination in log mode (power levels read out in dBm). 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 power sensor to the RF OUT 50 Ω.
7. On the spectrum analyzer, press **SRC PWR ON OFF** (ON), 20 **[–dBm]**, **[SGL SWP]**.
8. Press RATIO on the measuring receiver. The measuring receiver will now read out power levels relative to the power level at 300 MHz.
9. Set the spectrum analyzer CENTER FREQ to 300 kHz. Press **[SGL SWP]**.
10. Enter the appropriate power sensor Cal Factor into the measuring receiver as indicated in Table 3-5.
11. Record the power level displayed on the measuring receiver as the Flatness in Table 3-5.
12. Repeat steps 9 through 11 above to measure the flatness at each CENTER FREQ setting listed in Table 3-5. The **[▲]** key may be used to tune to center frequencies above 100 MHz.
13. Record the most positive Flatness reading in Table 3-5 for frequencies between 40 MHz and 300 MHz as the Maximum Positive Flatness.

    Maximum Positive Flatness (40 MHz to 300 MHz)____________dB

14. Record the most negative Flatness reading in Table 3-5 for frequencies between 40 MHz and 300 MHz as the Maximum Negative Flatness.

    Maximum Positive Flatness (40 MHz to 300 MHz)____________dB

15. Record the most positive Flatness reading for frequencies between 300 kHz and 10 MHz in Table 3-5 as the Maximum Positive Flatness.

    Maximum Positive Flatness (300 kHz to 10 MHz)____________dB

16. Record the most negative Flatness reading for frequencies between 300 kHz and 10 MHz in Table 3-5 as the Maximum Negative Flatness.

    Maximum Negative Flatness (300 kHz to 10 MHz)____________dB

17. Record the most positive Flatness reading for frequencies between 10 MHz and 2.9 GHz in Table 3-5 as the Maximum Positive Flatness.

    Maximum Positive Flatness (10 MHz to 2.9 MHz)____________dB

18. Record the most negative Flatness reading for frequencies between 10 MHz and 2.9 GHz in Table 3-5 as the Maximum Negative Flatness.

    Maximum Negative Flatness (10 MHz to 2.9 MHz)____________dB

**Table 3-5 Flatness Relative to 300 MHz**

| CENTER FREQ | FLATNESS (dB) | CAL FACTOR FREQ (MHz) | MEASUREMENT UNCERTAINTY (dB) |
|---|---|---|---|
| 300 kHz | ____________ | 0.3 | +0.28/–0.28 |
| 500 kHz | ____________ | 0.3 | +0.28/–0.28 |
| 1 MHz | ____________ | 1 | +0.24/–0.24 |
| 2 MHz | ____________ | 3 | +0.24/–0.24 |
| 5 MHz | ____________ | 3 | +0.24/–0.24 |
| 10 MHz | ____________ | 10 | +0.24/–0.24 |
| 20 MHz | ____________ | 30 | +0.24/–0.24 |
| 40 MHz | ____________ | 50 | +0.24/–0.24 |
| 50 MHz | ____________ | 10 | +0.24/–0.24 |
| 80 MHz | ____________ | 100 | +0.24/–0.24 |
| 100 MHz | ____________ | 100 | +0.24/–0.24 |
| 200 MHz | ____________ | 300 | +0.24/–0.24 |
| 300 MHz | ____________ | 300 | +0.24/–0.24 |
| 400 MHz | ____________ | 300 | +0.24/–0.24 |
| 500 MHz | ____________ | 100 | +0.24/–0.24 |
| 600 MHz | ____________ | 300 | +0.24/–0.24 |
| 700 MHz | ____________ | 1000 | +0.24/–0.24 |
| 800 MHz | ____________ | 1000 | +0.24/–0.24 |
| 900 MHz | ____________ | 1000 | +0.24/–0.24 |
| 1000 MHz | ____________ | 1000 | +0.24/–0.24 |
| 1100 MHz | ____________ | 1000 | +0.24/–0.24 |
| 1200 MHz | ____________ | 1000 | +0.24/–0.24 |
| 1300 MHz | ____________ | 1000 | +0.24/–0.24 |
| 1400 MHz | ____________ | 1000 | +0.24/–0.24 |
| 1500 MHz | ____________ | 2000 | +0.24/–0.24 |
| 1600 MHz | ____________ | 2000 | +0.24/–0.24 |
| 1700 MHz | ____________ | 2000 | +0.24/–0.24 |
| 1800 MHz | ____________ | 2000 | +0.24/–0.24 |
| 1900 MHz | ____________ | 2000 | +0.24/–0.24 |
| 2000 MHz | ____________ | 2000 | +0.41/–0.41 |
| 2100 MHz | ____________ | 2000 | +0.41/–0.41 |
| 2200 MHz | ____________ | 2000 | +0.41/–0.41 |
| 2300 MHz | ____________ | 2000 | +0.41/–0.41 |
| 2400 MHz | ____________ | 2000 | +0.41/–0.41 |
| 2500 MHz | ____________ | 3000 | +0.41/–0.41 |
| 2600 MHz | ____________ | 3000 | +0.41/–0.41 |
| 2700 MHz | ____________ | 3000 | +0.41/–0.41 |
| 2800 MHz | ____________ | 3000 | +0.41/–0.41 |
| 2900 MHz | ____________ | 3000 | +0.41/–0.41 |

# 6. Tracking Generator Frequency Accuracy

### Specification

Frequency Accuracy < ±[(frequency readout × frequency reference error) + SPAN accuracy + 1% of span + 20% of RES BW setting + 2 kHz]

### Related Adjustment

10 MHz Frequency Reference Adjustment

Tracking Oscillator Adjustment

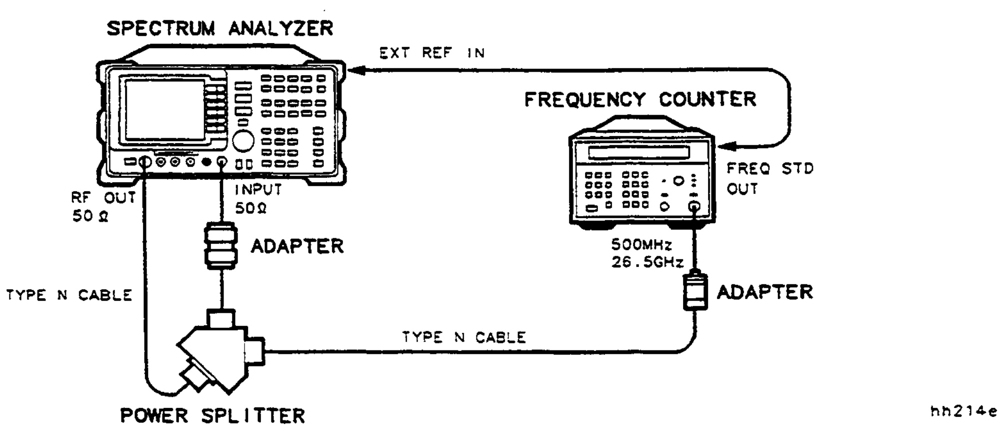
### Description

The tracking generator output is connected to the spectrum analyzer INPUT 50 Ω through a power splitter and the tracking is adjusted at 500 MHz for a maximum signal level. The other output of the power splitter is connected to a frequency counter. The frequency displayed on the counter is recorded. This is repeated at several other output frequencies.

The effect of the (frequency readout × frequency reference error) term is eliminated by locking the spectrum analyzer to the frequency counter's 10 MHz reference. The SPAN accuracy term is also eliminated by setting the SPAN to zero. These terms may be eliminated for the purpose of this test since these are measured in the 10 MHz Reference Accuracy and Frequency Readout Accuracy and Marker Count Accuracy tests.

The remaining terms are a function of the RES BW setting and the tracking adjustment and cannot be eliminated. The RES BW will be held constant for the purposes of this test. It is the effect of these terms which is verified in this test.

**Figure 3-6 Frequency Accuracy Test Setup**



## Equipment

Frequency Counter ........................................................ 5343A
Power Splitter ............................................................. 11667A

### Cable

Type N, 62 cm (24 in) (2 required)............................. 11500B/C
BNC, 122 cm (48 in) ................................................... 10503A

### Adapter

Type N (m) to Type N (m)........................................... 1250-1475

## Procedure

1. Remove the jumper between the EXT REF IN and 10 MHz REF OUTPUT connectors on the spectrum analyzer rear panel. Connect the equipment as shown in Figure 3-6. The frequency counter provides the frequency reference for the spectrum analyzer.
2. Press **[PRESET]**, **[SPAN]**, **BAND LOCK**, **0–2.9 Gz BAND 0** on the spectrum analyzer and set the controls as follows:

   CENTER FREQ ............................................................ 500 MHz
   SPAN ............................................................................ 0 Hz
   RES BW ........................................................................ 1 kHz
3. On the spectrum analyzer, press **[MKR]**, **[AUX CTRL]**, **TRACK GEN**, **SRC PWR ON OFF** (ON), 1 **[–dB]**.
4. On the spectrum analyzer, press **TRACKING PEAK** and wait for the “PEAKING” message to disappear (approximately 90 seconds).
5. Set the frequency counter controls as follows:

   SAMPLE RATE ........................................................ Midrange
   10 Hz-500 MHz / 500 MHz-26.5 GHz Switch........... 500 MHz-26.5 GHz
   RESOLUTION ............................................................ 1 Hz
6. Wait for the counter to gate two or three times and record the counter reading as the Measured Frequency in Table 3-6 for the 500 MHz CENTER FREQ setting.
7. Repeat steps 4 through 6 for the remaining CENTER FREQ settings in Table 3-6.
8. Subtract the CENTER FREQ from the Measured Frequency for each CENTER FREQ setting in Table 3-6 and record the result as the Frequency Error.
9. Locate in Table 3-6 the greatest Frequency Error, treating negative frequency errors as if they were positive. For example, if the Frequency Errors are –240, +110, –80, and +142, the greatest Frequency Error would be –240 Hz. Record the greatest Frequency Error below.

   Frequency Error__________Hz
10. Reconnect the jumper between EXT REF IN and 10 MHz REF OUTPUT on the spectrum analyzer’s rear panel.

**Table 3-6 Frequency Accuracy**

| CENTER FREQ Setting (MHz) | Measured Frequency (MHz) | Frequency Error (Hz) | Measurement Uncertainty (Hz) |
|---|---|---|---|
| 500 | ____________ | _________ | ±1.0 |
| 1000 | ____________ | _________ | ±1.0 |
| 1500 | ____________ | _________ | ±1.0 |
| 2000 | ____________ | _________ | ±1.0 |
| 2500 | ____________ | _________ | ±1.0 |
| 2900 | ____________ | _________ | ±1.0 |

# 7. Harmonic Spurious Outputs

## Specification

Harmonics Spurious:

<–25 dBc, 300 kHz to ≤400 MHz (–1 dBm output power)

<–15 dBc, >400 MHz to 2.9 GHz (–1 dBm output power)

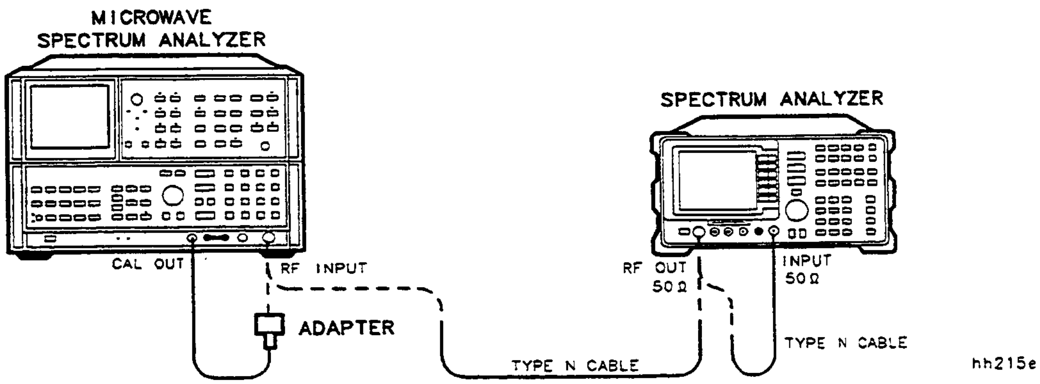
## Related Adjustment

There is no related adjustment for this performance test

## Description

The tracking generator output is connected to the 8593E spectrum analyzer's INPUT 50 Ω and the tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator output is then connected to the input of an 8566A/B 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.

**Figure 3-7 Harmonic Spurious Responses Test Setup**




## Equipment

Microwave Spectrum Analyzer .................................. 8566A/B

### Cables

Type N, 62 cm (24 in)................................................ 11500B/C
BNC, 23 cm (9 in) ...................................................... 10502A

### Adapter

Type N (m) to BNC (f)................................................ 1250-1476

### Procedure

**NOTE** The 8566A/B should be allowed to warm up for at least 30 minutes before proceeding.

1. Perform a front-panel calibration of the 8566A/B as follows:
   a. Connect a BNC cable between CAL OUTPUT and RF INPUT.
   b. Press **[2-22 GHz]** (INSTR PRESET), **[RECALL]**, 8. Adjust AMPTD CAL for a marker amplitude reading of –10 dBm.
   c. Press **[RECALL]**, 9. Adjust FREQ ZERO for a maximum amplitude response.
   d. Press **[SHIFT]**, **[FREQUENCY SPAN]** to start the 30 second internal error correction routine.
   e. When the `CALIBRATING!` message disappears, press **[SHIFT]**, **[START FREQ]** to use the error correction factors just calculated.
2. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the 8593E spectrum analyzer. See Figure 3-7.
3. Press **[PRESET]**, **[SPAN] BAND LOCK**, **0–2.9, Gz BAND 0**, and set the controls as follows:

   CENTER FREQ ........................................................ 300 MHz
   SPAN .............................................................................. 0 Hz
   RES BW ........................................................................ 30 kHz
4. On the 8593E, press **[MKR]**, **[AUX CTRL]**,**TRACK GEN**, **SRC PWR ON OFF** (ON), –5 **[dBm]**.
5. On the 8593E press **TRACKING PEAK**. Wait for the “`PEAKING`” message to disappear.
6. On the 8593E, press **SRC PWR ON OFF** (ON), 1 **[dBm]**, **[FREQUENCY]** 300 **[kHz]**, **[SGL SWP]**.
7. Connect the Type N cable from the tracking generator output to the 8566A/B RF INPUT. See Figure 3-7.
8. Set the 8566A/B controls as follows:

   CENTER FREQUENCY ........................................... 300 kHz
   SPAN .............................................................................. 100 kHz
   REFERENCE LEVEL ................................................ +5 dBm
   RES BW ........................................................................ 30 kHz
   LOG dB/DIV ............................................................... 10 dB

9. On the 8566A/B do the following:
   a. Press **[PEAK SEARCH]** and **[MKR FCTN]**, **MKR TRACK ON OFF** (ON). Wait for the signal to be displayed at center screen. Press **[MKR FCTN]**, **MKR TRACK ON OFF** (OFF).
   b. Press **[PEAK SEARCH]**, **[MKR/Δ -> STP SIZE]**, MARKER **[Δ]**.
   c. Press **[CENTER FREQUENCY]**, **[▲]** to tune to the second harmonic. Press **[PEAK SEARCH]**. If the CENTER FREQUENCY is greater than 2.5 GHz, press **[PRESEL PEAK]** and wait for the "PEAKING" message to disappear. Record the marker amplitude reading in Table 3-7 as the 2nd Harmonic Level for the 300 kHz Tracking Generator Output Frequency.
   d. If the tracking generator output frequency is less than 1 GHz, press **[CENTER FREQUENCY]**, **[▲]** to tune to the third harmonic. Press **[PEAK SEARCH]**. If the CENTER FREQUENCY is greater than 2.5 GHz, press **[PRESEL PEAK]** and wait for the "PEAKING" message to disappear. Record the marker amplitude reading in Table 3-7 as the 3rd Harmonic Level for the 300 kHz Tracking Generator Output Frequency.
   e. Press MARKER **[OFF]**.
10. Repeat steps 8 and 9 above for the remaining Tracking Generator Output Frequencies listed in Table 3-7. Note that the 8593E CENTER FREQ is the same as the Tracking Generator Output Frequency.
11. Locate the most positive 2nd Harmonic Level in Table 3-7 and record below.

2nd Harmonic Level_____________dBc

12. Locate the most positive 3rd Harmonic Level in Table 3-7 and record below.

3rd Harmonic Level_____________dBc

**Table 3-7 Harmonic Spurious Responses**

| TRACKING GENERATOR FREQUENCY | 2nd Harmonic Level (dBc) | 3rd Harmonic Level (dBc) | MEASUREMENT UNCERTAINTY (dB) |
|---|---|---|---|
| 300 kHz | ___________ | ___________ | +1.55/–1.80 |
| 100 MHz | ___________ | ___________ | +1.55/–1.80 |
| 300 MHz | ___________ | ___________ | +1.55/–1.80 |
| 900 MHz | ___________ | ___________ | +1.55/–1.80 |
| 1.4 GHz | ___________ | N/A | +3.45/–4.01 |

# 8. Non-Harmonic Spurious Outputs

## Specification

Non-Harmonic Spurious (–1 dBm output power)

300 kHz to ≤400 MHz: < –27 dBc

>400 MHz to 2.9 GHz < –15 dBc

## Related Adjustment

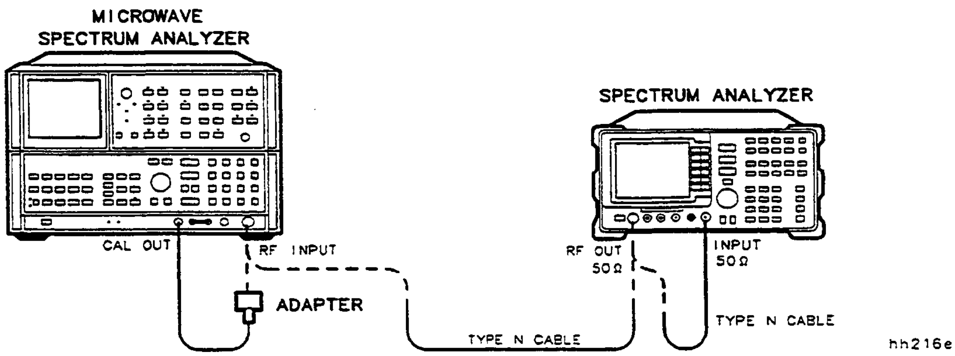
There is no related adjustment for this performance test.

## Description

The tracking generator output is connected to the 8593E spectrum analyzer's INPUT 50 Ω and the tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator output is then connected to the input of an 8566A/B spectrum analyzer. The tracking generator is set to several different output frequencies.

For each output frequency, several sweeps are taken on the 8566A/B 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 its harmonics are ignored; they are tested in the Harmonic Spurious Responses test. The amplitude of the highest spurious response is recorded.

**Figure 3-8 Non-Harmonic Spurious Responses Test Setup**




## Equipment

Microwave Spectrum Analyzer .................................... 8566A/B

### Cables

Type N, 62 cm (24 in).................................................... 11500B/C
BNC, 23 cm (9 in) ......................................................... 10502A

### Adapter

Type N (m) to BNC (f).................................................. 1250-1476

## Procedure

**NOTE** The 8566A/B should be allowed to warm up for at least 30 minutes before proceeding.

1. Perform a front-panel calibration of the 8566A/B as follows:
   a. Connect a BNC cable between CAL OUTPUT and RF INPUT.
   b. Press **[2-22 GHz]** (INSTR PRESET), **[RECALL]** 8. Adjust AMPTD CAL for a marker amplitude reading of –10 dBm.
   c. Press **[RECALL]**, **[9]**. Adjust FREQ ZERO for a maximum amplitude response.
   d. Press **[SHIFT]**, **[FREQUENCY SPAN]** to start the 30 second internal error correction routine.
   e. When the CALIBRATING! message disappears, press to use the error correction factors just calculated.
2. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the 8593E spectrum analyzer. See Figure 3-8.
3. Press **[PRESET]**, **[SPAN]**, **BAND LOCK**, **2-2.9 Gz BAND 0**, set the controls as follows:

   CENTER FREQ .......................................................... 300 MHz
   SPAN ................................................................. 0 Hz
   RES BW ............................................................... 30 kHz

4. On the 8593E, press **[MKR]**, **[AUX CTRL]**, **TRACK GEN**, **SRC PWR ON OFF** (ON) –5, **[dBm]**.
5. On the 8593E, press **TRACKING PEAK**. Wait for the “PEAKING” message to disappear.
6. On the 8593E, press **SRC PWR ON OFF** (ON), 1 **[-dBm]**, **[SGL SWP]**.
7. Connect the Type N cable from the tracking generator output to the 8566A/B RF INPUT. See Figure 3-8.

### Measuring Fundamental Amplitudes

8. Set the 8593E CENTER FREQ to the Fundamental Frequency listed in Table 3-8.
9. Set the 8566A/B controls as follows:

   SPAN ................................................................. 100 kHz
   REFERENCE LEVEL ...................................................... +5 dBm
   ATTEN ................................................................ 20 dB
   LOG dB/DIV ........................................................... 10 dB

10. Set the 8566A/B CENTER FREQUENCY to the Fundamental Frequency listed in Table 3-8.
11. On the 8566A/B, press **[PEAK SEARCH]**. If the marker frequency is greater than 2.5 GHz, press **[PRESEL PEAK]** and wait for the “PEAKING!” message to disappear. Press **[MKR -> REF LVL]**. Wait for another sweep to finish.

12. Record the 8566A/B marker amplitude reading in Table 3-8 as the Fundamental Amplitude.

13. Repeat steps 8 through 12 for all Fundamental Frequency settings in Table 3-8.

### Measuring Non-Harmonic Responses

14. On the 8593E, set the CENTER FREQ to 300 kHz.

15. Set the 8566A/B START FREQ, STOP FREQ, and RES BW as indicated in the first row of Table 3-8.

16. Press **[SINGLE]** on the 8566A/B and wait for the sweep to finish. Press **[PEAK SEARCH]**. If the marker frequency is greater than 2.5 GHz, press **[PRESEL PEAK]** and wait for the “PEAKING!” message to disappear.

17. Verify that the marked signal is not the fundamental or a harmonic of the fundamental as follows:

    a. Divide the marker frequency by the fundamental frequency (the 8593E CENTER FREQ setting). For example, if the marker frequency is 880 kHz and the fundamental frequency is 300 kHz, dividing 880 kHz by 300 kHz yields 2.933.

    b. Round the number calculated in step a the nearest whole number. In the example above, 2.933 should be rounded to 3.

    c. Multiply the fundamental frequency by the number calculated in step b. Following the example, multiplying 300 kHz by 3 yields 900 kHz.

    d. Calculate the difference between the marker frequency and the frequency calculated in step c above. Continuing the example, the difference would be 20 kHz.

    e. Due to span accuracy uncertainties in the 8566A/B, 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:

| Marker Frequencies | Tolerance |
|---|---|
| < 5 MHz | ±200 kHz |
| < 55 MHz | ±750 kHz |
| < 55 MHz | ±10 kHz |

    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.

18. 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.

19. If the marked signal is either the fundamental or a harmonic of the fundamental (see step 17) or a noise peak (see step 18), move the marker to the next highest signal by pressing **[SHIFT]**, **[PEAK SEARCH]**. Continue with step 17.

20. If the marked signal is not the fundamental or a harmonic of the fundamental (see step 17) and is a true response (see step 18), calculate the difference between the amplitude of marked signal and the Fundamental Amplitude as listed in Table 3-8.

    For example, if the Fundamental Amplitude for a fundamental frequency of 300 kHz is +1.2 dBm and the marker amplitude is –30.8 dBm, the difference is –32 dBc.

    Record this difference as the Non-Harmonic Response Amplitude for the appropriate 8593E CENTER FREQ and 8566A/B START and STOP FREQ settings in Table 3-9.

    Non-Harmonic Amplitude = Marker Amplitude – Fundamental Amplitude

21. If a true non-harmonic spurious response is not found, record “noise” as the Non-Harmonic Response Amplitude in Table 3-9 for the appropriate 8593E CENTER FREQ and 8566A/B START and STOP FREQ settings.

22. Repeat steps 16 through 21 for the remaining 8566A/B settings for START FREQ, STOP FREQ, and RES BW for the 8593E CENTER FREQ setting of 300 kHz.

23. Repeat steps 15 through 22 with the 8593E CENTER FREQ set to 1.5 GHz.

24. Repeat steps 15 through 22 with the 8593E CENTER FREQ set to 2.9 GHz.

25. Locate in Table 3-9 the most-positive Non-Harmonic Response Amplitude for 8566A/B STOP FREQ settings of less than or equal to 2000 MHz. Record this amplitude below.

    Non-Harmonic Response Amplitude (≤2000 MHz)______________dBc

26. Locate in Table 3-9 the most-positive Non-Harmonic Response Amplitude for the 8566A/B START FREQ settings greater than or equal to 2000 MHz. Record this amplitude below.

    Non-Harmonic Response Amplitude (≥2000 MHz)______________dBc

**Table 3-8 Fundamental Response Amplitudes**

| Fundamental Frequency | Fundamental Amplitudes |
|---|---|
| 300 kHz | ____________________dBm |
| 1.5 GHz | ____________________dBm |
| 2.9 GHz | ____________________dBm |

**Table 3-9 Non-Harmonic Responses**

| 8566A/B Settings | | | Non-Harmonic Response Amplitude (dBc) | | | MEASUREMENT UNCERTAINTY (dB) |
|---|---|---|---|---|---|---|
| START FREQ (MHz) | STOP FREQ (MHz) | RES BW | At 300 kHz CENTER FREQ | At 1.5 GHz CENTER FREQ | At 2.9 GHz CENTER FREQ | |
| 0.2 | 5.0 | 30 kHz | __________ | __________ | __________ | +1.55/–1.80 |
| 5.0 | 55 | 100 kHz | __________ | __________ | __________ | +1.55/–1.80 |
| 55 | 1240 | 1 MHz | __________ | __________ | __________ | +1.55/–1.80 |
| 1240 | 2000 | 1 MHz | __________ | __________ | __________ | +1.55/–1.80 |
| 2000 | 2900 | 1 MHz | __________ | __________ | __________ | +3.45/–4.01 |

# 9. Tracking Generator Feedthrough

## Specification

Tracking Generator Feedthrough:

400 kHz to 2.9 GHz: <–110 dBm

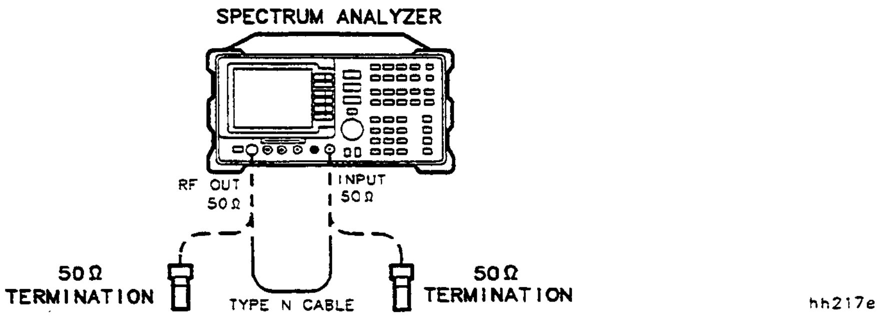
## Related Adjustment

There is no related adjustment for this performance test.

## Description

The tracking generator output is connected to the 8593E spectrum analyzer’s INPUT 50 Ω and the tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator output is terminated and set for –1 dBm output power (maximum levelled output power). The spectrum analyzer's INPUT 50 Ω is also terminated. The displayed average noise level of the spectrum analyzer is then measured over several frequency ranges.

**Figure 3-9 Tracking Generator Feedthrough Test Setup**




## Equipment

50 Ω Termination (2 required).................................... 908A

## Cables

Type N, 62 cm (24 in).................................................... 1500B/C
BNC, 23 cm (9 in) ........................................................ 10502A

## Adapter

Type N (m) to BNC (f)................................................... 1250-1476

### Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the 8593E spectrum analyzer. See Figure 3-8.
2. Press **[PRESET]**, **[SPAN]**, **BAND LOCK**, **0–2.9 Gz BAND 0** on the 8593E and set the controls as follows:

   CENTER FREQ ........................................................ 300 MHz
   SPAN ........................................................................ 0 Hz
   RES BW ................................................................... 30 kHz

3. On the 8593E, press **[MKR]**, **[AUX CTRL]**, **TRACK GEN**, **SRC PWR ON OFF** (ON), –5 **[dBm]**.
4. On the 8593E, press **TRACKING PEAK**. Wait for the “PEAKING” message to disappear.
5. Connect the CAL OUTPUT to the INPUT 50 Ω. Set the 8593E controls as follows:

   REF LEVEL ............................................................ –20 dBm
   SPAN ...................................................................... 10 MHz
   ATTEN ........................................................................ 0 dB

6. Press **[PEAK SEARCH]**, **[MKR FCTN]**, **MKR TRACK ON OFF** (ON), **[SPAN]**, 100 **[kHz]**. Wait for the AUTO ZOOM message to disappear. Set the controls as follows:

   VIDEO BW ................................................................. 30 Hz
   SIGNAL TRACK ............................................................ OFF

7. Press **[SGL SWP]** and wait for completion of a new sweep. Press **[PEAK SEARCH]**, **[AMPLITUDE]**, **MORE 1 of 2**, **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.

   +0.21 dB = –20 dBm – (–20.21 dBm)

8. Connect one 908A 50 Ω termination to the 8593E INPUT 50 Ω and another to the tracking generator’s RF OUT 50 Ω.
9. Press **[AUX CTRL]**, **TRACK GEN**, **SRC PWR ON OFF** (OFF).
10. Set the 8593E controls as follows:

    CENTER FREQ ............................................................ 0 Hz
    SPAN ...................................................................... 10 MHz
    RES BW ................................................................... –10 dBm
    Markers ..................................................................... OFF
    VIDEO BW ............................................................... AUTO
    TRIG ........................................................................ CONT

11. Press **[PEAK SEARCH]**, **[MKR->]**, **MARKER -> REF LVL**, **[MKR FCTN]**, **MKR TRACK ON OFF**, (ON), **[SPAN]**, 600 **[kHz]**. Wait for the AUTO ZOOM message to disappear. Press **[MKR FCTN]**, **MKR TRACK OFF** (OFF).

12. Press **[FREQUENCY]** and adjust the center frequency until the LO feedthrough peak is on the left-most graticule line. Set the control as follows:

    SPAN ............................................................... 50 kHz
    REF LEVEL ......................................................... –50 dBm
    RES BW ............................................................. 1 kHz
    VIDEO BW .......................................................... 30 Hz
    DETECTOR ......................................................... SAMPLE

13. Press **[AUX CTRL] TRACK GEN**, **SRC PWR ON OFF** (ON), 1 **[–dBm]**.
14. Press **[SGL SWP]** and wait for completion of a new sweep. Press **[DISPLAY]**, **DSP LINE ON OFF** (ON).
15. 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 3-10 as the noise level at 300 kHz.
16. Repeat steps 14 and 15 for the remaining Tracking Generator Output Frequencies (spectrum analyzer CENTER FREQ) listed in Table 3-10.
17. In Table 3-10, locate the most positive Noise Level Amplitude over the range from 300 kHz to 1 MHz. Record this amplitude here:

    TG Feedthrough (300 kHz to 1 MHz)_______________dBm

18. In Table 3-10, locate the most positive Noise Level Amplitude over the range from 1 MHz to 2.0 GHz. Record this amplitude here:

    TG Feedthrough (1 MHz to 2.0 GHz)_______________dBm

19. In Table 3-10, locate the most positive Noise Level Amplitude over the range from 2.0 GHz to 2.9 GHz. Record this amplitude here:

    TG Feedthrough (2.0 GHz to 2.9 GHz)_______________dBm

**Table 3-10 Tracking Generator Feedthrough Amplitude**

| Tracking Generator Output Frequency | Noise Level Amplitude (dB) | Measurement Uncertainty (dB) |
|---|---|---|
| 400 kHz | ____________ | +1.74/-1.98 |
| 500 kHz | ____________ | +1.74/-1.98 |
| 1 MHz | ____________ | +1.74/-1.98 |
| 20 MHz | ____________ | +1.74/-1.98 |
| 50 MHz | ____________ | +1.74/-1.98 |
| 100 MHz | ____________ | +1.74/-1.98 |
| 250 MHz | ____________ | +1.74/-1.98 |
| 400 MHz | ____________ | +1.74/-1.98 |
| 550 MHz | ____________ | +1.74/-1.98 |
| 700 MHz | ____________ | +1.74/-1.98 |
| 850 MHz | ____________ | +1.74/-1.98 |
| 1000 MHz | ____________ | +1.74/-1.98 |
| 1150 MHz | ____________ | +1.74/-1.98 |
| 1300 MHz | ____________ | +1.74/-1.98 |
| 1450 MHz | ____________ | +1.74/-1.98 |
| 1600 MHz | ____________ | +1.74/-1.98 |
| 1750 MHz | ____________ | +1.74/-1.98 |
| 2000 MHz | ____________ | +1.74/-1.98 |
| 2300 MHz | ____________ | +1.74/-1.98 |
| 2600 MHz | ____________ | +1.74/-1.98 |
| 2900 MHz | ____________ | +1.74/-1.98 |

# 10. RF Power-Off Residuals

## Specification

Residuals: <–120 dBm, 300 kHz to 2.9 GHz

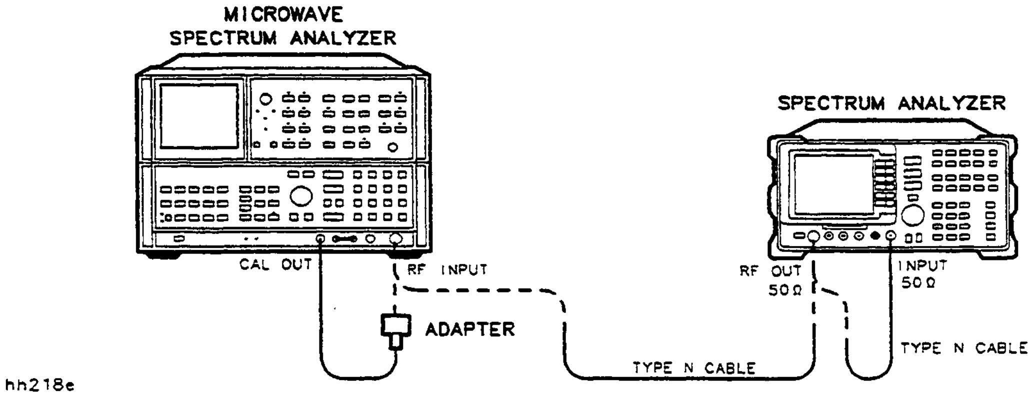
## Related Adjustment

There is no related adjustment for this performance test.

## Description

The tracking generator output is connected to the 8593E spectrum analyzer's INPUT 50 Ω and the tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator output is then connected to the input of an 8566A/B spectrum analyzer and the tracking generator is turned off. Several sweeps are taken on the 8566A/B over different frequency spans and the highest displayed residual is measured in each span. The amplitude of the highest residual is recorded.

**Figure 3-10 RF Power-Off Residuals Test Setup**




## Equipment

Microwave Spectrum Analyzer .................................... 8566A/B

## Cables

Type N, 62 cm (24 in).................................................... 11500B/C

BNC, 23 cm (9 in) ........................................................ 10502A

## Adapter

Type N (m) to BNC (f)................................................... 1250-1476

### Procedure

**NOTE** The 8566A/B should be allowed to warm up for at least 30 minutes before proceeding.

1. Perform a front-panel calibration of the 8566A/B as follows:
   a. Connect a BNC cable between CAL OUTPUT and RF INPUT.
   b. Press **[2–22 GHz]**, (INSTR PRESET), **[RECALL]**, 8. Adjust AMPTD CAL for a marker amplitude reading of –10 dBm.
   c. Press **[RECALL]**, 9. Adjust FREQ ZERO for a maximum amplitude response.
   d. Press **[SHIFT]**, **[FREQUENCY SPAN]** to start the 30 second internal error correction routine.
   e. After the CALIBRATING! message disappears, press **[SHIFT]**, **[START FREQ]** to use the error correction factors just calculated.
2. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the 8593E spectrum analyzer. Figure 3-10.
3. Press **[PRESET]** on the 8593E and set the controls as follows:

   CENTER FREQ ........................................................ 300 MHz
   SPAN ........................................................................... 0 Hz
   RES BW ...................................................................... 30 kHz

4. On the 8593E, press **[MKR]**, **[AUX CTRL]**, **TRACK GEN**, **SRC PWR ON OFF** (ON), 5 **[–dBm]**.
5. On the 8593E, press **TRACKING PEAK**. Wait for the “PEAKING” message to disappear.
6. On the 8593E, press **SRC PWR ON** (OFF), **[FREQUENCY]**, 300 **[kHz]**, **[SGL SWP]**.
7. Connect the Type N cable from the tracking generator output to the 8566A/B RF INPUT. See Figure 3-10.
8. Set the 8566A/B REFERENCE LEVEL to –20 dBm.
9. Set the 8566A/B START FREQUENCY, STOP FREQUENCY, and RES BW as indicated in the first row of Table 3-11.
10. Press **[SINGLE]** on the 8566A/B and wait for the sweep to finish. Press **[PEAK SEARCH]**.
11. If the marker is on a suspected residual response (as opposed to a noise peak), press **[SINGLE]** again and wait for the sweep to finish. A residual response will persist on successive sweeps but a noise peak will not. Press **[PEAK SEARCH]** again.

**NOTE** If the 8566A/B marker frequency is greater than or equal to 2.5 GHz, press **[PRESEL PEAK]** and wait for the “PEAKING” message to disappear before recording the marker amplitude.

12. Record the marker amplitude and frequency reading in Table 3-11 as the Residual Amplitude and Frequency.

13. Repeat steps 9 through 12 above for the remaining 8566A/B START FREQUENCY, STOP FREQUENCY, and RES BW settings indicated in Table 3-11.

14. Locate the residual response in Table 3-11 with the highest amplitude. Record the amplitude and frequency of this residual below.

Residual Response Amplitude____________dBm

Residual Response Frequency____________MHz

**Table 3-11 Residual Responses**

| 8566A/B Settings | | | Residual Response | | Measurement Uncertainty (dB) |
|---|---|---|---|---|---|
| **START FREQUENCY** | **STOP FREQUENCY** | **RES BW** | **AMPLITUDE (dBm)** | **FREQUENCY (MHz)** | |
| 300 kHz | 1 MHz | 3 kHz | | | ±1.33/–1.56 |
| 1 MHz | 100 MHz | 10 kHz | | | ±1.33/–1.56 |
| 100 MHz | 500 MHz | 10 kHz | | | ±1.33/–1.56 |
| 500 MHz | 1000 MHz | 10 kHz | | | ±1.33/–1.56 |
| 1000 MHz | 1500 MHz | 10 kHz | | | ±1.33/–1.56 |
| 1500 MHz | 2000 MHz | 10 kHz | | | ±1.33/–1.56 |
| 2000 MHz | 2500 MHz | 10 kHz | | | ±1.33/–1.56 |
| 2500 MHz | 2900 MHz | 10 kHz | | | ±2.02/–2.50 |

# 11. Tracking Generator LO Feedthrough Amplitude

### Specification

LO Feedthrough (output level set to –1 dBm)

3.9214 GHz to 6.8214 GHz: < –16 dBm

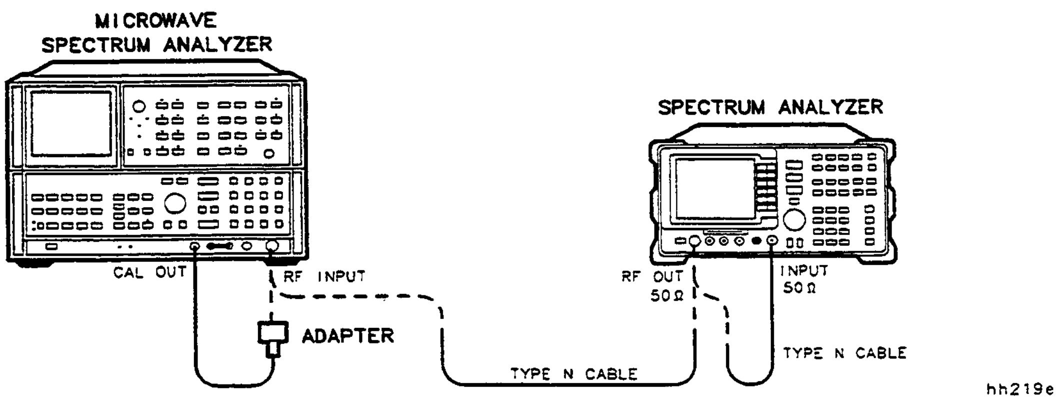
### Related Adjustment

There is no related adjustment for this performance test.

### Description

The tracking generator output is connected to the 8593E spectrum analyzer's INPUT 50 Ω and the tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator output is then connected to the input of an 8566A/B spectrum analyzer. The tracking generator is tuned to several different frequencies and the LO Feedthrough is measured at the frequency extremes of the LO.

**Figure 3-11 LO Feedthrough Amplitude Test Setup**




### Equipment

Microwave Spectrum Analyzer .................................... 8566A/B

#### Cables

Type N, 62 cm (24 in).................................................... 11500B/C

BNC, 23 cm. (9 in) ....................................................... 10502A

#### Adapter

Type N (m) to BNC (f)................................................... 1250-1476

### Procedure

| NOTE | The 8566A/B should be allowed to warm up for at least 30 minutes before proceeding. |
|---|---|

1. Perform a front-panel calibration of the 8566A/B as follows:
   a. Connect a BNC cable between CAL OUTPUT and RF INPUT.
   b. Press **[2–22 GHz]**, (INSTR PRESET), **[RECALL]**, 8. Adjust AMPTD CAL for a marker amplitude reading of –10 dBm.
   c. Press **[RECALL]**, 9. Adjust FREQ ZERO for a maximum amplitude response.
   d. Press **[SHIFT]**, **[FREQUENCY SPAN]** to start the 30 second internal error correction routine.
   e. After the `CALIBRATING!` message disappears, press **[SHIFT]**, **[START FREQ]** to use the error correction factors just calculated.
2. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the 8593E spectrum analyzer. Figure 3-11.
3. Press **[PRESET]**, **[SPAN]**, **BAND LOCK**, **0–2.9 Gz BAND 0** on the 8593E and set the controls as follows:

   CENTER FREQ ........................................................ 300 MHz
   SPAN ....................................................................... 0 Hz
   RES BW .................................................................. 30 kHz

4. On the 8593E, press **[MKR]**, **[AUX CTRL]**,**TRACK GEN**, **SRC PWR ON OFF** (ON), 5 **[–dBm]**.
5. On the 8593E, press **TRACKING PEAK**. Wait for the “`PEAKING`” message to disappear.
6. On the 8593E, press **SRC PWR ON OFF** (ON), 1 **[–dBm]**, **[FREQUENCY]**, 300 **[kHz]**, **[SGL SWP]**.
7. Connect the Type N cable from the tracking generator output to the 8566A/B RF INPUT. See Figure 3-11.
8. Set the 8566A/B controls as follows:

   CENTER FREQ ........................................................ 3.9217 GHz
   SPAN ....................................................................... 100 kHz
   REFERENCE LEVEL ............................................... 0 dBm
   RES BW .................................................................. 1 kHz
   LOG dB/DIV............................................................. 10 dB

9. On the 8566A/B, press **[PEAK SEARCH]** and **[MKR FCTN]**, **MKR TRACK ON OFF** (ON). Wait for the signal to be displayed at center screen. Press **[MKR FCTN]**, **MKR TRACK ON OFF** (OFF).
10. Press **[PEAK SEARCH]**, **[PRESEL PEAK]**. Wait for the “`PEAKING`” message to disappear.
11. Record the 8566A/B marker amplitude in Table 3-12 as the LO Feedthrough Amplitude for 3.9217 GHz.

12. Repeat steps 9 through 11 for the remaining 8593E CENTER FREQ and 8566A/B CENTER FREQUENCY settings listed in Table 3-12.

13. Locate in Table 3-12 the LO Feedthrough Amplitude with the greatest amplitude and record the amplitude below.

LO Feedthrough Amplitude_____________dBm

**Table 3-12 LO Feedthrough Amplitude**

| 8593E CENTER FREQ | 8566A/B CENTER FREQUENCY | LO Feedthrough Amplitude (dBm) | Measurement Uncertainty (dB) |
|---|---|---|---|
| 300 kHz | 3.9217 GHz | ____________________ | +2.02/–2.50 |
| 70 MHz | 3.9914 GHz | ____________________ | +2.02/–2.50 |
| 150 MHz | 4.0714 GHz | ____________________ | +2.02/–2.50 |
| 1.5 GHz | 5.4214 GHz | ____________________ | +2.02/–2.50 |
| 2.9 GHz | 6.8214 GHz | ____________________ | +2.10/–2.67 |

# 12. Residual AM and Residual FM

## Specification

Residual FM <500 Hz RMS (CW mode, 50 Hz to 15 kHz post-detection bandwidth)

Residual AM <–60 dBc (0.2%) at –1 dBm out (CW mode, 50 Hz to 15 kHz post-detection bandwidth)

## Related Adjustment

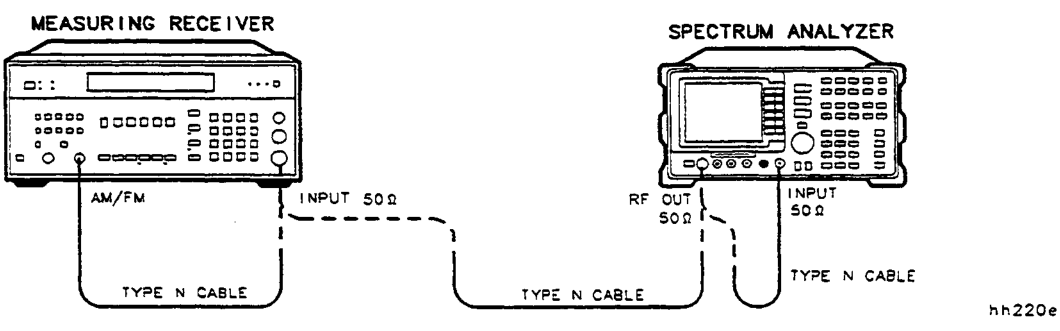
There is no related adjustment for this performance test

## Description

The tracking generator output is connected to the spectrum analyzer INPUT 50 Ω and the tracking is adjusted at 300 MHz for a maximum signal level. The output of the tracking generator is then connected to the input of the measuring receiver.

The measuring receiver is used to measure the residual AM and residual FM using the appropriate bandwidth and detector. The measured values of residual AM and residual FM are recorded.

**Figure 3-12 Residual AM and Residual FM Test Setup**




## Equipment

Measuring Receiver........................................................ 8902A

### Cable

Type N, 62 cm (24 in)...................................................... 11500B/C

## Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 3-12.
2. Press **[PRESET]** on the spectrum analyzer and set the controls as follows:

   CENTER FREQ ........................................................ 300 MHz
   SPAN ........................................................................ 0 Hz
   RES BW ..................................................................... 30 kHz

3. On the spectrum analyzer, press **[MKR]**, **[AUX CTRL]**, **TRACK GEN**, **SRC PWR ON OFF** (ON), –5 **[dBm]**.
4. On the spectrum analyzer, press **TRACKING PEAK**. Wait for the “PEAKING” message to disappear.
5. Reconnect the Type N cable between the measuring receiver’s INPUT 50 Ω and AM/FM connectors.
6. On the measuring receiver, press **[AM]**, **[CALIBRATE]**. After several seconds, the AM calibration factor will be displayed. Enter 16.1, **[SPCL]** to enable the AM calibration factor.
7. On the measuring receiver, press **[FM]**, **[CALIBRATE]**. After several seconds, the FM calibration factor will be displayed. Enter 17.1, **[SPCL]**, to enable the FM calibration factor.
8. Press **[CALIBRATE]** again to turn off the calibrator.
9. Connect the Type N cable between the spectrum analyzer’s RF OUT 50 Ω and the measuring receiver’s INPUT 50 Ω.
10. On the spectrum analyzer, press **SRC PWR ON OFF** (ON), 1 **[–dBm]**.
11. Set the spectrum analyzer CENTER FREQ to 300 MHz. Press **[SGL SWP]**.
12. On the measuring receiver, press **[AUTOMATIC OPERATION]**, **[AM]**, **[SHIFT]** (blue key), **[AVG]**. This tunes the measuring receiver to the input signal and sets the receiver to measure AM with an RMS detector. The measuring receiver will display the residual AM as a percentage.
13. On the measuring receiver, set the low pass filter to 50 Hz and the high pass filter to 15 kHz.
14. On the measuring receiver, press 200, **[RATIO]**, **[LOG/LIN]**. This sequence sets the measuring receiver to readout AM in dB relative to the carrier.
15. Record the amplitude displayed on the measuring receiver as the Residual AM.

    Residual AM__________dBc

16. On the measuring receiver, press **[AUTOMATIC OPERATION]**, **[FM]** (blue key), **[AVG]**. This tunes the measuring receiver to the input signal and sets the receiver to measure FM with an RMS detector.
17. On the measuring receiver, set the low pass filter to 50 Hz and the high pass filter to 15 kHz.
18. Record the deviation displayed on the measuring receiver as the Residual FM.

    Residual FM__________Hz

# 13. Event Counter

## Specifications

Gate Time Accuracy: <±0.1%
Input Level: TTL, open collector TTL
Maximum Pulse Rate: 100 kHz
Minimum. Pulse Width: 1 µs negative, 5 µs positive

## Related Adjustment

There is no related adjustment for this performance test.

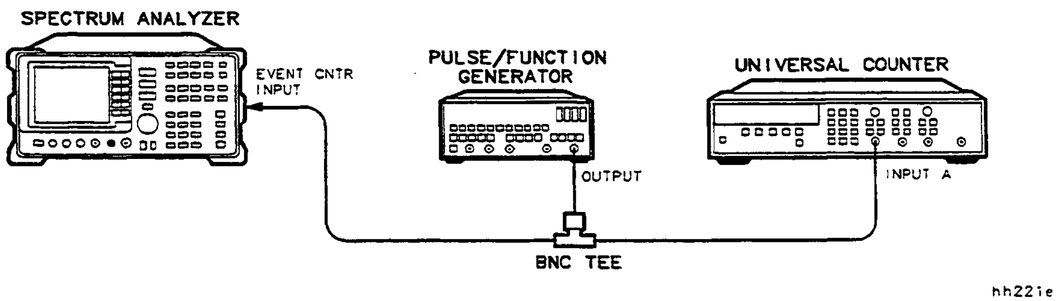
## Description

A pulse/function generator is used to apply pulses to the event counter input. The burst function on the pulse/function generator is used to check that the event counter is counting properly. The frequency, output level, and duty cycle of the pulses are varied to ensure that the counter is functioning properly.

The actual output frequency from the pulse/function generator is counted with an external counter. The error between the actual frequency and the number of events counted in a 1 second gate time is calculated to determine the time accuracy.

A functionality check of the Interval Counter is also performed; the accuracy is the same as that for the Event Counter.

**Figure 3-13 Event Counter Test Setup**




## Equipment

Pulse/Function Generator ........................................... 8116A Option 001

Universal Counter ....................................................... 5334A/B

## Cable

BNC, 122 cm (48 in) (2 required)................................... 10503A

## Adapters

BNC Tee (m) (f) (f) .......................................................... 1250-0781

### Procedure

1. Connect the equipment as shown in Figure 3-13. If a counter without a 50 Ω input impedance is used, connect a 50 Ω feedthrough termination, such as the 10100C, to the input of the counter.
2. Set the universal counter controls as follows:

   FUNCTION/DATA .......... FREQ A
   AUTO TRIG .......... ON
   100 kHz FILTER A .......... OFF
   INPUT A
   AC .......... OFF
   50 Ω Z .......... 30 kHz

3. Set the pulse/function generator controls as follows:

   MODE .......... NORM
   WAVEFORM .......... SQUAREWAVE
   FRQ (Frequency) .......... OFF
   DTY (Duty Cycle) .......... 50%
   HIL (High Output Level) .......... +5.00 V
   LOL (Low Output Level) .......... 0.0 V
   DISABLE .......... OFF
   COMPL .......... ON

**Gate Time Accuracy Test**

4. On the spectrum analyzer, press **[PRESET]**, **EVENT COUNTER**, **Gate Time**, **1 s**, **Main Menu**.
5. The EVENT CNTR display should read approximately 50,000. Record the EVENT CNTR reading below.

   EVENT CNTR Reading____________

6. Record the frequency displayed on the universal counter.

   Universal Counter Reading____________Hz

7. Calculate the error between the EVENT CNTR reading and the universal counter reading using the equation below. Record the result as the Gate Time Accuracy

$$\text{Gate Time Accuracy} = 100 \times \frac{\text{EVENT CNTR Reading} - \text{Universal Counter Reading}}{\text{Universal Counter Reading}}$$

   Gate Time Accuracy____________%

### Input Level Test

8. Set the pulse/function generator controls as follows:

   MODE ........................................................................ E BUR
   BUR (Number of periods in burst)............................ 1000

9. On the spectrum analyzer, press **TOTALIZE ON OFF** (ON).

10. Press **[MAN]** on the pulse/function generator.

11. Record the EVENT CNTR reading on the spectrum analyzer. The EVENT CNTR should read 1000 ±1 count.

    EVENT CNTR Reading (0 V to 5 V input)__________

12. Set the pulse/function generator controls as follows. These levels are comparable to TTL input levels:

    HIL .......................................................................... +2.2 V
    LOL ......................................................................... +0.72 V

13. Press **RESET CNTRS** on the spectrum analyzer. Press **[MAN]** on the pulse/function generator.

14. Record the EVENT CNTR reading on the spectrum analyzer. The EVENT CNTR should read 1000 ±1 count.

    EVENT CNTR Reading (TTL-Level Input)__________

### Maximum Pulse Rate Test

15. Set the pulse/function generator controls as follows:

    FRQ .......................................................................... 100 kHz

16. Press **RESET CNTRS** on the spectrum analyzer. Press **[MAN]** on the pulse/function generator.

17. Record the EVENT CNTR reading on the spectrum analyzer. The EVENT CNTR should read 1000 ±1 count.

    EVENT CNTR Reading (at 100 kHz)_____________

### Minimum Pulse Width Test

18. Set the pulse/function generator controls as follows:

    DTY .......................................................................... 10%

19. Press **RESET CNTRS** on the spectrum analyzer. Press **[MAN]** on the pulse/function generator.

20. Record the EVENT CNTR reading on the spectrum analyzer. The EVENT CNTR should read 1000 ±1 count.

    EVENT CNTR Reading (at 1 μs pulse width)_____________

### Interval Counter Functionality Check

21. Connect the BNC cable from the pulse/function generator to the INTERVAL CNTR jack on the spectrum analyzer rear panel.

22. Set the pulse/function generator controls as follows:

    MODE .......................................................................... NORM
    WAVEFORM ............................................................... SQUAREWAVE
    FRQ (Frequency) ........................................................ 50 kHz
    DTY (Duty Cycle)......................................................... 50%
    HIL (High Output Level) ........................................... +5.00 V
    LOL (Low Output Level)............................................. 0.0 V
    DISABLE ..................................................................... OFF

23. On the spectrum analyzer, press **TOTALIZE ON OFF** (OFF).

24. The INTERVAL CNTR display should read approximately 50,000. The count should be within 0.1% of the frequency displayed on the universal counter.

# 14. Flatness Analyzer Log Fidelity

## Specification

Log Fidelity

Reference Levels

–30 dBm to –20.1 dBm: ±0.7 dB/2 dB step, max. cumulative of 0.7 dB

–20 dBm to +15.9 dBm: ±0.4 dB/2 dB step, max. cumulative of 0.6 dB

+16 dBm to +20 dBm: ±0.8 dB/2 dB step, max. cumulative of 1.2 dB

## Related Adjustment

There is no related adjustment for this performance test.

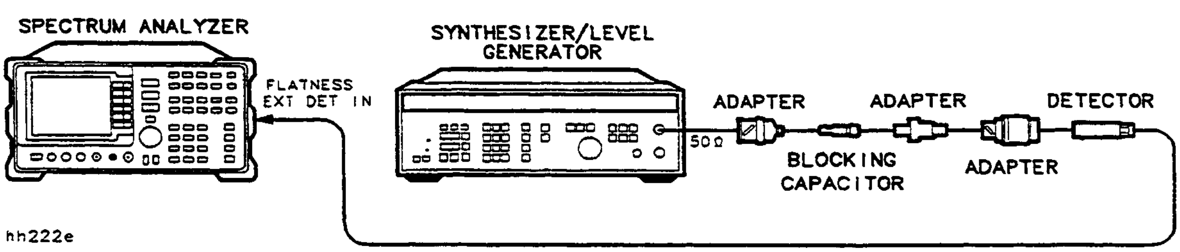
## Description

The output of an amplitude-accurate source is connected to the flatness detector. An amplitude reference is set at the bottom graticule and the output of the source is increased in precise 2 dB steps. The amplitude difference displayed on the spectrum analyzer is recorded.

The data is then corrected to reference the data to the reference level. The bottom-graticule reference is necessary to measure the log fidelity near the bottom of the display. The step-to-step, error is calculated between each step. This process is repeated to cover reference levels of –30 dBm to +15.9 dBm.

For reference levels of +16 dBm to +20 dBm, the output amplitude of another source with higher output power levels is characterized using a power meter. The source amplitude settings for specific output power levels are recorded. The detector is then connected to the source output. An amplitude reference is set on the spectrum analyzer and the output of the source is set to the predetermined settings. The amplitude difference displayed on the spectrum analyzer is recorded. The step-to-step error is calculated between each step.

**Figure 3-14 Flatness Detector Log Fidelity Test Setup, Reference Levels –30 dBm to +15.9 dBm**



### Equipment

Frequency Synthesizer ............................................... 3335A
Synthesizer/Function Generator............................... 3325A/B
Measuring Receiver (used as a power meter) ........... 8902A
Power Sensor ........................................................... 8482H
Detector. ................................................................... 8470B
Blocking Capacitor .................................................... 0955-0256

#### Cable

BNC, 122 cm (48 in.).....................................................10503A

#### Adapters

Type N (f) to BNC (m)................................................ 1250-1477
BNC (m) to SMA (f). .................................................. 1250-1700
BNC (f) to SMA (m) ................................................... 1250-1200

### Procedure

**Reference Levels –30 dBm to +20.1 dBm**

1. Connect the equipment as shown in Figure 3-14.
2. Set the frequency synthesizer controls as follows:

   FREQUENCY ........................................................... 20 MHz
   AMPLITUDE. ........................................................... 0 dBm
   AMPTD INCR........................................................... 2 dB
3. On the spectrum analyzer, press **[PRESET]**, **FLATNESS & SOURCES**. Set the controls as follows:

   CENTER FREQUENCY .......................................... 20 MHz
   SPAN. ........................................................................ 0 Hz
   AMPLITUDE ............................................................. +8 dBm
   SCALE LOG............................................................... 1 dB/DIV

**+8 dBm REF LEVEL Setting**

4. On the spectrum analyzer, press **[MKR] [AMPLITUDE]**. Adjust the REF LVL as necessary to place the signal (the horizontal line) at the bottom graticule line.
5. On the spectrum analyzer, press **[MKR]**, **MKR DELTA**.
6. On the frequency synthesizer, press **[AMPLITUDE]**.
7. On the frequency synthesizer, press INCR **[▲]**.
8. Record the marker amplitude in Table 3-13 as the Actual MKRΔ Reading.
9. Repeat steps 7 and 8 for the frequency synthesizer AMPLITUDE settings of +4 dBm to +8 dBm listed in Table 3-13 for the +8 dBm REF LEVEL Setting.

10. Record the Actual MKRΔ reading for the +8 dBm synthesizer AMPLITUDE setting below as the Top of Screen (TOS) Reading for the +8 dBm REF LEVEL Setting.

TOS Reading (+8 dBm)____________dB

11. Calculate the Cumulative Log Fidelity Error (CLFE) for each of the +8 dBm REF LEVEL Setting entries in Table 3-13 using the equation below. Record the results in Table 3-13.

CLFE = Actual MKRΔ - Ideal MKRΔ - TOS Reading (+8 dBm)

### 0 dBm REF LEVEL Setting

12. On the spectrum analyzer, press **[MKR]**, **MARKER NORMAL**.
13. Set the frequency synthesizer AMPLITUDE to –8 dBm.
14. On the spectrum analyzer, press **[AMPLITUDE]**, 0, **[+dBm]**. Adjust the REF LVL as necessary to place the signal at the bottom graticule line.
15. On the spectrum analyzer, press **[MKR]**, **MARKER DELTA**.
16. On the frequency synthesizer, press **[AMPLITUDE]**.
17. On the frequency synthesizer, press INCR **[▲]**.
18. Record the marker amplitude in Table 3-13 as the Actual MKRΔ Reading.
19. Repeat steps 17 and 18 for the frequency synthesizer AMPLITUDE settings of –4 dBm to +0 dBm listed in Table 3-13 for the +0 dBm REF LEVEL Setting.
20. Record the Actual MKRΔ reading for the +8 dBm synthesizer AMPLITUDE setting below as the Top of Screen (TOS) Reading for the +8 dBm REF LEVEL Setting.

TOS Reading (+0 dBm)____________dB

21. Calculate the Cumulative Log Fidelity Error (CLFE) for each of the 0 dBm REF LEVEL Setting entries in Table 3-13 using the equation below. Record the results in Table 3-13.

CLFE = Actual MKRΔ – Ideal MKRΔ – TOS Reading (+0 dBm)

### –8 dBm REF LEVEL Setting

22. On the spectrum analyzer, press **[MKR]**, **MARKER NORMAL**.
23. Set the frequency synthesizer AMPLITUDE to –16 dBm.
24. On the spectrum analyzer, press **[AMPLITUDE]**, 8, **[–dBm]**. Adjust the REF LVL as necessary to place the signal at the bottom graticule line.
25. On the spectrum analyzer, press **[MKR]**, **MARKER DELTA**.
26. On the frequency synthesizer, press **[AMPLITUDE]**.
27. On the frequency synthesizer, press INCR **[▲]**.
28. Record the marker amplitude in Table 3-13 as the Actual MKR Δ Reading.
29. Repeat steps 27 and 28 for the frequency synthesizer AMPLITUDE settings of –12 dBm to –8 dBm listed in Table 3-13 for the –8 dBm REF LEVEL Setting.

30. Record the Actual MKRΔ reading for the –8 dBm synthesizer AMPLITUDE setting below as the Top of Screen (TOS) Reading for the +8 dBm REF LEVEL Setting.

TOS Reading (–8 dBm)____________dB

31. Calculate the Cumulative Log Fidelity Error (CLFE) for each of the –8 dBm REF LEVEL Setting entries in Table 3-13 using the equation below. Record the results in Table 3-13.

CLFE = Actual MKRΔ – Ideal MKRΔ – TOS Reading (–8 dBm)

### –16 dBm REF LEVEL Setting

32. On the spectrum analyzer, press **[MKR]**, **MARKER NORMAL**.
33. Set the frequency synthesizer AMPLITUDE to –24 dBm.
34. On the spectrum analyzer, press **[AMPLITUDE]**, 16, **[–dBm]**. Adjust the REF LVL as necessary to place the signal at the bottom graticule line.
35. On the spectrum analyzer, press **[MKR]**, **MARKER DELTA**.
36. On the frequency synthesizer, press **[AMPLITUDE]**.
37. On the frequency synthesizer, press INCR **[▲]**.
38. Record the marker amplitude in Table 3-13 as the Actual MKR Δ Reading.
39. Repeat steps 37 and 38 for the frequency synthesizer AMPLITUDE settings of –20 dBm to –16 dBm listed in Table 3-13 for the –16 dBm REF LEVEL Setting.
40. Record the Actual MKR Δ reading for the –16 dBm synthesizer AMPLITUDE setting below as the Top of Screen (TOS) Reading for the +8 dBm REF LEVEL Setting.

TOS Reading (–16 dBm)____________dB

41. Calculate the Cumulative Log Fidelity Error (CLFE) for each of the –16 dBm REF LEVEL Setting entries in Table 3-13 using the equation below. Record the results in Table 3-13.

CLFE = Actual MKRΔ – Ideal MKRΔ – TOS Reading (–16 dBm)

### –22 dBm REF LEVEL Setting

42. On the spectrum analyzer, press **[MKR]**, **MARKER NORMAL**.
43. Set the frequency synthesizer AMPLITUDE to –30 dBm.
44. On the spectrum analyzer, press **[AMPLITUDE]**, 22, **[–dBm]**. Adjust the REF LVL as necessary to place the signal at the bottom graticule line.
45. On the spectrum analyzer, press **[MKR]**, **MARKER DELTA**.
46. On the frequency synthesizer, press **[AMPLITUDE]**.
47. On the frequency synthesizer, press INCR **[▲]**.
48. Record the marker amplitude in Table 3-13 as the Actual MKR Δ Reading.
49. Repeat steps 47 and 48 for the frequency synthesizer AMPLITUDE settings of –26 dBm to –22 dBm listed in Table 3-13 for the –22 dBm REF LEVEL Setting.

50. Record the Actual MKR Δ reading for the –22 dBm synthesizer AMPLITUDE setting below as the Top of Screen (TOS) Reading for the +8 dBm REF LEVEL Setting.

TOS Reading (–22 dBm)____________dB

51. Calculate the Cumulative Log Fidelity Error (CLFE) for each of the –22 dBm REF LEVEL Setting entries in Table 3-13 using the equation below. Record the results in Table 3-13.

CLFE = Actual MKRΔ – Ideal MKRΔ – TOS Reading (–22 dBm)

### Calculating Incremental Log Fidelity

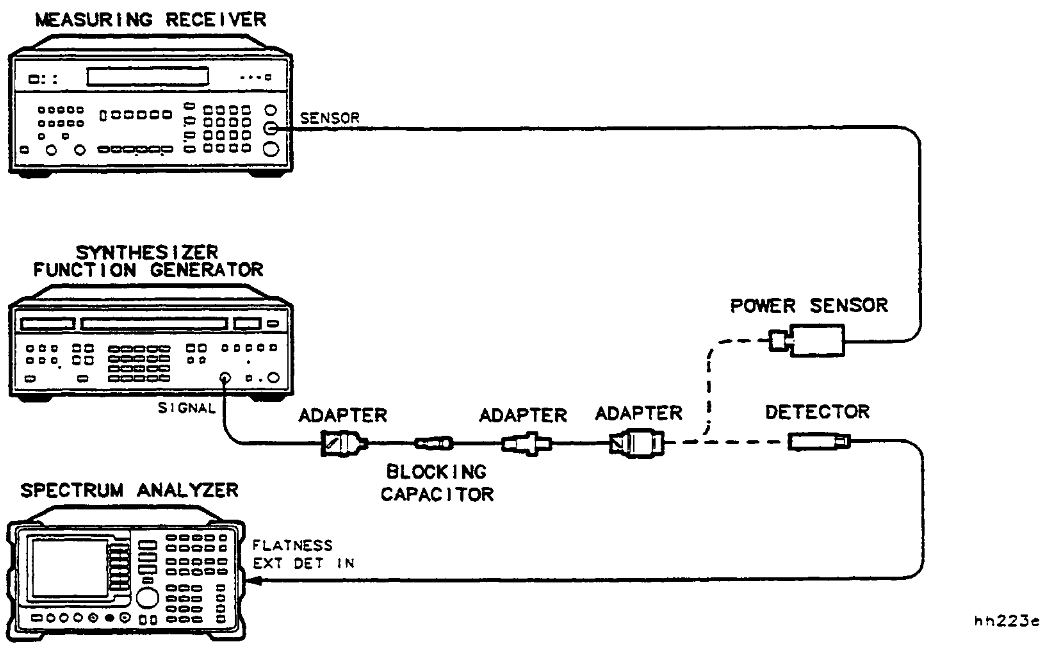
52. For all entries in Table 3-13, subtract the previous Cumulative Log Fidelity Error (CLFE) from the current Cumulative Log Fidelity Error and record the result as the Incremental Log Fidelity Error.

Incremental Log Fidelity Error = Current CLFE – Previous CLFE

**Table 3-13 Log Fidelity, +8 dBm to –30 dBm**

| 8593E REF LEVEL Setting (dBm) | Frequency Synthesizer AMPLITUDE (dBm) | MKR Δ Reading | | Log Fidelity Error | |
|---|---|---|---|---|---|
| | | Ideal (dB) | Actual (dB) | Cumulative (dB) | Incremental (dB) |
| +8 | +8 | 0 (Ref) | ________ | 0 (Ref) | 0 (Ref) |
| | +6 | –2 | ________ | ________ | ________ |
| | +4 | –4 | ________ | ________ | ________ |
| | +2 | –6 | ________ | ________ | ________ |
| | +0 | –8 | 0 (Ref) | ________ | ________ |
| +0 | +0 | 0 (Ref) | ________ | 0 (Ref) | 0 (Ref) |
| | –2 | –2 | ________ | ________ | ________ |
| | –4 | –4 | ________ | ________ | ________ |
| | –6 | –6 | ________ | ________ | ________ |
| | –8 | –8 | 0 (Ref) | ________ | ________ |
| –8 | –8 | 0 (Ref) | ________ | 0 (Ref) | 0 (Ref) |
| | –10 | –2 | ________ | ________ | ________ |
| | –12 | –4 | ________ | ________ | ________ |
| | –14 | –6 | ________ | ________ | ________ |
| | –16 | –8 | 0 (Ref) | ________ | ________ |
| –16 | –16 | 0 (Ref) | ________ | 0 (Ref) | 0 (Ref) |
| | –18 | –2 | ________ | ________ | ________ |
| | –20 | –4 | ________ | ________ | ________ |
| | –22 | –6 | ________ | ________ | ________ |
| | –24 | –8 | 0 (Ref) | ________ | ________ |
| –22 | –22 | 0 (Ref) | ________ | 0 (Ref) | 0 (Ref) |
| | –24 | –2 | ________ | ________ | ________ |
| | –26 | –4 | ________ | ________ | ________ |
| | –28 | –6 | ________ | ________ | ________ |
| | –30 | –8 | 0 (Ref) | ________ | ________ |

**Figure 3-15 Flatness Detector Log Fidelity Test Setup, Reference Levels +10 dBm to +20 dBm**




### Reference Levels +10 dBm to +20 dBm

53. Zero and calibrate the measuring receiver and power sensor in log mode (power levels read out in dBm). Enter the power sensor's 20 MHz Cal Factor into the 8902A.

54. Connect the equipment as shown in Figure 3-15, with the power sensor connect to the output of the synthesizer/function generator.

55. Set the synthesizer controls as follows:

FREQ........................................................................ 20 MHz
AMPTD. .................................................................... +20 dBm
FUNCTION................................................................ SINE
DC OFFSET.............................................................. OFF

56. Adjust the synthesizer amplitude level using the MODIFY keys until the measuring receiver reads +20 dBm ±0.02 dB. Record the synthesizer AMPTD setting in Table 3-14 for the +20 dBm Input Power Level.

57. Repeat step 56 for the remaining Input Power Levels listed in Table 3-14.

### +20 dBm REF LEVEL Setting

58. Disconnect the power sensor from the synthesizer output. Connect the detector to the synthesizer output.

59. On the spectrum analyzer, press **[MKR]**, **MARKER NORMAL.**

60. Set the synthesizer AMPTD as indicated in Table 3-14 for a +12 dBm Input Power Level.

61. On the spectrum analyzer, press **[AMPLITUDE]**, 20, **[+dBm]**. Adjust the REF LVL as necessary to place the signal at the bottom graticule line.

62. On the spectrum analyzer, press **[MKR]**, **MARKER DELTA**.

63. Set the synthesizer AMPTD as indicated in Table 3-14 for the +14 dBm Input Power Level.

64. Record the marker amplitude in Table 3-14 as the Actual MKRΔ Reading.

65. Repeat steps 63 and 64 for Input Power Levels of +16 dBm to +20 dBm for the +20 dBm RE LEVEL Setting.

66. Record the Actual MKRΔ reading for the +20 dBm Input Power Level below as the Top of Screen (TOS) Reading for the +20 dBm REF LEVEL Setting.

TOS Reading (+20 dBm)__________dB

67. Calculate the Cumulative Log Fidelity Error (CLFE) for each of the +20 dBm REF LEVEL Setting entries in Table 3-14 using the equation below. Record the results in Table 3-14.

CLFEE = Actual MKRΔ – Ideal MKRΔ – TOS Reading (+20 dBm)

### +16 dBm REF LEVEL Setting

68. On the spectrum analyzer, press **[MKR]**, **MARKER NORMAL.**

69. Set the synthesizer AMPTD as indicated in Table 3-14 for a +10 dBm Input Power Level.

70. On the spectrum analyzer, press **[AMPLITUDE]**, 16, **[+dBm]**. Adjust the REF LVL as necessary to place the signal at the bottom graticule line.

71. On the spectrum analyzer, press **[MKR]**, **MARKER DELTA**.

72. Set the synthesizer AMPTD as indicated in Table 3-14 for the +10 dBm Input Power Level.

73. Record the marker amplitude in Table 3-14 as the Actual MKRΔ Reading.

74. Repeat steps 72 and 73 for Input Power Levels of +12 dBm to +16 dBm for the +16 dBm REF LEVEL Setting.

75. Record the Actual MKRΔ reading for the +16 dBm Input Power Level below as the Top of Screen (TOS) Reading for the +16 dBm REF LEVEL Setting.

TOS Reading (+16 dBm)__________dB

76. Calculate the Cumulative Log Fidelity Error (CLFE) for each of the +16 dBm REF LEVEL Setting entries in Table 3-14 using the equation below. Record the results in Table 3-14.

CLFEE = Actual MKRΔ – Ideal MKRΔ – TOS Reading (+16 dBm)

### Calculating Incremental Log Fidelity

77. For all entries in Table 3-14, subtract the previous Cumulative Log Fidelity Error (CLFE) from the current Cumulative Log Fidelity Error and record the result as the Incremental Log Fidelity Error.

Incremental Log Fidelity Error = Current CLFE – Previous CLFE

### Table 3-14 Log Fidelity, +20 dBm to +8 dBm

| 8593E REF LEVEL Setting (dBm) | Input Power Level (dBm) | Synthesized AMPTD Setting (dBm) | MKR Δ Reading | | Log Fidelity Error | |
|---|---|---|---|---|---|---|
| | | | Ideal (dB) | Actual (dB) | Cumulative (dB) | Incremental (dB) |
| +20 | +20 | ________ | 0 (Ref) | ________ | 0 (Ref) | 0 (Ref) |
| | +18 | ________ | –2 | ________ | ________ | ________ |
| | +16 | ________ | –4 | ________ | ________ | ________ |
| | +14 | ________ | –6 | ________ | ________ | ________ |
| | +12 | ________ | –8 | 0 (Ref) | ________ | ________ |
| +16 | +16 | ________ | 0 (Ref) | ________ | 0 (Ref) | 0 (Ref) |
| | +14 | ________ | –2 | ________ | ________ | ________ |
| | +12 | ________ | –4 | ________ | ________ | ________ |
| | +10 | ________ | –6 | ________ | ________ | ________ |
| | +8 | ________ | –8 | 0 (Ref) | ________ | ________ |

# 8593E Option E02/E04 Performance Verification Test Record

**Table 3-15 8593E Option E02/E04 Performance Verification Test Record (Page 1 of 6)**

Calibration Entity

______________________________________ Report No.______________________________

______________________________________

______________________________________ Date____________________________________

______________________________________ (e.g. 10 SEP 1989)

Model 8593E Opt. E02/E04

Serial No.______________________________

Options________________________________

Firmware Revision______________________

Customer______________________________ Tested by______________________________

Ambient temperature_________________°C Relative humidity_______________________

Power mains line frequency_____________________Hz (nominal)

Notes/Comments

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

## 8593E Option E02/E04 Performance Verification Test Record (Page 2 of 6)

| | |
|---|---|
| 8593E Option E02/E04 | Report No.______________________________ |
| Serial No._____________________________ | Date_____________________________________ |

**Test Equipment Used:**

| Description | Model No. | Trace No. | Cal Due Date |
|---|---|---|---|
| Synthesizer/Function Generator | _______________ | _______________ | _______________ |
| Synthesizer/Level Generator | _______________ | _______________ | _______________ |
| Pulse/Function Generator | _______________ | _______________ | _______________ |
| Measuring Receiver | _______________ | _______________ | _______________ |
| Power Sensor | _______________ | _______________ | _______________ |
| High-Power Sensor | _______________ | _______________ | _______________ |
| Universal Frequency Counter | _______________ | _______________ | _______________ |
| 50 Ω Termination #1 | _______________ | _______________ | _______________ |
| 50 Ω Termination #2 | _______________ | _______________ | _______________ |
| Microwave Spectrum Analyzer | _______________ | _______________ | _______________ |

## 8593E Option E02/E04 Performance Verification Test Record (Page 3 of 6)

| | |
|---|---|
| 8593E Option E02/E04 | Report No.______________________________ |
| Serial No.______________________________ | Date____________________________________ |

| Test No. | Test Description | Min | Results Measured | Max | Measurement Uncertainty |
|---|---|---|---|---|---|
| 1. | **Resolution Bandwidth Selectivity** | | | | |
| | Measured 6 dB BW | | ____________ | | |
| | Measured Separation | | ____________ | | |
| | Actual 6 dB BW | | ____________ | | ±48.5 Hz |
| | Measured 60 dB BW | | ____________ | | |
| | Measured Separation | | ____________ | | |
| | Actual 60 dB BW | | ____________ | | ±142.6 Hz |
| | 1 kHz RES BW Selectivity | 10 | ____________ | | ±1.51% |
| 2. | **Three-Tone Intermodulation Distortion** | | | | |
| | 2.0 GHz CENTER FREQ | | | | |
| | Upper Product Suppression | | ____________ | –60 dBc | +2.07/-2–42 dB |
| | Lower Product Suppression | | ____________ | –57 dBc | +2.07/-2–42 dB |
| | 4.0 GHz CENTER FREQ | | | | |
| | Upper Product Suppression | | ____________ | –57 dBc | +2.07/-2–42 dB |
| | Lower Product Suppression | | ____________ | –57 dBc | +2.07/-2–42 dB |
| 3. | **Absolute Amplitude and Vernier Accuracy** | | | | |
| | Absolute Amplitude Accuracy | –0.75 dB | ____________ | –0.75 dB | +0.155/–0.161 dB |
| | Positive Absolute Vernier Accuracy | | ____________ | +0.50 dB | ±0.03 dB |
| | Negative Absolute Vernier Accuracy | –0.50 dB | ____________ | | ±0.03 dB |
| | Positive Step-to-Step Vernier Accuracy | | ____________ | +0.20 dB | ±0.03 dB |
| | Negative Step-to-Step Vernier Accuracy | –0.20 dB | ____________ | | ±0.03 dB |
| 4. | **Power Sweep Range** | | | | |
| | Start Power Level | | ____________ | | |
| | Stop Power Level | | ____________ | | |
| | Power Sweep Range | 9.0 dB | ____________ | | ±0.03 dB |

## 8593E Option E02/E04 Performance Verification Test Record (Page 4 of 6)

| | |
|---|---|
| 8593E Option E02/E04 | Report No.______________________ |
| Serial No.______________________ | Date______________________ |

| Test No. | Test Description | Min | Results Measured | Max | Measurement Uncertainty |
|---|---|---|---|---|---|
| 5. | **Tracking Generator Level Flatness** | | | | |
| | Maximum Positive Flatness | | | | |
| | 40 MHz to 300 MHz | | ________ | +1.50 dB | +0.28/–0.28 dB |
| | 300 kHz to 10 MHz | | ________ | +3.0 dB | |
| | 10 MHz to 2.9 GHz | | ________ | +2.0 dB | +0.42/–0.45 dB |
| | Maximum Negative Flatness | | | | |
| | 40 MHz to 300 MHz | 1.50 dB | ________ | | +0.28/–0.28 dB |
| | 300 kHz to 10 MHz | –3.0 dB | ________ | | |
| | 10 MHz to 2.9 GHz | –2.00 dB | ________ | | +0.42/–0.45 dB |
| 6. | **Tracking Generator Frequency Accuracy** | | | | |
| | Frequency Error | –2.2 kHz | ________ | +2.2 kHz | ±1 Hz |
| 7. | **Harmonic Spurious Outputs** | | | | |
| | 2nd Harmonic Level | | | | |
| | 300 kHz | –25 dBc | ________ | | +1.55/–1.80 dB |
| | 100 MHz | –25 dBc | ________ | | +1.55/–1.80 dB |
| | 300 MHz | –15 dBc | ________ | | +1.55/–1.80 dB |
| | 900 MHz | –15 dBc | ________ | | +1.55/–1.80 dB |
| | 1.4 GHz | –15 dBc | ________ | | +3.45/–1.80 dB |
| | 3rd Harmonic Level | | | | |
| | 300 kHz | –25 dBc | ________ | | +1.55/–1.80 dB |
| | 100 MHz | –25 dBc | ________ | | +1.55/–1.80 dB |
| | 300 MHz | –15 dBc | ________ | | +1.55/–1.80 dB |
| | 900 MHz | –15 dBc | ________ | | +3.45/–4.01 dB |
| 8. | **Non-Harmonic Spurious Outputs** | | | | |
| | Highest Non-Harmonic Response Amplitude | | | | |
| | 300 kHz to ≤400 MHz | –27 dBc | ________ | | +1.55/–1.80 dB |
| | >400 MHz to 2.9 GHz | –15 dBc | ________ | | +3.45/–4.01 dB |

## 8593E Option E02/E04 Performance Verification Test Record (Page 5 of 6)

| | |
|---|---|
| 8593E Option E02/E04 | Report No.______________________ |
| Serial No.______________________ | Date______________________ |

| Test No. | Test Description | Min | Results Measured | Max | Measurement Uncertainty |
|---|---|---|---|---|---|
| 9. | **Tracking Generator Feedthrough** | | | | |
| | 400 kHz to 2.9 GHz | | ________ | –110 dBm | +1.59/–1.70 dB |
| 10. | **RF Power-Off Residuals** | | ________ | | |
| | Residual Response Amplitude | | ________ | | |
| | 300 kHz to 2.9 GHz | | ________ | –120 dBm | +3.50/–4.17 dB |
| 11. | **Tracking Generator LO Feedthrough Amplitude** | | ________ | | |
| | 300 kHz | | ________ | –78 dBm | +1.63/–1.97 dB |
| | 70 MHz | | ________ | –78 dBm | +1.63/–1.97 dB |
| | 150 MHz | | | –78 dBm | +1.63/–1.97 dB |
| | 1.5 GHz | | | –78 dBm | +1.63/–1.97 dB |
| | 2.9 GHz | | ________ | –78 dBm | +3.50/–4.17 dB |
| 12. | **Residual AM and Residual FM** | | | | |
| | Residual AM | | ________ | –60 dBc | ±6.06 dB |
| | Residual FM | | ________ | 500 Hz | ±28.49 Hz |
| 13. | **Event Counter** | | | | |
| | Event Counter Reading | | ________ | | |
| | Universal Counter Reading | | ________ | | ±0.18 Hz |
| | Gate Time Accuracy | –0.1% | ________ | +0.1% | ±0.0004% |
| | EVENT CNTR Reading | | | | |
| | (0V - 5V Input) | 999 | ________ | 1001 | N/A |
| | EVENT CNTR Reading | | | | |
| | (TTL-Level Input) | 999 | ________ | 1001 | N/A |
| | EVENT CNTR Reading | | | | |
| | (TTL-Level Input) (at 100 kHz) | 999 | ________ | 1001 | N/A |
| | EVENT CNTR Reading | | | | |
| | (at 1 µs pulse width) | 999 | ________ | 1001 | N/A |

## 8593E Option E02/E04 Performance Verification Test Record (Page 6 of 6)

| | |
|---|---|
| 8593E Option E02/E04 | Report No.____________________________ |
| Serial No.____________________________ | Date__________________________________ |

| Test No. | Test Description | Min | Marker Δ Measured | Max | Measurement Uncertainty |
|---|---|---|---|---|---|
| 14. | **Flatness Analyzer Log Fidelity** | | | | |
| | Cumulative Log Fidelity Error | | | | |
| | +8 dBm REF LEVEL | | | | |
| | –2 dB from REF LEVEL | –0.4 dB | ____________ | +0.4 dB | ±0.04 dB |
| | –4 dB from REF LEVEL | –0.6 dB | ____________ | +0.6 dB | ±0.04 dB |
| | –6 dB from REF LEVEL | –0.6 dB | ____________ | +0.6 dB | ±0.04 dB |
| | –8 dB from REF LEVEL | –0.6 dB | ____________ | +0.6 dB | ±0.04 dB |
| | 0 dBm REF LEVEL | | | | |
| | –2 dB from REF LEVEL | –0.4 dB | ____________ | +0.4 dB | ±0.04 dB |
| | –4 dB from REF LEVEL | –0.6 dB | ____________ | +0.6 dB | ±0.04 dB |
| | –6 dB from REF LEVEL | –0.6 dB | ____________ | +0.6 dB | ±0.04 dB |
| | –8 dB from REF LEVEL | –0.6 dB | ____________ | +0.6 dB | ±0.04 dB |
| | –8 dBm REF LEVEL | | | | |
| | –2 dB from REF LEVEL | –0.4 dB | ____________ | +0.4 dB | ±0.04 dB |
| | –4 dB from REF LEVEL | –0.6 dB | ____________ | +0.6 dB | ±0.04 dB |
| | –6 dB from REF LEVEL | –0.6 dB | ____________ | +0.6 dB | ±0.04 dB |
| | –8 dB from REF LEVEL | –0.6 dB | ____________ | +0.6 dB | ±0.04 dB |
| | –16 dBm REF LEVEL | | | | |
| | –2 dB from REF LEVEL | –0.4 dB | ____________ | +0.4 dB | ±0.04 dB |
| | –4 dB from REF LEVEL | –0.6 dB | ____________ | +0.6 dB | ±0.04 dB |
| | –6 dB from REF LEVEL | –0.6 dB | ____________ | +0.6 dB | ±0.04 dB |
| | –8 dB from REF LEVEL | –0.6 dB | ____________ | +0.6 dB | ±0.04 dB |
| | –22 dBm REF LEVEL | | | | |
| | –2 dB from REF LEVEL | –0.7 dB | ____________ | +0.7 dB | ±0.04 dB |
| | –4 dB from REF LEVEL | –0.7 dB | ____________ | +0.7 dB | ±0.04 dB |
| | –6 dB from REF LEVEL | –0.7 dB | ____________ | +0.7 dB | ±0.04 dB |
| | –8 dB from REF LEVEL | –0.7 dB | ____________ | +0.7 dB | ±0.04 dB |
| | +20 dBm REF LEVEL | | | | |
| | –2 dB from REF LEVEL | –0.8 dB | ____________ | +0.8 dB | ±0.04 dB |
| | –4 dB from REF LEVEL | –1.2 dB | ____________ | +1.2 dB | ±0.04 dB |
| | –6 dB from REF LEVEL | –1.2 dB | ____________ | +1.2 dB | ±0.04 dB |
| | –8 dB from REF LEVEL | –1.2 dB | ____________ | +1.2 dB | ±0.04 dB |
| | +16 dBm REF LEVEL | | | | |
| | –2 dB from REF LEVEL | –0.8 dB | ____________ | +0.8 dB | ±0.04 dB |
| | –4 dB from REF LEVEL | –1.2 dB | ____________ | +1.2 dB | ±0.04 dB |
| | –6 dB from REF LEVEL | –1.2 dB | ____________ | +1.2 dB | ±0.04 dB |
| | –8 dB from REF LEVEL | –1.2 dB | ____________ | +1.2 dB | ±0.04 dB |

# 4 8593E Option E02/E04 Operation

# Introduction

This chapter provides operating information for the 8593E Option E02/E04. The purpose of this section is to help you become familiar with spectrum analyzer operation and to help you make some simple Digital Radio Test Set DRTS measurements. For further information on spectrum analyzer operation, please see the *8590 D-Series and E-Series Spectrum Analyzer User's Guide*.

## Preset

The green **[PRESET]** key presets the complete spectrum analyzer instrument state, including all the modes. It does not alter the instrument states saved by the user, traces saved by the user, or instrument calibration data.

## Frequency

The FREQUENCY key is used to set frequency parameters. When the FREQUENCY key is pressed, a group of softkeys is accessed that allow parameter setting. The softkeys allow the user to modify the center frequency, the start and stop frequencies, the center frequency step size, and the offset frequency.

**To set the center frequency:**

1. Press the **[FREQUENCY]** key.
2. Enter the desired center frequency using the DATA keys, the **[▲]** or **[▼]** keys, or the knob.

## Span

The SPAN key allows the user to adjust the frequency span of the display. The amount of span can be manually entered using the DATA keys, or a predetermined span can be selected using the softkeys.

**To manually enter a span:**

1. Press the **[SPAN]** key.
2. Enter the desired frequency span using the DATA keys.

**To select a predetermined span:**

1. Press the **[SPAN]** key.
2. For a full span, press the **FULL SPAN** softkey.
3. For a zero span, press the **ZERO SPAN** softkey.
4. To limit SPAN to a single band, press the **BANDLOCK** softkey, then the **BAND 0**, **BAND 1**, **BAND 2**, **BAND 3** or **BAND 4** softkey.

## Amplitude

The **[AMPLITUDE]** key allows the user to adjust the vertical parameters of the display. When the **[AMPLITUDE]** key is pressed, a group of softkeys is accessed that allows parameter modification. The user can modify the reference level, the scale (log or linear), and input attenuation.

**To set the reference level:**

1. Press the **[AMPLITUDE]** key.
2. Enter the desired reference level using the DATA keys, the **[▲]** or **[▼]** keys, or the knob.

## Preselector Alignment

The spectrum analyzer includes an internal pre-selector to filter out spurious signals from the display. The preselector is automatically adjusted for best tracking at a given frequency by using the **PRESEL PEAK** softkey. The spectrum analyzer must have a microwave input during the procedure. The following procedure will align the preselector.

Preselector peak automatically adjusts the preselector tracking to peak the signal at the active marker. Using preselector peak prior to measuring a signal yields the most accurate amplitude reading at the specified frequency. To maximize the peak response of the preselector and adjust the tracking, tune the marker to a signal and press **[AMPLITUDE]**, **PRESEL PEAK**.

---

**NOTE**

1. **PRESEL PEAK** maximizes the peak response of the signal of interest but may degrade the frequency response at other frequencies. Use **PRESEL DEFAULT** or **[PRESET]** to clear **PRESEL PEAK** before measuring another frequency.

   **PRESEL DEFAULT** provides best full single-band flatness for viewing several signals simultaneously.

2. **PRESEL PEAK** works in harmonic bands only (bands 1 through 4).

---

**Example:** Using the knob, step keys, or **[PEAK SEARCH]**, place the marker on your signal, and press **PRESEL PEAK**. The message `CAL: PEAKING` appears in the active function block while the routine is working.

If **PRESEL PEAK** has more than a 2 dB effect on signal amplitude when in BAND 1 or above and in a single-band sweep, perform **CAL YTF** with the COMB OUT signal, and store the data with **CAL STORE**. **CAL YTF** improves the **PRESEL DEFAULT** values (8593E only).

## CAL YTF

1. Press the **[PRESET]** key.
2. Connect the 100 MHz COMB OUT connector to the INPUT 50 Ω connector using the special cable supplied.
3. Press the **[CAL]** key.
4. Press **CAL YTF** softkey.
5. Press the **CAL STORE** softkey.
6. Press the **[PRESET]** key.

## Marker

A diamond-shaped marker can be placed on the signal peak to find the signal's frequency and amplitude. The marker can be placed manually or automatically. The signal's frequency and amplitude appear in the upper right corner of the display.

### Placing a marker manually:

1. Ensure that the signal to be measured is displayed on the spectrum analyzer's screen.
2. Press the **[MKR]** key.
3. Press the **MARKER NORMAL** softkey.
4. Turn the knob to place the marker at the signal peak.

### Placing a marker automatically:

1. Ensure that the signal to be measured is displayed on the spectrum analyzer's screen.
2. Press the **[PEAK SEARCH]** key.

   The marker will be automatically placed on the highest peak of the trace.

## Modes

Pressing the **[MODE]** key on the spectrum analyzer front panel accesses the Mode Menu that provides a selection of the modes currently in the memory of the 8593E spectrum analyzer. Other modes can be loaded in from a Memory Card to replace those that are currently installed in the spectrum analyzer.

Some of these modes make measurements using the spectrum analyzer input, while others make measurements on signals applied to various rear panel inputs. When switching between installed modes, the state of the last mode is automatically saved, and the state of the new mode is automatically recalled. The following modes are included on the Digital Radio Test System Measurement Personality ROM Card:

MODE LOADER
FLATNESS & SOURCES
EVENT COUNTER
FREQUENCY COUNTER
DIGITAL RADIO MASKS
SCALAR ANALYZER
LOW FREQUENCY OSCILLOSCOPE

## Mode Loader

The Mode Loader utility provides a convenient way to automatically dispose of and load the various modes that are provided on the DRTS Personality Measurement ROM Card. The total memory size required for these modes is larger than the user memory in the 8593E, so it is necessary to load in the modes in smaller groups. While this may be done manually, it is faster and easier to use the Mode Loader.

### Loading the Mode Loader

1. Press **[MODE]** to bring up the Mode Menu. Alternate presses of the **[MODE]** key will switch between the Main Menu of the current mode and the Mode Menu.

**NOTE** The Mode Menu always has **SPECTRUM ANALYZER** as the first softkey.

2. If **SPECTRUM ANALYZER** is the only softkey displayed on the Mode Menu, then skip to step number 8.
3. If **MODE LOADER** is one of the softkeys, then this utility is already loaded in the spectrum analyzer and the rest of this procedure may be skipped. See "Using the Mode Loader".
4. If other modes are present on these softkeys they should be disposed of before loading in the MODE LOADER by doing:
5. Press **[CONFIG]**. Press **MORE 1 of 2**.
6. Press **DISPOSE USER MEM** (an `IF YOU ARE SURE...` message appears).
7. Press **DISPOSE USER MEM** for a second time.
8. To load the MODE LOADER do the following:
9. Insert the Digital Radio Test System Personality Measurements ROM Card into the card reader on the front panel of the 8593E spectrum analyzer.
10. Press [**RECALL**].
11. Select the memory card by pressing **INTRNL CRD** to underline CRD.
12. Press **CATALOG CARD**.
13. Press **CATALOG ALL**. The file `dLOADME` will be highlighted.
14. Press **LOAD FILE** which loads the highlighted file.
15. **MODE LOADER** should now be one of the keys on the Mode Menu.
16. If a user Down Loadable Program (DLP) is to be used in conjunction with the Event Counter mode, it should be loaded in before the Event Counter mode is loaded.

### Using the Mode Loader

1. Insert the Digital Radio Test System Measurement Personality ROM Card into the card reader on the front panel of the 8593E, if not already inserted.

---

**NOTE** The Mode Menu always has **SPECTRUM ANALYZER** as the first softkey.

---

2. Press **[MODE]** to bring up the Mode Menu. (**MODE LOADER** should be the second softkey.)
3. Press **MODE LOADER**.
4. Select the desired mode or mode group by number using the **[DATA]** keys and press **[ENTER]** (**[HZ]** key). Usually, items 1, 2, or 3 would be selected, each of which loads several modes. Other item numbers allow the modes to be loaded in separately; which then leaves more room for user DLP's. It will take 10 to 60 seconds to dispose of the current modes and load in the new ones.

---

**NOTE** When an item number is selected, the Mode Loader first automatically disposes of any other DRTS modes that are resident in the 8593E memory, before loading in the new mode(s). However, user defined DLPs will not be disposed (provided that the guidelines for assigning names and keys for user DLP's was followed - as contained in the *8590 D-Series and E-Series Spectrum Analyzer Programmer's Guide*). An Instrument Preset command is automatically done after the new mode is loaded.

---

### Changing Modes and Presetting Modes

1. Once the mode is loaded, a softkey label for that mode will exist in the Mode Menu. Press **[MODE]** to display the Mode Menu and then press the mode name softkey to change to that mode. If a mode is re-entered it will be in the same state as when it was left, provided **[PRESET]** has not been pushed.
2. To return to the spectrum analyzer mode, press **[MODE]** to bring up the Mode Menu and then **SPECTRUM ANALYZER**. The spectrum analyzer will be returned to the same state as when it was left.
3. The green **[PRESET]** key may be used to take the instrument back to the spectrum analyzer mode, but this will also preset the instrument, including all modes, to the default state.

---

**NOTE** The green **[PRESET]** key should seldom need to be used. It is not necessary to press **[PRESET]** before switching to another mode.

---

4. An individual mode may be preset to its default state without affecting other modes by use of the mode **PRESET** softkey that is in the Main Menu of that mode.

### Accessing the Main Menu of a Mode

1. Press **[MODE]** and then the mode name softkey.
2. Or press **[MODE] [MODE]**.

## Setting Date and Time

Press **[CONFIG]**, press **TIME DATE**, press **SET DATE** or **SET TIME**.

**SET DATE** sets the date of the real-time clock. Enter the date in the YYMMDD format using the number keypad and press **[ENTER]**. Valid year (YY) values are 00 through 99. Valid month (MM) values are from 01 to 12, and valid day (DD) values are from 01 to 31.

**SET TIME** sets the time of the real-time clock. Enter the time in 24-hour, HHMMSS format, using the number keypad and enter the time by pressing **[ENTER]**. Valid hour (HH) values are from 00 to 23. Valid minute (MM) and second (SS) values are from 00 to 59.

## Digital Radio Mask Mode

The Digital Radio Mask mode uses the spectrum analyzer to measure spectral occupancy of digital radio signals. The transmitted spectrum of a digital radio is automatically measured and compared to agency or user defined mask limits. Mean power, frequency response, and transient analysis measurements may also be made in this mode. For more information refer to the *85713A Digital Radio Measurements Personality User's Guide*.

# Event Counter Mode

The event counter operation is independent of the spectrum analyzer operation. There are two TTL compatible inputs for this mode on the spectrum analyzer rear panel. The EVENT CNTR INPUT is used to count negative going pulses (a falling edge followed by a rising edge) occurring during the gate time interval. The INTERVAL CNTR INPUT is used for measuring the accumulated time that a pulse is low during the gate time interval. The number of negative going pulses is also displayed for this input, thus it can also be used as a second event counter. The counters display the count at the end of the gate time and are automatically restarted to do another count. If a continuous count for an indefinite time period is desired, the Totalize function may be used. Note that the gate time, Totalize, and Stop Cntrs functions control all counters together.

Following is a list of the softkeys that are available in the event counter mode.

**NOTE** For maximum operation speed, the event counter mode needs to be loaded into the spectrum analyzer memory last. The mode loader does this automatically for the DRTS modes. If a user DLP is used, it should be loaded into memory before loading the DRTS modes. This speed issue is primarily of concern for threshold errored second measurements with gate times of less than one second.

**PRESET EVNT CNT** sets the event counter to a known initial state.

GATE TIME ............. 1 s
TOTALIZE ............... OFF
STOP CNTRS .......... OFF
EVNT THLD............ 50000 cnt/s
Counter Values ........ 0

**RESET CNTRS** resets all the counters to zero and starts a new count.

**STOP CNTRS** turns off the counters and holds the last value of each on the display. The counters are reset to zero and restarted by pressing **RESET CNTRS**, changing the gate time, or turning Totalize on or off.

**GATE TIME** accesses the menu in which the gate time is selected. Keys are provided for 100 ms, 1 s, and 10 s. Or a value may be entered by using any of the data controls.

**TOTALIZE ON OFF** switches the counter between Totalize and gate time count. In Totalize, the counters keep incrementing until they are manually reset. With Totalize Off, the counters are reset and a new count is started at the end of every gate time interval. With Totalize On, the threshold errored seconds value is also displayed. This value will increase by one gate time interval; if during that gate interval, either the event counter value increases by more than the event threshold value, the interval counter value increases by any amount, or the interval counter time increases by any amount.

For Totalize with gate times less than 300 ms, XX is displayed for the Event and interval counters. To display these values, press **STOP CNTRS**.

**DSPLY SA ON OFF** turns the spectrum analysis display on and off. When on, this allows simultaneous viewing of both spectrum analyzer and event counter displays.

The spectrum analysis display is set to 15 dB/div, so that its display will not interfere with that of the event counter. The spectrum analyzer operation may be changed in the normal fashion by using the hard keys. The DSPLY SA function is automatically locked-out for Totalize with a gate time of less than one second.

**EVENT THRSHLD** allows the threshold value for the event counter to be changed. This is used in conjunction with threshold errored seconds measurements when in Totalize.

**Sources** access the menu that allows control of the IF and RF sources. To have access to this menu, the Flatness & Sources mode needs to be resident in the spectrum analyzer along with the event counter mode. The sources parameters may be changed while the counters are running, except for Totalize with a Gate Time of less than one second; in which case the counters are automatically stopped when the sources menu is accessed. For a description of the operation of the keys in this menu, refer to “Flatness & Sources Mode” section of the manual.

**Gate Indicator.** A “ “ is displayed on the CRT during the gate interval and momentarily flashes off at the end of the gate interval.

# Frequency Counter Mode

The Frequency Counter mode uses the spectrum analyzer to make highly accurate frequency measurements. The highest level signal applied to the input of the spectrum analyzer's INPUT 50 Ω connector is automatically found and its frequency and amplitude are displayed. The user needs to set just two parameters: the frequency band and the desired resolution. If the input signal is changed, the analyzer will automatically find and measure the new signal, provided it is in the displayed frequency band.

**NOTE** The frequency of a signal other than the highest can be determined in the spectrum analyzer mode by using the MKR CNT function. The accuracy is the same as when using the Frequency Counter mode.

Following is a list of softkeys that are available in Frequency Counter mode.

**PRESET FREQ CNT** sets the Frequency Counter to a known initial state.

RESOLN .................. 100 Hz
FREQ........................ 2.9
DSP HOLD .............. OFF

**RESET** restarts the search for the highest level signal present in the selected Band. This function seldom needs to be used, as searching automatically commences when no input signal above the threshold level is present.

**FREQ 2.9 22** This softkey selects the Frequency Band. The Analyzer will search for the highest level signal only in the selected Band. The 2.9 band is 10 MHz to 2.9 GHz. The 22 band is 2.75 to 22 GHz.

**RESOLN** accesses the menu in which Frequency Resolution is selected. Keys are provided for 1 Hz, 10 Hz, 100 Hz, 1 kHz, and 10 kHz.

**DSP HOLD ON OFF** switches the Display Hold function on and off. When it is on, the value displayed on the CRT is held.

**Searching.** A SEARCHING message is displayed if the counter has not acquired a signal.

**Measuring.** A MEASURING message is displayed when a frequency counter measurement is being made.

# Flatness & Sources Mode

## Flatness Analyzer

This mode is used to make swept flatness measurements. The source signal, connected to the input of the device under test, may come from either the IF tracking generator or the RF Source. An external 8470B Crystal Detector is connected to the output of the device under test. The output of the 8470B is connected to the FLATNESS EXT DET IN connector on the rear panel of the 8593E E02/E04. Measurements can be made IF to IF, RF to RF, IF to RF, or RF to IF.

**CAUTION** Do not apply more than +20 dBm to the detector. Use attenuators from the Power Sensor kit.

**NOTE** For IF measurements, use the 11852B Minimum Loss Pad from the Power Sensor kit.

Following is a list of softkeys that are available in the Flatness & Sources mode.

**PRESET FLATNESS** sets the flatness analyzer to a known initial state.

SOURCE ...................................... IF
SRC PWR (IF).............................. OFF, 0 dBm
SRC PWR (RF)............................. OFF, –10 dBm
SRC PWR OFFSET (IF).............. 0 dB
SRC PWR OFFSET (RF)............. 0 dB
PWR SWP .................................... OFF
REF LVL ...................................... 0 dBm
LOG SCALE................................. 1 dB/div
NORM REF POSN ....................... 7
SWEEP TIME............................... AUTO SCALAR
VBW ............................................. 1 kHz
TRANS/REFL .............................. TRANS
AMPL TRK .................................. OFF
NORMALIZE ............................... OFF
CENTER FREQ............................ 70 MHz
SPAN ............................................ 40 MHz

## Sources

This section of the Flatness & Sources Mode controls the IF and RF sources. These sources are used with the flatness analyzer and may also be used independently to provide either swept or CW signal sources.

The RF Source output is on the front panel of the 11758B. The RF Source is controlled by the softkeys of the spectrum analyzer. The frequency range is determined by the options configuration. The output level is adjustable from +5 to –15 dBm.

The spectrum analyzer includes a tracking generator that operates from 300 kHz to 2.9 GHz. The output is adjustable from +1 dBm to –10 dBm. The IF tracking generator output is on the front panel of the 8593E Spectrum Analyzer and is labeled RF OUT 50 Ω . For 75 Ω output, use the 11694A Transformer/Adaptor on the RF OUT 50Ω connector.

The **Sources** softkey or **[AUX CTRL]** hardkey activates the SRC PWR function and accesses the Sources menu. The Sources menu has the following softkeys:

**SOURCE IF RF** selects either the RF Source or the IF tracking generator. The source must be selected before setting Frequency, Span, or Source Power.

**CENTER FREQ** is used to set the selected source's frequency using the data keys, the arrow keys, or the knob.

**SPAN** allows the frequency range to be changed symmetrically about the center frequency.

**SRC PWR ON OFF** turns the source power on or off, and allows control of the output power level of the source. This separately controls the IF source or RF source, depending upon which is selected by the **SOURCE IF RF** softkey. If this function is active (SRC PWR highlighted), pressing it will toggle the function from on to off or from off to on. If this function is not active, pressing it will make it active.

**Src Pwr Menu** softkey accesses the source power menu.

**RF Src Band** softkey accesses the RF source band menu.

**3.0–6.8 BAND1** selects RF source frequencies from 3.0 to 6.8 GHz. This is the default range for the RF source.

**6.0–13.2 BAND2** selects RF source frequencies from 6.0 to 13.2 GHz when used with the correct option of 11758.

**9.0–19.8 BAND3** selects RF source frequencies from 9.0 to 19.8 GHz when used with the correct option of 11758.

**12.0–27.2 BAND4** selects RF source frequencies from 12.0 to 27.2 GHz when used with the correct option of 11758.

**SRC PWR OFFSET** adds in an offset number to the displayed value of the Source Power. This separately controls the IF source or RF source, depending upon which is selected by the **SOURCE IF RF** softkey.

**PWR SWP ON OFF** turns the power sweep function on or off, and allows control of the power sweep range of the IF source (tracking generator). This function sweeps the power as a function of the horizontal sweep ramp. It is used in Zero Span to make swept power measurements. It may be used with Span to provide slope compensation as a function of frequency.

### Calibration

The **[CAL]** or **CAL** softkey accesses the Flatness Calibration menu that has the following softkeys:

**CAL TRANS** is used to calibrate the measurement setup for transmission measurements. The message `Connect THRU, Store when ready` is displayed.

**STORE THRU** performs the actual transmission calibration by adjusting the peak of the response to the Reference Level, storing a reference trace, and then turning the normalization on. After calibration is completed, the message `THRU Cal stored, Normalization ON` is displayed.

**CAL REFL** is used to calibrate the measurement setup for reflection measurements. The message `Connect SHORT, Store when ready` is displayed.

**STORE SHORT** performs the actual reflection calibration by adjusting the peak of the response to the Reference Level, storing a reference trace, and then turning the normalization on. After calibration is completed, the message `SHORT Cal stored, Normalization ON` is displayed.

**CANCEL** stops the calibration without storing a new reference trace.

**NORMALIZE ON OFF** switches the normalization on and off.

---

**NOTE** The normalize reference position is at the seventh graticule line. It is indicated by the “>” and “<” marks. The unnormalized reference position is at the top graticule.

---

### Measure

The **[MEAS/USER]** key or **MEAS** softkey accesses the measurement menu that has the following softkeys.

**REFL TRANS** selects between reflection and transmission measurements. When switching from one to the other, some of the measurement conditions at the time of calibration are recalled, including the reference trace, Reference Level, and Log Scale. The source power and frequency parameters are not recalled, but must be the same for both reflection and transmission; except they may be different if the IF source is used for one measurement and the RF source for the other.

**AMPL TRK ON OFF** switches the Amplitude Track function on or off. With this function on, the Ref Level is automatically adjusted on each sweep to keep the maximum value of the trace approximately at the reference position. This is very useful when making flatness adjustments in 0.1 dB/div; as the gain of a device often varies considerably as the flatness is adjusted. Without this function, the user might need to repeatedly adjust the Ref Level to keep the trace on screen.

**SCALE LOG** sets the vertical graticule scale in dB per div.

**Meas Fcns** accesses the special functions menus. Refer to the *8590 Series Spectrum Analyzer User’s Guide* for a description of these functions.

### Front Panel Hard Keys

**[AMPLITUDE]** activates the reference level function and accesses the amplitude menu.

**[REF LVL]** sets the absolute level at the reference position on the screen. This is the level at the input to the 8470B Crystal Detector. When the calibration is performed, and the normalized trace displayed, both absolute reference and relative reference values are displayed. This differs from the Scalar mode where only the relative values are displayed when normalized. When the Amplitude Track function is on, the Ref Level is automatically adjusted.

**[BW]** accesses the Bandwidth menu, which has the following softkeys in the flatness analyzer mode.

**VID BW** sets the amount of post detection filtering. Decreasing this reduces trace noise. As the Video BW is decreased, the sweep time is automatically increased to maintain amplitude calibration.

**VID AVG ON/OFF** turns the averaging function on and off.

**[SWEEP]** activates the SWP TIME function and accesses the sweep menu.

# Scalar Analyzer Mode

The scalar analyzer mode is used to make swept scalar stimulus-response measurements. The source signal, connected to the input of the device under test, comes from the IF tracking generator's RF OUT 50 Ω connector on the spectrum analyzer. The output of the device under test is applied to the spectrum analyzer's INPUT 50 Ω connector.

**PRESET SCALAR** sets the scalar analyzer to a known initial state.

Following is a list of softkeys that are available in scalar analyzer mode.

SRC PWR .......................... OFF at 0 dBm
SRC PWR STP SIZE ........ AUTO
SRC PWR OFFSET .......... 0 dB
PWR SWP ......................... OFF
LOG SCALE ...................... 10 dB/div
NORM REF POSN ........... Top graticule
REF LVL ........................... 0 dBm
TRANS/REFL ................... TRANS
NORMALIZE .................... OFF
NORM REF LVL ............... 0 dB
SWEEP TIME ................... AUTO SCALAR
RES BW ............................ 10 kHz
VBW .................................. AUTO
DET ................................... SMPL
START FREQ.................... 0 Hz
STOP FREQ...................... 2.9 GHz

### Source

The **SOURCE** softkey or **[AUX CTRL]** hardkey activates SRC PWR and accesses the Source menu that has the following softkeys:

**NOTE** Use the **Source** softkey in the scalar analyzer menu. Do not use the **Sources** softkey in the flatness analyzer menu.

**SRC PWR ON OFF** turns the source power on or off, and allows control of the output power level of the source. If this function is active (SRC PWR highlighted), pressing it will toggle the function from on to off or from off to on. If this function is not active, pressing it will make it active.

**SRC PWR OFFSET** adds in an offset number to the displayed value of the Source Power.

**PWR SWP ON OFF** turns the power sweep function on or off, and allows control of the power sweep range of the tracking generator. This function sweeps the power as a function of the horizontal sweep ramp. It is used in Zero Span to make swept power measurements. It may be used with Span to provide slope compensation as a function of frequency.

### Calibration

The **cal** or **[CAL]** hardkey accesses the Scalar Calibration menu which has the following softkeys:

---

**NOTE** It is good practice to perform a TRACKING PEAK function at the beginning of each measurement session before performing a calibration.

---

**CAL REFL** is used to calibrate the Scalar measurement setup for reflection measurements. The message `Connect OPEN, Store When Ready` is displayed, followed by `Connect SHORT, Store When Ready`.

> **STORE OPEN** or **STORE SHORT** performs the actual calibration. A reference trace is stored, normalization is turned on and the normalized trace is displayed on the screen when this key is pressed. The message `OPEN/SHORT stored, Normalization, ON` is displayed.

---

**NOTE** An external directional coupler is required to make reflection (return loss) measurements.

---

**CANCEL** stops the calibration without storing a new reference trace.

**CAL TRANS** is used to calibrate the Scalar measurement setup for thru measurements. The message `Connect THRU, Store when ready` is displayed.

> **STORE THRU** performs the actual calibration. A reference trace is stored, normalization is turned on, and the normalized trace is displayed on the screen when this key is pressed. The message `THRU Cal Stored, Normalization, ON` is displayed.
>
> **CANCEL** stops the calibration without storing a new reference trace.

**TRACKING PEAK** performs an automatic routine to set the tracking generator frequency to precisely the same frequency as the spectrum analyzer. It is necessary to have a cable or the device under test connected between the tracking generator and spectrum analyzer before pushing this key.

**NORMLIZE ON OFF** switches the normalization on and off.

**Main Menu** returns to the SCALAR menu.

### Measurement

**REFL** selects reflection measurement for display on the screen. When switching from TRANS to REFL, the reflection reference trace and reflection amplitude parameters are recalled, and normalization is turned on.

**TRANS** selects transmission measurement for display on the screen. When switch from REFL to TRANS, the transmission reference trace and transmission amplitude parameters are recalled, and normalization is turned on.

---

**NOTE** **REFL** and **TRANS** have independent reference traces and amplitude parameters that are automatically saved and recalled when switching between the two measurements. The frequency and source power parameters are shared by both.

---

**NORMLIZE ON OFF** switches the normalization On and Off.

**Meas Fcns** accesses the special functions menus. Refer to the *8590 Series Spectrum Analyzer User's Guide* for a description of these functions.

### Front Panel Hard Keys

Most of the Front Panel hard keys may be used in this mode. Their operation is very similar to that for the spectrum analyzer mode. Some of the softkeys are different to better match the requirements for the scalar analyzer mode. The most important hard keys and related softkeys are described below.

**[FREQUENCY]** activates the Center Frequency function and allows selection of the frequency at the center of the screen. It also accesses the FREQUENCY menu.

**[SPAN]** activates the Span function and allows the frequency range to be changed symmetrically about the center frequency. It also accesses the SPAN menu.

**[AMPLITUDE]** activates the Reference Level function and accesses the amplitude menu.

**REF LVL (RANGE)** sets the absolute level at the Reference Level Position on the screen (the top horizontal graticule) before calibration. This is the level at the input to the spectrum analyzer.

**SCALE LOG** sets the vertical graticule scale in dB per div.

**NORM REF LVL** sets the relative level at the normalized reference position. It can be set either before or after calibration.

**NORM REF POSN** moves the position at which the normalized reference level applies. This reference level is indicated by “>” and “<” on the display when Normalization is on.

**[BW]** activates the RES BW function and accesses the BW menu.

**RES BW** sets the bandwidth of the IF bandpass filters. Narrowing the RES BW gives increased sensitivity, and hence increased dynamic range. As the RES BW is decreased, the sweep time is automatically increased to maintain amplitude calibration. Note that the RES BW does not restrict the bandwidth that can be measured on the device under test.

**VID BW** sets the amount of post detection filtering. Decreasing this reduces trace noise. As the Video BW is decreased, the sweep time is automatically increased to maintain amplitude calibration.

**VID AVG ON/OFF** turns the averaging function on and off.

**[SWEEP]** activates the SWP TIME function and accesses the Sweep menu.

**SWP TIME** When active (highlighted), the sweep time can be entered from the data control keys. AUTO or MANual operation may also be chosen. In Auto operation, the sweep time is automatically set as a function of RES BW and Video BW to give a correct amplitude display with most devices under test. If the device has unusually sharp skirts or resonances, a slower sweep in the manual mode may be required. Conversely, if the response is very flat a faster sweep time could be used if desired. This can be easily tested: the sweep time is not too fast if increasing it one increment produces no noticeable change (or an acceptable change) on the display.

**[MKR]** turns on the normal marker and accesses the marker menu. These functions are very useful for the scalar analyzer mode. See the spectrum analyzer operation for detailed description.

# Introduction to Digital Radio Measurements

This section provides operating information for the 8593E Option E02/E04. It includes several simple digital radio measurements. It does not provide an in-depth discussion of all of the features of the 8593E Option E02/E04. The purpose of this section is to help you become familiar with the spectrum analyzer and begin making measurements in a minimum amount of time. For additional information, please refer to *85718A Digital Radio Measurements Personality User's Guide* and the *8590 D-Series and E-Series Spectrum Analyzer User's Guide*. The following section includes test procedures for:

- Spectral Occupancy
- IF Frequency Measurement
- Flatness Through Upconverter
- Measuring Errors with the Event Counter

# Spectral Occupancy

This test measures the spectral occupancy of a transmitter and compares it with predefined masks to see if it falls within qualified bandwidth requirements. The measurement can be taken from an RF monitor port, or from the RF output if it is sufficiently attenuated.

### Test Equipment

Spectrum Analyzer ........................................................ 8593A
Type N cable.................................................................... 11500A

1. Load the digital radio masks if they are not already loaded.
    a. Place the DRTS mode card in the mode loader.
    b. Press: **[MODE]**
    c. Press: **MODE LOADER**
    d. Select Digital Radio Masks: Press: **[6] [ENTER]** (ENTER is the shifted HZ key)
    e. Wait until the masks are loaded.
    f. Press: **Digital Radio**
    g. Press: **Agency Masks**
    h. Select the mask appropriate for your radio. The masks are **4 GHz FCC MASK**, **6 GHz FCC MASK**, **11 GHz FCC MASK**, **13 GHz UK MASK**, and **13 GHz FRG MASK**.

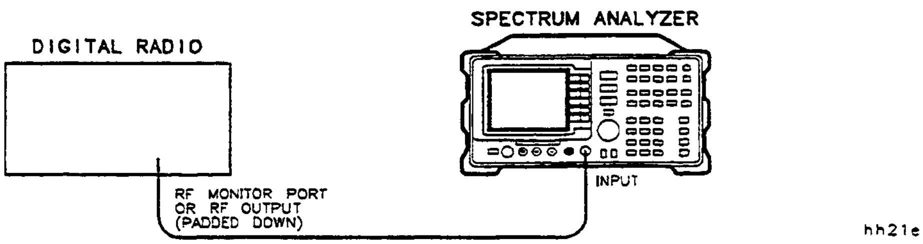
---

**NOTE** If you need to define your own mask, or for more detail, refer to the *85713A Digital Radio Measurements Personality User's Guide*. Once a mask has been defined, it can be moved to a different center frequency simply by pressing **[CENTER FREQ]** and using the rotary knob or data keys.

---

2. Connect the test setup as shown in Figure 3-1 below.

**Figure 4-1. Spectral Occupancy Setup**



---

**CAUTION** Use the attenuators provided in the accessory kit. Make sure that the high power attenuator is placed closest to the RF output.

---

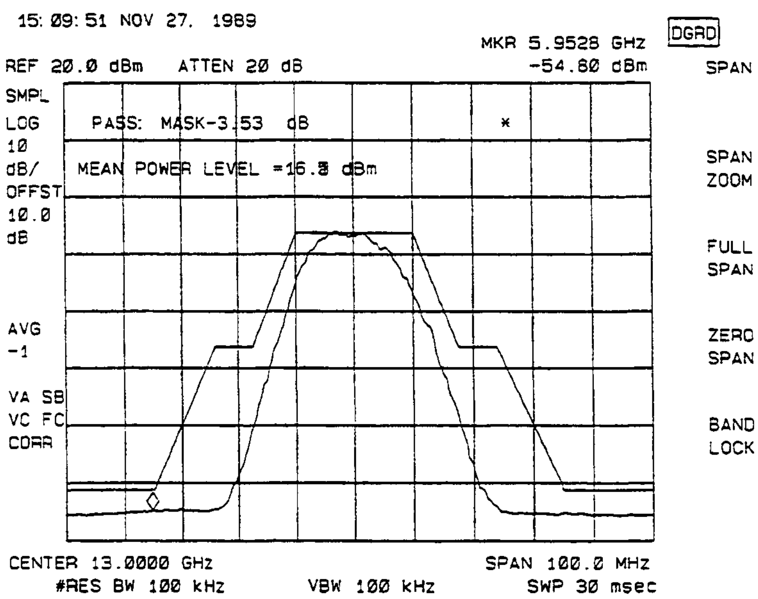
**NOTE** It may be necessary to make the spectral occupancy test at the actual RF output instead of the monitor port if there are additional RF filters present in the radio after the monitor port (filters are often responsible for keeping the sidelobes below the required mask).

---

3. Press: **Compare to Mask**

4. The spectrum analyzer display will show the mask and the spectrum of the radio. If the radio spectrum does not fall within the mask, a message will be displayed indicating failure.

**Figure 4-2. Display of Relative Mask**




Shown in Figure 3-2 is a relative mask. You also have the option of displaying an absolute mask, which references the top of the mask to the peak of the unmodulated carrier level.

# IF Frequency Measurement

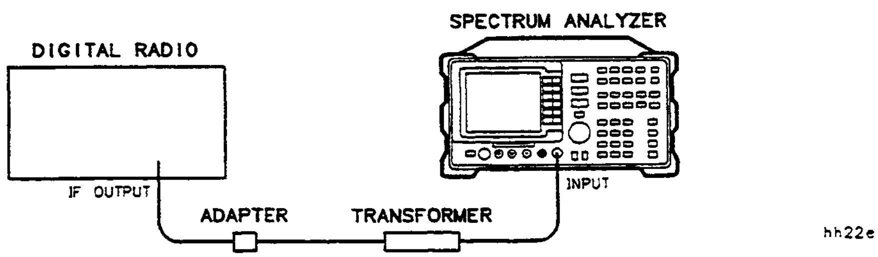
This measurement checks the IF frequency of a radio. The same technique can be used to measure the local oscillator used in the modulator or upconverter sections of the radio. It may also be used to measure the LO of the demodulator or down converter.

## Test Equipment

Spectrum Analyzer ........................................................ 8593A
75 Ω SMB-BNC Adapter ................................................ Depends on radio connector
75 Ω BNC Cable............................................................. 11758-60022
Transformer 50 Ω N (m) 75 Ω BNC (f) .......................... 9100-4859

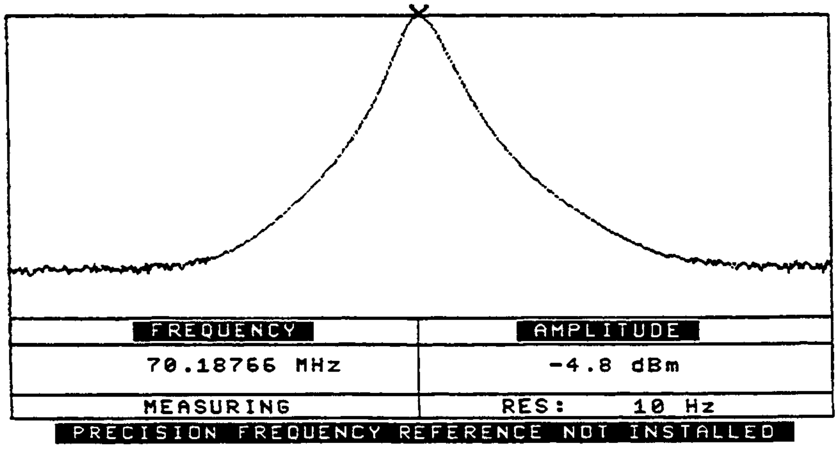
1. Set up equipment as shown in Figure 3-3.

**Figure 4-3. IF Frequency Measurement**




2. Turn off all modulation of the radio.
3. Load the frequency counter if it is not already loaded.
   a. Place the DRTS mode card in the mode loader. If you are not at the main menu that says “MODE LOADER”, then press **[MODE]**
   b. Press: **MOAD LOADER**
   c. Press: **[7]**, **[ENTER]**

**Figure 4-4. Frequency Counter Display**




d. Press: **FREQ COUNTER**

4. Check to make sure 2.9 GHz is underlined in the softkey display (or 22 GHz if the frequency is between 2.9 GHz and 22 GHz). Pressing the softkey toggles between 2.9 GHz and 22 GHz.
5. Press: **[RESET]**
6. Read frequency

# Flatness through Upconverter

This test checks the upconverter section of the transmitter for flatness of power across the frequency bandwidth.

A similar procedure can be used to measure flatness through any IF subsection. If the overall flatness measurement is not within specification, measure the individual sections until the defective section can be determined.

### Test Equipment

Spectrum Analyzer ........................................................ 8593A
Crystal Detector ............................................................ 8470B Opt 012
75 Ω SMB-BNC Adapter ................................................ Depends on radio connector
Two 75 Ω BNC Cables .................................................... 11758-60022
Type N Cable.................................................................. 11500A
Transformer 50 Ω N (m) 75 Ω BNC (f) .......................... 9100-4859
Attenuator...................................................................... Depends on RF output power

1. Load the flatness analyzer software.
    a. Place the DRTS mode card in the mode loader.
    b. Press: **[MODE]** if at main menu.
    c. Press: **MODE LOADER**
    d. To load **FLATNESS ANALYZER & SOURCES**
        i. Press: **[4] [ENTER]**
        ii. Wait for data to load.
        iii. Press: **FLATNESS AND SOUCES**
2. Press: **Sources**
3. Select the desired source frequency range using the **SOURCE IF RF** softkey.

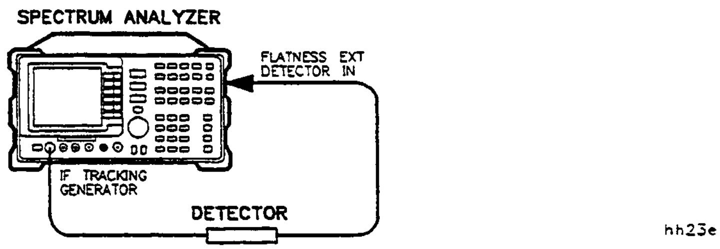
**NOTE** Use IF for source frequencies 300 kHz to 2.9 GHz. Use RF for source frequencies above 3.0 GHz.

4. Press: **CENTER FREQ**
5. Enter the center frequency using the DATA keys.
6. Press: **SPAN**
7. Enter the span using the DATA keys. The span should be the bandwidth over which the flatness is specified.
8. Press: **SRC PWR**
9. Enter the desired source power level using the DATA keys.

**NOTE** The amplitude range of the IF Tracking Generator can be extended from +10 dBm to –60 dBm using the Multipath Fading Simulator for frequencies between 40–200 MHz.

10. Configure the calibration setup as shown in Figure 3-5. If your transmitter's IF input is 75 Ω, attach the transformer/adapter to the IF Tracking Generator Output.

**Figure 4-5. Flatness Calibration, 0 to 2.9 GHz**

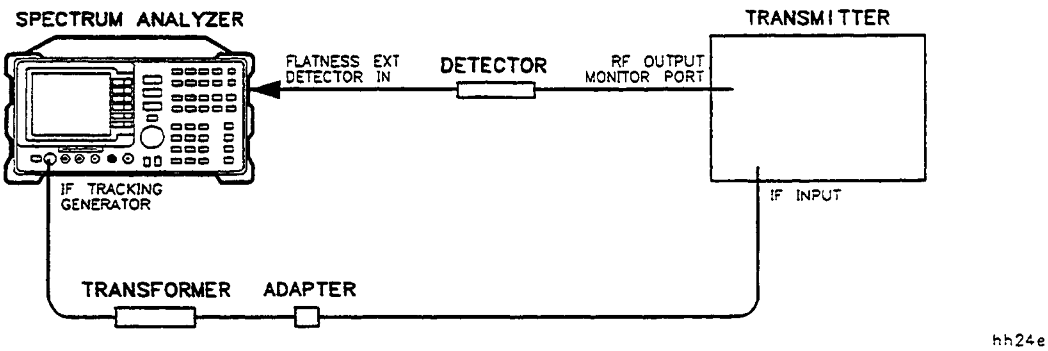



11. Press: **MAIN MENU**
12. Press: **CAL**
13. Press: **CAL TRANS**
14. Press: **STORE THRU** and wait until calibration finishes. A `"THRU Cal Stored"` message will appear.

**NOTE** If the frequency parameters or the source power are changed after performing a CAL TRANS, the calibration will be in error and another CAL TRANS will need to be done. Changing the amplitude parameters will not affect the calibration. For 75 Ω output, attach the transformer/ adapter to the RF Out 50 Ω connector.

15. Set up equipment as shown in the Figure 3-6.

**Figure 4-6. Flatness through Upconverter**




---

**NOTE** For levels greater than +20 dBm, use the 30 dB Attenuator before the crystal detector.

---

16. Press: **MAIN MENU** wait, then press: **MEAS**
17. Set the **AMPL TRK** softkey to ON.
18. Flatness will be displayed on the spectrum analyzer screen.
19. Adjust **SCALE LOG** for the desired vertical scale (dB/div).
20. Press Peak-to-peak measurement to read maximum amplitude variation over measured bandwidth. The measurement should be less than the flatness specified.

# Measuring Errors with Event Counter

The event counter (and interval counter) are functions independent of the operation of the spectrum analyzer. The event counter is used to count negative going pulses: a falling edge followed by a rising edge. The INTERVAL CNTR INPUT is used to measure the accumulated time that a pulse is low during the gate time interval. The gate time can be set to 100 ms, 1 s, and 10 s, or a value entered using data control keys.

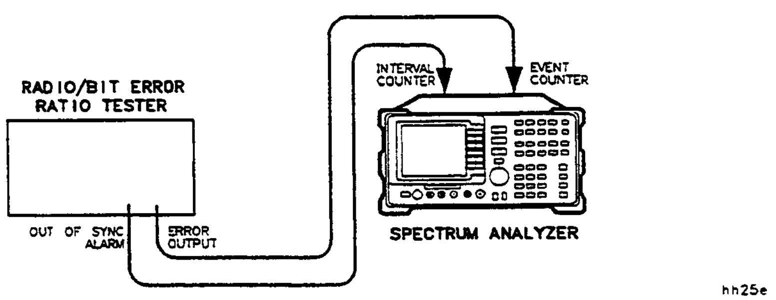
The event counter is useful for counting the number of data errors over a period of time. You can set the instrument to total the number of seconds, or some other period of gate time, that radio produces errors in over a length of time (perhaps all night). The following procedure shows how to set up the event counter and test for errors.

### Test Equipment

Spectrum Analyzer ........................................................... 8593A
Two 75 Ω BNC Cables ...................................................... 11758-60022
Bit Error Rate Tester ....................................................... If needed

1. Load the Event Counter Mode if it has not already been loaded.
   a. Insert the DRTS mode card into the mode loader.
   b. On the 8593A, press: **[MODE]**
   c. Press: **MODE LOADER**
   d. Press: **[5] [ENTER]** (the HZ key)
   e. Wait until the program has loaded before continuing.
   f. Press: **EVENT COUNTER**
2. Set up the equipment as shown in Figure 3-7.

**Figure 4-7. Event Counter Test Setup**




3. Press: **MORE**
4. Press: **EVENT THRESHOLD**
5. Press: **MORE**
6. Press: **GATE TIME**

7. Press: **1 SEC**
8. Press: **MAIN MENU**
9. Press: **TOTALIZE** so that the ON is underscored.
10. Run for a significant period of time (perhaps overnight).
11. Read the threshold errored seconds. This value tells you in how many seconds of the test period the error rate exceeded the value set for your radio.

# 5 8593E Option E02/E04 Programming Commands

This addition to the “Programming Commands” chapter of the *Agilent 8590 D-Series and E-Series Spectrum Analyzer Programmer’s Guide* contains:

- Information about remote operation of the 8593E Option E02/E04 modes.
- A functional index that groups the 8593E Option E02/E04 programming commands by category.
- The language reference for the 8593E Option E02/E04 mode programming commands.

# Remote Operation of the 8593E Option E02/E04 Modes

To operate the Option E02/E04 modes remotely you *must* follow these steps:

1. Use the LOAD command to load the Mode Loader downloadable program (DLP) into analyzer memory.
2. Use the Mode Loader commands to load the selected mode(s) into analyzer memory.
3. Use the MODE command to access a mode.

**NOTE** A mode can be accessed only if it has been loaded into analyzer memory.

The following sections explain these steps.

1. **Use the LOAD Command to Load the Mode Loader DLP into Analyzer Memory**

   To be able to access Mode Loader, the Mode Loader DLP must be in analyzer memory. Execute `OUTPUT 718; "LOAD %dLOADME%;"` to load the Mode Loader DLP into analyzer memory. (dLOADME is the file name for the Mode Loader DLP.)

2. **Use Mode Loader to Load DLP Modes into Analyzer Memory**

   To use the programming commands for a mode of operation, the downloadable program for that mode *must* be loaded into analyzer memory. Use the Mode Loader command nl_SELECT to load in the downloadable programs for the different modes. The following example demonstrates using nl_SELECT to load the Frequency Counter, Flatness and Sources, and the Event Counter DLPs into analyzer memory.

| | |
|---|---|
| `OUTPUT 718;"MODE 21;"` | *Uses the MODE command to select the mode loader mode. (The MODE command is described in the following section.)* |
| `OUTPUT 718; "nl_SELECT1;"` | *Selects menu choice number 1 from the Mode Loader menu. Menu choice number 1 is the Frequency Counter, Flatness and Sources, and Event Counter modes.* |

3. **Use the MODE Command to Access a Mode**

   The MODE command is used to access a mode. In the previous example, the MODE command accessed the Mode Loader mode with `OUTPUT 718; "MODE 21;"`. In the following example, the event counter mode is accessed by executing `OUTPUT 718;"MODE 7;"`. See "MODE Command" (later in this manual supplement) for more information.

| | |
|---|---|
| `OUTPUT 718;"MODE 7;"` | *Accesses the Event Counter mode.* |
| `OUTPUT 718;"ne_MP;"` | *Presets the Event Counter mode.* |

## Using Spectrum Analyzer Commands

While in an Option E02/E04 mode, some spectrum analyzer commands should not be used. For example, use ns_FFT while in the scalar analyzer mode instead of FFT. Also, do not use the programming commands of other modes. For example, do not use ns_FFT to do a fast Fourier transform while in the low frequency oscilloscope mode (use np_FFT instead).

Use the preset for the mode instead the IP command. IP changes the mode to spectrum analyzer. See the following example.

`OUTPUT 718;"ne_MP;"` *Presets the event counter mode if the current mode is event counter.*

### Using the MOV Command

It is recommended that the MOV command be used to execute all programming commands that take a number parameter. Using the MOV command is faster and avoids displaying text on the analyzer screen. For example, use `OUTPUT 718;"MOV nt_RL,–10;"` instead of `OUTPUT 718;"nt_RL–10;"`.

### Using the Tracking Generator Commands for the 8593E Option E02/E04

Most of the tracking generator commands documented in the “Programming Commands” chapter apply to the 8593E Option E02/E04 (when in the spectrum analyzer mode). Use the following table to determine if the tracking generator command can be used with the 8593E Option E02/E04.

**NOTE** The following table is for your information only; we recommend that you use the scalar analyzer mode commands to operate the 8593E Option E02/E04 Tracking Generator.

**Table 5-1. Functional Index**

| Command | Description | Available for the 8593 Option E02/E04? |
|---|---|---|
| MEASURE | Determines the type of measurement: signal analysis, stimulus response, or signal normalization. | Yes. |
| NRL | Sets the normalized reference level. | Yes. |
| RLPOS | Selects the position of reference level. | Yes. |
| SRCALC | Selects internal or external leveling for the tracking generator. | Only internal leveling (`SRCALC INT`) is allowed. |
| SRCAT | | Yes. |
| SRCNORM | Subtracts trace B from trace A, adds the display line, and sends the result to trace A. | Yes. |
| SRCPOFS | Offsets the source-power level. | Yes (the amplitude range of the command is valid over the specified amplitude range of the 8593E Option E02/E04). |
| SRCPSTP | Selects the source-power step size. | Yes (the amplitude range of the command is valid over the specified amplitude range of the 8593E Option E02/E04). |
| SRCPSWP | Selects sweep range of source-output. | Yes (the amplitude range of the command is valid over the specified amplitude range of the 8593E Option E02/E04). |
| SRCPWR | Selects the source-power level. | Yes (the amplitude range of the command is valid over the specified amplitude range of the 8593E Option E02/E04). |
| SRCTK | Adjusts tracking of source output with spectrum-analyzer sweep. | Yes. |
| SRCTKPK | Adjusts tracking of source output with spectrum analyzer sweep. | Yes. |
| SWPCPL | Selects a stimulus-response (SR) or spectrum-analyzer (SA) auto-coupled sweep time. | Yes. |

# 8593E Option E02/E04 Functional Index

Table 5-2 is a functional index that categorizes the 8593E Option E02/E04 commands by mode. The modes are listed in alphabetical order. The commands with brief definitions are shown. Use the "Corresponding Softkey" column to identify the command that is similar to the softkey function. Once the desired command is found, refer to the alphabetical listing of commands later in this manual supplement for further definition.

### Table 5-2. Functional Index of Commands Unique to 8593E Option E02/E04

| Mode | Command Mnemonic | Corresponding Softkey | Description |
|---|---|---|---|
| **DIGITAL RADIO MASKS** | KEYEXC 1807 | **CENTER 99% BW** | Centers the 99% power bandwidth on screen. |
| | KEYEXC 1808 | **COMPARE TO MASK** | Makes a mean power measurement, compares the result to selected mask. |
| | KEYEXC 1809 | **MEAN PWR LEVEL** | Determines the mean power level of the unmodulated carrier. |
| | KEYEXC 1810 | **TRANSIT ANALYSIS** | Searches for a signal within a mask's span of the display. |
| | KEYEXC 1811 | **FREQ RESPONSE** | Compares frequency responses in digital radio systems. |
| | KEYEXC 1813 | **4 GHz FCC MASK** | Selects the 4 GHz FCC agency mask. |
| | KEYEXC 1814 | **6 GHz FCC MASK** | Selects the 6 GHz FCC agency mask. |
| | KEYEXC 1815 | **11 GHz FCC MASK** | Selects the 11 GHz FCC agency mask. |
| | KEYEXC 1816 | **13 GHz UK MASK** | Selects the 13 GHz UK agency mask. |
| | KEYEXC 1817 | **13 GHz FRG MASK** | Selects the 13 GHz FRG agency mask. |
| | KEYEXC 1830 | **CONTINUE** | Continues a **COMPARE TO MASK** or **MEAN PWR LEVEL** measurement. |
| | KEYEXC 1831 | **EXIT** | Exits a **TRANSIT ANALYSIS** measurement. |
| | KEYEXC 1837 | **REFERNCE RESPONSE** | Does a reference response for **FREQ RESPONSE**. |
| | KEYEXC 1838 | **COMPARE RESPONSE** | Does a compare response for **FREQ RESPONSE**. |
| | KEYEXC 1845 | **AUTO CENTER** | Centers a signal on screen. |
| | KEYEXC 1846 | **SETUP COMPLETE** | Proceeds with the video-averaging after a **COMPARE RESPONSE** or **REFERNCE RESPONSE**. |
| | KEYEXC 1855 | **DO COMPARE** | Allows the user to enter the pass/fail criteria, then compares it to the frequency response. |
| | KEYEXC 1861 | **STORE REFERENC** | Saves the ref. freq. response in trace 0. |
| | KEYEXC 1867 | **EXTERNAL ATTEN** | Offsets the amplitude of the reference level without affecting the trace when external attenuation is used in the test setup. |
| | KEYEXC 1873 | **ABORT** | Aborts the frequency response function. |
| | KEYEXC 1879 | **SAVE MASK SET** | Saves the current mask set in one of three files on the memory card. |
| | KEYEXC 1880 | **RECALL MASK SET** | Recalls mask set from memory card. |

## Table 5-2. Functional Index of Commands Unique to 8593E Option E02/E04

| Mode | Command Mnemonic | Corresponding Softkey | Description |
|---|---|---|---|
| **EVENT COUNTER** | ne_COUNT | | Counts once for a specified gate time. |
| | ne_DISPOSE | **DISPOSE EVNT CNT** | Removes Event Counter DLP from analyzer memory. |
| | ne_DSA | **DSPLY SA ON OFF** | Turns simultaneous spectrum analyzer display on or off. |
| | ne_GTIME | **GATE TIME** | Sets the gate time. |
| | ne_MP | **PRESET EVNT CNT** | Presets the Event Counter mode. |
| | ne_RST | **RESET CNTRS** | Resets the counters. |
| | ne_STOP | **STOP CNTRS** | Stops the counters. |
| | ne_THCNT | **EVENT THRESHLD** | Sets the counter threshold. |
| | ne_TOT | **TOTALIZE ON OFF** | Turns the totalize operation on or off. |
| **FLATNESS & SOURCES** | nt_ATRACK | **AMPL TRK ON OFF** | Turns amplitude tracking on or off. |
| | nt_ATRKEL | **AMPL TRK ERR LIM** | Sets error limit for amp. track. func. |
| | nt_BAND | **BAND 1,2,3,4** | Sets Band for RF Source. |
| | nt_CALR | **CAL REFL** | Sets up for reflection calibration. |
| | nt_CALT | **CAL TRANS** | Sets up for transmission calibration. |
| | nt_DISPOSE | **DISPOSE FLATNESS** | Removes the Flatness and Sources DLP from analyzer memory. |
| | nt_FFT | **FFT MEAS** | Performs a fast Fourier transform func. |
| | nt_FOFST | **FREQ OFFSET** | Sets frequency offset of the current source (IF or RF). |
| | nt_MP | **PRESET FLATNESS** | Presets the Flatness and Sources mode. |
| | nt_NORM | **NORMLIZE ON OFF** | Switches the normalization on or off. |
| | nt_NRP | **NORM REF POSN** | Sets the normalized reference position. |
| | nt_REFL | **REFL TRANS** (REFL) | Recalls the reflection calibration data. |
| | nt_RL | **REF LVL** | Sets the reference level. |
| | nt_SRCIF | **SOURCE IF RF** (IF) | Selects the IF source. |
| | nt_SRCOFF | **SRC PWR ON OFF** (OFF) | Turns off both the IF and RF sources. |
| | nt_SRCPIF | **SRC PWR ON OFF** (IF) | Sets the IF source power. |
| | nt_SRCPIFO | **SRC PWR OFFSET** | Sets the power offset of the IF source. |
| | nt_SRCPRF | **SRC PWR ON OFF** (RF) | Sets the RF source power. |
| | nt_SRCPRFO | **SRC PWR OFFSET** (RF) | Sets the power offset of the RF source. |
| | nt_SRCRF | **SOURCE IF RF** (RF) | Selects the RF source. |
| | nt_STREF | **STORE THRU** (TRANS), **STORE SHORT** (REFL) | Stores reference trace and settings. |
| | nt_TRANS | **REFL TRANS** (TRANS) | Performs a transmission measurement and calibration. |

### Table 5-2. Functional Index of Commands Unique to 8593E Option E02/E04

| Mode | Command Mnemonic | Corresponding Softkey | Description |
|---|---|---|---|
| **FREQUENCY COUNTER** | nf_BAND | **FREQ 2.9 22** | Sets the frequency band and begins a new search. |
| | nf_DHLD | **DSP HOLD ON OFF** | Turns the display hold on or off. |
| | nf_DISPOSE | **DISPOSE FREQ CNT** | Removes the Frequency Counter downloadable program from analyzer memory. |
| | nf_MP | **PRESET FREQ CNT** | Presets the Frequency Counter mode. |
| | nf_RESOLN | **Resoln** | Sets the frequency resolution. |
| | nf_RST | **RESET** | Resets the counter and begins a new search. |
| **LOW FREQUENCY OSCILLOSCOPE** | np_DISPOSE | **DISPOSE SCOPE** | Removes the Low Frequency Oscilloscope downloadable program from analyzer memory. |
| | np_FFT | **FFT MEAS** | Performs a fast Fourier transform function. |
| | np_MP | **PRESET SCOPE** | Presets the Low Frequency Oscilloscope mode. |
| | np_VOFS | **OFFSET** | Sets the vertical offset. |
| | np_VOFSP | **OFST POL NEG POS** | Selects the vertical offset polarity. |
| | np_VS | **SCALE/div** | Sets the vertical scale. |
| **MODE LOADER** | nl_CKCRD | | Checks if the DRTS ROM card is inserted. |
| | nl_DISPOSE | | Removes the Mode Loader downloadable program from analyzer memory. |
| | nl_SELECT | | Loads the selected mode downloadable program into analyzer memory. |
| **SCALAR ANALYZER** | ns_CALR | **CAL REFL** | Sets up for reflection calibration. |
| | ns_CALT | **CAL TRANS** | Sets up for transmission calibration. |
| | ns_CAN | **CANCEL** | Cancels the calibration routine. |
| | ns_DISPOSE | **DISPOSE SCALAR** | Removes the Scalar Analyzer downloadable program from analyzer memory. |
| | ns_FFT | **FFT MEAS** | Performs a fast Fourier transform function. |
| | ns_MP | **PRESET SCALAR** | Presets the Scalar Analyzer mode. |
| | ns_NORM | **NORMLIZE ON OFF** | Switches the normalization on or off. |
| | ns_NRP | **NORM REF POSN** | Sets the normalized reference position. |
| | ns_REFL | **REFL** | Switches to a reflection measurement. |
| | ns_RL | **REF LVL (RANGE)** | Sets the reference level. |
| | ns_SRCOFF | **SRC PWR ON OFF** (OFF) | Turns off the tracking generator source. |
| | ns_SRCPOFS | **SRC PWR OFFSET** | Sets the source power offset. |
| | ns_SRC PWR | **SRC PWR ON OFF** | Sets the source power of the tracking generator. |
| | ns_STO | **STORE OPEN** | Stores the open reference trace. |
| | ns_STS | **STORE SHORT** | Stores the short reference trace and settings. |
| | ns_STTHRU | **STORE THRU** | Stores thru reference trace and settings. |
| | ns_TRANS | **TRANS** | Switches to a transmission measurement. |

# Language Reference for the 8593E Option E02/E04 Modes

The language reference section in this manual supplement is similar to the language reference section in the “Programming Commands” chapter of the *8590 D-Series and E-Series Spectrum Analyzer Programmer’s Guide*. The differences between them are as follows:

- This manual supplement contains the 8593E Option E02/E04 programming commands only. See the “Programming Commands” chapter for information about the spectrum analyzer programming commands.

**NOTE** The 8593E Option E02/E04 programming commands are listed alphabetically.

- This manual supplement includes boxed information with each programming command. The boxed information serves as a reminder of the following:

  1. The DLP for that mode needs to be loaded into analyzer memory.
  2. The mode needs to be accessed with the MODE command.

  The following is an example of the boxed information that accompanies the event counter mode commands:

| |
|---|
| Mode: Event Counter<br>MODE Parameter: 7 |

  “Mode: Event Counter” indicates that the command nl_SELECT should have been used to load in the Event Counter DLP. “MODE Parameter: 7” indicates that the MODE command should be set to 7 to access the Event Counter mode.

- The syntax for each command in this manual supplement is represented in an abbreviated format. Refer to the following sections “Notation Conventions” and “Syntax Conventions” for an explanation of the abbreviated format.

## Notation Conventions

The syntax for the programming commands and query response are shown in an abbreviated format. The abbreviated format uses symbols and type styles to denote the following:

**BOLD TYPE** All characters appearing in bold type are key words and must appear exactly as shown.

< > Characters appearing in angular brackets are considered to be elements of the language being defined. Their meanings can be found in the section "Syntax Conventions" unless otherwise specified with the keyword definition.

[ ] Square brackets indicate that whatever occurs within the brackets is optional.

| "or": Indicates a choice of exactly one element from a list (for example, <a> | <b> indicates <a> or <b> but not both).

( ) Parentheses are used to clarify which elements are to be chosen from.

- Indicates that a space must be placed at the indicated location (for example, A_<a> indicates there must be a space between the keyword A and the element <a>).

**NOTE** Do not confuse the notation for a space with the notation for an underscore within a command mnemonic. Most of the programming commands for the Option E02/E04 modes use an underscore as the third character of the mnemonic. The underscore will always be in the place for the third character and bolded. A space will be after the command mnemonic and unbolded.

::= "Is defined as" (for example, <a>::=<b><c> indicates that <a> can be replaced by the series of elements <b><c> in any statement where <a> occurs).

## Syntax Conventions

<numeric data format>::=

<number> <CR> <LF><EOI>.

<number>::=

Integer number or real number.

# Digital Radio Masks Mode

## KEYEXC
## Key Execution for Digital Radio Masks

The KEYEXC command is used to execute the Digital Radio Masks mode functions.

| |
|---|
| Mode: Digital Radio Masks<br>MODE Parameter: 5 |

Syntax: KEYEXC<number>;

<number>::=a valid key number. See the description.

### Example

| | |
|---|---|
| `OUTPUT 718;"MODE5;"` | *Select the Digital Radio Masks mode.* |
| `OUTPUT 718; "KEYEXC1808;"` | *KEYEXC1808 executes* **COMPARE TO MASK.** |

### Description

Unlike the programming commands for the other modes, Digital Radio Mask functions are specified by the KEYEXC command followed by a specific key number; the digital radio mask functions do not have unique command mnemonics. Executing the KEYEXC with the number for a Digital Radio Mask function is equivalent to pressing the softkey for the Digital Radio Masks function.

Use the following table to determine the key number to specify after the KEYEXC command.

### Table 5-3. Key Numbers to Operate the Digital Radio Masks Functions

| Key Number | Corresponding Softkey | Description |
|---|---|---|
| 1807 | **CENTER 99% BW** | Centers the 99% power bandwidth on screen. |
| 1808 | **COMPARE TO MASK** | Makes a mean power measurement, then compares the result to the selected mask. |
| 1809 | **MEAN PWR LEVEL** | Determines the mean power level of the unmodulated carrier. |
| 1810 | **TRANSIT ANALYSIS** | Searches for a signal within a mask’s span of the display. |
| 1811 | **FREQ RESPONSE** | Compares frequency responses in digital radio systems. |
| 1813 | **4 GHz FCC MASK** | Selects the 4 GHz FCC agency mask. |
| 1814 | **6 GHz FCC MASK** | Selects the 6 GHz FCC agency mask. |
| 1815 | **11 GHz FCC MASK** | Selects the 11 GHz FCC agency mask. |
| 1816 | **13 GHz UK MASK** | Selects the 13 GHz UK agency mask. |
| 1817 | **13 GHz FRG MASK** | Selects the 13 GHz FRG agency mask. |
| 1830 | **CONTINUE** | Continues a **COMPARE TO MASK** or **MEAN PWR LEVEL** measurement. |
| 1831 | **EXIT** | Exits a **TRANSIT ANALYSIS** measurement. |
| 1837 | **REFERNCE RESPONSE** | Does a reference response for **FREQ RESPONSE**. |
| 1838 | **COMPARE RESPONSE** | Does a compare response for **FREQ RESPONSE**. |
| 1845 | **AUTO CENTER** | Centers a displayed signal on the spectrum analyzer’s screen. |
| 1846 | **SETUP COMPLETE** | Proceeds with the video-averaging after a **COMPARE RESPONSE** or **REFERNCE RESPONSE**. |
| 1855 | **DO COMPARE** | Allows the user to enter the pass/fail criteria, then compares it to the frequency response. |
| 1861 | **STORE REFERENC** | Stores the reference frequency response in trace 0. |
| 1867[a] | **EXTERNAL ATTEN** | Offsets the amplitude of the reference level without affecting the trace when external attenuation is used in the test setup. |
| 1873 | **ABORT** | Aborts the frequency response function. |
| 1879[b] | **SAVE MASK SET** | Saves the current mask set in one of three files on the memory card. |
| 1880[b] | **RECALL MASK SET** | Recalls mask set from memory card. |

a. Key number 1867 accepts a real number as a parameter. For example, `OUTPUT 718;"KEYEXC1867,1.0;"`.

b. Key numbers 1879 and 1880 accept a “l,” “2,” or “3” as a parameter.

The following variables can be queried for the results of the specified Digital Radio Masks function. For example, to determine the COMPARE TO MASK result, execute the following:

| | |
|---|---|
| `OUTPUT 718; "KEYEXC1808;"` | *Performs a* **COMPARE TO MASK**. |
| `OUTPUT 718;"na_CTMR?;"` | *Queries the* **COMPARE TO MASK** *result.* |
| `ENTER 718;A` | *Places the result in variable A.* |
| `DISP A` | *Displays A.* |

| Variable Name | Description |
|---|---|
| na_CRR | Returns the **COMPARE RESPONSE** result. The result is the pass or fail power level in dB. |
| na_CTMR | Returns the **COMPARE TO MASK** result. The result is the pass or fail power level in dB. |
| na_CT | Returns the current number of transients in last completed sweep. |
| na_DRGD | Returns the revision date of the Digital Radio Masks DLP. The revision date is returned in a YYMMDD format. |
| na_EAA | Returns the external attenuation factor in dB. |
| na_MBP | Returns the number of mask breakpoints. |
| na_MBW | Returns the mask measurement bandwidth in Hz. |
| na_MCF | Returns the mask center frequency in Hz. |
| na_MNM | Returns the current mask number. The current mask number corresponds to the Digital Radio masks as follows:<br>1 to 11=user-defined mask<br>12 = **4 GHz FCC MASK**<br>13=**6 GHz FCC MASK**<br>14=**11 GHz FCC MASK**<br>15=**13 GHz UK MASK**<br>16=**13 GHz FRG MASK**. |
| na_MSP | Returns the mask frequency span in Hz. |
| na_PFC | Returns the pass/fail criteria for **FREQ RESPONSE** in dB. |
| na_PWR | Mean power level result in dB. |
| na_RAM | Returns a “1” or a “2.” A “1” is returned if the current mask is relative; a “2” is returned if the current mask is absolute. |
| na_TT | Returns the total number of transients since transient analysis was started, up to the last completed sweep. |

# MODE Command

## MODE
## Mode

The MODE command specifies the mode.

**Syntax: MODE**(0|2|5|6|7|8|9|21)|?;

### Example

| | |
|---|---|
| `OUTPUT 718;"MODE?;"` | *Finds the current mode.* |
| `ENTER 718;Mode` | *Places the result in the variable, Mode.* |
| `IF Mode<>6 THEN` | *If the current mode is not the Frequency Counter mode, change it to the Frequency Counter mode.* |
| `   OUTPUT 718;"MODE 6;"` | |
| `   WAIT 8` | |
| `ELSE` | |
| `   OUTPUT 718;"nf_MP;"` | *If the current mode is the Frequency Counter mode, do a mode preset.* |
| `   WAIT 6` | |
| `END IF` | |

### Description

The number specified as the MODE parameter accesses the mode *if* the mode DLP has been loaded into analyzer memory.

The following table summarizes the MODE command parameters.

| Mode Description | MODE Command Parameter |
|---|---|
| Spectrum Analyzer | 0 |
| Scalar Analyzer | 2 |
| Digital Radio Masks | 5 |
| Frequency Counter | 6 |
| Event Counter | 7 |
| Low Frequency Oscilloscope | 8 |
| Flatness and Sources | 9 |
| Mode Loader | 21 |

**NOTE** Entering the Frequency Counter mode (`"MODE 6;"`) requires a minimum of 8 seconds to preset the counter and begin searching. Use a WAIT command after executing `MODE 6;`. See the example.

**Query Response:** <numeric data format>.

# Event Counter Mode

## ne_COUNT
## Count Once

| |
|---|
| Mode: Event Counter<br>MODE Parameter: 7 |

**Syntax: ne_COUNT;**

### Example

```
OUTPUT 718;"ne_MP;"
OUTPUT 718;"ne_GTIME1;"
OUTPUT 718;"DISPOSE ONCYCLE;"
OUTPUT 718;"ne_COUNT;"
OUTPUT 718;"ne_ECNT?;"
ENTER 718; A
DISP A
```

### Description

Use ne_COUNT to count once for the gate time specified by ne_GTIME. The results of ne_COUNT are in the ne_ECNT, ne_ICNT, and ne_ITIME variables. ne_COUNT can be used in other modes; you do not have to be in the event counter mode to use ne_COUNT. To use ne_COUNT in the event counter mode, execute DISPOSE ONCYCLE before using ne_COUNT. (See the example.) To resume normal operation of the event counter mode, use ne_MP.

**Event Counter Mode Variables**

| Variable Name | Description |
|---|---|
| ne_ECNT | Measured event counter count. |
| ne_ICNT | Measured interval counter count. |
| ne_ITIME | Measured interval counter time. |
| ne_TES | Measured threshold errored seconds. |

Query the variable to get the result. See the example.

## ne_DISPOSE
## Dispose the Event Counter DLP

The ne_DISPOSE command disposes of the event counter downloadable program in analyzer memory.

| |
|---|
| Mode: Event Counter<br>MODE Parameter: 7 |

**Syntax: ne_DISPOSE;**

### Example

```
OUTPUT 718;"ne_DISPOSE;"
```

### Description

ne_DISPOSE is equivalent to **DISPOSE EVNT CNT**.

## ne_DSA
## Display Spectrum Analyzer

The ne_DSA command turns the display of spectrum analysis measurements on or off.

| |
|---|
| Mode: Event Counter<br>MODE Parameter: 7 |

**Syntax: ne_DSA**(0 | 1) | ?;

### Example

`OUTPUT 718;"ne_DSA1;"` *Turns on spectrum analyzer display.*

### Description

When ne_DSA1 is executed, it allows simultaneous viewing of both spectrum analyzer and event counter displays. (Note that the spectrum analyzer display is set to 15 dB/div, so that its display does not interfere with that of the event counter.) ne_DSA0 turns off the spectrum analyzer display. ne_MP (event counter mode preset) turns the spectrum analyzer display off.

ne_DSA is equivalent to **DSPLY SA ON OFF**.

**Query Response:** (0 | 1)<CR><LF><EOI>.

## ne_GTIME
## Gate Time

The ne_GTIME command sets the gate time.

| |
|---|
| Mode: Event Counter<br>MODE Parameter: 7 |

**Syntax: ne_GTIME**<number>|?;

<number>::=0.01 to 163 seconds.

### Description

ne_GTIME is equivalent to **GATE TIME**.

**Query Response:** <numeric data format>.

## ne_MP
## Event Counter Mode Preset

The ne_MP command presets the event counter mode.

| |
|---|
| Mode: Event Counter<br>MODE Parameter: 7 |

**Syntax: ne_MP;**

### Description

ne_MP changes the following settings:

GATE TIME......................... 1 s
TOTALIZE ........................... OFF
STOP CNTRS ...................... OFF
EVNT THLD........................ 50000 cnt/s
Counter Values .................... 0

ne_MP is equivalent to **PRESET EVNT CNT**.

## ne_RST
## Reset the Counters

The ne_RST command resets the counters.

| |
|---|
| Mode: Event Counter<br>MODE Parameter: 7 |

**Syntax: ne_RST;**

### Description

ne_RST sets the ne_ECNT, ne_ICNT, ne_ITIME, and ne_TES variables to zero. ne_RST is equivalent to **RESET CNTRS**.

**Event Counter Mode Variables**

| Variable Name | Description |
|---|---|
| ne_ECNT | Measured event counter count. |
| ne_ICNT | Measured interval counter count. |
| ne_ITIME | Measured interval counter time. |
| ne_TES | Measured threshold errored seconds. |

## ne_STOP
## Stop Counters

The ne_STOP command stops the counters.

| |
|---|
| Mode: Event Counter<br>MODE Parameter: 7 |

**Syntax: ne_STOP**(0 | 1) | ?;

### Description

Execute ne_STOP1 to stop the counters (equivalent to **STOP CNTRS**). Execute ne_STOP0 to reset the counters (equivalent to ne_RST).

**Event Counter Mode Variables**

| Variable Name | Description |
|---|---|
| ne_ECNT | Measured event counter count. |
| ne_ICNT | Measured interval counter count. |
| ne_ITIME | Measured interval counter time. |
| ne_TES | Measured threshold errored seconds. |

Query the variable to get the result.

**Query Response:** (0 | 1)<CR><LF><EOI>.

## ne_THCNT
## Threshold Count

The ne_THCNT command changes the threshold value for the event counter.

| |
|---|
| Mode: Event Counter<br>MODE Parameter: 7 |

**Syntax: ne_THCNT**<number> | ?;

<number>::= Any positive integer number.

### Description

ne_THCNT allows the threshold value for the event counter to be changed. This is used in conjunction with threshold errored seconds measurements when in Totalize.

The functions of ne_THCNT and **EVENT THRESHLD** are equivalent.

Query Response: <numeric data format>.

## ne_TOT
## Totalize

The ne_TOT command switches the counter between totalize operation and the normal gate time interval count.

| |
|---|
| Mode: Event Counter<br>MODE Parameter: 7 |

**Syntax: ne_TOT**(0 | 1) | ?;

### Description

ne_TOT0 turns the totalize operation off. ne_TOT1 turns the totalize operation on. The functions of ne_TOT and **TOTALIZE ON OFF** are equivalent.

Query Response: (0 | 1)<CR><LF><EOI>.

# Frequency Counter Mode

## nf_BAND
## Sets Frequency Band

The nf_BAND command sets the frequency band and begins a new search.

| |
|---|
| Mode: Frequency Counter<br>MODE Parameter: 6 |

**Syntax: nf_BAND**(0 | 1) | ?;

### Example

```
OUTPUT 718; "nf _BAND1;"
WAIT 5
```

### Description

nf_BAND0 sets the frequency band from 10 MHz to 2.9 GHz. nf_BAND1 sets the frequency band from 2.7 to 22 GHz. Since nf_BAND requires a minimum of 5 seconds to complete a new search, a WAIT statement should follow the nf_BAND command. See the example.

The functions of nf_BAND and **FREQ 2.9 22** are equivalent.

The results of a measurement sweep are stored in variables. See the following table.

**Event Counter Mode Variables**

| Variable Name | Description |
|---|---|
| nf_FOUND | Returns a “1” if a signal is found, a “0” if a signal is not found. |
| nf_FREQ | Returns the measured signal frequency in Hz. |
| nf_AMPL | Returns the measured signal amplitude in dBm. |

Query the variable to get the result.

**Query Response:** (0 | 1)<CR><LF><EOI>.

## nf_DHLD
## Display Hold

The nf_DHLD command turns the display hold on or off.

| |
|---|
| Mode: Frequency Counter<br>MODE Parameter: 6 |

**Syntax: nf_DHLD**(0 | 1) | ?;

### Description

nf_DHLD0 turns the display hold off. nf_DHLD1 turns the display hold on. The functions of nf_DHLD and **DSP HOLD ON OFF** are equivalent.

**Query Response:** (0 | 1)<CR><LF><EOI>.

## nf_DISPOSE
## Dispose the Frequency Counter DLP

The nf_DISPOSE command deletes the frequency counter downloadable program from analyzer memory.

| |
|---|
| Mode: Frequency Counter<br>MODE Parameter: 6 |

**Syntax: nf_DISPOSE;**

### Description

The functions of nf_DISPOSE and **DISPOSE FREQ CNT** are equivalent.

## nf_MP
## Frequency Counter Mode Preset

The nf_MP command presets the frequency counter mode.

| |
|---|
| Mode: Frequency Counter<br>MODE Parameter: 6 |

**Syntax: nf_MP;**

### Example

```
OUTPUT 718;"nf-MP;"
WAIT 6
```

### Description

Since nf_MP requires a minimum of 6 seconds to preset the counter and begin a search, a WAIT statement should follow an nf_MP command. See the example. nf_MP sets the frequency band to the 10 MHz to 2.9 GHz range. The functions of nf_MP and **PRESET FREQ COUNT** are equivalent.

**NOTE** Entering the frequency counter mode (MODE6;") requires a minimum of 8 seconds to preset the counter and begin searching.

## nf_RESOLN
## Frequency Counter Resolution

The nf_RESOLN command sets the frequency resolution of the frequency counter.

| |
|---|
| Mode: Frequency Counter<br>MODE Parameter: 6 |

**Syntax: nf_RESOLN**<number>|?;

<number>::=1|10|100|1000|10000 (unit is Hz).

### Description

The functions of nf_RESOLN and **Resoln** are equivalent.

**Query Response:** <numeric data-format>.

# nf_RST
# Reset the Frequency Counter

The nf_RST command resets the frequency counter and begins a new search.

| |
|---|
| Mode: Frequency Counter<br>MODE Parameter: 6 |

**Syntax: nf_RST;**

### Example

```
OUTPUT 718;"nf-RST;"
WAIT 5
```

### Description

Since nf_RST requires a minimum of 5 seconds to complete a new search, a WAIT statement should follow an nf_RST command. See the example. The functions of nf_RST and RESET are equivalent.

The results of a measurement sweep are stored in variables. See the following table.

**Frequency Counter Variables**

| Variable Name | Description |
|---|---|
| nf_FOUND | Returns a "1" if a signal is found, a "0" if a signal is not found. |
| nf_FREQ | Returns the measured signal frequency in Hz. |
| nf_AMPL | Returns the measured signal amplitude in dBm. |

Query the variable to get the result.

# Mode Loader Mode

## nl_CKCRD
## Check Memory Card

The nl_CKCRD command checks if the DRTS ROM card is inserted into the memory card reader.

| |
|---|
| Mode: Mode Loader<br>MODE Parameter: 21 |

**Syntax: nl_CKCRD;**

### Example

| | |
|---|---|
| `OUTPUT 718;"MODE 21;"` | *Selects the Mode Loader mode.* |
| `OUTPUT 718; "nl_CKCRD;"` | *Checks if the DRTS ROM card is inserted into the memory card reader.* |
| `OUTPUT 718;"IF nl_CRDVF,EQ,1 THEN nl_SELECT 5 ENDIF;"` | *If the DRTS ROM card is inserted, the Event Counter DLP is loaded into analyzer memory.* |
| `OUTPUT 718;"nl_CRDVF?;"` | *Returns the result of nl_CKCRD to the computer.* |
| `ENTER 718;A IF A=0 THEN` | *If the result of nl_CKCRD is zero, the DRTS ROM card is not inserted in the memory card reader.* |
| `  PRINT "ERROR-PLEASE INSERT DRTS ROM CARD"` | *Displays an error message if the DRTS ROM card is not inserted.* |
| `END IF` | |

### Description

The result of nl_CKCRD is stored in the variable nl_CRDVF. If the value of nl_CRDVF is 0, the card is not an DRTS ROM card. If the value of nl_CRDVF is 1, the card is an Option E02/E04 ROM card. See the example.

**NOTE** The nl_SELECT command also checks if an DRTS ROM card is inserted.

## nl_DISPOSE
## Dispose the Mode Loader DLP

The nl_DISPOSE command deletes the mode loader downloadable program from analyzer memory.

| |
|---|
| Mode: Mode Loader<br>MODE Parameter: 21 |

**Syntax: nl_DISPOSE;**

### Example

```
OUTPUT 718;"nl_DISPOSE;"
```

### Description

The functions of nl_DISPOSE and pressing **[TRIG]** (when the mode loader is the operating mode) are equivalent.

## nl_SELECT
## Select Downloadable Program

The nl_SELECT command checks for the DRTS ROM card, disposes of all the Option E02/E04 DLPs from analyzer Memory (except the mode loader mode), then loads in the selected modes into analyzer memory.

| |
|---|
| Mode: Mode Loader<br>MODE Parameter: 21 |

**Syntax: nl_SELECT**<number>;

<number>::= Any valid menu number. See the description.

### Example

| | |
|---|---|
| `OUTPUT 718;"MODE 21;"` | *Selects the Mode Loader mode.* |
| `OUTPUT 718; "nl_SELECT 5;"` | *Checks that the DRTS ROM card is inserted into the memory card reader. If the DRTS ROM card is inserted, the event counter mode DLP is loaded into analyzer memory.* |
| `OUTPUT 718;"MEM?"`<br>`ENTER 718;B` | *Determines the amount of available analyzer memory.* |
| `IF B>7000 THEN"` | *If there is more than 7000 bytes of analyzer memory available, the low frequency oscilloscope mode is loaded into analyzer memory.* |
| `OUTPUT 718;"nl_SELECT -9;"` | *Loads in the low frequency oscilloscope mode without disposing the event counter from analyzer memory. See the following description.* |
| `END IF` | |

## Description

**NOTE** Mode Loader takes 10 to 60 seconds to dispose of the current modes and load in the new ones.

The nl_SELECT parameter corresponds to the menu selection of **MODE LOADER**. The nl_SELECT parameter specifies the Option E02/E04 modes to be loaded into analyzer memory as follows:

| nl_SELECT Parameter | Modes Loaded |
|---|---|
| 1 | Frequency Counter, Flatness and Sources, Event Counter |
| 2 | Digital Radio Masks and Frequency Counter |
| 3 | Scalar Analyzer and Low Frequency Oscilloscope |
| 4 | Flatness Analyzer and Sources |
| 5 | Event Counter |
| 6 | Digital Radio Masks |
| 7 | Frequency Counter |
| 8 | Scalar Analyzer |
| 9 | Low Frequency Oscilloscope |
| 10 | Multipath Fading Simulator Calibrate |
| 11 | Disposes of all DRTS modes except Mode Loader |

nl_SELECT sets nl_CRDVF to “0” if the DRTS ROM card is not inserted in the memory card reader, or to “1” if the DRTS ROM card is inserted.

If necessary, a new DLP can be loaded into analyzer memory without deleting other Option E02/E04 DLPs in analyzer memory. To load a DLP into analyzer memory without deleting the other DLPs, specify a negative nl_SELECT parameter. See the example.

**NOTE** If nl_SELECT is used with a negative parameter, the other modes are not disposed of and there may not be enough available analyzer memory for loading the DLP. If you use nl_SELECT with a negative parameter, you must check that there is enough available analyzer memory *before* loading in a DLP. Use the MEM command to check if there is enough available analyzer memory. See the example.

# Low Frequency Oscilloscope Mode

## np_DISPOSE
## Dispose the Low Frequency Oscilloscope DLP

The np_DISPOSE command deletes the low frequency oscilloscope downloadable program from analyzer memory.

| |
|---|
| Mode: Low Frequency Oscilloscope<br>MODE Parameter: 8 |

**Syntax: np_DISPOSE;**

### Description

The functions of np_DISPOSE and **DISPOSE SCOPE** are equivalent.

## np_FFT
## Fast Fourier Transform

The np_FFT command performs a fast Fourier transform on the oscilloscope trace or returns to the low frequency oscilloscope display.

| |
|---|
| Mode: Low Frequency Oscilloscope<br>MODE Parameter: 8 |

**Syntax: np_FFT**(0 | 1) | ?;

### Description

np_FFT1 performs a fast Fourier transform on the oscilloscope trace. np_FFT0 returns to the low frequency oscilloscope display.

The results are contained in trace A. The functions of np_FFT and **FFT MEAS** are equivalent.

**Query Response:** (0 | 1)<CR><LF><EOI>.

## np_MP
## Low Frequency Oscilloscope Mode Preset

The np_MP command presets the low frequency oscilloscope mode.

| |
|---|
| Mode: Low Frequency Oscilloscope<br>MODE Parameter: 8 |

**Syntax: np_MP;**

### Description

The results are contained in trace A. The marker amplitude is in variable np_MKA.

The functions of np_MP and **PRESET SCOPE** are equivalent.

## np_VOFS
## Vertical Offset

The np_VOFS command sets the vertical offset.

| |
|---|
| Mode: Low Frequency Oscilloscope<br>MODE Parameter: 8 |

**Syntax: np_VOFS**<number>?;

<number>::=Any positive real number, 5 V to 2 mV.

### Description

The functions of np_VOFS and **OFFSET** are equivalent.

**Query Response:** <numeric data format>.

## np_VOFSP
## Vertical Offset Polarity

The up_VOFSP command selects the vertical offset polarity to be positive or negative.

| |
|---|
| Mode: Low Frequency Oscilloscope<br>MODE Parameter: 8 |

**Syntax: np_VOFSP**(0|1)|?;

### Description

np_VOFSP1 sets the polarity to negative; np_VOFSP0 sets the polarity to positive. The functions of np_VOFSP and **OFST POL NEG POS** are equivalent.

**Query Response:** (0|1)<CR><LF><EOI>.

## np_VS
## Vertical Scale

The np_VS command sets the vertical scale in volts per division.

| |
|---|
| Mode: Low Frequency Oscilloscope<br>MODE Parameter: 8 |

**Syntax: np_VS**<number>|?;

<number>::=Any positive real number, 1 V to 200 μV.

### Description

The functions of np_VS and **SCALE/div** are equivalent.

**Query Response:** <numeric data format>.

# Scalar Analyzer Mode

## ns_CALR
## Calibrate Reflection

The ns_CALR command sets up the reflection calibration.

| |
|---|
| Mode: Scalar Analyzer<br>MODE Parameter: 2 |

**Syntax: ns_CALR;**

### Description

Execute ns_STS after executing ns_CALR. The functions of ns_CALR and **CAL REFL** are equivalent.

## ns_CALT
## Calibrate Transmission

The ns_CALT command sets up the transmission calibration.

| |
|---|
| Mode: Scalar Analyzer<br>MODE Parameter: 2 |

**Syntax: ns_CALT;**

### Description

Execute ns_STTHRU after executing ns_CALT. The functions of ns_CALT and **CAL TRANS** are equivalent.

## ns_CAN
## Cancel Calibration Routine

The ns_CAN command cancels the calibration routine.

| |
|---|
| Mode: Scalar Analyzer<br>MODE Parameter: 2 |

**Syntax: ns_CAN;**

### Description

The functions of ns_CAN and **CANCEL** are equivalent.

## ns_DISPOSE
## Dispose the Scalar Analyzer DLP

The ns_DISPOSE command disposes of the scalar analyzer downloadable program in analyzer memory.

| |
|---|
| Mode: Scalar Analyzer<br>MODE Parameter: 2 |

**Syntax: ns_DISPOSE;**

### Description

The functions of ns_DISPOSE and **DISPOSE SCALAR** are equivalent.

## ns_FFT
## Fast Fourier Transform

The ns_FFT command performs a fast Fourier transform on the scalar analyzer trace or returns to the scalar analyzer display.

| |
|---|
| Mode: Scalar Analyzer<br>MODE Parameter: 2 |

**Syntax: ns_FFT**(0 | 1) | ?;

### Description

The amplitude measurement response is stored in trace A. ns_FFT1 performs a fast Fourier transform. ns_FFT0 returns to the scalar analyzer display. The functions of ns_FFT and **FFT MEAS** are equivalent.

**Query Response:** (0 | 1)<CR><LF><EOI>.

## ns_MP
## Scalar Analyzer Mode Preset

The ns_MP command presets the scalar analyzer mode.

Mode: Scalar Analyzer
MODE Parameter: 2

**Syntax: ns_MP;**

### Description

ns_MP does the following:

SRC PWR .............................. ON at 0 dBm
SRC PWR STP SIZE............. AUTO
SRC PWR OFFSET............... 0 dB
PWRSWP............................... OFF
LOG SCALE .......................... 10 dB/div
NORM REF POSN................ Top graticule
REF LVL................................ 0 dBm
TRANS/REFL........................ TRANS
NORMALIZE ........................ OFF
NORM REF LVL ................... 0 dB
SWEEP TIME ....................... AUTO SCALAR
RES BW................................. 10 kHz
VBW....................................... AUTO
DET........................................ SMPL
START FREQ........................ 300 kHz
STOP FREQ .......................... 2.9 GHz

The functions of ns_MP and **PRESET SCALAR** are equivalent.

## ns_NORM
## Normalization

The ns_NORM command turns normalization on or off.

Mode: Scalar Analyzer
MODE Parameter: 2

**Syntax: ns_NORM**(0 | 1) | ?;

### Description

ns_NORM1 turns normalization on. ns_NORM0 turns normalization off. When normalization is on, arrows appear on the left and right side of the screen graticule to indicate the reference level position. Use ns_NRP to change the reference level position. The normalized amplitude measurement response is contained in trace A.

The functions of ns_NORM and **NORMLIZE ON OFF** are equivalent.

**Query Response:** (0 | 1)<CR><LF><EOI>.

## ns_NRP
## Normalized Reference Position

The ns_NRP command sets the normalized reference position.

| |
|---|
| Mode: Scalar Analyzer<br>MODE Parameter: 2 |

**Syntax: ns_NRP**<number>|?;

<number>::=Any integer number, 0 to 8.

Step Increment: 1.

### Description

The ns_NRP command changes the position of the reference level when normalization is used. The top and bottom graticule lines correspond to 8 and 0, respectively. Arrows appear on the left and right side of the screen graticule when the reference level position is changed.

The functions of ns_NRP and **NORM REF POSN** are equivalent.

**Query Response:** <numeric data format>.

## ns_REFL
## Reflection Measurement and Calibration

The command ns_REFL switches to a reflection measurement.

| |
|---|
| Mode: Scalar Analyzer<br>MODE Parameter: 2 |

**Syntax: ns_REFL;**

### Description

ns_REFL recalls the reflection reference trace and amplitude settings and displays the reflection measurement. The functions of ns_REFL and **REFL** are equivalent.

## ns_RL
## Reference Level

The ns_RL command sets the reference level.

| |
|---|
| Mode: Scalar Analyzer<br>MODE Parameter: 2 |

**Syntax: ns_RL**<number>|?;

### Description

Use ns_RL to change the amplitude level when in the Scalar Analyzer mode, not RL. The functions of ns_RL and **REF LVL (RANGE)** are equivalent.

**Query Response:** <numeric data format>.

## ns_SRCOFF
## Source Power Off

The ns_SRCOFF command turns off the source power (the tracking generator).

| |
|---|
| Mode: Scalar Analyzer<br>MODE Parameter: 2 |

**Syntax: ns_SRCOFF;**

## ns_SRCPOFS
## Source Power Offset

The command ns_SRCPOFS sets the source power offset for the tracking generator.

| |
|---|
| Mode: Scalar Analyzer<br>MODE Parameter: 2 |

**Syntax: ns_SRCPOFS**<number>|?;

### Description

The functions of ns_SRCPOFS and **SRC PWR OFFSET** are equivalent.

**Query Response:** <numeric data format>.

## ns_SRCPWR
## Source Power

The ns_SRCPWR command sets the power level of the source for the tracking generator.

| |
|---|
| Mode: Scalar Analyzer<br>MODE Parameter: 2 |

**Syntax: ns_SRCPWR**<number>|?;

### Description

Sending a value with ns_SRCPWR turns on the source. The functions of ns_SRCPWR and **SRC PWR ON OFF** are equivalent.

**Query Response:** <numeric data format>.

## ns_STO
## Store Open

The ns_STO command stores the open reference trace.

| |
|---|
| Mode: Scalar Analyzer<br>MODE Parameter: 2 |

**Syntax: ns_STO;**

### Description

Perform ns_CALR before ns_STO. The functions of ns_STO and **STORE OPEN** are equivalent. The amplitude response is stored in trace A.

## ns_STS
## Store Short

The ns_STS command stores the short reference trace and amplitude settings.

| |
|---|
| Mode: Scalar Analyzer<br>MODE Parameter: 2 |

**Syntax: ns_STS;**

### Description

Execute ns_STS after executing ns_STO. ns_STS performs the actual calibration. A reference trace and amplitude settings are stored, normalization is turned on, and the normalized trace (trace A) is displayed. The functions of ns_STS and **STORE SHORT** are equivalent.

## ns_STTHRU
## Store Thru Reference Trace

The ns_STTHRU command stores the thru reference trace and amplitude settings.

| |
|---|
| Mode: Scalar Analyzer<br>MODE Parameter: 2 |

**Syntax: ns_STTHRU;**

### Description

ns_STTHRU performs the actual calibration. A reference trace and amplitude settings are stored, normalization is turned on, and the normalized trace (trace A) is displayed. Perform ns_CALT before ns_STTHRU. The functions of ns_STTHRU and **STORE THRU** are equivalent.

## ns_TRANS
## Transmission Measurement and Calibration

The command ns_TRANS switches to a transmission measurement.

| |
|---|
| Mode: Scalar Analyzer<br>MODE Parameter: 2 |

**Syntax: ns_TRANS;**

### Description

ns_TRANS recalls the transmission reference trace and amplitude settings and displays the transmission measurement. The amplitude response is stored in trace A. The functions of ns_TRANS and **TRANS** are equivalent.

# Flatness and Sources Mode

## nt_ATRACK
## Amplitude Track

The nt_ATRACK command turns the amplitude tracking function on or off.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_ATRACK**(0 | 1) | ?;

### Description

nt_ATRACK0 turns the amplitude tracking off; nt_ATRACK1 turns the amplitude tracking on. With amplitude tracking on, the reference level is adjusted automatically for each sweep to keep the maximum value of the trace at the reference position (approximately). Amplitude tracking is useful when making flatness adjustments in 0.1 dB/div since the gain of a device can vary as the flatness is adjusted. Using amplitude tracking avoids the need to readjust the reference level repeatedly to keep the trace on screen.

The amplitude measurement response is stored in trace A.

The functions of nt_ATRACK and **AMPL TRK ON OFF** are equivalent.

**Query Response:** (0 | 1)<CR><LF><EOI>.

## nt_ATRKEL
## Amplitude Tracking Error Limit

The command nt_ATRKEL sets the error limit for the amplitude tracking function.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_ATRKEL**<number> | ?;

<number>::=Any positive integer.

### Description

The functions of nt_ATRKEL and **AMPL TRK ERR LIM** are equivalent.

**Query Response:** <numeric data format>.

## nt_BAND
## Sets Frequency Band

The command nt_BAND sets the frequency band for the RF source.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_BAND**(1|2|3|4|)|?;

### Example

```
OUTPUT 718; "nt-BAND1;"
```

### Description

nt-BAND1 sets the RF source for frequencies from 3.0 to 6.8 GHz. nt_BAND2 sets the RF source for frequencies from 6.0 to 13.2 GHz. nt_BAND3 sets the RF source for frequencies from 9.0 to 19.8 GHz. nt_BAND4 sets the RF source for frequencies from 12.0 to 27.2 GHz. Note that nt_BAND must be used before setting the analyzer to the desired frequency. The parameter used with nt_BAND must correspond to the multiplier (i.e. option) used in the 11758B.

**Query Response:** (1|2|3|4|)<CR><LF><EOI>.

## nt_CALR
## Calibrate Reflection

The nt_CALR command sets up the reflection calibration.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_CALR;**

### Description

Execute nt_STREF after executing nt_CALR. The functions of nt_CALR and **CAL REFL** are equivalent.

## nt_CALT
## Calibrate Transmission

The nt_CALT command sets up the transmission calibration.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_CALT;**

### Description

Execute nt_STREF after executing nt_CALT. The functions of nt_CALT and **CAL TRANS** are equivalent.

## nt_DISPOSE
## Dispose the Flatness and Sources DLP

The nt_DISPOSE command disposes of the flatness and sources downloadable program in analyzer memory.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_DISPOSE;**

### Description

The functions of nt_DISPOSE and **DISPOSE FLATNESS** are equivalent.

## nt_FFT
## Fast Fourier Transform

The nt_FFT command performs a fast Fourier transform on the flatness analyzer trace or returns to the flatness analyzer display.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_FFT**(0 | 1) | ?;

### Description

nt_FFT1 performs a fast Fourier transform on the flatness analyzer trace. nt_FFT0 returns to the flatness analyzer display.

The amplitude measurement response is stored in trace A. The functions of nt_FFT and **FFT MEAS** are equivalent.

**Query Response:** (0 | 1)<CR><LF><EOI>.

## nt_FOFST
## Frequency Offset of Source

The command nt_FOFST sets the frequency offset of the IF or RF source.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_FOFST**<number>|?;

### Description

The functions of nt_FOFST and **FREQ OFFSET** are equivalent.

**Query Response:** <numeric data format>.

## nt_MP
## Flatness and Sources Mode Preset

The nt_MP Command presets the flatness and sources mode.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_MP;**

### Description

nt_MP does the following:

SOURCE................................ IF
SRC PWR (IF)....................... OFF, 0 dBm
SRC PWR (RF)...................... OFF, –10 dBm
SRC PWR OFFSET (IF)....... 0 dB
SRC PWR OFFSET (RF)...... 0 dB
PWR SWP............................. OFF
REF LVL................................ 0 dBm
LOG SCALE.......................... 1 dB/div
NORM REF POSN................ 7
SWEEP TIME....................... AUTO SCALAR
VBW...................................... AUTO
TRANS/REFL........................ TRANS
AMPL TRK........................... OFF
NORMALIZE ........................ OFF
CENTER FREQ ..................... 70 MHz
SPAN .................................... 40 MHz

The functions of nt_MP and **PRESET FLATNESS** are equivalent.

## nt_NORM
## Normalization

The nt_NORM command turns normalization on or off.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_NORM**(0 | 1) | ?;

### Description

nt_NORM1 turns normalization on, nt_NORM0 turns normalization off. When normalization is on, arrows appear on the left and right side of the screen graticule to indicate the reference level position. Use nt_NRP to change the reference level position. The normalized amplitude measurement response is contained in trace A.

The functions of nt_NORM and **NORMLIZE ON OFF** are equivalent.

**Query Response:** (0 | 1)<CR><LF><EOI>.

## nt_NRP
## Normalized Reference Position

The nt_NRP command sets the normalized reference position.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_NRP**<number> | ?;

### Description

The nt_NRP command changes the position of the reference level when normalization is used. The top and bottom graticule lines correspond to 8 and 0, respectively. Arrows appear on the left and right side of the screen graticule when the reference level position is changed.

**Query Response:** <numeric data format>.

## nt_REFL

The command nt_REFL switches to a reflection measurement.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_REFL;**

### Description

nt_REFL recalls the reflection reference trace and amplitude settings and displays the reflection measurement. The functions of nt_REFL and **REFL TRANS** (REFL) are similar.

## nt_RL
## Reference Level

The nt_RL command sets the reference level.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_RL**<number>|?;

### Description

Use nt_RL to change the amplitude level when in the Flatness and Sources mode, not RL.

**Query Response:** <numeric data format>.

## nt_SRCIF
## Source Selection (IF)

The command nt_SRCIF selects the IF source (the tracking generator) and turns off the RF source if it is on.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_SRCIF;**

### Description

The functions of nt_SRCIF and **SOURCE IF RF** (IF) are equivalent.

## nt_SRCOFF
## Turns Off Sources

The command nt_SRCOFF turns off both the RF and IF sources.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_SRCOFF;**

### Description

The functions of nt_SRCOFF and **SRC PWR ON OFF** (OFF) are equivalent.

## nt_SRCPIF
## Source Power of IF Source

The command nt_SRCPIF sets the source power of the IF source. Sending a value turns the IF source on.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_SRCPIF**<number>;

<number>::= Any real number.

### Description

The functions of nt_SRCPIF and **SRC PWR ON OFF** (IF) are equivalent. Use nt_SRCIF to select the IF source.

## nt_SRCPIFO
## Source Power Offset of IF Source

The command nt_SRCPIFO sets the source power offset of the IF source.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_SRCPIFO**<number>|?;

### Description

The functions of nt_SRCPIFO and **SRC PWR OFFSET** (for the IF source) are equivalent.

**Query Response:** <numeric data format>.

## nt_SRCPRF
## Source Power of RF Source

The command nt_SRCPRF sets the source power of the RF source. Sending a value turns the RF source on.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_SRCPRF**<number>;

<number>::= Any real number.

### Description

The functions of nt_SRCPRF and **SRC PWR ON OFF** (RF) are equivalent. Use nt_SRCRF to select the RF source.

## nt_SRCPRFO
## Source Power Offset of RF Source

The command nt_SRCPRFO sets the source power offset of the RF source.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_SRCPRFO**<number>|?;

### Description

The functions of nt_SRCPRFO and **SRC PWR OFFSET** (for the RF source) are equivalent.

**Query Response:** <numeric data format>.

## nt_SRCRF
## Source Selection (RF)

The command nt_SRCRF selects the RF source and turns off the IF source (the tracking generator) if it is on.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_SRCRF;**

### Description

The functions of nt_SRCRF and **SOURCE IF RF** (RF) are equivalent.

## nt_STREF
## Store Reference Trace

The command nt_STREF stores a reference trace and amplitude settings.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_STREF;**

### Description

Execute nt_CALT or nt_CALR *before* nt_STREF. The functions of nt_STREF and **STORE THRU** or **STORE SHORT** are equivalent.

# nt_TRANS
# Transmission Measurement and Calibration

The command nt_TRANS recalls the transmission calibration amplitude data.

| |
|---|
| Mode: Flatness and Sources<br>MODE Parameter: 9 |

**Syntax: nt_TRANS;**

## Description

nt_TRANS recalls the transmission reference trace and amplitude settings and displays the transmission measurement.

# 6 8593E Option E02/E04 Replaceable Parts

This information pertains to the replaceable parts for 8593E Option E02/E04 spectrum analyzers.

**Table 6-1. 8593E E02/E04 Spectrum Analyzer Assembly-Level Replaceable Parts**

| Reference Designator | Description | CD | Part Number |
|---|---|---|---|
| A3, A15 | Tracking Generator | | |
| | 8593E for Options E02 and E04 | 5 | 5086-7905 |
| | 8593E for Options E02 and E04 Prefix 3006A and above | 7 | 75086-7923 |
| | Tracking Generator Exchange | | |
| | 8593E for Options E02 and E04 | 3 | 5086-6905 |
| | 8593E for Options E02 and E04 Prefix 3006A and above | 5 | 15086-6923 |
| A10 | Tracking Generator Control | | |
| | 8593E for Options E02 and E04 | 2 | 5062-8231 |
| | 8593E for Options E02 and E04 Prefix 3006A and above | 5 | 5063-0634 |