Errata

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HP References in this Manual

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User's Guide

HP 85715B GSM900 Transmitter Measurements Personality

HEWLETT PACKARD

HP Part No. 85715-90014
Printed in USA July 1996

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Assistance

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.

Safety Symbols

The following safety symbols are used throughout this manual. Familiarize yourself with each of the symbols and its meaning before operating this instrument.

Caution The *caution* sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a *caution* sign until the indicated conditions are fully understood and met.

Warning **The *warning* sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a *warning* sign until the indicated conditions are fully understood and met.**

General Safety Considerations

Warning *Before this instrument is switched on,* **make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact.**

Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.

Warning **There are many points in the instrument which can, if contacted, cause personal injury. Be extremely careful.**

Any adjustments or service procedures that require operation of the instrument with protective covers removed should be performed only by trained service personnel.

Caution *Before this instrument is switched on,* make sure its primary power circuitry has been adapted to the voltage of the ac power source.

Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.

Overview of GSM900 and the HP 85715B GSM900 Transmitter Measurements Personality

What is GSM9OO and the HP 8590 Series Spectrum Analyzer Solution?

GSM9OO, the Digital Cellular System, is a digital cellular radio network. Every aspect, including tests for evaluating system hardware performance, of the GSM9OO system is defined by ETSI standards documents (*GSM Specifications*). The HP 85715B GSM9OO Transmitter Measurements Personality used with an HP 8593A/E, HP 8594A/E, HP 8595A/E, or an HP 8596A/E spectrum analyzer (with options) provides a solution tailored to the radio frequency (RF) hardware evaluation tests required by the GSM standard.

The GSM9OO system uses complex RF signals to link mobile stations and base stations. The link between these stations is known as the air interface. The GSM9OO frequency spectrum is divided into two bands named the uplink and the downlink. The uplink carries information from the mobile station to the base station. The downlink carries information from the base station to the mobile station. Within each frequency band, Frequency Division Multiple Access (FDMA) is used to divide each band into channels spaced 200 kHz apart. Each of these channels is identified by an absolute RF channel number (ARFCN). These channels can be shared by eight mobiles using Time Division Multiple Access (TDMA). A call in progress uses a traffic channel (TCH) to send and receive speech information on the up and down links. The traffic channel is a combination of an ARFCN and one of eight timeslots in the TDMA signal. Speech and control data is modulated on to the RF carriers using 0.3GMSK modulation.

These principles of GSM9OO lead to the need for the fundamental transmitter measurements such as:

- output RF spectrum which verifies that the RF carrier is contained within the designated 200 kHz channel.
- power versus time which verifies that the transmitter output power has the correct amplitude shape and timing for the TDMA sequence.
- phase and frequency error which verifies the accuracy of the transmitters 0.3GMSK modulation process.

Mobile Stations and Base Stations

The cellular system includes the following:

- Base stations with stationary transmitters (frequency range 925 MHz to 960 MHz) and receivers (frequency range 880 MHz to 915 MHz).
- Mobile stations with mobile transmitters (frequency range 880 MHz to 915 MHz) and receivers (frequency range 925 MHz to 960 MHz).

A base station can connect calls from several mobile stations. The base station links mobile station communications within and across geographically defined cells.

What is an ARFCN?

An ARFCN is the absolute channel number used in GSM9OO measurements. Each channel is shared by eight mobile stations using time division multiple access (TDMA).

How do You Select an ARFCN to Measure?

To measure a GSM9OO ARFCN with the HP 85715B GSM9OO Transmitter Measurements Personality, use the measurement personality menus to choose either base station (BS) or mobile station (MS) transmit bands. You also need to enter an absolute RF channel number (ARFCN). The ARFCN is an integer from 0 to 124 which designates the carrier frequency according to the following equations:

Mobile station transmit frequency = 1710.2 + 0.2 x (ARFCN -0) MHz

Base station transmit frequency = 1805.2 + 0.2 x (ARFCN -0) MHz

What are GSMSOO Timeslots?

In addition to a duplex, frequency-division scheme, the GSM9OO system uses time-division-multiple-access (TDMA) which allows eight users to use a single carrier frequency simultaneously. Simultaneous users avoid one another by transmitting in series. The eight users can transmit once every 4.62 ms for 1 timeslot which is 577 μs long. Typically, each 577 μs timeslot conveys 156.25 bits, which consists of 148 bits of data and 8.25 guard bits.

The receiving station chooses the transmission occurring at the right time, then combines the transmitted data bursts into streams of continuous data. The 4.62 ms required to cycle through eight transmissions is called a frame. Each of the eight users occupies one 577 μs timeslot. The eight user timeslots are numbered from 0 to 7. In a TDMA system, the shape of each transmitted burst must be controlled carefully to avoid over-lapping bursts in time.

How do You Select a Timeslot to Measure?

The HP 85715B GSM9OO Transmitter Measurements Personality identifies timeslots relative to a TTL trigger signal. The TTL trigger signal must occur once per frame, anywhere in the frame. The GSM9OO measurements personality assumes that the position of the trigger edge is at the beginning of timeslot 0 with no trigger delay. The delay time of each timeslot from the trigger edge is shown below:

Delay of timeslot TN = 576.9 μs x TN – trigger delay

The user must enter a timeslot number to complete the specification of the signal to be measured. If the position of the trigger edge is unknown, examine a full frame using the HP 85715B Power vs Time Frame measurement routine. The timeslot position of the transmitted burst is displayed by this measurement. The trigger position used by the GSM9OO measurement personality may be corrected by changing the trigger delay time.

What Makes GSM9OO a Digital Cellular System?

The information transmitted in a burst is contained in the digital modulation format called GMSK (Gaussian-minimum-shift-keying). Voice information is digitized and coded into a bit stream. The bits are conveyed though precise phase changes in the carrier. Assessment of the modulation quality requires exact reconstruction of the phase trajectory of the carrier during a burst.

What Does the HP 85715B GSM9OO Transmitter Measurements Personality Do?

The HP 85715B GSM9OO Transmitter Measurements Personality simplifies the testing of GSM9OO transmitters. It sets the spectrum analyzer to the required state for a particular GSM9OO transmitter measurement. The spectrum analyzer then performs the measurement and displays the measurement results, allowing you to analyze the GSM9OO transmitter performance.

The HP 85715B GSM9OO Transmitter Measurements Personality based on the GSM 05.05, 11.10 and 11.20 specifications, allows you to make the following key measurements:

- Combiner Tuning
- Demodulated Data Display with Option 151 and 163 combination
- Intermodulation Attenuation
- Mean Transmitter Carrier Power
- Output RF Spectrum
- Phase and Frequency Error with Option 151 and 163 combination
- Power vs Time
- Spurious Emissions

Evaluation of GSM9OO system hardware requires precise measurements to be made on the frequency and the time domain behavior of the high powered, pulsed, hopping RF carriers. Inspection of the transmission spectrum for small signals close to the large carriers must be carried out, as such signals may interfere with an adjacent spectrum. External attenuation is used to reduce the input power to the GSM9OO analyzer. Preamplifiers and external bandpass filters improve sensitivity in selected bandwidths.

Typeface Conventions

Italics	Italic type is used for emphasis.
Display	Computer text is used to show examples of messages, prompts etc that are displayed on the spectrum analyzer's screen.
[Keys)	Keycaps on the spectrum analyzer's keyboard are enclosed in boxes.
Soft keys	Functions which are accessed by pressing one of the six softkeys on the right hand side of the spectrum analyzer's display are shown shaded.

Softkeys which toggle between two states, and which display the two states as part of the label are shown with the active state underlined on the display, and annotated in this document as in the following example: MEASURE AVG PKS (AVG).

Contents

Figures

Tables

1

Setting Up

What's In This Chapter

Required Measurement Equipment	Refer to this listing for the equipment that is required for making GSM9OO measurements.
Getting Started	Refer to this section for information about GSM9OO analyzer connections, downloading the measurement personality, and using the measurement personality memory card.
Protecting From Electrostatic Discharge Damage	Refer to this table and illustration for electrostatic discharge (ESD) prevention recommendations.
Sales and Service Offices	Refer to this table for the list of Hewlett-Packard Sales and Service Offices.

Required Spectrum Analyzer Configuration

The HP 85715B GSM9OO Transmitter Measurements Personality can be used with an HP 8591A/E, HP 8593A/E, HP 8594A/E, HP 8595A/E, and HP 8596A/E. The spectrum analyzer configuration is listed below. Critical specifications for equipment substitution are provided in Chapter 8. "Specifications and Characteristics."

- Required HP 8590 series spectrum analyzer options:

  Option 004 Precision Frequency Reference (or an external 10 MHz reference)
  Option 101 Fast Time Domain Sweeps (not required if option 151 is installed)
  Option 105 Time-Gated Spectrum Analysis

- Additional HP 8590 series spectrum analyzer options required for phase and frequency error measurements (E-series spectrum analyzer only):

  Option 151 Fast ADC & Digital Demodulator
  Option 163 GSM/DCS Firmware for Option 151

Note Generic HP 8590 series spectrum analyzer front and back panel illustrations are used throughout this manual. Your analyzer's front and rear panels may be different, depending on the model number and options.

Getting Started

1. Connect the spectrum analyzer to an ac power source. Press (LINE) to turn the spectrum analyzer on.

Note In order for the spectrum analyzer to meet its specifications, allow it to warm up for 30 minutes after it is turned on. Do not attempt to make any calibrated measurements until the spectrum analyzer is warmed up. Be sure to calibrate the spectrum analyzer only *after* it has met operating temperature conditions.

The spectrum analyzer frequency and amplitude self-calibration routines are initiated by the CAL FREQ & AMPTD softkey in the menu located under the (CAL) key.

Caution Disconnect any cable attached to the rear panel GATE TRIGGER INPUT before beginning any calibration routines. Refer to the HP 8590 series spectrum analyzer operating manual for calibration information.

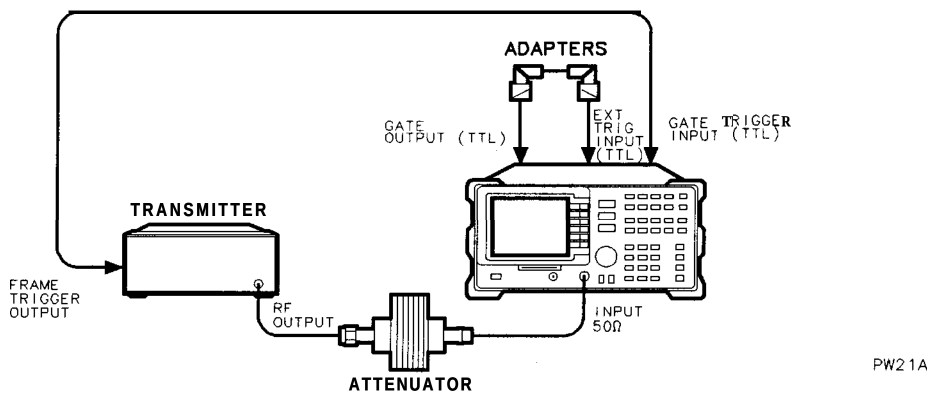

Figure l-l. Front and Rear Panel Connections

2. Attach the two right-angle BNC adapters (supplied with Option 105) to the GATE OUTPUT and the EXT TRIG INPUT connectors located on the rear panel of the spectrum analyzer. These adapters help to prevent BNC cable damage when the spectrum analyzer is set onto its rear feet.
3. Connect a BNC cable to the adapters on the GATE OUTPUT connector and the EXT TRIG INPUT connector.

Note During GSM900 measurements the cable connecting the GATE OUTPUT to the EXT TRIG INPUT can be left connected. This connection does not affect normal spectrum analyzer operation.

4. Connect A BNC cable from the EXT REF INPUT to either the 10 MHz REF OUTPUT or an external 10 MHz reference.

5. Connect an external TTL frame trigger signal to the GATE TRIGGER INPUT connector on the rear panel of the spectrum analyzer. The trigger signal needs to be a transistor-transistor logic (TTL) signal that generates a signal edge for every frame. The external trigger signal can be supplied by the unit under test or by an associated piece of test equipment that generates a frame trigger signal, such as the HP 85902A Burst Carrier Trigger or the HP 8922G GSM MS Test Set. This trigger signal is required for several GSM9OO measurements. Refer to “Triggering” in chapter 3 for a further description.

Caution The maximum power that can be safely applied to the spectrum analyzer input is +30 dBm (1 watt). Most transmitters need a 20 dB to 30 dB attenuator between their output and the spectrum analyzer INPUT 50Ω connector.

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6. Connect the output of the transmitter-under-test through an appropriate attenuator or directional coupler to the INPUT 500 connector on the front panel of the spectrum analyzer.

Downloading theGSM900 Transmitter Measurements Personality

Completely purge the spectrum analyzer’s user memory to make room for the GSM9OO Transmitter Measurements Personality. Refer to the procedure below to purge, then load the “core” contents of the GSM9OO personality.

Purging Spectrum Analyzer DLP Memory

1. Purge user memory by pressing (CONFIG) on the spectrum analyzer’s front panel.
2. Press MORE 1 of 3 .
3. Press Dispose User Mem .
4. Press ERASE DLP MEM twice to purge the spectrum analyzer DLP memory.
5. Press (PRESET).

Loading the GSM900 Transmitter Measurements Personality

1. Insert the HP 85715B GSM9OO Transmitter Measurements Personality memory card into the spectrum analyzer’s front-panel card reader. Match the card arrow with the arrow on the card reader slot.
2. Press (RECALL) on the spectrum analyzer’s front panel.
3. Press INTERNAL CARD until CARD is underlined.
4. Press CATALOG CARD, then CATALOG ALL.
5. Make sure dGSM900 is highlighted, then select LOAD FILE . After a moment, the spectrum analyzer screen returns.
6. Press (MODE) on the spectrum analyzer to display the SPECTRUM ANALYZER key and the GSMSOO ANALYZER key.
7. Press GSM900 ANALYZER to switch to the GSM9OO analyzer mode and access the Main menu of the HP 85715B GSM9OO Transmitter Measurements Personality.

The GSM9OO Transmitter Measurements Personality is still retained in the spectrum analyzer’s memory when the spectrum analyzer power is turned off or if you press (PRESET).

Using the GSM900 Transmitter Measurements Personality Card

The HP 85715B GSM9OO Transmitter Measurements Personality memory card must remain inserted in the instrument's front-panel card reader any time you select a new GSM9OO measurements set. The entire personality requires too much spectrum analyzer memory and cannot be completely downloaded at one time.

Because of the size of the program, the following method is used:

- The GSM9OO "core" program is copied into the spectrum analyzer's memory when the card is downloaded.
- When a different measurement set is selected from the Main menu, the last used measurement set may be purged. This is dependent on the amount of spectrum analyzer memory available. If the last used measurement is purged the new set is downloaded, indicated by the message PLEASE WAIT, LOADING FILE . . . . This operation takes from 5 to 20 seconds.

Once a measurement is selected and its menu appears, you can remove the card. If you want to access a different measurement set, reinsert the memory card into the card reader, otherwise, the message INSERT HP 85715B MEMORY CARD! & TRY AGAIN is displayed.

GSM9OO Measurements

The following GSM9OO measurements are available by pressing the appropriate Main menu key. Refer to chapter 3 for details on making these measurements.

- Power accesses the carrier power and power steps measurements.
- Power vs Time accesses the five different power versus time measurements.
- Output RF Spectrum accesses the RF spectrum due to modulation and RF spectrum due to switching transients measurements.
- Spurious Emission accesses the transmitter spurious and receiver spurious measurements.
- Intermod accesses the intermodulation attenuation and intermodulation intra-BSS measurements.
- Phase & Freq Err accesses the phase and frequency error measurements. (Only available when spectrum analyzer option 163 is installed.)

Using the Additional RAM Card

An HP 82215A 128K RAM Card is included with the HP 85715B GSM9OO Transmitter Measurements Personality shipment. This allows you to store setups to one card. A working copy of the GSM9OO Transmitter Measurements Personality is included on this card.

When you are using the spectrum analyzer and the GSM9OO measurements personality out in the field, keep the RAM card with the analyzer. Store the card labeled "HP 85715B GSM9OO Personality" in a safe place. *Read the license agreement located at the beginning of this manual.*

Changing the Memory Card Battery

It is recommended that the memory card battery be changed every 2 years. The battery is a lithium commercial CMOS type battery, part number CR 2016.

Note The minimum lifetime of the battery (under ordinary conditions) is more than 2 years.

Caution The battery power enables the memory card's memory to retain data. You can lose the data when the battery is removed. Replace the battery while the card is installed in a powered-up instrument.

The date that the memory card battery was installed is either engraved on the side of the memory card or written on a label on the memory card.

If the memory card does not have a label with the date that the battery was installed, use the date code engraved on side of the memory card. The date code engraved on the memory card consists of numbers and letters engraved in the black plastic on the side of the memory card. (See Figure l-2). The first number indicates the year, the following two characters indicate the month, and the following number indicates the week in the month that the memory card battery was installed. For example, 8OC3 indicates the battery was installed in the third week in October in 1988.

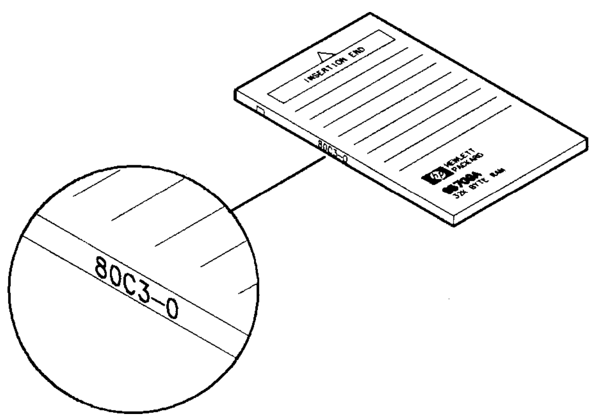

Figure 1-2. Memory Card Battery Date Code Location

Procedure to Change the Memory Card Battery

The battery is located beside the card's write-protect switch on the end opposite the connector.

Caution The battery power enables the memory card's memory to retain data. You can lose the data when the battery is removed. Replace the battery while the card is installed in a powered-up instrument.

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1. Locate the groove along the edge of the battery clip. See Figure l-3.
2. Gently pry the battery clip out of the card. The battery fits within this clip.
3. Replace the battery, making sure the plus (+) sign on the battery is on the same side as the plus (+) sign on the clip.
4. Insert the battery clip into the memory card, holding the clip as oriented in Figure l-3. (Face the "open" edge of the clip toward the write-protect switch on the memory card.)
5. Write the date that the battery was replaced on the memory card label. This will help you to remember when the battery should be replaced.

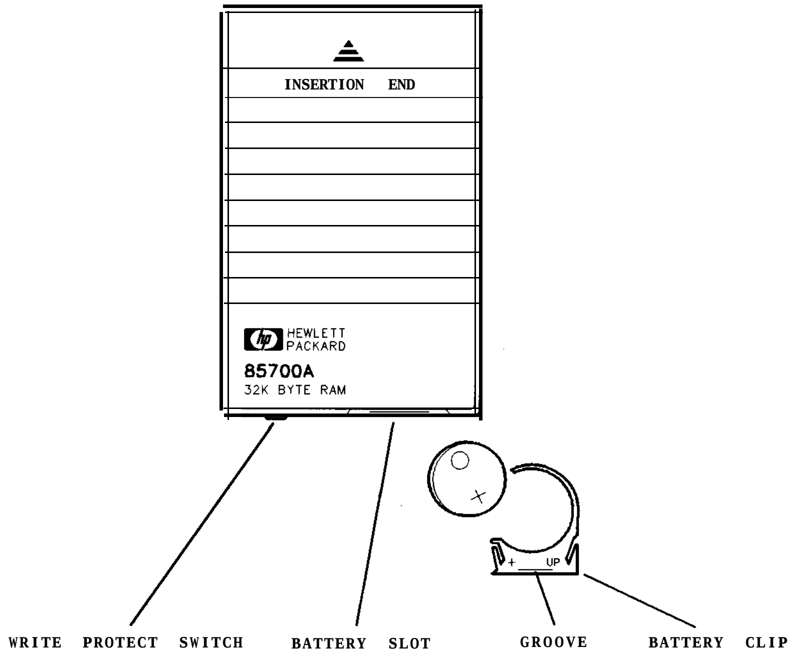


Figure 1-3. Memory Card Battery Replacement

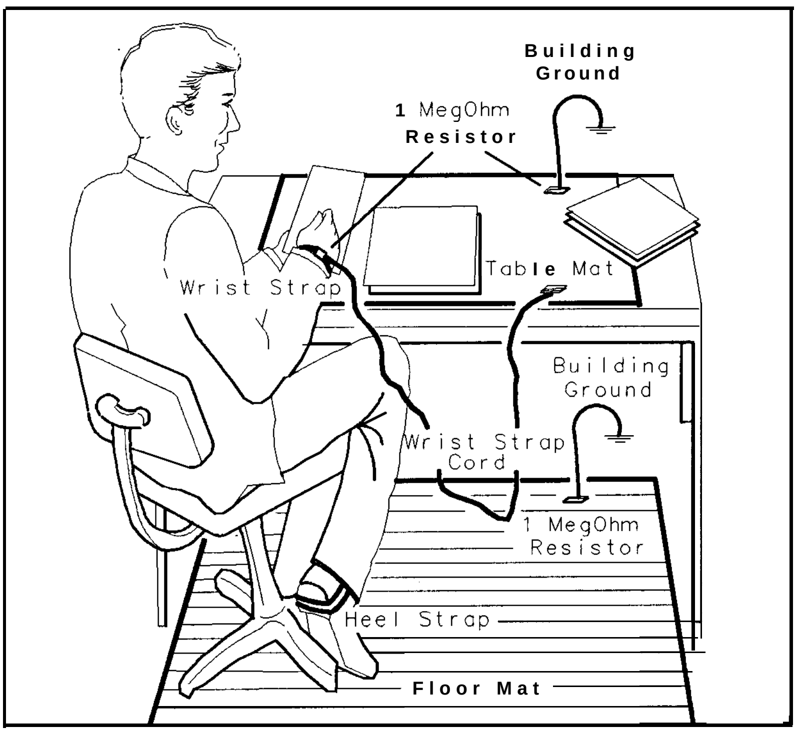
Protecting From Electrostatic Discharge Damage

Electrostatic discharge (ESD) can damage or destroy electronic components. All work performed on any electronic components should be done only at a static-safe workstation.

Figure Figure l-4 illustrates an example of a static-safe workstation using two types of ESD protection: (a) conductive table mat and wrist-strap combination, (b) conductive floor mat and heel-strap combination. These two types must be used together to ensure adequate ESD protection. Refer to Table l-l for a list of static-safe accessories **and** their part numbers.

Protecting Test Equipment from ESD

- Before connecting a coaxial cable to an instrument connector for the first time each day, momentarily ground the center and outer conductors of the cable.
- Personnel should be grounded with a resistor-isolated wrist strap before touching the center pin of any connector and before removing any assembly from the instrument.
- Be sure that all instruments are properly earth-grounded to prevent buildup of static charge.



FORMAT46

Figure 1-4. Example of Static-Safe Work Station

Static-Safe Accessories

Table 1-1. Static-Safe Accessories

HP Fart Number	Description
9300-0797	Set includes: 3M static control mat 0.6 m x 1.2 m (2 ft x 4 ft) and 4.6 cm (15 ft) ground wire. (The wrist-strap and wrist-strap cord are not included. They must be ordered separately.)
9300-0980	Wrist-strap cord 1.5 m (5 ft)
9300-1383	Wrist-strap, color black, stainless steel, without cord, has four adjustable links and a 7 mm post-type connection.
9300-l 169	ESD heel-strap (reusable 6 to 12 months).

Sales and Service Offices

Hewlett-Packard has sales and service offices around the world to provide support for your spectrum analyzer and the GSM9OO Transmitter Measurements Personality. To obtain servicing information or to order replacement parts, contact any sales office listed in Table l-2.

In any correspondence or telephone conversations, refer to the spectrum analyzer by its model number and its firmware date code. Use the following steps to determine the firmware date code:

1. Press (CONFIG) on the spectrum analyzer front panel.
2. Press **MORE 1 OF** 3.
3. Press ANALYZER **ADDRESS** .
4. Key in the spectrum analyzer address, 18, then press ENTER.
5. Read the firmware date code on the display.

Refer to the measurements personality by the version number listed on the label of the GSM9OO Transmitter Measurements Personality. You can also display the version number on the display by following the procedure below:

1. After loading the GSM9OO Transmitter Measurements Personality into the spectrum analyzer's user memory, press **GSM9OO ANALYZER** , then **Config** .
2. Press Mare 1 **of** 3, More 2 of 3, then **GSM900 REC** PER.
3. Read the displayed version of the GSM9OO Transmitter Measurements Personality you are using.

Table 1-2. Hewlett-Packard Sales and Service Offices

US FIELD OPERATIONS HEADQUARTERS
Hewlett-Packard Company
19320 Pruneridge Avenue
Cupertino, CA 95014, USA
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Hewlett-Packard Co.
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Fullerton, CA 92631
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Hewlett-Packard Co.
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Mountain View, CA 94041
(415) 694-2000

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Englewood, CO 80112
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Atlanta, GA 30339
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Canada
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Beijing, China
(86 1) 256-6888

Singapore
Hewlett-Packard Singapore
Pte. Ltd.
1150 Depot Road
Singapore 0410
(65) 273 7388

Taiwan
Hewlett-Packard Taiwan
8th Floor, H-P Building
337 Fu Hsing North Road
Taipei, Taiwan
(886 2) 712-0404

2

Verifying Operation

This chapter contains test procedures that verify the electrical performance of the GSM9OO and DCS1800 digital demodulator options (spectrum analyzer options 151 and 163), and the time-gated spectrum analysis card (spectrum analyzer option 105).

This chapter contains the following sections:

- Preparing for the verification tests.
- The following verification procedures:

  1. Gate delay accuracy and gate length accuracy.
  2. Gate card insertion loss.
  3. Phase error accuracy.
  4. Frequency error accuracy.

- The performance verification test record.

Note The HP 85715B GSM9OO Transmitter Measurements Personality is required to verify the phase and frequency error accuracy. The GSM900 option 100 Demonstration Personality may be used as an alternative.

Caution If it becomes necessary to return your spectrum analyzer to a Hewlett-Packard service center, save any user-defined functions or measurement personalities to a memory card. It may be necessary for the service center to load diagnostic or measurement personalities into user memory which would over-write existing programs, or memory could be erased during repair. Hewlett-Packard cannot guarantee that the user memory will be preserved. Refer to "Saving and Recalling Data from the Memory Card" in chapter 5 of the *HP 8590 Series Spectrum Analyzer User's Guide.*

Preparing for the Verification Tests

Do these four things before beginning a verification test:

1. Turn on the spectrum analyzer and allow it to warm up for at least 30 minutes.
2. Familiarize yourself with basic HP 8590 Series spectrum analyzer operation.
3. Perform the spectrum analyzer's self-calibration routines. Refer to the spectrum analyzer documentation for instructions. (Before performing the self-calibration routines, ensure that nothing is connected to the GATE TRIGGER INPUT connector. Otherwise, the self-calibration routine's results may not be valid.)
4. Read the rest of this section before you start any of the tests, and make a copy of the performance verification test record as described in "To record the test results."

The test equipment you will need

Table 2-l 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 or models.

To record the test results

Within the verification procedure, there are places to enter the test results. In addition, the performance verification test record (Table 2-2) has been provided at the end of the chapter. 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 records. This record could prove valuable in tracking gradual changes in test results over long periods of time.

Periodically verifying operation

The spectrum analyzer requires periodic verification of operation. Under most conditions of use, you should perform these verification tests once a year to ensure that the spectrum analyzer meets the specifications.

If the spectrum analyzer does not meet its specifications

1. Ensure that there is nothing connected to the spectrum analyzer's GATE TRIGGER INPUT connector.
2. Rerun the spectrum analyzer's frequency and amplitude self-calibration routines. See the spectrum analyzer documentation for more information.
3. Repeat the verification test.

If the spectrum analyzer continues to fail one or more of its specifications, complete any remaining tests and record the results on a copy of the performance verification test record, then return the spectrum analyzer with a copy of the completed test record to a Hewlett-Packard Sales and Service Office. Refer to the spectrum analyzer documentation for addresses and shipping instructions.

Recommended test equipment

Table 2-l lists the recommended test equipment for performing the verification tests.

Table 2-l. Recommended Test Equipment

Instrument	Critical Specifications for Equipment Substitution	Recommended Model	Use *
Synthesized signal generator	Frequency range: 932 MHz to 1806 MHz Amplitude: 0 dBm Modulation Modes: FM, Pulse Phase Noise: -95 dBc at 1 kHz offset -115 dBc at 10 kHz offset -125 dBc at 100 kHz offset	HP 8657B Option 003	P
Synthesizer/ function generator	Frequency: 1 kHz Amplitude: 2 V pk-pk	HP 3325B	P
Synthesizer-l level generator	Frequency range: 50 MHz Amplitude range: + 12 to -85 dBm Flatness:+/-0.15 dB Attenuator accuracy:+/-0.09 dB	HP 3335A	P,A,T
Oscilloscope	No substitute	HP 54501A	P,T
Universal counter	Time interval: 100 ns to 100 ms	HP 5316A	P
Pulse/function generator	Frequency: 100 Hz to 250 Hz Duty cycle: 13 - 50% Output: TTL square wave	HP 8116A	P
GSM900 Transmitter Measurements Personality	No substitute	HP 85715B *or* HP 85715B opt 100	P

* P = Performance Test, A = Adjustment, T = Troubleshooting

1. Verifying Gate Delay Accuracy and Gate Length Accuracy (Spectrum Analyzer Option 105 Only)

Specifications

Gate Delay Refer to Chapter 8 for specific values.

Gate Length Refer to Chapter 8 for specific values.

Description

The method used for measuring the gate length times is determined by the length of the gate. Shorter gate-length times are measured with an oscilloscope, and longer gate-length times are measured with a counter.

For shorter gate-length times, the output signal of a pulse generator is used to trigger the gate circuitry. To measure the gate delay, At markers are used. There is often up to 1 μs of jitter due to the 1 μs resolution of the gate delay clock. The "define measure" feature of the oscilloscope is used to measure and calculate the average length of the gate output automatically.

For longer gate-length times, a counter is used to measure the time period from the rising edge of the gate output to its falling edge. Because the gate-length time is equivalent to the clock accuracy of the spectrum analyzer, the gate-length time is compared to the specification for clock accuracy.

Equipment

Universal counter .... HP 5316A
Pulse/function generator .... HP 8116A
Digitizing oscilloscope .... HP 54501A

Cables
BNC, 120 cm (48 in) (four required) .... HP 10503A

Adapters
BNC tee (m) (f) (f) (two required) 1250-0781

To determine small gate delay and gate length (jitter-term)

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

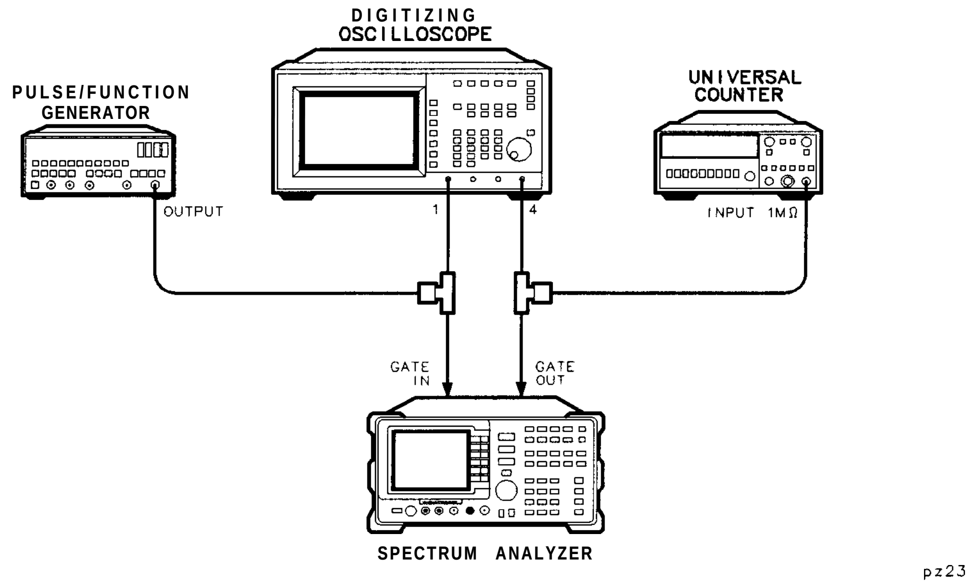


Figure 2-1. Gate Delay and Gate Length Test Setup

2. Press the following spectrum analyzer keys:

   (PRESET) (wait for the completion of the preset routine)
   (SPAN) ZERO SPAN
   (SWEEP) 20 (ms) GATE ON OFF (ON) GATE MENU GATE DELAY 1 (μs)
   GATE LENGTH 1 (μs)

3. Activate the square wave output on the function generator.
4. Set the pulse/function generator controls as follows:

   MODE ....NORM
   FRQ .... 100 Hz
   DTY 50%
   HIL .... 2.5 V
   LOL ....o.ov

5. Press the following keys on the oscilloscope:

   (RECALL)
   (CLEAR)
   (DISPLAY)
   off frame axes grid .... highlight grid
   connect dots off on .... highlight on
   (TRIG)
   source 1 2 3 4 .... highlight 4
   level ....2 V

(TIMEBASE) . . . . 500 ηs/div
(CHAN)
CHANNEL 1 2 3 4 off on

highlight **CHANNEL 1 on**
set **V/div** to 1 V and offset to 2 V
highlight **CHANNEL** 4 **on**
set **V/div** to 1 V and offset to 3 V

(DISPLAY)
DISPLAY norm **avg env** . . . . highlight **env**

6. Press (CLEAR DISPLAY) on the oscilloscope. Wait for the trace to fill in, then press the following keys:

(Δt ΔV)
Δt markers off **on** . . . . highlight **on**
stop marker . . . . 0 μs

To record the minimum and maximum gate delay values

7. On the oscilloscope, press **start** marker. Use the knob to position the start marker on the upper trace on the right side of the oscilloscope display. See Figure 2-2.

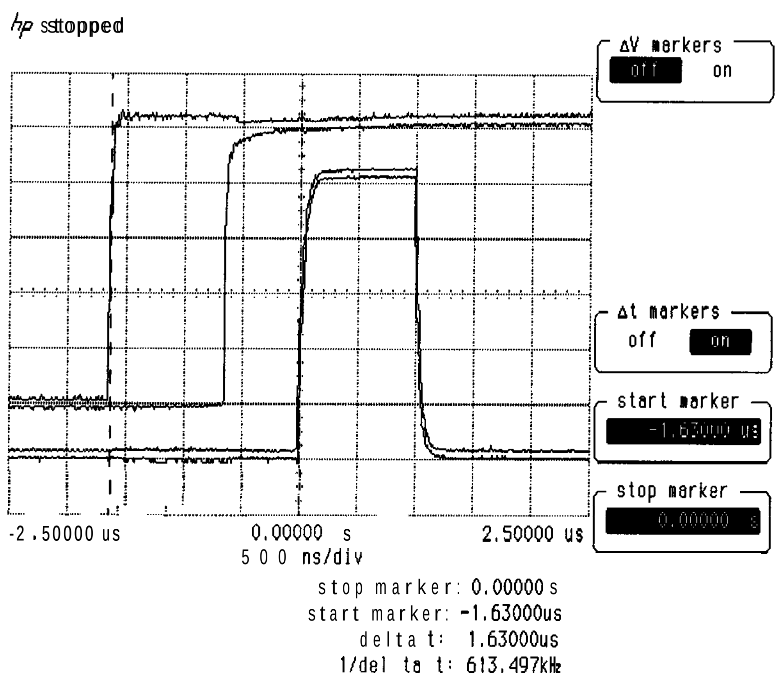


Figure 2-2. Oscilloscope Display of Minimum and Maximum Gate Delay Values

8. Record the Δt value of the start marker reading as the MIN gate delay.

MIN gate delay ____________

(the expected value is greater than 0.0 μs, but less than 2.0 μs)

9. Use the oscilloscope knob to position the start marker on the edge of the left side of the upper trace.

10. Record the At value of the start marker reading as the MAX gate delay.

    MAX gate delay ________________

    (the expected value is greater than 0.0 μs, but less than 2.0 μs)

To determine small gate length

11. Press the following keys on the oscilloscope:

    (BLUE) (+WIDTH) 4

    [DEFINE MEAS]

    statistics off on .... highlight ON

12. Read the average + width (4) displayed on the oscilloscope in the bottom right-hand annotation area.

13. Record this value as the 1 μs gate length value.

    1 μs gate length ________________

    (the 1μs gate length minimum width should be greater than 800 ηs and maximum width should be less than 1200 ηs.

To determine large gate length (clock accuracy term)

14. Press the following spectrum analyzer keys:

    [SWEEP] 150 (ms) GATE MENU GATE DELAY 10 (ms) GATE LENGTH 65 (ms)

15. Set the universal counter controls as follows:

    TI .... A → B
    GATE TIME delay .... mid-range
    CHANNEL A .... rising edge, dc couple, SENSITIVITY mode
    CHANNEL B .... falling edge, dc couple, SENSITIVITY mode
    COM A

16. Adjust LEVEL/SENS on the universal counter for best triggering.

17. Record the universal counter readout value as the 65 ms gate length.

    65 ms gate length ________________

    (minimum gate length width should be greater than 64.99 ms)

    (maximum width should be less than 65.01 ms)

2. Verifying Gate Card Insertion Loss (Spectrum Analyzer Option 105 Only)

Specifications

- Additional amplitude error due to gate-on enabled

Log scale	Refer to chapter 8 for specific values.
Linear scale	Refer to chapter 8 for specific values.

Description

Use this procedure to verify that the insertion loss for the Option 105 card is within the specifications. See the specifications in chapter 8 for the log and linear scale additional amplitude error due to gate-on enabled. The insertion loss is measured as follows:

1. HIGH SWEEP output on the spectrum analyzer is connected to GATE TRIGGER INPUT to provide a trigger signal for the gate circuitry.
2. The gate is turned off and a marker reading is taken.
3. The gate is then turned on and the synthesizer/level generator amplitude is adjusted to match the marker reading taken while the gate was off.

The difference between the two synthesizer/level generator readings is the measured insertion loss of the gate card.

Equipment

Synthesizer/level generator . . . . , ... HP 3335A

Cables
BNC, 122 cm (48 in) (two required) . . . . HP 10503A

Additional Equipment for Option 001 Spectrum Analyzer
BNC cable, 75 Ω, 120 cm (48 in) . . . . HP part number 15525-80010

To determine the card insertion loss

1. Connect the equipment as shown in Figure 2-3. (For Option 001 spectrum analyzers, attach the 75 Ω cable to the spectrum analyzer's RF input connector rather than the 50 Ω cable.)

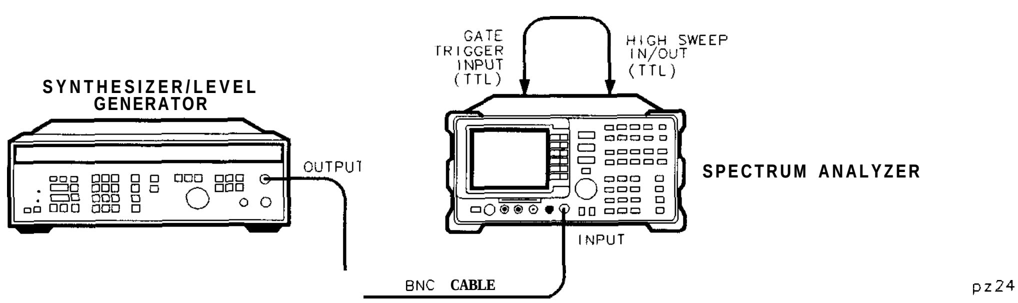


Figure 2-3. Gate Delay aud Gate Length Test Setup

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

FREQUENCY	50 MHz
AMPTD INCR	0.01 dB
AMPLITUDE	−5 dBm

3. On the spectrum analyzer, press (PRESET). Wait until preset is finished.
4. Press the following spectrum analyzer keys:

   (FREQUENCY) 50 (MHz)
   (SPAN) 1 (MHz)
   (BW) 100 (kHz)
   (SWEEP) 100 (ms) GATE ON OFF (OFF) GATE MENU GATE DELAY 20 (ms)
   GATE LENGTH 65 (ms)
   (PEAK SEARCH) MARKER DELTA
   (SWEEP) GATE ON OFF (ON)
   (PEAK SEARCH)

5. Use the step INCR (▲) or (▼) key on the synthesizer/level generator to adjust the output amplitude for a spectrum analyzer MKR Δ reading of 0.0 ±0.05 dB.
6. Record the amplitude displayed on the synthesizer/level generator as the synthesizer/level generator reading.

   synthesizer/level generator reading ____________________

7. Subtract the synthesizer/level generator reading you just recorded from −5.0 dBm. Record the result as the gate card insertion loss.

   For example, if the synthesizer/level generator reading is −4.96 dBm, then the result is −0.04 dBm as shown below:

   −5.0 dB minus the synthesizer reading is equal to the gate card insertion loss

   (−5.0) − (−4.96) = −0.04 dBm

   gate card insertion loss ____________________

   (the insertion loss should be between −0.3 dB and +0.3 dB)

3. Verifying Phase Error Accuracy (Spectrum Analyzer Option 151 and 163 Combination)

Specifications

Phase Error Refer to chapter 8 for specific GSM9OO values. Refer to the *HP 85722B DCS1800 Transmitter Measurements Personality User's Guide* for DCS1800 values.

Description

Use this procedure to verify that the phase error accuracy of the spectrum analyzer with options 151 and 163 installed is within specification. Phase errors are measured for both GSM9OO and DCS1800 frequency ranges. The phase error accuracy is measured as follows:

1. A frequency and amplitude self-calibration is performed on the HP 8590-series spectrum analyzer to improve the accuracy of the spectrum analyzer.
2. A stable RF signal of known frequency is input to the spectrum analyzer. The frequency corresponds to a GSM channel transmitting a stream of data zeros.
3. The RF signal is FM modulated to provide an rms phase error of 1.8” and peak phase error of 2.55”.
4. The rms and peak phase errors are measured using the GSM9OO Transmitter Measurements Personality.
5. The results are compared with the specified phase errors.

If the measured rms phase error is between 0.8 and 2.8 degrees for an HP 8593E through HP 8596E, the product is within specification.

If the measured peak phase error is less then 6.55 degrees for an HP 8593E through HP 8596E, the product is within specification.

Equipment

Synthesized signal generator .... .HP 8657B
Pulse generator .... HP 8116A
Synthesized function generator .... .HP 3325B

Cables
BNC, 122 cm (48 in) (three required) .... HP 10503A
BNC, 23 cm (9 in) .... HP 10502A

Adapters
Type N (m) to BNC (f) (two required) .... HP part number 1250-0780
BNC tee (m)(f)(f) .... HP part number 1250-0781

To determine the phase error accuracy

1. Ensure that there is nothing connected to the spectrum analyzer GATE TRIGGER INPUT connector. Perform a frequency and amplitude self-calibration on the spectrum analyzer. This improves the accuracy of the spectrum analyzer. If necessary, refer to the “Getting Started” chapter of the *HP* 8590 Series *Spectrum Analyzer* User's Guide for a complete explanation of this procedure.

2. Connect the equipment as shown in Figure 2-4.

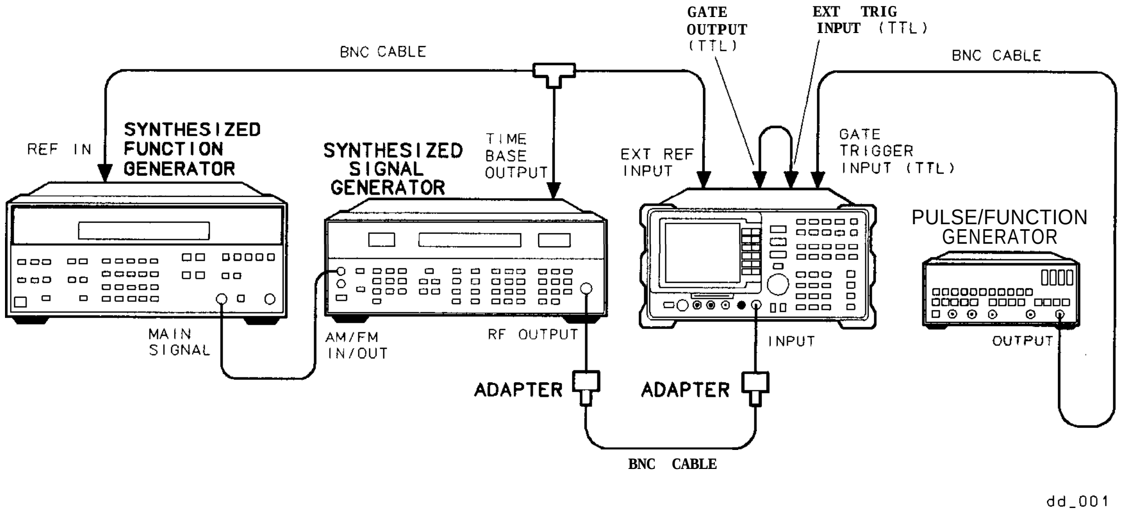


Figure 2-4. Phase Error Test Setup

3. Press the following synthesized signal generator keys:

(SHIFT) 0 (Presets the HP 8657B)
(FREQ) 935.267708 (MHz)
(AMPTD) 0 (+dBm)
(EXT) (FM) 1 (kHz)

4. Press the following function generator keys:

(FREQ) 22.5 (kHz)
(AMPTD) 1.1 (VOLTS)

Note If necessary, adjust the function generator amplitude so that neither the HI EXT nor the LO EXT indicators on the synthesized signal generator are illuminated.

---

5. Set the pulse generator as follows:

Square wave output
MODE . . . .Normal
FRQ . . . . .250 Hz
DTY 50%
HIL . . . . 2.5 V
LOL . . . . 0.0 V
(Ensure the pulse generator output is enabled.)

6. Press the following HP 8590-series spectrum analyzer keys:

   (PRESET)

   GSM900 ANALYZER

   Physical Channel.

   ARFCN -1 (ENTER)

   B M T ARFCN CTR FREQ ARFCN=-1 935.2 (MHz)

   Previous Menu

   Main **Menu**

   More 1 of *2*

   Phase **& Freq** Err

7. Press PHASE FREQ **NUMBER** BURSTS 10 (ENTER)

Note The spectrum analyzer measurement status window may display MIDAMBLE BAD. This message is expected because you are measuring a continuous stream of data zeros. For true GSM900 signals a combination of ones and zeros is expected from the midamble.

---

8. Wait until the message Peak Hold Measurement Completed is displayed in the spectrum analyzer measurement status window. Record the rms and peak phase errors from the spectrum analyzer phase error window as the maximum GSM900 phase errors in the performance verification test record.

Set up for a DCS1800 channel frequency as follows:

9. Press the following synthesized signal generator keys:

   (FREQ) 1805.267708 (MHz)

10. Press the following HP 8590-series spectrum analyzer keys:

    Physical Channel

    BMT ARFCN

    CTR FREQ ARFCN=-1 1805.2 (MHz)

    Previous Menu **Previous** Menu

    REPEAT **MEAS**

11. Wait until the message Peak Hold Measurement `Completed` is displayed in the spectrum analyzer measurement status window. Record the rms and peak phase errors from the spectrum analyzer phase error window as the maximum DCS1800 phase errors in the performance verification test record.

4. Verifying Frequency Error Accuracy (Spectrum Analyzer Option 151 and 163 Combination)

Specifications

Frequency Error Refer to chapter 8 for specific GSM9OO values. Refer to the *HP 85722B DCS1800 Transmitter Measurements Personality User's Guide* for DCS1800 values.

Description

Use this procedure to verify that the frequency error accuracy of the spectrum analyzer with options 151 and 163 installed is within specification. Frequency errors are measured for both GSM9OO and DCS1800 frequency ranges. The frequency error accuracy is measured as follows:

1. A frequency and amplitude self-calibration is performed on the HP 8590-series spectrum analyzer to improve the accuracy of the spectrum analyzer.
2. The mean frequency error and standard deviation are measured using the GSM9OO Transmitter Measurements Personality. The measurements are made using both CW and pulsed signals.
3. The results are compared with the specified errors.

Equipment

Pulse generator . . . . HP 8116A

Cables
BNC, 122 cm (48 in) (four required) . . . . HP 10503A
BNC, 23 cm (9 in) (one required) . . . . HP 10502A

Adapters
Type N (m) to BNC (f) (two required) . . . . HP part number 1250-0780

To determine the frequency error accuracy

1. Ensure that there is nothing connected to the spectrum analyzer GATE TRIGGER INPUT connector. Perform a frequency and amplitude self-calibration on the spectrum analyzer. This improves the accuracy of the spectrum analyzer. If necessary, refer to the "Getting Started" chapter of the *HP 8590 Series Spectrum Analyzer User's Guide* for a complete explanation of this procedure.

2. Connect the equipment as shown in Figure 2-5.

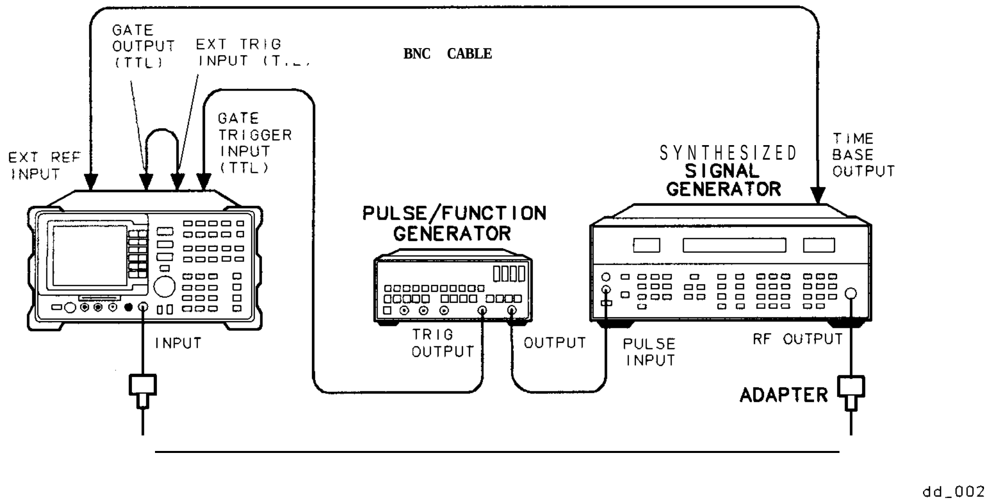


Figure 2-5. Phase Error Test Setup

3. Set the pulse generator as follows:

Square wave output
MODE ....Normal
FRQ .... 217 Hz
DTY 13%
HIL .... 2.5 V
LOL 0.0V
(Ensure the pulse generator output is enabled.)

4. Press the following synthesized signal generator keys:

(SHIFT) 0 (Presets the HP 8657B)
(FREQ) 935.267708 (MHz)
(AMPTD) 0 (+dBm)

5. Press the following HP 8590-series spectrum analyzer keys:

(PRESET)

GSM900 ANALYZER

Physical Channel

ARFCN -1 (ENTER)

B M T ARFCN CTR FREQ ARFCN=-1 935.2 (MHz)

Previous Menu

Main Menu

More 1 of 2

Phase & Freq Err

PHASE FREQ

NUMBER BURSTS 100 (ENTER)

MEASURE AVG PKS (AVG)

Note	The spectrum analyzer measurement status window may display MIDAMBLE BAD. This message is expected because you are measuring a continuous stream of data zeros. For true GSM9OO signals a combination of ones and zeros is expected from the midamble.

6. Wait until the message Averaged Measurement Completed is displayed in the spectrum analyzer measurement status window. Record the frequency error from the spectrum analyzer frequency error window as the Mean GSM9OO frequency error (CW) in the performance verification test record.
7. Press STD DEV ON OFF (ON)
8. Record the frequency error from the spectrum analyzer frequency error window as the GSM9OO standard deviation (CW) in the performance verification test record.
9. Press STD DEV ON OFF (OFF)
10. Press the following synthesized signal generator keys:

    (SHIFT) (AM)
11. Press the following HP 8590-series spectrum analyzer keys:

    (REPEAT MEAS)
12. Wait until the message Averaged Measurement Completed is displayed in the spectrum analyzer measurement status window. Record the frequency error from the spectrum analyzer frequency error window as the Mean GSM9OO frequency error (pulsed) in the performance verification test record.
13. Press STD DEV ON OFF (ON)
14. Record the frequency error from the spectrum analyzer frequency error window as the GSM9OO standard deviation (pulsed) in the performance verification test record.
15. Press STD DEV ON OFF (OFF)

Set up for a DCS1800 channel frequency as follows:

16. Press the following synthesized signal generator keys:

    (FREQ) 1805.267708 (MHz)
    (SHIFT) (AM) (OFF)

17. Press the following HP 8590-series spectrum analyzer keys:

    Physical Channel

    BMT ARFCN

    CTR FREQ ARFCN=-1 1805.2 (MHz)

    Previous Menu Previous Menu

    REPEAT MEAS

18. Wait until the message Averaged Measurement Completed is displayed in the spectrum analyzer measurement status window. Record the frequency error from the spectrum analyzer frequency error window as the Mean DCS1800 frequency error (CW) in the performance verification test record.

19. Press STD DEV ON OFF (ON)

20. Record the frequency error from the spectrum analyzer frequency error window as the DCS1800 standard deviation (CW) in the performance verification test record.

21. Press STD DEV ON OFF (OFF)

22. Press the following synthesized signal generator keys:

    (SHIFT) (AM)

23. Press the following HP 8590-series spectrum analyzer keys:

    (REPEAT MEAS)

24. Wait until the message Averaged Measurement Completed is displayed in the spectrum analyzer measurement status window. Record the frequency error from the spectrum analyzer frequency error window as the Mean DCS1800 frequency error (pulsed) in the performance verification test record.

25. Press STD DEV ON OFF (ON)

26. Record the frequency error from the spectrum analyzer frequency error window as the DCS1800 standard deviation (pulsed) in the performance verification test record.

27. If the GSM900 option 100 Demonstration personality was used for this performance test and the performance tests have been completed, you should delete it from the spectrum analyzer memory. Refer to “Purging Spectrum Analyzer DLP Memory” in chapter 1.

Performance Verification Test Record

The Performance Verification Test Record lists test specifications and acceptable limits. HP recommends that you make a copy of this table, record the complete test results on the copy of the performance verification test record, and keep the copy for your calibration test records. You may find that keeping a record of the calibration test records is helpful for tracking gradual changes in test results over long periods of time.

Table 2-2. Performance Verification Test Record (Page 1 of 2)

Hewlett-Packard Company	
Address:	Report No. ______
______	
______	Date ______
______	(e.g. 10 DEC 1993)
Model HP 8590 Series spectrum analyzer with HP 85715B/85722B	
Serial No. ______	
Options ______	
Firmware revision ______	
Customer ______	Tested by ______
Ambient temperature ______ °C	Relative humidity ______ %
Power mains line frequency ______ Hz (nominal)	

Test Equipment Used:

Description	Model No.	Trace No.	Cal Due Date
Synthesized signal generator			
Synthesizer/function generator			
Synthesizer/level generator			
Oscilloscope			
Universal counter			
Pulse/function generator			

Performance Verification Test Record (Page 2 of 2)

Hewlett-Packard Company
Model HP 8590 Series spectrum analyzer with HP 85715B/HP 85722B Report No. ______________

Serial No. ______________ Date ______________

Test No.	Test Description	Results Min	Measured	Max	Measurement Uncertainty
1.	**Gate delay accuracy**				
	Gate length accuracy				
	MIN gate delay	0.0 μs	______	2.0 μs	±0.011 μs
	MAX gate delay	0.0 μs	______	2.0 μs	±0.011 μs
	65 ms gate length	64.99 ms	______	65.01 ms	±0.434 μs
2.	**Gate card insertion loss**				
		−0.3 dB	______	+0.3 dB	±0.092 dB
3.	**Phase error accuracy**				
	Maximum GSM900 rms phase error	0.8°	______	2.8°	±0.26°
	Maximum DCS1800 rms phase error	0.8°	______	2.8°	±0.26°
	Maximum GSM900 peak phase error	0°	______	6.55°	±0.37°
	Maximum DCS1800 peak phase error	0°	______	6.55°	±0.37°
4.	**Frequency error accuracy**				
	Mean GSM900 frequency error (CW)	−7 Hz	______	+7 Hz	N/A
	GSM900 standard deviation (CW)	0 Hz	______	8 Hz	N/A
	Mean GSM900 frequency error (pulsed)	−10 Hz	______	+10 Hz	N/A
	GSM900 standard deviation (pulsed)	0 Hz	______	8 Hz	N/A
	Mean DCS1800 frequency error (CW)	−8 Hz	______	+8 Hz	N/A
	DCS1800 standard deviation (CW)	0 Hz	______	10 Hz	N/A
	Mean DCS1800 frequency error (pulsed)	−16 Hz	______	+16 Hz	N/A
	DCS1800 standard deviation (pulsed)	0 Hz	______	10 Hz	N/A

3

Making GSM900 Measurements With HP 85715B

What's In This Chapter

The following information is intended to get you ready for making GSM9OO measurements with the HP 85715B GSM9OO Transmitter Measurements Personality. This section is divided into the following stages of preparation:

Accessing Spectrum Analyzer or GSM9OO Analyzer Mode	Refer to this section to learn how to move from the GSM9OO analyzer mode to spectrum analyzer mode.
Using Spectrum Analyzer Front-Panel Keys During GSM9OO Operation	Refer to this section to learn how to use the spectrum analyzer hardkeys during GSM9OO analyzer operation. Front-panel keys that are disabled during GSM9OO analyzer operation are also listed here.
Accessing GSM9OO Analyzer Menus	Refer to this section to learn how to use the (MODE) key to switch from GSM9OO analyzer to spectrum analyzer menus, without changing the instrument state for either mode.
Reading GSM9OO Personality Display Annotation	Refer to this information to understand the display annotation used by the HP 85715B GSM9OO Transmitter Measurements Personality.
Selecting the GSM9OO Measurements	Refer to this information for a brief definition of the different measurements available with the HP 85715B GSM9OO Transmitter Measurements Personality.
Configuring the System for GSM9OO Measurements	Refer to this procedure to set up the HP 85715B GSM9OO Transmitter Measurements Personality for making GSM9OO measurements.
Entering Physical Channel Information	Refer to this procedure to enter the information about the GSM9OO channel number and timeslot number to test.
Triggering	Refer to this section for information on how to set up the triggering connections required for the GSM9OO measurements.
Using the GSM9OO Transmitter Measurements Personality Card	Refer to this section for a description on how to use the HP 85715B GSM9OO Transmitter Measurements Personality card.

Accessing Spectrum Analyzer or GSM900 Analyzer Mode

Use the spectrum analyzer (MODE) key to switch between spectrum analyzer mode and GSM900 analyzer mode at any time. The instrument states for the two modes are completely independent. As a result, you can move quickly to the last measurement (and instrument state) of the previous mode. Refer to the information below:

1. Press (MODE) to display the mode menu. The keys SPECTRUM ANALYZER and GSM900 ANALYZER should be displayed.

Note If the GSM900 ANALYZER key is not displayed, the program needs to be loaded into the spectrum analyzer's user memory. Refer to "Downloading the GSM900 Transmitter Measurements Personality" in Chapter 1 of this manual.

2. Once the mode menu is displayed, press GSM900 ANALYZER.
3. If GSM900 ANALYZER is not underlined, pressing the GSM900 ANALYZER key activates the GSM900 mode. The message PLEASE WAIT ... is displayed as the initial state is set up.
4. If GSM900 ANALYZER is already underlined, pressing the GSM900 ANALYZER key displays the GSM900 Main menu, without changing any parameters.
5. When the GSM900 mode is active, GSM900 is displayed above the softkey labels on the display.

Using Spectrum Analyzer Front-Panel Keys During GSM900 Operation

The menus of the GSM900 Transmitter Measurements Personality provide the softkeys that are normally needed for making measurements. Some spectrum analyzer front-panel keys, however, can provide useful, supplemental functions for GSM900 measurements. The more useful functions may be found under the following front-panel keys:

- (MKR) provides normal marker and marker delta functions. These may be used to obtain a readout of the trace values when the vertical scale represents amplitude. The readout may be in frequency or in time domains.
- (COPY) allows you to copy the screen to an HP-IB printer or a plotter that you select with the (CONFIG) key.
- (FREQUENCY) allows you to control the center frequency, start frequency, and stop frequency while you are making a band-measurement such as Spurious Emissions and Monitor TX Band.

  The (FREQUENCY) key duplicates the GSM900 Physical Channel menu when making channel measurements like the Power vs Time or Output RF Spectrum.

  This ensures that the center frequency always matches the selected ARFCN. If a particular center frequency is required, use CTR FREQ ARFCN=-1 under the (FREQUENCY) key, or BMT ARFCN to store the desired frequency for ARFCN=-1. This is the frequency used whenever an ARFCN is equal to -1 is selected.
- (SPAN) allows you to change the span of the displayed trace to optimize the view of measurement results.
- (AMPLITUDE) allows you to change the amplitude value of a displayed measurement result.

- (BW) allows you to adjust the resolution bandwidth or video bandwidth to optimize the view of measurement results.

Starting a new GSM9OO measurement always sets the spectrum analyzer parameters for making that measurement. This is true whether you used spectrum analyzer menu keys or GSM9OO menu keys to change settings. There is no need to press PRESET GSM900 or (PRESET) before beginning a new measurement.

The spectrum analyzer (SAVE) and (RECALL) hardkeys are incompatible with the GSM900-mode of operation.

Some of the spectrum analyzer softkey functions (not front-panel key functions) that are incompatible with GSM900-mode operation are disabled during GSM9OO mode of operation. The softkeys that are deleted from spectrum analyzer menus during GSM9OO operation are listed below:

- SCALE LIN
- AMPTD UNITS
- EXT PREAMP
- REF LVL OFFSET
- VAVG
- SAMPL PK

All of the above softkeys are available in normal spectrum analyzer operating mode.

Accessing GSM9OO Analyzer Menus

Once in the GSM9OO analyzer mode, you can leave the GSM9OO measurements menus and return to them at any time with the (MODE) key. Refer to the following methods:

- Press (MODE), then GSM900 ANALYZER to return from spectrum analyzer menus to the GSM9OO Main menu.
- Press (MODE) (MODE) to return from spectrum analyzer menus to the GSM9OO menu exited when you accessed a spectrum analyzer key.

Reading GSM900-Personality Display Annotation

During GSM9OO measurements there is annotation displayed along the left-hand side of the screen. The annotation supplies information related to GSM9OO measurements settings. Refer to the illustration below for an explanation of the annotation in this column,

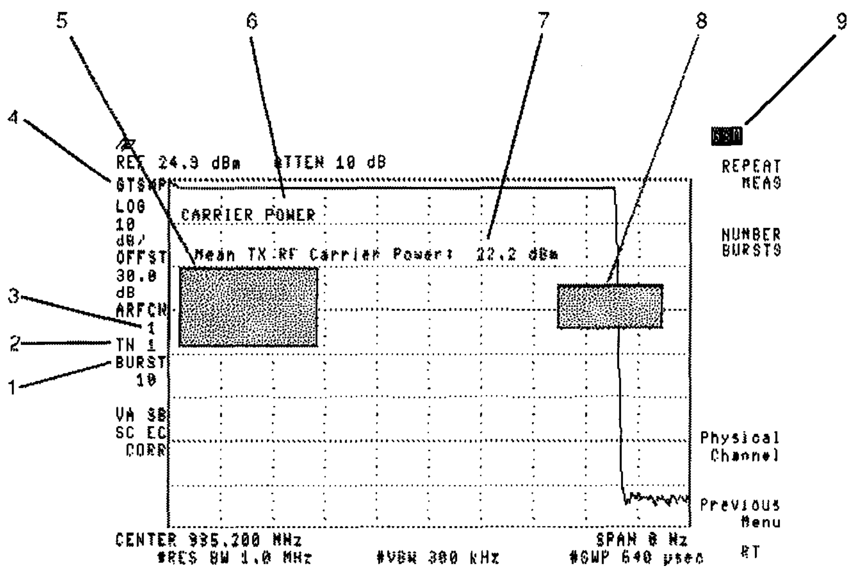


Figure 3-1. GSMSOO Annotation Column

Item	Display Annotation	Description
1	BURST	Number of bursts to measure
2	TN	Timeslot number
3	ARFCN	Absolute RF channel number
4	GTSMP	Detector in gated-sample mode
	GTPOS	Detector in gated-positive peak mode
	PEAK	Detector in peak mode
5	ACTIVE FUNCTION OR ERROR MESSGE	Selected active function or measurement error messages
6	MEASUREMENT	The active measurement
7	MEASUREMENT RESULT	The measurement results
8	LIMIT LINE PASS/FAIL MESSAGE	Results-of trace compared with limit line
9	GSM9OO MODE	The current analyzer mode

Selecting the GSM9OO Measurements

The following measurement menu groups are available from the HP 85715B GSM9OO Transmitter Measurements Personality Main menu:

Note Make sure the spectrum analyzer has been running and is warmed up for at least 30 minutes before beginning any measurement.

Power	Power measurements include mean transmitted-carrier power, power-step accuracy of the GSM9OO transmitter, and combiner tuning.
Power vs Time	Power vs time measures the carrier power of the bursted transmitted signal and compares it to the GSM specified limit-line template. Power vs time measurement choices are full frame, full timeslot, rising-edge, falling-edge, and top-10 dB (the GSM9OO transmitter-on state).
Out RF Spectrum	The output RF spectrum measurement characterizes the spectral energy emitted into adjacent channels. The spectral energy measured is due to GMSK modulation and switching transients. The measurements can be performed in a swept frequency mode or at discrete frequency offsets.
Spurious Emission	Spurious emissions measurements include transmitter spurious and receiver spurious tests.
Intermod	Intermodulation tests measure the immunity of the GSM9OO transmitter to intermodulation distortion. Intermodulation measurement choices are intermodulation attenuation and intra-BSS intermodulation.
Phase & Freq Err	The phase and frequency error measurement analyzes the accuracy of the transmitter's GMSK modulation process.
MONITOR TX BAND	Monitor TX band allows you to view the full transmit band as selected with the TX MS BS key. The total power of all carriers in the band is also displayed.

For specific information about any of the softkeys, refer to Chapter 6, "Menu Key Descriptions."

Configuring the System for GSM9OO Measurements

Most of the GSM9OO measurements require that many of the following settings be pre-determined. Refer to the procedure below to enter the basic setup information.

Note	GSM9OO configuration values (under the Configuration menu) are not erased by pressing (PRESET), PRESET GSM900 , or by power cycling the spectrum analyzer.

1. Press (MODE) to access the GSM900 ANALYZER softkey.
2. Press GSM900 ANALYZER and wait for the Main menu to appear.
3. Press Config to access the Configuration menus.
4. Press EXT ATTEN . Use the data keys to enter the external attenuation value (in dB) used in the system. Press (ENTER) on the spectrum analyzer to terminate the entry.

   The attenuation value should equal the total attenuation between the transmitter output and the spectrum analyzer input.
5. Press PREAMP GAIN . Use the data keys to enter a value (in dB). Press (ENTER) on the spectrum analyzer to terminate the entry.

Note	A preamplifier is required for receive-band intermodulation and receive-band spurious emissions measurements. The preamplifier gain correction factor should take into account the gain of the preamplifier, insertion loss of the bandpass filter, and any cable loss.

6. Press TRIG DELAY . Enter the external trigger delay time using the data keys. Press (ENTER) on the spectrum analyzer. Enter a value of 0 if the external frame trigger occurs at the start of bit 0 in timeslot number 0.

   A positive trigger delay shifts the displayed trace to the right, and a negative delay shifts the trace to the left. If the delay time is unknown, you can use the power versus time measurement to adjust the trigger delay time for relative measurements.
7. Press TOTAL PWR SGL MULT until SGL is underlined. Refer to "Making the Monitor TX Band Measurement" in Chapter 3. "Making GSM9OO Measurements" for more information.
8. Press More 1 of 3 , then SFH ON OFF until OFF is underlined to disable slow frequency hopping mode. If SFH is enabled, extra sweeps and longer sweeps are taken. Disable SFH (underline OFF) for GSM9OO measurements unless a hopping signal is being measured.
9. Press Main Menu to return to the Main menu.

The remaining Configuration menu keys are normally left in their default conditions. Refer to Chapter 6, "Menu Key Descriptions" for more information about any GSM9OO Transmitter Measurements Personality softkey.

Entering Physical Channel Information

1. Press Physical Channel in the Main menu. Refer to Chapter 7, "Menu Maps" for the menu maps.
2. Press TX MS BS until you underline either MS for mobile station testing or BS for base station testing. The TX or transmit band of either a mobile station or base station will be measured.

   The following conditions are affected by the mobile- or base-station settings:
   - The center frequency set by ARFCN.
   - The start and stop frequency of the monitor-band mode.
   - The output RF spectrum swept-mode limit lines.
   - The frequencies and limits of the spurious emissions tests.
   - The frequencies and limits of the intermodulation test.
3. Press ARFCN and use the data keys to enter the absolute RF channel number (ARFCN) of the carrier to be measured, then press (ENTER) on the spectrum analyzer. You can also use the step keys and step the ARFCN one channel at a time.

Note To make a "channel" measurement at a center frequency other than that specified by a channel number, select ARFCN and use the data keys to enter – 1. Then select B M T ARFCN CTR FREQ ARFCN=–1 and use the data keys to enter the frequency of interest.

4. Press TIMESLOT NUMBER and use the data keys to enter the timeslot number (TN) to measure, then press (ENTER) on the spectrum analyzer.
5. Press Auto Function. Follow by pressing either AUTO ARFCN , and AUTO TN , or press AUTO ARFCN&TN . Pressing AUTO ARFCN&TN is like pressing AUTO ARFCN , then AUTO TN. These functions automatically set the ARFCN or TN to the channel number or timeslot number having the highest power level. If multiple carriers are present, they need to be separated by at least 1 MHz.
6. Press Main Menu or Previous Menu to return to the Main menu.

Note Only the mean carrier power, power vs time, and output RF spectrum measurements require the ARFCN and TN to be specified. All measurements require that TX MS BS to be determined.

The remaining Physical Channel menu keys are normally left in their preset conditions. Refer to Chapter 6, "Menu Key Descriptions" for more information about any GSM900 Transmitter Measurements Personality softkey.

Triggering

The triggering connection is required for some measurements. The trigger signal needs to be supplied by the unit under test or by an associated piece of test equipment. The following list describes three methods of generating a frame trigger signal.

Note It is essential that an external trigger signal is applied for phase and frequency error measurements, otherwise the spectrum analyzer appears to hang up. Once the external trigger signal is applied the spectrum analyzer will continue to function correctly.

Using the unit under test

The spectrum analyzer EXT TRIG INPUT (‘ITL) and GATE OUTPUT (TTL) on the rear panel should be connected together. The source Frame Trigger Output should be connected to the spectrum analyzer rear panel GATE TRIGGER INPUT (TTL). Figure 3-2 shows these connections.

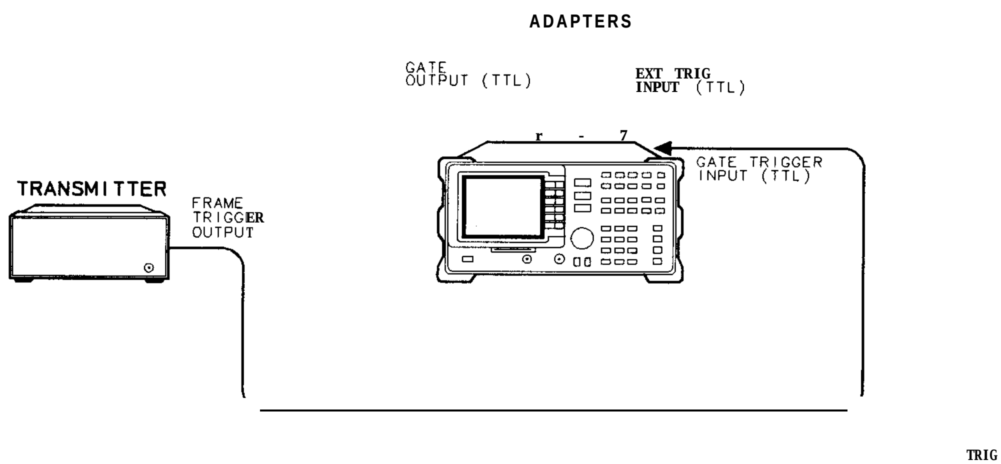


Figure 3-2. Triggering Connections using the Unit Under Test

Using the HP 85902A

The spectrum analyzer EXT TRIG INPUT (TTL) and GATE OUTPUT (TTL) on the rear panel should be connected together. The HP 85902A TRIG OUT (TTL) should be connected to the spectrum analyzer rear panel GATE TRIGGER INPUT (TTL). Figure 3-3 and Figure 3-4 show two methods of using the HP 85902A to provide the trigger signal.

Caution To *avoid spectrum analyzer damage* an external attenuator may be required. The total power applied to the spectrum analyzer INPUT 50Ω *can not exceed +30 dBm.* If the input exceeds +30 dBm, spectrum analyzer damage may result.

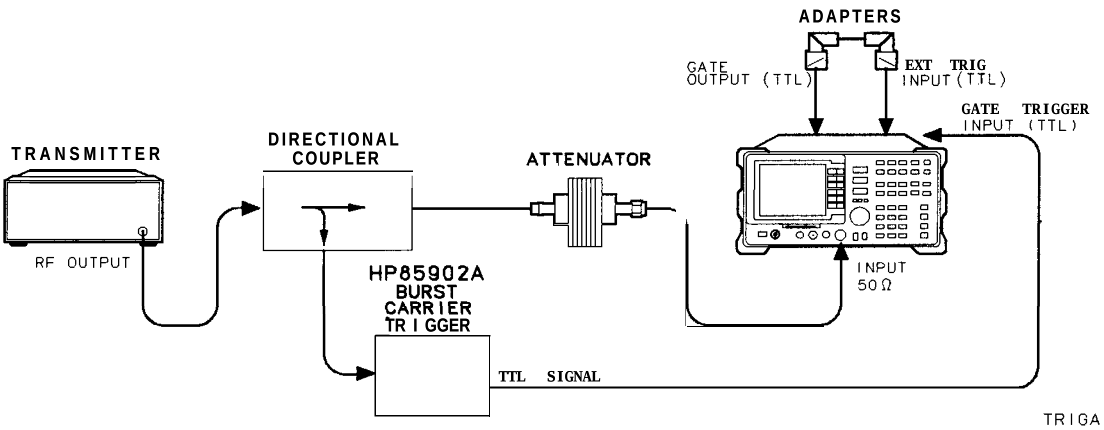


Figure 3-3. Triggering Connections using the HP 85902A and a Directional Coupler

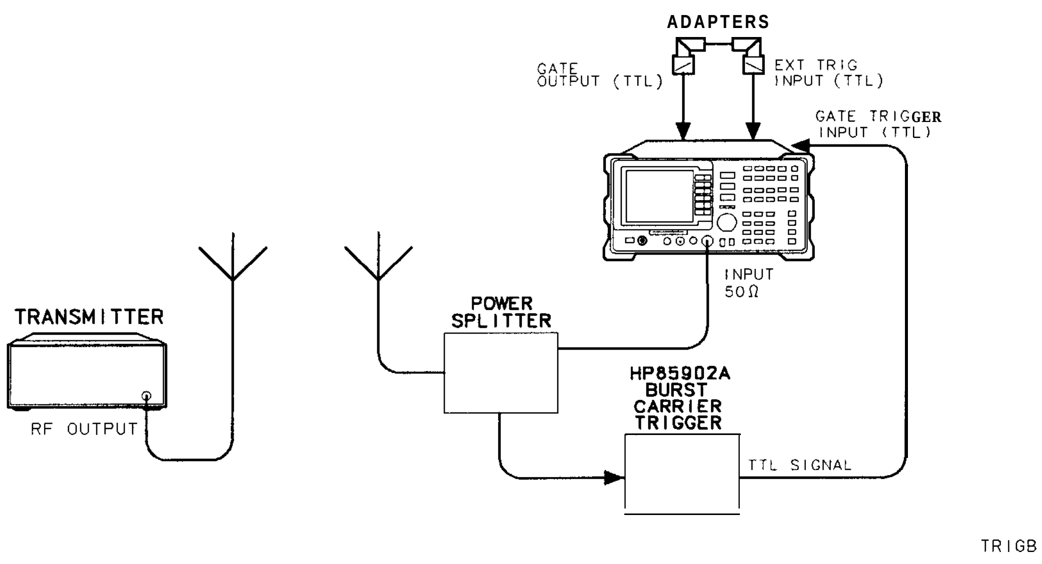


Figure 3-4. Triggering Connections using the HP 85902A and a Power Splitter

Using the HP 8922G

The spectrum analyzer EXT TRIG INPUT (TTL) and GATE OUTPUT (TTL) on the rear panel should be connected together. The spectrum analyzer rear panel GATE TRIGGER INPUT (TTL) should be connected to pin 24 (G_EXT_TRIG) and pin 2 (Ground) of the HP 8922G SYSTEM BUS. You will need to supply your own cable to make this connection.

The HP 8922G frame clock, **g_ext_trig**, can be enabled in the HP 8922G SERVICE Screen. From the HP 8922G SERVICE Screen select **g_ext_trig** in the `Latch` field and 305 in the Value field. To activate the clock, select g-ext-trig-enable in the `Latch` field and 1 in the `Value field.`

Refer to Figure 3-5 for the setup required to trigger the spectrum analyzer using the HP 8922G.

Caution To *avoid spectrum analyzer* damage an external attenuator may be required.

The total power applied to the spectrum analyzer INPUT 50Ω *can not exceed +30 dBm.* If the input exceeds + 30 dBm, spectrum analyzer damage may result.

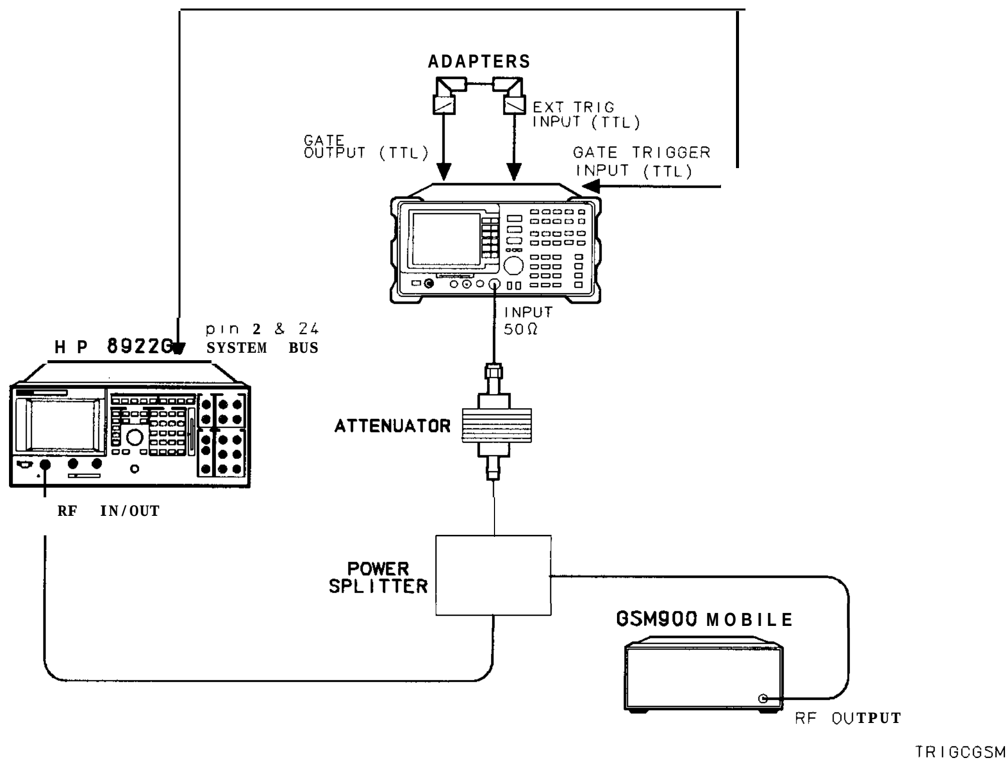


Figure 3-5. Triggering Connections using the HP 8922G

Using the GSM900 Transmitter Measurements Personality Card

The HP 85715B GSM9OO Transmitter Measurements Personality memory card must remain inserted in the instrument's front-panel card reader any time you select a new GSM9OO measurements set,. The entire personality requires too much of the spectrum analyzer's memory and cannot be completely downloaded at one time. Because of the size of the program, the following method is used:

- Only the GSM9OO "core" program is copied into the spectrum analyzer's memory when the card is downloaded.
- When a different measurement set is selected from the Main menu, the last used measurement, set may be purged. If so, the new set is downloaded, indicated by the message PLEASE WAIT, LOADING FILE... . This operation takes from 5 to 20 seconds.

Making the Mean Transmitted RF Carrier Power Measurement

Description

The mean transmitted carrier power measurement determines the average power for a specified ARFCN and TN. A zero span measurement is made and the average power level during the useful part of the burst is measured, then displayed.

SFH mode is available for this measurement.

An external frame trigger signal is required for this measurement.

Specification GSM 5.05 section 4.1 provides general information about making mean transmitted carrier power measurements.

Specification GSM 11.10 section 13.3 outlines the test method and limits required for measuring the mean transmitted carrier power for mobile stations.

Specification GSM 11.20 section 2.1.6.3 outlines the test method and limits required for measuring the mean transmitted carrier power for base stations.

Test Procedure

1. Enter all the information as specified in the "Configuring the System for GSM900 Measurements" and "Entering Physical Channel Information" sections of this chapter. For this test, specifically enter the desired ARFCN and TN via the Physical Channel menu. Refer to Chapter 7, "Menu Maps" for the menu maps.
2. Press **Power** in the Main menu, then **CARRIER POWER** . The program sets the spectrum analyzer to the GSM900 specified values for the measurement. The spectrum analyzer reference level is automatically set to the optimum value based on the measured carrier power level. A display of the mean carrier power is updated at the end of each sweep. After the selected number of bursts are measured, the trace is paused and the final result is displayed.

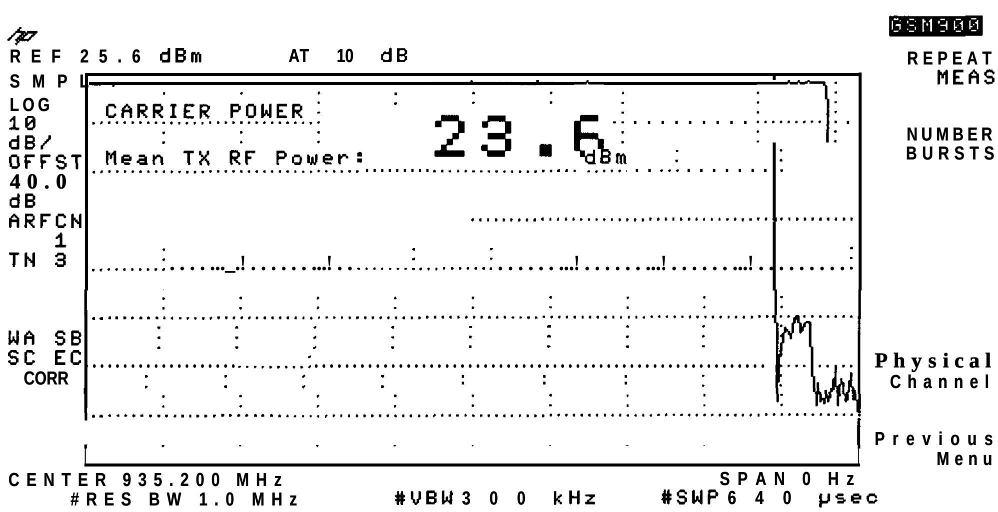


Figure 3-6. Example of Carrier Power Measurement Result

- Press **NUMBER BURSTS** and enter a new value if you want to change the number of bursts to be averaged. If **NUMBER BURSTS** is set to 1, the carrier power is continually measured. Changing the value automatically repeats the measurement.
- Press **Physical Channel**, then press either **ARFCN** or **TIMESLOT NUMBER** and enter a new value if you want to change either of these settings. Press **Previous Menu** to return to the carrier power menu.
- Press **REPEAT MEAS** to restart the measurement after making any settings changes or just to make the measurement again. You can also change parameters such as the resolution bandwidth, then repeat the measurement at the new resolution bandwidth setting by pressing **REPEAT MEAS**. Return to the current GSM900 menu from the spectrum analyzer keys by pressing (MODE) (MODE).

Making the Power Steps Measurement

Description

This measurement uses long sweep times to display the different power steps resulting from adaptive power control. Power step measures the dynamics of the power step changes. Use the more accurate mean carrier power measurement to make power measurements on carriers with a static power level. The power step measurement checks the maximum power of all 8 timeslots.

SFH mode is available for this measurement.

An external frame trigger signal is *not* required for this measurement.

Specification GSM 5.05, section 4.1 and *Specification GSM 5.08, section 4* provides general information about making mean transmitted carrier power measurements.

Specification GSM 11.10 section 13.3 outlines the test method and limits required for measuring the mean transmitted carrier power for mobile stations.

Specification GSM 11.20 section 2.1.6.3 outlines the test method and limits required for measuring the mean transmitted carrier power for base stations.

Test Procedure

1. Enter all the information as specified in the "Configuring the System for GSM900 Measurements" and "Entering Physical Channel Information" sections of this chapter. For this test, specifically enter the desired ARFCN via the Physical Channel menu. Refer to Chapter 7, "Menu Maps" for the menu maps.
2. Press Power to access the Power measurements menu keys.
3. Press CARRIER POWER to measure the carrier power at the maximum transmitter output. Make this measurement first to set the spectrum analyzer reference level for the power steps measurement.
4. Press Previous Menu.
5. Press POWER STEPS . The program sets the spectrum analyzer to the appropriate values for the measurement.
6. Press SWEEP CONT SGL and underline SGL to take one sweep, or underline CONT for continuous sweep mode.
7. Step the power of your GSM900 transmitter under test.

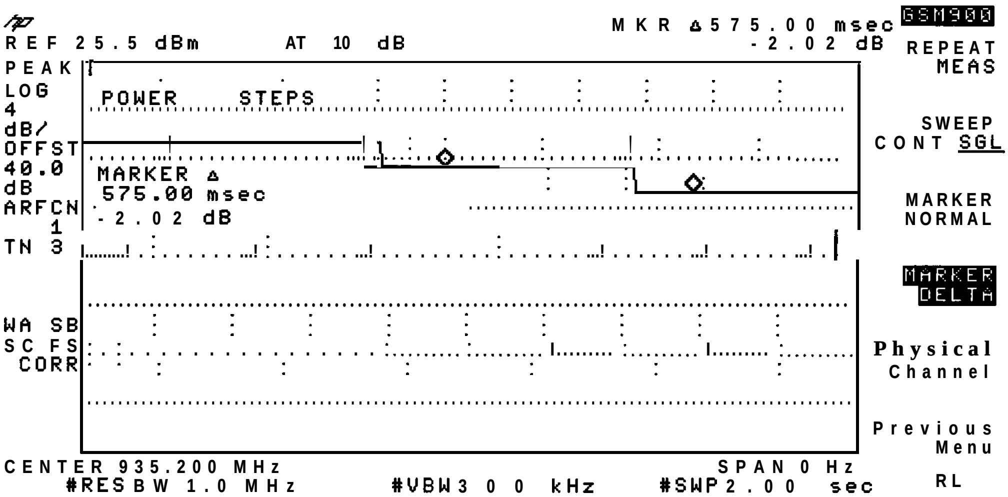


Figure 3-7. Example of Power Steps Measurement Results

8. If desired, you can enter a new sweep time or use the delta markers to evaluate the power steps measurement further. Use the procedure below:

- Use the spectrum analyzer (SWEEP) key to enter a new sweep time. Use the steps below to evaluate the power steps at a new sweeptime:

  a. Change the sweep time by pressing the spectrum analyzer (SWEEP) key. Enter a new sweep time, then press an appropriate units (seconds) key.

Note The sweep time needs to be greater than or equal to 2 seconds.

---

  b. Press (MODE) [MODE] to return to the current GSM900 menu from the spectrum analyzer keys.

  c. If CONT is underlined in the SWEEP CONT SGL key, the new sweeptime is automatically used. Press REPEAT MEAS to make the power steps measurement at the new sweeptime if SGL is underlined.

- Use the delta markers to determine the power and time between two points of the displayed trace. Use the procedure below:

  a. Press MARKER DELTA in the GSM900 menu to activate the markers.

  b. Position the marker on the reference point of interest. Press MARKER DELTA again.

  c. Rotate the knob to locate the marker on a second point of the trace. The power level and time difference between the two markers is displayed.

  d. To turn marker off press (MKR) MARKER 1 ON/OFF (MODE) (MODE).

9. Press Physical Channel , then press ARFCN and enter a new value if you want to change this setting.

10. Press Previous Menu to return to the measurement menu.

Making the Combiner Tuning Measurement

Description

This measurement allows the output power from several base station transmitters to be viewed so that the output power from each transmitter can be matched.

The base station transmitters should be set to produce a CW (not pulsed) signal.

The frequency spectrum of the full transmit band for base stations is displayed.

Marker lines are placed on the maximum carrier, another on the minimum carrier and a third on the threshold. The measurement shows numerically the power of the maximum carrier detected, and the power difference between the maximum and minimum carriers.

The following softkeys are shown under the combiner tuning measurement: REF LVL , SCALE LOG, START FREQ , STOP FREQ and Previous *Menu.* For specific information about any of the softkeys, refer to "Power measurements Menu Keys" in Chapter 6. To ensure correct power calculations, all of the carriers must be at least 1 MHz apart.

An external frame trigger is *not* required for this measurement,

Test Procedure

1. Enter all the information as specified in the "Configuring the System for GSM900 Measurements" and "Entering Physical Channel Information" sections of this chapter. Note that TX MS BS must be set to BS .
2. Press Power in the Main menu, then COMBINER TUNING . The spectrum analyzer reference level is automatically set to the optimum value based on the measured carrier power level.
3. If required the spectrum analyzer settings can be adjusted. Press REF LVL to adjust the reference level, SCALE LOG for the amplitude scale, START FREQ for the start frequency, and STOP FREQ for the stop frequency.
4. Adjust the output power of the transmitters. As the outputs are adjusted for equal amplitude, the distance between the upper and lower marker lines (Δ Pwr) will decrease.

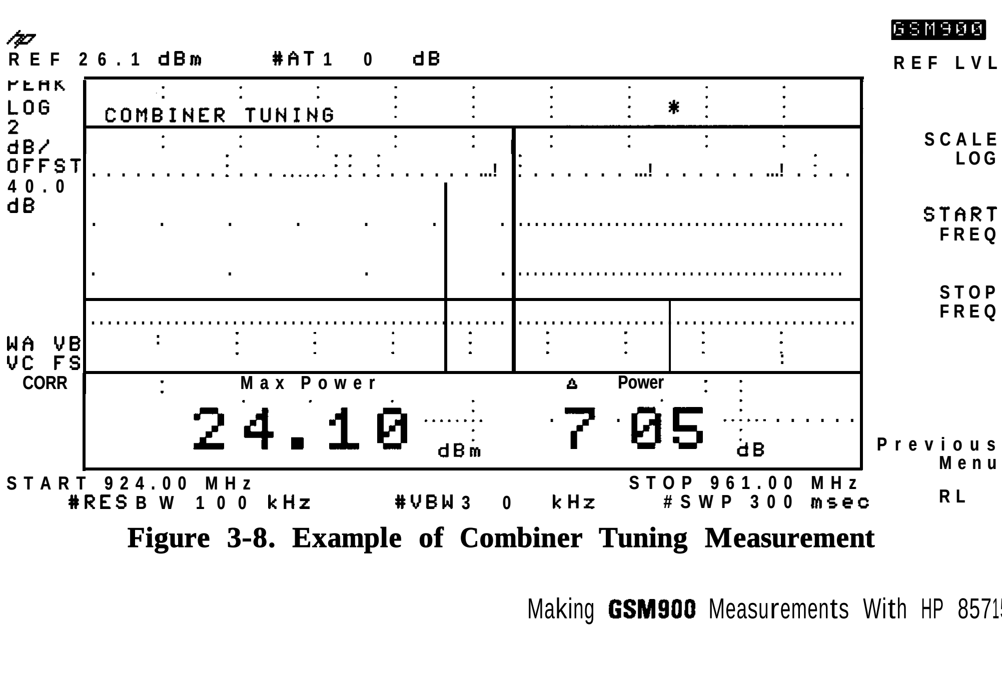


Figure 3-8. Example of Combiner Tuning Measurement

Making the Power vs Time Measurement

Description

The power versus time measurement analyzes the amplitude profile and timing of the bursted signal. Two of the five power versus time formats available with this GSM9OO personality are full frame and full timeslot. The other three formats are listed under sub-timeslot and are top 10 dB (of the GSM9OO pulse), rising edge, and falling edge.

When any, of the power versus time measurements are selected, the program sets the spectrum analyzer to the GSM9OO specified values for the measurement. The spectrum analyzer reference level is automatically set to the optimum value based on the measured carrier power level. The transmitter signal is then compared to a limit-line template, with limits derived as a function of the mean transmitted carrier power level. Limit pass or fail results are displayed at the completion of the measurements.

SFH mode is available for this measurement.

An external frame trigger signal is required for this measurement.

Specification GSM 5.05 section 4.5 and Annex B provide general information on making power versus time measurements.

Specification GSM 11.20 *section 2.1.6.4* outlines the test method and limits for measuring power versus time for base stations.

Specification GSM 11.10 *section* 13.3 outlines the test method and limits for measuring power versus time for mobile stations.

Test Procedure

1. Enter all the information as specified in the "Configuring the System for GSM9OO Measurements" and "Entering Physical Channel Information" sections of this chapter. For this test, specifically enter the desired ARFCN and TN via the Physical Channel menu. Refer to Chapter 7, "Menu Maps" for the menu maps.
2. Press Power vs Time in the Main menu.
   - Press P vs T FRAME to activate the full frame measurement.
   - Press P vs T TIMESLOT to activate the full timeslot measurement.
   - Press P vs T SUB TS to access the next three measurement formats.
     - Press P vs T TOP 10dB to measure the top 10 dB portion of the GSM9OO burst.
     - Press P vs T RISING to measure the rising edge of the GSM9OO burst.
     - Press P vs T FALLING to measure the falling edge of the GSM9OO burst.

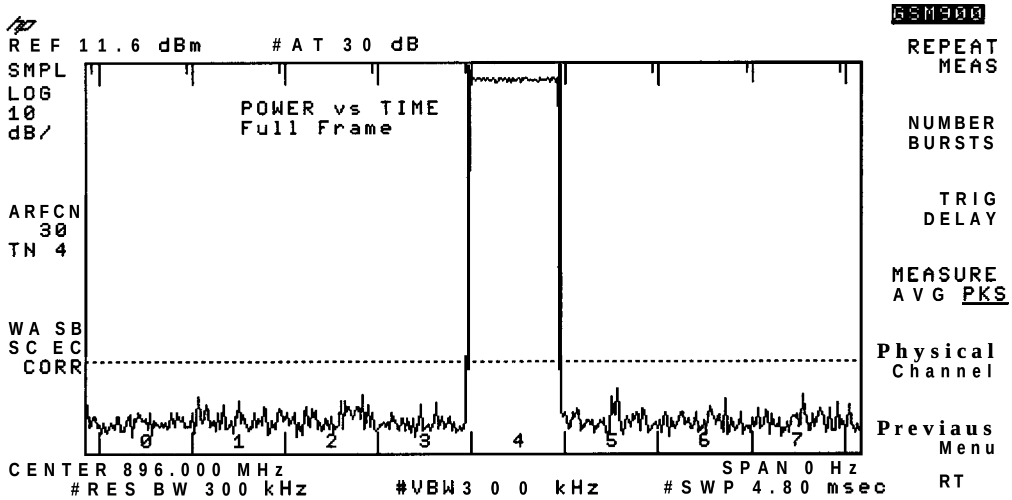


Figure 3-9. Example of Power vs Time, Full-Frame Measurement Result

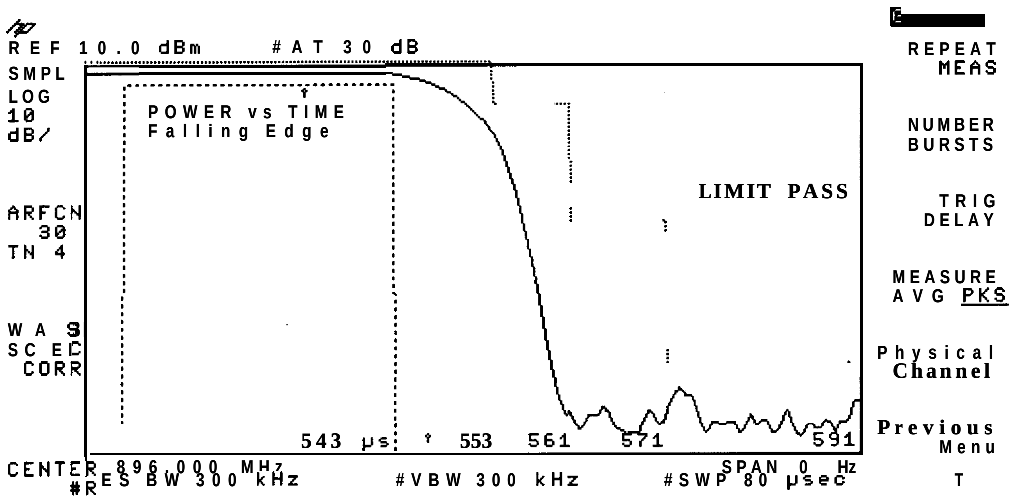


Figure 3-10. Example of Power vs Time, Falling-Edge Measurement Result

Note For the Power vs Time Falling measurement, the "rising edge" viewed during the first 4μs is due to the limitations of the delayed trigger hardware. It is *not* the rising edge of the burst. Data viewed after the first 4μs until the end of the 80μs sweep is valid.

3. Use the following keys to further modify the power vs time test parameters for any of the power vs time measurement formats:

   a. Press NUMBER BURSTS to change the number of bursts to be averaged, if desired. The GSM900 preset value is 1 which allows the power versus time signal to be continually measured. For values greater than 1, the sweep stops after the selected number of bursts is reached. Changing the value automatically repeats the measurement.

   b. Press TRIG DELAY to change the trigger delay value, if desired. Use the keys or the knob to enter a new value, then terminate with μs.

      A positive trigger delay shifts the displayed trace to the right, and a negative delay shifts the trace to the left. If the delay time is unknown, you can use the power versus time measurement to adjust the trigger delay time for relative measurements.

c. Press MEASURE AVE PKS and underline AVG to activate the averaging measurement. Underline PKS to activate the minimum-peaks and maximum-peaks measurement. This selection only applies when NUMBER BURSTS is greater than 1.

d. Press Physical Channel , then press either ARFCN or TIMESLOT NUMBER and enter a new value if you want to change either of these settings.

e. Press Previous Menu to return to the measurement menu.

4. Press REPEAT MEAS to restart the measurement after making any settings changes or just to make the measurement again. You can also change parameters such as the resolution bandwidth, then repeat the measurement at the new resolution bandwidth setting by pressing REPEAT MEAS . Return to the current GSM900 menu from the spectrum analyzer keys by pressing (MODE) (MODE).

Making Output RF Spectrum Measurements

Description

The output RF spectrum measurements determine the spectral energy emitted into the adjacent channels. The measurements are divided into two main groups. One group measures the RF spectrum that is due to the 0.3 GMSK modulation and the other measures the RF spectrum that is due to switching transients (burst ramping). In addition, you can measure the RF spectrum due to modulation in the RX band.

SFH mode is available for Output RF Spectrum Swept Measurements.

An external frame trigger signal is required for the spectrum due to modulation measurement, but is *not* required for the RF spectrum due to transient measurements.

Specification GSM 5.05 section 4.2 provides general information on making output RF spectrum measurements.

Specification GSM 11.20 section 2.1.6.5 outlines the test method and limits for measuring the output RF spectrum for base station transmitters.

Specification GSM 11.10 section 13.4 outlines the test method and limits for measuring the output RF spectrum for mobile stations transmitters.

GSM Specifications specify a test method where the spectrum analyzer, in zero span, is tuned to specified offsets from the carrier frequency. The HP 85715B GSM900 Transmitter Measurements Personality identifies this as single-offset or multiple-offset modes. The measurement made in these two modes is the same, except that the multiple-offset mode automatically makes the measurement at all the specified offset frequencies and lists the results in a table at the end of the measurement.

In these modes, the following conditions are met:

- In the output RF spectrum due to modulation measurement, the average value during at least 40 bits between bit 87 and 132 (approximately equivalent to the 50% to 90% portion of the burst, excluding midamble) is retained. The vertical lines mark the section of the burst over which the measurement is made. If multiple bursts are examined, an average of the average values is calculated. The relative power (difference between the average power of the burst at zero offset and the average power of the burst at the indicated offset) and the absolute power are displayed.
- In the output RF spectrum due to transients, the peak value of the burst is retained. If multiple bursts are examined, then the maximum of the peak values is retained. The relative power (difference between the peak power of the burst at zero offset and the peak power of the burst at the indicated offset) and the absolute power are displayed.

Another measurement method is the swept-frequency mode which uses the Option 105 time-gated spectrum analysis card. During this measurement, the GSM900 Transmitter Measurements Personality sweeps the spectrum analyzer, with the gate turned on only for the desired portion of the burst. The measurement results depicts the output RF spectrum in a graphic format, rather than numerical, as with the multiple-offset measurement. Limit lines corresponding with measurement limits as set by GSM specifications are displayed on the CRT. Pass or fail messages are displayed at the completion of the measurement.

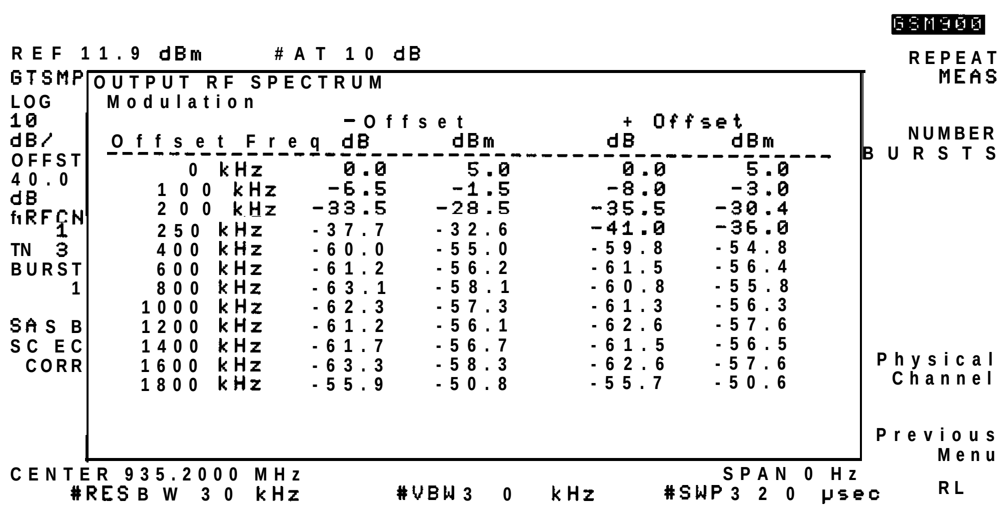
Notes

1. The default output RF spectrum measurements do not perform tests at frequency offsets greater than 1800 kHz from the carrier.
2. For each of the following measurements, enter all the information as specified in the "Configuring the System for GSM900 Measurements" and "Entering Physical Channel Information" sections of this chapter. Especially enter the desired ARFCN and TN via the Physical Channel menu.

Measurement Procedures for Output RF Spectrum Due to Modulation

For Modulation in Multiple- and Single-Offset Mode

1. Press Out RF Spectrum in the Main menu. Refer to Chapter 7, "Menu Maps" for the menu maps.
2. Press RF Spect Modulat , then MODULAT MULTIPLE . Review the table that appears at the end of the measurement.



Offset Freq	− Offset dB	− Offset dBm	+ Offset dB	+ Offset dBm
0 kHz	0.0	5.0	0.0	5.0
100 kHz	-6.5	-1.5	-8.0	-3.0
200 kHz	-33.5	-28.5	-35.5	-30.4
250 kHz	-37.7	-32.6	-41.0	-36.0
400 kHz	-60.0	-55.0	-59.8	-54.8
600 kHz	-61.2	-56.2	-61.5	-56.4
800 kHz	-63.1	-58.1	-60.8	-55.8
1000 kHz	-62.3	-57.3	-61.3	-56.3
1200 kHz	-61.2	-56.1	-62.6	-57.6
1400 kHz	-61.7	-56.7	-61.5	-56.5
1600 kHz	-63.3	-58.3	-62.6	-57.6
1800 kHz	-55.9	-50.8	-55.7	-50.6

Figure 3-l 1.
Example of Output RF Spectrum Due to Modulation - Multiple Offset Mode Measurement Result

- Press NUMBER BURSTS to change the number of bursts to be averaged, if desired. The GSM9OO preset value is 1 which allows the signal to be continually measured. For values greater than 1, the sweep stops after the selected number of bursts is reached. Changing the value automatically repeats the measurement.

Note A minimum of 25 sweeps are averaged for the 0 kHz offset, regardless of the "number of bursts" value.

- Press Physical Channel , then press either ARFCN or TIMESLOT NUMBER and enter a new value if you want to change either of these settings. Press Previous Menu to return to the modulation multiple menu.
- Press Previous Menu, then MODULAT SINGLE to examine the level at single offset frequencies.
- If in single-offset mode, press CARRIER OFFSET and enter the desired offset value. Use the step keys to change the value by 200 kHz increments.
- Press REPEAT MEAS to restart the measurement after making any settings changes or just to make the measurement again. You can also change parameters such as the resolution bandwidth, then repeat the measurement at the new resolution bandwidth setting by pressing REPEAT MEAS . Return to the current GSM9OO menu from the spectrum analyzer keys by pressing (MODE) (MODE).

For Modulation in Swept Frequency Mode

1. Press Out RF Spectrum in the Main menu. Refer to Chapter 7, "Menu Maps" for the menu maps.
2. Press RF Spect Modulat , then MODULAT SWEPT . The measurement results are displayed at the completion of the test.
   - Press NUMBER BURSTS to change the number of bursts to be averaged, if desired. The GSM9OO preset value is 1 which allows the power versus time signal to be continually measured. For values greater than 1, the sweep stops after the selected number of bursts is reached. Changing the value automatically repeats the measurement.

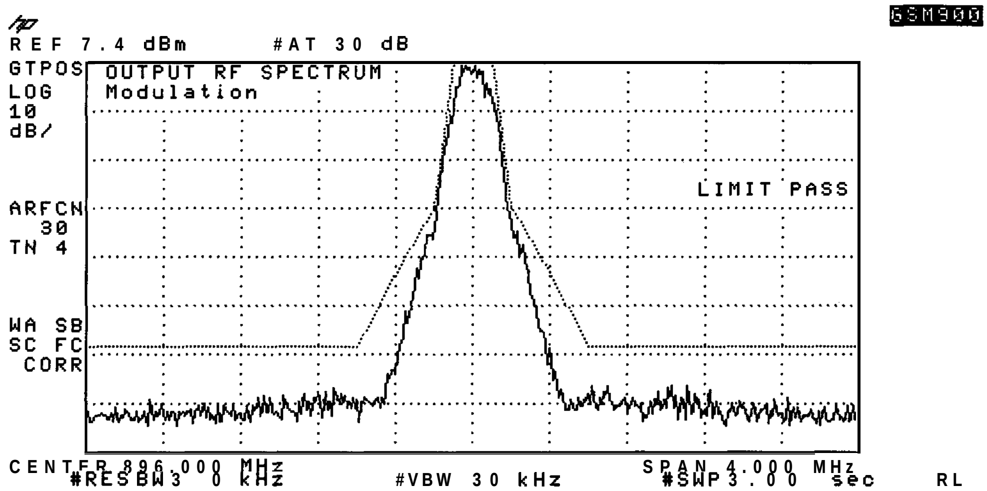


Figure 3-12.
Example of Output RF Spectrum Due to Modulation - Swept Frequency Mode Measurement Result

- Press Physical Channel , then press either ARFCN or TIMESLOT NUMBER and enter a new value if you want to change either of these settings. Press Previous Menu to return to the carrier power menu.
- Press SPAN and enter a new value to change the frequency span.
- Press REPEAT MEAS to restart the measurement after making any settings changes or just to make the measurement again. You can also change parameters such as the resolution bandwidth, then repeat the measurement at the new resolution bandwidth setting by pressing REPEAT MEAS . Return to the current GSM900 menu from the spectrum analyzer keys by pressing (MODE) (MODE).

Measurement Procedures for RF Spectrum due to Switching Transients

For Transients inMultiple- and Single-Offset Mode

1. Press Out RF Spectrum in the Main menu. Refer to Chapter 7, "Menu Maps" for the menu maps.
2. Press RF Spect Transnt , then TRANSNT MULTIPLE. Review the results that appears at the completion of the measurement.

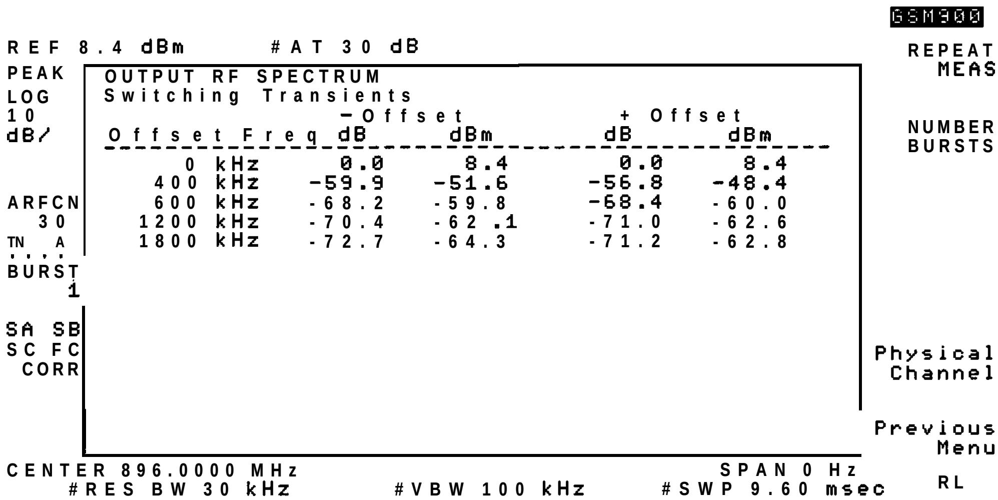


Figure 3-13.
Example of Output RF Spectrum Due to Switching Transients - Multiple Offset Mode Measurement Result

- Press NUMBER BURSTS to change the number of bursts to be used, if desired. The GSM900 preset value is 1 which allows the power versus time signal to be continually measured. For values greater than 1, the sweep stops after the selected number of bursts is reached. Changing the value automatically repeats the measurement.
- Press Physical Channel , then press either ARFCN or TIMESLOT NUMBER and enter a new value if you want to change either of these settings. Press Previous Menu to return to the transient multiple menu.
- Press Previous Menu, then TRANSNT SINGLE to examine the level at single offset frequencies.
- Press CARRIER OFFSET , if in single-offset mode, and enter the desired offset value. Use the step keys to change the value in 200 kHz increments.

. Press REPEAT MEAS to restart the measurement after making any settings changes or just to make the measurement again. You can also change parameters such as the resolution bandwidth, then repeat the measurement at the new resolution bandwidth setting by pressing REPEAT MEAS . Return to the current GSM900 menu from the spectrum analyzer keys by pressing (MODE) (MODE).

For Transient in Swept Frequency Mode

1. Press Out RF Spectrum in the Main menu. Refer to Chapter 7, "Menu Maps" for the menu maps.
2. Press RF Spect Modulat , then TRANSNT SWEPT . The results are displayed at the completion of the measurement.

■ Press NUMBER BURSTS to change the number of bursts to be used, if desired. The GSM900 preset value is 1 which allows the power versus time signal to be continually measured. For values greater than 1, the sweep stops after the selected number of bursts is reached. Changing the value automatically repeats the measurement.

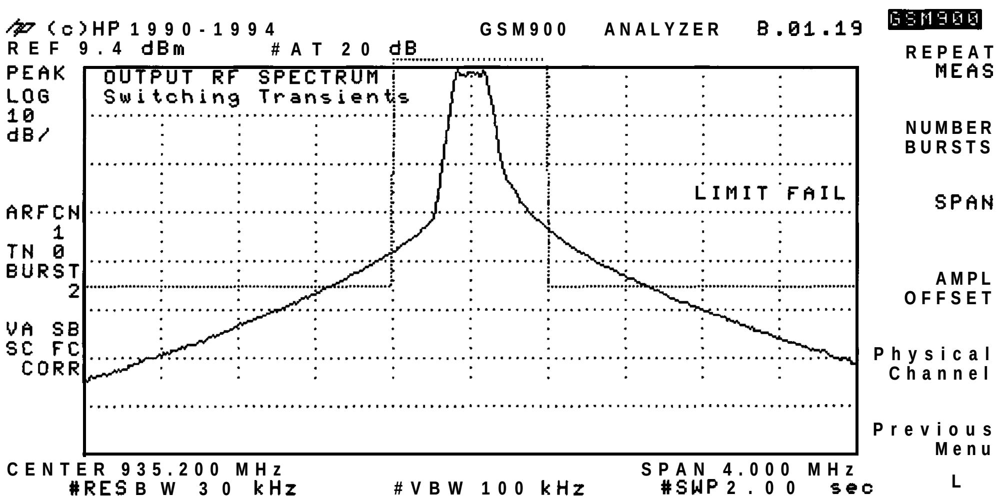


Figure 3-14.
Example of Output RF Spectrum Due to Switching Transients - Swept Frequency Mode Measurement Result

- Press Physical **Channel** , then press either **ARFCN** or **TIMESLOT NUMBER** and enter a new value if you want to change either of these settings. Press **Previous** ◆m■◆ to return to the carrier power menu.
- Press SPAN and enter a new value to change the frequency span.

. Press **REPEAT MEAS** to restart the measurement after making any settings changes or just to make the measurement again. You can also change parameters such as the resolution bandwidth, then repeat the measurement at the new resolution bandwidth setting by pressing REPEAT **MEAS** . Return to the current GSM900 menu from the spectrum analyzer keys by pressing (MODE) (MODE).

Measurement Procedures for Output RF Spectrum due to Modulation RX Band

1. Press Out RF Spectrum in the Main menu. Refer to Chapter 7, "Menu Maps" for the menu maps.
2. Press RF **Spect Modulat** , then **MODULAT** RX BAND . A caution and instruction message appears on the display.

Caution The spectrum analyzer is vulnerable to damage at the input during this measurement. The damage can occur because the input attenuator is set to 0 dB, and because the external attenuator is replaced by a bandpass filter. To *avoid analyzer damage*, you must observe the following precautions:

A receive-band bandpass filter (BPF) must be connected between the transmitter output and the spectrum analyzer INPUT 50Ω connector.

Make sure that the BPF used rejects the complete transmit band of the transmitter under test.

The total carrier power applied to the spectrum analyzer INPUT 50Ω can *not exceed* + 30 *dBm*. If the input exceeds + 30 dBm, spectrum analyzer damage may result.

---

3. Connect the receive-band BPF and the optional amplifier as illustrated in Figure 3-15.

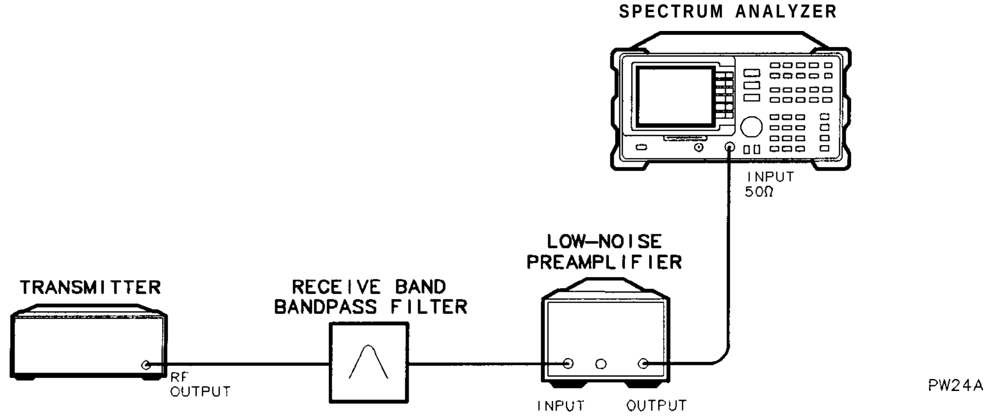


Figure 3-15.
Test Setup for Transmitter Output RF Spectrum Due to Modulation - RX Band

4. Press **PREAMP GAIN** and enter the combined value of preamplifier gain, bandpass filter loss, and cable loss. For valid measurements, the total power at the spectrum analyzer INPUT 50Ω, needs to remain less than -10 dBm.

5. Press **CONTINUE** *after the above steps are completed* to activate the measurement.

6. Review the graphic display of measurement results that appear at the completion of the test.

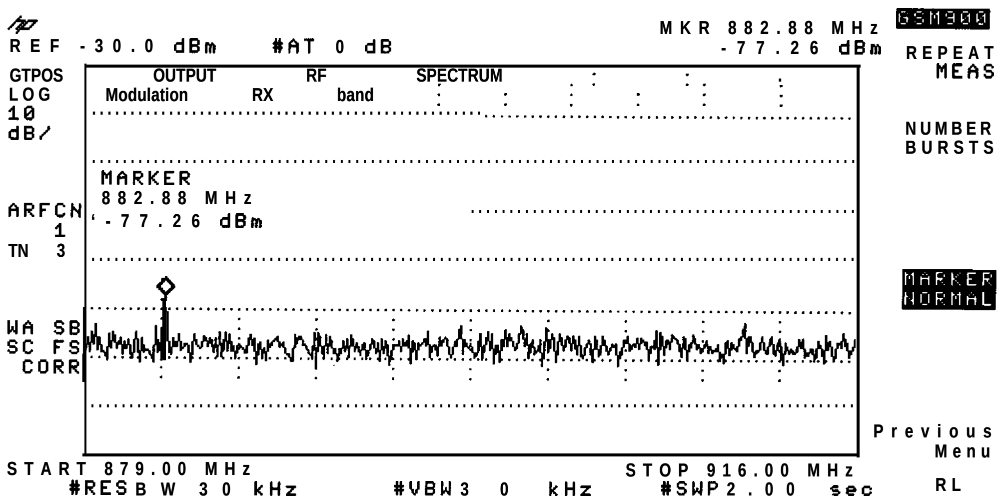


Figure 3-16.
Example of Output RF Spectrum Due to Modulation - RX Rand Measurement Result

7. Press MS CLASS 1 2-5 to underline either mobile station class 1, or class 2 through 5. The setting of this key affects the position of the displayed limit line.

Note The MS CLASS 1 2-5 key appears only if MS is underlined in TX BS MS .

8. Press REPEAT MEAS to repeat the measurement after you have changed any parameters or just to make the measurement again.

9. Press **NUMBER BURSTS** to change the number of bursts to be used, if desired. The default setting is 1 which allows the Output RF Spectrum in the RX band to be continually measured. For values greater than 1, the sweep stops after the selected number of bursts is reached. Changing the value automatically repeats the measurement.

Making the Spurious Emissions Measurement

Description

The spurious emissions test measures the power level of emissions at frequencies other than those of the carrier and sidebands associated with normal modulation and switching transients.

An external frame trigger signal is *not* required for this measurement.

SFH mode is available for Transmitter Spurious - RX Band, Transmitter Spurious - Outside TX and RX Band, and Receiver Spurious - Outside TX Band measurements.

Specification GSM 11.20 section 2.1.6.6 outlines the test method for measuring base station transmitter spurious emissions.

Specification GSM 11.10 12.1 outlines the test method for measuring mobile station transmitter spurious emissions.

Specification GSM 11.20 section 2.1.7.8 outlines the test method for measuring base station receiver spurious emissions.

Note This test measures spurious emissions at the antenna connector. Radiated and power-lead conducted spurious emissions are not specifically measured by the HP 85715B GSM9OO Transmitter Measurements Personality.

There are two groups of spurious emissions tests. One group measures transmitter spurious emissions, and the other group measures receiver spurious emissions. These two measurement groups each provide different test modes which are listed in their measurement descriptions.

At the completion of any test, a table of emissions that exceed or are within 6 dB of the GSM9OO specifications are listed by frequency and amplitude pairs.

Note Spurs in the table that are asterisked (*), indicate that they may actually be spectrum analyzer noise. In these cases, the spectrum analyzer's sensitivity specification exceeds or is within 6 dB of the GSM9OO spurious emissions specification. Investigate the spur more closely by removing the input signal. If the suspect spur remains, it is spectrum analyzer noise.

Measuring Transmitter Spurious Emissions

1. Press More 1 of 2, then Spurious Emission in the Main menu. Refer to Chapter 7, "Menu Maps" for the menu maps.
2. Press Xmtr Spurious.
3. Press TX BAND . Refer to Figure 3-17 for the test setup. The spectrum analyzer scans the band indicated and lists in a table the spurious signals that are found.

Note The transmitter must *not* be in SFH mode during this measurement.

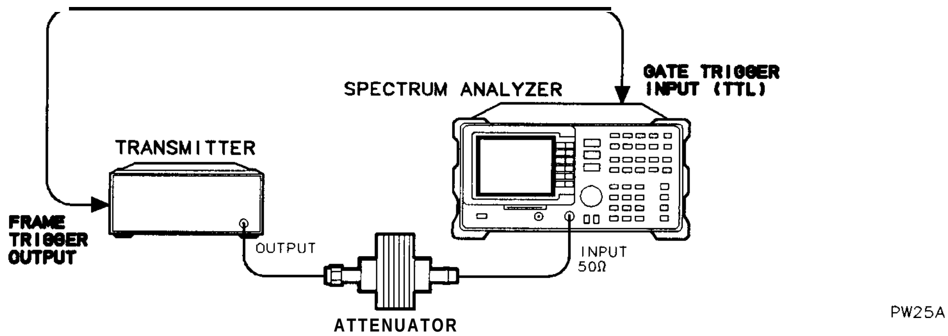


Figure 3-17. Test Setup Transmitter Spurious Emissions - TX Band/Outside Rand

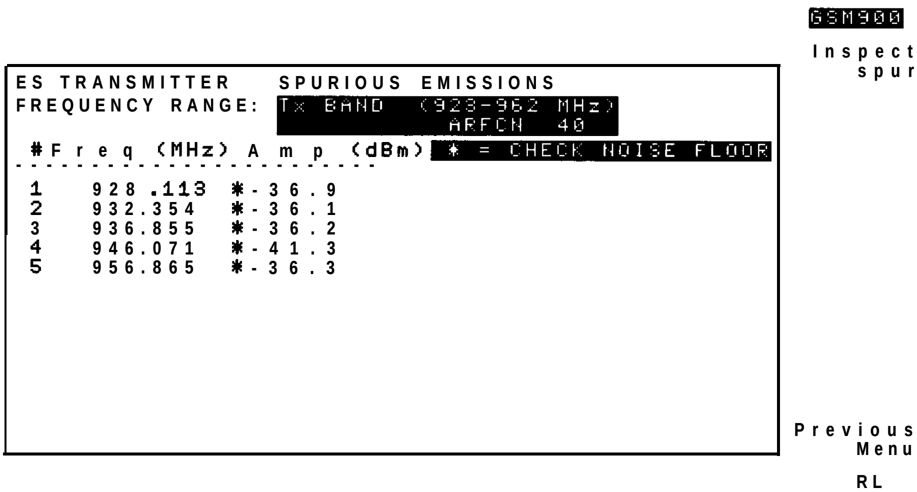


Figure 3-18. Example of Spurious Emissions in TX Rand Measurement Result

4. Press INSPECT SPUR at the completion of a measurement to examine a spur in the table more closely.

   a. Press ENTER SPUR # .

   b. Use the data keys to enter the number of the spur you want to review, then terminate the number with the (ENTER) key, or press (▲) or (▼) to automatically display other spurs. The spectrum analyzer state is automatically set to the state it was in when the spur was detected.

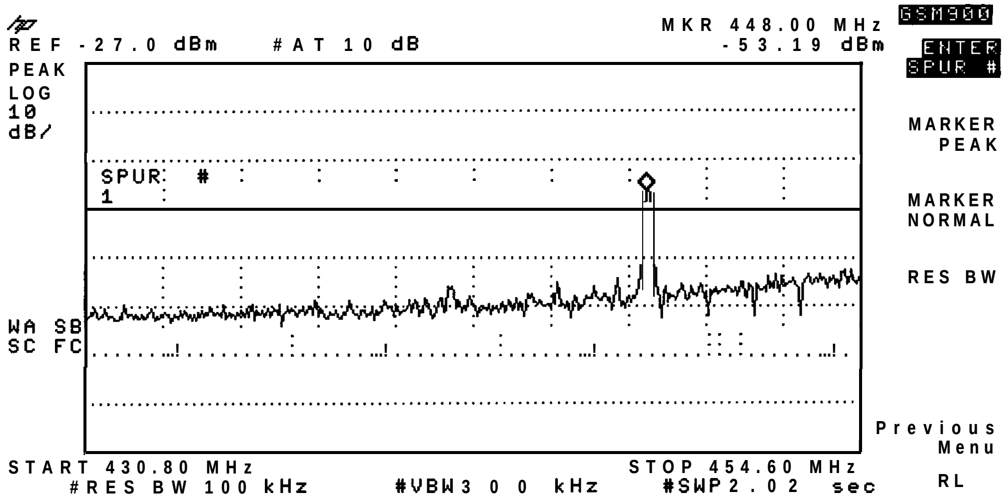


Figure 3-19. Example of Inspecting Spurs Routine

c. Press Previous Menu to return to the table of spurs found.

d. Press Previous Menu again to return to the Xmtr Spurious key.

5. Press OUTSIDE TX & RX . Refer to Figure 3-17 for the test setup. During the measurement, the spectrum analyzer scans outside the GSM900 transmit and receive bands for spurious signals. Spurious signals found are listed in a table.

6. Press INSPECT SPUR at the completion of a measurement to examine a spur in the table more closely, if any spurs were found.

   a. Press ENTER SPUR # .

   b. Use the data keys to enter the number of the spur you want to review, then terminate the number with the (ENTER) key, or press (▲) or (▼) to automatically display other spurs. The spectrum analyzer state is automatically set to the state it was in when the spur was detected.

   c. Press Previous Menu to return to the table of spurs found.

   d. Press Previous Menu again to return to the Xmtr Spurious key.

Notes

i. For spurs which are harmonically related to the carrier signal, and less than 2.9 GHz, spectrum analyzer distortion may mask the actual spurious amplitude level. To determine if this is the case, increase the spectrum analyzer input attenuator settings. Any change in the measured value of the signal indicates the spur is due to spectrum analyzer distortion.

ii. The SPUR TST ON OFF softkey can be used in the majority of applications to detect spurs which are internally generated by the spectrum analyzer without affecting the measurement of the external spurs. If the spur is determined to be internally generated it is removed from the table of spurious signals.

---

7. Press **RX BAND** . For RX band spurious emissions measurements, a caution and instruction message appears on the display. Connect the receive-band BPF and the preamplifier as illustrated in Figure 3-20.

Caution In this test setup, the transmitter output power is reflected by the bandpass filter back into the transmitter output port. Before connecting the equipment, make sure the transmitter can handle this power reflection without causing damage.

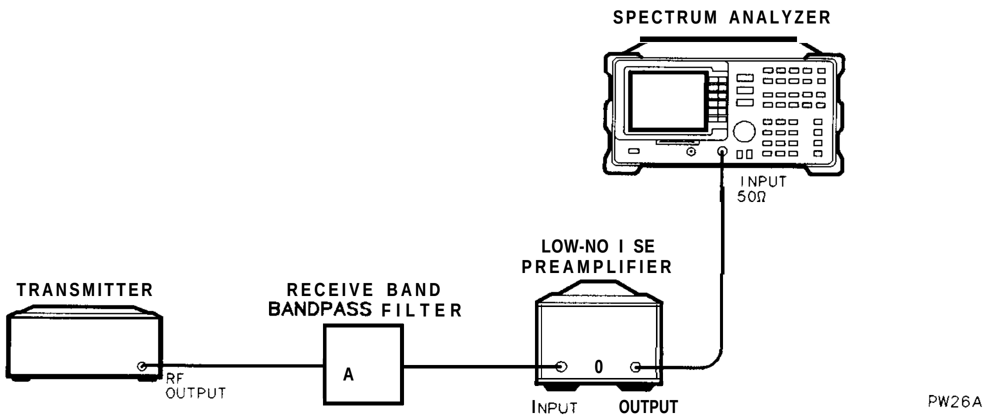


Figure 3-20. Test Setup for Spurious Emissions - RX Band

Caution The spectrum analyzer is vulnerable to damage at the input during the RX Band spurious emissions measurement. The damage can occur because the input attenuator is set to 0 dB, and because the external attenuator is replaced by a bandpass filter. To *avoid analyzer* damage, you must observe the following precautions:

A receive-band bandpass filter (BPF) must be connected between the transmitter output and the spectrum analyzer INPUT 50Ω connector.

Make sure that the BPF used rejects the complete transmit band of the transmitter under test.

The total carrier power applied to the spectrum analyzer INPUT 50Ω *can not exceed* + 30 *dBm*. If the input exceeds + 30 dBm, spectrum analyzer damage may result.

- Set the preamplifier gain correction factor to a value that takes into account the gain of the preamplifier, insertion loss of the bandpass filter, and any cable loss. For valid measurements, the total input power at the INPUT 50Ω connector must be kept to less than -10 dBm.

8. Press **CONTINUE** *afler the above steps are completed* to start the measurement.

9. Press **INSPECT** SPUR at the completion of a measurement to examine a spur in the table more closely, if any spurs were found.

a. Press **ENTER SPUR #** .

b. Use the data keys to enter the number of the spur you want to review, then terminate the number with the (ENTER) key, or press (▲) or (▼) to automatically display other spurs. The spectrum analyzer state is automatically set to the state it was in when the spur was detected.

c. Press **Previous** Menu to return to the table of spurs found.

d. Press Previous Menu again to return to the **Xmtr** Spurious key.

Measuring Mobile Station Transmitter (in Idle Mode) Spurious Emissions

To test mobile stations in idle mode, underline YES in IDLE YES NO . *Specification GSM* 11.10 specifies the measurement of TX Band and Outside TX Band spurious emissions. Refer to Figure 3-21 below for the test setup. Conduct the measurement as instructed in the previous section.

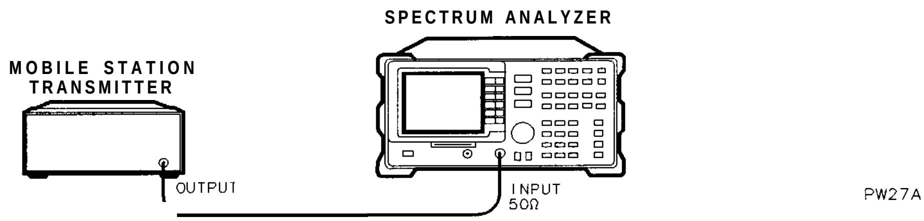


Figure 3-2 1. Test Setup for Spurious Emissions - Mobile Station Transmitter in Idle Mode

Measuring Receiver Spurious Emissions

1. Press More **1 of** 2, then Spurious Emission in the Main menu. Refer to Chapter 7, "Menu Maps" for the menu maps.

2. Press **Rcvr** Spurious. Refer to Figure 3-22 for the test setup.

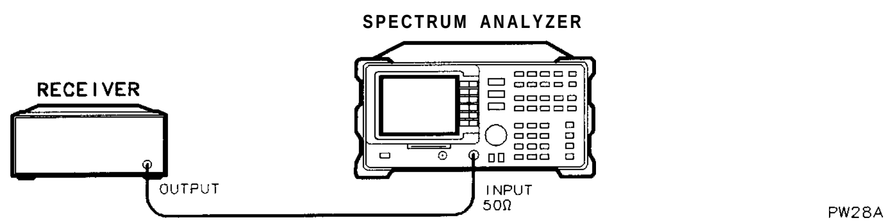


Figure 3-22. Test Setup for Receiver Spurious Emissions

3. Press TX **BAND** , the spectrum analyzer uses the current value of ARFCN and scans the band indicated and lists valid spurious signals in a table.

Note The transmitter must not be in SFH mode during this measurement.

---

4. Press **INSPECT** SPUR at the completion of the measurements to examine a spur in the table.

   a. Press **ENTER SPUR #** and enter the number of the spur you want to review. The spectrum analyzer state is automatically set to the state it was in when the spur was detected.

   b. Press Previous Menu to return to the table of spurs found.

   c. Press **Previous Menu** again to return to the **Rcvr** Spurious key.

5. Press OUTSIDE TX BAND . The spectrum analyzer scans the bands outside the GSM900 transceiver transmit band for spurious signals. Spurious signals that are found are listed in a table.

   a. Press **ENTER** SPUR **#** and enter the number of the spur you want to review. The spectrum analyzer state is automatically set to the state it was in when the spur was detected.

   b. Press Previous Menu to return to the table of spurs found.

   c. Press Previous Menu again to return to the **Rcvr** Spurious key.

Note The SPUR TST ON OFF softkey can be used in the majority of applications to detect spurs which are internally generated by the spectrum analyzer without affecting the measurement of the external spurs. If the spur is determined to be internally generated it is removed from the table of spurious signals.

Making the Intermodulation Attenuation Measurements

Description

The intermodulation attenuation measurement checks the capability of the base-station transmitter to inhibit the generation of intermodulation distortion products. Intermodulation products are caused by the interaction of the carrier and an interfering signal in the non-linear elements of the transmitter.

For the TX band measurement, the intermodulation attenuation value is defined as the dB ratio of the carrier output power to the highest intermodulation component. For this test, the transmitter is set to maximum power and SFH mode is disabled.

Specification GSM 11.10 *section 13.5* specifies the test method for measuring intermodulation products of mobile stations.

Specification GSM 11.20 *section 2.1.6.7* specifies the test method for measuring intermodulation products of base stations.

The two parts of the intermodulation attenuation measurement are as follows:

- The TX BAND selection tests for intermodulation products that fall within the base station transmitter's transmit band (925 MHz to 960 MHz). For this test, a CW test signal is injected into the transmitter at either 800 kHz above or 800 kHz below the carrier signal.
- The RX BAND selection tests for the intermodulation products that fall within the receive band (880 MHz to 915 MHz) of the base station. For this test, a CW test signal is injected into the transmitter. The CW test signal is separated from the carrier, such that the third-order, fifth-order, or seventh-order intermodulation product falls on the corresponding channel in the receive band.

An external CW source is required to create the interfering signal. A circulator is also required. In testing the receive band (880 MHz to 915 MHz), a preamplifier and receive-band BPF is needed.

For both measurements, the carrier output power is first measured. The CW source is then set 30 dB below the carrier's power level to produce the selected intermodulation product.

An external frame trigger signal is *not* required for this measurement.

Note The intermodulation attenuation measurements only test for expected intermodulation products at selected frequencies.

For TX Band Intermodulation Products

1. From the Main menu, press More 1 of 2 , then **Intermod**. Refer to Chapter 7, "Menu Maps" for the menu maps.
2. Press **Intermod Atten**, then TX BAND. Refer to Figure 3-23 for the initial test setup. If a carrier is present, the spectrum analyzer measures the carrier to determine its peak power.

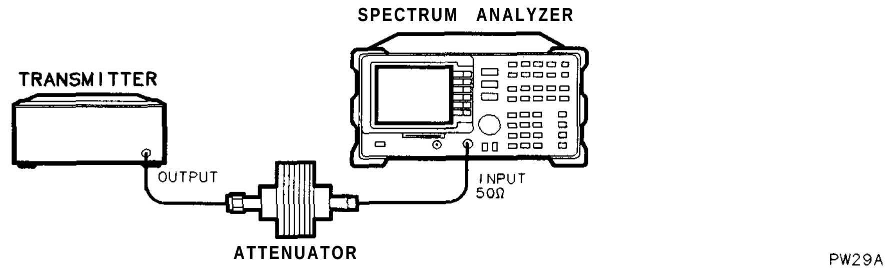


Figure 3-23. Test Setup for Initial Intermodulation Attenuation Measurement

Note Intermodulation attenuation measurements are relative to a carrier. If a carrier with a signal level greater than -10 dBm is not detected, the message `NO CARRIER, TEST STOPPED !` appears. Check the cable connections to the spectrum analyzer input.

3. Read the message that appears on the display.
4. Decide whether you want the interfering signal 800 kHz above or 800 kHz below the carrier. Refer to the steps below:
   a. Press **ABOVE** to measure intermodulation products due to an interfering signal 800 kHz above the carrier.
   b. Press BELOW to measure intermodulation products due to an interfering signal 800 kHz below the carrier.
5. Read the message that appears on the display and connect the equipment as described in the text. Refer to Figure 3-24 for the equipment setup.

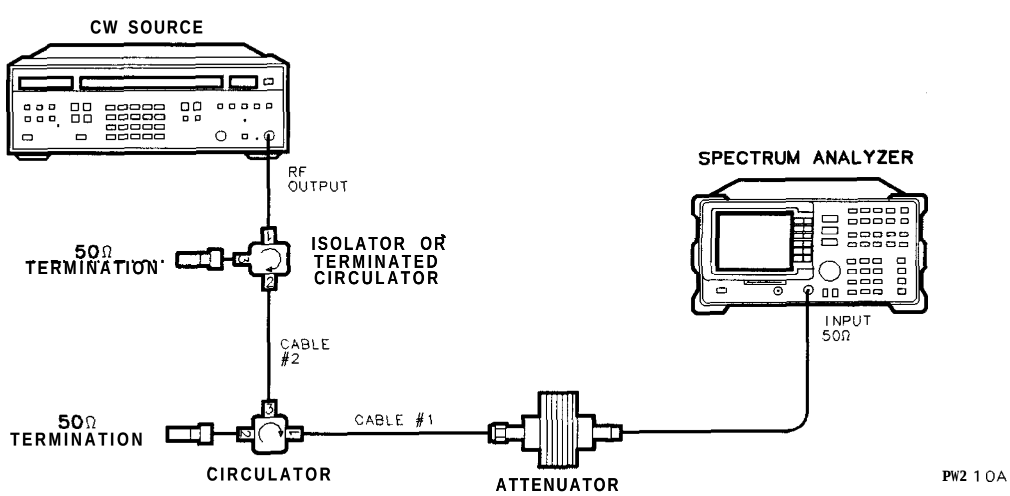


Figure 3-24. Test Setup for CW Source Adjustment

6. Press CONTINUE when you are ready.
7. Adjust the CW source frequency and amplitude for the values displayed in the upper left-hand corner of the graticule. The CW source frequency should be in the center of the display. The source amplitude should be at the display line on the display.
8. Press CONTINUE when ready.

Note	If the CW source frequency or amplitude are not set correctly, the message **FREQUENCY >0.** 1 MHz OFF! or AMPLITUDE **>1 dB** OFF! appears. The measurement can continue, however, the final measurement results may not be valid.

9. Read the text and make the test setup connections described in the displayed text. Refer to Figure 3-25 for the test setup.

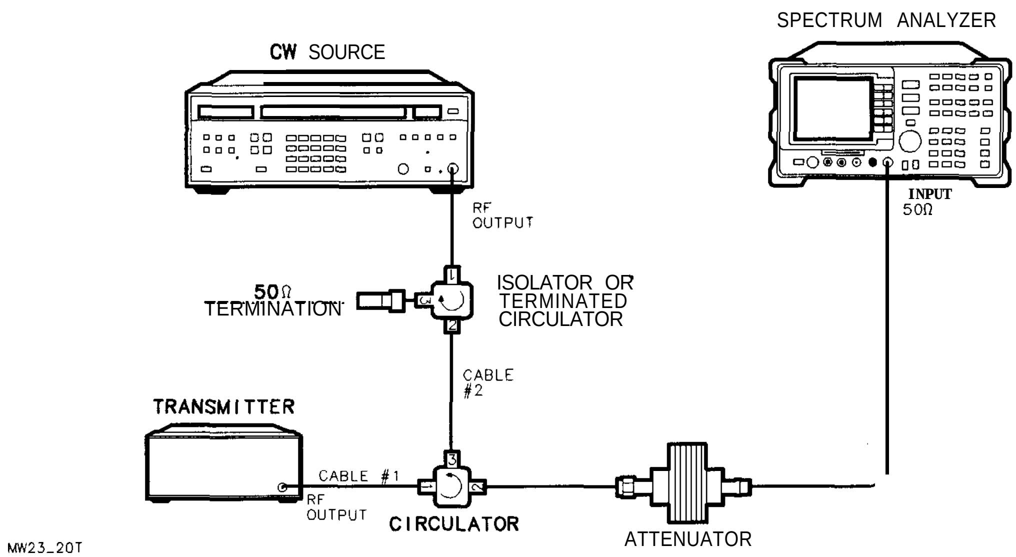


Figure 3-25. Test Setup for Intermodulation Attenuation - TX Band

10. Press CONTINUE when you are ready to start the measurement. The test results are displayed at the completion of the measurement.

Note	If a carrier> −20 dBm is not detected, the message NO CARRIER, CHECK SETUP! appears. The setup information from the previous screen is displayed again.

The measurement result trace is stored in a viewed trace. A second trace is enabled to sweep. Adjustments that affect the level of the products may then be made. The results are immediately displayed on the sweeping trace.

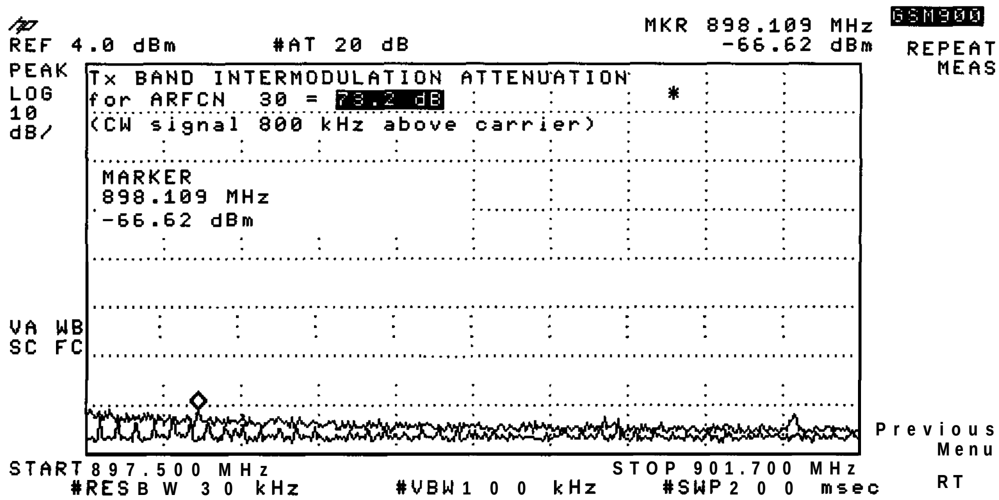


Figure 3-26. Example of Intermodulation Attenuation - TX Rand Measurement Result

11. Press REPEAT **MEAS** to restart the measurement after making any settings changes or just to make the measurement again.
12. Press Previous **Menu** to return to the top level **Intermod Atten** menu. You can select another ARFCN or intermodulation product in the top level menu.

For RX Band Intermodulation Products

1. Connect the equipment as shown in Figure 3-27. Press **Intermod Atten**, then RX **BAND**. Refer to Chapter 7, "Menu Maps" for the menu maps. If a carrier is present, the spectrum analyzer measures the carrier to determine its peak power.

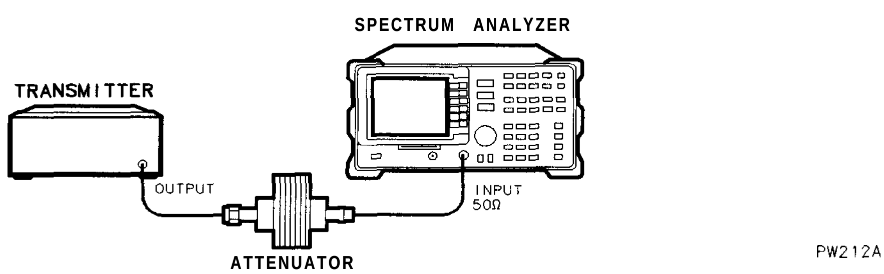


Figure 3-27. Test Setup for Initial Intermodulation Attenuation - RX Rand

---

Note If a carrier is not detected, the message `NO CARRIER, TEST STOPPED !` appears. Check the connections to the spectrum analyzer input. Repeat the above steps after you have resolved the problem.

---

2. Read the message that appears on the display. Decide whether you want the interfering signal to produce third, fifth, or seventh order intermodulation products. Refer to the descriptions below:

- Press 3rd to measure an intermodulation product due to an interfering signal producing a 3rd order product.

- Press 5th to measure an intermodulation product due to an interfering signal producing a 5th order product.
- Press 7th to measure an intermodulation product due to an interfering signal producing a 7th order product.

3. Read the text displayed and make the connections described. Refer to Figure 3-28 for the equipment setup.

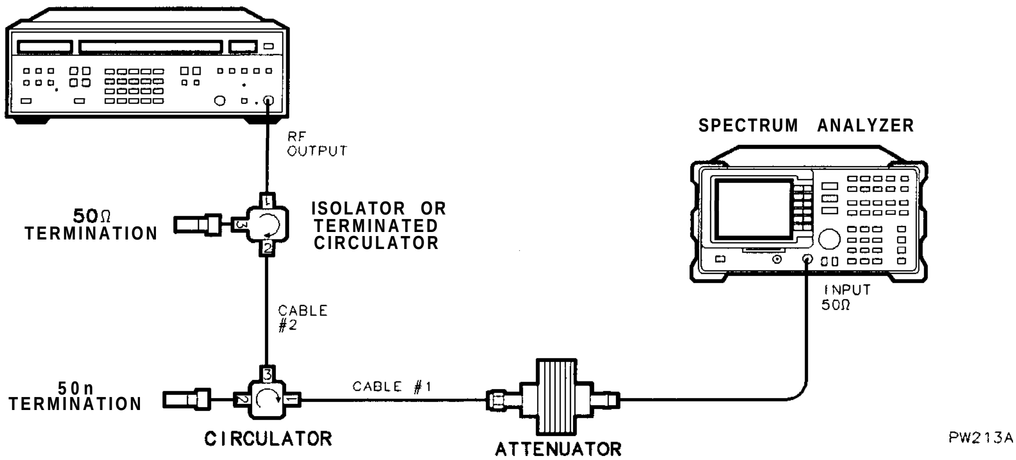


Figure 3-28. Test Setup for CW Source Adjustment

4. Adjust the CW source frequency and amplitude for the values displayed in the upper left-hand corner of the graticule. The CW source frequency should be in the center of the display. The source amplitude should be at the display line on the display.
5. Press CONTINUE when ready.

Note If the CW source frequency or amplitude are not set correctly, the message `FREQUENCY >0.1 MHz OFF!` or `AMPLITUDE >1 dB OFF!` appears. The measurement can continue, however, the final measurement results may not be valid.

---

6. Read the text and make the test setup connections described in the displayed text. Refer to Figure 3-29 for the test setup.

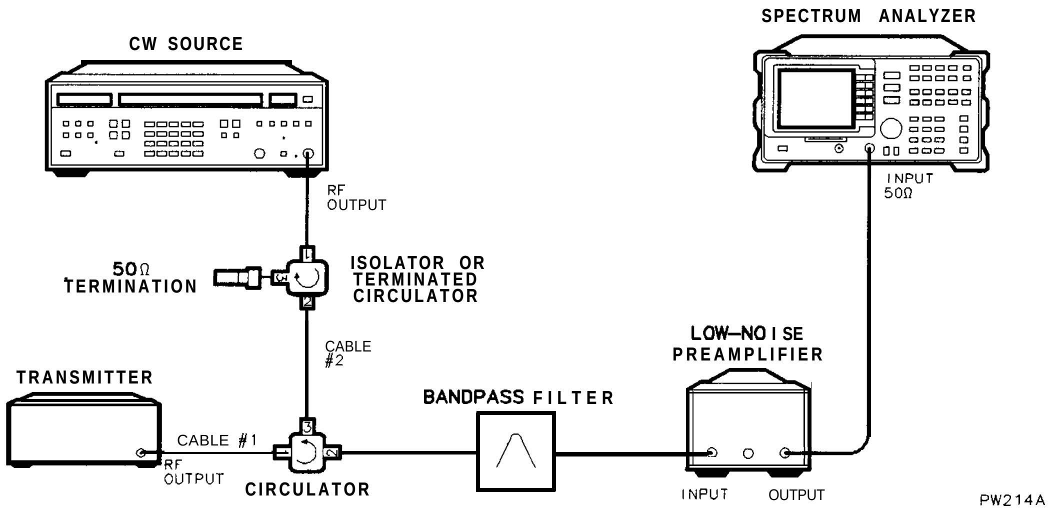


Figure 3-29. Test Setup for Intermodulation Attenuation - RX Rand

Caution The spectrum analyzer is vulnerable to damage at the input during this measurement. The damage can occur because the input attenuator is set to 0 dB, and because the external attenuator is replaced by a bandpass filter. lb *avoid* analyzer *damage*, you must observe the following precautions:

A receive-band bandpass filter (BPF) must be connected between the transmitter output and the spectrum analyzer INPUT 50Ω connector.

Make sure that the BPF used rejects the complete transmit band of the transmitter under test.

The total carrier power applied to the spectrum analyzer INPUT 50Ω *can not exceed +30 dBm*. If the input exceeds +30 dBm, spectrum analyzer damage may result.

Caution For the test setup illustrated in Figure 3-29, the base station output power is reflected from the bandpass filter (BPF), through the circulator, and into the isolator/circulator at the output of the CW source. Make certain that this isolator/circulator is capable (rated) of dissipating the output power generated by the base station transmitter. Failure to supply an adequately rated isolator/circulator can damage the isolator/circulator or the CW source.

7. Press CONTINUE when ready.

Note If a carrier larger than -20 dBm is detected, the message CARRIER PRESENT, CHECK SETUP! is displayed. The test setup screen is displayed again.

8. Read the caution screen that is displayed. Verify the test setup connections.

9. Adjust the PREAMP GAIN value displayed, if necessary. This value needs to be the combined preamplifier gain, cable loss, BPF loss values in the next screen. Press CONTINUE to activate the measurement. The test results are displayed at the completion of the measurement. The measurement results trace is stored in a viewed trace, and a second trace is enabled to sweep. Adjustments that affect the level of the products may then be made, and the results are immediately viewed on the sweeping trace.

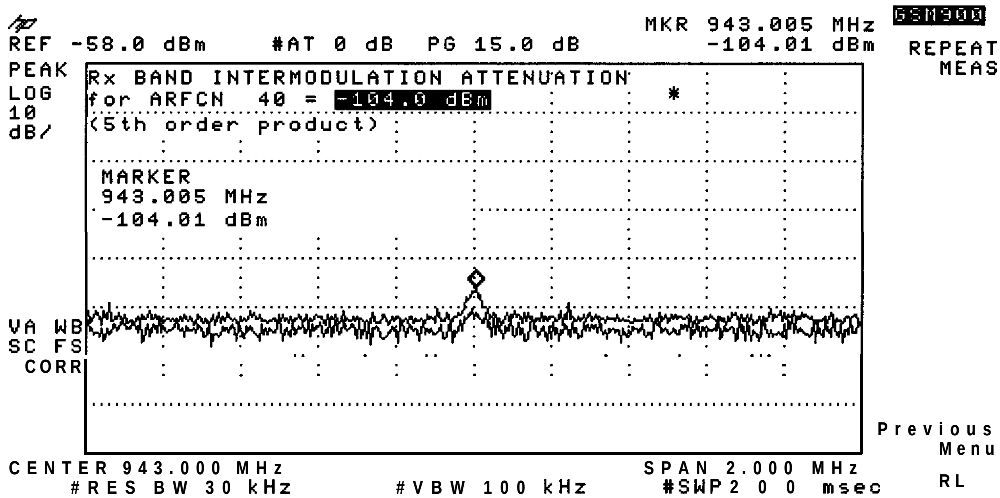


Figure 3-30.
Example of Intermodulation Attenuation - RX Rand Measurement Results

10. Press REPEAT MEAS to restart the measurement after making any settings changes or just to make the measurement again.

11. Press Previous Menu to return to the top level Intermod Atten menu. You can select another intermodulation product in the top level menu.

Making the Intra-BSS Intermodulation Attenuation Measurement

Description

The intra-base station measurement examines the intermodulation products caused by combining several transmitters to a single antenna. The leakage of each carrier into the other transmitters and the presence of non-linear elements causes intermodulation products to appear

This test assumes that in addition to the other carriers, there is a reference channel (ARFCN = 3) present. You can change the ARFCN to another channel, if desired. Press **REF CHANNEL** , then enter the number of the desired channel. The transmitters are set to maximum power and the channel spacing is set to minimum.

For the TX Band measurement, the Intra-BSS Intermodulation Attenuation measurement is defined as the dB ratio of the reference channel carrier output power to the highest intermodulation component.

Specification GSM 11.20, Section 2.1.6.8 describes the test method and limits for measuring the intra-BSS intermodulation products for base stations.

The Intra-BSS measurement is divided into the following two parts:

- The TX **BAND** selection measures intermodulation products that occur within the transmitters transmit band.
- The RX **BAND** selection measures intermodulation products which fall within the transmitters receive-band. The receive-band measurement requires the use of an external preamplifier and receive-band bandpass filter (BPF).

An external frame trigger signal is *not* required for this measurement.

Notes

1. The default intra-BSS intermodulation attenuation measurements do not perform tests at frequency offsets greater than 1800 kHz from the carrier.
2. In certain cases, spectrum analyzer distortion products may mask intermodulation products. To determine the cause of the product, increase the spectrum analyzer's input attenuator setting. Any change in the indicated value of the signal indicates the product is due to spectrum analyzer distortion products.

For TX Band Intra-BSS Intermodulation

Caution The total power of all carriers may exceed the rated value of the recommended 30 dB attenuator (HP 8498A Option 030 attenuator) or the +30 dBm safe input level to the of the spectrum analyzer's INPUT 50Ω connector. Be sure to provide adequate protection if this is a potential during your measurement to prevent damage to the attenuator or the spectrum analyzer.

1. Refer to Figure 3-31 for the test setup.

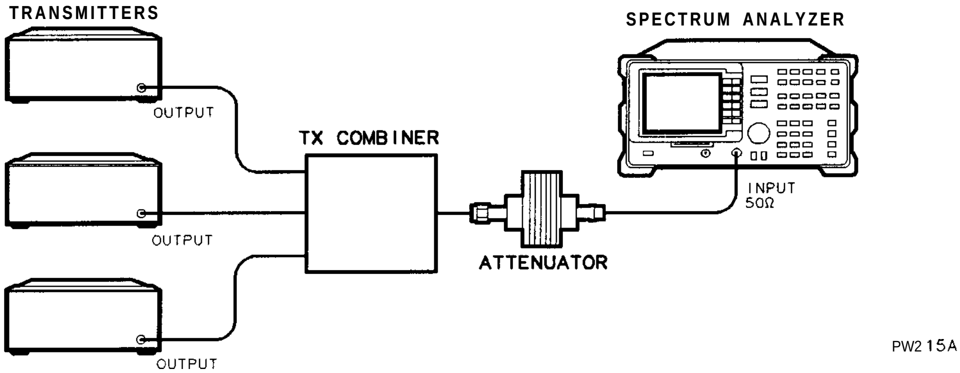


Figure 3-31. Test Setup for Intra-BSS Intermodulation - TX Band

2. Press `Intermod`, then `IntraBSS Intermod` and TX HAND. Refer to Chapter 7, "Menu Maps" for the menu maps. If carriers are detected, the spectrum analyzer measures the total power to determine the analyzer reference level setting, then measures the reference channel output power. Once these measurements are finished, the Intra-BSS Intermodulation measurement starts.

Note If a carrier is not detected, the message `NO CARRIER, TEST STOPPED!` is displayed. This test requires a carrier signal because it is a dB relative measurement.

If the reference channel is not detected, the message REFERENCE CHANNEL NOT `PRESENT! TEST STOPPED!` is displayed.

---

3. At the completion of the measurement, the results are displayed in the upper left-hand corner of the display. The results trace is stored in a viewed trace, and a second trace is enabled to sweep. Adjustments that affect the level of the products may then be made, and the results are immediately viewed on the sweeping trace.

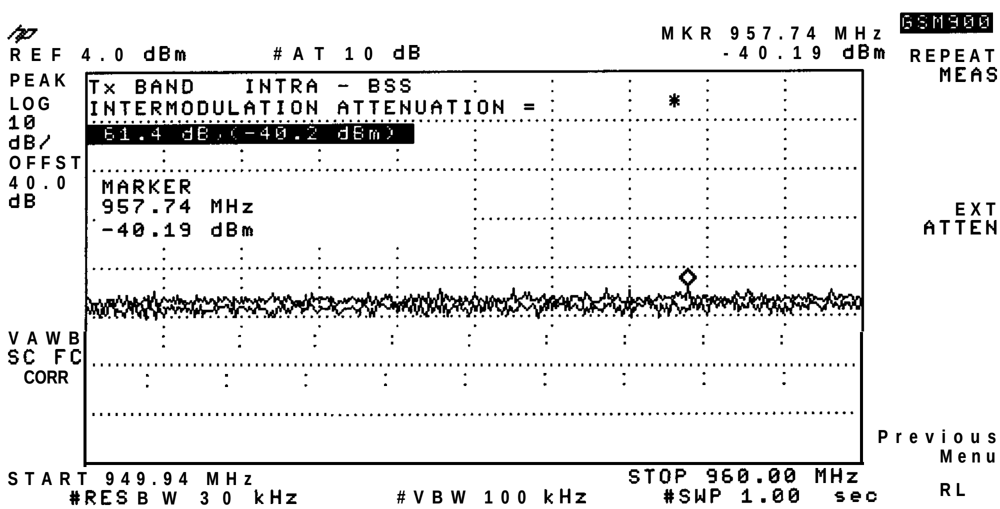


Figure 3-32. Example of Intra-BSS - TX Band Measurement Result

4. Press REPEAT MEAS to restart the measurement after making any settings changes or just to make the measurement again.

5. Press Previous Menu to return to the top level Intra-BSS Intermodulation menu.

Note If the spectrum analyzer's sensitivity specification is greater than the GSM900 intermodulation attenuation specification, the message CHECK NOISE FLOOR! appears.

For RX Band Intra-BSS Intermodulation

For sufficient dynamic range, a preamplifier and bandpass filter (with a frequency range covering the receive-band frequencies), must be included in the test setup. Refer to the text on the display.

Caution The spectrum analyzer is vulnerable to damage at the input during this measurement. The damage can occur because the input attenuator is set to 0 dB, and because the external attenuator is replaced by a bandpass filter. To *avoid analyzer damage*, you must observe the following precautions:

A receive-band bandpass filter (BPF) must be connected between the transmitter output and the spectrum analyzer INPUT 50Ω connector.

Make sure that the BPF used rejects the complete transmit band of the transmitters under test.

The total carrier power applied to the spectrum analyzer INPUT 50Ω *can not exceed +30 dBm.* If the input exceeds +30 dBm, spectrum analyzer damage may result.

1. Refer to Figure 3-33 for the test setup.

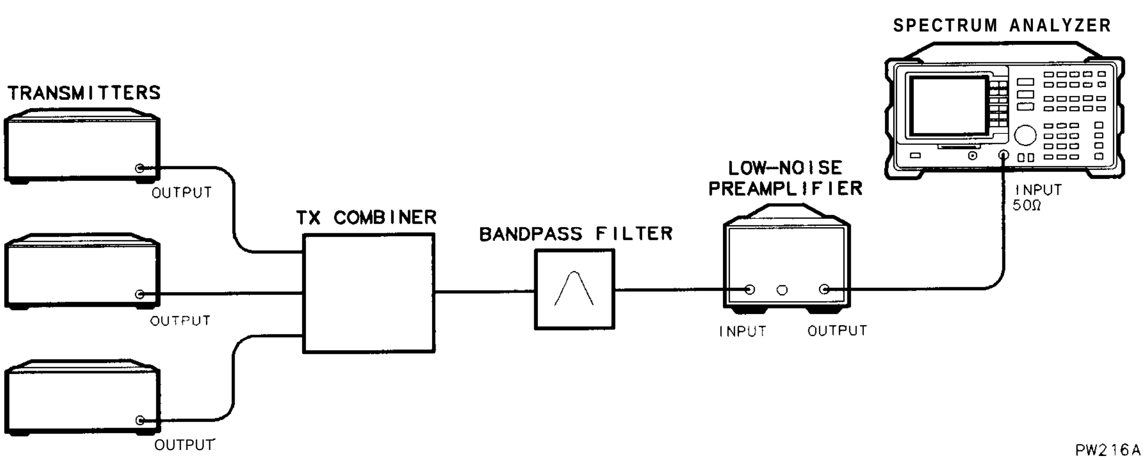


Figure 3-33. Test Setup for Intra-BSS Intermodulation - RX Band

2. Press Intermod , IntraBSS Intermod , then RX BAND . Refer to Chapter 7, "Menu Maps" for the menu maps.

3. Read the caution screen displayed. Read the text, then verify the connections.

4. Adjust the displayed PREAMP GAIN value if necessary. This value needs to be the combined value of preamplifier gain, cable loss, and BPF loss. Press CONTINUE to activate the measurement.

Note If a carrier >−20 dBm is detected, the message CARRIER PRESENT, TEST STOPPED ! is displayed.

---

5. The measurement results are displayed on the screen at the completion of the test. The results trace is stored in a viewed trace, and a second trace is enabled to sweep. Adjustments that affect the level of the products may then be made, and the results are immediately viewed on the sweeping trace.
6. Press REPEAT MEAS to restart the measurement after making any settings changes or to make the measurement again.
7. Press Previous Menu to return to the top level Intra-BSS Intermodulation menu.

Making the Phase and Frequency Error Measurement

Description

The phase and frequency error measurement analyzes the accuracy of the transmitters GMSK modulation. The phase and frequency errors on the useful part of the burst are calculated by obtaining a sample of the transmitted phase trajectory and comparing it with the theoretically expected phase trajectory. This measurement allows you to display these errors numerically and graphically on the spectrum analyzer display. It also allows you to view a binary representation of the demodulated data bits.

Notes

1. It is essential that an external trigger signal is applied for this measurement, otherwise the spectrum analyzer appears to hang up. Once the external trigger signal is applied the spectrum analyzer will continue to function correctly.
2. Although single burst measurements can be made, the measurement process requires that multiple triggers are received. In normal circumstances, with a repetitive frame trigger, this need is satisfied.

Specification GSM 5.05 section 4.6 provides general information on making phase accuracy measurements.

Specification GSM 11.20 section 2.1.6.2 outlines the test method and limits for measuring the phase and frequency error for base stations.

Specification GSM 11.10 section 13.1 outlines the test method and limits for measuring the phase and frequency error for mobile stations.

Test Procedure

1. Enter all the information as specified in the "Configuring the System for GSM900 Measurements" and "Entering Physical Channel Information" sections of this chapter. For this test, specifically enter the desired ARFCN and TN via the Physical Channel menu. Refer to Chapter 7, "Menu Maps" for the menu maps.
2. Press Mare 1 of 2, Phase & Freq Err in the Main menu.
3. Refer to Figure 3-34 for the test setup.

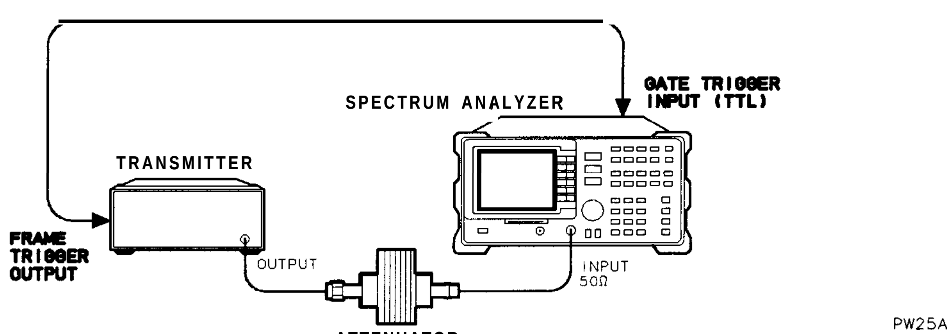


Figure 3-34. Test Setup for Phase and Frequency Error

4. Press PHASE FREQ to make the phase and frequency error measurement.

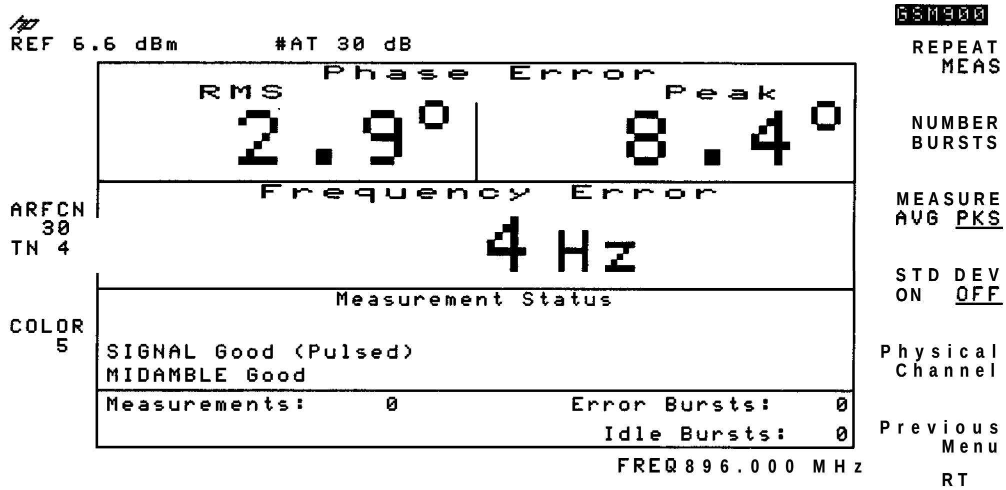


Figure 3-35. Example of Phase and Frequency Error Measurement Result

5. Press the **Meas Config** key to access a menu which allows you to modify the phase and frequency error test parameters.

   a. Press Burst Type to select the type of burst expected for the measurement,

   b. Press COLOR **AUTO** MAN to select either automatic or manual detection of the color pattern sent by the transmitter.

   c. Press SYNC **MID** ANPL to select which signal the spectrum analyzer uses for synchronization. Underline MID to select synchronization using the midamble section of the burst. Underline AMPL to select synchronization using the rising edge of the burst.

   d. Press **MEASURE** AVG PKS and underline AVG to activate the averaging measurement. Underline PKS to activate the minimum-peaks and maximum-peaks measurement. This selection only applies when **NUMBER** BURSTS is greater than 1. The main displayed result is the average, or peak value from the selected number of bursts.

   e. Press **FREQ** ERR OFFSET to enter a known frequency error within your system. This error is then subtracted from all the measured values, giving more accurate measurement results.

   f. Press **Previous** Menu to return to the measurement menu.

6. To further modify the phase and frequency error test parameters the following keys can be pressed.

   a. Press **NUMBER** BURSTS to change the number of bursts to be measured, if desired. The GSM900 preset value is 1 phase and frequency error signal to be continually measured. For values greater than 1, the sweep stops after the selected number of bursts is reached. Changing the value automatically repeats the measurement.

   b. Press Physical Channel , then press either ARFCN or **TIMESLOT NUMBER** and enter a new value if you want to change either of these settings.

7. Press REPEAT **MEAS** to restart the measurement after making any settings changes or just to make the measurement again. If you have gone to the spectrum analyzer menu you can return to the current GSM900 menu by pressing (MODE) (MODE).

8. If you wish to view a graph of the errors press Graphs in the Phase and Frequency Error Measurement Menu. This accesses a menu which allows you to select the graph which you wish to display; either the phase, frequency deviation or phase and frequency graph. The graph displays also show the numerical values of the peak phase error, the RMS phase error, the frequency error and the sync status.

9. If you wish to view a binary representation of the demodulated signal press DATA BITS in the Phase and Frequency Error Measurement Menu. Midamble bits are indicated with an "M".

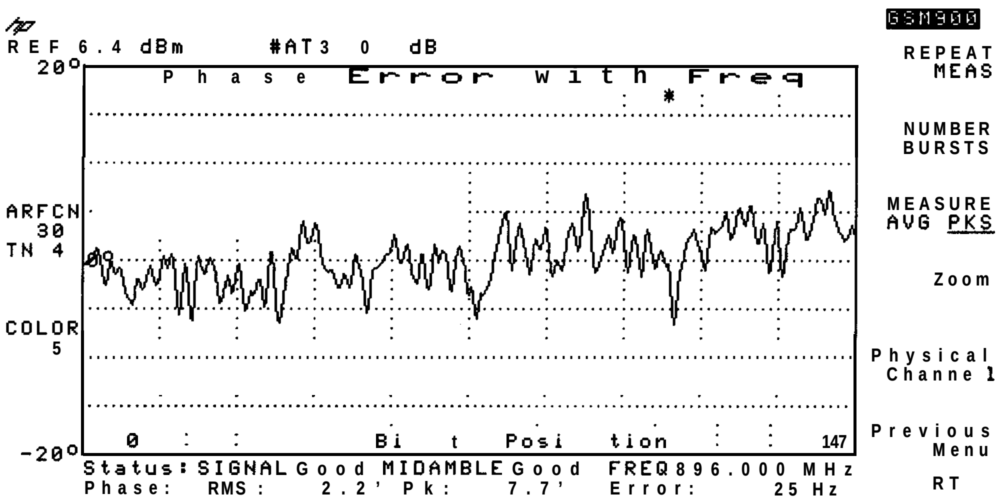


Figure 3-36.
Example of Phase and Frequency Error Measurement - Phase Error with Frequency Graph

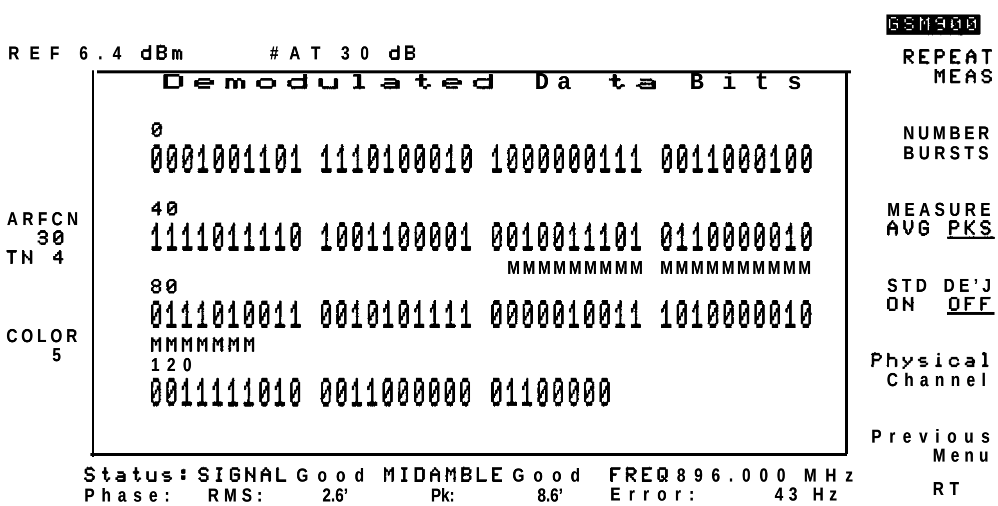


Figure 3-37.
Example of Phase and Frequency Error Measurement - Demodulated Data Bits

Making the Monitor TX Band Measurement

Description

The monitor transmit band measurement displays the frequency spectrum of the full transmit band for either the mobile station or base station, as selected with the TX MS BS key.

During the measurement, the following conditions are set:

- The spectrum analyzer's input attenuator is automatically set to an optimum level that is based upon the total measured power of all carriers present.
- The reference level is automatically set so that the maximum carrier is positioned 5 dB below the top graticule line.

The total transmit band power is displayed and continually updated at the end of each sweep. When this measurement is made, the first calculated total power value is used to update the TOTL PWR SGL MULT setting.

The TOTL PWR SGL MULT key selection only applies to the channel measurements such as Carrier Power, Power vs Time, and Output RF Spectrum measurements.

- If MULT is underlined in the TOTL PWR SGL MULT key, the input attenuator is automatically set to the optimum value based upon the total power measured during the Monitor TX Band measurement.
- If SGL is underlined in the TOTL PWR SGL MULT key, the input attenuator is automatically set to the optimum value based upon the currently measured carrier power at the selected ARFCN.

To ensure correct total power calculations, all of the carriers must be at least (1 MHz) apart. An external frame trigger is *not* required for this measurement.

Test Procedure

1. Enter the configuration information as specified in the "Getting Started" section of this chapter.
2. Press More 1 of 2, then MONITOR TX BAND in the Main menu. Refer to Chapter 7, "Menu Maps" for the menu maps. The spectrum at the selected TX band is displayed. The total TX band peak power is calculated and the displayed value updated at the end of every sweep.

4

If You Have a Problem

The purpose of this chapter is to help you troubleshoot problems when operating the GSM9OO Transmitter Measurements Personality, including any hardware or options installed with the personality to make it function. If the problem is related to the spectrum analyzer and not the GSM9OO Transmitter Measurements Personality, consult the spectrum analyzer documentation.

This chapter uses displayed error messages as the foundation for troubleshooting problems with the GSM9OO Transmitter Measurements Personality. It is likely that an error message is the first thing you see following a failure. However, a procedure is also provided for problems not reported by an error message. The messages are listed in alphabetical order, followed by a brief explanation of what each message means.

Order of Troubleshooting

1. First, follow the procedure listed in "Before Troubleshooting." Most issues involving setup and common errors are discussed there.
2. Second, if an error message is displayed, locate the message in "Error Messages" in this chapter and follow the directions given for that message.
3. If required, contact your nearest HP Sales and Service Office listed in chapter 1.

Before Troubleshooting

If an error message appears, or if you suspect a problem, check the system setup first. Make sure the GSM900 Transmitter Measurements Personality settings match the signal type under test.

Check the following common errors:

- Testing a mobile station when the personality is configured for a base station, or vice versa. This is set by TX MS BS in the physical channel menu.
- Tuning to the wrong carrier channel or timeslot number. These are set by ARFCN and TIMESLOT NUMBER in the physical channel menu.
- The external attenuation being set incorrectly. This is set by EXT ATTEN in the configuration menu.
- No frame trigger being supplied to the rear panel GATE TRIGGER INPUT when required by a measurement.
- The GATE OUTPUT not being connected to the EXT TRIG INPUT.

If the Spectrum Analyzer does not appear to respond to key presses

During phase and frequency error measurements this may occur when there is no frame trigger supplied or if the frame trigger is configured incorrectly. Pressing (PRESET) should return the spectrum analyzer to the default state.

If the GSM900 Transmitter Measurements Personality does not make a measurement

If you press one of the measurement functions and the personality does not make the measurement, it could be caused by one of the following:

- The channel number is not correct.

  Make sure that the channel number corresponds to the transmitted carrier frequency. AUTO ARFCN and AUTO ARFCN&TN in the physical channel menu can be used to automatically find the carrier in the transmit band with the highest signal level.
- The external trigger signal is missing.

  Make sure that a repetitive external trigger is input to the spectrum analyzer, when required. External triggering is used for channel power, power versus time, RF spectrum due to modulation and phase and frequency error measurements.
- The timeslot number is wrong.

  Make sure that the timeslot number corresponds to a carrier pulse. AUTO TN,

  P vs T FRAME, TRIG DELAY and AUTO ARFCN&TN can be used to select the correct timeslot number.
- While in Phase and Frequency Error Measurement mode a DLP parameter is highlighted.

  To restart the measurement, press [Enter) or Previous Menu .

If the test results are not what you expected

If the test results are incorrect or not what you expected, it could be caused by one of the following conditions:

- The external trigger settings are not correct.

  Make sure that the correct trigger source, period, delay, and polarity have been selected.

- The personality is configured for the wrong transmitter format.

  Make sure that BS is underlined in the TX BS MS softkey (in the physical channel menu), if a base station is being tested. Likewise, make sure that MS is underlined in the TX BS MS softkey, if a mobile station is being tested.

- The external attenuation value is incorrect.

  Make sure that the EXT ATTEN , in the configuration menu, has been set correctly. A symptom of this problem is incorrect power measurement results, and NO CARRIER error messages.

- The total power setting is incorrect.

  Make sure that TOTL PWR SGL MULT , in the configuration menu, has been set correctly. If only one carrier is incident to the spectrum analyzer, make sure SGL is underlined. If multiple carriers are incident, make sure MULT is underlined and the value for the TOTL PWR function is equal to the total power for all the carriers. Use MONITOR TX BAND to set the value automatically.

- The Slow Frequency Hopping (SFH) is incorrect.

  Make sure that SFH ON OFF is set to OFF, unless the signal being measured is hopping.

- The self-calibration routines need to be performed as described in chapter 1.

  Perform the self-calibration routines periodically to make accurate measurements. When you perform the spectrum analyzer self-calibration routines, make sure that nothing is connected to the GATE TRIGGER INPUT connector on the spectrum analyzer rear panel. If there is anything connected to the GATE TRIGGER INPUT connector during the self-calibration routines, it can cause incorrect calibration data. A symptom of this problem is that the time-gated channel power measurement trace results are displayed too far up on the spectrum analyzer display (even above the top graticule).

  If the error message CAL: DD DAC Failed appears on the screen, then the spectrum analyzer attempted to run an amplitude self-calibration but failed. In this case, make sure the calibration reference signal is connected to the front panel input connector and run the calibration again. If it still fails, the option 151 assembly may be faulty. Contact your nearest HP sales and service office.

- Excess frequency drift is interrupting the measurement.

  The spectrum analyzer center frequency has not yet stabilized to internal operating temperature. Wait a few minutes after turning on the spectrum analyzer until the OVEN COLD message disappears before beginning phase and frequency error measurements.

- Additional carriers are interfering with the measurement.

  For phase and frequency error measurements, carriers should be at least 2 MHz apart, if problems persist make sure only one carrier is incident to the spectrum analyzer. For other measurements, carriers should be at least 1 MHz apart.

- Noise on the external frequency reference is interfering with the phase and frequency error measurements.

  Poor sideband noise or sideband spurs on the external reference may worsen the measurement results. Try using the spectrum analyzer rear panel option 004, Precision Reference Frequency, to examine differences in the noise level.

- Vibration effects are interfering with the measurement.

  The frequency error measurement may show some sensitivity to vibration. Mount the spectrum analyzer on a steady base and avoid knocking or moving the spectrum analyzer while measurements are in progress.

- Frequency has not stabilized after a large frequency shift.

  The frequency error measurement may show an error after a large frequency shift. Repeating the measurement should correct this problem.

- FREQ ERR OFFSET value is not sufficient to compensate for frequency error.

  The FREQ ERR OFFSET function allows a known frequency error to be used as an offset in the frequency error measurement. This offset can be made equal to the average frequency error, which for best effect should be determined over a minimum of 15 bursts. At the end of the set number of bursts, the value displayed on the analyzer is the average frequency error for the system. Assign this value to the FREQ ERR OFFSET function and rerun the frequency error measurement. The displayed average frequency error should settle close to 0 Hz after about 10 bursts.

Error Messages

All error messages are listed alphabetically by the first word in the message.

AMPLITUDE > 1 dB OFF!

This message indicates that the CW source's test signal amplitude measured greater than 1 dB from the intended value during the Intermodulation Attenuation Measurement procedure.

To solve this problem:

- Ensure that the requested CW signal frequency and level are correct.

CAL: DD DAC Failed

This message indicates that the spectrum analyzer attempted to run an amplitude self-calibration but failed.

To solve this problem:

- Make sure the calibration reference signal is connected to the front panel input connector.
- If the calibration reference signal is correct, the option 151 assembly may be faulty. Contact your nearest HP sales and service office.

CARRIER PRESENT, CHECK SETUP!

This message indicates that the maximum signal level measured during the Intermodulation Attenuation RX Band measurement is greater than expected.

To solve this problem:

- A bandpass filter (BPF) is required in this measurement setup configuration. Refer to "Making the Intermodulation Attenuation Measurements" in chapter 3 to verify the setup.
- Ensure there is no carrier being generated which lies within the test frequency band.

CARRIER PRESENT, TEST STOPPED!

This message indicates that the maximum signal level measured is greater than the expected value. The measurement is stopped because it is not reasonable to continue when a carrier is present.

To solve this problem:

- A bandpass filter (BPF) may be required in this measurement setup configuration. Refer to the appropriate measurement description in chapter 3 to verify the setup.
- Ensure there is no carrier being generated which lies within the test frequency band.

CHECK NOISE FLOOR

This message indicates that the spurious signal was measured with spectrum analyzer settings at conditions in which its sensitivity specification exceeded or was within 6 dB of the GSM900 spurious specification.

To solve this problem:

- Examine the spurious signal in more detail using the Inspect Spur key.
- Remove the input signal, if the spur remains, it is caused by noise in the test equipment.

DD DSP FAIL

This message indicates that either the option 151 GSMSOO digital demodulator is faulty or that the option 163 GSMSOO DSP firmware is missing or faulty.

To solve this problem:

- If option 151 is installed in the spectrum analyzer it may have failed. See the documentation for your spectrum analyzer for more information about returning the spectrum analyzer for repair.
- If option 151 is installed in the spectrum analyzer, option 163 is required. If option 163 is not installed; contact your local HP Sales and Service Office for more information.
- If option 163 is installed in the spectrum analyzer it may be faulty. See the documentation for your spectrum analyzer for more information about returning the spectrum analyzer for repair.

EX PRECISION FREQ REFERENCE REQUIRED

This indicates that the spectrum analyzer does not have option 004, the precision frequency reference, installed. If the spectrum analyzer does not have option 004 installed, you must use an external precision frequency reference to make accurate measurements with the GSMSOO Transmitter Measurements Personality.

To use an external precision frequency reference:

- Disconnect the connector from the 10 MHz REF OUTPUT and EXT REF IN connectors on the rear panel. Connect the 10 MHz signal from a precision external frequency reference to the EXT REF IN connector. Note that the message will still be present when an external 10 MHz reference is correctly connected.

EXTERNAL TRIG REQUIRED

This message indicates that the measurement requested requires an external trigger signal.

To solve this problem:

- Connect a frame trigger signal to the rear panel EXT TRIG INPUT (TTL) port.
- The FRAME TRIG OUTPUT (TTL) port can be used to supply the frame trigger signal, however, this signal is likely to drift compared with the device under test.

FASTADC REQUIRED: (Opt 101 or Opt 151)

This indicates that neither options 101 or 151 have been installed in the spectrum analyzer. Option 101 is the fast time-domain sweep assembly, and option 151 is the GSMSOO digital demodulator assembly. Your spectrum analyzer must have fast ADC capability for the power versus time measurements on a mobile station when used with the HP 85715B GSMSOO Transmitter Measurements Personality.

The fast ADC function required for the phase and frequency error measurement has been added to the option 151 assembly. The option 101 fast time-domain sweep assembly is *not* recommended to be installed with option 151. Option 151 replaces option 101 functions in the spectrum analyzer for GSMSOO measurements.

To solve this problem:

- If option 101 or 151 is installed in the spectrum analyzer, that option may have failed. See the documentation for your spectrum analyzer for more information about returning the spectrum analyzer for repair.
- If option 101 or 151 is not installed in the spectrum analyzer, either option can be installed; contact your local HP Sales and Service Office for more information.

FREQUENCY >0.1 MHz OFF!

This message indicates that the CW source's test signal frequency measured greater than 0.1 MHz from the intended value during the Intermodulation Attenuation Measurement procedure.

To solve this problem:

- Ensure that the requested CW signal frequency and level are correct.

GATE CARD REQUIRED: (Opt 105)

This indicates that the spectrum analyzer does not have option 105, the time-gated spectrum analysis card, installed. Option 105 must be installed to make most GSM900 measurements.

To solve this problem:

- If option 105 is installed, it may have failed. See the documentation for your spectrum analyzer for more information about returning the spectrum analyzer for repair.
- If option 105 is not installed in the spectrum analyzer, it can be installed; contact your local HP Sales and Service Office for more information.

GSM Phase Frequency firmware required: (opt 163)

This indicates that the spectrum analyzer does not have option 163, the GSM firmware installed in the option 151 digital demodulator assembly.

To solve this problem:

- If option 163 is installed in the spectrum analyzer, it may have failed. See the documentation for your spectrum analyzer for more information about returning the spectrum analyzer for repair.
- If option 163 is not installed in the spectrum analyzer, it can be installed; contact your local HP sales and service office for more information.

INSERT HP 85715B MEMORY CARD & TRY AGAIN

This message indicates that the memory card containing the GSM900 Transmitter Measurements Personality was not found in the card reader.

To solve this problem:

- Insert the card so that the measurement you have selected can be loaded into the spectrum analyzer's memory.

`INVALID SYMTAB ENTRY: SYMTAB OVERFLOW`

This indicates that there was not enough available memory in the spectrum analyzer to hold the GSMSOO Transmitter Measurements Personality.

To solve this problem:

- Press (CONFIG) More 1 of 3 SHOW OPTIONS and check the firmware version of your spectrum analyzer.

  If the version is earlier than 931217, then obtain the latest spectrum analyzer firmware from your nearest HP Customer Sales and Service Office. Earlier firmware dates were given in a different format with the word REV preceding the day, month, and year separated by periods.

- If your spectrum analyzer firmware is 931217 or later, then there is insufficient available memory. You must delete the other programs in the spectrum analyzer memory as follows:

  1. Press (PRESET).
  2. Press (CONFIG) Mare 1 of 3 Dispose User Mem ERASE DLP MEM ERASE DLP MEM (PRESET).
  3. Reload the GSMSOO Transmitter Measurements Personality using the procedure in "Loading the GSMSOO Transmitter Measurements Personality" in chapter 1.

`MIDAMBLE BAD<n> Errorbits -Wrong Color Code?`

This message indicates that the phase and frequency error measurement has detected a midamble bit sequence which does not match the selected color code value.

To solve this problem:

- If the color code selection is set to manual (COLOR AUTO MAN , MAN underlined) select the correct color code pattern for the signal being measured. Alternatively select AUTO underlined, for automatic detection of the color code pattern.

- If the color code selection is set to automatic (COLOR AUTO MAN , AUTO underlined) the measured signal does not match any recognized color code pattern. Check the DATA BITS screen.

- Set SYNC MID AMPL to AMPL underlined, so that the spectrum analyzer uses the rising edge of the burst for synchronization.

`NEWERFIRMWAREREQUIRED: REV931217 OR LATER`

This message indicates that the spectrum analyzer firmware must be updated before the GSMSOO Transmitter Measurements Personality can be used.

Press (CONFIG) More 1 of 3 SHOW OPTIONS to view the firmware version of your spectrum analyzer. Earlier firmware dates were given in a different format with the word REV preceding the day, month, and year separated by periods.

To solve this problem:

- Contact your local HP Sales and Service Office for more information about updating the firmware in your spectrum analyzer.

Newer opt 163 firmware required: rev 931217 or later

This message indicates that newer option 163 firmware is required for the HP 85715B GSM9OO Transmitter Measurements Personality.

lb solve this problem:

- Contact your local HP sales and service office for information about obtaining the latest option 163 ROMs.

NO CARRIER!

This message indicates that the maximum signal level measured is less than the expected value for valid carrier power.

To solve this problem:

- Verify that the correct channel number (ARFCN) and timeslot number have been selected in the physical channel menu.
- Verify that the external attenuation set in the configuration menu is correct.
- Verify that the signal in the MONITOR TX BAND display is at the correct frequency and at a legitimate GSM9OO level.

NO CARRIER, CHECK SETUP!

This message indicates that the maximum signal level measured during the Intermodulation Attenuation TX Band measurement is less than the expected value for a valid carrier power.

To solve this problem:

- Verify that the correct channel number (ARFCN) and timeslot number have been selected in the physical channel menu.
- Verify that the external attenuation set in the configuration menu is correct.
- Verify that the signal in the MONITOR TX BAND display is at the correct frequency and at a legitimate GSM9OO level.

NO CARRIERLEVEL C-20 dBm

This message indicates that the maximum signal level measured is less than the expected value for valid carrier power.

To solve this problem:

- Verify that the correct channel number (ARFCN) and timeslot number have been selected in the physical channel menu.
- Verify that the external attenuation set in the configuration menu is correct.
- Verify that the signal in the MONITOR TX BAND display is at the correct frequency and at a legitimate GSM9OO level.

NO CARRIER, TEST STOPPED!

This message indicates that the maximum signal level measured is smaller than the expected value for a valid carrier's power. The measurement is stopped. It is not reasonable to continue the measurement without having a carrier signal with a valid power level because the measurement is in dB relative to the carrier signal.

To solve this problem:

- Verify that the correct channel number (ARFCN) and timeslot number have been selected in the physical channel menu.
- Verify that the external attenuation set in the configuration menu is correct.
- Verify that the signal in the MONITOR TX BAND display is at the correct frequency and at a legitimate GSM900 level.

NO SPURS

This message indicates that the INSPECT SPUR key was pressed, but there were no spurs detected during the Spurious Emissions measurement.

Options 151&163 required for Phase Freq Error

This message indicates that options 151 and 163, are not installed in the spectrum analyzer. Options 151 and 163 are required to make phase and frequency error measurements.

To solve this problem:

- If option 151 and 163 are installed in the spectrum analyzer, they may have failed. See the documentation for your spectrum analyzer for more information about returning the spectrum analyzer for repair.
- If option 151 and 163 are not installed in the spectrum analyzer, they can be installed; contact your local HP sales and service office for more information.

REFERENCECHANNELLEVEL <-20 dBm TEST STOPPED!

This message indicates that the maximum signal level measured during the Intra-BSS Intermodulation measurement is less than the expected value for a valid reference channel carrier power.

To solve this problem:

- Verify that the correct channel number (REF CHANNEL) has been selected in intermodulation measurement menu.
- Verify that the external attenuation set in the configuration menu is correct.
- Verify that the signal in the MONITOR TX BAND display is at the correct frequency and at a legitimate GSM900 level.

SIGNAL ERROR <n>

This message indicates that an unexpected burst shape was detected.

To solve this problem:

- Record the value of <n> along with any relevant details then contact your local HP sales and service office for further information.

SIGNAL FREQ ERROR> 10 kHz - Results poor

This message indicates that the detected frequency error was greater than 10 kHz, therefore the reported results may be inaccurate.

To solve this problem:

- Verify that the correct channel number (ARFCN) and timeslot number have been selected in the physical channel menu.
- Verify that the external attenuation set in the configuration menu is correct.
- Verify that the trigger delay set in the configuration menu is correct.
- Examine the signal using MONITOR TX BAND in the GSM900 main menu, and P vs T FRAME in the power vs time menu.

SIGNAL - Idle Burst

This message indicates that during the phase and frequency measurement a trigger was received, but no signal was present. This can be expected during the normal operation of a mobile station.

SIGNAL LEVEL LATE

This message occurs only when the spectrum analyzer is using the midamble section of the burst for synchronization (SYNC MID AMPL , MID underlined). This message indicates that the burst amplitude did not rise until after the expected position of the initial bits, which are determined from the detected midamble sequence.

To solve this problem:

- Examine the burst shape using the power versus time menu.
- Set SYNC MID AMPL to AMPL underlined, so that the spectrum analyzer uses the rising edge of the burst for synchronization.

SIGNALLEVELLOW - Decrease REF level

This message indicates that the phase and frequency error assembly is receiving a signal level which is too low to measure accurately.

To solve this problem:

- Verify that the correct channel number (ARFCN) and timeslot number have been selected in the physical channel menu.
- Verify that the external attenuation set in the configuration menu is correct.
- Verify that the trigger delay set in the configuration menu is correct.
- Examine the signal using MONITOR TX BAND in the GSM900 main menu, and P vs T FRAME in the power vs time menu.

SIGNAL LEVEL SHORT

This message occurs only when the spectrum analyzer is using the rising edge of the burst for synchronization (SYNC MID AMPL , AMPL underlined). This message indicates that the burst amplitude fell before the expected position of the final bits, which are determined from the detected midamble sequence.

To solve this problem:

- Examine the burst shape using the power versus time menu.
- Set SYNC MID AMPL to AMPL underlined, so that the spectrum analyzer uses the rising edge of the burst for synchronization.

SIGNALLEVELTOO HIGH - Increase REF level

This message indicates that the phase and frequency error assembly is receiving a signal level which is too high to measure accurately.

To solve this problem:

- Press REPEAT MEAS to automatically set the reference level to the current signal.
- Verify that the external attenuation set in the configuration menu is correct.
- Verify that the correct channel number (ARFCN) and timeslot number have been selected in the physical channel menu.

SIGNAL NOT DETECTED

This message indicates that the phase and frequency error assembly is not receiving a signal level high enough to measure.

To solve this problem:

- Verify that the correct channel number (ARFCN) and timeslot number have been selected in the physical channel menu.
- Verify that the external attenuation set in the configuration menu is correct.
- Verify that the trigger delay set in the configuration menu is correct.
- Examine the signal using MONITOR TX BAND in the GSM900 main menu, and P vs T FRAME in the power vs time menu.

SIGNALPHASEERRORTOO BIG - Results Poor

This message indicates that the detected phase error was greater than 999°, therefore the reported results may be inaccurate.

To solve this problem:

- Verify that the correct channel number (ARFCN) and timeslot number have been selected in the physical channel menu.
- Verify that the external attenuation set in the configuration menu is correct.
- Verify that the trigger delay set in the configuration menu is correct.
- Examine the signal using MONITOR TX BAND in the GSM900 main menu, and P vs T FRAME in the power vs time menu.

`SIGNAL SHORT BURST`

This message indicates that the amplitude envelope of the burst was shorter than expected.

To solve this problem:

- Examine the burst shape using the power versus time menu.

`SIGNAL TOO SHORT`

This message indicates that the amplitude envelope of the burst was very much shorter than expected.

To solve this problem:

- Examine the burst shape using the power versus time menu.

5

Programming Commands

What's in This Chapter

This remote programming reference is for use with an HP 8590 series spectrum analyzer equipped with the HP 85715B GSM9OO Transmitter Measurement Personality. This section contains both summary information and a set of command descriptions ordered alphabetically.

Accessing the GSM9OO Analyzer Mode for Remote Operation	Refer to this section to learn how to remotely load and access the memory card program.
Programming Basics for GSM9OO Remote Operation	Refer to this information to learn some basics about the GSM9OO Transmitter Measurements Personality.
Advanced Programming	Refer to this section for information about changing measurement limit values or limit lines for the GSM9OO measurements.
Table 5-3. Syntax Elements	Refer to this table to learn about the different syntax elements. The elements are defined and their ranges identified here.
Table 5-4. Functional Index	In this table, the commands are categorized by command groups. The groups are organized alphabetically by softkey name with the corresponding remote command sequence beside the softkey name.

Before you can program the spectrum analyzer, you must connect the spectrum analyzer to a computer. Refer to chapter 1 in the *HP 8590 Series Spectrum Analyzer Programmer's Guide* for further information.

All examples in this manual are written in HPBASIC and it is assumed that the HP-IB address is 18 and the select code of the controller part is 7.

Note **RS 232 remote interface operation.**
To obtain the measurement completed values referred to in "Determining When a Measurement is Completed" in this chapter, select RMT SYNC ON OFF (ON) from the Config menu.

Accessing the GSM9OO Analyzer Mode for Remote Operation

To use the GSM9OO program language, the GSM9OO Transmitter Measurements Personality program must be in the spectrum analyzer's memory, and GSM9OO Analyzer mode must be selected. Refer to the procedures below.

Loading theGSM900 Transmitter Measurements Personality

If you need to load the GSM9OO Transmitter Measurements Personality, insert the HP 85715B GSM9OO Transmitter Measurements Personality memory card into the analyzer's front-panel card reader. Enter the following command line:

OUTPUT 7 18;"LOAD/dGSM900/;" *dGSM900 is the file name for the core portion of the GSM9OO program.*

Switching to the GSM9OO Analyzer Mode

To switch to the GSM9OO analyzer mode from any other mode, enter the following command line:

OUTPUT 718; "MODE 10;" *Mode 10 is the GSM9OO analyzer mode.*

Programming Basics for GSM900 Remote Operation

The following information explains the use of GSM9OO remote commands. Refer to individual commands in this chapter, for specifics.

Using Command Name Prefixes

All GSM9OO remote commands start with "ng". The command prefix can be in either upper-case or lower-case lettering.

The measurement groups are divided as follows:

ng_ prefix for the core group commands. The core group includes measurement configuration and physical channel commands.

ngi- prefix for the intermod measurement group commands.

ngp_ prefix for the power vs time measurement groups commands.

ngs- prefix for the spurious measurement group commands.

ngos-prefix for the output RF spectrum measurement group commands.

ngd- prefix for the frequency and phase error measurement group commands. (Spectrum analyzer option 163 required.)

Selecting a Measurement Group

The remote command to load a GSM9OO measurement group is "ng_GROUP" followed by either 1, 2, 3, 4, or 5. These numbers are explained below:

1 selects the power vs time measurement group (ngp-).

2 selects the output RF spectrum measurement group (ngos_).

3 selects the spurious measurement group (ngs_).

4 selects the intermod measurement group (ngi-).

5 selects the phase and frequency error measurement group (ngd_). (Spectrum analyzer option 163 required.)

Loading a new measurement group with the ng_GROUP command may purge the previous measurement group.

Note The GSM9OO Transmitter Measurements Personality card must be fully inserted into the front panel card reader before you execute the GROUP command. The measurements personality requires too much of the spectrum analyzer memory to be loaded all at once. An error occurs if the card is not inserted.

Using the Spectrum Analyzer MOV Command

You are encouraged to use the MOV (move) command with commands that require number parameters. Using MOV improves speed because no text gets displayed in the active function area during command execution.

```
OUTPUT 718 ;"MOV ng_TN ,4;"
```
Set the timeslot number to 4.

UsingGSM900 Measurement Setup and Measurement Commands

Many measurements require a setup command, followed by a measurement command. A setup command sets the spectrum analyzer parameters to the correct values for that measurement. You can change setup parameters (such as resolution bandwidth or video bandwidth) before executing the measurement command. The measurement command starts the actual measurement.

Using Multiple Bursts inGSM900 Measurements

Many GSM9OO measurements require multiple bursts for accurate measurement results. Select the number of bursts to use for measurements before executing measurement setup and measurement commands.

```
OUTPUT 718;"MOV ng_NB,100;"
```
Select the number of bursts = 100.

Using the Repeat Command

You can use the ng-RPT command to repeat a Power, Power vs Time, or Output RF Spectrum measurement. GSM9OO parameters such as ARFCN and TN can be changed prior to executing ng_RPT.

`OUTPUT 718;"MOV ng_ARFCN,26;"`	*Change the RF channel to number 26.*
`OUTPUT718;"ng_RPT;"`	*Repeat the previous measurement at the new channel number*

Determining When a Measurement is Completed

The external controller must wait for the measurement to be completed before trying to read the results or before sending a command for another measurement. The controller sends an ENTER command after sending a measurement command. A value is returned to the controller when the measurement is completed. A value of 1 indicates that the measurement successfully completed. If the value is greater than `1`, an error was detected during the measurement (such as no signal).

`1 OUTPUT 718;"ng_CPS;"`	*Setup for Carrier Power measurement*
`2 OUTPUT 718;"ng_CPM;"`	*Execute the Carrier Power measurement*
`3 ENTER 718;Meas_state`	*Enter the measurement state (the controller waits for the measurement to complete). A value is placed in the spectrum analyzer output buffer when the measurement is completed.*
`4 OUTPUT 718;"ng_CPA?;"`	*Query for measurement results*
`5 ENTER 718;Carrier-pwr`	*Enter the measurement value*

Programming Examples

The following example shows how to load a measurement group into the spectrum analyzer's memory:

`OUTPUT 718;"MOV ng_GROUP,1;"`	*Load the Power vs Time measurement group into the spectrum analyzer's memory*

The Carrier Power Measurement With Single Value Result

`1 INTEGER Meas_state`	*Declare the measurement state variable.*
`2 REAL Carrier-pwr`	*Declare the measurement value variable.*
`3 ASSIGN @Sa TO 718`	*Assign the i/o path to the spectrum analyzer*
`4 OUTPUT @Sa;"MOV ng_NB,10;"`	*Set the number of bursts to 10.*
`5 OUTPUT @Sa;"ng_CPS;"`	*Set up the Carrier Power measurement.*
`6 OUTPUT @Sa;"ng_CPM;"`	*Execute the Carrier Power measurement.*
`7 ENTER @Sa;Meas_state`	*Enter the measurement state (the controller waits for the measurement to complete). A value is placed in the spectrum analyzer output buffer when the measurement is completed.*
`8 IF Meas_state=1 THEN`	*The measurement is completed, no errors detected.*
`9   OUTPUT @Sa;"ng_CPA?;"`	*Query the measurement value.*
`10   ENTER @Sa;Carrier_pwr`	*Enter the measurement value.*
`11   DISP "Carrier power= ";`	
`12        Carrier_pwr;"dBm"`	*Display the value.*
`13 ELSE`	*The measurement is completed, errors were detected.*
`14   IF Meas_state=2 THEN`	*Condition: the measurement state is 2.*
`15     DISP "No carrier detected"`	*A carrier was not detected.*
`16   END IF`	
`17 END IF`	
`18 END`	

The Power vs Time Frame Measurement With a Spectrum Analyzer Trace Result

Program	Description
`1 INTEGER Meas_state`	*Declare the measurement state variable.*
`2 INTEGER I`	*Declare the loop variable.*
`3 REAL Trace_data(1:401)`	*Declare the measurement result array.*
`4 ASSIGN @Sa TO 718`	Assign *the i/o path to the spectrum analyzer.*
`5 OUTPUT @Sa;"MOV ng_NB,5;"`	*Set the number **of bursts to** 5.*
`6 OUTPUT @Sa;"ngp_FRS;"`	*Set up the **Power** vs Time, **Full** Frame measurement.*
`7 OUTPUT @Sa;"ngp_FRM;"`	*Execute the **Power** vs **Time, Full** Frame measurement.*
`8 ENTER @Sa;Meas_state`	*Enter the measurement state (the controller waits **for** the measurement to complete). A value is placed in the spectrum analyzer output **buffer** when the measurement is completed.*
`9 IF Meas_state=1 THEN`	*The measurement* is *completed, no errors detected.*
`10   OUTPUT @Sa;"TRA?;"`	*Query the measurement trace.*
`11   ENTER @Sa;Trace_data(*)`	*Enter the measurement result into the array.*
`12   FOR I=1 TO 401`	*Loop through all the trace elements.*
`13     PRINT Trace-data(I);`	*Print each trace element.*
`14   NEXT I`	
`15 ELSE`	*The measurement is completed, errors were detected.*
`16   IF Meas_state=2 THEN`	*The measurement state is 2.*
`17     DISP "No carrier detected"`	*A carrier was not detected.*
`18   END IF`	
`19 END IF`	
`20 END`	

The Transmitter Spurious in TX Band Measurement With Multiple DLP Trace Results

`1 INTEGER Meas_state`	*Declare the measurement state variable.*
`2 INTEGER Num_spurs`	*Declare the measurement result: number of spurs.*
`3 INTEGER Spur,frq-m`	*Declare the measurement result: spur frequency (MHz).*
`4 INTEGER Spur-frq-k`	*Declare the measurement result: spur frequency (kHz).*
`5 INTEGER Spur-amp`	*Declare the measurement result: spur amplitude.*
`6 INTEGER Spur-ok`	*Declare the measurement result: spur flag.*
`7 INTEGER I`	*Declare the loop variable.*
`8 REAL Sp_freq(1:30)`	*Declare the array to hold spur frequency results (MHz).*
`9 REAL Sp_amp(1:30)`	*Declare the array to hold spur amplitude results (dBm).*
`10 INTEGER_Sp_ok(1:30)`	*Declare the array to hold spur flag results.*
`11 ASSIGN @SA TO 718`	*Assign the i/o path to the spectrum analyzer*
`12 OUTPUT @Sa;"MOV ngs_RCVRF,0;"`	*Set the spur measurement for transmitter measurements.*
`13 OUTPUT @Sa;"ngs_MEASTX;"`	*Execute the TX Band Spurious measurement.*
`14 ENTER @Sa;Meas_state`	*Enter the measurement state (the controller waits for the measurement to complete). A value is placed in the spectrum analyzer output buffer when the measurement is completed.*
`15 IF Meas_state=1 THEN`	*The measurement is completed, no errors detected.*
`16   OUTPUT @Sa;"ngs_SPCNT?;"`	*Query the number of spurs found.*
`17   ENTER @Sa;Num_spurs`	*Enter the number of spurs found.*
`18   IF Num_spurs<1 THEN`	*Condition: if the number if spurs is less than 1.*
`19     PRINT "No spurs found"`	
`20   ELSE`	*Condition: the number of spurs is greater than or equal to 1.*
`21     FOR I=1 TO Num,spurs`	*Loop through the spurs found.*
`22       OUTPUT @Sa;"ngs_SPFRQM[";I;"]?;"`	*Query to obtain the MHz portion.*
`23       ENTER @Sa;Spur_frq_m`	*Enter the MHz portion of the spur found.*
`24       OUTPUT @Sa;"ngs_SPFRQK[";I;"I?;"`	*Query to obtain the kHz portion.*
`25       ENTER @Sa;Spur_frq_k`	*Enter the kHz portion of the spur found.*
`26       Sp_freq(I)=Spur_frq_m+`	
`27                 (Spur_frq_k/1000)`	*Assemble the frequency results into an array (MHz).*
`28       OUTPUT @Sa;"ngs_SPFAMP[";I;"I?;"`	*Query to obtain the amplitude of the spur*
`29       ENTER @Sa;Spur_amp`	*Enter the amplitude value of the spur found.*

30 Sp_amp(I)=Spur_amp/10)	*Convert the amplitude value to **dBm**, then **place** it in the array.*
31 OUTPUT@Sa;"ngs_SPOK[";I;"]?;"	*Query for the **spur flag**.*
32 ENTER @Sa;Spur_ok	*Enter the **spur flag**.*
33 Sp_ok(I)=Spur_ok	*Place the **spur flag** in the array.*
34 NEXT I	
35 PRINT "# Freq (MHz) Amp (dBm)"	
36 PRINT "_____________________"	
37 FOR I=1 TO Num_spurs	*Loop through the spurs again.*
38 PRINT I,Sp_freq(I),Sp_amp(I);	*Print each **spur**, suppress carriage return and line feed.*
39 IF Sp_ok(I)=1 THEN	*Condition: **ifthe flag** value = 1.*
40 PRINT	*Carriage return and **line** feed.*
41 ELSE	*Condition: **if** thejlag value = 0.*
42 PRINT "*"	**Carriage return and line feed.*
43 END IF	
44 NEXT I	
45 END IF	
46 END IF	
47 END	

The Phase and Frequency Error Measurement

```
REAL Fre,Ppe,Rpe
INTEGER Meas_state,I
!
ASSIGN @Sa TO 718                        Assign i/o to Spectrum Analyzer
!
OUTPUT @Sa;"ngd_PFS;";                   Setup Phase Frequency Error
OUTPUT @Sa;"ngd_MEAS;";                  Make Measurement
I=0
REPEAT
I=I+1                                    Increment counter
ENTER @Sa;Meas_state                     Enter the measurement state
OUTPUT @Sa;"ng_ARFCN;";                  Set an Active Parameter to suspend the
                                         measurement
IF (Meas_state<>1) THEN                  If Measurement state is not 1
PRINT "Meas Failed: ";Meas_state         Measurement Failed
ELSE                                     Otherwise
OUTPUT @Sa;"ngd_FRE?";                   Measurement OK so read results
ENTER @Sa;Fre
OUTPUT @Sa;"ngd_PPE?";
ENTER @Sa;Ppe
OUTPUT @Sa;"ngd_RPE?";
ENTER @Sa;Rpe
PRINT Fre,Ppe,Rpe                        Print results
END IF
OUTPUT @Sa;"HD;";                        Clear the Active Parameter to re-enable
                                         the measurement
UNTIL (I=10)                             Repeat 10 times
END
```

To load the GSM9OO measurements personality remotely

1. Insert the HP 85715B GSM9OO Transmitter Measurements Personality memory card into the analyzer's front-panel memory card reader.
2. Prepare the spectrum analyzer for the DONE command by doing an instrument preset and placing the spectrum analyzer into a single sweep mode.
3. Execute the take sweep (TS) command. You must execute the take sweep command before the DONE command.
4. Execute the DONE command.
5. Wait until the DONE command returns a " 1. "
6. Remove any personalities from the spectrum analyzer by executing the DISPOSE ALL command.
7. Wait until the DISPOSE ALL command has finished.
8. Use the spectrum analyzer's LOAD command to load the file called "dGSM900" into spectrum analyzer memory.
9. Execute the take sweep (TS) command. You must execute the take sweep command before the DONE command.
10. Execute the DONE command.
11. Wait until the DONE command returns a " 1. "

This procedure describes how to use programming commands to load the GSMSOO measurement personality into spectrum analyzer memory. However, you may find it more convenient to use the spectrum analyzer's front-panel keys to load the personality into memory.

Example

1	`OUTPUT718;"IP;SNGLS;"`	*Does an instrument preset and places the spectrum analyzer in the single sweep mode.*
2	`OUTPUT 718;"TS;"`	*Performs a take sweep.*
3	`OUTPUT 718;"DONE?;"`	*Queries the spectrum analyzer to return a "1" when the take sweep (TS) command completes.*
4	`ENTER 718;Done`	*Waits until a "1" is returned.*
5	`OUTPUT 718;"DISPOSE ALL;"`	*Removes any personalities from spectrum analyzer memory.*
6	`WAIT 10`	*Wait for DISPOSE ALL to finish.*
7	`OUTPUT718;"LOAD/dGSM900/;"`	*Loads the GSM9OO measurements personality into spectrum analyzer memory. "dGSM900" is the file name for the GSM9OO measurements personality program.*
8	`OUTPUT 718;"TS;"`	*Performs a take sweep.*
9	`OUTPUT 718;"DONE?;"`	*DONE? returns a "1" when the LOAD and the TS commands are completed.*
10	`ENTER 718;Done`	*Waits until a "1" is returned.*

To select the GSM900 analyzer mode remotely

1. Prepare the spectrum analyzer for the DONE command by doing an instrument preset and placing the spectrum analyzer into a single sweep mode.
2. Change to the GSMSOO analyzer mode by setting the value of the MODE command to 10.
3. Perform a take sweep. You must do a take sweep before executing the DONE command.
4. Execute the DONE command.
5. Wait until the DONE command returns a " 1. "

The spectrum analyzer must be using the GSMSOO analyzer mode before you can send any GSMSOO programming commands to the spectrum analyzer. You need to execute the DONE command to ensure that the spectrum analyzer has finished executing the MODE command.

Example

1 OUTPUT 718;"IP;SNGLS;"	*Does an instrument preset and places the spectrum analyzer in the single sweep mode.*
2 OUTPUT 718;"MODE 10;"	*Changes to the GSM9OO mode.*
3 OUTPUT 7 18;"TS;"	***Performs a** take sweep.*
4 OUTPUT 718;"DONE?;"	*DONE? returns a "1" when the MODE and take sweep commands are completed.*
5 ENTER 718;Done	*Waits until a "1" is returned.*

To use an external keyboard to enter commands

1. Turn off the spectrum analyzer.

Caution Do not connect the keyboard to the spectrum analyzer while the spectrum analyzer is turned on.

---

2. Connect an HP Cl405 Option 2 cable from the spectrum analyzer's rear panel connection (marked EXT KEYBOARD) to the HP Cl405 Option ABA keyboard.
3. Press (LINE) to turn on the spectrum analyzer, then press (MODE) **GSM900 ANALYZER** .
4. Press (F8) on the external keyboard to enter the "keyboard to command" mode.
5. Type in the command syntax. The characters that type are shown at the top of the spectrum analyzer display. You can enter more than one command per line by separating the commands with a semicolon (for example, `IP ; SNGLS ;`).
6. Press (ENTER).

You can enter the programming commands into the spectrum analyzer by using a keyboard that is connected to the spectrum analyzer's external keyboard connector. The external keyboard connector is included with an Option 021 or Option 023 spectrum analyzer. Refer to the documentation for the spectrum analyzer for more information about the different external keyboard functions.

Because you are not using an external computer, the GSM900 personality and spectrum analyzer commands are entered without an OUTPUT or PRINT statement preceding them.

Example

Type in following programming line. Press (ENTER) after the programming line has been entered.

`MOV ng_ARFCN,2;`	*Changes the channel number to 2. ng_ARFCN is the command for the channel number:*

Customizing the GSM9OO Personality

The GSM9OO personality uses limits and limit lines when performing the measurements. You can change the values of the limits and limit lines so that the GSM9OO personality performs the measurements according to your particular test situation. For your convenience, you can store the limits and parameters that you have changed on a RAM memory card so the values can be easily loaded into the spectrum analyzer memory, whenever needed. This section contains the following procedures:

- Change the value of limit variables.
- Create a limit line function.
- Changing Output RF spectrum offset values.
- Save the revised limit variables or limit line functions on a RAM card, using an external keyboard.
- Save the revised limit variables or limit line functions on a RAM card, using a computer.
- Modify the default values or limit line functions used by the personality.

To change the value of limit variables

- Use the MOV command to move the new value for a limit into the variable for the limit.

or,

- Use the VARDEF command to move the new value for a limit into the variable for the limit. Using VARDEF to move the value for a limit redefines the instrument preset (IP) value of that limit.

The GSMSOO measurements personality uses a "limit" to decide if the measurement results failed or passed. For example, if a signal is above the Rx band spurious limit, the unit under test will fail the Rx band spurious measurement. You can change a limit by changing the value of the limit variable. See Table 5-l for a list of all the limit variables.

If you use the MOV command:

The limit variable will be reset to the default value for the limit variable if an instrument preset (IP) is executed or the spectrum analyzer is turned off.

Example of the MOV command

`OUTPUT 718;"MOV ngs_XBTA,-33;"`	*Change the limit value from its default of -36 dBm to -33 dBm.*

If you use the VARDEF command:

The value for the limit variable is retained by the limit variable even if an instrument preset (IP) is executed or the spectrum analyzer is turned off.

Example for the VARDEF command

`OUTPUT 718;"VARDEF ngs_XBTA,-33;"`	*Change the limit value from its default of -36 dBm to -33 dBm.*

The VARDEF command changes the GSM9OO measurements personality that is currently in spectrum analyzer memory; the VARDEF command does not change the program on the HP 85715B memory card. If you reload the GSM9OO measurements personality from the HP 85715B memory card, all the limit variables are set to their default values.

Table 5-1. Factory Defined Limit Variable Names

Measurement	Condition	Variable Name	Default Limit Value
	Base Station, TX Band Start Frequency	ng-BA	925E6 Hz
	Base Station, TX Band End Frequency	ng-BB	960E6 Hz
Modulation	Base Station, less than 6 MHz Offset	ng-BSMA	-40 dBm
Modulation	Base Station, greater than 6 MHz Offset	ng-BSMB	-45 dBm
Transients	Base Station, 400 kHz Offset	ng_BSRA	-57 dBc
Transients	Base Station, 600 kHz Offset	ng_BSRB	-67 dBc
Transients	Base Station, 1.2 MHz Offset	ng_BSRC	-74 dBc
Transients	Base Station, 1.8 MHz Offset	ng_BSRD	-74 dBc
Transients	Base Station, Minimum Absolute Limit	ng-BSA	-36 dBm
Spurious TX	Base Station, TX and Outside Bands less than 1 GHz	ng-XBTA	-36 dBm
Spurious TX	Base Station, Outside Band greater than 1 GHz	ng-XBTB	-30 dBm
Spurious TX	Base Station, RX Band	ng_XBR	-98 dBm
Spurious TX	Base Station, GSM900, TX Band	ng_OTX	-47 dBm
Spurious RX	Base Station, TX and Outside Bands less than 1 GHz	ng-RBTA	-57 dBm
Spurious RX	Base Station, Outside Band greater than 1 GHz	ng-RBTB	-47 dBm
PvT	Base Station, Inactive Timeslot	ng-BSIDR	-30 dBc
PvT	Base Station, Inactive Timeslot Absolute Limit	ng_BSIDA	None

Table 5-1. Factory Defined Limit Variable Names (continued)

Measurement	Condition	Variable Name	Default Limit Value
	Mobile Station, TX Band Start Frequency	ng-MA	880E6 Hz
	Mobile Station, TX Band End Frequency	ng-MB	915E6 Hz
Modulation	Mobile Station, less than 600 kHz Offset	ng-MSMA	-36 dBm
Modulation	Mobile Station, Offset 600 kHz up to 1.8 GHz	ng_MSMB	-51 dBm
Transients	Mobile Station, Class 1 P-GSM RX Band	ng-MRA	-71 dBm
Transients	Mobile Station, RX Band	ng-MRB	-79 dBm
Transients	Mobile Station, DCS1800, RX Band	ng-MRE	-71 dBm
Spurious TX	Mobile Station, TX and Outside Bands less than 1 GHz	ng-XMTA	-36 dBm
Spurious TX	Mobile Station, Outside Band greater than 1 GHz	ng_XMTB	-30 dBm
Spurious TX	Mobile Station, Idle Mode, TX and Outside Bands less than 1 GHz	ng_XMTIA	-57 dBm
Spurious TX	Mobile Station, Idle Mode, Outside Bands greater than 1 GHz	ng-XMTIB	-47 dBm
Spurious TX	Mobile Station, Idle Mode, E-GSM TX Band	ng-XMTIC	-59 dBm
Spurious TX	Mobile Station, Idle Mode, DCS1800 TX Band	ng_XMTID	-53 dBm
Spurious TX	Mobile Station, Class 1 P-GSM RX Band	ng_XMRA	-71 dBm
Spurious TX	Mobile Station, P-GSM RX Band	ng-XMRB	-79 dBm
Spurious TX	Mobile Station, Class 1 G1 RX Band	ng_XMRC	-59 dBm
Spurious TX	Mobile Station, G1 RX Band	ng-XMRD	-67 dBm
Spurious TX	Mobile Station, DCS1800 RX Band	ng-XMRE	-71 dBm
Spurious RX	Mobile Station, TX and Outside Bands less than 1 GHz	ng_RBTA	-57 dBm
Spurious RX	Mobile Station, Outside Band greater than 1 GHz	ng_RBTB	-47 dBm
PvT	Mobile Station, Inactive Timeslot	ng_MSIDR	-59 dBc
PvT	Mobile Station, Inactive Timeslot Absolute Limit	ng_MSIDA	-54 dBm
PvT	Mobile Station, Preceding Timeslot Absolute Limit	ng-MSIDP	-36 dBm

To create a limit line function

When a measurement is made, the limit line (mask) for that function is automatically drawn on the display. Table 5-2 contains the functions that are called by the various measurement commands. Some of these functions provide dynamic limit lines (that is, the limit line levels that are calculated as a function of the measured carrier power level).

Factory defined limit lines can be redefined by downloading program functions into the spectrum analyzer memory. A custom function overwrites the factory defined program function in the spectrum analyzer memory. The factory defined limit line function is restored when the group is reloaded into the spectrum analyzer from the memory card.

1. Use the FUNCDEF command to create a limit line function.

   The power versus time burst, power versus time rising edge, and power versus time falling edge measurements each have a specific limit line function definition (FUNCDEF) assigned to the measurement. (See Table 5-2 for a list of the limit line function names.) When you use the FUNCDEF command to create a limit line function, you are actually redefining the existing limit line function that was created by the GSM900 measurements personality.

2. Use the LIMIDEL command to delete any current limit lines. See the programming documentation for the spectrum analyzer for more information about the LIMIDEL command.

3. Enter the values for the new upper limit line into a trace.

   The values must be in display units. With an amplitude scale of 10 dB/div, there are 0 to 8000 display units for the spectrum analyzer display, with 0 representing the bottom graticule and 8000 representing the top graticule. A display unit is equal to 0.01 dB.

4. Move the contents of the trace into the upper limit line with the LIMIHI command.

   See the programming documentation for the spectrum analyzer for more information about the LIMIHI command.

5. Repeat step 3, and then move the contents of the trace into the lower limit line with the LIMILO command.

   See the programming documentation for the spectrum analyzer for more information about the LIMILO command.

6. Turn on limit line testing with the LIMITEST command.

   See the programming documentation for the spectrum analyzer for more information about the LIMITEST command.

7. End the FUNCDEF declaration.

The power versus time burst, power versus time rising edge, and power versus time falling edge measurements use and display an upper and a lower limit line as part of the measurement. You can change the position and shape of these limit lines by creating a limit line function.

Once you have created a limit line function, your limit line function remains in use unless you reload the measurement group into spectrum analyzer memory.

Table 5-2. Factory Defined Limit Line Conditions and Function Names

Measurement Name	Condition	Function Name
Power vs Time Frame	148 & 88 bit burst	ngp-FRLIM
Power vs Time Timeslot	148 bit burst	ngp-SLIM
Power vs Time Timeslot	88 bit burst	ngp-SXLIM
Power vs Time Top 10 dB	148 bit burst	ngp-TPLIM
Power vs Time Top 10 dB	88 bit burst	ngp-TPXLIM
Power vs Time Rising	148 & 88 bit burst	ngp-RLIM
Power vs Time Falling	148 bit burst	ngp-FLIM
Power vs Time Falling	88 bit burst	ngp-FXLIM
RF Spectrum Modulation	MS	ngos_MMLIM
RF Spectrum Modulation	BS	ngos-MBLIM
RF Spectrum Modulation RX Band	MS	ngos-MRXLIM
RF Spectrum Modulation RX Band	BS	ngos-BRXLIM
RF Spectrum Transient	MS	ngos-XMLIM
RF Spectrum Transient	BS	ngos_XBLIM

Example 1

The following example shows you how you can create a limit line function for changing the limit lines that are used in the power versus time rising measurement.

```
!                                          GSM900 Power vs Time Rising edge
                                           Limits
!
!                                          Notes:
!                                          Horizontal: trace elements go from 1
                                           thru 401.
!                                          Vertical: 100 display units/dB, Ref Lvl
                                           = 8000
!
!                                          The mean of the burst is positioned
                                           2dB below Ref Lvl = 7800.
!
!                                          Swp Time = 80 us, gives 0.2 us per
                                           trace element
!
OUTPUT @Sa;"FUNCDEF ngp_RLIM,@";           Limit line function name
!
OUTPUT @Sa;"LIMIDEL;";                     delete existing limit lines
!
!                                          upper limit line
!                                          calc vert position for absolute limit
                                           line segment.
OUTPUT @Sa;"{_X=8000-3200};";              calculate dynamic position
!                                          30 dB below signal level
!                                          (32 below ref level)
!                                          draw upper limit line in Trace A, then
                                           transfer to Limit Line Hi
OUTPUT @Sa;"MOV TRA[1,150],_X;";           1st horiz seg, calculated _X
OUTPUT @Sa;"MOV TRA[151,401],8030;";       2nd horiz seg, mean + 2.3 dB
OUTPUT @Sa;"LIMIHI TRA;";                  transfer TRA to LIMIHI
!
!                                          lower limit line
!                                          draw lower limit line in Trace A, then
                                           transfer to Limit Line Lo
OUTPUT @Sa;"MOV TRA[1,240],-8000;";        1st horiz seg, off screen
OUTPUT @Sa;"MOV TRA[241,401],5800;";       2nd horiz seg, mean-20 dB
OUTPUT @Sa;"LIMILO TRA;";                  transfer TRA to LIMILO
OUTPUT @Sa;"LIMITEST1;";                   turn on Limit Test
OUTPUT @Sa;"@;";
```

Changing Output RF Spectrum Offset Values

The list of offset frequencies used for the Output RF Spectrum, Multiple Mode measurements is contained in the function ngos-OFS. This function needs to contain the two statements provided below, which place the frequency offset values into two single-dimension arrays (traces).

Output RF Spectrum Modulation Offset List

```
ng_MOFST< number, number, . . . . . . . number >;
< number > ::= integer from 0 through 32767
Units in kHz
```

Output RF Spectrum Transient Offset List

```
ng_TOFST < number, number, . . . . . . . number >;
< number > ::= integer from 0 through 32767
Units in kHz
```

For each offset number in the following lists, two measurements are made. One at the negative (-) frequency offset, and the other at the positive (+) frequency offset. The maximum number of offsets in the list is 16. The end of the list is marked using a value of 0. The reference measurement at 0 offset is always made and does not need to be specified in the list.

The following example is the function as defined in the GSM900 Transmitter Measurements Personality.

`FUNCDEF ngos_OFS,@`	*Define the function ngos_OFS.*
`ngos_MOFST 100,200,250,400,600,800,` `1000,1200,1400,1600,1800,0;`	*Place the offset values into trace ngos-MOFST for modulation multiple measurement.*
`ngos_TOFST 400,600,1200,1800,0;`	*Place the offset values into trace ngos_TOFST for transient multiple measurement.*
`@;`	*End of function.*

To save limit variables and limit line functions on a RAM card, using an external keyboard

1. Refer to "To use an external keyboard to enter commands" (located earlier in this chapter) for information about connecting an external keyboard to the spectrum analyzer.
2. Delete the current version of the GSMSOO personality and any other downloadable programs from analyzer memory by pressing (CONFIG) More 1 of 3 Dispose User Mem ERASE DLP MEM ERASE DLP HEM.
3. Insert a RAM card into the analyzer's front-panel memory card reader. Ensure that the RAM card is not write-protected (the switch on the RAM card should be set to the read/write (↔) position).
4. Type in the programming statements that define the limit variable or limit line function.
   - For a limit variable, type in "VARDEF, " the name of the variable (see Table 5-l for a complete list of limit variables), a comma, and the value you want for the limit. Repeat this step for each limit you want to define.
   - For a limit line function, create the limit line function. (See "To create a limit line function" for information about how to create a limit line function, but do not use the OUTPUT or PRINT statements to send the commands to the spectrum analyzer.) Repeat this step for each limit line function that you want to define.
5. Type in "STOR d,'dLIMIT1',*;" to store all the newly defined limits and limit line functions on the memory card. The limits and limit line functions will be stored in a file called "dLIMIT1".
6. Load the personality into spectrum analyzer memory (see "Downloading the GSM9OO transmitter Measurements Personality" in Chapter 1 for more information). Switch to the GSMSOO personality by pressing (MODE) GSM900 ANALYZER.
7. Remove the GSM9OO memory card from the memory card reader and insert the RAM card (with the dLIMIT1 file on it) into the memory card reader.
8. Load the dLIMIT1 file into spectrum analyzer memory by pressing (RECALL) Catalog Card More 1 of 2 CATALOG DLP . If necessary, turn the large knob on the spectrum analyzer's front panel until "dLIMIT1" is highlighted. Press LOAD FILE .

When you load the GSM9OO measurements personality, the measurements personality uses default values for the limits and limit line functions. If you then load the dLIMIT1 file into spectrum analyzer memory, the personality will use the revised limit values or limit line function. The revised values will remain in spectrum analyzer memory until the analyzer memory is erased, or the personality is reloaded from the memory card.

Note Limit line functions will be overwritten when a measurement group is loaded or re-loaded. To overcome this, either follow step 8 again or see "Modify the default values or limit line functions used by the personality" in this chapter.

Example

Use an external keyboard to enter in the following command example lines. Press ENTER after each line:

```
VARDEF ngs_XBTA,-38;
VARDEF ngs_XBTB,-32;
STOR d,'dLIMIT1',*;
```

The previous command lines will change the Base Station Spurious Limit (≤1 GHz) to -38 dBm, (>1 GHz) to -32 dBm. The last line stores these limits on a RAM card with the file name "dLIMIT1."

To save limit variables and limit line functions on a RAM card, using a computer

1. Insert a RAM card into the analyzer's front-panel memory card reader. Ensure that the RAM card is not write-protected (the switch on the RAM card should be set to the read/write (↔) position).
2. Delete the current version of the GSMSOO personality and any other downloadable programs from analyzer memory with the DISPOSE ALL command.
3. Type in the programming statements that define the limit, parameter, or limit line function.
   - For a limit variable, use an OUTPUT or PRINT command to send the spectrum analyzer command VARDEF (defines the limit variable) and the limit variable name. See Table 5-l for a complete list of limit variables. Repeat this step for each variable you want to define.
   - For a limit line function, create the limit line function. (See "To create a limit line function" for information about how to create a limit line function.) Repeat this step for each limit line function that you want to define.
4. Use an OUTPUT or PRINT command to send the STOR spectrum analyzer command. Use "STOR d,'dLIMIT1', *;" to store the newly defined variables or limit line functions on the memory card. The variables and limit line function will be stored in a file called "dLIMIT1."
5. Load the personality into spectrum analyzer memory (see "To load the GSM9OO measurements personality remotely" for more information).
6. Remove the GSM9OO memory card from the memory card reader and insert the RAM card (with the dLIMIT1 file on it) into the memory card reader.
7. Load the dLIMIT1 file into spectrum analyzer memory. You can load the dLIMIT1 file by pressing (RECALL) Catalog Card Mare 1 of 2 CATALOG DLP . If necessary, turn the large knob on the spectrum analyzer's front panel until "dLIMIT1" is highlighted. Press LOAD FILE . Switch to the GSM9OO personality by sending "MODE 10" or pressing [MODE) GSM900 ANALYZER.

   Or,

   Use the LOAD command to load the dLIMIT1 file. For example, execute OUTPUT 718;"LOAD %dLIMIT1%;".

When you load the GSM9OO measurements personality, the measurements personality uses default values for the limit variables and the limit line functions. If you then load the dLIMIT1 file into spectrum analyzer memory, the personality will use the revised limit or parameter values or limit line functions. The revised values or limit line functions will remain in spectrum analyzer memory until the analyzer memory is erased, or the personality is reloaded from the memory card.

Note Limit line functions will be overwritten when a measurement group is loaded or re-loaded. To overcome this, either follow step 7 again or see "Modify the default values or limit line functions used by the personality" in this chapter.

Any number of custom limit files may be created and stored on a memory card as long as each file has a unique file name, and there is enough space on the RAM card to store the files.

Example

`!`	*restore "LIMIT1_EX"*
`!`	*Shows how to save custom measurement limits to a card for the GSM900 DLP. This card file can then be loaded after loading GSM900.*
`!`	
`ASSIGN @Sa TO 718`	*i/o path to spectrum analyzer*
`!`	
`!`	
`OUTPUT @Sa;"IP;SNGLS;"`	
`OUTPUT @Sa;"TS;DONE?"`	
`ENTER @Sa;Done`	
`OUTPUT @Sa;"DISPOSE ALL;"`	*make sure all DLPs erased.*
`WAIT 10`	*wait for dispose all to finish.*
`OUTPUT @Sa;"VARDEF ngs_XBTA,-38;"`	*change carrier pwr high limit to -38 dBm*
`OUTPUT @Sa;"VARDEF ngs_XBTB,-32;"`	*change carrier pwr low limit to -32 dBm*
`!`	
`OUTPUT @Sa;"STOR d,'dLIMIT1',*;"`	*store to RAM memory card*
`OUTPUT @Sa;"CONTS;"`	*continuous sweep*
`DISP "DONE"`	
`!`	
`END`	

To modify the default values or limit line functions used by the personality

- Create a custom limits file on a RAM card as described earlier. For example "dLIMIT1".
- Delete the current version of the GSM9OO personality and any other downloadable programs from analyzer memory by pressing (CONFIG) More 1 of 3 Dispose User Mem ERASE DLP MEM ERASE DLP MEM.
- Load the dLIMIT1 file into spectrum analyzer memory by pressing (RECALL) Catalog Card More 1 of 2 CATALOG DLP . If necessary, turn the large knob on the spectrum analyzer's front panel until "dLIMIT1" is highlighted. Press LOAD FILE.
- Insert the RAM card containing the GSM9OO personality into the analyzer's front-panel memory card reader. Ensure that the RAM card is not write-protected (the switch on the RAM card should be set to the read/write (↔) position).
- Type in "STOR d,'CUSTLIM',*;" to create a new custom limits file which will be used whenever the GSM9OO personality is run, or a new personality group is loaded from this card.

Syntax Conventions

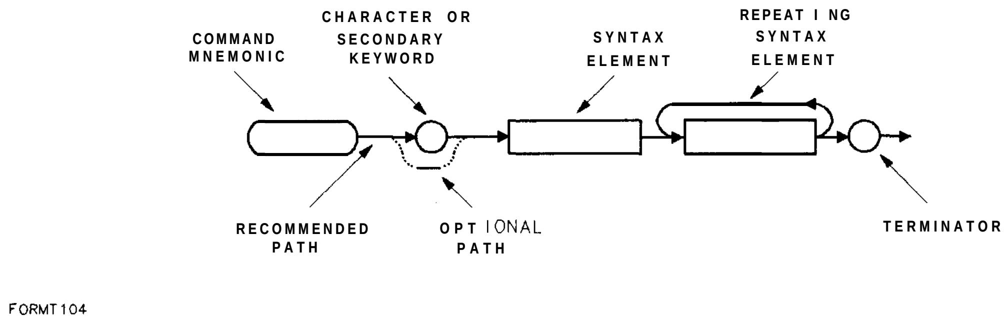


Figure 5-1. Pictorial Command Syntax Conventions

- Command mnemonics are shown within ovals. The command mnemonic must be entered exactly as shown.
- Syntax elements are shown within rectangles.
- A loop above a syntax element indicates that the syntax element can be repeated.
- Solid lines represent the recommended path.
- Dotted lines indicate an optional path.
- Curved intersections (not illustrated in Figure 5-l) indicate command path direction.
- Semicolons or question marks are the required command terminators. Question marks do not need to be followed with a semicolon. However, using semicolons makes programs easier to read, prevents command misinterpretation, and is recommended by IEEE Standard 728.

Note You may use either upper-case or lower-case letters for any command mnemonic.

Table 5-3. Syntax Elements

Syntax Component	Definition or Range
GSM900 remote command	Any command in this chapter, using the required syntax.
character	SP ! " # $ % & ' ( ) + , / 0 1 2 3 4 5 6 7 8 9 : ; A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [\ ] ? - ' a b c d e f g h i j k l m n o p q r s t u v w x y z (Characters are a subset of data byte, and SP indicates a blank space.)
character & EOI	8-bit byte containing character data only, followed by end-or-identify (EOI) condition, where the EOI control line on HP-IB is asserted to indicate the end of the transmission. END signifies the EOI condition.
data byte	8-bit byte containing numeric or character data.
data byte & EOI	8-bit byte containing numeric or character data followed by end-or-identify (EOI) condition, where the EOI control line on HP-IB is asserted to indicate the end of the transmission. END signifies the EOI condition.
delimiter	/ " & % ' : ! @ Matching characters that mark the beginning and end of a character string, or a list of user-defined functions or analyzer commands. Choose delimiting characters that are not used within the string they delimit.
digit	0 1 2 3 4 5 6 7 8 9 Digit is a subset of character.
number	Expressed as integer, decimal, or in exponential (E) form. The allowed real-number range is typically command dependent. Integer Number Range: -32,768 through +32,767
output termination	Carriage return (CR) and line feed (LF) with end-or-identify (EOI) condition. ASCII codes 13 (carriage return) and 10 (line feed) are sent via HP-IB, then the end-or-identify control line on HP-IB sets to indicate the end of the transmission.
string	A delimited sequence of zero or more characters.
units	Represent standard scientific units. Frequency Units: GHZ or GZ, MHZ or MZ, KHZ or KZ, HZ Amplitude Units: DB, DBM, DM, DBMV, DBUV, V, MV, UV, W, MW, UW Time Units: SC, MS, US Phase Angle Units: DEG

Using the Functional Index Table

The following table lists GSM900 Transmitter Measurements Personality softkeys beside their related remote command. Some remote commands need more than one command to produce the effect of a related softkey.

In the table, multiple commands are listed with semicolons between the command names. Use the semicolon to delimit the multiple command string.

Table 5-4. Functional Index

GSM900 Softkey	Corresponding Remote Command Sequence
ng Group -- Configuration, Physical Channel, Carrier Power, and Monitor TX Rand Commands	
156.25 157/156	ng_FRMS;
ARFCN	ng_ARFCN;
AUTO TN	ng_ATN;
AUTO ARFCN	ng-AA;
AUTO ARFCN&TN	ng_AATN;
BITS 88 148	ng_BURST;
CARRIER OFFSET	ng_COFST;
CARRIER POWER	ng_CPS;ng_CPM;
DEFAULT CONFIG	ng-DEFAULT;
DISPOSE GSM900	ng-DISPOSE;
EXT ATTEN	ng-EXTATN;
MEASURE AVG PKS	ng-PKAVG;
MONITOR TXBAND	ng_MBS;ng_MBM;
MS CLASS 1 2-5	ng_MSCL;
NUMBER BURSTS	ng-NB;

Table 5-4. Functional Index (continued)

GSM900 Softkey	Corresponding Remote Command Sequence
ng Group – Configuration, Physical Channel, Carrier Power, and Monitor TX Rand Commands (continued)	
PREAMP GAIN	ng-PREAMPG;
PRESET GSM900	ng-MP;
REPEAT MEAS	ng-RPT;
SFH ON OFF	ng-SFH;
TIMESLOT NUMBER	ng-TN;
TOTL PWR SGL MULT	ng-TPMODE; *or* ng-TOTPWR;
TRIG DELAY	ng-TRIGD;
TRIG POL NEG POS	ng_TRIGP;
TX MS BS	ng_BSMS;
ngp Group – Power Steps and Power vs Time (Command: ng_GROUP 1)	
COMBINER TUNING	ngp_CTS;ngp_CTM;
POWER STEPS	ngp-STEPS;ngp-STEPM;
P vs T FALLING	ngp_FS;ngp_FM; †
P vs T FRAME	ngp_FRS;ngp_FRM;
P vs T RISING	ngp_RS;ngp_RM; †
P vs T SUB TS	ngp_SSS;ngp_SSM;
P vs T TIMESLOT	ngp_SS;ngp_SM;
P vs T TOP 10dB	ngp_TPS;ngp_TPM; †

† The power vs time falling edge, rising edge, and Top 10 dB measurements must be preceded by the P vs T SUB TS commands.

Table 5-4. Functional Index (continued)

GSM900 Softkey	Corresponding Remote Command Sequence
ngos Group – Output RF Spectrum (Command: ng_GROUP 2)	
MODULAT RX BAND	ngos-MRXS;ngos-MRXM;
MODULAT SWEPT	ngos_MODE0;ngos_MS;ngos_MM;
MODULAT SINGLE	ngos_MODE2;ngos_MS;ngos_MM;
MODULAT MULTIPLE	ngos_MODE1;ngos_MS;ngos_MM;
TRANSNT SWEPT	ngos_MODE0;ngos_XS;ngos_XM;
TRANSNT SINGLE	ngos_MODE2;ngos_XS;ngos_XM;
TRANSNT MULTIPLE	ngos_MODE1;ngos_XS;ngos_XM;
ngs Group – Spurious Emissions (Command: ng_GROUP 3)	
IDLE YES NO	ngs-IDLEF;
MAXIMUM RES BW	ngs-MAXRBW;
NUMBER SWEEPS	ngs-NUMBSWPS;
OUTSIDE TX & RX (for Transmitter Spurious Emissions)	ngs_RCVRF0;ngs_MEASOUT;
OUTSIDE TX BAND (for Receiver Spurious Emissions)	ngs-RCVRFl;ngs-MEASOUT;
RX BAND (for Transmitter Spurious Emissions)	ngs-MEASRX
SPUR TST ON OFF	ngs-TSTF
TX BAND (for Transmitter Spurious Emissions)	ngs_RCVRF0;ngs_MEASTX;
TX BAND (for Receiver Spurious Emissions)	ngs_RCVRF1;ngs_MEASTX;
ngi Group – Intermodulation Attenuation (Command: ng_GROUP 4)	
REF CHANNEL	ngi-REFCH;
RX BAND (Intra-BSS Intermodulation)	ngi-INTRARX;
TX BAND (Intra-BSS Intermodulation)	ngi-INTRATX;

Table 5-4. Functional Index (continued)

GSM900 Softkey	Corresponding Remote Command Sequence
ngd Group – Demodulation(Phase and FrequencyError)(Command: ng_GROUP 5) (Spectrum analyzer option 163 required.)	
COLOR AUTO MAN	ngd_AC; or ngd_COL;
DATA BITS	ngd_DBS;ngd_MEAS;
END BIT	ngd-END;
FREQ DEV GRAPH	ngd_FGS;ngd_MEAS;
FREQ ERR OFFSET	ngd_FOST;
MEAS CAL ON OFF	ngd-MCAL;
PHASE & FRQ GRAPH	ngd_PFG;ngd_MEAS;
PHASE FREQ	ngd-PFS;ngd-MEAS;
PHASE GRAPH	ngd_PGS;ngd_MEAS;
SCALE	ngd_SCALE;
START BIT	ngd-START;
STD DEV ON OFF	ngd-STDEV;
SYNC MID AMPL	ngd_SYNC;

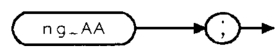
ng_AA

Automatic ARFCN

The ng-AA command automatically sets the absolute RF channel number (ARFCN) to the channel having the maximum signal level.

Syntax

ng_AA



Description

The ng-AA command is equivalent to pressing the **AUTO** ARFGN key.

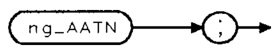
ng_AATN

Automatic ARFCN andTimeslot Number

The **ng_AATN** command automatically sets both the absolute RF channel number (ARFCN) and the timeslot number. The command sets the ARFCN to the RF channel with the maximum signal level, then sets the timeslot to the one with the maximum signal level for the selected ARFCN .

Syntax

ng_AATN



Description

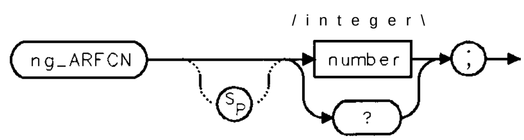
The **ng_AATN** command is equivalent to pressing the AUTO **ARFCN&TN** key.

ng_ARFCN

Absolute RF Channel Number

The **ng_ARFCN** command selects the RF Channel to be measured. The center frequency of the spectrum analyzer is tuned to the center frequency of the selected RF channel for channel measurements such as Carrier Power, Power Steps, Power vs Time, and Output RF Spectrum. In other words, the ARFCN is only coupled to the center frequency for channel measurements.

ng_ARFCN



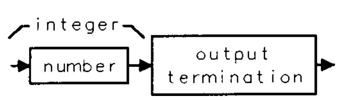
Item	Description	Range
number	A valid integer within the specified range.	0 through 124 and 975 through 1023

Description

The ng-ARFCN command is equivalent to pressing the **ARFCN** key.

Query Response

Q1



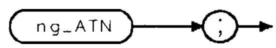
ng-ATN

Automatic Timeslot Number

The ng-ATN command automatically sets the timeslot to the one with the maximum signal level for the selected ARFCN.

Syntax

ng_ATN



Description

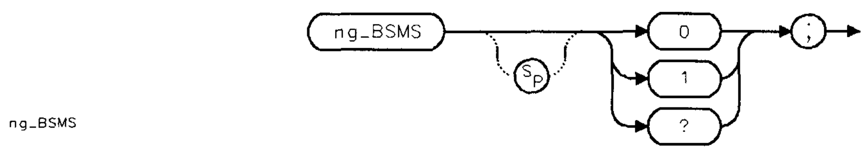
The **ng_ATN** command is equivalent to pressing the **AUTO** TN key.

ng_BSMS

Base Station and Mobile Station Selector

The ng_BSMS command sets the spectrum analyzer frequency to be in either the base station or mobile station transmit band. The setting also serves as a flag for measurements which differ between base and mobile station testing.

Syntax

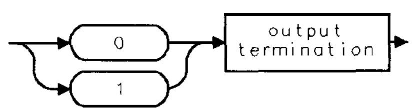


Item	Description
0	Base Station transmit band 925 MHz to 960 MHz
1	Mobile Station transmit band 880 MHz to 915 MHz

Description

The ng-BSMS command is equivalent to pressing the TX MS BS key.

Query Response

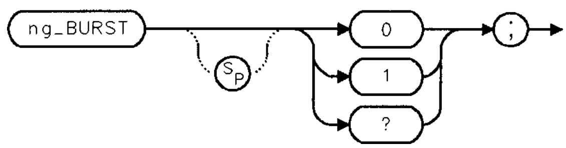


ng_BURST

Burst Type

The ng-BURST command selects the type of burst to use for measurements.

Syntax



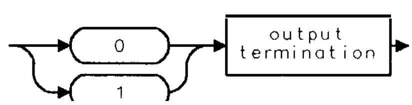
ng_BUSRT

Item	Description
0	An 148-bit burst
1	An 88-bit burst (access burst for mobile station testing)

Description

The ng-BURST command is equivalent to pressing the BITS 88 148 or Burst Type keys.

Query Response



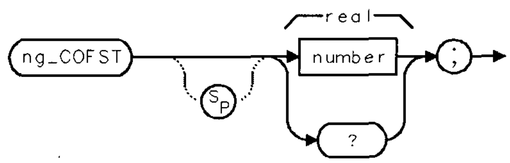
03

ng_COFST

Carrier Offset

The ng-COFST command sets the spectrum analyzer center frequency to the center of the RF channel frequency plus the carrier offset.

Syntax



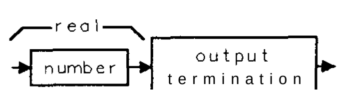
ng-COFST

Item	Description	Range
number	A real number within the specified range.	–10E8 Hz to 10E8 Hz

Description

The **ng_COFST** command is equivalent to pressing the CARRIER OFFSET key.

Query Response



Q2

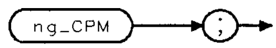
ng-CPM

Carrier Power Measurement

The ng_CPM command starts the Carrier Power measurement. Refer to the Measurement Results table below for the variable or trace name that contains the measurement results.

Syntax

ng_CPM



Variable or Trace	Description of Contents	Units
Measurement State = 1	Measurement completed; no errors detected.	
Measurement State = 2	Measurement completed; no carrier found.	
ng-CPA	Contains Carrier Power measurement results.	dBm
TRA	Contains Dower waveform.	dBm

Description

The ng-CPS command followed by the ng_CPM command is equivalent to pressing the CARRIER POWER key.

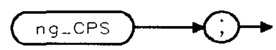
ng_CPS

Carrier Power Measurement Setup

The ng-CPS command sets the spectrum analyzer parameters to make the Carrier Power measurement.

Syntax

ng_CPS



Description

The **ng_CPS** command followed by the ng-CPM command is equivalent to pressing the CARRIER POWER key.

ng-DEFAULT

Default Configuration

The ng_DEFAULT command sets all parameters located in the Configuration menu to their default states. The configuration parameters are not modified or lost as a result of pressing (PRESET) or cycling the spectrum analyzer's power.

Syntax

ng_DEFAU

Description

The ng-DEFAULT command is equivalent to pressing the DEFAULT **CONFIG** key. Refer to Table 6-1, "GSM900 Measurement Preset States and Default Conditions" for a list of the default settings.

ng-DISPOSE

Dispose GSM900

The ng-DISPOSE command erases the GSM900 Transmitter Measurements Personality from spectrum analyzer memory. Other downloaded functions in spectrum analyzer memory are not erased or changed.

Syntax

Description

The ng-DISPOSE command is equivalent to pressing the DISPOSE **GSM900** key.

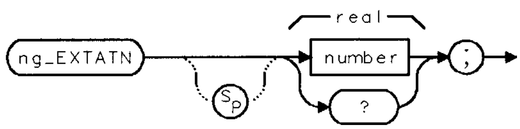
ng_EXTATN

External Attenuation

The ng_EXTATN command allows you to enter the value of the external attenuation between the transmitter output and the RF INPUT of the spectrum analyzer.

Syntax

ng_EXTAT



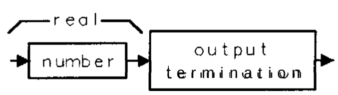
Item	Description	Range
number	Any real number within the specified range.	0 dB through 60 dB

Description

The ng_EXTATN command is equivalent to pressing the EXT ATTEN key.

Query Response

02

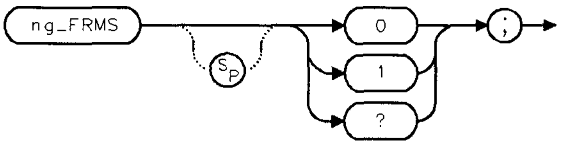


ng-FRMS

Frame Structure

The ng_FRMS command selects the type of frame structure to use during some of the GSM900 measurements.

Syntax



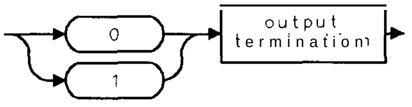
ng_FRMS

Item	Description
0	A 156.25-bit burst in all timeslots.
1	A 157-bit burst in timeslots 0 and 4, and a 156-bit burst in timeslots 1, 2, 3, 5, 6, and 7.

Description

The ng_FRMS command is equivalent to pressing the 156.25 157/156 key.

Query Response



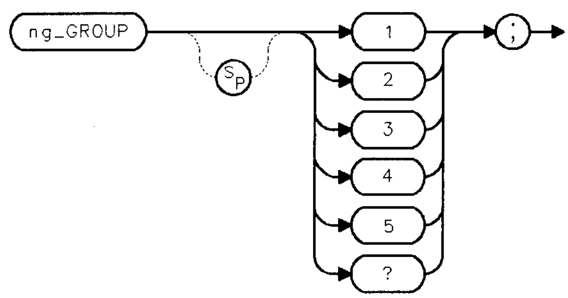
Q3

ng_GROUP

Select GSM900 Measurement Group

The ng_GROUP command first clears the spectrum analyzer's memory of any previously stored GSM900 measurement groups. Next, the command loads the new measurement group and all related softkeys and menus into the spectrum analyzer's memory.

Syntax



ng_GRP

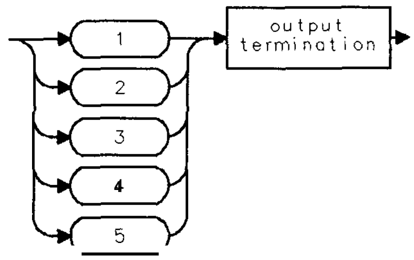
Item	Description
1	Power Step and Power vs Time measurement group (ngp_ prefix)
2	Output RF Spectrum measurement group (ngos_ prefix)
3	Spurious measurement group (ngs_ prefix)
4	Intermod measurement group (ngi_ prefix)
5	Phase and Frequency Error measurement group (ngd_ prefix) (Spectrum analyzer option 163 required.)

Description

A group must be loaded into the spectrum analyzer memory before sending any GSM900 Transmitter Measurements Personality remote commands that belong to that group.

Variable or Trace	Description of Contents
ng-OK = 0	No memory card or wrong memory card detected.
ng-OK = 1	Correct memory card detected.

Query Response



QGROUP

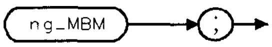
ng_MBM

Monitor TX Band Power Measurement

The ng-MBM command starts the Monitor TX Band Power measurement.

Syntax

ng_MBM



Variable or Trace	Description of Contents	Units
Measurement State = 1	Measurement completed; no errors detected.	
ng-TPWRV	Contains the total power measured in TX band.	dBm
TRA	Contains the TX band spectrum.	dBm

Description

The **ng_MBS** command followed by the ng-MBM command is equivalent to pressing the MONITOR TX BAND key.

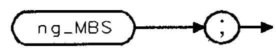
ng-MBS

Monitor TX Band Power Measurement Setup

The ng-MBS command sets the spectrum analyzer parameters to make the Monitor TX Band Power measurement.

Syntax

ng_MBS



Description

The ng-MBS command followed by the ng-MBM command is equivalent to pressing the **MONITOR** TX BAND key.

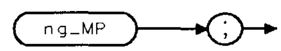
ng_MP

Mode Preset

The ng-MP command presets the GSM9OO analyzer parameters to their initial states. Only the GSM9OO mode is affected.

Syntax

ng_MP



Description

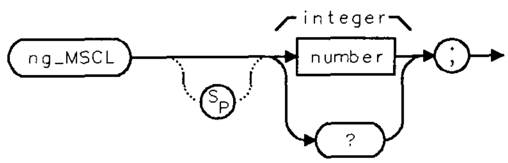
The ng-MP command is equivalent to pressing the PRESET GSM900 key. Refer to Table 6-1, "GSM9OO Measurement Preset States and Default Conditions" for a list of the GSM9OO measurement preset states.

ng_MSCL

Mobile Station Class

The ng_MSCL command specifies the class of the mobile station being measured. The class selection sets the proper limits for the measurement.

Syntax



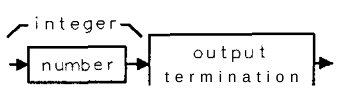
ng_MSCL

Item	Description
1	The measurement limits for class 1 mobile station.
2	The measurement limits for class 2 mobile station.
3	The measurement limits for class 3 mobile station.
4	The measurement limits for class 4 mobile station.
5	The measurement limits for class 5 mobile station.

Description

The ng-MSCL command is equivalent to pressing the MS CLASS 1 2-5 key.

Query Response



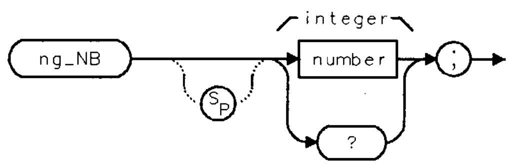
Q1

ng-NB

Number of Bursts

The ng-NB command allows you to enter the number of bursts to use for GSM900 measurements.

Syntax



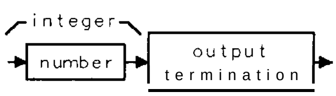
ng_NB

Item	Description	Range
number	An integer within the specified range.	1 through 2,000

Description

The ng_NB command is equivalent to pressing the NUMBER BURSTS key.

Query Response



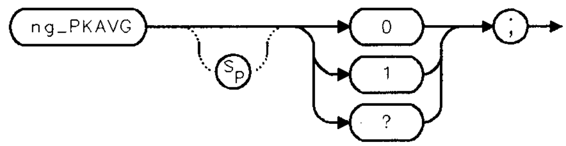
Q1

ng-PKAVG

Peak Average

The ng-PKAVG command selects either an average measurement or a maximum/minimum peak measurement for the Power vs Time or Phase and Frequency Error measurements.

Syntax

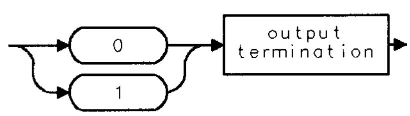


Item	Description
0	The maximum/minimum peak measurement mode.
1	The average measurement mode.

Description

The ng-PKAVG command is equivalent to pressing the MEASURE AVG PKS key.

Query Response



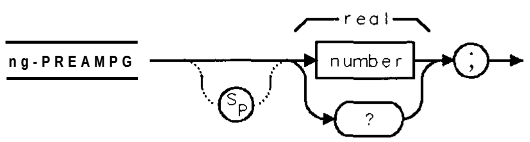
Q3

ng-PREAMPG

Preamplifier Gain

The ng_PREAMPG command allows entry of the combined preamplifier gain, bandpass filter insertion loss, and any known cable loss values into the program. The value is used during the Spurious, Intermod, and Output RF Spectrum measurements of the RX band.

Syntax



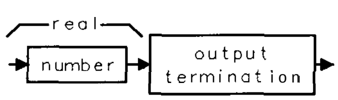
ng_PREAM

Item	Description	Range
number	Any real number within the specified range.	-20 through 50 dB

Description

The ng_PREAMPG command is equivalent to pressing the PREAMP GAIN key.

Query Response



Q2

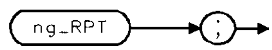
ng-RPT

Repeat Measurement

The ng-RPT command allows you to repeat the last-performed measurement, without having to re-do a measurement setup command.

Syntax

ng_RPT



Description

The ng_RPT command is equivalent to pressing the **REPEAT MEAS** key.

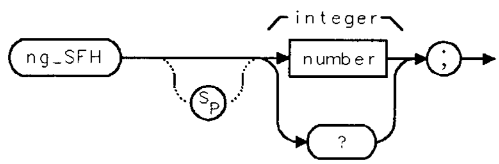
ng_SFH

Slow Frequency Hopping Repetition Factor

The ng-SFH command enables or disables the slow frequency hopping mode. The command also allows you to enter the SFH repetition factor.

Syntax

ng_SFH



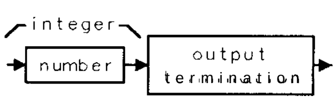
Item	Description
number	An integer whose value equals the SFH repetition factor.
1	Slow frequency hopping disabled. Repetition factor is 1.
2 – 100	Slow frequency hopping enabled. Repetition factor equals integer between 2 and 100.

Description

The ng-SFH command is equivalent to pressing the SFH ON OFF key.

Query Response

Q1

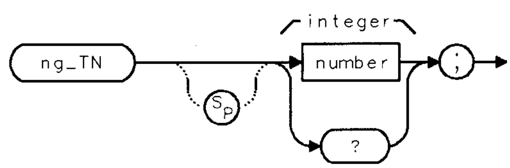


ng-TN

Timeslot Number

The ng_TN command selects the timeslot to be measured. The correct time parameters are set for channel measurements. These measurements include the Carrier Power, Power Steps, Power vs Time, Output RF Spectrum, and Phase and Frequency Error measurements.

Syntax



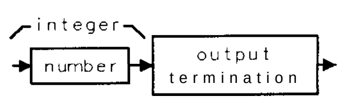
ng_TN

Item	Description	Range
number	An integer within the specified range.	0 through 7

Description

The ng_TN command is equivalent to pressing the **TIMESLOT NUMBER** key.

Query Response



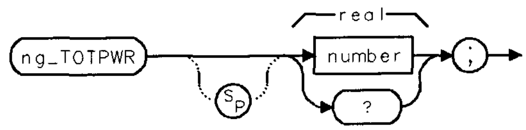
Q1

ng-TOTPWR

Total Power

The ng-TOTPWR command allows you to enter the total power used for multiple-carrier power mode.

Syntax



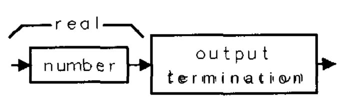
ng_TOTPW

Item	Description	Range
number	A real number within the specified range.	0 through 50 dBm

Description

The ng-TOTPWR command is equivalent to entering a value with **TOTL PWR** key.

Query Response



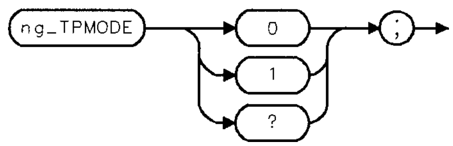
Q2

ng_TPMODE

Total Power Mode

The ng-TPMODE command selects either single-carrier or multiple-carrier power mode.

Syntax



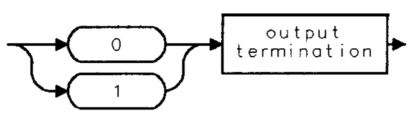
ng_TPMOD

Item	Description
0	The single-carrier power mode.
1	The multiple-carrier power mode.

Description

The ng-TPMODE command is equivalent to pressing the **TOTL** PWR **SGL MULT** key.

Query Response



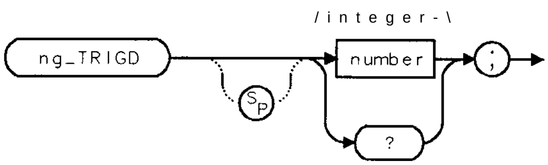
03

ng-TRIGD

Trigger Delay

The ng-TRIGD command sets the value of the trigger delay with respect to the external frame trigger signal. A trigger delay value of 0 places the trigger point at the start of bit 0 in timeslot 0.

Syntax



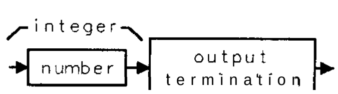
ng_TRIGD

Item	Description	Range
number	A valid integer within the range specified.	-4680 through 250 μs

Description

The ng-TRIGD command is equivalent to pressing the TRIG DELAY key,

Query Response



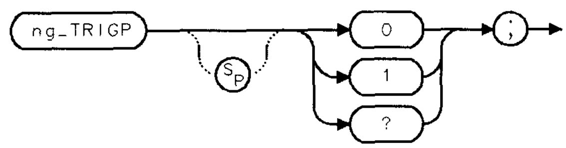
Q1

ng_TRIGP

Trigger Polarity

The ng_TRIGP command selects either positive-edge trigger mode or negative-edge trigger mode for the external frame trigger signal.

Syntax



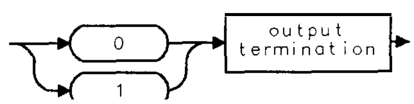
ng_TRIGP

Item	Description
0	The negative-edge trigger mode.
1	The positive-edge trigger mode.

Description

The ng_TRIGP command is equivalent to pressing the TRIG **POL NEG POS** key.

Query Response



03

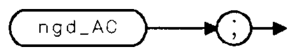
ngd_AC

Automatic Color Selection

Spectrum analyzer option 163 required

The ngd_AC command automatically selects the color pattern sent by the transmitter.

Syntax



ac

Description

The ngd-AC command is equivalent to pressing the COLOR AUTO MAN key until AUTO is underlined.

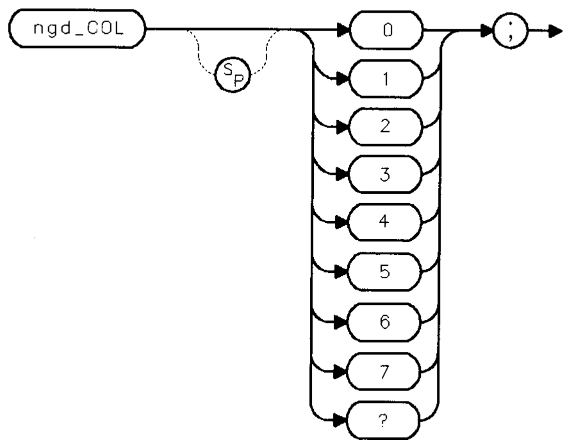
ngd_COL

Color Code Selection

Spectrum analyzer option 163 required

The ngd_COL command allows you to set the expected color code sent by the transmitter. This determines the expected midamble bit sequence, and must be correctly set to avoid error bits being reported.

Syntax

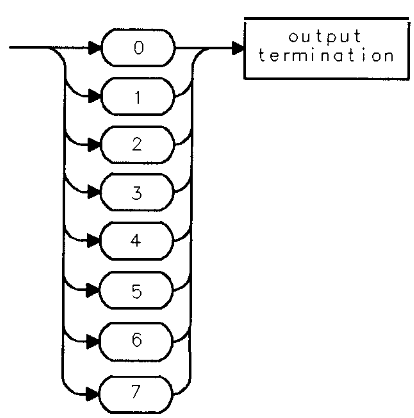


COL

Description

The ngd_COL command is equivalent to pressing the COLOR AUTO MAN key until MAN is underlined. The color codes range from 0 through 7 therefore a value in this range can be entered.

Query Response



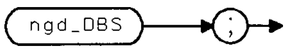
ngd_DBS

Data Bits Setup

Spectrum analyzer option 163 required

The ngd_DBS command performs the setup for the data bits measurement.

Syntax



DBS

Description

The ngd-DBS command followed by the ngd_MEAS command is equivalent to pressing the DATA BITS key.

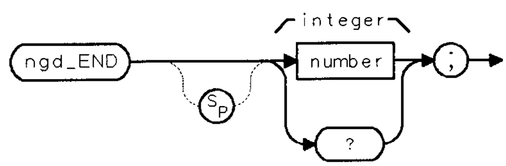
ngd_END

End Bit Number for Graph Display

Spectrum analyzer option 163 required

The ngd-END command allows you to enter the value of the last bit number in the burst you require on the graph display. This command is used in conjunction with **ngd_START**.

Syntax



end

Item	Description	Range
number	A valid integer within the range specified.	0 through 147

Description

The ngd-END command is equivalent to pressing the END BIT key.

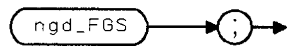
ngd_FGS

Frequency Deviation Graph Setup

Spectrum analyzer option 163 required

The ngd_FGS command performs the setup for the frequency deviation graph measurement.

Syntax



FGS

Description

The ngd-FGS command followed by the ngd_MEAS command is equivalent to pressing the **FREQ** DEV **GRAPH** key.

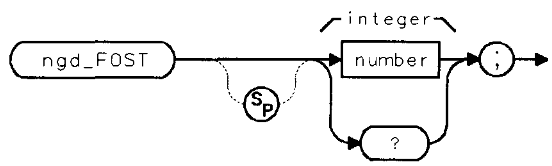
ngd_FOST

Frequency Error Offset

Spectrum analyzer option 163 required

The ngd-FOST command allows you to enter a known frequency error. This error is then subtracted from all the measured values, giving more accurate measurement results.

Syntax



FOST

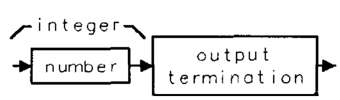
Item	Description	Range
number	A valid integer within the range specified.	-10,000 through 10,000 Hz

Description

The ngd-FOST command is equivalent to pressing the **FREQ** ERR OFFSET key.

Query Response

Q1



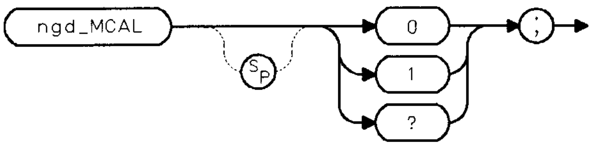
ngd-MCAL

Measurement Calibration

Spectrum analyzer option 163 required

The ngd-MCAL command allows you to initiate a frequency error self-calibration routine which is carried out prior to each frequency error measurement. This should generally be carried out whenever making frequency error measurements. The self-calibration routine can be switched off. This has the benefit of an improved update rate, but the results may not be as accurate.

Syntax



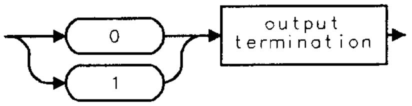
MCAL

Item	Description
0	Switches the frequency error self-calibration routine off.
1	Switches the frequency error self-calibration routine on.

Description

The ngd_MCAL command is equivalent to pressing the MEAS CAL ON OFF key.

Query Response



Q3

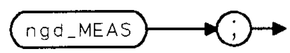
ngd_MEAS

Demodulation Measurement

Spectrum analyzer option 163 required

The **ngd_MEAS** command makes the demodulation measurement. The Trace A (TRA) and Trace B (TRB) results are determined by the last set-up performed.

Syntax



Variable or Trace	Description of Contents	Units
Measurement State = 1	Measurement completed.	
Measurement State = 2	Measurement completed; carrier detected is smaller than -20 dBm.	
Measurement State = 3	Result not valid; bad signal.	
ngd-FRE	Contains the frequency error to a resolution of 1 Hz.	Hz
ngd_PPE	Contains the peak phase error to a resolution of 0.1 °.	°
ngd_RPE	Contains the RMS phase error to a resolution of 0.1 °.	°
TRA	Contains the results waveform for the graph measurements determined by the last set-up.	Display Units
TRB	Contains the bit sequence from the data bits measurement if ngd-DBS is set-up.	
ngd_STAT[6]	Number of error bits in burst.	
ngd_STAT[1]	Results status; 0 = Good, >0 = Bad.	

Description

The **ngd_MEAS** command preceded with the following command:

- ngd-DBS is equivalent to pressing the DATA BITS key.
- **ngd_FGS** is equivalent to pressing the FREQ DEV GRAPH key.
- **ngd_PFG** is equivalent to pressing the PHASE & FRQ GRAPH key.
- ngd-PGS is equivalent to pressing the PHASE GRAPH key.
- ngd-PFS is equivalent to pressing the PHASE FREQ key.

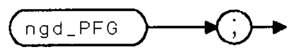
ngd-PFG

Phase and Frequency Graph Setup

Spectrum analyzer option 163 required

The ngd_PFG command performs the setup for the phase and frequency graph measurement.

Syntax



PFG

Description

The ngd_PFG command followed by the ngd_MEAS command is equivalent to pressing the PHASE & FRQ GRPH key.

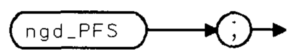
ngd_PFS

Phase Frequency Setup

Spectrum analyzer option 163 required

The ngd_PFS command performs the setup for the phase frequency measurement.

Syntax



PFS

Description

The ngd-PFS command followed by the ngd_MEAS command is equivalent to pressing the PHASE FREQ key.

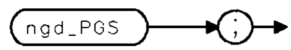
ngd_PGS

Phase Graph Setup

Spectrum analyzer option 163 required

The ngd-PGS command performs the setup for the phase graph measurement.

Syntax



PGS

Description

The ngd-PGS command followed by the ngd_MEAS command is equivalent to pressing the PHASE GRAPH key.

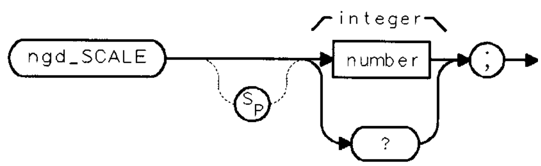
ngd_SCALE

Full Scale Deflection for Phase Graphs

Spectrum analyzer option 163 required

The ngd_SCALE command allows you to configure the scale of the graph to allow you to examine a section of the burst.

Syntax



scale

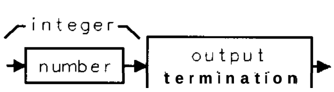
Item	Description	Range
number	A valid integer within the range specified.	1 through 4000

Description

The ngd_SCALE command is equivalent to pressing the SCALE key.

Query Response

Q1



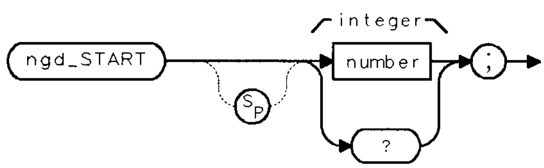
ngd-START

Start Bit Number for Graph Display

Spectrum analyzer option 163 required

The ngd-START command allows you to enter the value of the first bit number in the burst you require on the graph display. This command is used in conjunction with ngd-END.

Syntax



start

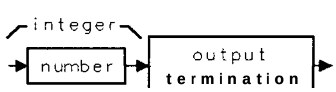
Item	Description	Range
number	A valid integer within the range specified.	0 through 147

Description

The ngd-START command is equivalent to pressing the START BIT key.

Query Response

Q1



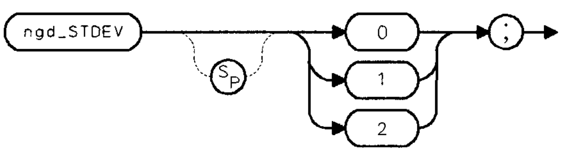
ngd-STDEV

Standard Deviation

Spectrum analyzer option 163 required

The ngd_STDEV command selects standard deviation measurement for the Phase and Frequency Error measurements. When on, this mode overrides the Peak Average (ng_PKAVG) setting.

Syntax



ngd_stdev

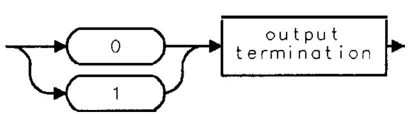
Item	Description
0	Mode off.
1	Mode on.

Description

The ngd-STDEV command is equivalent to pressing the STD DEV ON OFF key.

Query Response

Q3



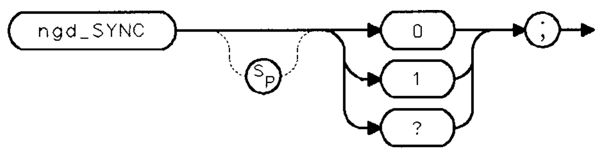
ngd-SYNC

Synchronization Selection

Spectrum analyzer option 163 required

The ngd_SYNC command selects which part of the burst the spectrum analyzer uses for synchronization.

Syntax



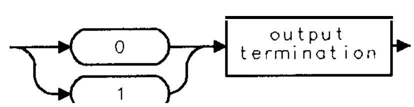
SYNC

Item	Description
0	Midamble section of the burst is used.
1	Rising edge of the burst is used.

Description

The ngd-SYNC command is equivalent to pressing the **SYNC** MID **AMPL** key.

Query Response



Q3

ngi-INTRARX

Intra-BSS Intermod Attenuation in RX Band Measurement

The **ngi_INTRARX** command makes the RX band, intra-BSS intermodulation attenuation measurement.

Syntax

NGI_INTR

Variable or Trace	Description of Contents	Units
Measurement State = 1	Measurement completed; no errors detected.	
Measurement State = 2	Measurement aborted; carrier detected in transmit band is larger than -20 dBm.	
ngi_IRESRX	Contains the measurement result.	dBm
ngi_OK = 0	The measurement caution flag: the product measured greater than the GSM9OO specification, and the calculated system DANL is greater than the GSM9OO specification.	
ngi_OK = 1	The measurement caution flag: the product measured less than the GSM9OO specification.	

Description

The **ngi_INTRARX** command is equivalent to pressing RX BAND in the Intra-BSS menu. The default specification for this measurement is contained in the variable ng_ISPECRX.

ngi-INTRATX

Intra-BSS TX Band Measurement

The ng-INTRATX command makes the TX band, intra-BSS intermodulation attenuation measurement.

The measurement requires a signal that is larger than the quantity:

(-30 dB + EXT ATTEN)

Syntax

NGI_INTT

Variable or Trace	Description of Contents	Units
Measurement State = 1	Measurement completed; no errors detected.	
Measurement State = 2	Measurement aborted; carrier detected is smaller than (-30 dBm + EXT ATTEN).	
Measurement State = 3	Measurement aborted; reference channel error is more than 200 kHz or more than 20 dB lower than total incident power.	
ngi_IRESTXB	Contains the measurement result. The value is in absolute dBm.	dBm
ngi-IRESTXA	Contains the measurement result. The value is in dB relative to the reference channel.	dB
ngi_OK = 0	The measurement caution flag: the product measured greater than the GSM9OO specification, and the calculated system DANL is greater than the GSM9OO specification.	
ngi_OK = 1	The measurement caution flag: the product measured less than the GSM9OO specification.	

Description

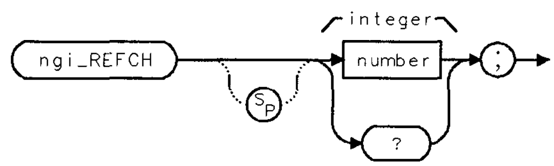
The ngi_INTRATX command is equivalent to pressing TX BAND in the Intra-BSS menu. The default specifications for this measurement are contained in the variables ng_ISPCTXA (70dB from the reference channel) and ng-ISPCTXB (-36 dBm). The test automatically uses the smallest of these two values as the specification.

ngi_REFCH

Reference Channel

The ngi-REFCH command allows you to enter the reference channel (ARFCN) to use during the Intra-BSS TX band measurement.

Syntax



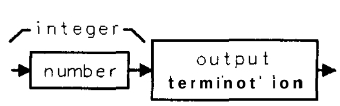
ngi-REFC

Item	Description	Range
number	An integer within the specified range.	0 through 124 and 975 through 1023

Description

The ngi_REFCH command is equivalent to pressing the **REF** CHANNEL key.

Query Response



Q1

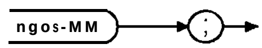
ngos_MM

Modulation Measurement Mode

The ngos_MM command starts the Output RF Spectrum due to Modulation measurement.

Syntax

ngos_MM



Variable or Trace	Description of Contents	Units
Measurement State = 1	Measurement completed; no errors detected.	
Measurement State = 2	Measurement completed; carrier detected is smaller than -20 dBm.	
For ngos-MODE0 Swept Measurement		
TRA	Contains the swept RF spectrum.	dBm
ng_LIMF = 0	Limit pass/fail flag: limit test pass.	
ng_LIMF = 1	Limit pass/fail flag: limit test fail.	
na-LIMF = 2	Limit pass/fail flag: limit test off.	
For ng s-MODE1 Multiple Offset Measurement		
	Results stored in groups of 5, where n = 0 to n^{th} frequency offset (n = 16, maximum).	
ngos_RES[5n+1]	Contains the magnitude of the offset frequency.	kHz
ngos_RES[5n+2]	Contains the relative amplitude for negative offset frequency.	$\frac{1}{10}$ dB*
ngos_RES[5n+3]	Contains the absolute amplitude for negative offset frequency.	$\frac{1}{10}$ dB*
ngos_RES[5n+4]	Contains the relative amplitude for positive offset frequency.	$\frac{1}{10}$ dB*
ngos_RES[5n+5]	Contains the absolute amplitude for positive offset frequency.	$\frac{1}{10}$ dB*
For ngos_MODE2 Single Offset Measurement		
ng_COFST	Contains the offset frequency.	Hz
ngos_DBC	Contains the relative average amplitude value.	dB
ngos-DBM	Contains the absolute average amplitude value.	dBm
TRA	Contains the results waveform.	dBm
* Divide the value by 10 to convert to dB.		

Description

For ngos_MODE0, the ngos-MS command followed by the ngos_MM command is equivalent to pressing **MODULAT SWEPT** .

For ngos_MODE1, the ngos-MS command followed by the ngos-MM command is equivalent to pressing **MODULAT** MULTIPLE .

For ngos_MODE2, the ngos_MS command followed by the ngos_MM command is equivalent to pressing **MODULAT** SINGLE .

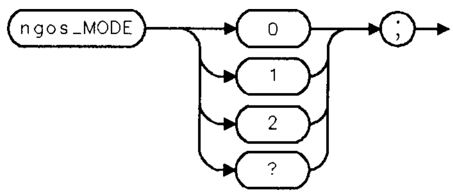
Use the ng_COFST command followed by ng_RPT command to make a measurement at the selected carrier offset frequency.

ngos-MODE

Output RF Spectrum Measurement Mode

The ngos_MODE command allows you to select the measurement mode for the Output RF Spectrum measurements. The ngos-MODE command must precede the ngos-MS command or ngos_TS command.

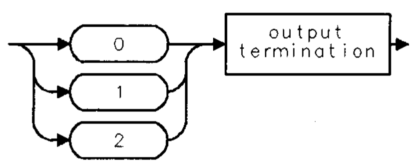
Syntax



ngos_MOD

Item	Description
0	The swept spectrum measurement.
1	The multiple discrete frequency measurement mode.
2	The single freauencv measurement mode.

Query Response



Q4

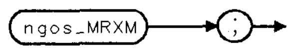
ngos_MRXM

Modulation RX Band Measurement

The ngos-MRXM command starts the Output RF Spectrum due to Modulation in the RX Band measurement.

Syntax

ngosMRXM



Variable or Trace	Description of Contents	Units
Measurement State = 1	Measurement completed; no errors detected.	
TRA	Contains the measurement result for RX band spectrum measurement.	dBm
ng_LIMF = 0	Limit pass/fail flag: limit test pass.	
ng_LIMF = 1	Limit pass/fail flag: limit test fail.	
ng-LIMF = 4	Limit pass/fail flag: limit test off.	

Description

The ngos-MRXS command followed by the ngos_MRXM command is equivalent to pressing the **MODULAT** RX **BAND** key

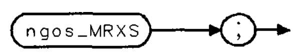
ngos-MRXS

Modulation RX Band Setup

The ngos-MRXS command sets up the parameters of the spectrum analyzer to make the Output RF Spectrum due to Modulation in the RX band measurement.

Syntax

ngosMRXS



Description

The **ngos_MRXS** command followed by the ngos-MRXM command is equivalent to pressing the **MODULAT** RX **BAND** key.

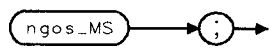
ngos_MS

Modulation Setup

The ngos-MS command sets the spectrum analyzer to make the Output RF Spectrum due to Modulation measurement.

Syntax

ngos_MS



Description

For ngos-MODEO, the **ngos_MS** command followed by the ngos-MM command is equivalent to pressing **MODULAT SWEPT** .

For **ngos_MODE1**, the **ngos_MS** command followed by the ngos-MM command is equivalent to pressing **MODULAT MULTIPLE** .

For **ngos_MODE2**, the **ngos_MS** command followed by the **ngos_MM** command is equivalent to pressing **MODULAT** SINGLE .

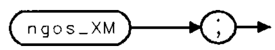
ngos-XM

Transient Measurement

The ngos_XM command starts the Output RF Spectrum due to Transient Switching measurement.

Syntax

ngos_XM



Variable or Trace	Description of Contents	Units
Measurement State = 1	Measurement completed; no errors detected.	
Measurement State = 2	Measurement completed; carrier detected is smaller than -20 dBm.	
For ngos_MODE0 Swept Measurement		
TRA	Contains the swept RF spectrum.	dBm
ng-LIMF = 0	Limit pass/fail flag: limit test pass.	
ng-LIMF = 1	Limit pass/fail flag: limit test fail.	
ng-LIMF = 2	Limit pass/fail flag: limit test off.	
For ngos_MODE1 Multiple Offset Measurement		
Results are stored in groups of 5, where n = 0 to n^{th} frequency offset (n = 16, maximum).		
ngos_RES[5n+1]	Contains the magnitude of the offset frequency.	kHz
ngos_RES[5n+2]	Contains the relative amplitude for negative offset frequency.	$\frac{1}{10}$ dB*
ngos_RES[5n+3]	Contains the absolute amplitude for negative offset frequency.	$\frac{1}{10}$ dB*
ngos_RES[5n+4]	Contains the relative amplitude for positive offset frequency.	$\frac{1}{10}$ dB*
ngos_RES[5n+5]	Contains the absolute amplitude for positive offset frequency.	$\frac{1}{10}$ dB*
For ngos-MODE2 Single Offset Measurement		
ng_COFST	Contains the offset frequency.	Hz
ngos_DBC	Contains the relative peak amplitude value.	dB
ngos_DBM	Contains the absolute peak amplitude value.	dBm
TRA	Contains the results waveform.	dBm
* Divide the value by 10 to convert to dB.		

Description

For ngos_MODE0, the ngos_XS command followed by the ngos-XM command is equivalent to pressing **TRANSNT** SWEPT .

For ngos_MODE1, the ngos-XS command followed by the ngos_XM command is equivalent to pressing **TRANSNT** MULTIPLE .

For ngos-MODE2, the ngos-XS command followed by the ngos_XM command is equivalent to pressing **TRANSNT** SINGLE .

Use the ng_COFST command followed by ng_RPT command to make a measurement at the selected carrier offset frequency.

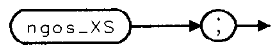
ngos_XS

Transient Measurement Setup

The ngos_XS command sets up the spectrum analyzer parameters for making the Output RF Spectrum due to Transient Switching measurement.

Syntax

ngos_XS



Description

For ngos-MODEO, the ngos-XS command followed by the ngos-XM command is equivalent to pressing **TRANSNT** SWEPT .

For ngos_MODE1, the ngos-XS command followed by the ngos_XM command is equivalent to pressing **TRANSNT** MULTIPLE .

For ngos_MODE2, the ngos-XS command followed by the ngos-XM command is equivalent to pressing **TRANSNT** SINGLE .

ngp_CTM

Combiner Tuning Measurement

The ngp_CTM command starts the combiner tuning measurement.

Syntax

Variable or Trace	Description of Contents	Units
Measurement State = 1	Measurement completed; no errors detected.	
TRA	TRA is trace A. Trace A contains the swept RF spectrum.	dBm
TRB	TRB is trace B. Trace B acts as a marker line, and it is placed at the signal peak with the maximum amplitude.	dBm
TRC	TRC is trace C. Trace C acts as a marker line, and it is placed at the signal peak with the minimum amplitude.	dBm

Description

The ngp_CTS command followed by the ngp_CTM command is equivalent to pressing the COMBINER TUNING.

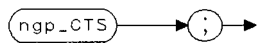
ngp_CTS

Combiner Tuning Setup

The **ngp_CTS** command performs the setup for the combiner tuning measurement.

Syntax

ngp_CTS



Description

The ngp-CTS command followed by the ngp-CTM command is equivalent to pressing the COMBINER TUNING key.

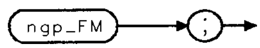
ngp-FM

Power vs Time Palling Edge Measurement

The ngp-FM command starts the Power vs Time Falling Edge measurement.

Syntax

ngp_FM



Variable or Trace	Description of Contents	Units
Measurement State = 1	Measurement completed; no errors detected.	
Measurement State = 2	Measurement completed; carrier detected is smaller than -20 dBm.	
ng-LIMF = 0	Limit pass/fail flag: limit test pass.	
ng-LIMF = 1	Limit pass/fail flag: limit test fail.	
ng-LIMF = 4	Limit pass/fail flag: limit test off.	
For number bursts equals 1:		
TRA	Contains the carrier power vs time waveform.	dBm
For number bursts equals more than 1, average mode:		
TRA	Contains the average power vs time waveform.	dBm
For number bursts equals more than 1, peaks mode:		
TRB	Contains the maximum power vs time waveform.	dBm
TRC	Contains the minimum power vs time waveform.	dBm

Description

The ngp-FS command followed by the ngp-FM command is equivalent to pressing the P vs T FALLING key

ngp_FRM

Power vs Time Frame Measurement

The ngp-FRM command starts the Power vs Time Full Frame measurement. The spectrum analyzer's reference level is automatically set to an appropriate value based upon the measured peak power.

Syntax

Variable or Trace	Description of Contents	Units
Measurement State = 1	Measurement completed; no errors detected.	
Measurement State = 2	Measurement completed; carrier detected is smaller than -20 dBm.	
ng-LIMF = 0	Limit pass/fail flag: limit test pass.	
ng_LIMF = 1	Limit pass/fail flag: limit test fail.	
ng-LIMF = 4	Limit pass/fail flag: limit test off.	
For number bursts equals 1:		
TRA	Contains the carrier power vs time waveform.	dBm
For number bursts equals more than 1, average mode:		
TRA	Contains the average power vs time waveform.	dBm
For number bursts equals more than 1, peaks mode:		
TRB	Contains the maximum power vs time waveform.	dBm
TRC	Contains the minimum power vs time waveform.	dBm

Description

The ngp_FRS command followed by the ngp_FRM command is equivalent to pressing the P vs T FRAME key.

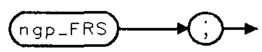
ngp_FRS

Power vs Time Frame Measurement Setup

The ngp-FRS command sets the spectrum analyzer parameters for making the Power vs Time Full Frame measurement.

Syntax

ngp_FRS



Description

The ngp-FRS command followed by the ngp-FRM command is equivalent to pressing the P vs T FRAME key.

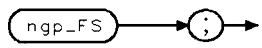
ngp_FS

Power vs Time Palling Edge Measurement Setup

The ngp-FS command sets the spectrum analyzer parameters to make the Power vs Time Falling Edge measurement. Precede this command with the ngp_SSS command, followed by the ngp_SSM command.

Syntax

ngp_FS



Description

The ngp-FS command followed by the ngp-FM command is equivalent to pressing the P vs T FALLING key. If the transmitter power level is increased or decreased more than 0.2 dB since the last time you executed the ngp_SSS followed by ngp-SSM commands, it is necessary to set up the spectrum analyzer to make the Power vs Time Falling Edge measurement at the new power level. Execute ngp-SSS followed by ngp_SSM commands again, before executing ngp-FS followed by ngp_FM.

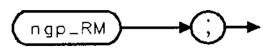
ngp_RM

Power vs Time Rising Edge Measurement

The ngp-RM command starts the Power vs Time Rising Edge measurement.

Syntax

ngp_RM



Variable or Trace	Description of Contents	Units
Measurement State = 1	Measurement completed; no errors detected.	
Measurement State = 2	Measurement completed; carrier detected is smaller than -20 dBm.	
ng-LIMF = 0	Limit pass/fail flag: limit test pass.	
ng-LIMF = 1	Limit pass/fail flag: limit test fail.	
ng-LIMF = 4	Limit pass/fail flag: limit test off.	
For number bursts equals 1:		
TRA	Contains the carrier power vs time waveform.	dBm
For number bursts equals more than 1, average mode:		
TRA	Contains the average power vs time waveform.	dBm
For number bursts equals more than 1, peaks mode:		
TRB	Contains the maximum power vs time waveform.	dBm
TRC	Contains the minimum power vs time waveform.	dBm

Description

The ngp-RS command followed by the ngp-RM command is equivalent to pressing the P vs T RISING key.

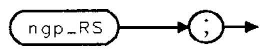
ngp_RS

Power vs Time Rising Edge Measurement Setup

The ng-RS command sets the spectrum analyzer parameters to make the Power vs Time Rising Edge measurement. Precede this command with the ngp_SSS command, followed by ngp_SSM.

Syntax

ngp_RS



Description

The ngp-RS command followed by the ngp-RM command is equivalent to pressing the P vs T RISING key. If the transmitter power level is increased or decreased more than 0.2 dB since the last time you executed the ngp-SSS followed by ngp_SSM commands, it is necessary to set up the spectrum analyzer to make the Power vs Time Rising Edge measurement at the new power level. Execute ngp-SSS followed by ngp_SSM commands again, before executing ngp_RS followed by ngp_RM.

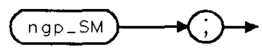
ngp_SM

Power vs TimeTimeslot Measurement

The ngp-SM command starts the Power vs Time Full Timeslot measurement.

Syntax

ngp_SM



Description

The ngp-SS command followed by the ngp-SM command is equivalent to pressing the P **vs** T **TIMESLOT** key.

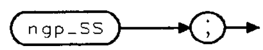
ngp_SS

Power vs TimeTimeslot Measurement Setup

The ngp_SS command sets up the spectrum analyzer to make the Power vs Time Timeslot measurement.

Syntax

ngp_SS



Description

The ngp-SS command followed by the ngp_SM command is equivalent to pressing the P vs T TIMESLOT key.

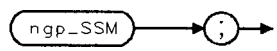
ngp_SSM

Power vs Time Frame Sub-Timeslot Measurement

The **ngp_SSM** command starts the Power vs Time Sub-Timeslot measurement. This command operation must be executed prior to measuring the power vs time rising edge, falling edge, or Top 10 **dB** measurements.

Syntax

ngp_SSM



Description

The ngp-SSS command followed by the **ngp_SSM** command is equivalent to pressing the P **vs** T **SUB** TS key. Measurement results do not immediately follow this command execution. This command is only a preliminary measurement. This command does not need to directly precede the Power vs Time Rising Edge, Falling Edge or Top 10 **dB** measurement commands, but can be executed just once, prior to these other measurements.

If the transmitter power level is increased or decreased more than 0.2 **dB** since the last time you executed the ngp-SSS command followed by the **ngp_SSM** command, execute **ngp_SSS** followed by **ngp_SSM** again before executing any of the Power vs Time Rising Edge, Falling Edge or Top 10 **dB** commands.

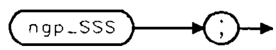
ngp_SSS

Power vs Time Sub-Timeslot Measurement Setup

The ngp-SSS sets up the spectrum analyzer parameters to make the Power vs Time Sub-Timeslot measurements.

Syntax

ngp_SSS



Description

The ngp-SSS command followed by the ngp_SSM command is equivalent to pressing the P vs T SUB TS key.

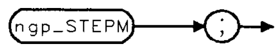
ngp-STEPM

Power vs Time Power Steps Measurement

The ngp_STEPM command starts the Power Steps measurement.

Syntax

ngpSTEPM



Variable or Trace	Description of Contents	Units
Measurement State = 1	Measurement completed; no errors detected.	
TRA	Contains the power waveform.	dBm

Description

The ngp-STEPS command followed by the ngp_STEPM command is equivalent to pressing the POWER STEPS key.

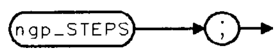
ngp_STEPS

Power vs Time Power Steps Measurement Setup

The ngp-STEPS command sets the spectrum analyzer parameters for making the Power Steps measurement.

Syntax

ngpSTEPS



Description

The **ngp_STEPS** command followed by the ngp-STEPM command is equivalent to pressing the POWER STEPS key.

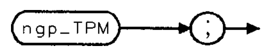
ngp-TPM

Power vs TimeTop 10 dB Measurement

The ngp_TPM command starts the Power vs Time Top 10 dB measurement.

Syntax

ngp_TPM



Variable or Trace	Description of Contents	Units
Measurement State = 1	Measurement completed; no errors detected.	
Measurement State = 2	Measurement completed; carrier detected is smaller than -20 dBm.	
ng-LIMF = 0	Limit pass/fail flag: limit test pass.	
ng-LIMF = 1	Limit pass/fail flag: limit test fail.	
ng-LIMF = 4	Limit pass/fail flag: limit test off.	
For number bursts equals 1:		
TRA	Contains the carrier power vs time waveform.	dBm
For number bursts equals more than 1, average mode:		
TRA	Contains the average power vs time waveform.	dBm
For number bursts equals more than 1, peaks mode:		
TRB	Contains the maximum power vs time waveform.	dBm
TRC	Contains the minimum power vs time waveform.	dBm

Description

The ngp-TPS command followed by the ngp_TPM command is equivalent to pressing the P vs T TOP 10dB key.

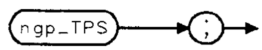
ngp_TPS

Power vs TimeTop 10 dB Measurement Setup

The ng_TPS command sets up the spectrum analyzer to make the Power vs Time Top 10 dB measurement. You must precede this command with ngp_SSS, followed by ngp-SSM. Refer to the description below.

Syntax

ngp_TPS



Description

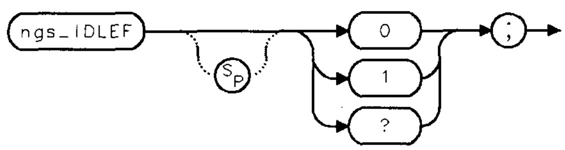
The ngp_TPS command followed by the ngp-TPM command is equivalent to pressing the P vs T TOP 10dB key. If the transmitter power level increased or decreased more than 0.2 dB since the last time you executed the ngp_SSS followed by ngp_SSM commands, it is necessary to set up the spectrum analyzer to make the Power vs Time Top 10 dB measurement at the new power level. Execute ngp_SSS followed by ngp-SSM commands again, before executing ngp_TPS followed by ngp_TPM.

ngs-IDLEF

Spurious Emissions Measurement Carrier Idle Flag

The ngs_IDLEF command sets a flag which controls the action of the ngs_MEASTX and ngs_MEASOUT commands when making spurious emissions measurements on mobile station transmitters.

Syntax



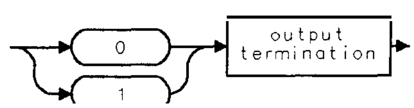
ngs_IDLE

Item	Description
0	Non-idle mode.
1	The idle mode.

Description

The ngs-IDLEF command is equivalent to pressing IDLE YES NO in the Transmitter Spurious menu.

Query Response



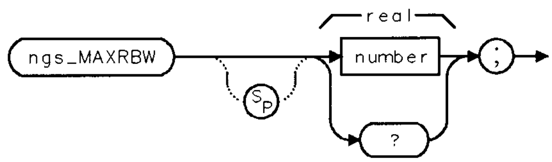
Q3

ngs-MAXRBW

Spurious Emissions Measurement Maximum Resolution Bandwidth

The ngs-MAXRBW command sets the maximum resolution bandwidth during the spurious emissions measurements. The value entered is rounded to a value closest to 300 kHz, 1 MHz, or 3 MHz.

Syntax



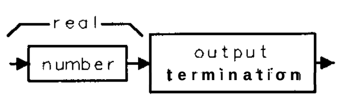
ngs_MAXR

Item	Description	Range
number	Any real number within the range specified.	300E3 Hz to 3E6 Hz

Description

The ngs_MAXRBW command is equivalent to pressing the **MAXIMUM RES BW** key.

Query Response



Q2

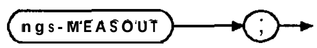
ngs_MEASOUT

Spurious Emissions Outside Band Measurement

The ngs_MEASOUT command makes the spurious emissions measurements on the outside bands.

Syntax

ngs_MEAS



Variable or Trace	Description of Contents	Units
Measurement State = 1	Measurement completed; no errors detected.	
Measurement State = 3	Measurement aborted; carrier detected is larger than -16 dBm for Mobile Station Idle Mode measurement or for Receiver measurement.	
ngs_NOCARRF = 0	The carrier detected is larger than -16 dBm.	
ng-NOCARRF = 1	No carrier detected is larger than -16 dBm.	
ngs_SPCNT	Contains the number of spurs found.	
ngs_SPAMP[n]	Contains the array of amplitude values (multiplied by 10) for spurs found.	$\frac{1}{10}$ dBm
ngs_SPFRQM[n]	Contains the array of frequency values (MHz portion) of the spurs found.	MHz
ngs_SPFRQK[n]	Contains the frequency values (kHz portion) of the spurs found.	kHz
ngs_SPOK[n]	Contains the array of measurement caution flags for the spurs found.	
= 0	The spur measured with calculated spectrum analyzer DANL larger than the quantity: (GSM900 specification – 6 dB).	
= 1	The spur measured with calculated spectrum analyzer DANL smaller than the quantity: (GSM900 specification – 6 dB).	

Index the arrays by stepping n from 1 to ngs-SPCNT. Divide the value in ngs_SPAMP[n] by 10 to convert the spur amplitude values to dBm. Divide the value in ngs_SPFRQK[n] by 1000, then add this to the (MHz) value in ngs-SPFRQM[n] to obtain the spur's full frequency value.

Spur Frequency = ngs-SPFRQM[n] + (ngs_SPFRQK[n]/1000)

Description

The ngs_RCVRF0 command followed by the ngs_MEASOUT command is equivalent to pressing OUTSIDE TX & RX in the Transmitter Spurious menu.

The ngs_RCVRF1 command followed by ngs_MEASOUT command is equivalent to pressing OUTSIDE TX BAND in the Receiver Spurious menu.

ngs_MEASRX

Spurious Emissions RX Band Measurement

The ngs-MEASRX command makes the spurious emissions measurements in the receive band.

Syntax

Variable or Trace	Description of Contents	Units
Measurement State = 1	Measurement completed; no errors detected.	
Measurement State = 3	Measurement aborted; carrier detected is larger than -20 dBm.	
ngs-SPCNT	Contains the number of spurs found.	
ngs-SPAMP[n]	Contains the array of amplitude values (multiplied by 10) for spurs found.	$\frac{1}{10}$ dBm
ngs_SPFRQM[n]	Contains the array of frequency values (MHz portion) of the spurs found.	MHz
ngs_SPFRQK[n]	Contains the frequency values (kHz portion) of the spurs found.	kHz
ngs_SPOK[n]	Contains the array of measurement caution flags for the spurs found.	
= 0	The spur measured with calculated spectrum analyzer DANL larger than the quantity: (GSM900 specification − 6 dB).	
= 1	The spur measured with calculated spectrum analyzer DANL smaller than the quantity: GSM900 specification − 6 dB).	
Index the arrays by stepping n from 1 to ngs_SPCNT. Divide the value in ngs_SPAMP[n] by 10 to convert the spur amplitude values to dBm. Divide the value in ngs_SPFRQK[n] by 1000, then add this to the (MHz) value in ngs_SPFRQM[n] to obtain the spur's full frequency value. Spur Frequency = ngs-SPFRQM[n] + (ngs_SPFRQK[n]/1000)		

Description

The ngs_RCVRF0 command followed by ngs_MEASRX command is equivalent to pressing **RX BAND** in the Transmitter Spurious menu.

ngs-MEASTX

Spurious Emissions TX Band Measurement

The ngs_MEASTX command sets up the spectrum analyzer to make spurious emissions measurements in the transmit bands, then starts the measurement.

Syntax

Variable or Trace	Description of Contents	Units
Measurement State = 1 Measurement State = 3	Measurement completed; no errors detected. Measurement aborted; carrier detected is larger than -16 dBm for mobile station Idle Mode measurement or for the Receiver measurement.	
ngs-NOCARRF = 0 ng-NOCARRF = 1	The carrier detected is larger than -16 dBm. No carrier detected is larger than -16 dBm. (The test continues, using the current ARFCN value.)	
ngs_SPCNT ngs-SPAMP[n] ngs_SPFRQM[n] ngs_SPFRQK[n]	Contains the number of spurs found. Contains the array of amplitude values (multiplied by 10) for spurs found. Contains the array of frequency values (MHz portion) of the spurs found. Contains the frequency values (kHz portion) of the spurs found.	$\frac{1}{10}$ dBm MHz kHz
ngs_SPOK[n] = 0 = 1	Contains the array of measurement caution flags for the spurs found. The spur measured with calculated spectrum analyzer DANL larger than the quantity: (GSM900 specification – 6 dB). The spur measured with calculated spectrum analyzer DANL smaller than the quantity: (GSM900 specification – 6 dB).	

Index the arrays by stepping n from 1 to ngs_SPCNT. Divide the value in ngs_SPAMP[n] by 10 to convert the spur amplitude values to dBm. Divide the value in ngs-SPFRQK[n] by 1000, then add this to the (MHz) value in ngs-SPFRQM[n] to obtain the spur's full frequency value.

Spur Frequency = ngs_SPFRQM[n] + (ngs_SPFRQK[n]/1000)

Description

The ngs-RCVRFO command followed by **ngs_MEASTX** command is equivalent to pressing TX BAND in the Transmitter Spurious menu.

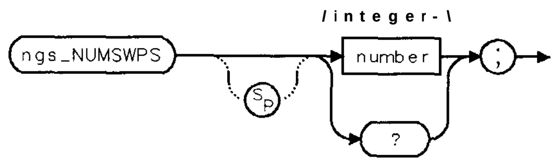
The **ngs_RCVRF1** command followed by ngs-MEASX command is equivalent to pressing TX BAND in the Receiver Spurious menu.

ngs_NUMSWPS

Number of Sweeps

The ngs_NUMSWPS command sets the number of sweeps taken (for each frequency span) during spurious emissions measurement.

Syntax



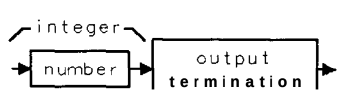
ngs_NUMS

Item	Description	Range
number	An integer within the range specified.	1 through 99

Description

The ngs-NUMSWPS command is equivalent to pressing NUMBER SWEEPS .

Query Response



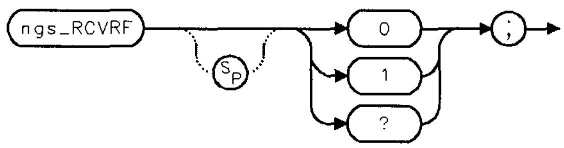
Q1

ngs-RCVRF

Receiver Flag

The **ngs_RCVRF** command is a flag which controls the action of the **ngs_MEASTX** and ngs-MEASOUT commands.

Syntax



ngs_RCVR

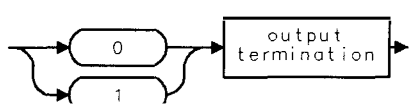
Variable	Description
ngs_RCVR = 0	The commands ngs-MEASTX and ngs-MEASOUT make transmitter spurious measurements.
ngs-RCVR = 1	The commands **ngs_MEASTX** and **ngs_MEASOUT** make receiver spurious measurements.

Description

The ngs-RCVRFO command is equivalent to pressing **XMTR SPURIOUS** .

The **ngs_RCVRF1** command is equivalent to pressing **RCVR** SPURIOUS .

Query Response



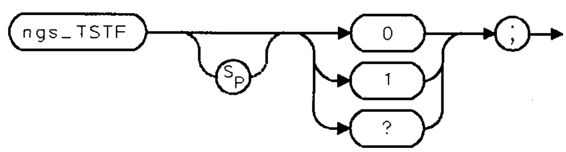
Q3

ngs-TSTF

SpurTest Flag

The ngs_TSTF command sets a flag which enables a spur test on the spurious emissions measurements. It can be used in the majority of applications to detect spurs which are internally generated by the spectrum analyzer without affecting the measurement of the external spurs. If the spur is determined to be internally generated it is removed from the table of spurious signals.

Syntax



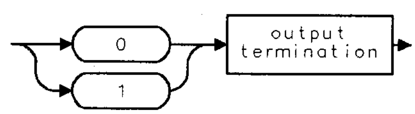
ngs_TSTF

Variable	Description
ngs-TSTF = 0	Switches the spur check off.
ngs-TSTF = 1	Switches the spur check on.

Description

The ngs_TSTF command is equivalent to pressing SPUR TST ON OFF .

Query Response



Q3

6

Menu Key Descriptions

What's In This Chapter

GSM9OO Analyzer Preset States and Default Conditions	Refer to this table for the GSM9OO analyzer preset states and default conditions. Refer to the specific key description to find out about changing these parameters for your measurement needs.
Accessing GSM9OO Analyzer Menus	Refer to the menu key name for information about the keys related to this menu.

GSM900 Preset States and Default Conditions

Table 6-1. GSM900 Measurement Preset States and Default Conditions

GSM900 Preset Values		GSM900 Configuration Default Values	
TX MS BS	BS (base station)	Preamp Gain	0 dB
ARFCN	1	Trigger Delay	0 μs
Timeslot Number	0	Trigger Polarity	positive
Bottom ARFCN	1	External Attenuation	0 dB
Middle ARFCN	62	SFH	off
Top ARFCN	124	Frame Structure	156.25 bits/timeslot
Number Bursts	1	Total Power Mode	Single
Start Frequency	924 MHz	Total Power Value	0 dB
Stop Frequency	961 MHz		
Span	37 MHz		
CF Step	200 kHz		
Frequency Offset	0 Hz		
Reference Level	30 dBm + External Attenuation		
Log Scale	10 dB/div		
Amplitude Units	dBm		
Res BW	100 kHz		
Video BW	100 kHz		
Video Averaging	off		
Sweeptime	2 s		
Detector	peak		
Sweep	continuous		
Trigger Mode	free run		
Markers	off		
A − B → A	off		
Trace A	clear-write		
Trace B	store-blank		
Trace C	store-blank		
Threshold Level	off		
Display Line Level	off		
Limit Line Testing	off		
Graticule	on		
For HP 8590E Series with Option 163:			
Start bit	0		
End bit	147		
Graph scale	20°		
Measurement calibration	on		
Burst type	normal		
Color	automatic		
Synchronization	midamble		
Frequency error offset	0 Hz		
Spur Test	off		

Accessing GSM9OO Analyzer Menus

Once in the GSM9OO analyzer mode, you can leave the GSM9OO measurements menus and return to them at any time with the [MODE) key. Refer to the following methods:

- Press (MODE), then **GSM900 ANALYZER** to return from spectrum analyzer menus to the GSM9OO Main menu.
- Press (MODE) (MODE) to return from spectrum analyzer menus to the GSM9OO menu exited when you accessed a spectrum analyzer key.

The GSM9OO Analyzer Main Menu Softkeys

This section gives a description of the softkeys which are available in the main menu of the GSM9OO Transmitter Measurements Personality. Pressing (MODE), GSM900 ANALYZER accesses the main menu.

Config — Press this key to access the GSM9OO configuration menus. The menu keys include selections of external attenuation correction, trigger delay, slow-frequency-hopping (SFH) mode, and TDMA frame structure.

Physical Channel — Press this key to access the menu used to control the physical channel parameters of GSM9OO measurements. These parameters include the RF channel and timeslot number.

Power — Press this key to access the GSM9OO Power measurement menu. There are three power measurements: (1) the mean transmitted carrier power measurement, (2) the power step accuracy measurement and (3) combiner tuning.

Power vs Time — Press this key to access the menu of Power versus Time measurement choices. Two of the choices, full frame and full timeslot, allow you to measure the full frame or full timeslot respectively. The additional measurement choices, which appear under the P vs T SUB TS key, are top 10 dB (of the GSM9OO pulse), rising edge, and falling edge choices. Use these keys to examine sections of the measured burst more closely.

Out RF Spectrum — Press this key to access the output RF spectrum measurements menu. The measurements are in these two groups (1) output RF spectrum due to modulation and (2) output RF spectrum due to switching transients.

More 1 of 2 — Press this key to access the second page of the Main menu.

Spurious Emission — Press this key to access the menu relating to spurious emissions measurements. There are measurements for both transmitter spurious and receiver spurious emissions.

Intermod — Press this key to access the menu of keys relating to the intermodulation measurements. The two types of intermodulation measurements are (1) intermodulation attenuation and (2) intra-BSS attenuation.

Phase & Freq Err — Press this key to access the Phase and Frequency Error measurements menu. This menu allows you to measure the accuracy of the transmitter's modulation. The errors are measured and displayed numerically or with optional graphical displays. This menu also allows you to examine the demodulated data bits. (Spectrum analyzer option 163 and 151 required.)

MONITOR TX BAND — Press this key to display the full transmit (TX) band and all of the signals that are present.

If MS is underlined in the TX MS BS key of the Physical Channel menu, the start frequency is 879 MHz, and the stop frequency is 916 MHz. If BS is underlined in the TX MS BS key of the Physical Channel menu, the start frequency is 924 MHz, and the stop frequency is 961 MHz.

More 2 of 2 — Press this key to return to the first level of the Main menu.

The Configuration Menu Softkeys

Pressing **Config** accesses the GSM9OO configuration menus. The menu keys include selections of external attenuation correction, trigger delay, slow-frequency-hopping (SFH) mode, and TDMA frame structure.

Note	GSM9OO configuration settings are not erased by pressing (PRESET), PRESET **GSM900**, or by power cycling the spectrum analyzer.

EXT ATTEN Press this key and use the data keys to enter the external attenuation value (in dB) used in the system. The attenuation values should equal the total attenuation between the transmitter output and the spectrum analyzer input. The GSM9OO Transmitter Measurements Personality takes the external attenuation value into account when it calculates the actual amplitude readouts. Therefore, the readouts indicate the true power level at the transmitter output. The GSM9OO Transmitter Measurements Personality then uses this measured power level to draw the correct limit-line templates. The range for the external attenuation correction factor is 0 to 70 dB. The configuration default value is 0 dB.

PREAMP GAIN Press this key, then use the data keys to enter the known preamplifier gain value (in dB) that is present in the GSM9OO system. The GSM9OO Transmitter Measurements Personality uses this value when it calculates the actual amplitude readouts for certain measurements. The range for the preamplifier gain correction factor is -20 to +50 dB. The configuration default value is 0 dB.

Note	A preamplifier is required for receive-band intermodulation and receive-band spurious emissions measurements. The preamplifier gain correction factor should take into account the gain of the preamplifier, insertion loss of the bandpass filter, and any cable loss.

TRIG DELAY Press this key, then use the data keys or knob to enter the delay time (in μs) for the external frame trigger. A value of 0 corresponds to a trigger occurring at the start of bit 0 of timeslot number (TN) 0. A positive trigger-delay value shifts the displayed trace to the right. A negative trigger-delay value shifts the trace to the left. The configuration default value is 0 μs. The range is from -4680 μs to + 250 μs, inclusive.

An external trigger signal is required for the following measurements:

- Mean carrier power
- Power vs time, which includes:
  - Full frame
  - Full timeslot
  - Top 10 dB
  - Rising edge
  - Falling edge

Output RF Spectrum due to modulation, which includes:

- Swept
- Multiple
- Single

Phase and frequency error, which includes:

- Phase and Frequency error
- Data bits
- Graphs

Auto timeslot number

Auto ARFCN and timeslot number

The external trigger signal supplied to the spectrum analyzer is at TTL levels. The trigger can be on the positive edge or negative edge. The trigger needs to occur once every time division multiple access (TDMA) frame. A GSM900 frame has eight timeslots. If a timeslot trigger (instead of a frame trigger) is used, the GSM900 Transmitter Measurements Personality cannot distinguish between the timeslots in a frame. As a result, all bursts will appear to be in timeslot number 0 (TN 0).

An external trigger signal is *not* required to make the following measurements:

- Power steps
- Output RF spectrum due to switching transients (swept, multiple, and single)
- Spurious emissions
- Intermodulation attenuation
- Intra BSS intermodulation attenuation
- Monitor TX band

TOTL PWR SGL MULT Press this key to choose single or multiple carrier mode for the automatic setting of the input attenuator in the spectrum analyzer. This key also allows manual entry of the total power within the transmit (TX) band.

This key affects only the "channel" measurements such as Carrier Power, Power Steps, Power versus Time, and Output RF Spectrum.

In normal operation, SGL is underlined in the TOTL PWR SGL MULT key. The setting of the spectrum analyzer input attenuator is based upon the currently measured carrier power at the selected ARFCN. Use single mode when: (1) there is only one carrier present; or (2) if the total power of all carriers is less than 1 dB greater than the power of just the carrier to be measured.

Otherwise, underline MULT in the TOTL PWR SCL MULT key to prevent signal compression in the spectrum analyzer. The total transmit band power is determined and entered. One method of determining the total power is to run the Monitor TX Band measurement, located in the Main menu. The Monitor TX Band measurement measures the total power of all the carriers in the transmit band. When you start the Monitor TX Band measurement, the first calculated value is used as the total power variable. Alternatively, a known total power can be manually entered via the data keys after selecting TOTL PWR SGL MULT while MULT is underlined. If you do this, note that running the Monitor TX Band measurement will change the value. The configuration default setting is SGL.

Main Menu Press this key to return to the Main menu.

More 1 of 3 Press this key to access the second page of the Configuration menu.

SFH ON OFF Press this key to turn the slow frequency hopping measurement mode on or off. With the slow frequency hopping mode on, the sweep is ignored if the power of the measured burst is more than 20 dB below the expected power level. If the difference between the power of the measured burst and the expected power level is less than 40 dB, then the sweep is included in the average or the minimum and maximum peaks calculation.

With SFH mode enabled, the SFH repetition factor can be entered. For example, if the carrier is hopping between 3 frequencies, enter the number 3 for the slow frequency hopping repeat value.

Note With SFH mode enabled, extra sweeps or longer sweeps are taken. Therefore, SFH mode should be disabled unless a hopping frequency is to be measured.

The configuration default state is SFH mode OFF.

156.25 157/156 Press this key to agree with the TDMA frame structure of the transmitter under test. Underline 156.25 for 156.25 bits in every timeslot in the TDMA frame. Underline 157/156 for 157 bits in two timeslots and 156 bits in six timeslots within the frame. The configuration default mode is 156.25 bits per timeslot.

For more information on TDMA frame structure, refer to ***Specification GSM 11.20 Section 2.1.8.3.3.***

TRIG POL NEG POS Press this key to select the edge trigger polarity for the external TTL frame trigger signal. The configuration default is POS.

Main Menu Press this key to return to the Main menu.

More 2 of 3 Press this key to access the third page of the Configuration menu.

PRESET GSM900 Press this key to reset the GSM9OO Transmitter Measurements Personality to its initial state. Pressing this key does not change any of the user-defined values selected in the Configuration menu. Refer to Table 6-l in this chapter for a list of GSM9OO preset values.

GSM900 REX VER Press this key to display the version of your GSM9OO Transmitter Measurements Personality and the option 163 revision, if installed. Also view which versions of the ***Specification GSM 5.01, 5.05, 11.10, and 11.20*** were used to derive the measurement routines of this HP 85715B GSM9OO Transmitter Measurements Personality.

DEFAULT **CONFIG** — Press this key once to display the warning message IF YOU ARE SURE, PRESS KEY AGAIN TO RESET TO DEFAULT **CONFIG.** Press the key a second time to restore the default configuration values for all parameters in the Configuration menu. If you press any other key in this menu after the first key press, the process is canceled and the new key pressed takes effect. Note that the configuration settings are *not* changed by pressing PRESET **GSM9OO** or (PRESET) on the spectrum analyzer. Refer to Table 6-l in this chapter for a list of GSM9OO preset values.

DISPOSE GSM9OO — Press this key once to access the facility which allows you to erase the GSM9OO Transmitter Measurements Personality from the spectrum analyzer's memory. The first press will display the message IF YOU ARE SURE, PRESS KEY AGAIN TO PURGE DATA. Press the key a second time to erase the GSM9OO Transmitter Measurements Personality from the spectrum analyzer's memory. If you press any other key in this menu after the first key press, the process is canceled and the new key pressed takes effect. You must press the key twice to purge the GSM9OO Transmitter Measurements Personality.

Main Menu — Press this key to return to the Main menu.

More **3** of 3 — Press this key to return to the first page of the Configuration menu.

The Physical Channel Menu Softkeys

Pressing `Physical Channel` accesses the menu used to control the physical channel parameters of GSM900 measurements. These parameters include the RF channel and timeslot number.

`TX MS BS` Press this key to agree with the transmit (TX) band of the GSM900 transmitter under test. When MS is underlined, the mobile station transmit band of 880 MHz to 915 MHz is measured. When BS is underlined, the base station transmit band of 925 MHz to 960 MHz is measured. The GSM900 preset mode is BS.

`ARFCN` Press this key to enter a value for the absolute RF channel number (ARFCN) to be measured. Enter a number using the data keys. Press (ENTER) to terminate the value. When a "channel" measurement is made, the center frequency is set to the correct value based upon the chosen ARFCN. The channel measurements include Carrier Power, Power versus Time, and Output RF Spectrum. The GSM900 defined ARFCN range is 0 to 124 and 975 to 1023 inclusive. The GSM900 preset channel is 1.

Press `CTR FREQ ARFCN=-1` located under `BMT ARFCN` to enter a user defined center frequency value. This value is then used for the "channel" measurements whenever ARFCN is set to −1. This can be used to make measurements on signals which are not at standard GSM900 frequencies.

`TIMESLOT NUMBER` Press this key to enter a timeslot number to measure. Valid numbers are from 0 to 7 inclusive. The GSM900 preset value is 0. The timeslot number (TN) is displayed in the annotation column on the left-hand side of the display. See Figure 3-1. When a "channel" measurement is made, the timing of the spectrum analyzer is set to the correct value based upon the chosen timeslot number.

`B M T ARFCN` Press this key to access the menu for recalling or changing the ARFCN values for the bottom (B), middle (M), or top (T) channels.

- `BOTTOM ARFCN` Press this key to recall the last-saved bottom channel value and to set the ARFCN to this value. If no channel value has been entered, the GSM900 preset value of 1 is recalled. To change the bottom ARFCN, select a number from 0 to 124 or 975 to 1023 inclusive then press (ENTER). This value becomes the new bottom ARFCN value, until the instrument is preset or power is cycled.

- `MIDDLE ARFCN` Press this key to recall the last-saved middle channel value and to set the ARFCN to this value. If no channel value has been entered, the GSM900 preset value of 62 is recalled. To change the middle ARFCN, select a number from 0 to 124 or 975 to 1023 inclusive then press (ENTER). This value becomes the new middle ARFCN value, until the instrument is preset or power is cycled.

- `TOP ARFCN` Press this key to recall the last-saved top channel value and to set the ARFCN to this value. If no channel value has been entered, the GSM900 preset value of 124 is recalled. To change the top ARFCN, select a number from 0 to 124 or 975 to 1023 inclusive then press (ENTER). This value becomes the new top ARFCN value, until the instrument is preset or power is cycled.

- `CTR FREQ ARFCN=-1` Press and use the data keys or knob to enter a user-defined center frequency value. This is recalled whenever ARFCN is set to −1. This is useful if you want to make a "channel" measurement at a center frequency other than that specified by ARFCN 0 through 124 and 975 through 1023.

Previous Menu Press to return to the Physical Channel menu.

Auto Function Press this key to access the menu of automatic functions. Use these functions to automatically locate the highest carrier power in the selected frequency band or frame.

AUTO ARFCN Press this key to have the spectrum analyzer automatically tune to the ARFCN having the highest power level.

AUTO TN Press this key to have the timeslot number (TN) automatically set to the timeslot that has the highest carrier power at the previously selected ARFCN.

AUTO ARFCN &TN Press this key instead of pressing the AUTO ARFCN key, followed by the AUTO TN key. The results are the same.

Previous Menu Press this key to return to the Physical Channel menu.

Main Menu Press this key to return to the Main menu.

The Power Measurements Menu Softkeys

Pressing **Power** accesses the GSM900 Power measurement menu. There are three power measurements: (1) the mean transmitted carrier power measurement, (2) the power step accuracy measurement and (3) combiner tuning..

CARRIER POWER Press this key to begin the mean transmitted carrier power measurement. An external frame trigger signal is required. The spectrum analyzer is automatically set to the following:

Span = 0 Hz
RBW = 1 MHz
VBW = 300 kHz
Sweeptime = 640 μs
Trigger mode = EXT

The power over the useful bits of the burst is measured. The measured results are then numerically and graphically displayed. The length of the burst to be measured is selected when you press BITS 88 148 and underline your preference.

REPEAT MEAS Press this key to start the mean carrier power measurement again. If desired, you can change parameters such as ARFCN, TN, trigger delay, and resolution bandwidth before you press this key.

NUMBER BURSTS Press this key to enter the number of bursts to use for calculating the average or maximum trace values. Enter a number from 1 to 10,000 inclusive. The GSM900 preset value is 1. The number of bursts measured appears under BURSTS in the center of the annotation column on the left-hand side of the display as shown in Figure 3-l. The bursts annotation on the display is a counter that shows how many bursts are included in the measurement so far. It does not display the selected value until the measurement is finished. If the number of bursts is set to 1, the trace displayed remains active and the measured value is updated at the end of every sweep.

Physical Channel Press this key to access the Physical Channel menu. From this menu, you can change the ARFCN and TN settings. Refer to "The Physical Channel Menu Softkeys" section in this chapter for a description of this key.

Previous Menu Press this key to return to the Power menu. You can also use this key to stop the mean carrier power measurement.

POWER STEPS
: Press this key to begin the power step accuracy measurement. The spectrum analyzer is automatically set to the following:

Span = 0 Hz
RBW = 1 MHz
VBW = 300 kHz
Sweeptime = 2 seconds
Detector = PEAK
Trigger mode = FREE RUN
Scale = 4 dB/DIV

Note The carrier power measurement needs to be run first so that the spectrum analyzer reference level is set correctly.

The 2-second sweeptime gives the transmitter enough time to step its output power through its specified power levels. An external frame trigger is *not* required for this measurement.

You can change the sweeptime for this measurement if desired. However, the sweeptime needs to be greater than or equal to 2 seconds.

To change the sweeptime, press (SWEEP) on the spectrum analyzer's front panel. Press SWP TIME AUTO MAN . Use the knob, the data keys, or the step keys to enter a new sweeptime value. Press (MODE) (MODE) to return to the GSM900 menu you exited.

REPEAT MEAS
: Press this key to start the power steps measurement again. If desired, you can change parameters such as ARFCN and resolution bandwidth before you press this key.

SWEEP CONT SGL
: Press this key to select either continuous or single sweep mode for the power step accuracy measurement. The GSM900 preset mode is continuous sweep.

MARKER NORMAL
: Press this key to activate the normal marker. Position the marker by rotating the knob. The marker readout of frequency and amplitude appears in the upper right-hand corner of the display and on the graph display.

To turn the markers off press (MKR) MARKER 1 ON/OFF (MODE) (MODE).

MARKER DELTA
: Press this key to activate the delta markers. Use the delta markers to display the difference in power between discrete power steps. Position the marker by rotating the knob.

Physical Channel
: Press this key to access the Physical Channel menu. From this menu, you can change the ARFCN and TN settings. Refer to "The Physical Channel Menu Softkeys" section within this chapter for a description of this key.

Previous Menu
: Press this key to return to the Power menu.

COMBINER TUNING Press this key to view the output power from several transmitters and allows you to adjust the output power from each transmitter. The GSM9OO Transmitter Measurements Personality places three marker lines, one on the maximum carrier, one on the minimum carrier and one on the threshold. The measurement also shows numerically the power of the maximum carrier detected, and the power difference between the maximum and minimum carriers.

Note The Combiner Tuning test can only be performed when testing a base station. It can not be used for testing a mobile station.

REF LVL Press this key to adjust the reference level of the spectrum analyzer.

SCALE LOG Press this key to change the number of dB per division. COMBINER TUNING changes the scale to 2 dB per division, but you can press SCALE LOG, and then use the step keys or data keys to enter the desired dB per division. The range is from 0.1 dB/div to 20 dB/div inclusive.

START FREQ Press this key to adjust the start frequency of the spectrum analyzer.

STOP FREQ Press this key to adjust the stop frequency of the spectrum analyzer.

Previous Menu Press this key to return to the Power menu.

NUMBER BURSTS Press this key to enter the number of bursts to use for calculating the average or maximum trace values. Enter a number from 1 to 10,000 inclusive. The GSM9OO preset value is 1. The number of bursts measured appears under BURSTS in the center of the annotation column on the left-hand side of the display. If the number of bursts is set to 1, the trace displayed remains active and the measured value is updated at the end of every sweep.

BITS 88 248 Press this key to select the length of the burst to be measured. All normal duration GSM9OO bursts contain 148 useful bits. The access burst, for example RACH, contains 88 useful bits (used for mobile station testing only). This parameter is used to establish the correct limit-line templates for the Power versus Time measurements and to set the correct number of bits for the mean carrier power measurement. Refer to ***Specification GSM 5.01 and 5.05*** for more information. The GSM9OO preset value is 148 useful bits.

Main Menu Press this key to return to the Main menu.

The Power versus Time Measurement Menu Softkeys

Note Depending on the previous measurements selected, you may have to insert the GSM9OO Transmitter Measurements Personality card into the card reader before pressing the Power vs Time key.

Pressing Power vs Time accesses the menu of Power versus Time measurement choices. Two of the choices, full frame and full timeslot, allow you to measure the full frame or full timeslot respectively. The additional measurement choices, which appear under the P vs T SUB TS key, are top 10 dB (of the GSM9OO burst), rising edge, and falling edge. Use these keys to examine sections of the measured burst more closely.

In the power versus time measurements, adaptive limit lines are displayed (as per *Specifications GSM 11.10 Section 13.3.2.1, GSM 11.20 Section 2.1.6.4, and GSM 5.01* Section 5 *and GSM 5.05 Annex B).*

Note A valid trigger signal must be detected by the spectrum analyzer before the softkey menus under P vs T FRAME , P vs T TIMESLOT , and P vs T SUB TS can appear. Use the Physical Channel menu keys to set ARFCN (channel number) and TN (timeslot number) for the power versus time measurement.

P vs T FRAME Press this key and the GSM9OO Transmitter Measurements Personality measures the peak carrier power, sets the reference level to the correct value, and makes the power versus time full-frame measurement. The measurement results are graphically displayed. The spectrum analyzer is automatically set to the following:

Span = 0 Hz
Sweeptime = 4.8 ms
RBW = 300 kHz
VBW = 300 kHz
Scale = 10 dB/DIV
Trigger mode = EXT

An adaptive limit line is displayed. This line represents the maximum level for the off-state of the burst. An external frame trigger signal is required.

P vs T TIMESLOT Press this key and the GSM9OO Transmitter Measurements Personality makes a mean carrier power measurement, sets the reference level to the correct value, and makes the power versus time full timeslot measurement. The measurement results are graphically displayed. The spectrum analyzer is automatically set to the following:

Span = 0 Hz
Sweeptime = 800 μs
RBW = 300 kHz
VBW = 300 kHz
Scale = 10 dB/DIV
Trigger mode = EXT

An adaptive limit-line template is drawn on the display. An external frame trigger signal is required.

Note

For all P vs T formats, a LIMIT FAIL message indicates that the trace has exceeded the limit line. A LIMIT PASS message indicates the trace is within the limit line. The mask does not ensure that a burst passed limits given in the GSM specifications, since wider amplitude and timing limits are used due to display resolution limitations.

For best accuracy and limits corresponding to GSM specifications, use the formats under the P vs T SUB TS key to further analyze the Top 10 dB, rising-edge, and falling-edge portions of the measured burst.

The following six softkeys are available when P vs T FRAME and P vs T TIMESLOT are selected.

REPEAT MEAS
: Press this key to start the power versus time full-timeslot measurement again. If desired, you can change parameters such as ARFCN, TN, trigger delay, and resolution bandwidth before you press this key.

NUMBER BURSTS
: Press this key to enter the number of bursts to use for calculating either the average or the minimum and maximum trace values. Enter a number from 1 to 10,000, inclusive. The GSM900 preset value is 1. The number of bursts measured appears under BURSTS in the center of the annotation column on the left-hand side of the display. If the number of bursts is set to 1, the trace displayed remains active. An external frame trigger signal is required.

TRIG DELAY
: Press this key and use the data keys or knob to enter the delay time to use for the external frame trigger. The range is from -4680 μs to 250 μs inclusive. The configuration default value is 0 μs. If the precise position of the trigger timing is known, this value should be used. Otherwise, the value can be adjusted for relative measurements while viewing the trace.

MEASURE AVG PKS
: Press this key to select whether the trace or measurement is an average of the bursts (underline AVG), or the minimum and maximum peaks of the bursts (underline PKS). The GSM900 preset mode is PKS. This selection applies only when the number of bursts to measure is greater than 1.

Physical Channel
: Press this key to access the Physical Channel menu. From this menu, you can change the ARFCN and TN settings. Refer to "The Physical Channel Menu Softkeys" section in this chapter for a description of this key.

Previous Menu
: Press this key to return to the Power versus Time menu. You can also press this key to stop the measurement.

P vs T SUB TS Press this key to access the menu of softkeys that can further analyze the power versus time results over the following portions of the burst:

- The power versus time top 10 dB portion of the measured burst (the GSM9OO transmitter on-state)
- The power versus time rising edge portion of the measured burst
- The power versus time falling edge portion of the measured burst

For the most accurate determination of the burst timeslot characteristics, make all three of these measurements. Press this key to make a mean carrier power measurement. The spectrum analyzer reference level is set with respect to the mean carrier power measurement. This setting is used in the three measurements. An external frame trigger signal is required.

REPEAT MEAS Press this key to repeat the Power versus Time Sub Timeslot measurement. If desired, you can change parameters such as ARFCN, TN, trigger delay, and resolution bandwidth before you press this key.

TRIG DELAY Press this key and use the data keys or knob to enter the delay time for the external frame trigger. The range is from -4680 μs to 250 μs inclusive. The configuration default value is 0 μs. If the precise position of the trigger timing is known, this value should be used. Otherwise, the value can be adjusted for relative measurements while viewing the trace.

P vs T TOP 10dB Press this key and the GSM9OO Transmitter Measurements Personality again measures the carrier power and accurately positions the mean carrier power at the midpoint of the limit-line template. Then, the power versus time top 10 dB (the GSM9OO transmitter on-state) measurement is made. The results from this measurement provide the most accurate values for the GSM9OO transmitter on-state portion of the burst. The resolution bandwidth is set to 1 MHz, so the modulation is not converted to AM. The spectrum analyzer is automatically set to the following:

Span = 0 Hz
Sweeptime = 640 μs
RBW = 1 MHz
VBW = 300 kHz
Scale = LINEAR
Trigger mode = EXT

A limit-line template is drawn and the program displays the message LIMITPASS/FAIL.

P vs T RISING Press this key to start the power versus time rising-edge measurement. Use this test to obtain the most accurate data about the rising edge of the measured burst. The spectrum analyzer is automatically set to the following:

Span = 0 Hz
ST = 80 μs
RBW = 300 kHz
VBW = 300 kHz
Scale = 10 dB/DIV
Trigger mode = EXT

An adaptive limit-line template is drawn and the program displays the message LIMITPASS/FAIL.

P vs T FALLING Press this key to begin the power versus time falling-edge measurement. Use this measurement to obtain the most accurate data about the falling edge of the measured burst. The spectrum analyzer is automatically set to the following:

Span = 0 Hz
ST = 80 μs
RBW = 300 kHz
VBW = 300 kHz
Scale = 10 dB/DIV
Trigger mode = EXT

An adaptive limit-line template is drawn and the program displays the message LIMITPASS/FAIL.

The following six softkeys are available when P vs T TOP 10dB, P vs T RISING, or P vs T FALLING are selected.

REPEAT MEAS Press this key to start the power versus time full-timeslot measurement again. If desired, you can change parameters such as ARFCN, TN, trigger delay, and resolution bandwidth before you press this key.

NUMBER BURSTS Press this key to enter the number of bursts to use for calculating either the average or the minimum and maximum trace values. Enter a number from 1 to 10,000, inclusive. The GSM900 preset value is 1. The number of bursts measured appears under BURSTS in the center of the annotation column on the left-hand side of the display. If the number of bursts is set to 1, the trace displayed remains active. An external frame trigger signal is required.

TRIG DELAY — Press this key and use the data keys or knob to enter the delay time to use for the external frame trigger. The range is from -4680 μs to 250 μs inclusive. The configuration default value is 0 μs. If the precise position of the trigger timing is known, this value should be used. Otherwise, the value can be adjusted for relative measurements while viewing the trace.

MEASURE AVG PKS — Press this key to select whether the trace or measurement is an average of the bursts (underline AVG), or the minimum and maximum peaks of the bursts (underline PKS). The GSM9OO preset mode is PKS. This selection applies only when the number of bursts to measure is greater than 1.

Physical Channel — Press this key to access the Physical Channel menu. From this menu, you can change the ARFCN and TN settings. Refer to "The Physical Channel Menu Softkeys" section in this chapter for a description of this key.

Previous Menu — Press this key to return to the Power versus Time menu. You can also press this key to stop the measurement.

Previous Menu — Press this key to return to the Power versus Time menu. You can also press this key to stop the measurement.

BITS 88 148 — Press this key to select the length of the burst to be measured. All normal duration GSM9OO bursts contain 148 useful bits. The access burst, for example RACH, contains 88 useful bits (used for mobile station testing only). This parameter is used to establish the correct limit-line templates for the power versus time measurements and to set the correct number of bits for the mean carrier power measurement. Refer to ***Specification GSM 5.01 and 5.05*** for more information. The GSM9OO preset value is 148 useful bits.

Main Menu — Press this key to return to the Main menu.

Output RF Spectrum Measurement Menu Softkeys

Pressing Out RF Spectrum accesses the output RF spectrum measurements menu. The measurements are in these two groups (1) output RF spectrum due to modulation and (2) output RF spectrum due to switching transients.

Note Depending on the previous measurements selected, you may have to insert the GSM900 Transmitter Measurements Personality card into the card reader before pressing the OUT RF Spectrum key.

RF Spect Modulat Press this key to access the output RF spectrum due to modulation measurement menu.

MODULAT SWEPT Press this key to measure the output RF spectrum that is due to the effect of modulation. First, the transmitted carrier power is measured so the reference level can be set and the adaptive limit line can be drawn. The result is displayed in a swept-frequency format.

The spectrum analyzer is automatically set to the following:

Span = 4 MHz
Sweeptime = 2 s
RBW = 30 kHz
VBW = 30 kHz
Detector = GTPOS
Trigger mode = FREE

As per ***GSM 11.10 and*** 11.20, the only spectrum displayed is the result of at least 40 of the bits 87 to 132 of the burst (approximately equivalent to the 50% to 90% portion of the burst, excluding the midamble). An external frame trigger signal is required.

The displayed limit line reflects the limits given in ***GSM 11.10 section 13.4.2.2, GSM 11.20 section 2.1.6.5.1, and GSM 5.05 section 4.2.1 and Annex 1.***

If any portion of the trace exceeds the limit line, the message LIMIT FAIL appears in the middle-right portion of the display. Otherwise, LIMITPASS appears.

REPEAT MEAS Press this key to start the measurement again. If desired, you can change parameters such as ARFCN, TN, trigger delay, and resolution bandwidth before you press this key.

NUMBER BURSTS Press this key to enter the number of bursts to use for calculating either the average or minimum and maximum trace value. Enter a number from 1 to 10,000, inclusive. The GSM900 preset value is 1. The number of bursts measured is displayed under BURSTS in the center of the annotation column on the left-hand side of the screen. If the number of bursts is set to 1, the trace displayed remains active.

SPAN Press this key to change the span setting. The measurement may be repeated for frequency spans other than 4 MHz. Use the marker functions to display frequency and amplitude readouts.

Physical Channel Press this key to access the Physical Channel menu. From this menu, you can change the ARFCN and TN settings. Refer to "The Physical Channel Menu Softkeys" section in this chapter for a description of this key.

Previous Menu Press this key to access the Output RF Spectrum Modulation menu. You can also press this key to stop the measurement.

MODULAT MULTIPLE Press this key to begin the measurement for output RF spectrum due to the effect of modulation. The measurement is made at multiple, discrete frequency offsets. The offsets specified by *Specification GSM 11.10 and 11.20*, up to a frequency of 1800 kHz are used.

Table 6-2. Frequency Offset Values - Output RF Spectrum Due to Modulation

0 kHz	±400 kHz	±1200 kHz
±100 kHz	±600 kHz	±1400 kHz
±200 kHz	±800 kHz	±1600 kHz
±250 kHz	±1000 kHz	±1800 kHz

The results displayed in tabular form are for both relative (dBc) and absolute (dBm) values. An external frame trigger signal is required for this measurement.

Note A minimum of 25 sweeps are averaged for the 0 kHz offset, regardless of the "number of bursts" value.

Note Offsets can be changed via remote commands. Refer to the remote programming section of this manual for more information.

REPEAT MEAS Press this key to start the measurement again.

NUMBER BURSTS Press this key to enter the number of bursts to use to calculating either the average or minimum and maximum burst measurement value. Enter a number from 1 to 10,000, inclusive. The GSM900 preset value is 1. The number of bursts measured is displayed under BURSTS in the center of the annotation column on the left-hand side of the screen.

Physical Channel Press this key to access the Physical Channel menu. From this menu, you can change the ARFCN and TN settings. Refer to "The Physical Channel Menu Softkeys" section in this chapter for a description of this key.

Previous Menu Press this key to return to the Output RF Spectrum Modulation menu.

MODULAT SINGLE Press this key to measure the output RF spectrum due to the effects of modulation at a single frequency offset. The GSM900 preset offset is 0 Hz. Change the frequency offset value via the CARRIER **OFFSET** softkey.

Press REPEAT **MEAS** to measure the modulation products at the new offset. An external frame trigger signal is required for this measurement.

REPEAT MEAS Press this key to start the measurement again at the same offset or at another offset.

NUMBER BURSTS Press this key to enter the number of bursts to use for calculating either the average or minimum and maximum trace values. Enter a number from 1 to 10,000, inclusive. The GSM900 preset value is 1. The number of bursts measured is displayed under BURSTS in the center of the annotation column on the left-hand side of the screen. If the number of bursts is set to 1, the trace displayed remains active and the measured value is updated at the end of every sweep.

CARRIER OFFSET Press this key to enter a desired frequency offset. The range is from -100 MHz to + 100 MHz inclusive. Be sure to use the minus sign (-) for negative offsets. Use the step keys to change the carrier offset in 200 kHz increments.

Press REPEAT **MEAS** to perform the measurement at the new offset. The first measurement at any new channel needs to be done at a carrier offset of 0 kHz to establish the reference amplitude.

Physical Channel Press this key to access the Physical Channel menu. From this menu, you can change the ARFCN and TN settings. Refer to "The Physical Channel Menu Softkeys" section in this chapter for a description of this key.

Previous Menu Press this key to stop the measurement and return to the Output RF Spectrum Modulation menu.

MODULAT RX BAND Press this key to measure the output RF spectrum in the receive (RX) band that is due to the effects of modulation. The mobile station measurement requires a bandpass filter with a range of 925 MHz to 960 MHz (the RX band range). The filter increases the spectrum analyzer's dynamic range. An external frame trigger signal is also required.

The measurement can be performed on a base-station transmitter by underlining BS in the TX MS BS key. If a base station measurement is made, a bandpass filter with the frequency range of 880 MHz to 915 MHz should be used.

Caution The spectrum analyzer is vulnerable to damage at the input during the MODULAT RX BAND measurement. The damage can occur because the input attenuator is set to 0 dB, and because the external attenuator is replaced by a bandpass filter. To ***avoid analyzer damage***, you must observe the following precautions:

A receive-band bandpass filter (BPF) must be connected between the transmitter output and the spectrum analyzer INPUT 50Ω connector.

Make sure that the BPF used rejects the complete transmit band of the transmitter under test.

The total carrier power applied to the spectrum analyzer INPUT 50Ω ***can not exceed +30 dBm***. If the input exceeds +30 dBm, spectrum analyzer damage may result.

This measurement can be separately made on each of several transmitted hopping frequencies. 'lb do this, set up the transmitter so that each hopping frequency occurs in different timeslot numbers (TN).

CONTINUE Press this key to activate the measurement after the steps specified on the display are completed.

The measurement checks for an attenuated signal to verify whether a bandpass filter is attached. If a signal greater than -20 dBm is detected, the signal is not attenuated. The measurement stops, and the spectrum analyzer displays the error message `CARRIER PRESENT, TEST STOPPED ! .`

REPEAT MEAS Press this key to start the measurement again.

NUMBER BURSTS — Press this key to enter the number of bursts to use for calculating either the average or maximum or minimum trace values. Enter a number from 1 to 10,000 inclusive. The GSM900 preset value is 1. The number of bursts measured is displayed under BURSTS in the center of the annotation column on the left-hand side of the screen. If the number of bursts is set to 1, the trace displayed remains active.

MS CLASS 1 2-5 — Press this key to select the mobile station (MS) power. (This key appears only when MS is underlined in the TX MS BS key.) Underline 1 for mobile station power class-l power measurements, or underline 2-5 for mobile station power classes 2-5. The limit line is positioned correctly for the power class you select.

MARKER NORMAL — Press this key to activate the marker function. Use the marker to measure the amplitude at any selected frequency.

Previous Menu — Press this key to return to the Output RF Spectrum Modulation menu. You can press press this key to stop the measurement.

PREAMP GAIN — Press this key to enter the combined value of preamplifier gain, insertion loss of the bandpass filter, and any cable losses.

Previous Menu — Press this key to return to the previous menu.

NUMBER BURSTS — Press this key to enter the number of bursts to use for calculating the average or minimum and maximum trace values. Enter a number from 1 to 10,000 inclusive. The GSM900 preset value is 1. The number of bursts measured is displayed under BURSTS in the center of the annotation column on the left-hand side of the screen. If the number of bursts is set to 1, the trace displayed remains active.

Previous Menu — Press this key to return to the Output RF Spectrum Measurement menu.

RF Spect Transnt Press this key to access the measurement menus for output RF spectrum due to switching transients.

TRANSNT SWEPT Press this key to begin the Output RF Spectrum due to switching transients measurement. First, the transmitted carrier power is measured so the reference level can be set and the adaptive limit line can be drawn. Then, measurement results are displayed in a swept-frequency format.

The spectrum analyzer is automatically set to the following:

Span = 4 MHz
Sweeptime = 2 s
RBW = 30 kHz
VBW = 100 kHz
Detector = PEAK
Trigger mode = FREE

Neither the time-gate card (Option 105), nor an external frame trigger signal are required for this measurement.

The displayed limit line reflects the limits given in ***GSM 11.10 section 13.4.2.2, GSM11.20section2.1.6.5.2, and GSM 5.05 section 4.2.2.***

If any portion of the trace exceeds the limit line, the message LIMIT FAIL appears in the upper-right portion of the display. Otherwise, LIMIT PASS appears.

REPEAT MEAS Press this key to start the measurement again. If desired, you can change parameters such as ARFCN, TN, trigger delay, and resolution bandwidth before you press this key.

NUMBER BURSTS Press this key to enter the number of bursts to use for calculating either the average or minimum and maximum trace values. Enter a number from 1 to 10,000 inclusive. The GSM900 preset value is 1. The number of bursts measured is displayed under BURSTS in the center of the annotation column on the left-hand side of the screen. If the number of bursts is set to 1, the trace displayed remains active.

SPAN Press this key to change the span setting. The measurement may be repeated for frequency spans other than 4 MHz. Use the marker functions to display frequency and amplitude readouts.

AMPL OFFSET Press this key and enter an amplitude offset value. The range is from 0 dBm to +30 dBm inclusive. Press REPEAT MEAS to perform the measurement at the new offset. The new offset shifts the displayed dynamic range so that a better measurement can be made at the lower level portion of the spectrum. The part of the trace above the top graticule line is invalid and should not be measured.

`Physical Channel` Press this key to access the Physical Channel menu. From this menu, you can change the ARFCN and TN settings. Refer to "The Physical Channel Menu Softkeys" section in this chapter for a description of this key.

`Previous Menu` Press this key to return to the Output RF Spectrum Transient menu. You can also press this key to stop the measurement.

`TRANSNT MULTIPLE` Press this key to begin the measurement for output RF spectrum that is due to the effect of switching transients. The measurement looks at multiple, discrete frequency offsets. The offsets are specified by *Specification GSM 11.10 and 11.20.* The frequency offset values are as follows:

±0 kHz
±400 kHz
±600 kHz
±1200 kHz
±1800 kHz

The results are displayed in tabular form. Both relative (dBc) and absolute (dBm) values are listed.

Note Offsets can be changed via remote commands. Refer to Chapter 5, "Programming Commands" in this manual for more information.

`REPEAT MEAS` Press this key to start the measurement again.

`NUMBER BURSTS` Press this key to enter the number of bursts to use for calculating either the average or minimum and maximum trace values. Enter a number from 1 to 10,000 inclusive. The GSM900 preset value is 1. The number of bursts measured is displayed under `BURSTS` in the center of the annotation column on the left-hand side of the screen. If the number of bursts is set to 1, the trace displayed remains active.

`Physical Channel` Press this key to access the Physical Channel menu. From this menu, you can change the ARFCN and TN settings. Refer to "The Physical Channel Menu Softkeys" section in this chapter for a description of this key.

`Previous Menu` Press this key to return to the Output RF Spectrum Transient menu. You can also press this key to stop the measurement.

`TRANSNT SINGLE` Press this key to measure the switching transients at a single frequency offset. The GSM900 preset offset is 0 Hz. Change the frequency offset value via the `CARRIER OFFSET` softkey. Press `REPEAT MEAS` to measure the switching transient products at the new offset. An external frame trigger signal is *not* required.

`REPEAT MEAS` Press this key to start the measurement again at the same offset or at another offset.

NUMBER BURSTS Press this key to enter the number of bursts to use for calculating either the average or minimum and maximum trace values. Enter a number from 1 to 10,000, inclusive. The GSM9OO preset value is 1. The number of bursts measured is displayed under BURSTS in the center of the annotation column on the left-hand side of the screen. If the number of bursts is set to 1, the trace displayed remains active and the measured value is updated at the end of every sweep.

CARRIER OFFSET Press this key to enter a desired frequency offset. The range is from -100 MHz to + 100 MHz inclusive. Be sure to use the minus sign (-) for negative offsets. Use the step keys to increment the carrier offset in 200 **kHz** steps. Press **REPEAT MEAS** to perform the measurement at the new offset. The first measurement at any new channel needs to be done at a carrier offset of 0 **kHz** to establish the reference amplitude.

Physical Channel Press this key to access the Physical Channel menu. From this menu, you can change the ARFCN and TN settings. Refer to "The Physical Channel Menu Softkeys" section in this chapter for a description of this key.

Previous Menu Press this key to return to the Output RF Spectrum Switching Transients menu. You can also press this key to stop the measurement.

NUMBER BURSTS Press this key to enter the number of bursts to use for calculating either the average or minimum and maximum trace values. Enter a number from 1 to 10,000, inclusive. The GSM9OO preset value is 1. The number of bursts measured is displayed under BURSTS in the center of the annotation column on the left-hand side of the screen. If the number of bursts is set to 1, the trace displayed remains active and the measured value is updated at the end of every sweep.

Previous Menu Press this key to return to the Output RF Spectrum Measurement menu.

BITS 88 148 Press this key to select the length of the burst to be measured. All normal duration GSM9OO bursts contain 148 useful bits. The access burst, for example RACH, burst contains 88 useful bits (used for mobile station testing only). The GSM9OO preset value is 148 useful bits.

Main Menu Press this key to return to the Main menu.

The Spurious Emissions Measurement Menu Softkeys

Pressing **Spurious** Emission accesses the menu relating to spurious emissions measurements. There are measurements for both transmitter spurious and receiver spurious emissions. An external frame trigger signal is *not* required for these measurements.

Note Depending on the previous measurements selected, you may have to insert the GSM9OO Transmitter Measurements Personality card into the card reader before pressing the **Spurious Emission** key.

During the Spurious Emissions measurements, the ABORT key is displayed. Press ABORT anytime to stop a measurement. The measurement is aborted after the current sweep is completed.

Notes

1. Some of the measurements require different equipment setups. Refer to Chapter 3, "Making GSM9OO Measurements With HP 85715B".
2. Spurs which exceed or are within 6 dB of the GSM9OO specification are listed in a table at the completion of the measurement. For some combinations of spectrum analyzer gain and resolution bandwidths, the noise floor of the spectrum analyzer may be above (or within 6 dB of) the GSM900-specified limit. Spurious emissions measurements may still be conducted under these conditions, however, an asterisk (*) is listed beside a detected spur.

   Press INSPECT SPUN after the measurement is completed to closely examine an asterisked (*) spur. Remove any input signals to the spectrum analyzer. If the spur does not change, the spectrum analyzer's sensitivity is insufficient to make the measurement. Refer to Chapter 8. "Specifications and Characteristics."

Xmtr Spurious Press this key to access the selections for measuring conducted spurious emissions at the transmitter antenna connector. The measurement is divided into three parts (1) transmit band, (2) receive band, and (3) outside the transmit and receive bands. At the conclusion of each test, spurious emissions above or within 6 dB of the GSM9OO specified test limits are listed in a table. Up to 28 frequency and amplitude pairs for the spurs are listed in the table. Press INSPECT SPUR after the measurement is completed to examine a spur.

TX BAND Press this key to test for spurious emissions in the transmit band as defined with the TX BS MS key. The transmit band is checked for spurs at fixed frequency offsets from the carrier frequency. Slow frequency hopping (SFH) mode is not supported in transmit-band spurious emissions measurements.

If no signal greater than -20 dBm is detected, the message NO CARRIER is displayed. The test continues using the current value of ARFCN. If a valid signal is found, the program identifies the exact channel number of the carrier signal. The GSM900 specified test limit is displayed as a horizontal line across the screen during the measurement. Any signals that exceed or are within 6 dB of the limit line are listed in a table at the completion of the measurement.

Measurements within the transmit band (+ 2 MHz on either side) are conducted using the following spectrum analyzer settings as documented in the GSM specifications.

Table 6-3. GSM Recommended Offset Values

Offset From Carrier	Resolution Bandwidth
1.8 to 6 MHz	30 kHz
>6 MHz	100 kHz

INSPECT SPUR Press this key to inspect a spur that is listed in the spurious emissions table. The first spur in the table is displayed on the screen. If INSPECT SPUR is activated, but there are no valid spurs, the message NO SPURS FOUND ! is displayed.

ENTER SPUR # Press this key to select a spur number to further examine. Enter a number corresponding with a spur listed in the table, then press [ENTER). You can also press the ▲ or ▼ keys to automatically display different spurs in the table. The spectrum analyzer recalls the measurement state in which the test was performed (CF, RBW, VBW, SPAN, RL and so forth) then positions the marker on the selected spur.

MARKER PEAK Press this key to position a marker at the highest level on the trace.

MARKER NORMAL Press this key to activate the normal marker. The position of the marker can be changed by using the knob, step keys, or data keys.

RES BW Press this key to change the resolution bandwidth. Video bandwidth and sweeptime remain correctly coupled for GSM900 signals.

EXT ATTEN Press this key to view or change the value of external attenuation. More accurate amplitude measurements are possible if the exact value of external attenuation is known for the selected spectrum analyzer center frequency.

Previous Menu Press this key to display the detected spurious emissions table.

Previous Menu Press this key to return to the top level spurious emissions menu.

RX BAND Press this key to test for emissions in the receive band as selected with the TX BS MS key. The measurement requires a receive band bandpass filter to reject the carrier signal. The GSM900 specified test limit is displayed as a horizontal line across the screen during the measurement. Any signals that exceed or are within 6 dB of the limit line are listed in a table at the completion of the measurement.

Caution The spectrum analyzer is vulnerable to damage at the input during the RX BAND measurement. The damage can occur because the input attenuator is set to 0 dB, and because the external attenuator is replaced by a bandpass filter. To ***avoid analyzer damage***, you must observe the following precautions:

A receive-band bandpass filter (BPF) must be connected between the transmitter output and the spectrum analyzer INPUT 50Ω connector.

Make sure that the BPF used rejects the complete transmit band of the transmitter under test.

The total carrier power applied to the spectrum analyzer INPUT 50Ω ***can not exceed +30 dBm.*** If the input exceeds + 30 dBm, spectrum analyzer damage may result.

CONTINUE Press this key to continue the RX Band measurement.

INSPECT SPUR Press this key to inspect a spur that is listed in the spurious emissions table. The first spur in the table is displayed on the screen. If INSPECT SPUR is activated, but there are no valid spurs, the message NO SPURS FOUND! is displayed.

ENTER SPUR # Press this key to select a spur number to further examine. Enter a number corresponding with a spur listed in the table, then press ENTER. You can also press the ▲ or ▼ keys to automatically display different spurs in the table. The spectrum analyzer recalls the measurement state in which the test was performed (CF, RBW, VBW, SPAN, RL, RT and marker values) then positions the marker on the selected spur.

MARKER PEAK Press this key to position a marker at the highest level on the trace.

MARKER NORMAL Press this key to activate the normal marker. The position of the marker can be changed by using the knob, step keys, or data keys.

RES BW Press this key to change the resolution bandwidth. Video bandwidth and sweeptime remain correctly coupled for GSM900 signals.

PREAMP GAIN Press this key to view or change the value of preamplifier gain.

Previous Menu Press this key to display the detected spurious emissions table.

Previous Menu Press this key to return to the previous menu.

PREAMP GAIN Press this key to view or enter a new value for preamplifier gain. This value needs to be the combined values of bandpass filter insertion loss, preamplifier gain, and any known cable losses.

Previous Menu Press this key to return to the top level Spurious Emissions menu.

SPUR TST ON OFF Press this key to test each spur to determine whether it is a true spur or one which has been internally generated by the spectrum analyzer. If the spur is determined to be internally generated it is removed from the table of spurious signals. This key can be used in the majority of applications to determine internally generated spurs without affecting the measurement of the external spurs.

OUTSIDE TX & RX — Press this key to test for emissions outside the transmit and receive bands of the transmitter.

Note For mobile stations, this key is labeled OUTSIDE TX and measures outside the TX band. It does not skip the RX band.

If no signal larger than -20 dBm is detected, the message NO CARRIER is displayed. However, the test continues. The GSM900 specified test limit is displayed as a horizontal line across the screen during the measurement. Any signals that exceed or are within 6 dB of the limit line are listed in a table at the completion of the measurement.

As specified by the GSM specifications, a different resolution bandwidth is used depending on the frequency range. The following tables list the different resolution bandwidths that are used with the frequency ranges.

Table 6-4. Resolution Bandwidths Used for Base Station Transmitter Spurious Emissions - Outside TX and RX Rand

Start Frequency	Stop Frequency	Resolution Bandwidth
100 kHz	5 MHz	10 kHz
5 MHz	50 MHz	10 kHz
50 MHz	500 MHz	100 kHz
500 MHz	880 MHz	3 MHz
915 MHz	920 MHz	100 kHz
920 MHz	923 MHz	30 kHz
962 MHz	965 MHz	30 kHz
965 MHz	970 MHz	100 kHz
970 MHz	980 MHz	300 kHz
980 MHz	990 MHz	1 MHz
990 MHz	12.75 GHz	3 MHz

Note All spectrum analyzers and measuring receivers lose sensitivity at low frequencies. This is due to the phase noise of the built-in oscillator and the resolution bandwidth (RBW) filter shape.

The current version of *Specification GSM* 11.20 specifies testing for transmitter spurious emissions from 9 kHz to 12.75 GHz. In examining frequencies around 9 kHz, the spectrum analyzer's LO feedthrough may mask spurious signals. *Specification GSM 11.10* has changed the start frequencies and resolution bandwidths to account for this.

In anticipation of future changes to *Specification GSM 11.20* and for valid measurement results, the frequencies and RBWs have been changed for base station testing (for frequencies less than 500 MHz).

Table 6-5. Resolution Bandwidths Used for Mobile Station Transmitter Spurious Emissions - Outside TX Band

Start Frequency	Stop Frequency	Resolution Bandwidth
100 kHz	5 MHz	10 kHz
5 MHz	50 MHz	10 kHz
50 MHz	500 MHz	100 kHz
500 MHz	850 MHz	3 MHz
850 MHz	860 MHz	1 MHz
860 MHz	870 MHz	300 kHz
870 MHz	875 MHz	100 kHz
875 MHz	878 MHz	30 kHz
917 MHz	920 MHz	30 kHz
920 MHz	925 MHz	100 kHz
925 MHz	935 MHz	300 kHz
935 MHz	945 MHz	1 MHz
945 MHz	12.75 GHz	3 MHz

INSPECT SPUR Press this key to inspect a spur that is listed in the spurious emissions table, displayed on the analyzer. The first spur in the table is displayed on the screen. If INSPECT SPUR is activated, but there are no valid spurs, the message NO SPURS FOUND! is displayed.

ENTER SPUR # Press this key to select a spur number to further examine. Enter a number corresponding with a spur listed in the table, then press (ENTER). You can also press the (▲) or (▼) keys to automatically display different spurs in the table. The spectrum analyzer recalls the measurement state in which the test was performed (CF, RBW, VBW, SPAN, RL, AT and marker values) then positions the marker on the selected spur.

MARKER PEAK Press this key to position a marker at the highest-level on the trace.

MARKER NORMAL Press this key to activate the normal marker. The position of the marker can be changed by using the knob, step keys, or data keys.

RES BW Press this key to change the resolution bandwidth. Video bandwidth and sweeptime remain correctly coupled for GSM900 signals.

EXT ATTEN Press this key to view or change the value of external attenuation. More accurate amplitude measurements are possible if the exact value of external attenuation is known for the selected spectrum analyzer center frequency.

Previous Menu Press this key to display the detected spurious emissions table.

Previous Menu Press this key to return to the top level spurious emissions menu.

SFH ON OFF This key appears only if you are testing base stations. Press it if the base station transmitter is in slow frequency hopping mode. When ON is underlined, the measurements take sweeps which are the nominal sweep time, multiplied by the SLOW FREQ HOP REPEAT value.

IDLE YES NO This key appears only if you are testing mobile station transmitters. Press it if the mobile station transmitter is in idle mode. When YES is underlined, the TX Band and Outside TX Band measurements are made differently.

For TX Band measurements, the full mobile station transmit band is measured with a 100 kHz resolution bandwidth.

Note The carrier may be detected as a “spur” itself during the TX Band, mobile station in idle mode measurement.

For Outside TX Band measurements, Table 6-6 lists the resolution bandwidths that are used.

Table 6-6. Resolution Bandwidths Used for Mobile Station Transmitter Spurious Emissions - Transmitter in Idle Mode

Start Frequency	Stop Frequency	Resolution Bandwidth
100 kHz	5 MHz	10 kHz
5 MHz	50 MHz	10 kHz
50 MHz	878 MHz	100 kHz
917 MHz	12.75 GHz	100 kHz

Previous Menu Press this key to return to the top level Spurious Emissions menu.

Rcvr Spurious Press this key to access the menu of keys for testing the spurious emissions of the receiver.

TX BAND Press this key to test for spurious emissions in the transmit band as defined with the TX BS MS key. The transmit band is checked for spurs at fixed frequency offset from the carrier frequency. Slow frequency hopping (SFH) mode is not supported in transmit band spurious emissions measurements.

If a signal larger than -20 dBm is detected, the message CARRIER PRESENT, TEST STOPPED! is displayed and the test stops. If no signal larger than -20 dBm is detected, the test uses the current ARFCN value as the carrier channel and the test continues.

The GSM900 specified test limit is displayed as a horizontal line across the screen during the measurement. Any signals that exceed or are within 6 dB of the limit line are listed in a table at the completion of the measurement. Refer to Table 6-3 for spectrum analyzer settings.

OUTSIDE TX RAND Press this key to test for spurious emissions outside the transmit band. If a signal larger than -20 dBm is detected, the message CARRIER PRESENT, TEST STOPPED! is displayed and the test stops. If no signal larger than -20 dBm is detected, the test continues.

The GSM900 specified test limit is displayed as a horizontal line on the screen during the measurement. Any signals that exceed or are within 6 dB of the limit line are listed in a table at the completion of the measurement. Refer to Table 6-4 and Table 6-5 for spectrum analyzer settings.

The following seven softkeys are available when TX RAND or OUTSIDE TX BAND are selected.

INSPECT SPUR — Press this key to inspect a spur that is listed in the spurious emissions table. The first spur in the table is displayed on the screen. If INSPECT SPUR is activated, but there are no valid spurs, the message NO SPURS FOUND! is displayed.

ENTER SPUR # — Press this key to select a spur number to further examine. Enter a number corresponding with a spur listed in the table, then press (ENTER). You can also press the (▲) or (▼) keys to automatically display different spurs in the table. The spectrum analyzer recalls the measurement state in which the test was performed (CF, RBW, VBW, SPAN, RL, AT and marker values) then positions the marker on the selected spur.

MARKER PEAK — Press this key to position a marker at the highest-level on the trace.

MARKER NORMAL — Press this key to activate the normal marker. The position of the marker can be changed by using the knob, step keys, or data keys.

RES BW — Press this key to change the resolution bandwidth. Video bandwidth and sweeptime remain correctly coupled for GSM900 signals.

Previous Menu — Press this key to display the detected spurious emissions table.

Previous Menu — Press this key to return to the top level spurious emissions menu.

SPUR TST ON OFF — Press this key to test each spur to determine whether it is a true spur or one which has been internally generated by the spectrum analyzer. If the spur is determined to be internally generated it is removed from the table of spurious signals. This key can be used in the majority of applications to determine internally generated spurs without affecting the measurement of the external spurs.

SFH ON OFF — This key appears only if you are testing base stations. Press it if the base station transmitter is in slow frequency hopping mode. When ON is underlined, the measurements take sweeps which are the nominal sweep time, multiplied by the SLOW FREQ HOP REPEAT value.

Previous Menu — Press this key to return to the top level spurious emissions menu.

NUMBER SWEEPS — Press this key to enter the number of sweeps that are used when making the spurious emissions measurements. The GSM900 preset value is 1. Valid values range from 1 to 99, inclusive.

MAXIMUM RES BW Press this key to enter the maximum resolution bandwidth to use during the spurious emissions measurements. The lower limit for this value is 30 kHz. Changing this to a value smaller than its default 3 MHz improves the sensitivity of the spectrum analyzer, however the test time increases.

MAXIMUM FREQ Press this key to enter the maximum frequency to use during the spurious emissions measurements. The range is from 2.9 GHz to 12.75 GHz inclusive.

Main Menu Press this key to return to the main GSM900 menu.

The Intermodulation Measurement Menu Softkeys

Note Depending on the previous measurements selected, you may have to insert the GSM9OO Transmitter Measurements Personality card into the card reader before pressing the **Intermod** key.

During the Intermodulation measurements, the ABORT key is displayed. Press this key at any time to stop a measurement.

Pressing **Intermod** accesses the menu of keys relating to the intermodulation measurements. The two types of intermodulation measurements are (1) intermodulation attenuation and (2) intra-BSS attenuation.

Intermodulation Attenuation measurements require the user to set up equipment. The GSM9OO Transmitter Measurements Personality displays instructions to help facilitate this process.

Note An external CW source and a circulator are required for Intermodulation Attenuation measurements. Refer to Chapter 3, "Making GSM9OO Measurements With HP 85715B" for the measurement procedure.

An external frame trigger signal is *not* required for any of the intermodulation measurements.

Intermod Atten Press this key to access the selections to measure intermodulation attenuation. The transmit-band measurement is a separate measurement from the receive-band measurement. At the completion of the measurement, the GSM9OO Transmitter Measurements Personality displays the measured value of the intermodulation products.

TX BAND Press this key to activate the intermodulation attenuation measurement in the base station transmit band.

The measurement first measures the carrier power. If no signal larger than -20 dBm is detected, the message `NO CARRIER, TEST STOPPED !` is displayed, and the test stops. If a valid signal is found, the program identifies the exact channel number of the carrier signal.

GSM Specification 11.20 outlines testing for intermodulation products. The testing is based on an interference signal that is either 800 kHz above or below the carrier. Therefore, the following softkey menu is displayed once the carrier is measured.

ABOVE Press this key and the instructions for connecting the equipment to measure the CW signal 800 kHz above the carrier frequency are displayed. The measured frequency and amplitude of the carrier is also displayed.

BELOW Press this key and the instructions for connecting the equipment to measure the CW signal 800 kHz below the carrier frequency are displayed. The measured frequency and amplitude of the carrier is also displayed.

The following three softkeys are available when **ABOVE** or BELOW are selected.

CONTINUE Press this key to allow adjustments to the frequency and amplitude of the CW signal.

Press CONTINUE a second time to measure the frequency and amplitude of the CW signal. If the center frequency of the CW signal is greater than 100 kHz from its specified 800 kHz offset, then the message FREQUENCY > 0.1 MHz OFF ! appears. In addition, if the amplitude of the CW signal is greater than ±1 dB from its specified -30 dBc, then the message AMPLITUDE > 1 dB OFF! is displayed. In either case, the test continues.

An instructions screen appears explaining the equipment connections. The frequency and amplitude of the carrier as well as the measured frequency and amplitude of the CW signal are all displayed.

Press **CONTINUE** a third time to measure the carrier again which verifies that the equipment is connected correctly. If the carrier is larger than -20 dBm, the measurement begins. Otherwise, the message NO CARRIER! CHECK SETUP! is displayed along with the previous instructions screen.

The transmit-band intermodulation attenuation measurement sweeps from 100 kHz below the third-order intermodulation product to 100 kHz above the thirteenth-order product.

The TX Band intermodulation attenuation is defined as the dB difference from the carrier to the highest intermodulation product.

Note When the CW signal is below the carrier, the carrier's modulation envelope can be greater than the GSM900 specification.

Note *GSM Specification 11.20* outlines the use of a 300 kHz resolution bandwidth for the transmit-band intermodulation attenuation measurement. However, the HP 85715B GSM900 Transmitter Measurements Personality uses a 30 kHz resolution bandwidth to resolve the 800 kHz products, as well as improve sensitivity.

REPEAT MEAS — Press this key to start the intermodulation measurement again.

Previous Menu — Press this key at the completion of the measurement to return to the Intermodulation menu.

RX BAND — Press this key to activate the intermodulation attenuation measurement in the base station receive band.

Note The receive-band intermodulation attenuation measurement requires a preamplifier, bandpass filter, CW source, and a circulator. Refer to Chapter 3. "Making GSM900 Measurements With HP 85715B" for measurement examples.

The measurement first measures the carrier power. If no signal larger than -20 dBm is detected, the message NO CARRIER, TEST STOPPED ! is displayed, and the test stops. If a valid signal is found, the program identifies the exact channel number of the carrier signal.

Testing for intermodulation products based upon an interference signal which generates a 3rd, 5th, or 7th order product on the corresponding carrier receive band frequency. Therefore, the following softkey menu is displayed once the carrier is measured:

3rd — Press this key to select 3rd-order intermodulation interference. Instructions for connecting the equipment to measure the CW signal are displayed. The measured frequency and amplitude of the carrier is also displayed.

5th — Press this key to select 5th-order intermodulation interference. Instructions for connecting the equipment to measure the CW signal are displayed. The measured frequency and amplitude of the carrier is also displayed.

7th — Press this key to select 7th-order intermodulation interference. Instructions for connecting the equipment to measure the CW signal are displayed. The measured frequency and amplitude of the carrier is also displayed.

CONTINUE Press this key to allow adjustment of the frequency and amplitude of the CW signal. Press CONTINUE a second time to measure the frequency and amplitude of the CW signal.

If the CW source frequency is greater than ±100 kHz from the specified source frequency, the message FREQUENCY > 0.1 MHz OFF ! appears.

If the CW source amplitude is greater than ± 1 dB from its specified -30 dBc, then the message AMPLITUDE > 1 dB OFF! is displayed. In either case, the measurement continues.

An instructions screen for equipment connections appears. The frequency and amplitude of the carrier as well as the measured frequency and amplitude of the CW signal are all displayed.

Press **CONTINUE** a third time to measure the carrier again and to verify that the equipment is connected correctly. If the carrier is less than -20 dBm, the measurement continues. Otherwise, the message CARRIER PRESENT ! TEST STOPPED ! is displayed. The previous instructions screen is displayed again.

A caution screen appears next. The caution emphasizes the importance of correct connections and allows you to change the currently displayed PREAMP GAIN value.

Press CONTINUE a fourth time to begin the measurement. The RX band intermodulation attenuation is defined as the highest signal detected in the carrier's corresponding receive band.

REPEAT MEAS Press this key to start the intermodulation measurement again.

Previous Menu Press this key at the completion of the measurement to return to the Intermodulation menu.

IntraBSS Intermod Press this key to access the Intra-Base station Intermodulation Attenuation measurement menu. The transmit band measurement is a separate measurement from the receive band measurement, Refer to Chapter 3, "Making GSM900 Measurements With HP 85715B" for equipment setup.

TX BAND Press this key to activate transmit band intermodulation measurement.

REPEAT **MEAS** Press this key to begin the measurement again.

The transmit band intra-BSS intermodulation attenuation measurement sweeps from 700 kHz below the first product to the top of the transmit band. The result is displayed as both the number of dB from the reference channel amplitude to the highest product detected as well as the absolute power of the highest product detected.

EXT **ATTEN** Press this key if a step attenuator is in series with the external attenuator connected to the input of the spectrum analyzer. Use this key to adjust the step gain of the spectrum analyzer while adjusting the step attenuator to optimize the display of intermodulation products. The range is from 0 dBm to +70 dBm inclusive.

Previous Menu Press this key to return to the previous menu.

Rx **BAND** Press this key to activate receive band intermodulation measurement. A caution screen is displayed.

CONTINUE Press this key after you have made the connections and verified that the preamplifier gain value is correct.

The test first measures the carrier power. If a signal larger than -20 dBm is detected, the message CARRIER PRESENT ! TEST STOPPED ! is displayed and the test stops. Otherwise the measurement continues.

The receive band intra-BSS intermodulation attenuation measurement sweeps the full receive band. The result is displayed as the highest product detected.

REPEAT **MEAS** Press this key to begin the measurement again.

PREAMP GAIN Press this key to adjust the value of preamplifier gain to optimize the display of intermodulation products (used in conjunction with external step attenuator).

Previous **Menu** Press this key to return to the Intra-BSS Intermod menu.

PREAMP GAIN Press this key to enter the combined value of preamplifier gain, insertion loss of the bandpass filter, and any cable losses.

REF CHANNEL Press this key to enter a reference channel number other than the default ARFCN 3.

Previous Menu Press this key to return to the previous menu.

Main Menu Press this key to return to the main GSM900 menu.

Phase and Frequency Error Measurement Menu Softkeys

Spectrum analyzer option 163 required

Note Depending on the previous measurements selected, you may have to insert the GSM9OO Transmitter Measurements Personality card into the card reader before pressing the Phase & Freq Err key.

Phase & Freq Err — Press this key to access the Phase and Frequency Error measurements menu. This menu allows you to measure the accuracy of the transmitter's modulation. The errors are measured and displayed numerically or with optional graphical displays. This menu also allows you to examine the demodulated data bits.

Note A valid trigger signal must be detected by the spectrum analyzer before the measurements which appear under Phase & Freq Err can be run. Use the Physical Channel menu keys to set ARFCN (channel number) and TN (timeslot number) for the Phase and Frequency Error measurement.

PHASE FREQ — Press this key to begin the Phase and Frequency Error measurement, and display the Numeric Results. The spectrum analyzer is automatically set to the following:

Span = 0 Hz
Trigger mode = EXT

DATA BITS — Press this key to view a binary representation of the demodulated signal. If you selected SYNC MID AMPL such that MID is underlined in the measurement configuration menu, the midamble bits are marked with the letter "M" underneath.

The following softkeys are available when PHASE FREQ or DATA BITS are selected.

REPEAT MEAS — Press this key to start the measurement again. If desired, you can change parameters such as ARFCN, TN, FREQ ERR OFFSET, and VERTICAL SCALE before you press this key.

NUMBER BURSTS — Press this key to enter the number of bursts to use for calculating either the average or peak values. Enter a number from 1 to 2,000, inclusive. The GSMSOO preset value is 1. The number of bursts measured is displayed under BURSTS in the center of the annotation column on the left-hand side of the screen. If the number of bursts is set to 1, the trace displayed remains active and the measured value is updated at the end of every sweep. The results from individual measurements are displayed at the bottom of the spectrum analyzer display when number of bursts is >1.

Note The data bits result is not averaged.

MEASURE AVG PKS — Press this key to select whether the trace or measurement is an average of the bursts (underline AVG), or the minimum and maximum peaks of the bursts (underline PKS). The GSMSOO preset mode is PKS. This selection applies only when the number of bursts to measure is greater than 1.

STD DEV **ON** OFF — Press this key to select standard deviation measurement for the Phase and Frequency Error measurements. When on, this mode overrides the Peak Average setting (**MEASURE** AVG PKS).

Physical Channel — Press this key to access the Physical Channel menu. From this menu, you can change the ARFCN and TN settings. Refer to "The Physical Channel Menu Softkeys" section in this chapter for a description of this key.

Previous **Menu** — Press this key to return to the previous menu.

Graphs — Press this key to view a graphical representation of the errors. The graph displays also show the numerical values of the peak phase error, the RMS phase error, the frequency error and the sync status.

PHASE **GRAPH** — Press this key to view a graphical representation of the phase error. The vertical axis represents the instantaneous phase error and has a preset value of ± 20 °. The horizontal axis represents the bit position in the burst. The trace can be modified using the Zoom and SCALE functions.

FREQ DEV **GRAPH** — Press this key to view a graphical representation of the frequency deviation. The horizontal axis represents the bit position in the burst. The trace can be modified using the Zoom and SCALE functions.

The nominal scale reading is ±100 kHz.

PHASE **&** **FRQ GRAPH** — Press this key to view a graphical representation of the combined frequency and phase error. The horizontal axis represents the bit position in the burst. The slope of the graph indicates the frequency error of the burst. The trace can be modified using the Zoom function. A 10 Hz mean frequency error will give approximately a 2" slope across a normal burst.

The following softkeys are available when PHASE **GRAPH** , **FREQ** DEV GRAPH or PHASE **&** FRQ GRAPH are selected.

REPEAT MEAS — Press this key to start the measurement again. If desired, you can change parameters such as ARFCN, TN, trigger delay, and resolution bandwidth before you press this key.

NUMBER BURSTS — Press this key to enter the number of bursts to use for calculating either the average or minimum and maximum trace values. Enter a number from 1 to 2,000, inclusive. The GSM900 preset value is 1. The number of bursts measured is displayed under BURSTS in the center of the annotation column on the left-hand side of the screen. If the number of bursts is set to 1, the trace displayed remains active and the measured value is updated at the end of every sweep.

MEASURE AVG PKS — Press this key to select whether the trace or measurement is an average of the bursts (underline AVG), or the minimum and maximum peaks of the bursts (underline PKS). The GSM900 preset mode is PKS. This selection applies only when the number of bursts to measure is greater than 1.

Zoom Press this key to examine the graph in more detail. A further menu appears which allows you to set the spectrum analyzer display so that you can view the required section of the burst. The GSM9OO preset setting is full burst.

START BIT Press this key to enter the first bit number in the burst you require on the display. The GSM9OO preset value is 0.

END BIT Press this key to enter the last bit number in the burst you require on the display. The GSM9OO preset value is 147.

MIDAMBLE Press this key to display only the midamble section of the burst. The first bit displayed is bit 61 of the burst, that is the first midamble bit. The last bit displayed is bit 87 of the burst, that is the last midamble bit.

FULL BURST Press this key to display the complete burst. This is the GSM9OO preset setting.

VERTICAL SCALE Press this key to configure the vertical scale of the graph. Enter a numerical value, then press (ENTER). You can also press the ▲ or ▼ keys to select the scale. The GSM9OO preset value is 20°.

Previous **Menu** Press this key to return to the previous menu.

Physical Channel Press this key to access the Physical Channel menu. From this menu, you can change the ARFCN and TN settings. Refer to "The Physical Channel Menu Softkeys" section in this chapter for a description of this key.

Previous Menu Press this key to return to the previous menu.

Previous Menu Press this key to return to the Phase and Frequency Error menu.

MEAS CAL ON OFF Press this key such that ON is underlined to initiate a frequency error self-calibration routine. This self-calibration routine is carried out prior to each frequency error measurement. An uncalibrated measurement can be made by selecting OFF underlined. This has the benefit of an improved update rate, but the results will not be as accurate. The GSM9OO preset value is ON.

Meas Config Press this key to access a menu which allows you to set the configuration for the Phase and Frequency Error measurement.

Burst Type Press this key to access a menu which allows you to select the type of burst expected for the Phase and Frequency Error measurement. The GSM9OO preset burst type is normal.

NORMAL (TCH,BCH) Press this key to select a normal duration GSM9OO burst of 148 useful bits. This type of burst would normally be expected on a traffic or broadcast channel (TCH or BCH). Pressing this key is equivalent to selecting 148 in BITS 88 148.

SHORT **(RACH)** Press this key to select a short duration GSM9OO burst of 88 useful bits. This type of burst would be expected on a random access channel (RACH) and is only used by mobile stations (MS). Pressing this key is equivalent to selecting 88 in BITS 88 148 .

Previous Menu Press this key to return to the previous menu.

COLOR AUTO MAN Press this key to select either automatic (AUTO underlined) or manual (MAN underlined) detection of the color pattern sent by the transmitter. If you select AUTO the spectrum analyzer automatically detects and sets the initial color code received from the transmitter. If you select MAN, enter the expected color code, within the range 0 through 7, then press (ENTER). You can also press the (▲) or (▼) keys to select the color codes. The GSMSOO preset value is AUTO.

SYNC MID AMPL Press this key to select what signal the spectrum analyzer uses for synchronization. If MID is underlined the spectrum analyzer uses the midamble section of the burst. If AMPL is underlined the spectrum analyzer uses the rising edge of the burst. The GSM9OO preset value is MID.

MEASURE AVG PKS Press this key to select whether the trace or measurement is an average of the bursts (underline AVG), or the minimum and maximum peaks of the bursts (underline PKS). The GSM9OO preset mode is PKS. This selection applies only when the number of bursts to measure is greater than 1.

FREQ ERR OFFSET Press this key to enter a known system frequency error. This allows you to eliminated known frequency errors leading to more accurate frequency error measurements. The range is from -10,000 Hz to + 10,000 Hz inclusive. The GSM9OO preset value is 0 Hz.

Previous **Menu** Press this key to return to the previous menu.

Main Menu Press this key to return to the main GSM9OO menu.

GSM900 Transmitter Measurements Personality Menu Maps

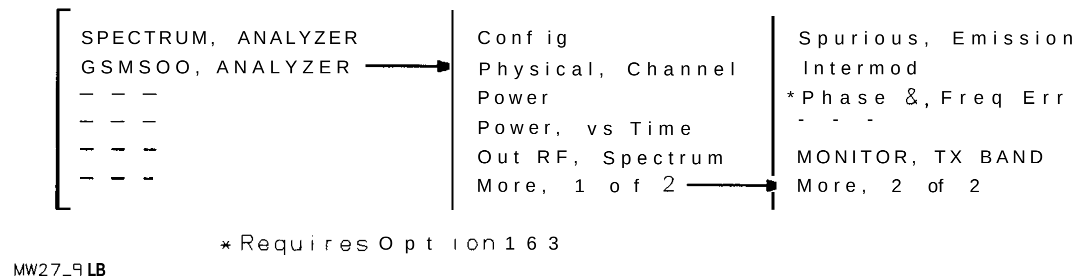


Figure 7-1. HP 85715B GSM900 Main Menu

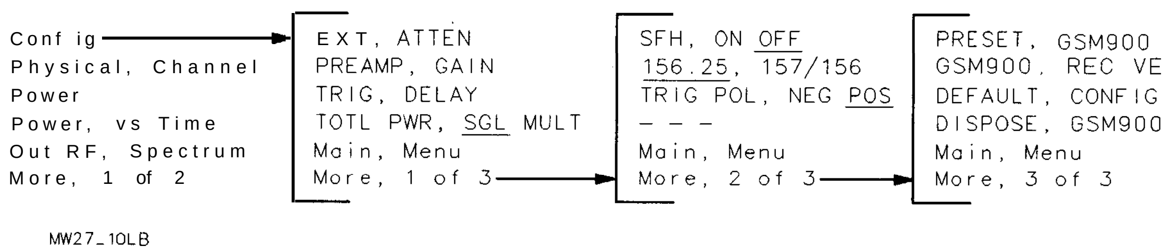


Figure 7-2. Configuration Menu

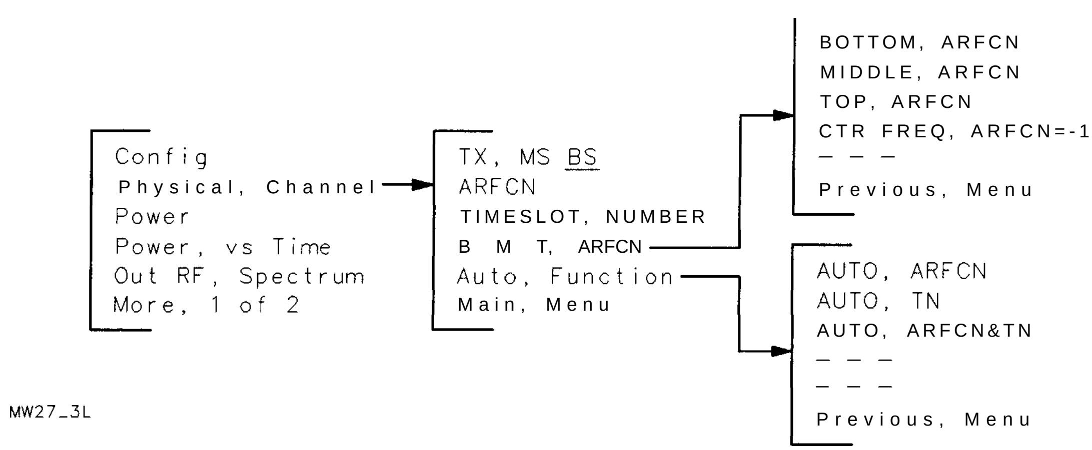


Figure 7-3. Physical Channel Menu

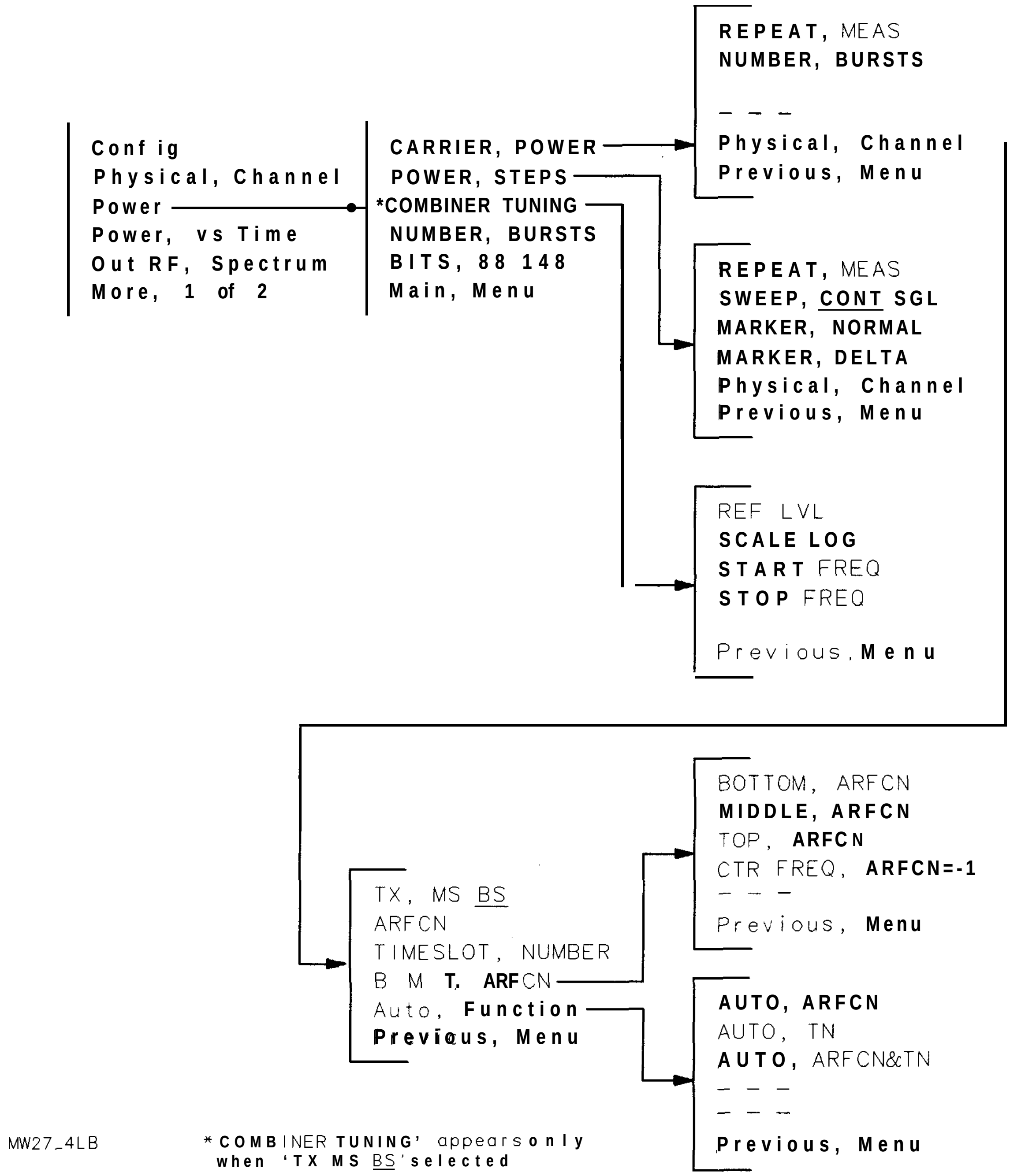


Figure 7-4. Power Measurement Menu

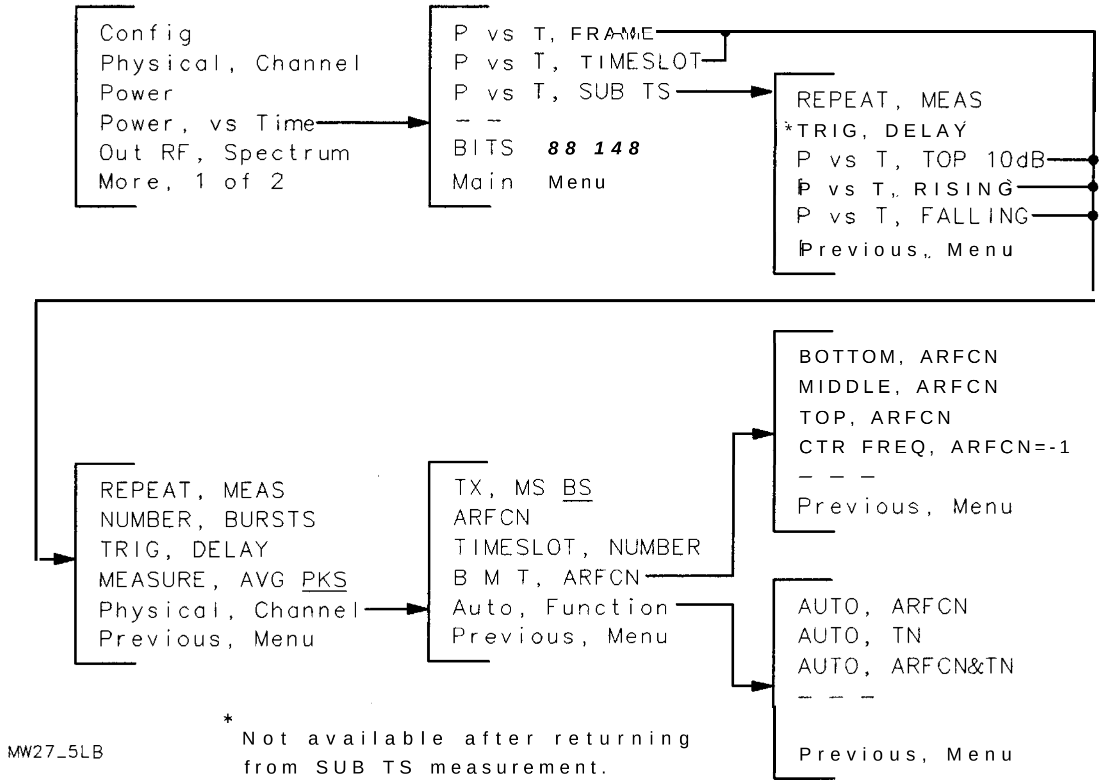


Figure 7-5. Power vs Time Measurement Menu

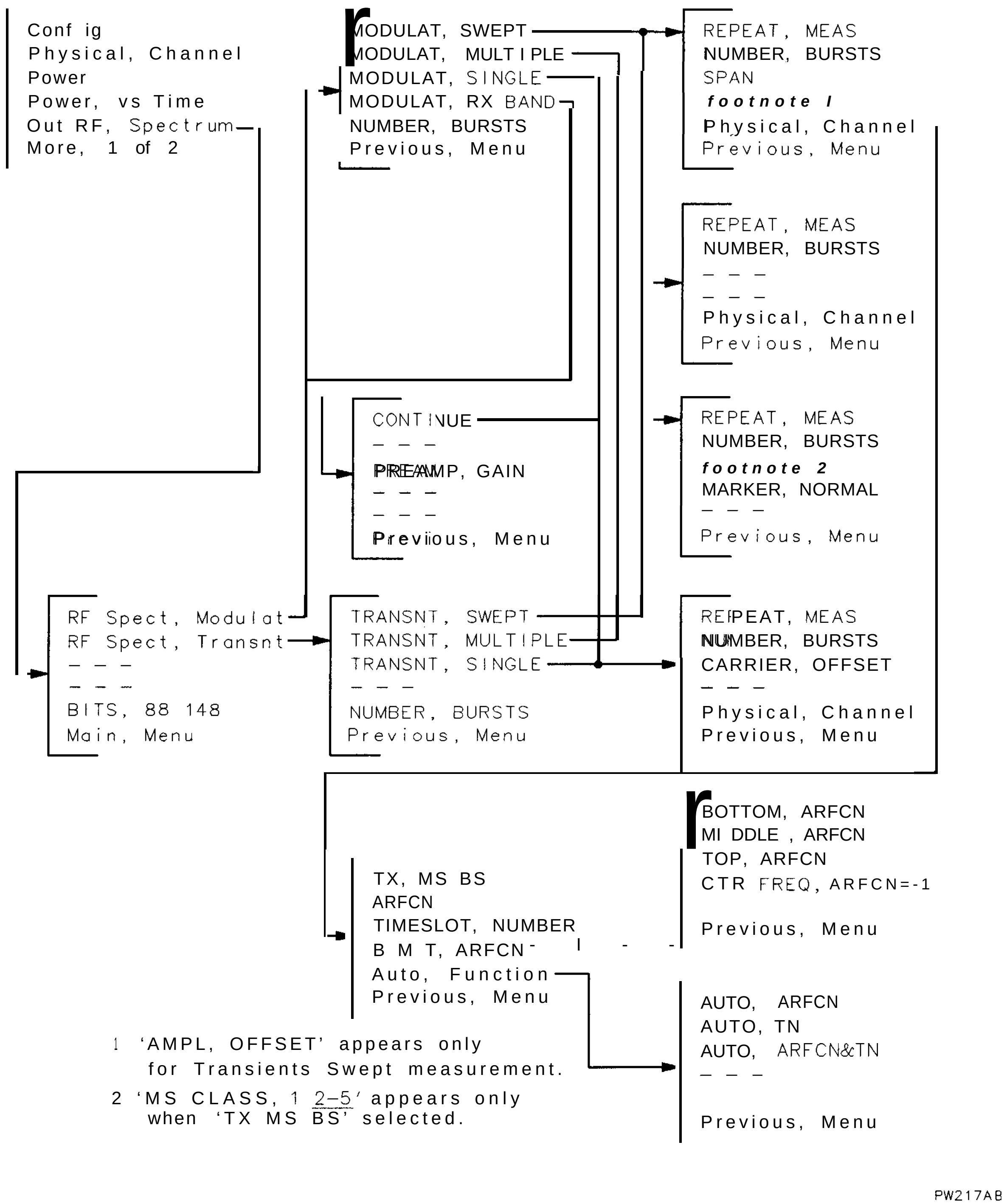
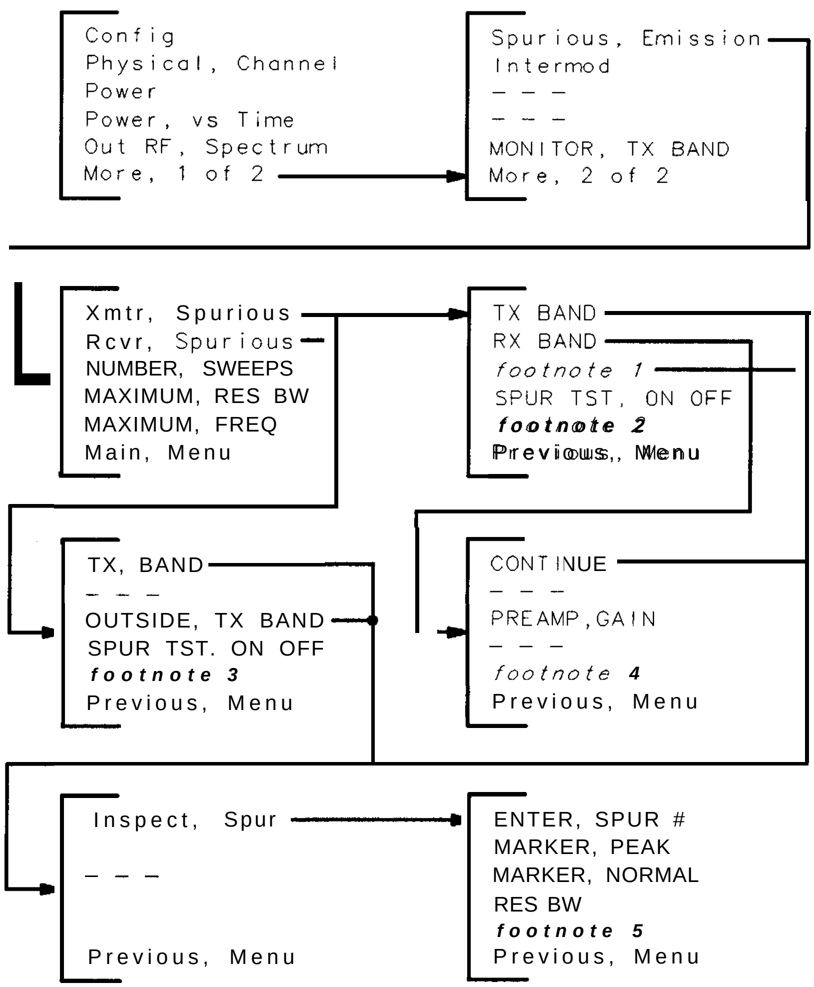


Figure 7-6. Output RF Spectrum Measurement Menu



1 'OUTSIDE, TX & RX' appears if BS selected.
'OUTSIDE, TX BAND' appears if MS selected.

2 'SFH, ON OFF' appears if BS selected,
IDLE, YES NO' appears if MS selected

3 'SFH, ON OFF' appears if BS selected,
blank if MS selected

4 'MS CLASS. 1 2-5' appears if MS selected
blank if BS selected

5 'EXT. ATTEN' for 'TX BAND', 'OUTSIDE TX BAND' and 'OUTSIDE TX & RX,
'PREAMP. GAIN' for 'RX BAND tests,
blank if 'Rcvr, Spurious' or MS IDLE

6 'MAXIMUM, FREQ' appears only on an HP8593 or HP8596.

PW218A_2

Figure 7-7. Spurious Emissions Measurement Menu

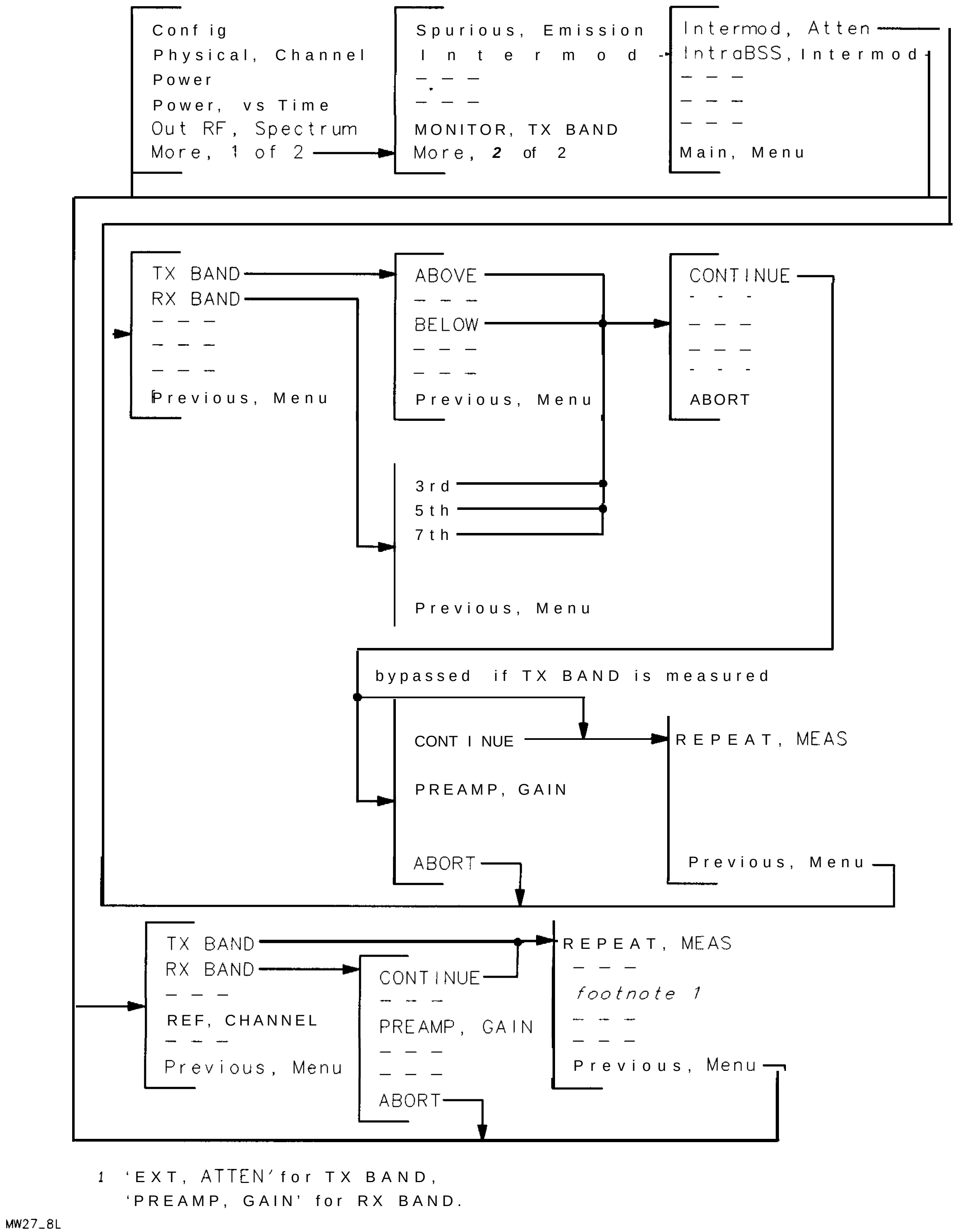
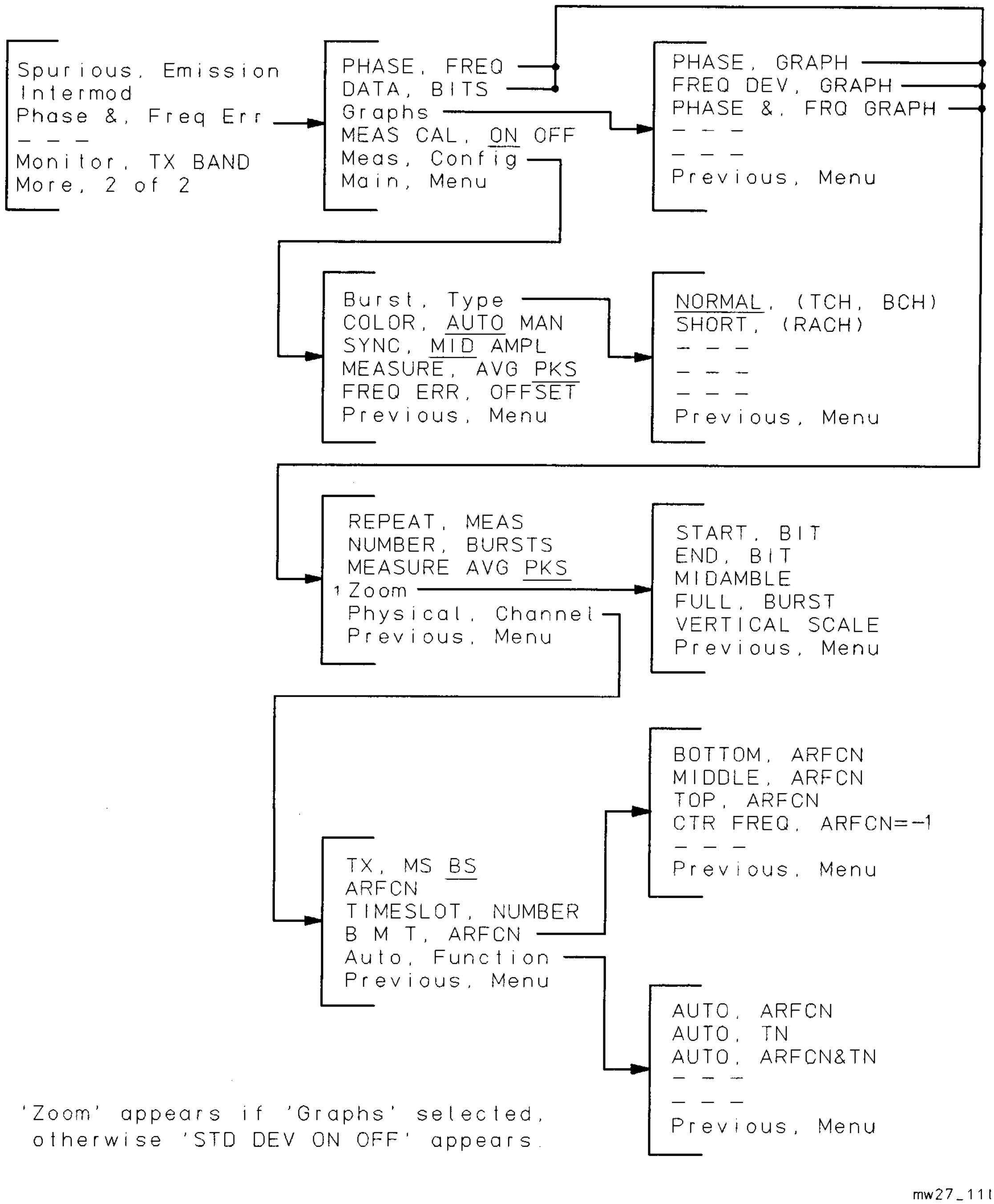


Figure 7-8. Intermodulation Measurement Menu



1 'Zoom' appears if 'Graphs' selected, otherwise 'STD DEV ON OFF' appears.

Figure 7-9. Phase and Frequency Error Measurement Menu (Option 163 only)

8

Specifications and Characteristics

General System Requirements

A positive or negative TTL transition signal is required to synchronize the measurement system with the transmitter under test. The synchronization signal must occur once per GSM9OO frame. This trigger signal is required for carrier power, power versus time, output RF spectrum modulation, and phase and frequency error measurements.

GSM9OO System Description

Note The *GSM900 System* refers to the following equipment configuration:

- HP 8591A/E, HP 8593A/E, HP 8594A/E, HP 8595A/E or HP 8596A/E spectrum analyzer configured with:
  - Option 101 (fast time domain sweeps) *or* Options 151 and 163† (Fast ADC & Digital Demodulator and GSM/DCS Firmware),
  - Option 105 (time gated spectrum analysis),
  - Option 004 (precision frequency reference) or equivalent external reference.

  † Options 151 and 163 are required for phase and frequency error measurements.
- HP 85715B GSM900 Transmitter Measurements Personality
- HP 8498A Option 030 Attenuator Critical specifications for attenuator substitution:

  Frequency range: dc to 18 GHz

  Maximum input power: 25 W Avg, 500 W Peak

  Attenuation Accuracy: ± 1.0 dB

  Attenuation: 30 dB

  SWR: 1.1
- HP 87405A Preamplifier Critical specifications for preamplifier substitution:

  Frequency Range: 10 to 3000 MHz
  Noise figure: <7.5 dB
  Gain: ≥22 dB
- Bandpass filter (mobile station receive band) Critical specifications for BPF substitution:

  Insertion loss: <4 dB
  Maximum ripple: ± 1 dB
  Stopband: 90 dB at 880 MHz to 915 MHz
  Passband: 925 MHz to 960 MHz

- Bandpass filter (base station receive band) Critical specifications for BPF substitution:

  Insertion loss: <4 dB
  Maximum ripple: ± 1 dB
  Stopband: 90 dB at 925 MHz to 960 MHz
  Passband: 880 MHz to 915 MHz

GSM900 System Specifications

Maximum Safe Input Level

Caution Due to high input signal power, an external attenuator is required. System specification assumes 30 dB of fixed external attenuation for signals within the input power range. We recommend use of HP 8498A fixed attenuator with this GSM900 system.

If you do not use the recommended attenuator, refer to the Maximum Safe Input Level specification in the Installation and Verification Manual for the spectrum analyzer in use.

With the recommended external attenuator, the system maximum input power is +46 dBm, 40 W. The system input power range is +43 dBm to + 13 dBm. This corresponds to GSM900 base station Class 4 with a mean carrier power of 43 dBm +3/−0 dB.

Mean Transmitted Carrier Power

Accuracy .... ±2.3 dB

Relative Accuracy .... ±1.0 dB

Note This specification is derived from both the spectrum analyzer and HP 8498A option 030 external attenuator specifications.

Internal Frequency Reference (Opt. 004)

Aging .... $\pm 1 \times 10^{-7}$ /year

Typical Measurement Speed: (Does not include set-up time)

	1 burst	10 bursts
Phase & Frequency Error	2 sec	20 sec
Carrier Power	3 sec	8 sec
Power vs Time	4 sec	8 sec
Output RF Spectrum (Swept)	5 sec	24 sec
Spurious Emissions (TX Band)	40 sec	
Intermodulation Attenuation	15 sec	

Option 105 Time Gated Spectrum Analysis Specifications

Note When using Option 105 with the GSM900 System, the gate delay, gate length and additional amplitude error are specified.

Gate Delay	
Range	1 μs to 65.535 ms
Resolution	1 μs
Accuracy (from GATE TRIGGER INPUT to positive edge of GATE OUTPUT)	±(1 μs + (0.01% × GATE DELAY readout))*
Gate Length	
Range	1 μs to 65.535 ms
Resolution	1 μs
Accuracy (from positive edge to negative edge of GATE OUTPUT)	±(0.2 μs + (0.01% × GATE LENGTH Readout))
Gate Amplitude †	
Additional Error	Log: ±0.3 dB Linear: ±0.4 % of reference level

* Up to 1 μs jitter due to 1 μs resolution of gate delay clock

†With GATE ON enabled and triggered, CW Signal, and Peak Detector Mode

GSM900 System Characteristics

Output RF Spectrum Dynamic Range (all input power levels)

Modulation Spectra

Offset from Carrier	Dynamic Range
Multiple and Single Mode	
100 kHz	30 dB
200 kHz	52 dB
250 kHz	60 dB
400 kHz	72 dB
600 kHz to 1800 kHz	75 dB
Swept Mode	
N/A	70 dB
Sensitivity in the Mobile Receive Rand	
-87 dBm	

Note Sensitivity requires the use of the specified external bandpass filter centered on the receive band; spectrum analyzer input level <10 dBm.

Switching Transient Spectra

Offset from Carrier	Dynamic Range
Multiple and Single Mode	
400 kHz	72 dB
600 kHz	75 dB
1200 kHz	75 dB
1800 kHz	75 dB
Swept Mode	
N/A	70 dB

Spurious Emissions Characteristics

Sensitivity outside the Receive Band

Note The values listed below are referenced to the input of the external attenuator. The values apply when Max Hold and Peak Detector modes are active. They apply for signals offset more than 600 kHz from the carrier.

Note In Sample Detector and Clear Write modes, sensitivity is improved by approximately 13 dB.

Peak Power (dBm)	Resolution Bandwidth (kHz)							
	1	3	10	30	100	300	1000	3000
43	-42	-36	-30	-26	-21	-16	-11	-6
40	-52	-46	-40	-36	-31	-26	-21	-16
39	-52	-46	-40	-36	-31	-26	-21	-16
37	-52	-46	-40	-36	-31	-26	-21	-16
34	-52	-46	-40	-36	-31	-26	-21	-16
33	-52	-46	-40	-36	-31	-26	-21	-16
30	-62	-56	-50	-46	-41	-36	-31	-26
29	-62	-56	-50	-46	-41	-36	-31	-26
24	-62	-56	-50	-46	-41	-36	-31	-26
21	-62	-56	-50	-46	-41	-36	-31	-26
13	-72	-66	-60	-56	-51	-46	-41	-36

Sensitivity Inside the Receive Band

Note Receive band measurement system requires an input level less than -40 dBm.

Requires bandpass filter centered on receive band.

Requires the specified preamplifier between the input receive band bandpass filter and the spectrum analyzer.

Resolution Bandwidth	Displayed Average Noise Level
30 kHz	-107 dBm + insertion loss of BPF
100 kHz	−102 dBm + insertion loss of BPF
300 kHz	−97 dBm + insertion loss of BPF

Receive Band Amplitude Accuracy

Absolute Accuracy	±4.9 dB
Relative Amplitude Accuracy	±1.0 dB

Note This characteristic is derived from the Root Sum Squared (RSS) errors of the BPF, preamplifier, external attenuator, and the spectrum analyzer specifications.

Intermodulation Attenuation Characteristics

Outside Receive Band

Dynamic Range Outside of Receive Band (<6 GHz) . . . . 75 dB

Dynamic Range Outside of Receive Band (>6 GHz) . . . . 68 dB

Note Frequency range is from 100 kHz to 6 GHz.

Signals must be greater than 600 kHz from carrier.

Applies to all input power levels.

GSM specifications currently specify a measurement bandwidth of 30 kHz. A 4 or 5 pole 300 kHz synchronously tuned filter cannot resolve first intermodulation products at 800 kHz from the carrier or interfering signal. Improved selectivity and dynamic range can be achieved using a measurement bandwidth of 30 kHz.

Inside Receive Band

Note Receive band measurement system requires an input level less than -40 dBm.

Requires bandpass filter centered on receive band.

Requires the specified preamplifier between the input receive band bandpass filter and the spectrum analyzer.

In intra-base station tests, optimum spectrum analyzer spurious responses and distortion levels may be desired in the receive band. A mixer level of -40 dBm is optimal for TOI and spurious.

An external step attenuator (1 dB) can be used to optimize spectrum analyzer intermodulation performance and sensitivity.

Sensitivity in the Receive Band

Resolution Bandwidth	Displayed Average Noise Level
30 kHz	-107 dBm + insertion loss of BPF
100 kHz	−102 dBm + insertion loss of BPF
300 kHz	−97 dBm + insertion loss of BPF

Amplitude Accuracy

Absolute Amplitude Accuracy	+/-4.9dB
Relative Amplitude Accuracy	±1.0 dB

Note This characteristic is derived from the RSS of the BPF, preamplifier, external attenuator, and the spectrum analyzer specifications.

Power Vs Time

Relative Amplitude Accuracy	
(linear scale)	± 3.0%
(log scale)	0.25 dB

Dynamic Range (all power levels)

Resolution Bandwidth	Dynamic Range
300 kHz	70 dB
1 MHz	68 dB

Displayed Time Resolution

Measurement	Displayed Time Resolution
Full timeslot	2.0 μs
Top 10 dB	1.6 μs
Rising Edge	0.2 μs
Falling Edge	0.2 μs

Centering Error (referenced to bit 13/14 edge or t0)

Measurement	RES BW 300 kHz	RES BW 1 MHz
Full Timeslot	−4/+6.5 μs	−4/+5 μs
Top 10 dB	−4/+6.5 μs	−4/+5 μs
Rising Edge	−2.2/+5.9 μs	−2.2/+3.1 μs
Falling Edge	−2.2/+6 μs	−2.2/+3.2 μs

Phase and Frequency Error

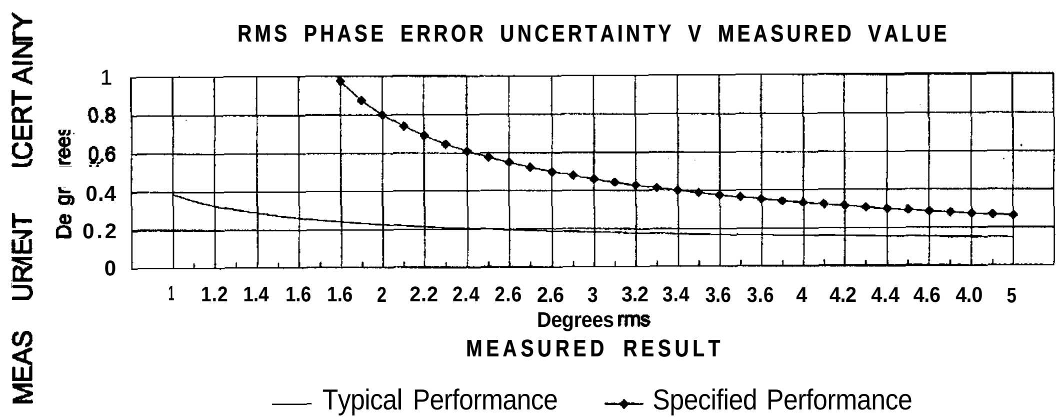
Phase Error (Phase Trajectory)

Range	±999°
Resolution	0.1°
Measurement Uncertainty[1,2]	1° rms 4° peak
Measurement Rate	1 reading/2.4 sec[3]

1 For Measured readings greater than 1.5° rms.

2 0-55° c.

3 1 reading/sec with *Frequency* Calibration turned off.



$$Uncertainty = Reading - \sqrt{Reading^2 - AnalyzerNoise^2}$$

Frequency Error Measurement

	20 - 30" c	0 - 55" c
Noise (Standard Deviation)[1]	7 Hz	9 Hz
Mean CW[1]	±(6 + Ref Err*) Hz	±(12 + Ref Err*) Hz
Mean Pulsed[1]	±(10 + Ref Err*) Hz[3]	±(12 + Ref Err*) Hz[3]

1 Based on 200 burst measurement

2 *Ref* Err is (frequency Reference Accuracy x Carrier Frequency). Refer to "Frequency Reference Specifications" in the Spectrum Analyzer Calibration Guide.

3 The Pulsed error component depends on the pulse shape. A ramp conforming to GSM specifications will give a smaller error than an abrupt pulse.

The total measurement uncertainty in individual readings is obtained by adding the mean and noise components.

The noise component is found by multiplying the standard deviation shown in the table by the factor appropriate to the confidence required. The noise has a Gaussian distribution. thus, for example, 99% of readings, which would be contained within 2.57 x the standard deviation (obtained from standard statistical tables), will have a total uncertainty of:

$$\leq \pm(6 + 2.57 \times 7) = \pm 24 Hz$$

Glossary

absolute amplitude accuracy
The degree of correctness or uncertainty (expressed in either volts or dB power). It includes relative uncertainties plus calibrator uncertainty. For improved accuracy, some spectrum analyzers specify frequency response relative to the calibrator as well as relative to the midpoint between peak-to-peak extremes. Refer also to **relative amplitude accuracy.**

active function readout
The area of a display screen where the active function and its state are displayed. The active function is the one that was completed by the last key selection or remote-programming command.

active marker
The marker on a trace that can be repositioned by front-panel controls or programming commands.

active drive
The disk drive from which files are accessed by the controller used in the test system or test setup. It is sometimes called the current or default drive.

active trace
The trace (commonly A, B, or C) that is being swept (updated) with incoming signal information.

amplitude accuracy
The general uncertainty of a spectrum analyzer amplitude measurement, whether relative or absolute.

amplitude-left marker
This term identifies a second marker when the analyzer is in relative-marker mode. The position of the second marker is made relative to the position of the original marker. The marker readout in this mode represents the frequency and amplitude difference between the original marker and the second marker.

amplitude-right marker
This term represents a third marker when the analyzer is in relative-marker mode. The position of the third marker is made relative to the position of the original marker. The marker readout in this mode represents the frequency and amplitude difference between the original marker and the third marker.

ARFCN
The absolute RF channel number used in GSM900 measurements. The number denotes the nominal carrier frequency. ARFCN is sometimes referred to as the GSM900 channel number.

ASCII
The acronym for American Standard Code for Information Interchange. It is an eight-part code (7 bits plus parity check) used for data (information) interchange. An ASCII value is a specific combination of bits ranging from 0 to 255 that represent characters in machine language that computers and controllers can understand.

attenuation
A general term used to denote a decrease of signal magnitude in transmission from one point to another. Attenuation may be expressed as a scalar ratio of the input to the output magnitude in decibels.

bandwidth selectivity
This is a measure of the analyzer's ability to resolve signals unequal in amplitude. It is the ratio of the 60 dB bandwidth to the 3 dB bandwidth for a given resolution filter (IF). Bandwidth selectivity indicates the slope of the filter skirts. Bandwidth selectivity is sometimes called shape factor.

battery-backed RAM
Random access memory (RAM) data retained by a battery. RAM memory cards can contain data that is maintained with a battery. Refer **also** to **nonvolatile memory.**

blank mode
This is an analyzer function that stores any active trace in the analyzer's reserved memory, and blanks the display. The stored trace may be either A, B, or C. Refer **also** to **reserved memory.**

BMTARFCN
The abbreviation for bottom-, middle-, and top-ARFCNs. The terms refer to GSM900 measurement conditions. They denote nominal carrier frequencies located either in the lower, middle, and upper third of the allowed transmit spectrum.

broadband response
A signal whose spectrum is wider than the resolution bandwidth of a spectrum analyzer, and whose repetition frequency is lower than the bandwidth of the spectrum analyzer. It is a combination of signal and receiver characteristics that determines when a signal is classified as broadband. For refining incoming signal responses, select narrower spans and bandwidths. Refer **also** to **narrowband response.** The following checks can help verify whether or not the response is broadband:

- Change the resolution bandwidth. The displayed amplitude should change.
- Change the sweep time. The spacing of the responses on the display should change as you change the sweep time.
- Change the span. The spacing of the responses should not change. They should be independent of frequency span.
- Change the video bandwidth. If the video bandwidth is made narrower than the resolution bandwidth, the displayed amplitude of the responses should decrease.

BS (base station)
The GSM900 stationary hardware used to transmit and receive carrier signals. The base transceiver station connects many mobile stations simultaneously in a cell. Refer also to **cell, TX (transmit) band,** and **RX (receive) band.**

BSS (base station system)
A collection of base transceiver stations feeding to a common aerial.

BTS (base transceiver station)
Refer to **BS (base station).**

burst
A GSM9OO signal transmission. An RF pulse of a GMSK modulated carrier signal.

card reader
See memory card.

cell
The GSM9OO term that identifies a geographic area served by a base station. The cell sizes and locations are determined by the geographic terrain and the base station power. Refer also to **GSM9OO.**

channel number
The channel number used in GSM9OO measurements. The number denotes the nominal carrier frequency. Refer also to **ARFCN.**

character set.
The set of elementary symbols. These normally include both alpha and numeric codes, plus punctuation or any other symbol which may be read, stored, or written and used for organization, control, or representation of data.

carrier
A signal used to convey information through modulation of signal characteristics. Its power is usually the greatest among the signals present.

class
A term used to differentiate between mobile stations or base stations with differing output-power ratings.

clear-write mode
This is an analyzer function that clears the specified trace (A, B, or C) from the display, then sweeps (updates) the trace each time trigger conditions are met. When trigger conditions are met, the new input-signal data is displayed, then cleared, and the process begins again.

command
A set of instructions that are translated into instrument actions. The actions are usually made up of individual steps that together can execute an operation. Generally, for spectrum analyzers it is a code sequence that controls some operation of a spectrum analyzer. These codes can be keyed in via a controller, or computer. Refer **also** to **function.**

continuous sweep mode
The analyzer condition where traces are automatically updated each time trigger conditions are met.

CORR
A prompt displayed that indicates the measurement correction routine is in effect. It appears when correction factors are applied to measurement results.

correction factor
The factor by which a measurement reading is multiplied to correct for the effects of errors due to spectrum analyzer circuitry. This factor is the product of the ratio and phase-angle correction factors for the existing conditions of operation.

CRT persistence
An indication of the rate at which the image fades on the display. In analyzers that digitize the trace information (video) before writing it to the screen, the refresh rate is high enough to prevent any flicker in the display (therefore, short-persistence displays are used). Purely analog analyzers typically use long-persistence or variable-persistence displays because the refresh rate equals the sweep rate.

data line
The area on a display where user-selected characters are displayed. These characters are selected from the front-panel keys.

DANL
The abbreviation for displayed-average-noise-level of the spectrum analyzer. Refer also to **displayed average noise level.**

GSM900
The abbreviation for Global Systems for Mobile Communications. GSM900 is a European digital-cellular radio standard and system. Frequency division multiplexing and time division multiple access (TDMA) are used. The data transmission format is GMSK modulation on a bursted carrier. Refer **also** to **burst, GMSK** and **TDMA.**

default
The factory-defined conditions, options, or parameters of an instrument. The default state may be changed by choosing key selections or writing programming commands to use other conditions.

delta marker
An analyzer mode in which a fixed reference marker is established, then a second active marker becomes available so it can be placed anywhere along the trace. A readout indicates the relative frequency separation and amplitude difference between the reference and active markers.

display detector mode
The manner in which analog, video information is processed prior to being digitized and stored in memory. Refer also to **negative peak, positive peak, quasi-peak detector,** and **sample.**

display dynamic range
The maximum dynamic range over which both the larger and smaller signal can be viewed simultaneously on the display. For analyzers with a maximum logarithmic display of 10 dB/division, the actual dynamic range may be greater than the display dynamic range. Refer **also** to **dynamic range.**

display range
The calibrated range of the display for a particular display mode or scale factor. Refer also to **linear display, log display,** and **scale factor.**

displayed average noise level
The noise level viewed on the analyzer's display after narrowing the video bandwidth setting enough to reduce the peak-to-peak noise fluctuations. The resulting noise display is essentially a straight line. Usually this term refers to the analyzer's own internally generated noise as a measure of sensitivity. It is typically specified in dBm under conditions of minimum resolution bandwidth and minimum input attenuation.

DLP
The abbreviation for downloadable program. A single programming command or a sequence of programming commands used to perform specific operations. DLPs can be made up of several functions, variables, and traces defined by the program creator. The DLP can be downloaded from one electronic storage medium into another and executed without a controller.

drift

The slow (relative to sweep time) change of signal position on the display as a result of a change in local oscillator frequency versus sweep voltage. While analyzer drift may require periodic re-tuning, it does not impair frequency resolution.

dynamic range

The power ratio (dB) between the smallest and largest signals simultaneously present at the input of an analyzer that can be measured with some degree of accuracy. Dynamic range generally refers to measurement of distortion or intermodulation products.

envelope detector

A detector circuit whose output follows the envelope, but not the instantaneous variation of its input signal. This detector is sometimes called a peak detector. In superheterodyne spectrum analyzers, the input to the envelope detector comes from the final IF, and the output is a video signal. When you put the spectrum analyzer in zero span, the envelope detector demodulates the input signal, and you can observe the modulating signal as a function of time on the display.

error message

A message displayed on the screen indicating missing or failed hardware, improper user operation, or other conditions that require additional attention. Generally, the requested action or operation cannot be completed until the condition is resolved.

external mixer

An independent mixer, usually having a waveguide input port, used to extend the frequency range of those spectrum analyzers designed to use them. The analyzer provides the local oscillator signal and mixer bias (if needed), then returns the mixing products to the analyzer's IF input.

external trigger signal

A signal level or signal edge that initiates a sweep of the analyzer. In the GSM9OO Transmitter Measurements Personality, a TTL edge provided to the time gate input to make measurements synchronous with the frame rate.

FFT

The abbreviation for fast Fourier transform. It is a mathematical operation performed on a time-domain signal to yield the individual spectral components that constitute the signal. Refer **also** to **spectrum.**

firmware

An assembly made up of hardware and instruction code that are integrated to form a functional set which cannot be altered during normal operation. The instruction code, permanently installed in the circuitry of the instrument, is classified as ROM (read-only memory). The firmware determines the operating characteristics of the instrument or equipment. Each firmware version is identified by a revision code number, or date code.

flatness

The displayed amplitude variation corresponding to the tuned frequency range of the spectrum analyzer. Flatness of ± 1 dB indicates that maximum and minimum values of the analyzer's frequency response are less than 2 dB apart.

frame

A GSM9OO time division multiple access (TDMA) frame is the span of time containing eight timeslots. A GSM9OO TDMA frame occurs every 4.62 ms. Refer also to **timeslot.**

frequency accuracy
The uncertainty with which the frequency of a signal or spectral component is indicated, either in an absolute sense or relative to some other signal or spectral component. Absolute and relative frequency accuracies are specified independently.

frequency range
The range of frequencies which the spectrum analyzer performance is specified. The maximum frequency range of many microwave analyzers can be extended with the application of external mixers.

frequency resolution
The ability of a spectrum analyzer to separate closely spaced spectral components and display them individually. Resolution of equal amplitude components is determined by resolution bandwidth. Resolution of unequal amplitude signals is determined by resolution bandwidth and bandwidth selectivity.

frequency response
The peak-to-peak variation in the displayed signal amplitude over a specified center frequency range. Frequency response is typically specified in terms of ±dB relative to the value midway between the extremes. It also may be specified relative to the calibrator signal.

frequency span
The magnitude of the displayed frequency component. Span is represented by the horizontal axis of the display. Generally, frequency span is given as the total span across the full display. Some analyzers represent frequency span (scan width) as a per-division value.

frequency stability
The stability of a frequency component to remain unchanged in frequency or amplitude over short- and long-term periods of time. Stability refers to the local oscillator's ability to remain fixed at a particular frequency over time. The sweep ramp that tunes the local oscillator influences where a signal appears on the display. Any long-term variation in local oscillator frequency (drift) with respect to the sweep ramp causes a signal to shift its horizontal position on the display slowly. Shorter-term local oscillator instability can appear as random FM or phase noise on an otherwise stable signal.

front-panel key
Keys, typically labeled, and located on the front panel of an instrument. The key labels identify the function the key activities. Numeric keys and step keys are two examples of front-panel keys.

full span
A mode of operation in which the spectrum analyzer scans the entire frequency band of an analyzer.

function
The action or purpose which a specific item is intended to perform or serve. The spectrum analyzer contains functions that can be executed via front-panel key selections, or through programming commands. The characteristics of these functions are determined by the firmware in the instrument. In some cases, a DLP (downloadable program) execution of a function allows you to execute the function from front-panel key selections.

gain compression
The signal level at the input mixer of a spectrum analyzer where the displayed amplitude of the signal is a specific number of dB too low due just to mixer saturation. The signal level is generally specified for 1 dB or 0.5 dB compression and is usually between -3 dBm and -10 dBm.

GMSK
The abbreviation for Gaussian-Minimum-Shift-Keying. The term represents the digital signal modulation format for GSM900 systems. It is a variant of frequency-shift keying.

GSM
The abbreviation for Global Systems for Mobile Communications. GSM is a European digital-cellular radio standard and system. Frequency division multiplexing and time division multiple access (TDMA) are used. The data transmission format is GMSK modulation on a bursted carrier. Refer **also** to **burst, GMSK** and **TDMA**.

hard copy
Information or data printed onto paper as opposed to its being stored on disk or in the instrument's memory.

harmonic distortion
Undesired frequency components added to signals as a result of nonlinear behavior of the device (for example, a mixer or an amplifier) through which signals pass. These unwanted components are harmonically related to the original signal.

harmonic mixing
The utilization of local oscillator harmonics generated in a mixer to extend the tuning range of a spectrum analyzer beyond the range achievable using just the local oscillator fundamental. The mathematical algorithm is:

$$F_{IN} = F_{LO} + F_{IF}$$

HP-IB
The abbreviation for Hewlett-Packard Interface Bus. It is a parallel interface that allows you to "daisy-chain" more than one device to a port on a computer or instrument. Interface protocol is defined in IEEE 488.2. It is equivalent to the industry standard GPIB.

idle mode
A GSM900 mobile station mode during which the RF output is temporarily turned off.

IF
The abbreviation for intermediate frequency. An IF frequency is a frequency to which a signal wave is shifted locally as an intermediate step in transmission or reception. On spectrum analyzers, this is the frequency resulting from conversion before demodulation.

IF gain/IF attenuation
A control that adjusts the vertical position of displayed signals without affecting the signal level at the input mixer. When changed, the value of the reference level is changed accordingly.

IF feedthrough
A condition that results in a rise in amplitude of the baseline trace. This occurs as a result of an input signal at the intermediate frequency (IF) passing through the input mixer. This a usually only a potential problem on nonpreselected spectrum analyzers. The entire baseline trace rises because the signal is always at the IF (Mixing with the local oscillator is not required.)

image response
A displayed signal that is actually twice the intermediate frequency (IF) away from the frequency indicated by the spectrum analyzer. For each harmonic of the local oscillator there is an image pair. One is below the local oscillator frequency by the IF and the other is above. Images usually only appear on nonpreselected spectrum analyzers.

impedance

The apparent opposition in an electrical path to the flow of current. The specified nominal input impedance of a spectrum analyzer is stated for the input connector. The most common impedance for RF and microwave spectrum analyzers is 50Ω. However, 75Ω is typically used for cable television (CATV) work.

impulse bandwidth

The width of a rectangular filter that has the same peak voltage output as the actual analyzer filter. The impulse bandwidth of the synchronously-tuned, Gaussian-like resolution filters in the Hewlett-Packard spectrum analyzers is approximately 1.5 times the 3 dB bandwidth.

incidental FM

Undesired frequency modulation on the output of a device (for example a signal source or an amplifier) caused by or, incidental to, some other form of modulation, such as amplitude modulation.

input attenuator

An attenuator between the input connector and the first mixer of a spectrum analyzer (also called an RF attenuator). The input attenuator is used to adjust the signal level incident to the first mixer, and to prevent gain compression due to high-level or broadband signals. It is also used to set the dynamic range by controlling the degree of internally-generated distortion. For some analyzers, changing the input attenuator settings changes the vertical position of the signal on the display, which then changes the reference level accordingly. In Hewlett-Packard microprocessor-controlled spectrum analyzers, the IF gain is changed to compensate for changes in input attenuator settings. Because of this, the signals remain stationary on the display, and the reference level is not changed.

input impedance

The terminating impedance that the analyzer presents to the signal source. The nominal impedance for RF and microwave analyzers is usually 50Ω. For some systems, such as cable TV, 75Ω is standard. The degree of mismatch between the nominal and actual input impedance is called the VSWR (voltage standing wave ratio).

interface

The point at which different parts of a system interact. Also, the point at which operators and instruments interact.

intermodulation attenuation

A measure of the capability of the GSM900 transmitter to inhibit the generation of intermodulation distortion products.

intermodulation distortion

Undesired frequency components resulting from the interaction of two or more spectral components passing through a device having nonlinear behavior, such as a mixer or an amplifier. The undesired components are related to the fundamental components by sums and differences of the fundamentals and various harmonics. The algorithm is:

$$f_1 \pm f_2, 2 \times f_1 \pm f_2, 2 \times f_2 \pm f_1, 3 \times f_1 \pm 2 \times f_2, \ \textit{and so on}$$

intra-BSS intermodulation distortion

A measure of the capability of the GSM900 transmitter to inhibit the generation of intermodulation products caused by combining several transmitters.

limit line
A test limit made up of a series of line segments, positioned according to frequency or time, and amplitude, within the spectrum analyzer's measurement range. Two defined limit lines may be displayed simultaneously. One sets an upper test limit, the other sets a lower test limit. Trace data can be compared with the limit lines as the spectrum analyzer sweeps. If the trace data exceeds either the upper or lower limits, the spectrum analyzer displays a message or sounds a warning, indicating that the trace failed the test limits.

limit-line Ale
The user-memory file that contains the limit-line table entries. Limit lines are composed of frequency and amplitude components that make up a trace array and this data is stored in the file. The limit-line file feature is available on spectrum analyzers that are capable of limit-line operation. Refer **also** to **limit line.**

limit-line table
The line segments of a limit line are stored in the limit-line table. The table can be recalled to edit the line segments, then restored in the limit-line file. Refer **also** to **limit line.**

linear display
The display mode in which vertical deflection on the screen is directly proportional to the voltage of the input signal. The bottom line of the graticule represents 0 V; the top line represents the reference level. The reference level is a non-zero value characteristic to the spectrum analyzer model. On the HP 140 series analyzers, select a specific scale factor in volts per division. On newer models of spectrum analyzers, select the reference level. The scale factor becomes the reference level value divided by the number of graticule divisions. Although the display is linear, analyzers with microprocessors allow reference level and marker values to be indicated in dBm, dBmV, dBμV, volts, and in some cases, watts.

linear input level
The maximum input-signal level where gain compression does not occur. Refer also to **gain compression.**

LO
The abbreviation for local oscillator. The local oscillator output in a superheterodyne system is mixed with the received signal to produce a sum or difference equal to the intermediate frequency (IF) of the receiver. Refer also to **IF.**

LO feedthrough
The response that occurs on a spectrum analyzer's CRT when the first local oscillator frequency is equal to the first IF. The LO feedthrough is a 0 Hz marker with no error, so it can be used to improve the frequency accuracy of spectrum analyzers with nonsynthesized LO systems.

local oscillator emission or feadout
The presence of the local oscillator signal at the input of a spectrum analyzer. The level can be greater than 0 dBm on nonpreselected spectrum analyzers, but it is usually less than -70 dBm on preselected spectrum analyzers.

log display
The display mode in which vertical deflection is a logarithmic function of the input-signal voltage. Log display is also referred to as logarithmic mode. The display calibration is set by selecting the value of the top graticule line (reference level), and scale factor in volts per division. On Hewlett-Packard analyzers, the bottom graticule line represents zero volts for scale factors of 10 dB/division or more. The bottom division, therefore, is not calibrated for those analyzers. Analyzers with microprocessors allow reference level and marker values to be indicated in dBm, dBmV, dBμV, volts, and occasionally in watts. Nonmicroprocessor-based analyzers usually offer only one kind of unit, typically dBm.

marker

A visual indicator you can place anywhere along the displayed trace. A marker readout indicates the absolute value of the trace frequency and amplitude at the marked point. The amplitude value is displayed with the currently selected units. Refer **also** to **delta marker** and **noise marker.**

maximum input level

The maximum signal power that may be safely applied to the input of a spectrum analyzer. Typically 1 W (-30 dBm) for Hewlett-Packard spectrum analyzers.

MEAS UNCAL

A prompt displayed that indicates an uncalibrated measurement condition exists. It appears when instrument settings affect accuracy of measurement results to the extent that they no longer meet specifications.

measurement bandwidth

The resolution bandwidth required for a specific EM1 measurement. For MIL-STD measurements, the resolution bandwidth is often determined by the tester with the approval of the contracting agency.

For commercial testing the measurement bandwidths required usually follow the recommendations of CISPR:

Band **A** (10 kHz to 150 kHz): 200 Hz

Band B (150 kHz to 30 MHz): 9 kHz

Band C and D (30 MHz to 1 GHz): 120 kHz

measurement range

The ratio, expressed in dB, of the maximum signal level that can be measured (usually the maximum safe input level) to the lowest achievable average noise level. This ratio is almost always much greater than can be realized in a single measurement. Refer also to **dynamic range.**

memory

A storage medium, device, or recording medium into which data can be stored and held until some later time, and from which the entire original data may be retrieved.

memory card

A small, credit-card-shaped memory device that can store data or programs. The programs are sometimes called personalities and give additional capabilities to your instrument. Typically, there is only one personality per memory card. Refer **also** to **personality.**

menu

The spectrum analyzer functions that appear on the display and are selected by pressing front-panel keys. These selections may evoke a series of other related functions that establish groups called menus.

midamble

A GSM900 pattern of 26 bits that are centered in the burst. The bits contain station identification information. Refer also to **burst.**

mixing mode

A description of the particular circumstance that creates a given response on a spectrum analyzer. The mixing mode, such as 1 + , indicates the harmonic of the local oscillator used in the mixing process, and whether the input signal is above (+) or below (–) that harmonic.

MS (mobile station)
The GSM900 transmit and receive hardware of a single user. Mobile stations are free to move from cell to cell. Refer **also** to **cell, TX (transmit) band,** and RX **(receive) band.**

multiple responses
Two or more responses on a spectrum analyzer display from a single input signal. Multiple responses occur only when mixing modes overlap and the local oscillator is swept over a wide enough range to allow the input signal to mix on more than one mixing mode. Normally, this is not a problem with preselected analyzers.

narrowband response
A response measured under conditions in which there is only one spectral component at a time in the passband of a spectrum analyzer's resolution filter. This condition occurs for continuous wave signals and repetitive signals whose repetition rate is greater than about twice the resolution bandwidth of the analyzer. Note that a signal can have a spread spectrum and still be viewed in the narrowband mode on the spectrum analyzer. The same checks that were listed under **broadband response** are used here but with different results:

- Change the frequency span. The frequency separation of the components remains unchanged.
- Change the resolution bandwidth. The amplitude of the responses does not change with resolution bandwidth changes (as long as the bandwidth remains narrow relative to the separation of the responses).
- Change the sweep time. The separation of the responses is independent of sweep time.
- Change the video bandwidth. The amplitude of the responses is unaffected by changes in video bandwidth.

negative peak
The minimum, instantaneous value of an incoming signal. On digital displays, each displayed point of the signal indicates the minimum value of the signal for that part of the frequency span or time interval represented by the point.

noise figure
The ratio, usually expressed in dB, of the signal-to-noise ratio at the input of a device (for example, a mixer or amplifier) to the signal-to-noise ratio at the output of the device.

noise marker
A marker whose readout represents the noise level in a 1 Hz noise power bandwidth. When the noise marker is selected, the sample display detection mode is activated, the values of a number of consecutive trace points about the marker (the number depends on the type of analyzer) are averaged, and this average value is normalized to an equivalent value in a 1 Hz noise power bandwidth. The normalization process accounts for detection and bandwidth plus the effect of the log amplifier when we select the log-display mode.

noise sidebands
Modulation sidebands that indicate the short-term instability of the local oscillator (primarily the first local oscillator) system of a spectrum analyzer. The modulating signal is noise, in the local oscillator circuit itself or in the local oscillator stabilizing circuit. The sidebands comprise a noise spectrum. The mixing process transfers any local oscillator instability to the mixing products. Thus the noise sidebands appear on any spectral component displayed on the analyzer above the broadband noise floor. Because the sidebands are noise, their level relative to a spectral component is a function of resolution bandwidth. Noise sidebands are typically specified in terms of dBc/Hz (amplitude in a 1 Hz bandwidth relative to the carrier) at a given offset from the carrier. The carrier being a spectral component viewed on the display.

nonvolatile memory
Memory data that is retained in the absence of an ac power source. This memory is typically retained with a battery. Refer also to **battery-backed RAM.**

operating system
A group of programs that control the general operation of a computer and its peripherals. The operating system assigns memory space, schedules jobs, and controls input and output.

parameter units
Standard units of measure, which include the following:

Measured Parameter	Unit Name	Unit Abbreviation
frequency	hertz	Hz
power level	decibel relative to milliwatts	dBm
power ratio	decibel	dB
voltage	volt	V
time	second.	s
electrical current	ampere	A
impedance (resistance)	ohm	Ω

peak detection mode
The analyzer state where circuits calculate the peak value of a displayed signal. This value is determined by evaluating a series of measured values from an active trace.

peak detector
A detector that follows the peak or envelope of the signal applied to it. The standard detector in a spectrum analyzer is typically a peak detector. MIL-STD EM1 measurements usually call for peak detection. Refer **also** to **quasi-peak detector and envelope detector.**

personality
Applications available on a memory card or other electronic media that extends the capability of an instrument for specific uses. Examples include digital radio personalities and cable TV personalities.

phase noise
Refer to **noise sidebands.**

physical channel
A GSM900 RF transmission channel. The channel is specified by current ARFCN and TN settings.

position units
The position unit describes the location of a point along the horizontal axis of a trace. Position unit values of a trace begin on the left-hand side of the graticule and increase to a predefined value (specific to the spectrum analyzer model) on the right-hand side of the graticule.

positive peak
The maximum, instantaneous value of an incoming signal. On digital displays, each displayed point of the signal indicates the maximum value of the signal for that part of the frequency span or time interval represented by the point.

preamplifier
An external, low-noise-figure amplifier that improves system (preamplifier/spectrum analyzer) sensitivity over that of the analyzer itself.

predefined trace
Trace A, B, or C of a spectrum analyzer. Refer also to **trace.**

preselector
A tunable bandpass filter placed ahead of a frequency converter, or mixer, of a spectrum analyzer. It tracks the appropriate mixing mode and passes signals of a desired frequency and reduces others. Preselectors are typically used only above 2 GHz. They essentially eliminate multiple and image responses and, for certain signal conditions, improve dynamic range.

quasi-peak detector
A detector circuit designed with time constants that give a weighted value to the amplitude of a detected signal. The displayed signal output is an indication of the degree to which the detected signal would impair the intelligibility of a desired signal. The time constants (rise, fall, average) for EM1 purposes are based on the recommendations of CISPR that are in turn based on subjective tests. Interference limits for commercial EM1 tests are often given in quasi-peak values.

query
Any spectrum analyzer programming command having the distinct function of returning a response. These commands may end with a question mark (?). Query commands return information either to the computer or to the analyzer display.

random-access memory
RAM (random-access memory) or read-write memory, is a storage area allowing access to any of its storage locations. Data can be written to or retrieved from RAM, but data storage is only temporary. When the power is removed, the information disappears. User-generated information appearing on a display is RAM data.

raster display
A television-like display in which the image is formed by scanning the electron beam rapidly across and slowly down the CRT face and gating the beam on as appropriate. The scanning rates are fast enough to produce a flicker-free display. Refer also to **vector display.**

read-only memory
ROM (read-only memory) that is encoded into the analyzer's firmware. The data can be accessed (read) only; it cannot be altered by the user.

RX (receive) band
The frequency range over which a GSM900 mobile station or base station can receive transmitted carrier signals. The mobile station receive band (RX band) frequencies range from 925 MHz to 960 MHz. The base station receive band frequencies range from 880 MHz to 915 MHz. Refer also to **TX (transmit) band, MS (mobile station),** and **BS (base station).**

reference level
The calibrated vertical position on the display used as a reference for amplitude measurement in which the amplitude of one signal is compared with the amplitude of another regardless of the absolute amplitude of either.

relative amplitude accuracy
The uncertainty of an amplitude measurement in which the amplitude of one signal is compared with the amplitude of another, regardless of the absolute amplitude of either. Distortion measurements are relative measurements. Contributors to uncertainty include frequency response and display fidelity and changes of input attenuation, IF gain, scale factor, and resolution bandwidth.

relative-marker mode
The active marker is positioned relative to the position of the reference marker. Marker readout shows amplitude, frequency, or time differences between the two markers.

reserved memory
An area used to store measurement results (trace A, B, or C), configuration information, correction factors, and selections made with front-panel keys or programming commands. The limit-line table contents are stored in reserved memory as well as the currently active key menu.

residual FM
The inherent short-term frequency instability of an oscillator in the absence of any other modulation. In the case of spectrum analyzers, you usually expand the definition to include the case where the local oscillator is swept. Residual FM is usually specified in peak-to-peak values, because they are most easily measured on the display, if they are visible at all.

residual responses
These are discrete responses seen on a spectrum analyzer display although no input signal is applied.

resolution
Refer to **frequency resolution.**

resolution bandwidth
The ability of a spectrum analyzer to display adjacent responses discretely (hertz, hertz decibel down). This term is used to identify the width of the resolution bandwidth filter of a spectrum analyzer at some level below the minimum insertion-loss point (maximum deflection point on the display). The 3 dB resolution bandwidth is specified; for others, it is the 6 dB resolution bandwidth.

sample
The instantaneous value of an incoming signal. On digital displays, each displayed point of the signal indicates the instantaneous value of the signal for that part of the frequency span or time interval represented by the point.

sample detector
A detector that yields the instantaneous value of the signal at the sample time.

scale factor
The per-division calibration of the vertical axis of the display.

scan (frequency span) linearity
The measured accuracy of the horizontal axis of the analyzer display. When two horizontal points are set with analyzer controls, then measured, the linearity is the calculated error between the two points compared with the analyzer settings.

sensitivity
The level of the smallest sinusoid that can be observed on a spectrum analyzer. This is usually under the optimized conditions of minimum resolution bandwidth, 0 dB input attenuation, and minimum video bandwidth. Hewlett-Packard defines sensitivity as the

displayed average noise level. A sinusoid at that level appears to be about 2 dB above the noise.

serial prefix
Serial numbers that identify an instrument begin with a five-character prefix. The prefix in this case represents the version of firmware that particular instrument was shipped with.

SFH
The abbreviation for slow-frequency-hopping. SFH is the switching of a user signal through a sequence of carrier frequencies.

shape factor
Refer to **bandwidth selectivity.**

signal resolution
The ability of the spectrum analyzer to resolve two separate input signals. Closely spaced signals are more difficult to resolve than signals spaced far apart. Refer also to **resolution bandwidth** and **shape factor.**

signal identification
A routine, either manual or automatic, that identifies whether or not a particular response on the spectrum analyzer's display is from the mixing mode to which the display is calibrated. If the routine is automatic, the analyzer's tuning may change to show the signal in the correct mixing mode, or may tell you the signal's frequency. It may then give you the option of ignoring the signal or having the analyzer tune itself properly for the signal. This operation is not generally needed for preselected spectrum analyzers.

single-sweep mode
The spectrum analyzer sweeps once when trigger conditions are met. Each sweep is initiated by pressing an appropriate front-panel key, or by sending a programming command.

sinusoid
A wave whose electric-field vector is proportional to the sine (or cosine) of an angle that is a linear function of time, or distance or both.

softkey
Key labels displayed on a screen or monitor which are activated by mechanical keys surrounding the display, or located on a keyboard. Softkey selections usually evoke menus that are written into the program software. Front-panel key selections determine which menu (set of softkeys) appears on the display.

span
Span equals the stop frequency minus the start frequency. The span setting determines the horizontal-axis scale of the spectrum analyzer display.

span accuracy
The uncertainty of the indicated frequency separation of any two signals on the display.

spectral purity
Refer to **noise sidebands.**

spectral component
One of the sine waves comprising a spectrum.

spectrum
An array of sine waves differing in frequency and amplitude. They are properly related with respect to phase and, taken as a whole, constitute a particular time-domain signal.

spectrum analyzer
A device that effectively performs a Fourier transform and displays the individual spectral components (sine waves) that constitute a time-domain signal.

spurious emissions
The signals at frequencies other than those associated with the normal modulating and switching of the GSM900 carrier.

spurious response
The undesired responses that appear on a spectrum analyzer display as a result of the input signal. Internally generated distortion products are spurious responses, as are image and multiple responses. These can be either harmonic responses or nonharmonic responses. Harmonic responses are second, third, fourth, and so on, harmonics of the input signal. Nonharmonic responses are intermodulation and residual responses.

state-register
The area of user memory in the analyzer where measurement results and associated analyzer settings are stored.

step
The increment of change that results when you press the front-panel step keys, ▲ and ▼, or by program commands.

stimulus-response mode
The operating state that allows a spectrum analyzer to make measurements similar to those of a network-analysis measurement system. Spectrum analyzers with this ability use tracking generator functions. The tracking generator may be an external instrument (stand-alone tracking generators) or designed into the analyzer hardware. Measurement results are displayed in a relative-amplitude scale resulting from a variation, plus or minus, from a reference (normalized) value stored in a trace.

stop/start frequency
Terms used in association with the stop and start points of the frequency measurement range. Together they determine the span of the measurement range.

syntax
The grammar rules that specify how commands must be structured for an operating system, programming language, or applications.

TDMA
The abbreviation for Time-Division-Multiple-Access. User signals are separated by the time they transmit, in addition to the frequency at which they transmit. GSM900 time multiplexes eight users onto one carrier frequency.

test limit
The acceptable results levels for any given measurement. The levels vary from country to country, and depend on the equipment being tested.

time-gate card
An option card (printed-circuit board) that can be installed into the spectrum analyzer card cage. The time-gate card permits the selection of discrete events in the time domain to be measured.

timeslot

A segment in a frame that is allocated 576.9 μs for the user to transmit or receive information in the GSM9OO system. Each timeslot permits 156.25 bits to be transmitted. The physical content of a timeslot is called a burst. Refer **also** to **frame** and **timeslot number.**

timeslot number

A timeslot number denotes the position of a transmission burst in a frame. There are eight timeslots that are numbered from 0 to 7. Refer **also** to **timeslot** and **frame.**

total power (GSM9OO)

The sum of power values of the carrier signals that are active in the transmit band.

trace

A trace is made up of a series of data points containing frequency and amplitude information. The series of data points is often referred to as an array. Traces A, B, and C are the typical names of traces displayed on the analyzer. The number of traces is specific to the instrument.

transducer

A device that receives energy from one system, then supplies energy to another. The desired characteristics of the input energy appear at the output of the system. The energy being supplied by the device does not have to be of the same form as the energy the device received. As an example, a close-field probe receives energy from some source, then transmits the energy to a receiver, which then displays the information on the CRT.

transfer impedance

Ratio of the voltage output from a current probe to the current through a wire enclosed by the probe. Commonly expressed in decibels, referenced to 1Ω (dBΩ).

$$Z\ (dB\Omega) = V\ (dB\mu V) - I\ (dB\mu A)$$

I = current through the wire
V = probe output voltage
Z = transfer impedance of the probe

TX (transmit) band

The frequency range over which a GSM9OO mobile station or base station can transmit on carrier signals. The mobile station transmit band (TX band) frequencies range from 880 MHz to 915 MHz. The base station receive band frequencies range from 925 MHz to 960 MHz. Refer **also** to **RX (receive) band, MS (mobile station),** and **BS (base station).**

trigger delay

The delay of the start of a sweep after an external trigger signal is received. The delay is used to isolate GSM9OO measurements within the desired timeslot, or sub-timeslot. Refer also to **timeslot** and **external trigger signal.**

units

Dimensions on the measured quantities. Units usually refer to amplitude quantities because they can be changed. In spectrum analyzers with microprocessors, available units are dBm (dB relative to 1 mW (milliwatt) dissipated in the nominal input impedance of the analyzer), dBmV (dB relative to 1 mV (millivolt)), dBμV (dB relative to 1 μV), volts, and in some analyzers watts.

update

To make existing information current; to bring information up to date.

upgrade

lb improve the quality or extend the capability of an instrument or product. Enhancements to upgrade the product. These enhancements can then be documented in an update package.

vector display

The display type where the electron beam is directed so the image (consisting of trace, graticule, and annotation) is written directly onto the display face. It is not created from a series of dots as with the raster display.

video

A term describing the output of a spectrum analyzer's envelope detector. The frequency range extends from 0 Hz to a frequency that is typically well beyond the widest resolution bandwidth available in the analyzer. However, the ultimate bandwidth of the video chain is determined by the setting of the video filter.

video amplifier

A post-detection, dc-coupled amplifier that drives the vertical deflection plates of the display. Refer **also** to **video bandwidth** and **video filter.**

video average

The digital averaging of spectrum analyzer trace information. It is available only on analyzers with digital displays. Each point on the display is averaged independently and the average is computed based on the number of sweeps selected by the user. The averaging algorithm applies a factor to the amplitude value of a given point on the current sweep ($1/n$, where n is the number of the current sweep); applies another factor to the previously stored average $[(n - 1/n)]$; and combines the two for a current average. After the designated number of sweeps are completed, the factors remain constant, and the display becomes a running average.

video bandwidth

The cut-off frequency (3 dB point) of an adjustable low-pass filter in the video circuit. When the video bandwidth is equal to or less than the resolution bandwidth, the video circuit cannot fully respond to the more rapid fluctuations of the output of the envelope detector. The result is a smoothing of the trace, or a reduction in the peak-to-peak excursion, of broadband signals such as noise and pulsed RF when viewed in broadband mode. The degree of averaging or smoothing is a function of the ratio of the video bandwidth to the resolution bandwidth.

video filter

A post-detection, low-pass filter that determines the bandwidth of the video amplifier. It is used to average or smooth a trace. Refer also to **video bandwidth.**

zero span

The case in which a spectrum analyzer's local oscillator remains fixed at a given frequency so that the analyzer becomes a fixed-tuned receiver. In this state, the bandwidth is equal to the resolution bandwidth. Signal amplitude variations are displayed as a function of time. lb avoid loss of signal information, the resolution bandwidth must be as wide as the signal bandwidth. To avoid any smoothing, the video bandwidth must be set wider than the resolution bandwidth.

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