

ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *Keysight / Agilent 85727A* at our website: ***Click HERE***

Notice

Hewlett-Packard to Agilent Technologies Transition

This documentation supports a product that previously shipped under the Hewlett-Packard company brand name. The brand name has now been changed to Agilent Technologies. The two products are functionally identical, only our name has changed. The document still includes references to Hewlett-Packard products, some of which have been transitioned to Agilent Technologies.



Printed in USA March 2000

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

85727A GSM Multiband Transmitter Measurements Personality

Quick Reference Guide



HP Part No. 85727-90002
Printed in USA
February 1998

Rev A.01.01
© Copyright Agilent Technologies, Inc. 1998

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Notice

The information contained in this document is subject to change without notice.

Hewlett-Packard makes no warranty of any kind with regard to this material, including but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Regulatory Information

All regulatory information is detailed in the *Calibration Guide* for your spectrum analyzer.

License Agreement

The License Agreement is printed in the HP 85727A GSM Multiband Transmitter Measurement Personality *User's Guide*. Carefully read the License Agreement before loading the software or operating the equipment with the software downloaded.

© Copyright Hewlett-Packard Ltd. 1998.
All Rights Reserved. Reproduction, adaptation, or translation without prior written permission is prohibited, except as allowed under the copyright laws.
Station Road, South Queensferry, Scotland, EH30 9TG, UK.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

HP 85727A GSM Multiband Transmitter Measurement Personality Documentation Description

The following guides are shipped with your GSM Multiband Transmitter Measurement Personality

HP 85727A GSM Multiband Transmitter Measurement Personality Quick Reference Guide

- This book - tells you how to use the GSM Measurement Personality. It also contains other spectrum analyzer measurement methods. The small size makes it easy to carry with you when working at base station sites.

HP 85727A GSM Multiband Transmitter Measurement Personality User's Guide

- Tells you how to use the GSM Measurement Personality. It also contains other spectrum analyzer measurement methods, specifications and characteristics, error messages and a glossary.

HP 85727A GSM Multiband Transmitter Measurement Personality Remote Programming Guide

- Tell you how to use the GSM Measurement Personality using the remote programming commands. Use this guide with the *HP 8590-E Series Programmer's Guide* shipped with your spectrum analyzer.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Notational Conventions

The display features six **softkeys** at the right-hand side of the display. A softkey executes a function defined by firmware or by software. The name of the function appears on the display next to the activating key.

This manual uses the following conventions:

(FRONT PANEL KEY)	An function name in a keycap symbol represents a labeled key physically located on the instrument. This key is referred to as either a **key** or a **hardkey**.
`Softkey`	A function name in screen-font indicates a softkey that either directly executes its function or provides access to a subset menu of softkeys.
`Softkey ON OFF` **(ON)**	A boxed word written in this typeface with the words ON and OFF can turn a function on or off. The underlined function is shown in brackets (parenthesis).
`Softkey AUTO MAN` **(AUTO)**	A boxed word written in this typeface with the words AUTO and MAN can either be auto-coupled or have its value manually changed. The underlined function is shown in brackets (parenthesis).
`CRT Text`	Unboxed text in a monospace font indicates any displayed text other than softkeys.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

How to Use This Manual

If you have not installed your spectrum analyzer, or if you are not familiar with its operation refer to “Preparing for Use” in your *HP 8590 Series Spectrum Analyzer User’s Guide*. It describes spectrum analyzer features and tells you how to make spectrum analyzer measurements.

Likewise, if you have not already loaded the GSM Measurement Personality you should refer to "chapter 1, Getting Started."

If you are ready to use the capability of your HP 85727A GSM Multiband Transmitter Measurement Personality, turn to "chapter 2, Preparing to make GSM Measurements."

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Contents

1 Getting Started

Required Spectrum Analyzer Configuration 11
Getting Started 12

2 Preparing to make GSM Measurements

Preparing to Make GSM Measurements 20
GSM Analyzer Mode 21
Configuring the test system for GSM Measurements 26

3 Making GSM Measurements

Making GSM Measurements 38
GSM Analyzer Mode 39
Making GSM Measurements 40
Mean Transmitted RF Carrier Power Measurements 41
Power Step Measurements 43
Combiner Tuning Measurements 45
Power vs. Time Measurements 47
Output RF Spectrum Measurements 50
Spurious Emissions Measurements 60
Intermodulation Attenuation Measurements 67
Intra-BSS Intermodulation Attenuation Measurements 76
Phase and Frequency Error Measurements 81
Monitor TX Band Measurements 85

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

4 Making Measurements in Spectrum Analyzer Mode

Making Spectrum Analyzer Measurements 88
Amplitude Correction Factors 89
Identifying Distortion Products Using the RF Attenuator and Traces 96
Measuring Amplitude Modulation with the Fast Fourier Transform Function 101
Stimulus-Response Measurements 108
Using the One Button Measurements to Measure N dB Bandwidth, Percent Amplitude Modulation, and Third Order Intercept (TOI) 116
Saving and Recalling Data from Analyzer Memory 122
Saving and Recalling Data from the Memory Card 128

5 If You Have a Problem

If You Have a Problem 142
Before Troubleshooting 143
Error Messages 147

Index

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Getting Started

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1

Getting Started

What You'll Find In This Chapter

This chapter shows you how to re-load the HP 85727A GSM Multiband Transmitter Measurement Personality. It contains the following sections:

- Required equipment for making GSM measurements.
- Loading the measurement personality.
- Using the measurement personality memory card.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1

Required Spectrum Analyzer Configuration

The HP 85727A GSM Multiband Transmitter Measurement Personality can be used with an HP 8593E, HP 8594E, HP 8595E, and HP 8596E. The spectrum analyzer configuration is listed below. Critical specifications for equipment substitution are provided in the *HP 85727A GSM Multiband Transmitter Measurement Personality User's Guide.*

- 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 8590E-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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1

Getting Started

If you have previously operated the HP 85727A GSM Multiband Transmitter Measurement Personality with your spectrum analyzer you may wish to omit the next sections and begin making measurements on your system using Chapter 2, "Preparing to make GSM Measurements", Chapter 3, "Making GSM Measurements"and Chapter 4, "Making Measurements in Spectrum Analyzer Mode" for reference.

If however you need to reload the GSM Measurement Personality, use the following procedures before proceeding.

Loading the HP 85727A GSM Multiband Transmitter Measurement Personality

Completely purge the spectrum analyzer's user memory to make room for the GSM Multiband Transmitter Measurement Personality. Refer to the procedure below to purge, then load the GSM Measurement 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).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Loading the GSM Multiband Transmitter Measurement Personality

1. Insert the HP 85727A GSM Multiband Transmitter Measurement 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 **dGSM** 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 **GSM ANALYZER** key.
7. Press **GSM ANALYZER** to switch to the GSM analyzer mode and access the Main menu of the HP 85727A GSM Multiband Transmitter Measurement Personality.

The GSM Multiband Transmitter Measurement Personality is still retained in the spectrum analyzer's memory when the spectrum analyzer power is turned off or if you press (PRESET).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1

Using the HP 85727A GSM Multiband Transmitter Measurement Personality

The GSM Multiband Transmitter Measurement Personality memory card should remain in the instrument's front-panel card reader. There are two reasons for this:

- Memory capacity restriction: The complete GSM Measurement Personality may require more memory than is available in your analyzer.
- Measurement limits files: Each standard requires a different limits file. The files are loaded from the card only when required.

When there is not enough memory for the complete GSM Measurement Personality, the following method is used:

- The GSM "core" program is copied into the spectrum analyzer's memory when the card is loaded.
- 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 loaded, indicated by the message **PLEASE WAIT, LOADING FILE…**. This operation can take up to 50 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 85727A MEMORY CARD & TRY AGAIN** is displayed.

NOTE: Ensure the card is inserted in the card reader if you need to make measurements on different standards.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

GSM Multiband Measurements

The following GSM measurements are available by pressing the appropriate Main menu key. Refer to Chapter 3, "Making GSM Measurements" 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 85727A GSM Multiband Transmitter Measurement Personality shipment. This allows you to store setups to one card. A working copy of the GSM Multiband Transmitter Measurement Personality is included on this card.

When you are using the spectrum analyzer and the GSM Measurement Personality out in the field, keep the RAM card with the analyzer. Store the card labeled “HP 85727A GSM Multiband Personality” in a safe place. *Ensure you read the license agreement located at the beginning of the HP 85727A GSM Multiband Transmitter Measurement Personality User’s Guidel.*

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1

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 1). 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.

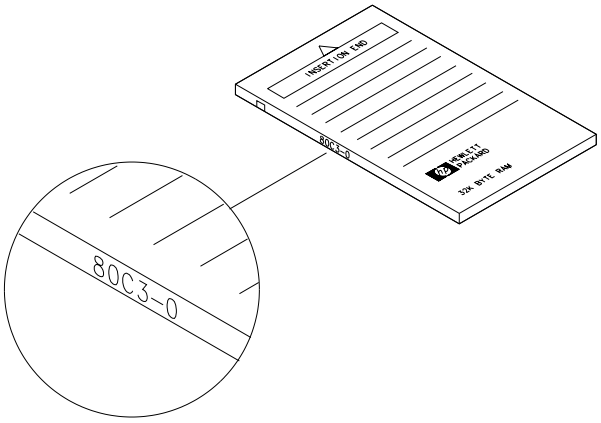


Figure 1 Memory Card Battery Date Code Location

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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.

1. Locate the groove along the edge of the battery clip. See Figure 2.
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 2. (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.

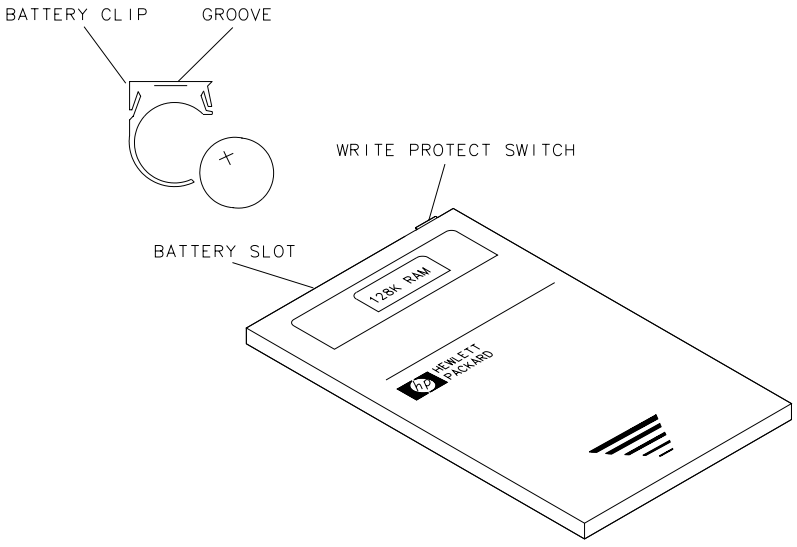


Figure 2 Memory Card Battery Replacement

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2

2

Preparing to make GSM Measurements

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Preparing to Make GSM Measurements

What You'll Find In This Chapter

This chapter tells you how to configure the HP 85727A GSM Multiband Transmitter Measurement Personality. It is divided into the following sections:

- GSM Analyzer Mode.
- Configuring the test system.

2

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

GSM Analyzer Mode

Accessing GSM Analyzer Mode

Using the spectrum analyzer (MODE) key and associated softkeys allows you to switch between spectrum analyzer mode and GSM 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 **GSM ANALYZER** are displayed.

NOTE:

If the **GSM ANALYZER** key is not displayed, the program needs to be loaded into the spectrum analyzer's user memory. Refer to 'Loading the HP 85727A GSM Multiband Transmitter Measurement Personality' on page 12.

2 Once the mode menu is displayed, press **GSM ANALYZER**.

3 If **GSM ANALYZER** is not underlined, pressing the **GSM ANALYZER** key activates the GSM mode. The message **PLEASE WAIT…** is displayed as the initial state is set up.

4 If **GSM ANALYZER** is already underlined, pressing the **GSM ANALYZER** key displays the GSM Main menu, without changing any parameters.

5 When the GSM mode is active, **GSM900**, **DCS1800** or **PCS1900** is displayed above the softkey labels on the display.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

GSM Analyzer Menu Access and Display Annotation

Accessing GSM Measurement Personality Menus

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

- Press MODE, then **GSM ANALYZER** to return from spectrum analyzer menus to the GSM Main menu.
- Press MODE, MODE to return from spectrum analyzer menus to the GSM menu exited when you accessed a spectrum analyzer key.

GSM Measurement Personality Display Annotation

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

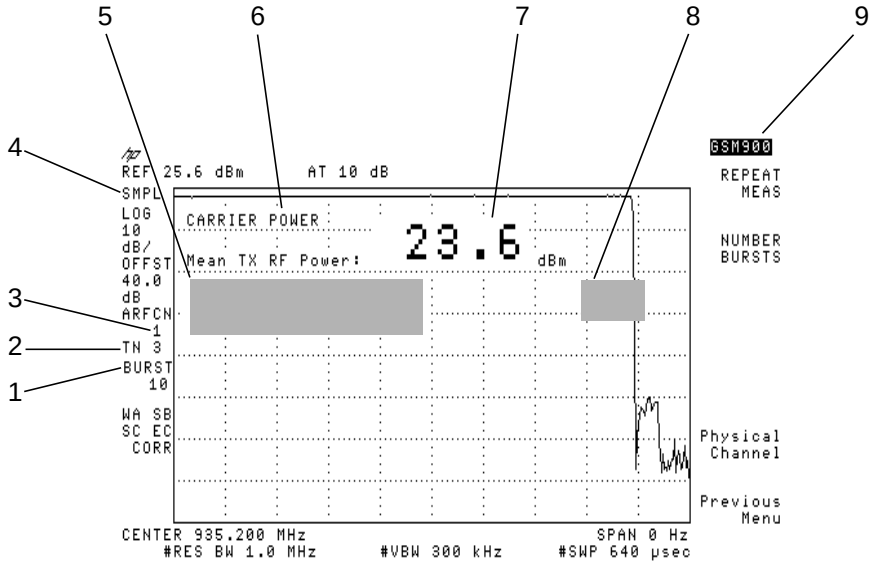


Figure 3 GSM Annotation

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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	**GSM900 or DCS1800 or PCS1900**	The current analyzer mode

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Using Spectrum Analyzer Front-Panel Keys During GSM Operation

The menus of the GSM Multiband Transmitter Measurement Personality provide the softkeys that are normally needed for making measurements. Some spectrum analyzer front-panel keys, however, can provide useful, supplemental functions for GSM 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 GSM 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 GSM measurement always sets the spectrum analyzer parameters for making that measurement. This is true whether you used spectrum analyzer menu keys or GSM menu keys to change settings. There is no need to press **PRESET GSM DLP** or (PRESET) before beginning a new measurement.

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Configuring the test system for GSM Measurements

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

Entering Configuration Information

NOTE: GSM configuration values (under the Configuration menu) are not erased by pressing (PRESET), **PRESET GSM DLP**, or by power cycling the spectrum analyzer.

1 Press (MODE) to access the **GSM ANALYZER** softkey.

2 Press **GSM 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

8 Press **512-810 DCS PCS**, to underline DCS if you want to tune to DCS1800 channels when an ARFCN in the range 512-810 is entered.
If you want to tune to PCS1900 channels with an ARFCN in the 512-810 range, press **512-810 DCS PCS** to underline PCS.

9 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 GSM measurements unless a hopping signal is being measured.

10 Press **Main Menu** to return to the Main menu.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Entering Physical Channel Information

1 In GSM analyzer mode, press **Physical Channel** in the Main menu.

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 ARFCNTN**.
Pressing **AUTO ARFCNTN** 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Preset States and Default Conditions

Table 1 GSM Measurement Preset States

Preset Values			
	GSM900	**DCS1800**	**PCS1900**
ARFCN	1	512	512
Bottom ARFCN	1	512	512
Middle ARFCN	62	699	661
Top ARFCN	124	885	810
Start Frequency	924 MHz	1804 MHz	1929 MHz
Stop Frequency	961 MHz	1881 MHz	1989 MHz
Span	37 MHz	77 MHz	60 MHz
Note:	The analyzer presets to the GSM standard in use immediately before initiating PRESET.		
TX MS BS	BS (base station)		
Timeslot Number	0		
Number Bursts	1		
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		

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2

Table 1 GSM Measurement Preset States

Preset Values	
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

Table 2 Measurement Default Conditions

Configuration Default Values	
Preamp Gain	0 dB
Trigger Delay	0 µs
Trigger Polarity	positive
External Attenuation	0 dB
SFH	off
Frame Structure	156.25 bits/timeslot
Total Power Mode	Single
Total Power Value	0 dB

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 methods can be used to generate 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 does not complete the measurement. 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 (TTL) 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 4 shows these connections.

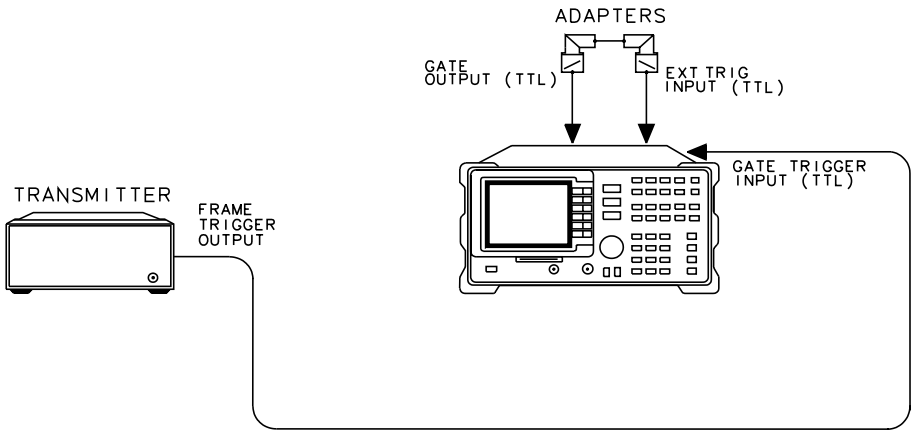


Figure 4 Triggering Connections using the Unit Under Test

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2

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 5 on page 32 and Figure 6 on page 33 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.

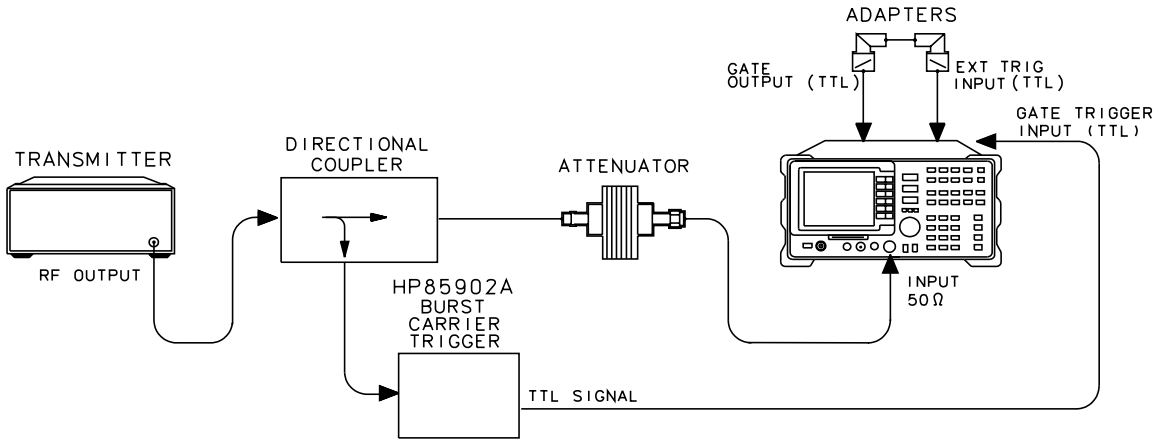


Figure 5 Triggering Connections using the HP 85902A and a Directional Coupler

NOTE: Ensure the Transmitter is configured to transmit only once per time frame.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

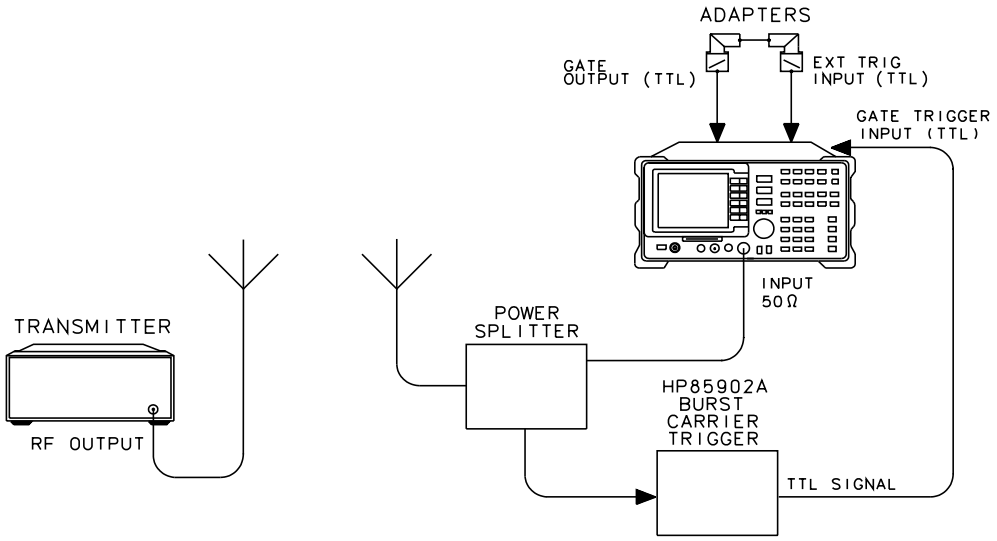


Figure 6 Triggering Connections using the HP 85902A and a Power Splitter

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Using the HP 8922

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 8922 SYSTEM BUS. You will need to supply your own cable to make this connection.

The HP 8922 frame clock, g_ext_trig, can be enabled in the HP 8922 SERVICE Screen. From the HP 8922 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 7 on page 35 for the setup required to trigger the spectrum analyzer using the HP 8922.

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

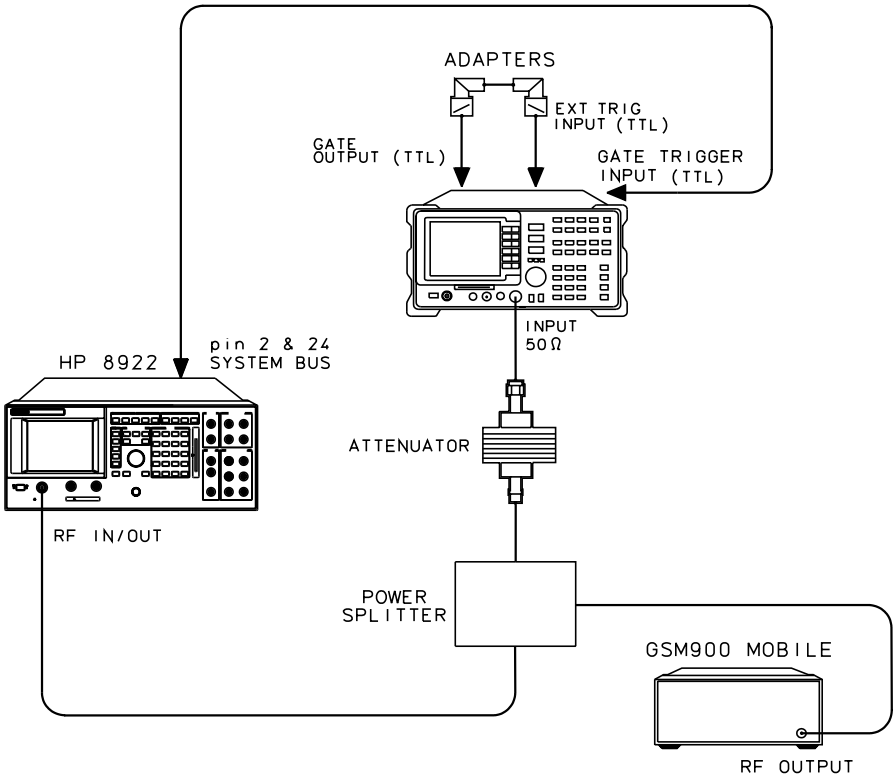


Figure 7 Triggering Connections using the HP 8922

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2

Using the spectrum analyzer internal trigger (Option 151 only)

The spectrum analyzer EXT TRIG INPUT (TTL) and GATE OUTPUT (TTL) on the rear panel should be connected together. The spectrum analyzer FRAME TRIGGER OUTPUT (TTL) and GATE TRIGGER INPUT (TTL) on the rear panel should also be connected together. Figure 8 shows the connections.

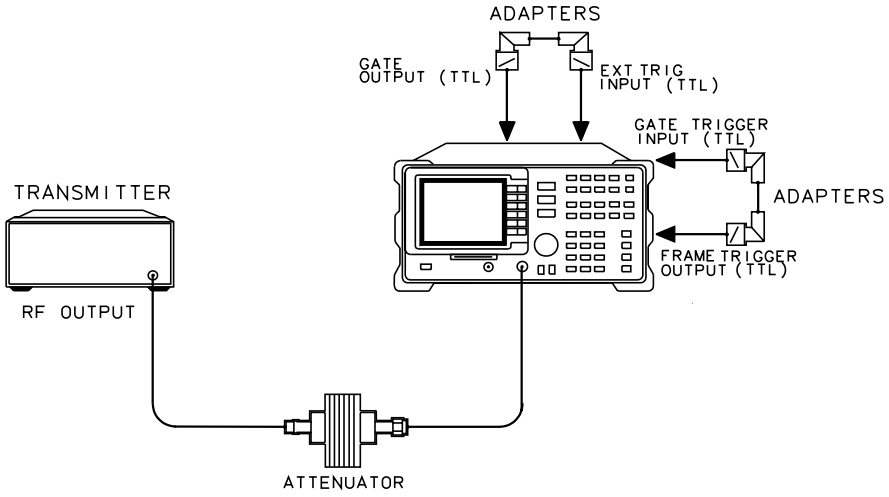


Figure 8 Connections using the spectrum analyzer internal trigger

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3

3

Making GSM Measurements

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Making GSM Measurements

What You'll Find In This Chapter

This chapter tells you how to use the HP 85727A GSM Multiband Transmitter Measurement Personality. It contains the following section:

- Making GSM Measurements.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

GSM Analyzer Mode

Accessing GSM Analyzer Mode

Using the spectrum analyzer (MODE) key and associated softkeys allows you to switch between spectrum analyzer mode and GSM 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 **GSM ANALYZER** are displayed.

NOTE: If the **GSM ANALYZER** key is not displayed, the program needs to be loaded into the spectrum analyzer's user memory. Refer to 'Loading the HP 85727A GSM Multiband Transmitter Measurement Personality' on page 12.

2 Once the mode menu is displayed, press **GSM ANALYZER**.
3 If **GSM ANALYZER** is not underlined, pressing the **GSM ANALYZER** key activates the GSM mode. The message **PLEASE WAIT…** is displayed as the initial state is set up.
4 If **GSM ANALYZER** is already underlined, pressing the **GSM ANALYZER** key displays the GSM Main menu, without changing any parameters.
5 When the GSM mode is active, **GSM900**, **DCS1800** or **PCS1900** is displayed above the softkey labels on the display.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Making GSM Measurements

This section contains descriptions and procedures for the measurements available from the GSM Multiband Transmitter Measurement Personality. Ensure you have completed the analyzer configuration before proceeding.

Using the GSM Multiband Transmitter Measurement Personality Card

The HP 85727A GSM Multiband Transmitter Measurement Personality memory card must remain inserted in the instrument's front-panel card reader. The entire personality may require too much of the spectrum analyzer's memory and measurement limit files are loaded from the card when the analyzer is tuned from one standard to another.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Mean Transmitted RF Carrier Power Measurements

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.

Test Procedure

1. Enter all the information as specified in the "Configuring the test system for GSM Measurements" and "Entering Physical Channel Information" sections of Chapter 2. For this test, specifically enter the desired ARFCN and TN via the Physical Channel menu.
2. Press **Power** in the Main menu, then **CARRIER POWER**. The program sets the spectrum analyzer to the GSM 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

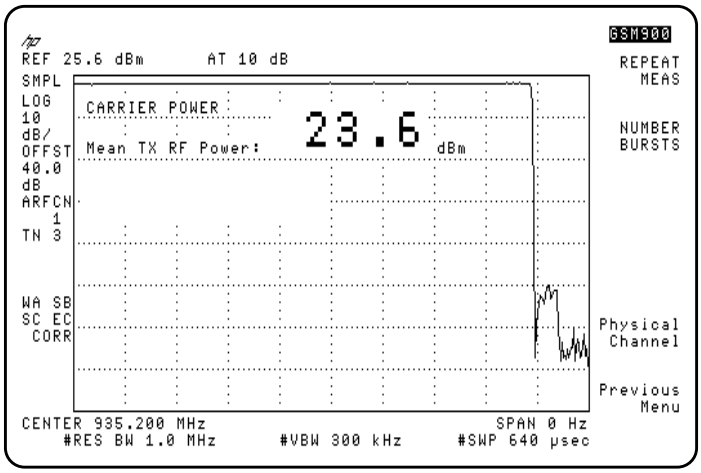


Figure 9 Example of Carrier Power Measurement Result

- 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 GSM menu from the spectrum analyzer keys by pressing (MODE) (MODE).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Power Step Measurements

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.

Test Procedure

1. Enter all the information as specified in the “Configuring the System for GSM Measurements” and “Entering Physical Channel Information” sections of this chapter. For this test, specifically enter the desired ARFCN via the Physical Channel menu.
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 GSM transmitter under test.
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 following steps to evaluate the power steps at a new sweeptime:

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 GSM 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:

d Press **MARKER DELTA** in the GSM menu to activate the markers.

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

f 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.

g To turn marker off press (MKR), **MARKER 1 ON/OFF**, (MODE), (MODE).

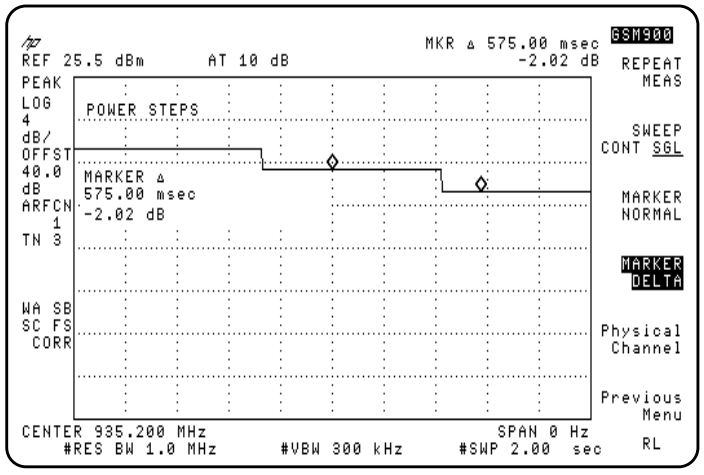


Figure 10 Example of Power Steps Measurement Results

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Combiner Tuning Measurements

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`. 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 test system for GSM Measurements” and “Entering Physical Channel Information” sections of Chapter 2. 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 FROM` 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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

decrease.

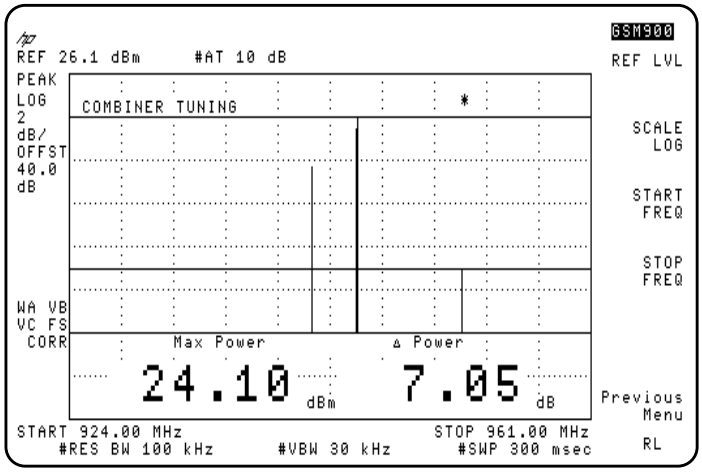


Figure 11 Example of Combiner Tuning Measurement

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Power vs. Time Measurements

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 GSM Measurement Personality are full frame and full timeslot. The other three formats are listed under sub-timeslot and are top 10 dB (of the GSM pulse), rising edge, and falling edge.

When any of the power versus time measurements are selected, the program sets the spectrum analyzer to the 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.

Test Procedure

1 Enter all the information as specified in the “Configuring the test system for GSM Measurements” and “Entering Physical Channel Information” sections of Chapter 1.For this test, specifically enter the desired ARFCN and TN via the Physical Channel menu.

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 GSM burst.
  - Press **`P vs T RISING`** to measure the rising edge of the GSM burst.
  - Press **`P vs T FALLING`** to measure the falling edge of the GSM burst.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

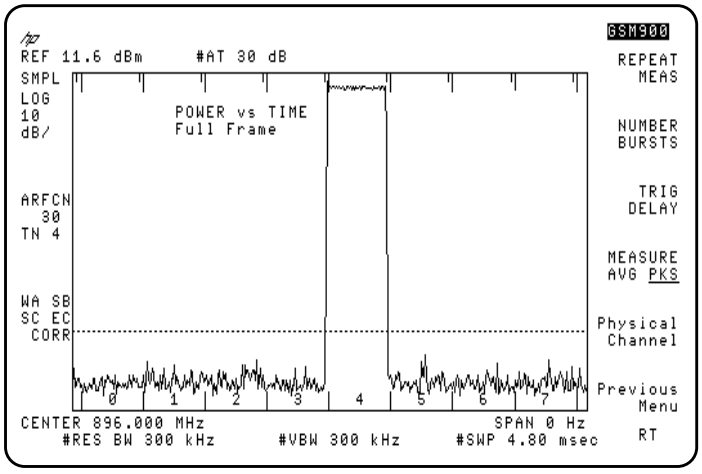


Figure 12 Example of Power vs. Time, Full-Frame Measurement Result

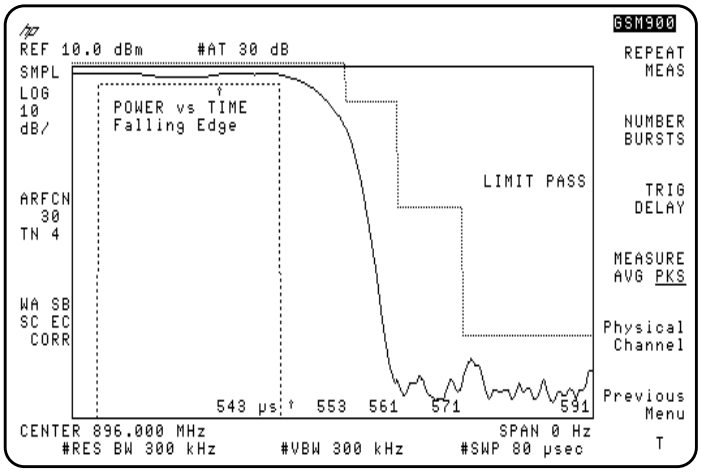


Figure 13 Example of Power vs. Time, Falling-Edge Measurement Result

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 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 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.

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 GSM menu from the spectrum analyzer keys by pressing (MODE), (MODE).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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.

GSM Specifications specify a test method where the spectrum analyzer, in zero span, is tuned to specified offsets from the carrier frequency. The HP 85727A GSM Multiband Transmitter Measurement 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Another measurement method is the swept-frequency mode which uses the Option 105 time-gated spectrum analysis card. During this measurement, the GSM Measurement 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

The default output RF spectrum measurements do not perform tests at frequency offsets greater than 1800 kHz from the carrier.

For each of the following measurements, enter all the information as specified in the “Configuring the test system for GSM Measurements” and “Entering Physical Channel Information” sections of Chapter 2. Especially enter the desired ARFCN and TN via the Physical Channel menu.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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.

2 Press **RF Spect Modulat**, then **MODULAT MULTIPLE**. Review the table that appears at the end of the measurement.

- Press **NUMBER BURSTS** to change the number of bursts to be averaged, if desired. The 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**, 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.

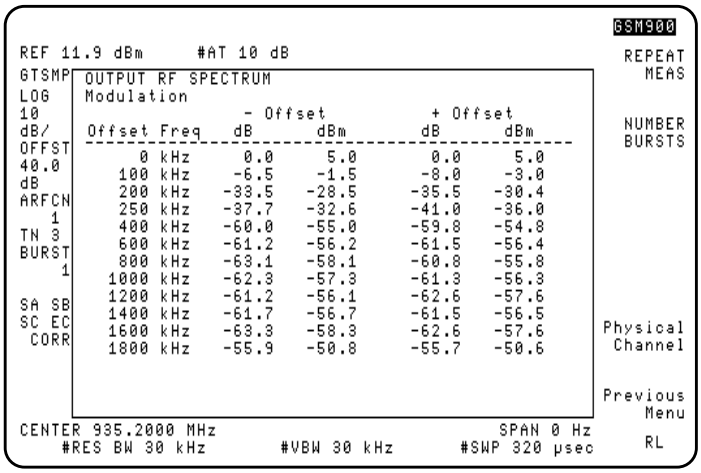


Figure 14 Example of Output RF Spectrum Due to Modulation - Multiple Offset Mode Measurement Result

- Press **Previous Menu**, then **MODULAT SINGLE** to examine the level at single offset frequencies.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- 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 GSM 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.

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 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.

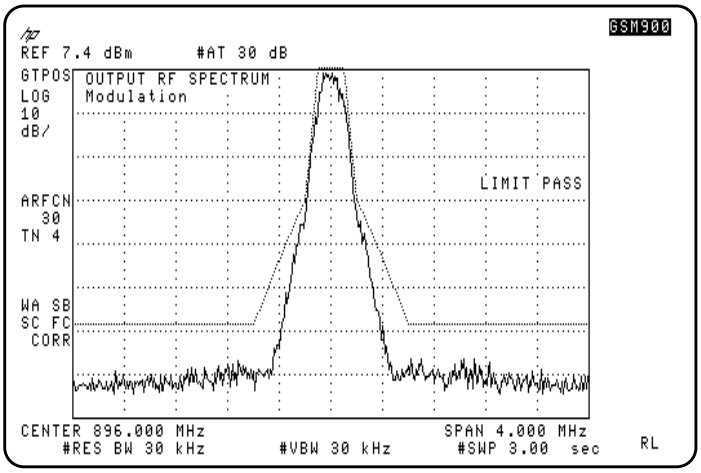


Figure 15 Example of Output RF Spectrum Due to Modulation - Swept Frequency Mode Measurement Result

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 GSM menu from the spectrum analyzer keys by pressing (MODE), (MODE).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Measurement Procedures for RF Spectrum due to Switching Transients

For Transients in Multiple- and Single-Offset Mode

1 Press **Out RF Spectrum** in the Main menu.

2 Press **RF Spect Transnt**, then **TRANSNT MULTIPLE**. Review the results that appears at the completion of the measurement.

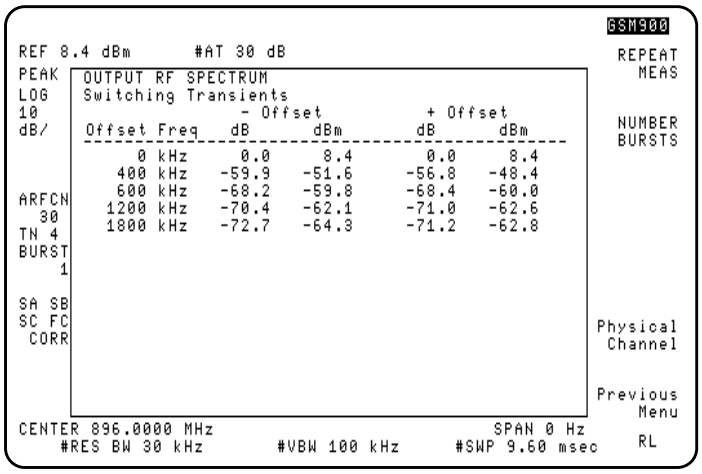


Figure 16 Example of Output RF Spectrum Due to Switching Transients - Multiple Offset Mode Measurement Result

- Press **NUMBER BURSTS** to change the number of bursts to be used, if desired. The 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- 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 GSM 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.

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 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.

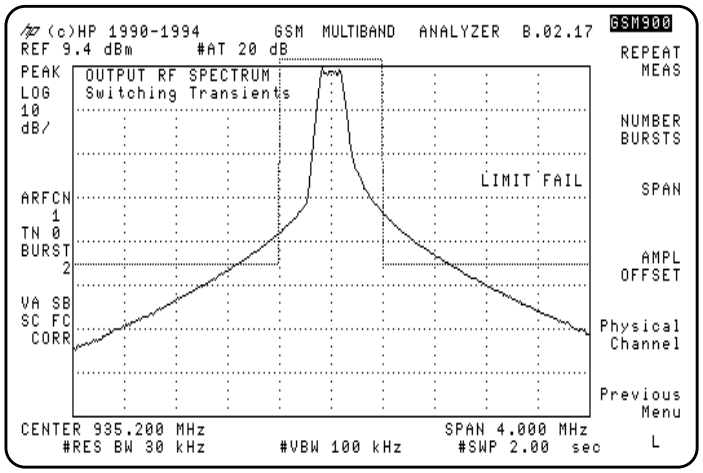


Figure 17 Example of Output RF Spectrum Due to Switching Transients - Swept Frequency Mode Measurement Result

- 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 Menu** to return to the carrier power menu.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- 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 GSM 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.

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 18 on page 58.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

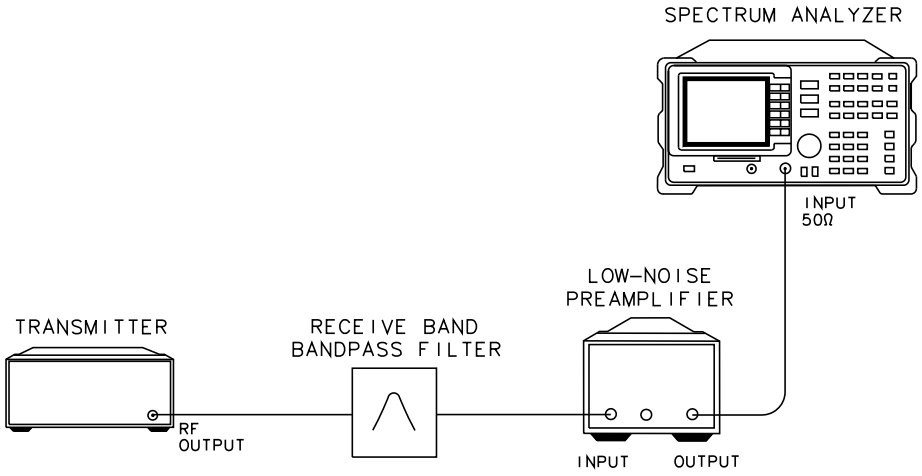


Figure 18 Test Setup for Transmitter Output RF Spectrum Due to Modulation - RX Band

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

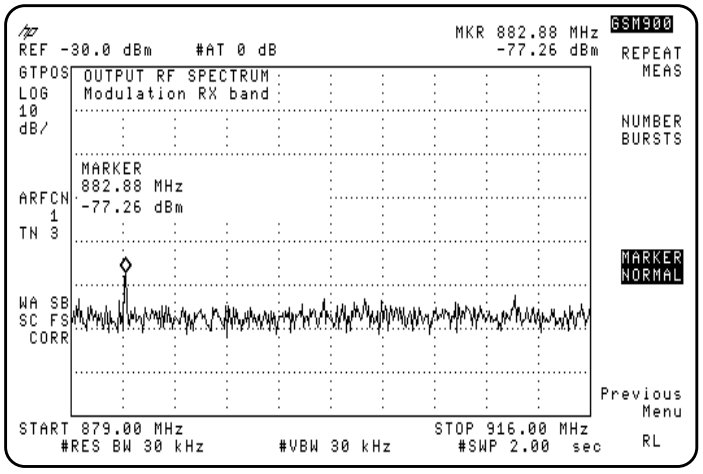


Figure 19 Example of Output RF Spectrum Due to Modulation - RX Band Measurement Result

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Spurious Emissions Measurements

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.

NOTE: This test measures spurious emissions at the antenna connector. Radiated and power-lead conducted spurious emissions are not specifically measured by the HP 85727A GSM Multiband Transmitter Measurement 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 GSM specifications are listed by frequency and amplitude pairs.

NOTE: Standard measurement limits for GSM900 are used for this measurement. If you are making measurements in the R-GSM ARFCN range (955-974) and need to use the specified limits refer to the section “To modify the default values or limit line functions used by the personality” in the *HP 85727A GSM Multiband Transmitter Measurement Personality Remote Programming Guide.*

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 GSM 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.

2 Press **Xmtr Spurious**.

3 Press **TX BAND**. Refer to Figure 20 on page 61 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.

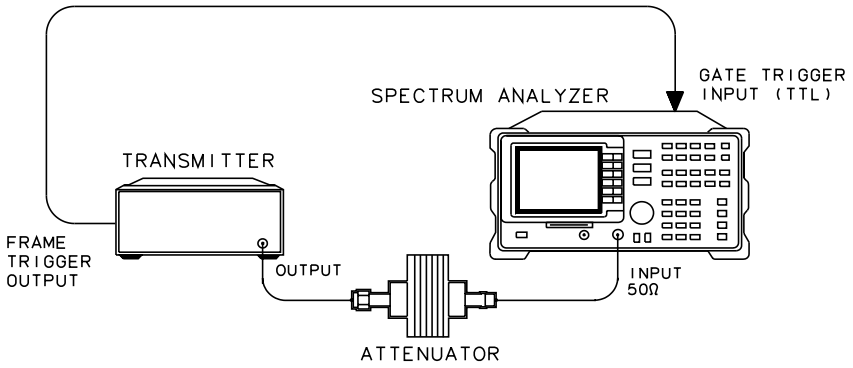


Figure 20 Test Setup Transmitter Spurious Emissions - TX Band/Outside Band

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

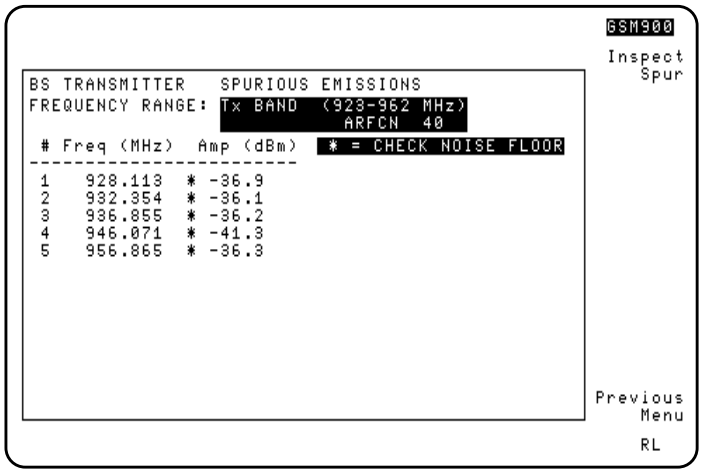


Figure 21 Example of Spurious Emissions in TX Band Measurement Result

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.

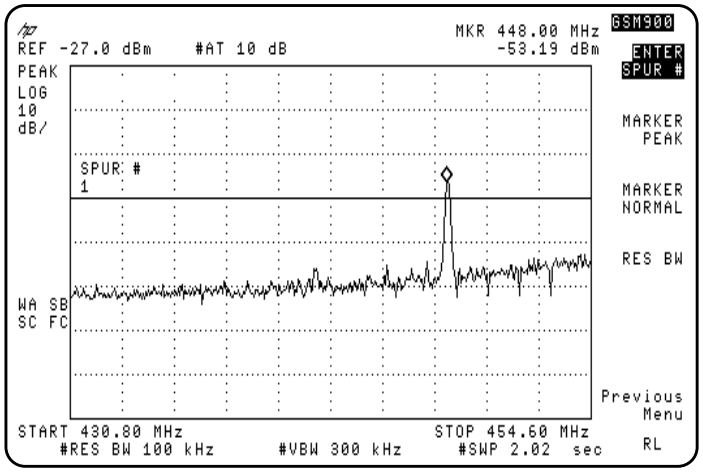


Figure 22 Example of Inspecting Spurs Routine

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 23 on page 64 for the test setup. During the measurement, the spectrum analyzer scans outside the GSM 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 **INSPECT 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

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.

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 23 on page 64.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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.

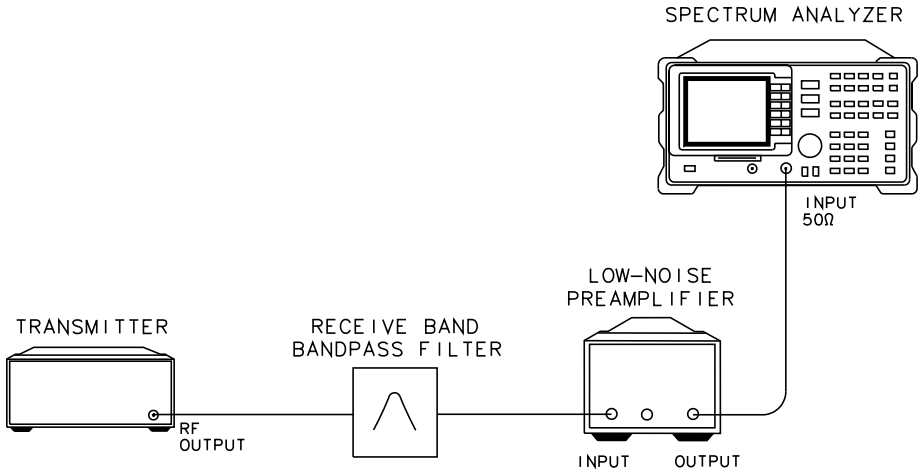


Figure 23 Test Setup for Spurious Emissions - RX Band

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** *after the above steps are completed* to start the measurement.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 24 on page 65 below for the test setup. Conduct the measurement as instructed in the previous section.

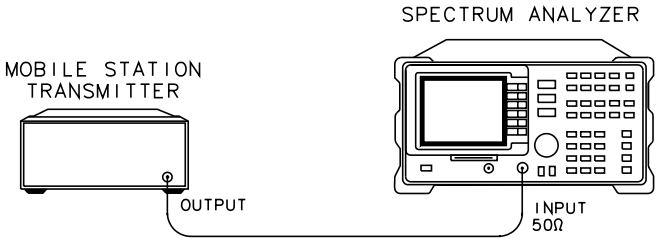


Figure 24 Test Setup for Spurious Emissions - Mobile Station Transmitter in Idle Mode

Measuring Receiver Spurious Emissions

1 Press **More 1 of 2**, then **Spurious Emission** in the Main menu.

2 Press **Rcvr Spurious**. Refer to Figure 25 on page 66 for the test setup.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

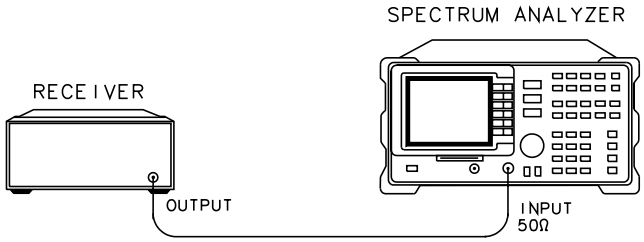


Figure 25 Test Setup for Receiver Spurious Emissions

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 GSM 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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.

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. 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 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

For TX Band Intermodulation Products

1 From the Main menu, press **More 1 of 2**, then **Intermod**.

2 Press **Intermod Atten**, then **TX BAND**. Refer to Figure 26 on page 68 for the initial test setup. If a carrier is present, the spectrum analyzer measures the carrier to determine its peak power.

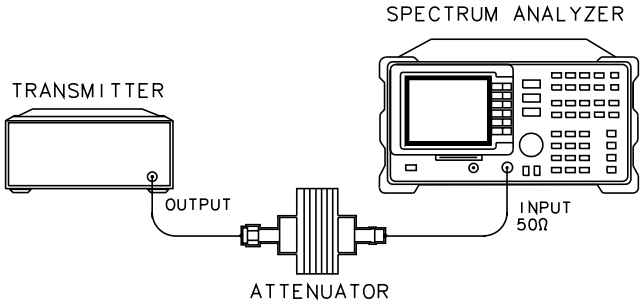


Figure 26 Test Setup for Initial Intermodulation Attenuation Measurement

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 27 on page 69 for the equipment setup.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

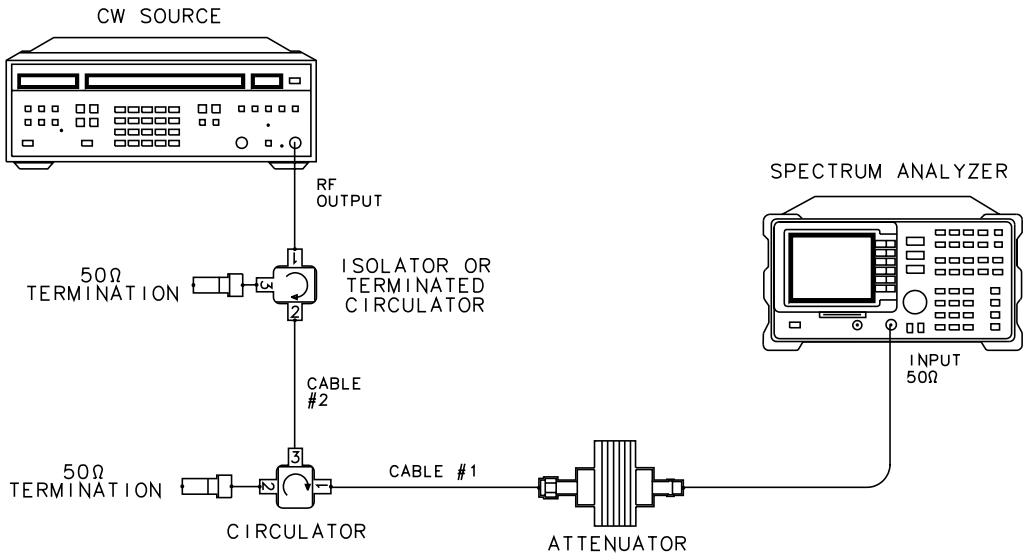


Figure 27 Test Setup for CW Source Adjustment

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 28 on page 70 for the test setup.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

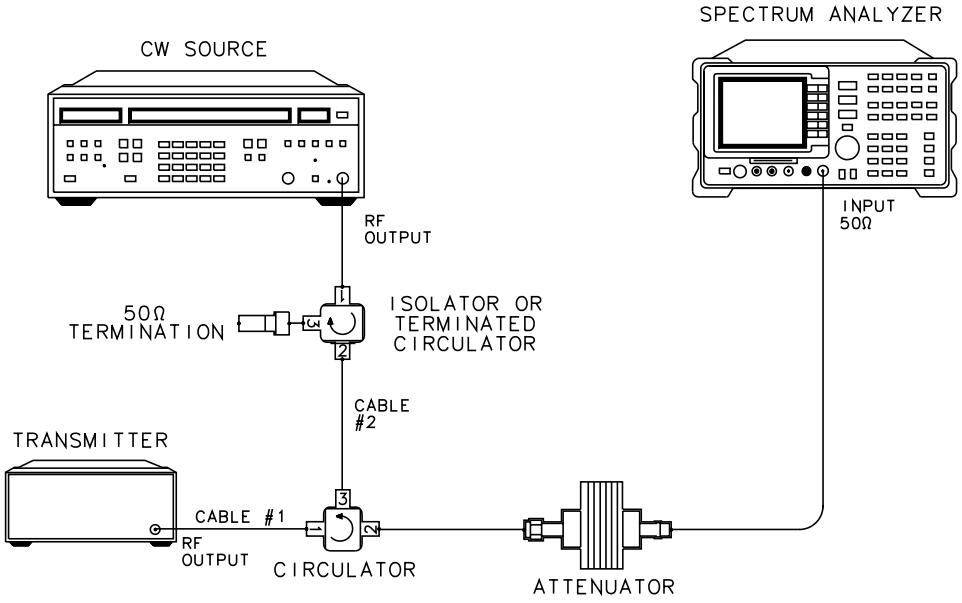


Figure 28 Test Setup for Intermodulation Attenuation - TX Band

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

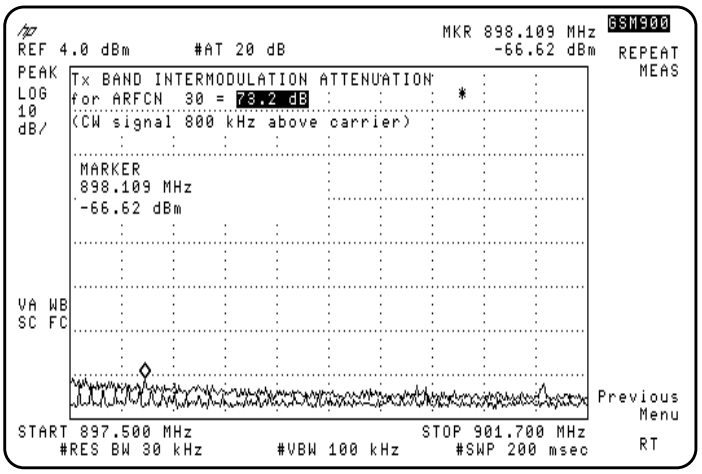


Figure 29 Example of Intermodulation Attenuation - TX Band Measurement Result

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 29 on page 71. Press **Intermod Atten**, then **RX BAND**. If a carrier is present, the spectrum analyzer measures the carrier to determine its peak power.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

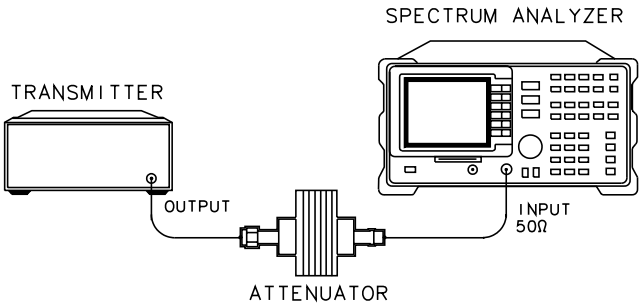


Figure 30 Test Setup for Initial Intermodulation Attenuation - RX Band

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 3^{rd} order product.
- Press **5th** to measure an intermodulation product due to an interfering signal producing a 5^{th} order product.
- Press **7th** to measure an intermodulation product due to an interfering signal producing a 7^{th} order product.

3 Read the text displayed and make the connections described. Refer to Figure 31 on page 73 for the equipment setup.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

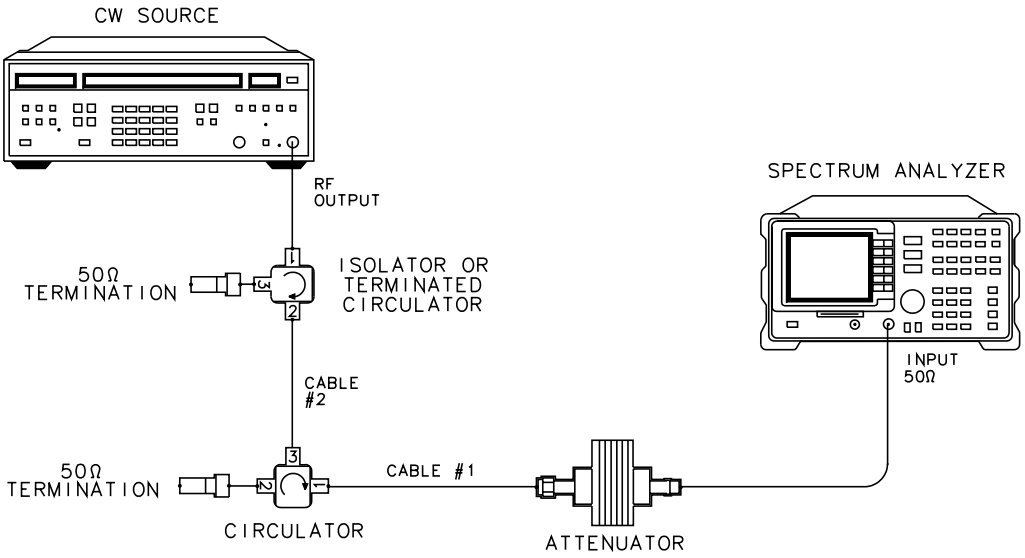


Figure 31 Test Setup for CW Source Adjustment

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 32 on page 74 for the test setup.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

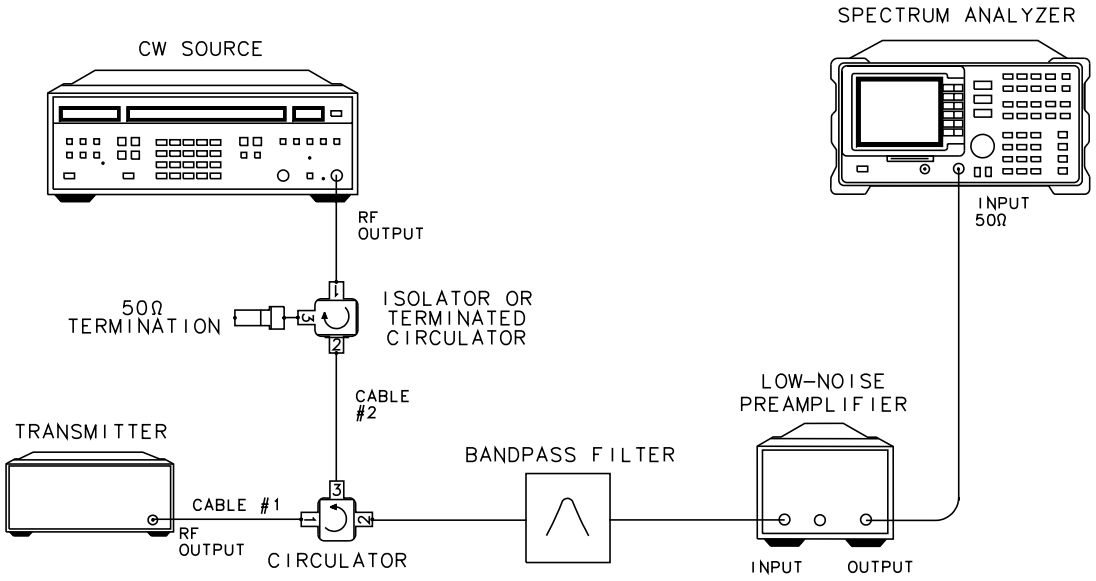


Figure 32 Test Setup for Intermodulation Attenuation - RX Band

3

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.

For the test setup illustrated in Figure 32 on page 74, 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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.

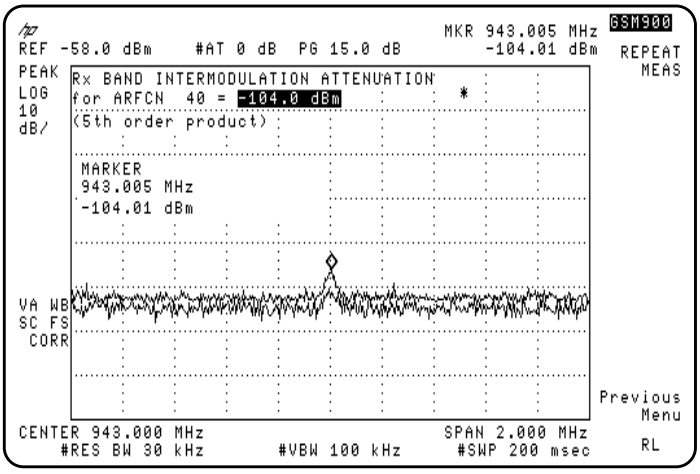


Figure 33 Example of Intermodulation Attenuation - RX Band Measurement Results

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Intra-BSS Intermodulation Attenuation Measurements

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.

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

The default intra-BSS intermodulation attenuation measurements do not perform tests at frequency offsets greater than 1800 kHz from the carrier.

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 34 on page 77 for the test setup.

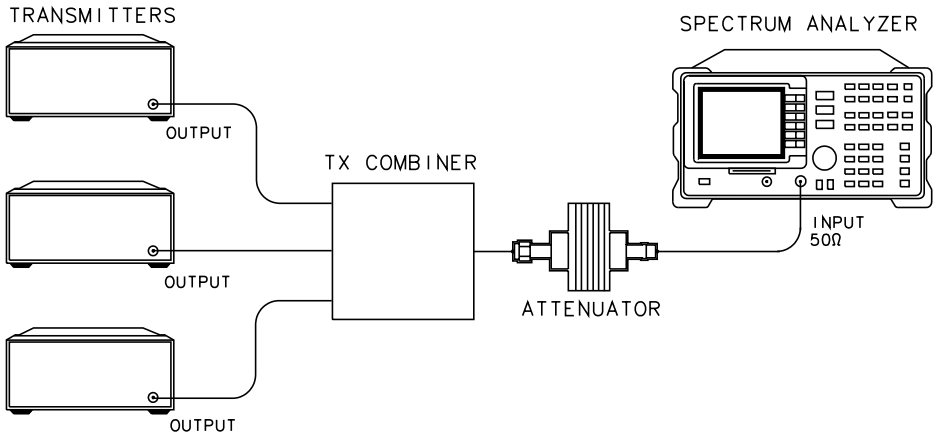


Figure 34 Test Setup for Intra-BSS Intermodulation - TX Band

2 Press **Intermod**, then **IntraBss Intermod** and **TX BAND**. 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

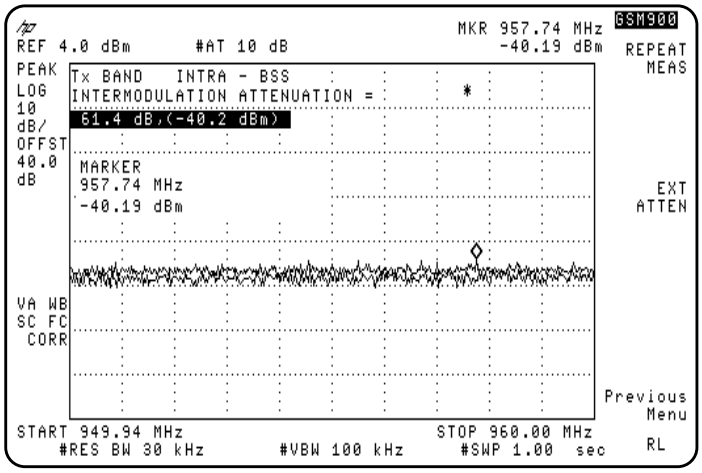


Figure 35 Example of Intra-BSS - TX Band Measurement Result

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.

3

NOTE:

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 36 on page 79 for the test setup.

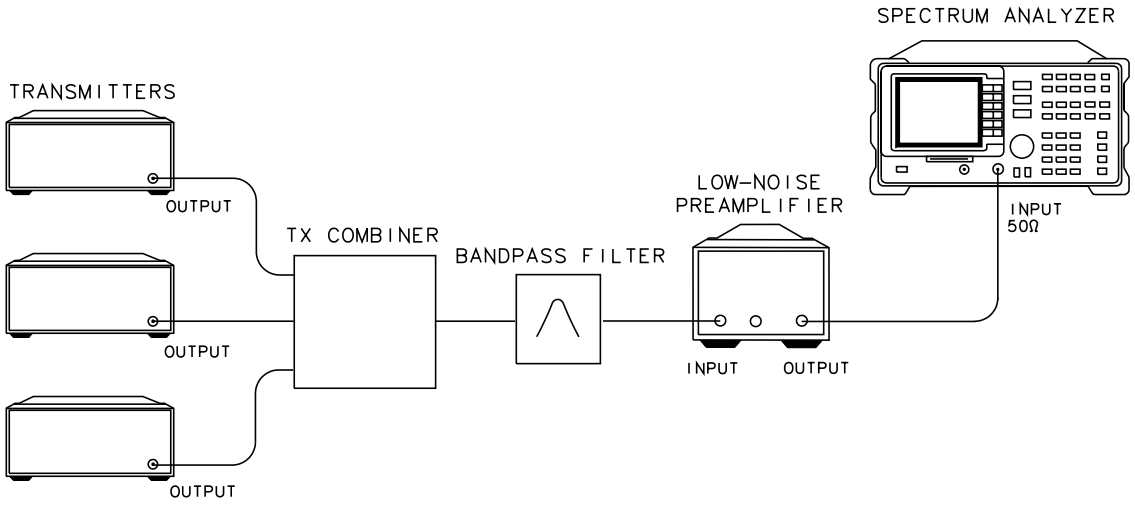


Figure 36 Test Setup for Intra-BSS Intermodulation - RX Band

2 Press **Intermod**, **IntraBss Intermod**, then **RX BAND**.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Phase and Frequency Error Measurements

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.

NOTE:

It is essential that an external trigger signal is applied for this measurement, otherwise the spectrum analyzer does not complete the measurement. Once the external trigger signal is applied the spectrum analyzer will continue to function correctly.

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.

Test Procedure

1. Enter all the information as specified in the “Configuring the test system for GSM Measurements” and “Entering Physical Channel Information” sections of Chapter 2.
2. Press **`More 1 of 2`**, **`Phase & Freq Err`** in the Main menu.
3. Refer to Figure 37 on page 81 for the test setup.

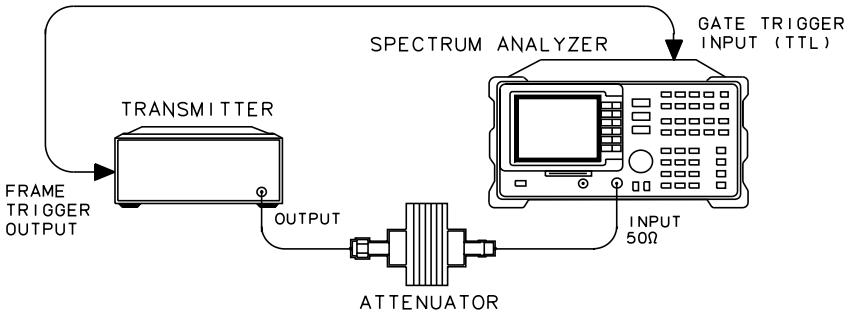


Figure 37 Test Setup for Phase and Frequency Error

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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

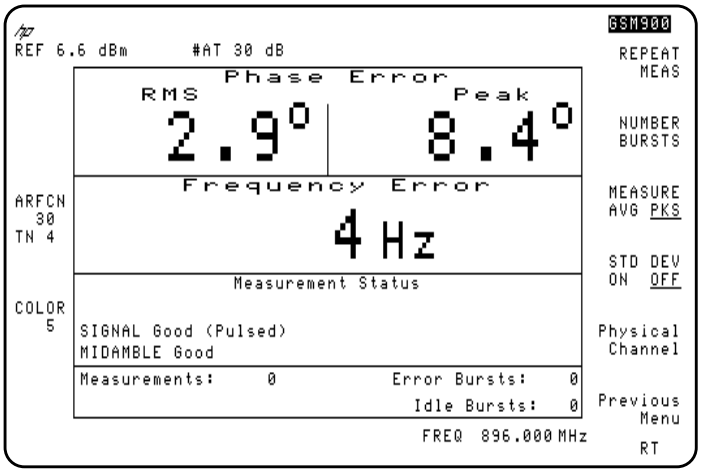


Figure 38 Example of Phase and Frequency Error Measurement Result

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

- Press **Burst Type** to select the type of burst expected for the measurement.
- Press **COLOR AUTO MAN** to select either automatic or manual detection of the color pattern sent by the transmitter.
- Press **SYNC MID AMPL** 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.
- 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.
- 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.
- Press **Previous Menu** to return to the measurement menu.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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

- Press **NUMBER BURSTS** to change the number of bursts to be measured, if desired. The 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.
- 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 GSM 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”.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

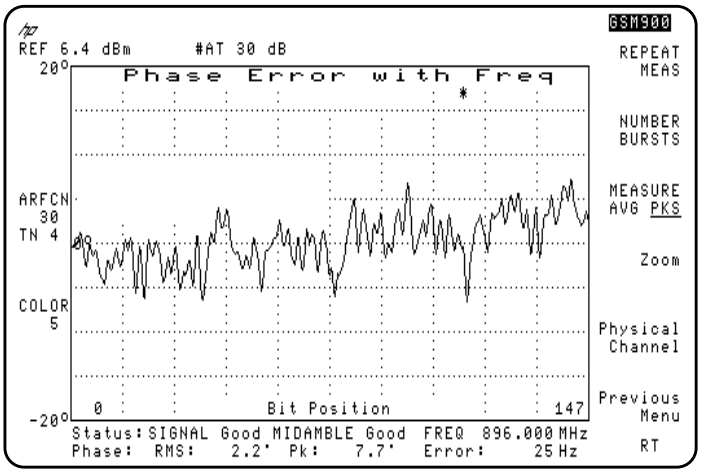


Figure 39 Example of Phase and Frequency Error Measurement - Phase Error with Frequency Graph

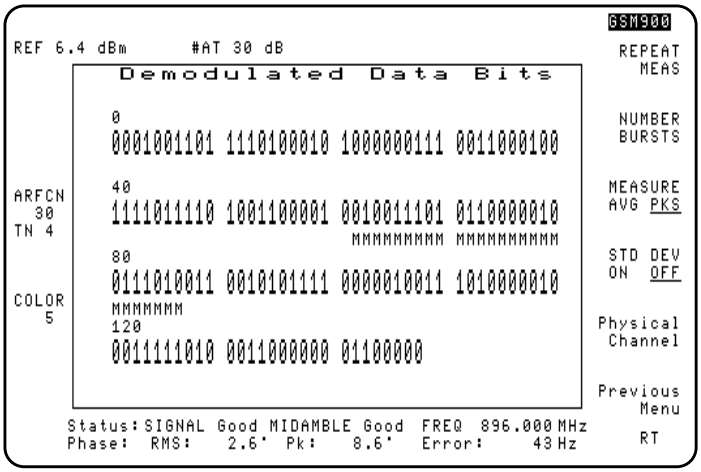


Figure 40 Example of Phase and Frequency Error Measurement - Demodulated Data Bits

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Monitor TX Band Measurements

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 "Configuring the test system for GSM Measurements" section of Chapter 2.
2. Press **More 1 of 2**, then **MONITOR TX BAND** in the Main menu. 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Making Measurements in Spectrum Analyzer Mode

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Making Spectrum Analyzer Measurements

What You'll Learn in This Chapter

This chapter demonstrates spectrum analyzer measurement techniques you may find useful in addition to the measurements provided by the GSM Multiband Transmitter Measurement Personality. Use the spectrum analyzer (MODE) key to switch between spectrum analyzer mode and GSM analyzer mode at any time.

It contains the following sections:

- Amplitude Correction Factors.
- Identifying distortion products using the RF attenuator and traces.
- Measuring amplitude modulation using the fast Fourier transform function.
- Stimulus-response measurements using the built-in tracking generator (Option 010 or 011).
- Using the one-button measurements to measure N dB bandwidth, percent amplitude modulation, and third order intercept (TOI).
  - N dB Bandwidth
  - Percent Amplitude Modulation
  - Third Order Intermodulation
- Save and recall data from analyzer memory.
- Save and recall data from the memory card.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Amplitude Correction Factors

This section provides an overview of amplitude correction, a procedure for creating amplitude-correction data, and descriptions of the amplitude-correction functions.

Amplitude corrections provide an easy way to adjust trace data with a set of amplitude and frequency parameters while the spectrum analyzer is sweeping the measurement range. Every measurement sweep of data is adjusted by the amplitude-correction values. When using the amplitude-correction functions, an **A** is displayed at the left-hand side of the graticule edge.

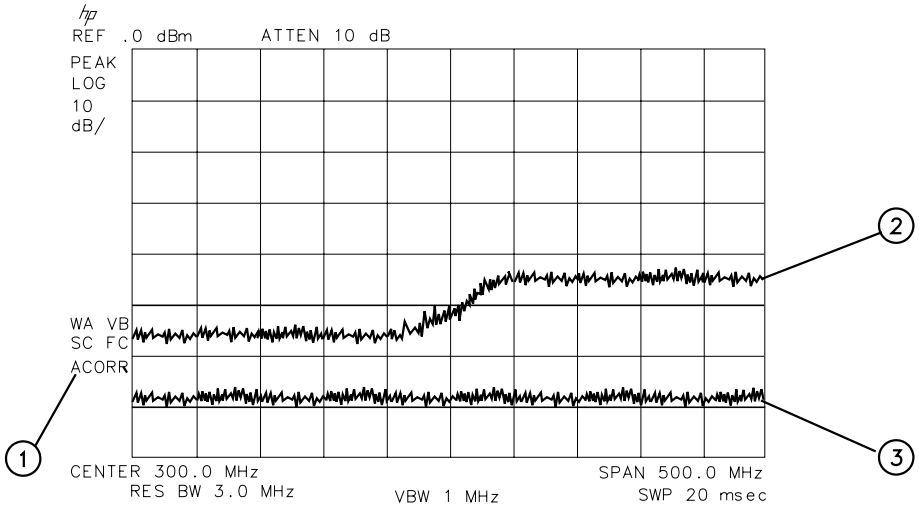


Figure 41 Amplitude-Correction Display

Item	Description of Items in Figure 41
1	Indicates amplitude-correction factors are on.
2	Amplitude corrections ON.
3	Amplitude corrections OFF.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Procedure for Creating Amplitude-Correction Factors

This procedure demonstrates how to create and activate amplitude-correction data. Detailed descriptions of the amplitude-correction functions follow this procedure.

1 Press (PRESET).

NOTE: A signal is not used in this procedure for demonstrating how to create amplitude-correction data. Disconnect any cable on the spectrum analyzer input.

2 Set the center frequency to 300 MHz and the span to 500 MHz by pressing:

(FREQUENCY) 300 (MHz)
(SPAN) 500 (MHz)

3 Press (CAL), **More 1 of 4**, **More 2 of 4**, **More 3 of 4**, then **Amp Cor** to access the amplitude-correction menus.

4 Press **Edit Amp Cor** to access the editing menus for amplitude-correction factors.

5 To clear any existing amplitude-correction data, press **PURGE AMP COR** two times consecutively.

NOTE: After pressing **PURGE AMP COR** the first time, the message **If you are sure, press key again to purge data** will appear. Pressing **PURGE AMP COR** a second time erases the amplitude-correction data.

6 Specify the first amplitude-correction point by pressing the following keys:

SELECT FREQ
50 (MHz)
12 (+dBm)

7 Specify the second amplitude-correction point by pressing the following keys:

250 (MHz)
10 (+dBm)

NOTE: Table entries can be edited if you make a mistake. To edit an existing point, use **SELECT POINT** to specify the point. Then use **SELECT FREQ** or **SELECT AMPLITUD** to specify the entry that you wish to edit.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

8 Specify the third and fourth amplitude-correction points by using the following key sequence:

300 (MHz) 15 (+dBm)
350 (MHz) 22 (+dBm)

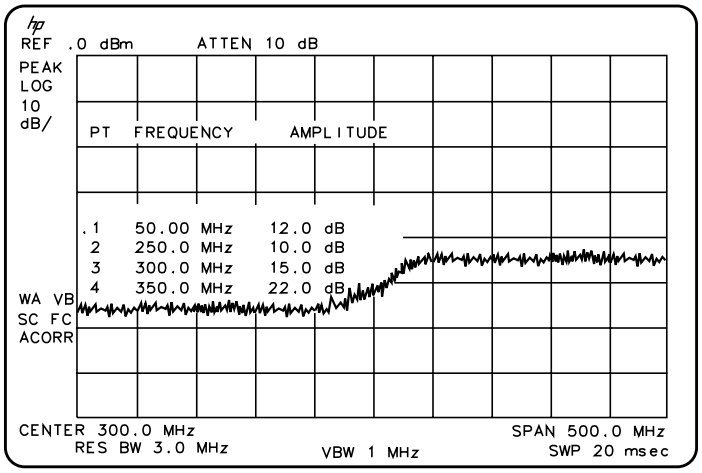


Figure 42 Completed Amplitude-Correction Table

9 Press **EDIT DONE** when all the points have been entered.

Use steps 10 and 11 to display corrected versus uncorrected amplitude trace data for trace comparison.

10 Display the amplitude-corrected trace in trace A by pressing the following keys:

(TRACE)
CLEAR WRITE A
VIEW A

11 Display the uncorrected amplitude trace in trace B by pressing the following keys:

TRACE A B C until B is selected
CLEAR WRITE B
(CAL), **More 1 of 4**, **More 2 of 4**, **More 3 of 4**, **Amp Cor**
AMP COR ON OFF until OFF is selected

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Amplitude-Correction Functions

This section describes the amplitude-correction functions in the order they are usually used.

Editing or Viewing the Amplitude-Correction Tables

Pressing (CAL), **More 1 of 4**, **More 2 of 4**, **More 3 of 4**, **Amp Cor** accesses the softkey menus for creating an amplitude-correction table.

NOTE: (PRESET) turns amplitude-correction factors off (if it is on), but does not clear an existing amplitude-correction table. Use **PURGE AMP COR** to clear an existing amplitude-correction table.

Press **Edit Amp Cor** to edit an existing amplitude-correction table or, if no amplitude-correction table currently exists, to create an amplitude-correction table.

Pressing **PURGE AMP COR** two times consecutively clears an existing amplitude-correction table.

Selecting the Amplitude-Correction Point

Pressing **SELECT POINT** specifies the amplitude-correction point to be entered or edited. Amplitude-correction data is constructed from left to right and is created by entering frequency and amplitude values into an amplitude-correction table. The frequency and amplitude values specify a coordinate point from which amplitude-corrections are interpolated. See Figure 43 on page 93. Up to 79 points can be specified for the amplitude-corrections table.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

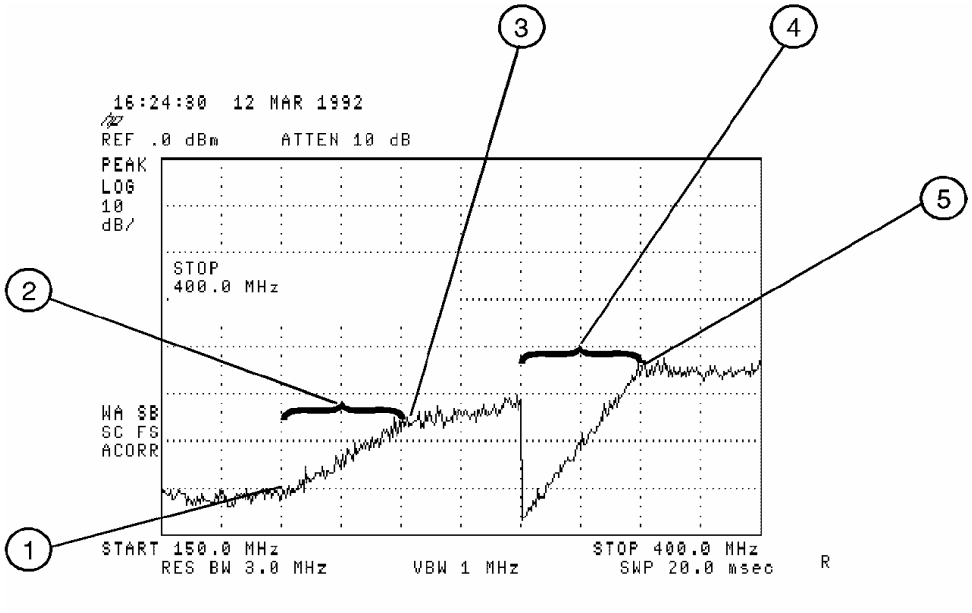


Figure 43 Amplitude-Correction Points

Item	Description of Items in Figure 43
1	Frequencies below first point use first amplitude level.
2	First segment interpolated with the 10 dB amplitude level.
3	Frequency and amplitude coordinate that starts the second segment.
4	Third segment interpolated with the −10 dB amplitude level.
5	Frequency and amplitude coordinate that starts the fourth segment.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Selecting the Frequency Coordinate

Press **SELECT FREQ**, then enter a frequency value for the point.

NOTE:

Only two entries per frequency are used. If more points with the same frequency are entered, only the first and last entries are used. All other amplitude values are ignored. See Figure 43 for an example of two entries at the same frequency.

When entering amplitude-correction data, the frequency and amplitude values will be listed as asterisks (***) until new values are entered. Once the frequency value is entered, the segment is immediately sorted into the table according to this value.

Selecting the Amplitude Coordinate

The amplitude value is entered by pressing **SELECT AMPLITUD**, entering an amplitude value, and pressing a units key.

NOTE:

Frequency or amplitude values that are not within range will be modified. For example, a frequency value of 60 GHz will be modified to 30 GHz.

Completing Table Entry and Activating Amplitude Corrections

Pressing **EDIT DONE** blanks the amplitude-correction table from the screen and accesses the menu with **AMP COR ON OFF**.

Pressing **AMP COR ON OFF** turns the amplitude corrections on and off.

Saving or Recalling Amplitude Correction Tables

Pressing **Amp Cor** under the (DISPLAY) key accesses **SAVE AMP COR** and **RECALL AMP COR**. These softkey functions provide an easy way to save or recall current amplitude-correction tables. **SAVE AMP COR** saves the current amplitude-correction table in the current mass storage device (spectrum analyzer memory or memory card). To determine the current mass storage device, press **SAVE AMP COR**. If **MAX REG #** appears on the spectrum analyzer display, the current mass storage device is analyzer memory. If **PREFIX=** is displayed, the memory card is the mass storage device. (Press (SAVE) or (RECALL), **INTERNAL CARD** to change the current mass storage device.) Press **EXT PAD YES NO**, enter a register number, then press (ENTER) to save the current amplitude-correction table in spectrum analyzer memory or on the memory card.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

RECALL AMP COR recalls amplitude-correction tables from the current mass storage device (spectrum analyzer memory or memory card). To determine the current mass storage device, press **RECALL AMP COR**. If **MAX REG #** appears on the spectrum analyzer display, the current mass storage device is analyzer memory. If **PREFIX=** is displayed, the memory card is the mass storage device. (Press SAVE or RECALL, **INTERNAL CARD** to change the current mass storage device.) When recalling an amplitude-correction table from the memory card, it is necessary that the current prefix match the prefix that the table was originally stored with. Use **Change Prefix** to change the current prefix. To recall an amplitude-correction table, enter the register number that the table was saved under, then press ENTER.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Identifying Distortion Products Using the RF Attenuator and Traces

Distortion from the Analyzer

High-level input signals may cause spectrum analyzer distortion products that could mask the real distortion measured on the input signal. Using trace B and the RF attenuator, you can determine which signals, if any, are internally generated distortion products.

Example: Using a signal from a signal generator, determine whether the harmonic distortion products are generated by the spectrum analyzer.

1 Connect a signal generator to the spectrum analyzer INPUT 50Ω.Set the signal generator frequency to 200 MHz and the amplitude to 0 dBm.

Set the center frequency of the spectrum analyzer to 400 MHz and the span to 500 MHz: press (FREQUENCY), 400 (MHz), (SPAN) 500 (MHz). The signal shown in Figure 44 produces harmonic distortion products in the spectrum analyzer input mixer.

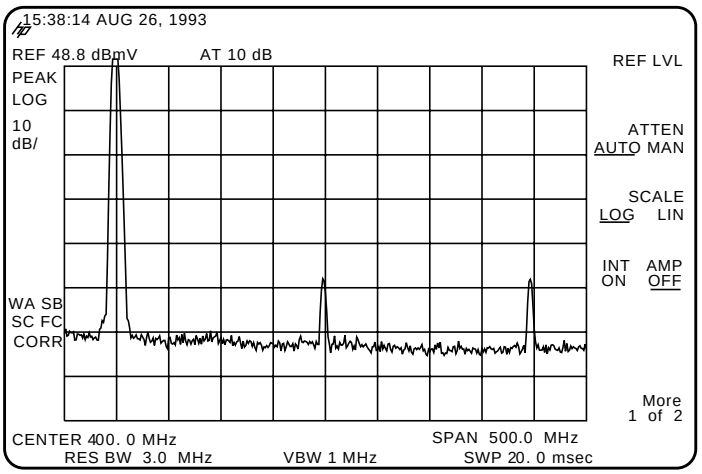


Figure 44 Harmonic Distortion

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2 Change the span to 200 MHz: press (SPAN), 200 (MHz).

3 Change the attenuation to 0 dB: press (AMPLITUDE), **ATTEN AUTO MAN**, 0 (dBm).

4 To determine whether the harmonic distortion products are generated by the spectrum analyzer, first save the screen data in trace B.

Press (TRACE), **TRACE A B C** (until trace B is underlined), then **CLEAR WRITE B**. Allow the trace to update (two sweeps) and press **VIEW B**, (PEAK SEARCH), **MARKER Δ**. The spectrum analyzer display shows the stored data in trace B and the measured data in trace A.

5 Next, increase the RF attenuation by 10 dB: press (AMPLITUDE), **ATTEN AUTO MAN**, and the step-up key ((⇧)) once. See Figure 45.

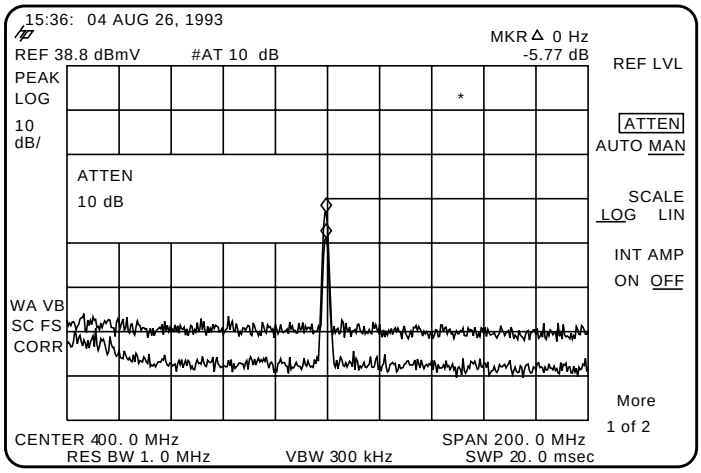


Figure 45 RF Attenuation of 10 dB

6 Compare the response in trace A to the response in trace B. If the distortion product decreases as the attenuation increases, distortion products are caused by the spectrum analyzer input mixer.

The change in the distortion product is shown by the marker-delta value. The high-level signals causing the overload conditions must be attenuated to eliminate the interference caused by the internal distortion.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

If the responses in trace A and trace B differ, as in Figure 45, then attenuation is required. If there is no change in the signal level, the distortion is not caused internally. For example, the signal amplitude in Figure 46 is not high enough to cause internal distortion in the spectrum analyzer so any distortion that is displayed is present on the input signal.

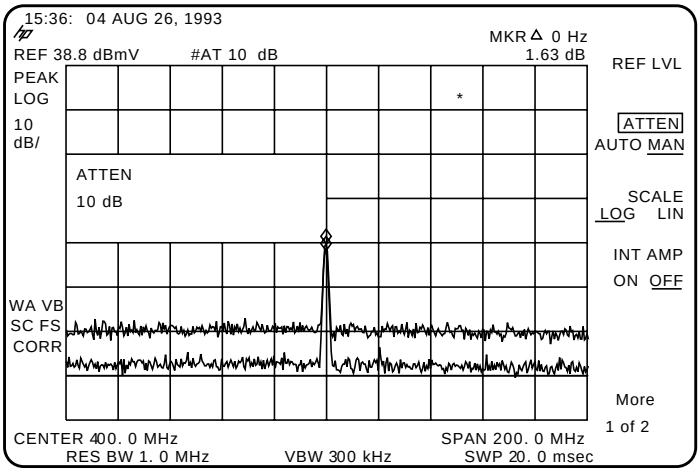


Figure 46 No Harmonic Distortion

Third-Order Intermodulation Distortion

Two-tone, third-order intermodulation distortion is a common problem in communication systems. When two signals are present in a system, they can mix with the second harmonics generated and create third-order intermodulation distortion products, which are located close to the original signals. These distortion products are generated by system components such as amplifiers and mixers.

Example: Test a device for third-order intermodulation. This example uses two sources, one set to 300 MHz and the other to approximately 301 MHz. (Other source frequencies may be substituted, but try to maintain a frequency separation of approximately 1 MHz.)

1 Connect the equipment as shown in Figure 47.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

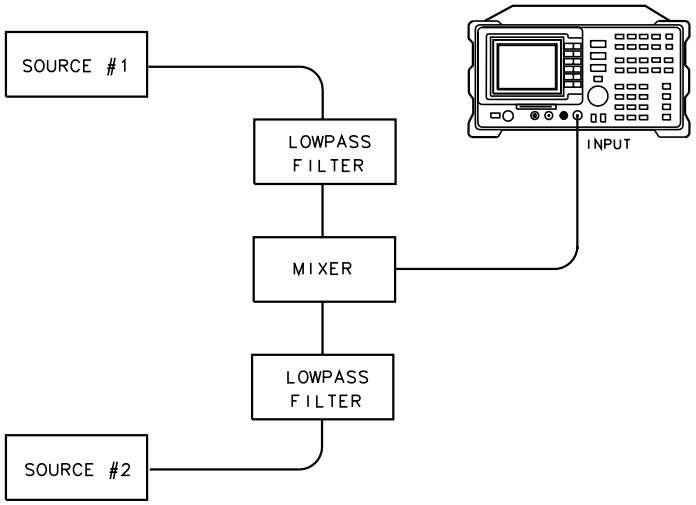


Figure 47 Third-Order Intermodulation Equipment Setup

2 Set one source to 300 MHz and the other source to 301 MHz for a frequency separation of 1 MHz. Set the sources equal in amplitude (in this example, the sources are set to –5 dBm).

3 Tune both signals onto the screen by setting the center frequency between 300 and 301 MHz. Then, using the knob, center the two signals on the display. Reduce the frequency span to 5 MHz for a span wide enough to include the distortion products on the screen. To be sure the distortion products are resolved, reduce the resolution bandwidth until the distortion products are visible. Press (BW), **RES BW**, and then use the step-down key (⇩) to reduce the resolution bandwidth until the distortion products are visible.

4 For best dynamic range, set the mixer input level to –40 dBm and move the signal to the reference level: press (AMPLITUDE), **More 1 of 3**, **MAX MXR LEVEL**, 40 (-dBm).

The spectrum analyzer automatically sets the attenuation so that a signal at the reference level will be a maximum of –40 dBm at the input mixer.

5 To measure a distortion product, press (PEAK SEARCH) to place a marker on a source signal. To activate the second marker, press **MARKER Δ**. Using the knob, adjust the second marker to the peak of the distortion product that is beside the test tone. The difference between the markers is displayed in the active function block.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

To measure the other distortion product, press PEAK SEARCH, **NEXT PEAK**. This places a marker on the next highest peak, which, in this case, is the other source signal. To measure the difference between this test tone and the second distortion product, press **MARKER Δ** and use the knob to adjust the second marker to the peak of the second distortion product. See Figure 48.

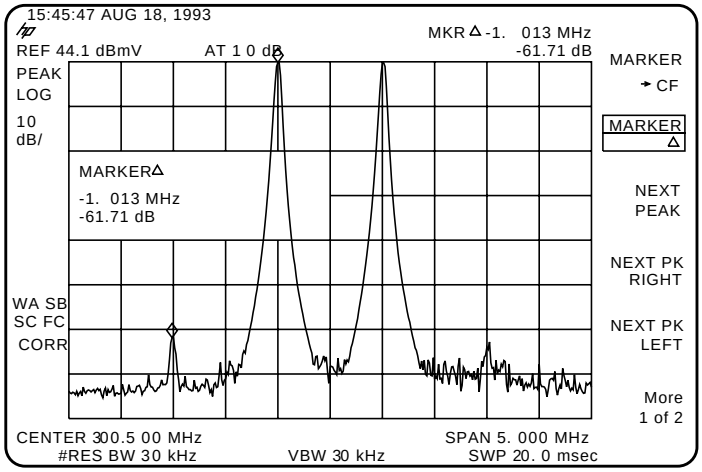


Figure 48 Measuring the Distortion Product

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Measuring Amplitude Modulation with the Fast Fourier Transform Function

A Fourier transform, transforms time domain data (zero span) into the frequency domain. The fast Fourier transform (FFT) function of the spectrum analyzer allows measurements of amplitude modulation (AM). It is commonly used to measure AM at rates that cannot be measured in the normal frequency domain due to spectrum analyzer limitations on narrow resolution bandwidths. For a given AM rate, the FFT function can generate a trace faster than using the frequency domain for the equivalent spectrum analyzer measurement.

NOTE: The fast ADC Option 101 extends FFT operation. The standard spectrum analyzer has sweep times (in zero span) up to 20 ms and allows FFT stop frequencies from 20 Hz to 10 kHz. With Option 101, spans of 20 µs can be used and FFT stop frequencies up to 10 MHz are available.

The FFT function calculates the magnitude of each frequency component from a block of time-domain samples of the input signal. It uses a flat top filter response. This implementation is a post-detection Fourier transform and it cannot be used to resolve continuous wave or carrier signals.

When (MEAS/USER), **FFT Menu**, and **SINGLE FFT** are pressed, sample-detection mode is selected and a sweep is taken to obtain a sample of the input signal. Then the spectrum analyzer executes a series of computations on the time data to produce the frequency-domain results. **CONTINUOUS FFT** can be used instead of **SINGLE FFT** and the spectrum analyzer will be put in continuous sweep mode with an FFT being performed at the end of each sweep.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

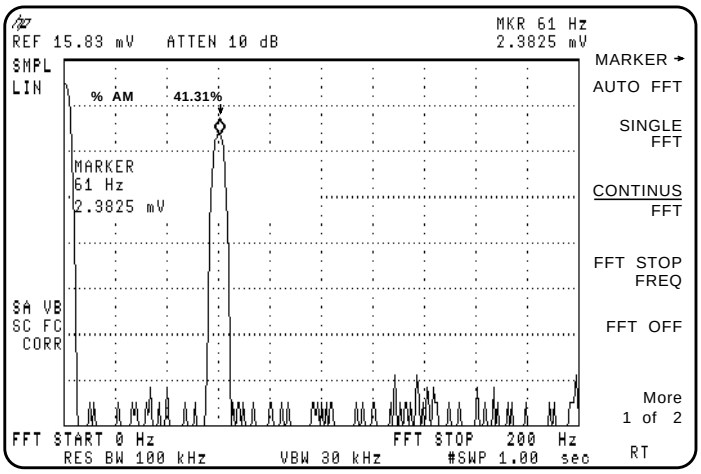


Figure 49 FFT Annotation

Some of the screen annotation is altered when the FFT function is active. The left edge of the graticule is relabeled FFT START and represents 0 Hz relative to the carrier. The right edge of the graticule is relabeled FFT STOP and is the maximum FFT frequency used in the transformation. The annotation LIN in the upper left corner refers to the scale of the incoming data being transformed. The FFT results, which are being displayed, are always in LOG scale. The carrier appears at the left edge of the graticule with the modulation sidebands and any distortion appearing along the horizontal axis. The amplitude relationships of all the signals are the same as they would be if the components were displayed with normal swept-tuned operation in log mode, 10 dB per division.

If the FFT stop frequency is less than the highest harmonic of the AM modulation, than the FFT results may include aliased signals. That is, it will include some signals that are being displayed at the wrong frequency. The sweep time affects the sample rate and must be optimized to avoid aliasing.

The single and continuous FFT functions require a specific spectrum analyzer setup before they can be activated. First, an AM signal is demodulated in the time domain. In order to do this, the resolution bandwidth is widened to include the signal sidebands within the passband of

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

the spectrum analyzer. Next, zero span is selected so that the spectrum analyzer operates as a fixed-tuned receiver. Tuning is centered around the AM carrier.

The **MARKER → AUTO FFT** softkey activates the FFT function with very little preliminary setup required. Two examples of using the FFT function are included in this section.

- First example: uses the manual FFT functions.
- Second example: uses the automatic FFT measurement.

NOTE: After the FFT function is used, the markers are still in FFT mode for use in evaluating data. Turn off the FFT markers before attempting to use markers in the normal fashion. Press **FFT OFF** in the FFT menu to turn off the markers and exit the FFT measurement.

Example 1: Use the manual FFT measurement to look at 60 Hz AM modulation.

1. Connect a signal generator to the spectrum analyzer INPUT 50Ω. Adjust the signal generator to produce an AM signal with a 60 Hz modulation frequency.
2. Press (FREQUENCY) and set the spectrum analyzer center frequency to the frequency of the modulated input signal. Press (SPAN), 10 MHz. Press (FREQUENCY) again and center the signal on the spectrum analyzer display.
3. Press (SPAN), 1 MHz. Press (FREQUENCY) and center the signal on the spectrum analyzer display again.
4. Press (BW), 100 kHz. (Re-center the signal, if necessary.)

   Press (SPAN) 200 kHz, re-centering the signal again if it is necessary.
5. Press **VID BW AUTO MAN**, 1 kHz. The video bandwidth should be about ten times greater than the highest modulation frequency of interest for the best amplitude accuracy.
6. Press **REF LVL** and turn the knob to change the reference level, placing the signal peak within the top division of the screen. The signal peak must be below the reference level. The signal amplitude moves up and down because the spectrum analyzer catches the signal at different points of modulated amplitude each time it sweeps.
7. Change the amplitude scale to linear by pressing (AMPLITUDE) and **SCALE LOG LIN** so that LIN is underlined. The FFT will give incorrect results when the spectrum analyzer is in Log mode.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Press **REF LVL** and place the signal peak within the top division of the screen.

8 Press (SPAN), 0 Hz. The spectrum analyzer now operates as a fixed-tuned receiver.

9 Press (MEAS/USER), **FFT Menu**, and **CONTINUS FFT**. The spectrum analyzer will now be taking FFTs continuously, updating the measurement at the end of every sweep.

Press **FFT STOP FREQ**, 250 Hz. This sets the spectrum analyzer to include the fourth harmonic of the 60 Hz modulation signal on the screen.

10 To confirm that the resolution bandwidth and video bandwidth are correct for measuring the modulation amplitude, use the following procedure:

a Press (MKR) and use the knob to move the marker to the desired modulation signal. In this example, place the marker on the 60 Hz fundamental modulation signal.

b Press (BW) and decrease the resolution bandwidth using the (⇩) key, until measured signal amplitude drops. Then press (⇧) to increase the bandwidth until the signal amplitude stops increasing and stays the same, or until the maximum resolution bandwidth is reached. Use the narrowest bandwidth that does not cause a change in the signal amplitude.

NOTE: As the resolution bandwidth is stepped down, the modulated signal must be re-centered in the filter bandwidth. This is a zero span display. To center the signal, select (FREQUENCY) and adjust the center frequency to maximize the amplitude of the trace. If this is not done, the signal amplitude can decrease due to off tuning of the spectrum analyzer and not because of the resolution bandwidth chosen.

For the best amplitude accuracy, the resolution bandwidth should be about 10 times greater than the highest modulation frequency of interest.

For the 60 Hz fundamental, a 1 kHz resolution bandwidth works well. (For the HP 8593E, HP 8594E, HP 8595E, and HP 8596E, if harmonics are not a concern, a 100 kHz resolution bandwidth can be used and it will provide a faster update rate.)

c Press (BW), **VID BW AUTO MAN** (MAN) and use the step keys to decrease the video bandwidth until the amplitude of the measured signal drops. Then step the bandwidth up until the signal amplitude stops increasing, or until the maximum video bandwidth is reached. Use the narrowest video bandwidth that does not cause a change in the signal amplitude.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

For the best amplitude accuracy, the video bandwidth should be about 10 times greater than the highest modulation frequency of interest.

For the 60 Hz fundamental, a 1 kHz video bandwidth works well.

11 Press (MEAS/USER) and **% AM ON OFF** so that ON is underlined. The spectrum analyzer reads out the percent AM of the largest modulation frequency. An arrow indicates the signal being measured. See Figure 50. This measurement does not include all of the harmonics of the modulating signal.

NOTE: The percent AM function will not run if the **SIGNAL CLIPPED** error message is being displayed. Increase the reference level until the error message goes away.

When the FFT measurement is active, pressing the (MEAS/USER) key will cycle between the MEAS/USER and FFT menus.

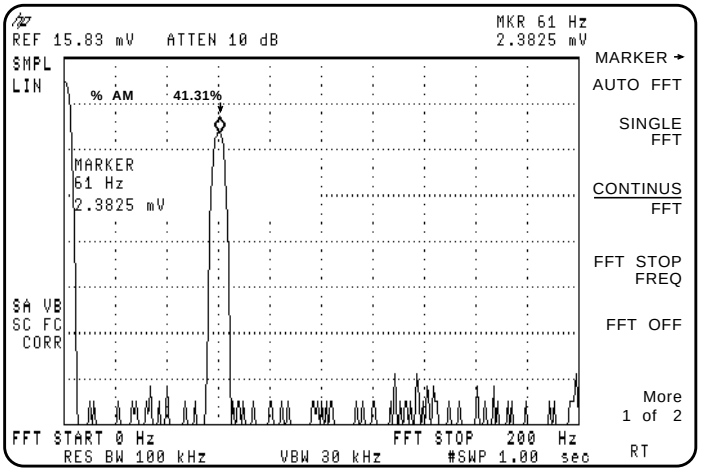


Figure 50 Percent Amplitude Modulation Measurement

Example 2: Use the automatic FFT measurement to look at 60 Hz AM modulation.

1 Connect a signal generator to the spectrum analyzer INPUT 50Ω. Adjust the signal generator to produce an AM signal with a 60 Hz modulation frequency.

2 Press (FREQUENCY) and set the spectrum analyzer center frequency to the frequency of the modulated input signal. Press (SPAN), 10 (MHz). Press (FREQUENCY) to keep the signal on the spectrum analyzer display.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3 Press (MEAS/USER), **FFT Menu**, and **MARKER → AUTO FFT**. This initiates the FFT function and activates a marker.

4 Use the knob to place the marker on the AM modulated signal and press **MARKER → AUTO FFT** again. The spectrum analyzer will perform the following steps:

- Save the present instrument state in state register 8.
- Reduce the span to zoom in on the signal.
- Set the detector mode to sample.
- Set the scale to linear.
- Change the span to zero span.
- Start the continuous FFT function.
- Set the FFT stop frequency to 10 kHz.

5 Press **FFT STOP FREQ**, 250 (Hz). This sets the spectrum analyzer to include the fourth harmonic of the 60 Hz modulation signal on the screen.

6 To confirm that the resolution bandwidth and video bandwidth are correct for measuring the modulation amplitude, use the following procedure:

a Press (MKR) and use the knob to move the marker to the desired modulation signal. In this example, place the marker on the 60 Hz fundamental modulation signal.

b Press (BW) and decrease the resolution bandwidth using the (⇩) key, until measured signal amplitude drops. Then press (⇧) to increase the bandwidth until the signal amplitude stops increasing and stays the same, or until the maximum resolution bandwidth is reached. Use the narrowest bandwidth that does not cause a change in the signal amplitude.

NOTE: As the resolution bandwidth is stepped down, the modulated signal must be re-centered on the spectrum analyzer display. If this is not done, the signal amplitude can decrease due to off tuning of the spectrum analyzer and not because of the resolution bandwidth chosen.

For the best amplitude accuracy, the resolution bandwidth should be about 10 times greater than the highest modulation frequency of interest.

For the 60 Hz fundamental, a 1 kHz resolution bandwidth works well. (For the HP 8593E, HP 8594E, HP 8595E, and HP 8596E, if harmonics are not a concern, a 100 kHz resolution bandwidth can be used and it will provide a faster update rate.)

c Press (BW), **VID BW AUTO MAN** (MAN) and use the step keys to decrease the video bandwidth until the amplitude of the measured signal drops. Then

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

step the bandwidth up until the signal amplitude stops increasing, or until the maximum video bandwidth is reached. Use the narrowest video bandwidth that does not cause a change in the signal amplitude.

For the best amplitude accuracy, the video bandwidth should be about 10 times greater than the highest modulation frequency of interest.

For the 60 Hz fundamental, a 1 kHz video bandwidth works well.

7 Press (MEAS/USER) and **% AM ON OFF** so that ON is underlined. The spectrum analyzer reads out the percent AM of the largest modulation frequency. An arrow indicates the signal being measured. See Figure 50 on page 105. This measurement does not include all of the harmonics of the modulating signal.

NOTE: The percent AM function will not run if the **SIGNAL CLIPPED** error message is being displayed. Increase the reference level until the error message goes away.

To return to the spectrum analyzer state prior to running the FFT function, press the **FFT OFF** softkey. This turns off the FFT function. Press (RECALL), **INTERNAL → STATE**, and 8 to recall the state from state register 8.

When the FFT measurement is active, pressing the (MEAS/USER) key will cycle between the MEAS/USER and FFT menus.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Stimulus-Response Measurements

NOTE: This application should only be performed using an HP 8593E, HP 8594E, HP 8595E, or HP 8596E with Option 010.

What Are Stimulus-Response Measurements?

Stimulus-response measurements require a source to stimulate a device under test (DUT), a receiver to analyze the frequency-response characteristics of the DUT, and, for return-loss measurements, a directional coupler. Characterization of a DUT can be made in terms of its transmission or reflection parameters. Examples of transmission measurements include flatness and rejection. A reflection measurement is return loss.

A spectrum analyzer combined with a tracking generator forms a stimulus-response measurement system. With the tracking generator as the swept source and the spectrum analyzer as the receiver, operation is analogous to a single-channel scalar network analyzer. A narrow-band system has a wide dynamic measurement range, but the tracking generator's output frequency must be made to precisely track the spectrum analyzer input frequency. This wide dynamic range will be illustrated in the following example. Figure 51 shows the block diagram of a spectrum analyzer and tracking-generator system.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

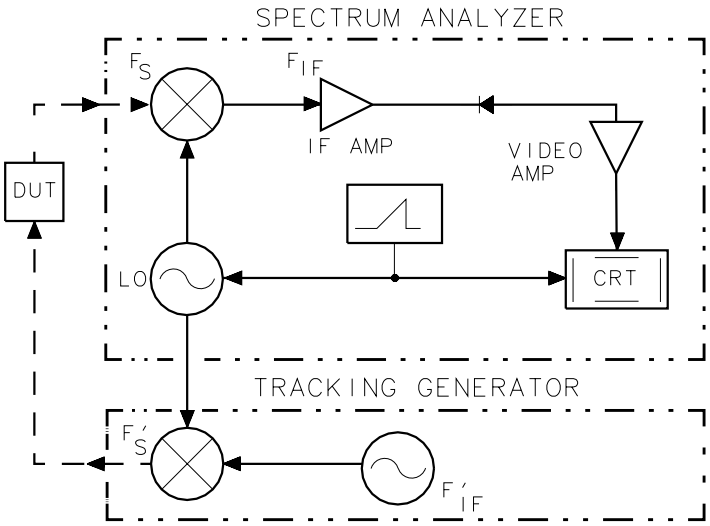


Figure 51 Block Diagram of a Spectrum Analyzer/Tracking-Generator Measurement System

Using A Spectrum Analyzer With A Tracking Generator

The procedure below describes how to use the built-in tracking generator system of the HP 8590E-Series Option 010 spectrum analyzer to measure the rejection of a low-pass filter which is a type of transmission measurement. Illustrated in this example are the functions in the tracking-generator menu, such as adjusting the tracking-generator output power, source calibration, and normalization. Refer to the HP Spectrum Analyzer Seminar, or Application Note 150-7, for more information.

Stepping Through the Measurement

There are four basic steps in performing a stimulus-response measurement, whether it be a transmission or reflection measurement: set up the spectrum analyzer settings, calibrate, normalize, and measure.

1 If necessary, perform the self-calibration routine for the tracking generator described in “Performing the Tracking Generator Self-Calibration Routine” in the *HP 8590E-Series Spectrum Analyzer User’s Guide*.

2 To measure the rejection of a low-pass filter, connect the equipment as shown in Figure 52. This example uses a filter with a cut-off frequency of 300 MHz as the DUT.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

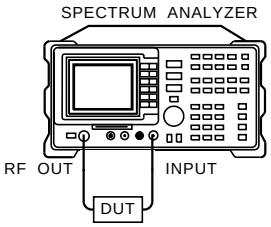


Figure 52 Transmission Measurement Test Setup

3 Activate the tracking generator menu by pressing (AUX CTRL) and **Track Gen**. To activate the tracking-generator power level, press **SRC PWR ON OFF** until ON is underlined. See Figure 53.

CAUTION: Excessive signal input may damage the DUT. Do not exceed the maximum power that the device under test can tolerate.

NOTE: To reduce ripples caused by source return loss, use 10 dB or greater tracking generator output attenuation. Tracking generator output attenuation is normally a function of the source power selected. However, the output attenuation may be controlled by using **SRC ATN AUTO MAN**. Refer to specifications and characteristics in your calibration guide for more information on the relationship between source power and source attenuation.

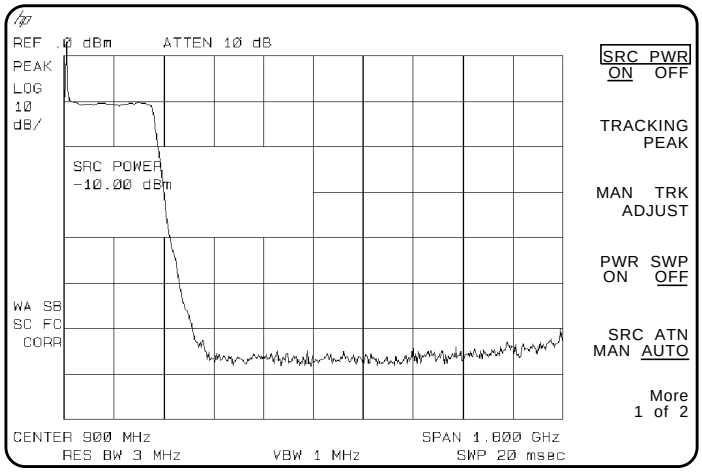


Figure 53 Tracking-Generator Output Power Activated

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

4 Put the sweep time of the analyzer into stimulus-response auto-coupled mode by pressing **More 1 of 2**, then **SWP CPLG SR SA** until SR (stimulus-response mode) is underlined. Auto-coupled sweep times are usually much faster for swept-response measurements than they are for spectrum analyzer measurements.

NOTE: In the stimulus-response mode, the Q (reactance versus resistance) of the DUT can determine the fastest rate at which the spectrum analyzer can be swept. To determine whether the analyzer is sweeping too fast, slow the sweep time and note whether there is a frequency or amplitude shift of the trace. Continue to slow the sweep time until there is no longer a frequency or amplitude shift.

5 Since we are only interested in the rejection of the low-pass filter, tune the spectrum analyzer center frequency so that the roll-off of the filter comprises the majority of the trace on the display (see Figure 54).

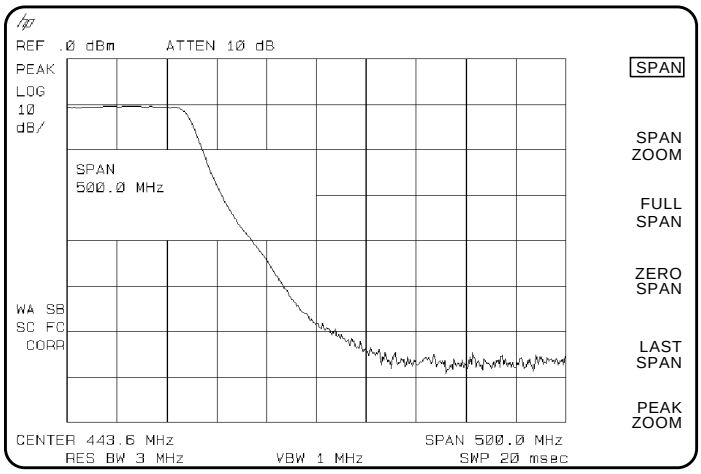


Figure 54 Spectrum Analyzer Settings According to the Measurement Requirement

6 Decrease the resolution bandwidth to increase sensitivity, and narrow the video bandwidth to smooth the noise. In Figure 55, the resolution bandwidth has been decreased to 10 kHz.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

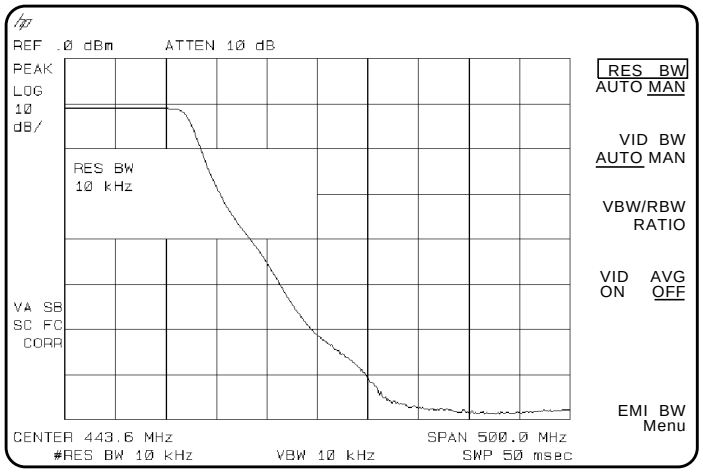


Figure 55 Decrease the Resolution Bandwidth to Improve Sensitivity

Adjusting the resolution bandwidth may result in a decrease in amplitude of the signal. This is known as a tracking error. Tracking errors occur when the tracking generator's output frequency is not exactly matched to the input frequency of the spectrum analyzer. Tracking errors are most notable when using narrow resolution bandwidths. Tracking error can be compensated manually or automatically. In narrow bandwidths, the manual method of adjusting the tracking is usually faster than the automatic tracking adjustment.

To compensate for the tracking error manually, press AUX CTRL, **Track Gen**, and **MAN TRK ADJUST**, then use the knob to adjust the trace for the highest amplitude. To compensate for the tracking error automatically, press AUX CTRL, **Track Gen**, then **TRACKING PEAK**.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

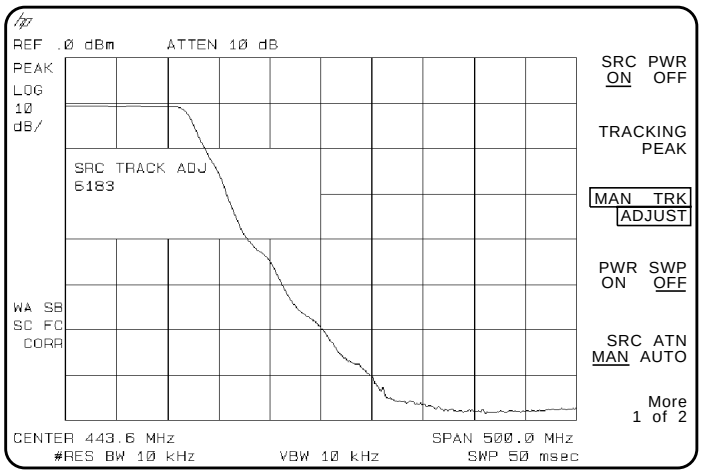


Figure 56 Manual Tracking Adjustment Compensates for Tracking Error

NOTE: If the automatic tracking routine is activated in a narrow resolution bandwidth, it usually is not necessary to use the tracking adjust again when increasing the resolution bandwidth.

7 To make a transmission measurement accurately, the frequency response of the test system must be known. To measure the frequency response of the test system, connect the cable (but not the DUT) from the tracking generator output to the spectrum analyzer input. Press (TRACE), **TRACE A B C** (so B is underlined), **CLEAR WRITE B**, **BLANK B**. The frequency response of the test system is now stored in trace B.

8 To normalize, reconnect the DUT to the spectrum analyzer. Press (TRACE), **More 1 of 3**, **NORMLIZE ON OFF** until ON is underlined. Press **NORMLIZE POSITION** to activate the display line. This display line marks the normalized reference position, or the position where 0 dB insertion loss (transmission measurements) or 0 dB return loss (reflection measurements) will normally reside. Using the knob results in a change in the position of the normalized trace, within the range of the graticule.

Normalization eliminates the frequency response error of the test system. When normalization is on, trace math is being performed on the active trace. The trace math performed is trace A minus trace B plus the display line, with the result placed into trace A. Remember that trace A contained the measurement trace,

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

trace B contained the stored calibration trace, and DL (display line) represents the normalized reference position. Note that the units of the reference level, dB, reflect this relative measurement.

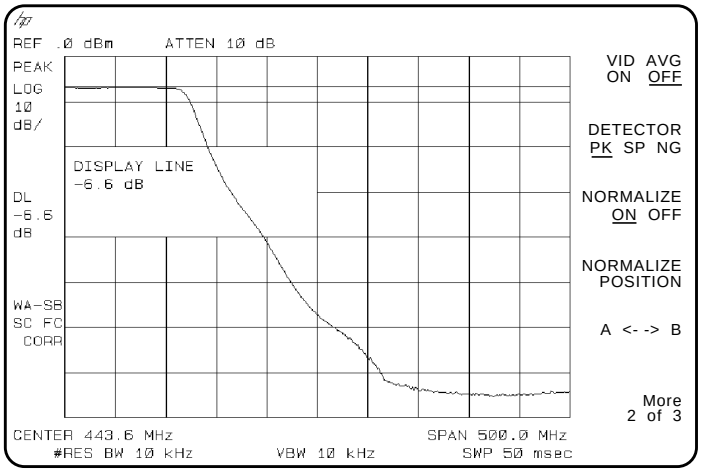


Figure 57 Normalized Trace

9 To measure the rejection of the filter at a given frequency, press (MKR), and enter the frequency. For example, enter 350 MHz. The marker readout displays the rejection of the filter at 350 MHz (see Figure 58).

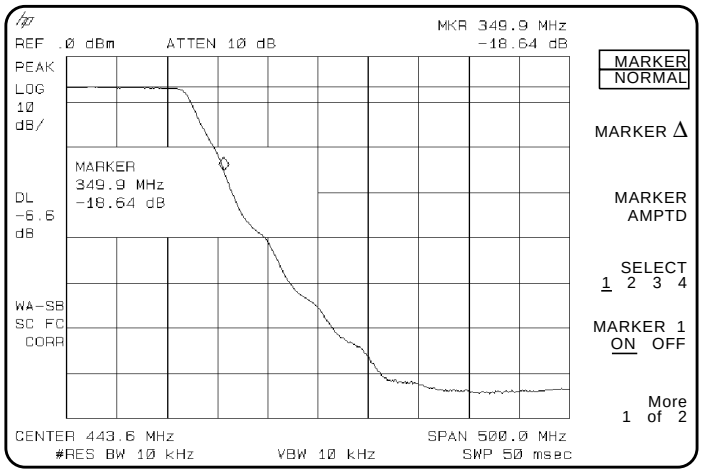


Figure 58 Measure the Rejection Range with Delta Markers

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Tracking Generator Unleveled Condition

When using the tracking generator, the message **TG UNLVL** may appear. The **TG UNLVL** message indicates that the tracking generator source power (**SRC PWR ON OFF**) could not be maintained at the user-selected level during some portion of the sweep. If the unleveled condition exists at the beginning of the sweep, the message will be displayed immediately. If the unleveled condition occurs after the sweep begins, the message will be displayed after the sweep is completed. A momentary unleveled condition may not be detected when the sweep time is small. The message will be cleared after a sweep is completed with no unleveled conditions.

The unleveled condition may be caused by any of the following:

- Start frequency is too low or the stop frequency is too high. The unleveled condition is likely to occur if the true frequency range exceeds the tracking generator frequency specification (especially the low frequency specification). The true frequency range being swept may be significantly different than the start or stop frequency annotations indicate, depending on other spectrum-analyzer settings, especially the span (see specifications and characteristics in your calibration guide for your instrument). For better frequency accuracy, use a narrower span.
- Tracking peak may be required (use **TRACKING PEAK**).
- Source attenuation may be set incorrectly (select **SRC ATN MAN AUTO** (AUTO) for optimum setting).
- The source power may be set too high or too low, use **SRC PWR ON OFF** to reset it.
- The source power sweep may be set too high, resulting in an unleveled condition at the end of the sweep. Use **PWR SWP ON OFF** to decrease the amplitude.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Using the One Button Measurements to Measure N dB Bandwidth, Percent Amplitude Modulation, and Third Order Intercept (TOI)

The spectrum analyzer includes one-button measurement functions. With one key press they make accurate measurements of:

- N dB Bandwidth
- Percent Amplitude Modulation
- Third Order Intermodulation

The signal or signals being measured must be displayed before activating the measurement. Measurements are made continuously, updating at the end of each sweep. This allows you to make adjustments and see changes as they happen. The single sweep mode can also be used, providing time to study or record the data. The individual measurements are described below.

N dB Bandwidth Measurement

It is often necessary to measure a signal response's bandwidth, such as when testing a band-pass filter. The signal to be measured must be centered on the display with a span that includes the full response. Activate the measurement by turning the **N dB PTS ON OFF** key (ON). The spectrum analyzer places arrow markers at the –3 dB points on either side of the response and reads the bandwidth. For other bandwidth responses enter the number of dB down desired, from 1 dB to 80 dB.

No other signal can appear on the display within N dB of the highest signal. The measured signal cannot have more than one peak that is greater than or equal to N dB. A signal must have a peak greater than the peak excursion to be identified. The default value for the peak excursion is 6 dB.

The N dB bandwidth measurement error is typically:

- about ±2% of the span, for spans <10 MHz
- about ±3% of the span, for spans >10 MHz

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

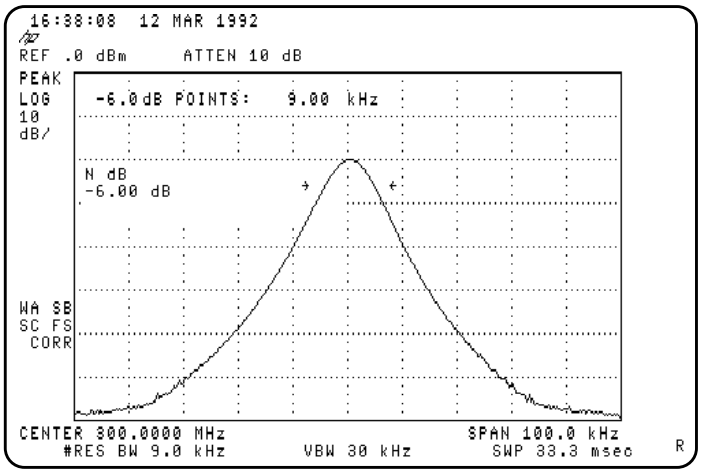


Figure 59 N dB Bandwidth Measurement

Example: Measure the 6 dB bandwidth of the spectrum analyzer internal 9 kHz EMI bandwidth.

1. On the spectrum analyzer, press (PRESET), (PEAK SEARCH), (MKR FCTN), **MK TRACK ON OFF** (ON), (SPAN), and enter 200 kHz.
2. Select the 9 kHz EMI bandwidth by pressing (BW), **EMI BW Menu**, and **9 kHz EMI BW**.
3. Press (MEAS/USER) and **N dB PTS ON OFF** (ON) to activate the N dB bandwidth function.
4. Read the measurement results in the upper left corner of the screen.
5. The knob or the data entry keys can be used to change the N dB value from 3 dB to 6 dB.
6. Press **N dB PTS ON OFF** (OFF) to turn the measurement off.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Percent Amplitude Modulation Measurement

Percent amplitude modulation can be measured quickly and easily using the one-button % AM function. The signal and both its sidebands must be on the display. The sidebands are assumed to be entirely from amplitude modulation. The spectrum analyzer places arrow markers on the three signals to be used to compute percent amplitude modulation, and displays the value. If the sidebands are not in the frequency span or their frequency spacing is not equal, the measurement stops and an error message is displayed.

Percent AM measurement accuracy for close signals:

- typically about ±0.1%/%, for log mode
- typically about ±3%, for linear mode

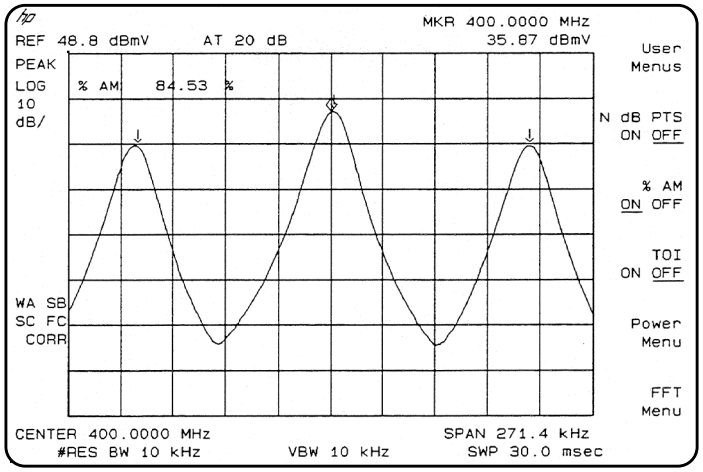


Figure 60 Percent Amplitude Modulation Measurement

Example: Use the % AM function to make a measurement.

1 Press (PRESET). Connect a signal with amplitude modulation, to the spectrum analyzer INPUT 50Ω.

2 Press (FREQUENCY) and enter the frequency of your input signal to place the signal at the spectrum analyzer center frequency.

3 Press (SPAN). Change the span until only the signal and its two sidebands appear on the display.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

4 Press (MEAS/USER) and **% AM ON OFF** (ON) to activate the percent amplitude modulation function.

5 Read the measurement results in the upper left corner of the screen.

6 Press **% AM ON OFF** (OFF) to turn the measurement off.

Third Order Intermodulation Measurement (TOI)

Use the TOI one-button measurement to make quick and easy intermodulation measurements of microwave spectrum analyzers, mixers or converters. When the TOI measurement is turned on there must be four signals on the display, two test signals and their two associated distortion products. All of the signals must have peaks greater than the peak excursion value. (The default value for the peak excursion is 6 dB.) The two highest amplitude signals are assumed to be the test signals for the third-order intercept measurement.

The spectrum analyzer computes and displays the third order intercept (TOI) of the displayed signals, marking all four signals with arrows to confirm the correct signal selection. The measurement updates at the end of every sweep, which enables real-time optimization of devices or systems under test.

The third order intermodulation is calculated as follows:

$$TOI = \frac{2 \times Ampl_{signal\ A} - Ampl_{distortion\ product\ A} + Ampl_{signal\ B}}{2}$$

where the frequency of distortion product A is:

$$Freq_{distortion\ product\ A} = 2 \times Freq_{signal\ A} - Freq_{signal\ B}$$

*Third Order Intercept:*Third order intercept is defined as the absolute power level at which the third-order distortion products intercept the level of two equal level test signals. If the distortion products are due to true third-order distortion, then the measurement result will be independent of the level of the test signals.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

The measurement algorithm used by **TOI ON OFF** (see above equation) corrects for the two test signals being different amplitudes. The result is a calculated value for the two test signals being equal amplitude, and is independent of the absolute level of either test signal. In order to minimize the measurement error, it is best to keep the test signals as close as possible to the same level and to the top of the screen.

The TOI measurement accuracy (assuming the measured signals are near the top of the display) is typically about ±1.8 dB.

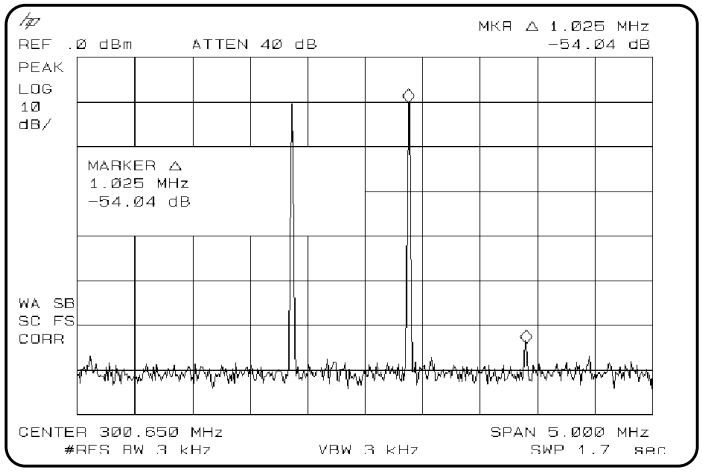


Figure 61 Third-Order Intermodulation Measurement

Example: Use the TOI function to make a measurement.

1. Press (PRESET). Connect two equal amplitude signals with different frequencies, to the spectrum analyzer INPUT 50Ω.
2. Press (FREQUENCY) and enter the frequency of one of your input signals to place the signal at the spectrum-analyzer center frequency.
3. Press (SPAN). Change the span until only the two signals and their two distortion products appear on the display.
4. Press (MEAS/USER) and **TOI ON OFF** (ON) to activate the third order intercept measurement function.
5. Read the measurement results in the upper left corner of the screen.
6. Press **TOI ON OFF** (OFF) to turn the measurement off.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

It is important to verify that the TOI being measured is coming from the device under test and not from the spectrum analyzer. An easy way to do this is as follows:

1. Set up the TOI measurement and turn it on.
2. Press (AMPLITUDE), **ATTEN AUTO MAN** (AUTO) and increase the attenuation +10 dB by pressing (⇧).
3. If the displayed result of the TOI measurement remains constant, then the value is the result of the device under test.
4. If the displayed result of the TOI measurement decreases, then the value is due to spectrum analyzer distortion and not the device under test. In this case, continue to increase the attenuator setting until the measurement result no longer changes as the attenuator is changed. When the value remains constant, the result is from the device under test.

   Increasing the attenuator setting of the spectrum analyzer decreases the level of the signal internal to the spectrum analyzer and therefore decreases the distortion generated by the analyzer. Refer to the characteristics information in specifications and characteristics in your calibration guide for a graph of the typical distortion performance of the spectrum analyzer.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Saving and Recalling Data from Analyzer Memory

This section explains how to save and recall state, trace, limit line, and amplitude correction factor data to and from spectrum analyzer memory. You can use **STATE → INTRNL** to store up to eight states in analyzer memory, and **Trace → Intrnl** to store many traces, limit-line tables, and amplitude-correction factors.

Saving state data saves the spectrum analyzer settings, but not the trace data. Saving trace data saves the trace data and the state data. Limit-line data and amplitude correction factors are stored in trace registers, but state and trace data are not recalled with the limit-line data or the amplitude correction factors. States, traces, limit-line tables, and amplitude correction factors are saved in spectrum analyzer memory even if the instrument is turned off or (PRESET) is pressed.

Refer to CROSS REF TO NEXT TABLE at the end of this section for a summary of saving and recalling data to and from spectrum analyzer memory.

To Save a State

1. Set up the spectrum analyzer settings to be saved.
2. Press (SAVE). If CARD is underlined, press **INTERNAL CARD** to select INTERNAL. Selecting INTERNAL selects the spectrum analyzer memory as the mass storage device.
3. Press **STATE → INTRNL**. **SAVE: REG** is displayed on the spectrum analyzer display.
4. Enter a number from one to eight using the numeric keypad and the state is saved automatically.

To Recall a State

1. Press (RECALL). If CARD is underlined, press **INTERNAL CARD** to select INTERNAL.
2. Press **INTERNAL → STATE**.
3. Enter the register number under which the state was saved and the state is recalled automatically.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

State data can also be recalled by using the catalog:

1 Press (RECALL). If CARD is underlined, press **INTERNAL CARD** to select INTERNAL.

2 Press **Catalog Internal** and **CATALOG REGISTER**. Use the knob to highlight the number of the state register to be retrieved. The state registers have a “ST” preceding the register number.

3 Press **LOAD FILE**.

NOTE: Register 9 is a special register which can aid in recovering from inadvertent loss of line power (power failure). Press (RECALL), **INTERNAL → STATE**, then 9 to place the spectrum analyzer in the state that existed just prior to the loss of power or set POWER ON LAST to do this automatically.

To Save a Trace

Saving trace data is very similar to saving state data. Saving trace data saves both the trace data and the state data.

1 Enter a screen title, if desired, by using (DISPLAY) and **Change Title**.

2 Set up the trace to be stored.

3 Press (SAVE). If CARD is underlined, press **INTERNAL CARD** to select INTERNAL.

4 Press **Trace → Intrnl**. This accesses a menu displaying **TRACE A**, **TRACE B**, and **TRACE C**.

5 Press the softkey for the trace that you want to save: **TRACE A**, **TRACE B**, or **TRACE C**. **REGISTER #** and **MAX REG # =** are displayed on the spectrum analyzer display. The number after **MAX REG # =** indicates the maximum register number that can be entered for trace storage in spectrum analyzer memory.

6 Use the numeric keypad to enter a number from 0 to the maximum register number and then press (ENTER).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

To Recall a Trace

1 Press (RECALL). If CARD is underlined, press **INTERNAL CARD** to select INTERNAL.

2 Press **Internal → Trace**. This accesses a menu displaying **TRACE A**, **TRACE B**, **TRACE C**, **LIMIT LINES**, and **AMP COR**.

3 Press **TRACE A**, **TRACE B**, or **TRACE C** to select the trace in which you want to place the trace data.

4 Enter the register number under which the trace was stored.

5 Press (ENTER). The recalled trace is placed in the view mode and the spectrum analyzer state is changed to the state that was saved.

Trace data can also be recalled by using the catalog:

1 Press (RECALL). If CARD is underlined, press **INTERNAL CARD** to select INTERNAL.

2 Press **Catalog Internal**, **CATALOG REGISTER**. Use the knob to highlight the number of the trace register to be retrieved. The trace registers have a “TR” preceding the trace register number.

3 Press **LOAD FILE**. The recalled trace is placed into trace B and the spectrum analyzer state is changed to the state that was saved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

To Save a Limit-Line Table or Amplitude Correction Factors

The procedure for saving limit-line tables or amplitude correction factors is similar to saving trace data. State and trace data is not recalled with limit-line tables or amplitude-correction factors.

1. Enter a screen title, if desired, by using (DISPLAY), **Change Title**. The screen title is displayed when **CATALOG REGISTER** is used to catalog the trace registers. The screen title is not recalled, however, with the limit-line tables or amplitude correction factors.
2. When saving limit-line tables, set up the limit-line table to be stored. See "Using the Limit-Line Functions" in this chapter. When saving amplitude correction factors, enter the data using the remote programming AMPCOR command or use the amplitude-correction function softkeys. See "Using Amplitude Correction Functions" in this chapter for more information about entering amplitude correction factors via the front-panel.
3. Press (SAVE). If CARD is underlined, press **INTERNAL CARD** to select INTERNAL.
4. Press **Trace → Intrnl**. This accesses a menu with **LIMIT LINES** and **AMP COR**.
5. Press **LIMIT LINES** to save limit-line tables. Press **AMP COR** to save amplitude-correction factors. **REGISTER #** and **MAX REG # =** are displayed on the spectrum analyzer screen. The number after **MAX REG # =** indicates the maximum register number that can be entered for storage in spectrum analyzer memory.
6. Use the numeric keypad to enter a number from 0 to the maximum register number and then press (ENTER).

To Recall Limit-Line Tables or Amplitude Correction Factors

1. Press (RECALL). If CARD is underlined, press **INTERNAL CARD** to select INTERNAL.
2. Press **Internal → Trace**. This accesses a menu with **LIMIT LINES** and **AMP COR**.
3. Press either **LIMIT LINES** to recall a limit-line table or, **AMP COR** to recall amplitude-correction factors.
4. Enter the register number under which the data was stored.
5. Press (ENTER).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

To Protect Data From Being Overwritten

If you want to protect all state, trace, limit line, and amplitude correction data from being overwritten, press (SAVE), then **SAV LOCK ON OFF** so that ON is underlined. Table 3 summarizes the functions when saving and recalling data to and from spectrum analyzer memory.

NOTE: This feature does not protect state, trace, limit line, and amplitude correction data from (ERASE MEM ALL).

Table 3 Summary of Save and Recall Operations, Analyzer Memory

Operation	Screen Title Available?	Register Range	Key Sequence
save state	No	1 to 8	(SAVE) **STATE → INTRNL** (register number)
recall state	No	1 to 8*	(RECALL) **INTERNAL → STATE** (register number)†
save trace	Yes	0 to MAX REG #	(SAVE) **Trace → Intrnl** (**TRACE A**, **TRACE B**, or **TRACE C**) (register number) (ENTER)
recall trace	Yes	0 to MAX REG #	(RECALL) **Internal → Trace** (**TRACE A**, **TRACE B**, or **TRACE C**) (register number) (ENTER)†

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Table 3 Summary of Save and Recall Operations, Analyzer Memory

Operation	Screen Title Available?	Register Range	Key Sequence
save limit line table	Yes‡	0 to MAX REG #	(SAVE) **Trace → Intrnl** **LIMIT LINES** (register number) (ENTER)
recall limit line table	No	0 to MAX REG #	(RECALL) **Internal → Trace** **LIMIT LINES** (register number) (ENTER)†
save amplitude correction factors	Yes	0 to MAXREG #	(SAVE) **Trace → Intrnl** **AMP COR** (register number) (ENTER)
recall amplitude correction factors	No	0 to MAX REG #	(RECALL) **Internal → Trace** **AMP COR** (register number) (ENTER)†
* Registers 1 through 8 are available for the user to save a state. State register 0 contains the current state of the analyzer, state register 9 contains the previous state of the spectrum analyzer.			
† The alternate method for recalling data uses the key sequence: (RECALL), **Catalog Internal**, **CATALOG REGISTER**, use the step keys or knob to highlight the item to be recalled, **LOAD FILE**.			
‡ The screen title is displayed when cataloging the trace registers with **CATALOG REGISTER**. The screen title is not recalled with the limit-line tables or amplitude correction factors.			

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Saving and Recalling Data from the Memory Card

The memory card provides additional memory for saving instrument states, traces, display images, limit-line tables, amplitude correction factors, and programs. Each HP 85700A battery-backed RAM card provides 32 kilobytes of memory. Several different memory cards are available with up to 512 kilobytes of memory. Instrument states, traces, display images, limit-line tables, amplitude-correction factors, and programs are easily retrievable without the need for an external controller to transfer data.

The process of saving and recalling data from the memory card is similar to saving and recalling data from the spectrum analyzer memory. Due to the expanded capabilities of the memory card, there are some important differences. For example, data is stored in spectrum analyzer memory as an item; on the memory card data is stored as a logical interchange file (LIF). Memory card data can be stored and recalled using a prefix. A prefix is an optional user-defined label for states, traces, and programs. The prefix becomes part of the file name. If you do not specify a prefix, the file name will be created without it. Table 4 on page 129 compares the save and recall operations of spectrum analyzer memory and the memory card.

Refer to Figure 5 on page 138 at the end of this section for a summary of saving and recalling data to and from spectrum analyzer memory.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Table 4 Comparison of Analyzer Memory and Memory Card Operations

Mass Storage Device	Data Stored As	Stored with a Prefix?	Restriction on Register Number	Types of Data That Can Be Stored	Catalog Functions Available
Analyzer Memory	Item	No	1 to 8 for states, 0 to MAXREG # for traces, limit lines, amplitude correction factors	States, traces, limit-line tables, amplitude correction factors	`CATALOG ALL` `CATALOG REGISTER` `CATALOG VARIABLS` `CATALOG ON EVENT` `CATALOG PREFIX` `CATALOG DLP` `DELETE FILE` `LOAD FILE` †
Memory Card	File	Yes	Prefix + register # ≤ 8 characters	States, traces, limit-line tables, amplitude correction factors, display images, and downloadable programs	`CATALOG ALL` `CATALOG STATES` `CATALOG TRACES` `CATALOG PREFIX` `CATALOG DLP` `CATALOG AMP COR` `CATALOG LMT LINE` `DELETE FILE` `LOAD FILE`
Specifies types of data that can be stored by using normal front-panel operation.					
† When cataloging analyzer memory, `LOAD FILE` is available for `CATALOG REGISTER` only.					

Preparing the Memory Card for Use

NOTE: Improper insertion causes error messages to occur, but generally does not damage the card or instrument. Care must be taken, however, not to force the card into place. The cards are easy to insert when installed properly.

1 Locate the arrow printed on the card's label.

2 Insert the card with its arrow matching the raised arrow on the bezel around the card-insertion slot. See Figure 62 on page 130.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

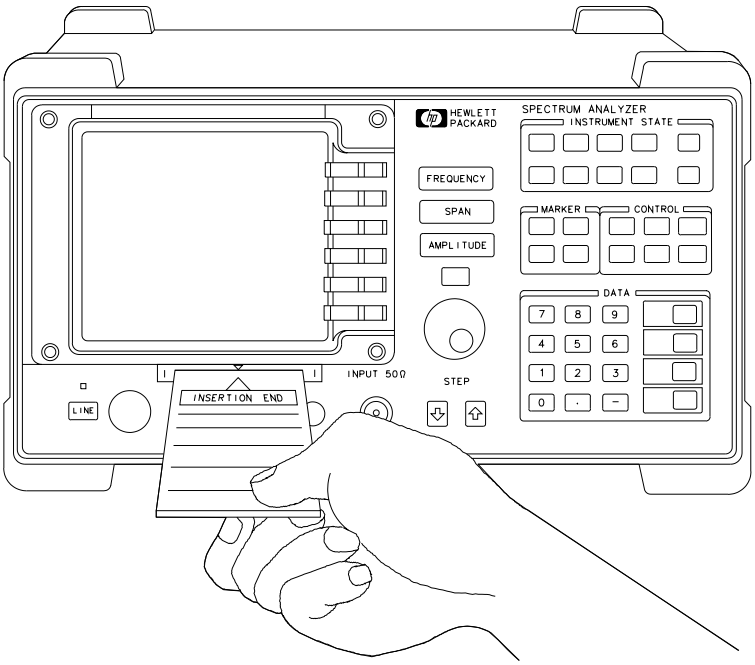


Figure 62 Inserting the Memory Card

3 Press the card into the slot. When correctly inserted, about 19 mm (0.75 in) of the card is exposed.

4 If this is a new memory card, it must be formatted before use. Since formatting a card deletes any data stored on the memory card, catalog the card before using the format card function if you suspect the memory card might contain data.

To format a new card, press CONFIG, **More 1 of 3**, **Card Config**, **FORMAT CARD**. The message **If you are sure, press key again to purge data** appears on the spectrum analyzer screen. Press **FORMAT CARD** again. (**FORMAT CARD** requires a double key press.)

To catalog a memory card, press CONFIG, **More 1 of 3**, **Card Config**, **Catalog Card**. **Catalog Card** either displays any existing data that is on the memory card (if the memory card has been formatted) or, displays **INVALID CARD: DIRECTORY** if the card has not been formatted. Use **BLANK CARD** if you wish to delete the files from the memory card.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

To Enter a Prefix

Memory card data can be stored and recalled using a prefix. To enter a prefix, press (DISPLAY) or (CONFIG), **Change Prefix**.

Pressing **Change Prefix** accesses a menu containing the letters of the alphabet, the underscore symbol (_), the number symbol (#), a space, and the clear function. To select a character, press the softkey that displays the group of characters that contains the desired character. The softkey menu changes to allow you to select an individual character. If you make a mistake, press (BK SP) to space back over the incorrect character. Additional characters are available by pressing **More 1 of 2**. Numbers may be selected with the numeric keypad.

The prefix can be from one to seven characters long. The longer the prefix, the shorter the register number must be. The total length of the prefix and register number cannot exceed eight characters. The prefix can be any character; however, the underscore should not be the first character of the prefix.

An existing prefix can be cleared with the clear function. Press (CONFIG) or (DISPLAY), **Change Prefix**, **YZ_# Spc Clear**, then **Clear** to clear the current prefix. To change a prefix, clear the existing prefix and then enter a new prefix.

To Save a State

1 Press (DISPLAY) or (CONFIG), **Change Prefix**. Use the softkeys to enter the prefix under which you want the state saved. A prefix can be one to seven characters long.

   If you do not specify a prefix, the state will be saved with a file name consisting of s_(register number).

2 Press (SAVE). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD. Selecting CARD selects the memory card as the mass storage device.

3 Press **STATE → CARD**. **REGISTER #** and **PREFIX=** are displayed on the spectrum analyzer display.

4 Use the numeric keypad to enter a register number and then press (ENTER).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

To Recall a State

1 Press (SAVE) or (RECALL). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD.

2 Press **Catalog Card** then **CATALOG STATES**. Use the knob to highlight the state data to be retrieved.

3 Press **LOAD FILE**.

State data can also be recalled by specifying the prefix and the register number:

1 Use **Change Prefix** to enter the prefix, or use the existing prefix.

2 Press (RECALL). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD.

3 Press **CARD → STATE** .

4 Enter the register number that the state was saved under, and then press (ENTER).

To Save a Trace

Saving trace data saves the trace data and the state data.

1 Press (DISPLAY) or (CONFIG), and then **Change Prefix** to enter a new prefix or change the existing prefix.

If you do not specify a prefix, the trace will be saved with a file name consisting of s_(register number).

2 Enter a screen title, if desired, by using (DISPLAY) then **Change Title**.

3 Set up the trace to be stored.

4 Press (SAVE). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD. Press **Trace → Card** to access the menu that displays **TRACE A** , **TRACE B**, and **TRACE C**.

5 Press the softkey label of the trace that you want to save: **TRACE A**, **TRACE B**, or **TRACE C**. **REGISTER #** and **PREFIX=** are displayed on the spectrum analyzer display.

6 Use the numeric keypad to enter a register number and then press (ENTER).

The trace data is saved with a file name consisting of a “t,” the current prefix, an underscore (_), and the register number. The “t” denotes that the file contains trace data.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

To Recall a Trace

1 Press (SAVE) or (RECALL). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD.

2 Press **Catalog Card** then **CATALOG TRACES**. Use the knob to highlight the trace data to be retrieved.

3 Press **LOAD FILE**. The trace data is placed in trace B.

Trace data can also be recalled by specifying the prefix and the register number:

1 Use **Change Prefix** to enter the prefix, or use the existing prefix.

2 Press (RECALL). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD.

3 Press **Card → Trace** to access the menu that displays **TRACE A**, **TRACE B**, and **TRACE C**.

4 Select the trace in which you want the trace data stored by pressing **TRACE A**, **TRACE B**, or **TRACE C**.

5 Enter the register number that the trace was saved under and then press (ENTER). The recalled trace is placed in view mode.

To Save a Display Image

1 Press (DISPLAY) or (CONFIG), **Change Prefix**. Use the softkeys to enter a prefix under which you want the state saved. A prefix can be one to seven characters long.

If you do not specify a prefix, the display image will be saved with a file name consisting of i_(register number).

2 Press (SAVE). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD. Selecting CARD selects the memory card as the mass storage device.

3 Press **DISPLAY → CARD**. **REGISTER #** and **PREFIX=** are displayed on the spectrum analyzer display.

4 Use the numeric keypad to enter a register number and then press (ENTER).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

To Recall a Display Image

1 Use **Change Prefix** to enter the prefix, or use the existing prefix.

2 Press (SAVE) or (RECALL). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD.

3 Press **Catalog Card** then **CATALOG ALL**. Use the knob to highlight the display image data to be retrieved.

4 Press **LOAD FILE**.

NOTE: The intensity of some screen items may differ if the window configuration of the current spectrum analyzer state does not match the recalled display image. This will not affect the ability to copy the screen.

Display image data can also be recalled by specifying the prefix and the register number:

1 Press (RECALL). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD.

2 Press **CARD → DISPLAY**.

3 Enter the register number that the state was saved under, and then press (ENTER).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

To Save Limit-Line Tables or Amplitude Correction Factors

The procedure for saving limit-line tables or amplitude correction factors is similar to saving trace data. State and trace data is not recalled when the limit-line tables or amplitude correction factors are recalled.

1 Press (DISPLAY) or (CONFIG), **Change Prefix** to enter a new prefix or change the existing prefix.

If you do not specify a prefix, the limit line table will be saved with a file name consisting of l_(register number). A table of amplitude correction factors will be saved with a file name consisting of a_(register number).

2 When saving tables, set up the table to be stored. See "Using the Limit-Line Functions" or "Using Amplitude Correction Functions" for more information about entering data.

3 Press (SAVE). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD. Press **Trace → Card** to access the menu with **LIMIT LINES** and **AMP COR**.

4 Press either **LIMIT LINES**, to save limit-line tables, or **AMP COR**, to save amplitude-correction factors. **REGISTER #** and **PREFIX=** are displayed on the spectrum analyzer display.

5 Use the numeric keypad to enter a register number and then press (ENTER).

The data is saved with a file name consisting of a "l" (for limit-line tables) or "a" (for amplitude-correction factors), the prefix that was entered, an underscore (_), and the register number.

To Recall Limit-Line Tables or Amplitude Correction Factors

1 Use **Change Prefix** to enter the prefix, or use the existing prefix.

2 press (RECALL). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD.

3 Press **Card → Trace** to access the menu with **LIMIT LINES** and **AMP COR**.

4 Press either **LIMIT LINES**, to recall a limit-line table, or **AMP COR**, to recall amplitude-correction factors.

5 Enter the register number that the limit-line data or amplitude-correction factors was saved under and then press (ENTER).

NOTE: If **LOAD FILE** is used to recall limit-line files or amplitude-correction factor files, the traces are set to the store-blank mode. Press (TRACE), **CLEAR WRITE A** to view trace A data, or press (PRESET).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Saving and Recalling Programs with a Memory Card

Programs (also called downloadable programs or DLPs) can be loaded into spectrum analyzer memory either by loading a program from a memory card or by defining a function with programming commands. (Remote programming ability is available with Option 041 or 043).

The process of saving and recalling programs from the memory card is similar to saving state data. To save program information to the memory card use **ALL DLP → CARD**.

NOTE: **ALL DLP → CARD** saves an image of the spectrum analyzer memory. This means a program cannot be saved selectively if several programs are present in the spectrum analyzer memory at the time. Use **Catalog Internal**, **DELET FILE** to delete the items in user memory that you do not wish to be saved on the memory card. **ALL DLP → CARD** saves all programs and key definitions that are in spectrum analyzer memory onto the memory card.

To Save a Program

1. Press (CONFIG) or (DISPLAY), then **Change Prefix** to enter a new prefix or change the existing prefix.

   If you do not specify a prefix, the program will be saved with a file name consisting of d_(register number).

2. Press (SAVE). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD.

3. Press **ALL DLP → CARD**. **REGISTER #** and **PREFIX=** are displayed on the spectrum analyzer display.

4. Use the numeric keypad to enter a register number and then press (ENTER).

   The data is saved with a file name consisting of a "d," the prefix that was entered, an underscore (_), and the register number. The "d" denotes that the file contains downloadable program data.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

To Recall a Program

1 Press (SAVE) or (RECALL). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD. (CARD is underlined when the memory card is selected).

2 Press **Catalog Card**, **More 1 of 2**, then **CATAOLG DLP**. Use the knob to highlight the data to be retrieved.

3 Press **LOAD FILE**.

Programs can also be recalled by specifying the prefix and the register number:

1 Use **Change Prefix** to enter the prefix, or use the existing prefix.

2 Press (RECALL). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD.

3 Press **CARD → DLP**, enter the register number that the program was saved under, and then press (ENTER).

Table 5 summarizes the functions when saving and recalling data to and from the memory card.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Table 5 Save and Recall Functions Using Memory Card

Operation	Screen Title Available?	File Name	Register Range	Key Sequence
save state	No	s(current prefix)_(register #)	Prefix + register # ≤ 8 characters	(SAVE) **STATE → CARD** (register #) (ENTER)
recall state	No	s(current prefix)_(register #)	Prefix + register # ≤ 8 characters	(RECALL) **CARD → STATE** (register #) (ENTER)*
save trace	Yes	t(current prefix)_(register #)	Prefix + register # ≤ 8 characters	(SAVE) **Trace → Card** (**TRACE A**, **TRACE B**, or **TRACE C**) (register #) (ENTER)
recall trace	Yes	t(current prefix)_(register #)	Prefix + register # ≤ 8 characters	(RECALL) **Card → Trace** (**TRACE A**, **TRACE B**, or **TRACE C**) (register #) (ENTER)*
save display image	Yes†	i(currentprefix) _(register #)	Prefix + register # ≤ 8 characters	(SAVE) **DISPLAY → CARD** (register #) (ENTER)
recall display image	Yes†	i(currentprefix) _(register #)	Prefix + register # ≤ 8 characters	(RECALL) **CARD → DISPLAY** (register #) (ENTER)*
save limit line table	No	l(currentprefix) (register #)	Prefix + register # ≤ 8 characters	(SAVE) **Trace → Card** **LIMIT LINES** (register#) (ENTER)
recall limit line table	No	l(currentprefix)_(register #)	Prefix + register # ≤ 8 characters	(RECALL) **Card → Trace** **LIMIT LINES** (register #) (ENTER)*

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Table 5 Save and Recall Functions Using Memory Card

Operation	Screen Title Available?	File Name	Register Range	Key Sequence
save amplitude correction factors	No	a(currentprefix) _(register #)	Prefix + register # ≤ 8 characters	(SAVE) **Trace → Card** **AMP COR** (register #) (ENTER)
recall amplitude correction factors	No	a(currentprefix) _(register #)	Prefix + register # ≤ 8 characters	(RECALL) **Card → Trace** **AMP COR** (register#) (ENTER) *
save DLP	No	d(current prefix)_(register #)	Prefix + register # ≤ 8 characters	(SAVE) **ALL DLP → CARD** (register #) (ENTER)
recall DLP	No	d(current prefix)_(register #)	Prefix + register # ≤ 8 characters	(RECALL) **CARD → DLP** (register #) (ENTER) *
* An alternate method for recalling a file uses the key sequence: (RECALL), **Catalog Card**, **CATALOG ALL**, use the knob to highlight the desired file, then **LOAD FILE**.				
† The screen title is part of the display image, but is an image only. It is not recalled as a title.				

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5 If You Have a Problem

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5

If You Have a Problem

What You'll Find In This Chapter

This chapter helps you troubleshoot any problems found while operating the GSM Multiband Transmitter Measurement 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 GSM Multiband Transmitter Measurement Personality, consult the spectrum analyzer documentation.

This chapter uses displayed error messages as the foundation for troubleshooting problems with the GSM Multiband Transmitter Measurement 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.

- First, follow the procedure listed in "Before Troubleshooting." Most issues involving setup and common errors are discussed there.
- Second, if an error message is displayed, locate the message in "Error Messages" in this chapter and follow the directions given for that message.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5

Before Troubleshooting

If an error message appears, or if you suspect a problem, check the system setup first. Make sure the GSM Multiband Transmitter Measurement 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) returns the spectrum analyzer to the default state.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5

If the GSM Multiband Transmitter Measurement 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5

- 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5

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 'Intermodulation Attenuation Measurements' on page 67 to verify the setup.
- Ensure there is no carrier being generated which lies within the test frequency band.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5

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 measurement procedure 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 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 GSM digital demodulator is faulty or that the option 163 GSM 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

EXT 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 GSM Multiband Transmitter Measurement 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5

FAST ADC 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 GSM 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 85727A GSM Multiband Transmitter Measurement 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 GSM Multiband Transmitter Measurement Personality.

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 GSM 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5

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 85727A MEMORY CARD & TRY AGAIN

This message indicates that the memory card containing the GSM Multiband Transmitter Measurement 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 HP 85727A GSM Multiband Transmitter Measurement 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), **More 1 of 3**, **Dispose User Mem**, **ERASE DLP MEM**, **ERASE DLP MEM**, (PRESET).

  3 Reload the GSM Multiband Transmitter Measurement Personality using the procedure in 'Loading the HP 85727A GSM Multiband Transmitter Measurement Personality' on page 12.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5

MIDAMBLE BAD Error bits - 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.

NEWER FIRMWARE REQUIRED: REV 931217 OR LATER

This message indicates that the spectrum analyzer firmware must be updated before the GSM Multiband Transmitter Measurement 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 85727A GSM Multiband Transmitter Measurement Personality.

To solve this problem:

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 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 level.

NO CARRIER LEVEL <–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 level.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5

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 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

REFERENCE CHANNEL LEVEL <–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 level.

SIGNAL ERROR

This message indicates that an unexpected burst shape was detected.

To solve this problem:

- Record the value of 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 GSM 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5

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.

SIGNAL LEVEL LOW - 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 GSM 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5

SIGNAL LEVEL TOO 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 **MONITOR TX BAND** in the GSM main menu, and **P vs T FRAME** in the power vs. time menu.

SIGNAL PHASE ERROR TOO 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 GSM main menu, and **P vs T FRAME** in the power vs. time menu.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Index

Symbols
% AM ON OFF, 117

A
accessing
  GSM mode, 21, 39
  spectrum analyzer mode, 21, 39
accessing GSM analyzer menus, 22
accessing the personality, 14
adding the personality, 13
adjacent channel power measurement, 121
aliasing
  FFT function, 102
Amp Cor, 92
AMP COR ON OFF, 91, 94
amplitude correction
  amplitude coordinate, 94
  frequency coordinate, 94
  point, 92
  testing, 94
  using RECALL AMP COR, 94
  using SAVE AMP COR, 94
amplitude correction factors, 89
amplitude corrections
  creating, 91
  editing, 90
amplitude modulation measurement, 116
amplitude-correction factors, 89, 95
amplitude-correction functions, 92
amplitude-corrections
  creating, 90
analyzer distortion products, 96
analyzer memory
  recalling a state, 122
  recalling a trace, 124
  recalling amplitude-correction factors, 125
  recalling limit lines, 125
  saving a state, 122
  saving a trace, 123
  saving amplitude-correction factors, 125
  saving and recalling data, 122
  saving limit lines, 125
annotation, 22
attenuation setting, 26

B
bandwidth
  measurement, 116
base-station, effects on physical channel settings, 28
battery
  changing the battery, 15
BLANK CARD, 130

C
card
  changing the battery, 15
Catalog Card, 130
channel power measurement, 121
combiner tuning measurement, 45
common measurements
  stimulus-response, 108, 115
configuration for measurements, 26
core program, 40
creating amplitude-correction factors, 90

D
data protection, 126
default states, 29
default versus preset states, 29
definitions
  CRT text, iv
  hardkey, iv
  key, iv
  softkey, iv
deleting the personality from analyzer memory, 12
disabled hardkeys, 24
display annotation, 22
display image
  saving and recalling, 137
distortion products, 96
DLP, 136
downloadable programs, 136
downloading the DLP, 12
downloading the personality, 12

E
Edit Amp Cor, 92
EDIT DONE, 91, 94
editing amplitude corrections, 90
entering a prefix, 131
equipment required, 11
error messages, 147, 158
Ext precision freq reference required error message, 149
External trigger required error message, 149

F
Fast ADC card required
  (opt 101 or opt 151) error message, 150
fast Fourier transform function, 101
FFT display annotation, 102
FFT measurement, 101
  automatic, 105
  manual, 103
  setup, 102, 103
FORMAT CARD, 130
front-panel keys, 24

G
gate card required
  (opt 105) error message, 150
getting started, 12
GSM analyzer mode, 21, 39
GSM analyzer vs spectrum analyzer hardkeys, 24
GSM measurements attenuation, 26
GSM mode
  accessing, 21, 39

H
hanging up, spectrum analyzer, 143
hardkeys that are disabled, 24
how to use this manual, v

I
identifying distortion products, 96
intermodulation attenuation measurement, 67
intermodulation distortion, third order, 98
intermodulation products
  for RX band, 71
  for RX band intra-BSS, 79
  for TX band, 68
  for TX band intra-BSS, 77
intra-BSS intermodulation attenuation measurement, 76
INVALID SYMTAB ENTRY
  SYMTAB OVERFLOW error message, 151

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Index

L
loading the GSM program, 13
loading the personality, 13

M
main menu choices, 15
making measurements, 19, 37
  combiner tuning, 45
  intermodulation attenuation, 67
  intra-BSS intermodulation attenuation, 76
  mean transmitted RF carrier power, 41
  monitor TX band, 85
  output RF spectrum, 50
  output RF spectrum due to modulation RX band, 57
  phase and frequency error, 81
  power steps, 43
  power vs time, 47
  spurious emissions, 60
MAN TRK ADJUST, 112
mean transmitted RF carrier power measurement, 41
measurement
  if the personality does not make a measurement, 144
measurements
  if the test results are not what you expected, 144
  making, 19, 37
measurements and the memory card, 24
measuring amplitude modulation, 101
memory card
  battery, 15
  blank card, 130
  cataloging, 130
  changing the battery, 15
  formatting, 130
  preparation for use, 129
  recalling a display image, 134
  recalling a program, 137
  recalling a state, 132
  recalling a trace, 133
  recalling amplitude-correction factors, 135
  recalling limit lines, 135
  saving a display image, 133
  saving a program, 136
  saving a state, 131
  saving a trace, 132
  saving amplitude-correction factors, 135
  saving and recalling data, 128
  saving and recalling programs, 136
  saving limit lines, 135
  write-protect switch, 17
menu access, 22
mobile station transmitter, spurious emissions, 65
mobile-station, effects on physical channel settings, 28
MODE key, 21, 39
modulation
  multiple-offset mode, 52
  single-offset mode, 52
  swept frequency mode, 53
monitor TX band measurement, 85

N
N dB bandwidth measurement, 116
N dB PTS ON OFF, 116
Newer firmware required
  REV 931217 or later error message, 152
normalization, 113
NORMLIZE ON OFF, 113
notation conventions, iv

O
occupied power bandwidth measurement, 121
Option 101
  used with FFT measurements, 101
options required, 11
output RF spectrum
  due to modulation, 52
  measurement, 50

P
percent amplitude modulation measurement, 117
percent amplitude modulation measurement, 116
phase and frequency
  error measurement, 81
physical channel settings, 28
power bandwidth measurement, 121
power steps measurement, 43
power vs time
  measurement, 47
preparing memory card for use, 129
preset states, 29
preset versus default states, 29
problems
  if the personality does not make a measurement, 144
  if the test results are not what you expected, 144
protect data, 126
PURGE AMP COR, 92
purging the personality from analyzer memory, 12

R
RAM card, 15
recalling a display image from the memory card, 134
recalling a program from the memory card, 137
recalling a state from analyzer memory, 122
recalling a state from the memory card, 132
recalling a trace from analyzer memory, 124
recalling a trace from the memory card, 133
recalling amplitude correction factors from analyzermemory, 125, 126
recalling amplitude correction factors from the memorycard, 135
recalling limit lines from analyzer memory, 125, 126
recalling limit-line tables from the memory card, 135
receiver spurious emissions, 65
required options, 11
RX band
  intra-BSS intermodulation, 79
  measuring intermodulation products, 71

S
SAV LOCK ON OFF, 126
saving a display image on the memory card, 133

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Index

saving a limit-line table into analyzer memory, 125
saving a program on the memory card, 136
saving a state into analyzer memory, 122
saving a state on the memory card, 131
saving a trace into analyzer memory, 123
saving a trace on the memory card, 132
saving amplitude correction factors into analyzer memory, 125
saving amplitude correction factors into analyzermemory, 125
saving amplitude correction factors on the memory card, 135
saving and recalling data from analyzer memory, 122, 126
saving and recalling data from the memory card, 128, 137
saving and recalling programs with a memory card, 136
saving limit-line tables on the memory card, 135
SELECT AMPLITUD, 94
SELECT FREQ, 94
SELECT POINT, 92
setting for measurements, 26
spectrum analyzer mode
  accessing, 21, 39
spurious emissions
  measurements, 60
  mobile station transmitter, 65
  receiver, 65
  transmitter, 61
SRC PWR ON OFF, 110
stimulus-response measurements, 108
SWP CPLG SR SA, 110

T
test results, if the test results are not what you expected, 144
TG UNLVL message, 115
third order intercept measurement, 116
third order intermodulation measurement, 119
  verification of, 120
third-order intermodulation distortion, 98
TOI ON OFF, 119
Track Gen, 110
tracking generator
  normalization, 113
  operation, 108
  stimulus-response, 108
tracking generator unleveled condition, 115
TRACKING PEAK, 113
tracking peak
  automatic adjustment, 112
  manual adjustment, 112
transients
  multiple offset mode, 55
  single offset mode, 55
  swept frequency mode, 56
transmitter spurious emissions, 61
triggering, 31
  using the HP 85902A, 32
  using the HP 8922G, 34
  using the unit under test, 31, 36
TX band
  intra-BSS intermodulation, 77
  measuring intermodulation products, 68

U
unleveled condition, tracking generator, 115
using the personality, 14
using this manual, v

W
write-protect switch, 17

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP