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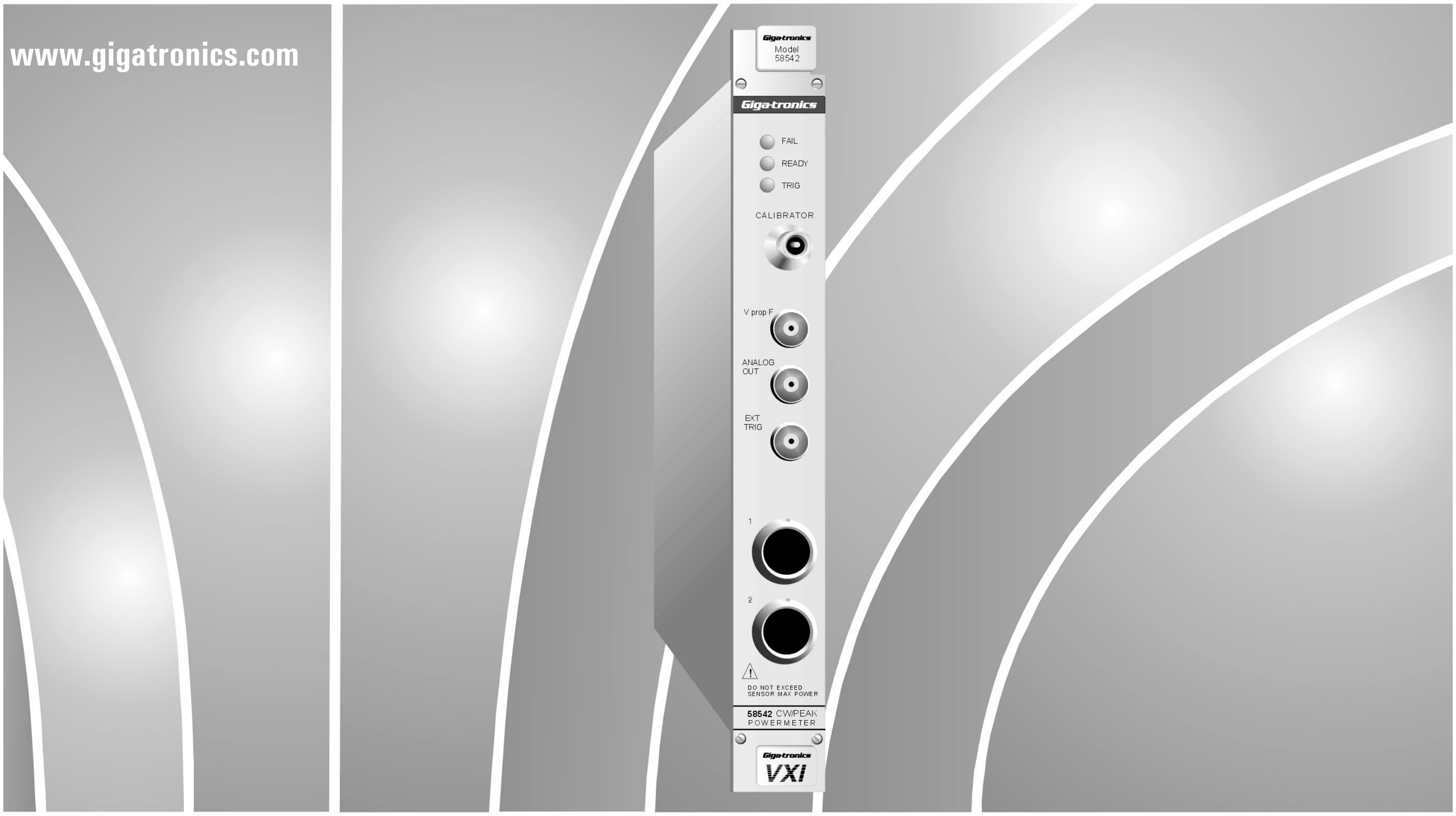

58542 VXIbus Universal Power Meter

Operation & Maintenance Manual

Registered 04 June 1996 ❖ Amended 10 September 2001
CE
Certified Product

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ISO 9001
Certified Process
Registrar: BSI, Certification FM 34226

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DECLARATION OF CONFORMITY

Application of Council Directive(s)

Standard(s) to which Conformity is Declared:

89/336/EEC and 73/23/EEC	EMC Directive and Low Voltage Directive
EN61010-1 (1993)	Electrical Safety
EN61326-1 (1997)	EMC – Emissions & Immunity

Manufacturer's Name:
Giga-tronics Incorporated

Manufacturer's Address:
4650 Norris Canyon Road
San Ramon, California 94583
U.S.A.

Type of Equipment:
Universal Power Meter

Model Series Number:
58540

Model Number in Series:
58542

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).

Steve Gredell
(Full Name)

(Signature)

Acting Director of Quality Assurance
(Position)

San Ramon, California
(Place)

August 2, 2002
(Date)

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About this Publication

This publication contains the following chapters to describe the operation and maintenance of the 58542 VXIbus Universal Power Meter.

Preface

In addition to a comprehensive Contents and general information about the publication, the Preface also contains a record of changes made to the publication since its production, and a description of Special Configurations. If a user-specific produce has been ordered, please refer to page xv for a description of the special configuration.

Chapters

1- Introduction

Contains a brief introduction to the instrument and its performance parameters.

2 - Operation

Contains a guide to the instrument and its configuration menus.

3 - Theory of Operation

Contains a block diagram level description of the instrument and its circuits for maintenance and applications.

4 - Calibration & Testing

Contains procedures for inspection, calibration and performance testing.

5 - Maintenance

Contains procedures for maintenance and troubleshooting.

6 - Parts Lists

Contains list of components, parts and their sources.

7 - Diagrams

Contains schematics and component diagrams for circuits.

Appendices

A - Program Examples

Contains examples of programs for controlling the 58542 remotely over the GPIB.

B - Power Sensors

Contains specifications and technical data for the selection and application of power sensors.

C - Options

Contains a description of options available for the 58542.

Index - 58542 VXIbus Universal Power Meter

A subject listing of contents for the 58542.

Changes that occur after production of this publication, and Special Configuration data will be inserted as loose pages in the publication binder. Please insert and/or replace the indicated pages as detailed in the Technical Publication Change Instructions included with new and replacement pages.

Conventions

The following conventions are used in this publication. Additional conventions not included here will be defined at the time of usage.

Warning

WARNING

The WARNING statement is encased in gray and centered in the page. This calls attention to a situation, or an operating or maintenance procedure, or practice, which if not strictly corrected or observed, could result in injury or death of personnel. An example is the proximity of high voltage.

Caution

CAUTION

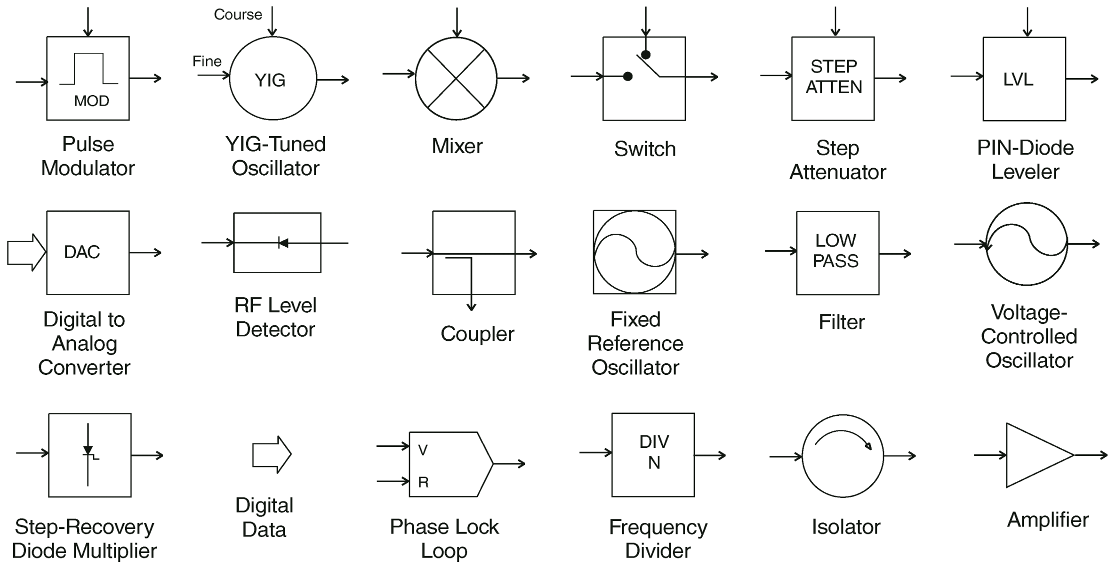
The CAUTION statement is enclosed with single lines and centered in the page. This calls attention to a situation, or an operating or maintenance procedure, or practice, which if not strictly corrected or observed, could result in temporary or permanent damage to the equipment, or loss of effectiveness.

Notes

☛ ***NOTE:*** *A NOTE Highlights or amplifies an essential operating or maintenance procedure, practice, condition or statement.*

Symbols

Block diagram symbols frequently used in the publication are illustrated below.



Record of Publication Changes

This table is provided for convenience to maintain a permanent record of publication change data. Corrected replacement pages will be issued as TPCI (Technical Publication Change Instructions), and will be inserted at the front of the binder. Remove the corresponding old pages, insert the new pages and record the changes here.

TPCI Number	TPCI Issue Date	Date Entered	Comments

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When the accompanying product has been configured for user-specific application(s), supplemental pages will be inserted at the front of the publication binder. Remove the indicated page(s) and replace it (them) with the furnished Special Configuration supplemental page(s).

1

Introduction

1.1 Description

The Giga-tronics 58542 VXI Universal Power Meter offers high accuracy with an ultra-fast reading rate and dual power inputs. Depending on the sensor used, the frequency range is from 10 MHz to 40 GHz for CW signals and 50 MHz to 40 GHz for pulsed signals. The unit is optimized for fast measurements over the VXI bus. Maximum measurement speed is achieved with an internal data buffer, which logs a user-specified number of measurements for subsequent transfer over the VXI bus.

The 58542 is optimized for the fast measurements required by ATE systems. The 58542 diode-based sensors have response times significantly faster than thermal sensors. The high measurement speeds are available over a wider dynamic range than with thermal sensors. The power meter uses the Standard Commands for Programmable Instruments (SCPI) language. It is a message-based instrument that responds to high level ASCII character SCPI commands. The commands are parsed and interpreted by the power meter. Their standardized (English) language format makes SCPI program development fast and easy.

The power sweep calibrator incorporates a built-in thermistor-based power meter bridge. The thermistor oven stability provides a standard 1 mW power reference at 50 MHz, traceable to the National Institute of Standards and Technology (NIST). The thermistors inherent linearity produces 51 precisely controlled power levels from -30 to +20 dBm for linearizing the diodes in the power sensors.

The excellent resulting linearity of ±0.5% (±0.02 dB) complements the low VSWR of the sensors and tightly specified Cal Factor uncertainty. The Cal Factors are stored in EEPROMs in each sensor so that only entering a frequency of operation to the power meter is needed to obtain frequency corrected power readings.

The 58542 power meter is a standard C-size (single-width) VXI module. It weighs 2.5 kg (5.5 lbs). Power requirements are +5 Vdc @ 800 mA, +24 Vdc @ 250 mA and -24 Vdc @ 250 mA.

The 58542 uses Giga-tronics Series 80300 Schottky diode-based sensors for fast measurements with a dynamic range of up to 90 dB, depending on the sensor. Excellent linearity of ± 0.5% is assured through a built-in power sweep calibrator. Special purpose CW sensors are available, including low VSWR sensors, four high-power versions (1W, 5W, 25W and 50W), and True RMS sensors with 50 dB dynamic range. Peak power sensors are available for making true instantaneous power readings on pulsed signals such as radar and digital communications. The sensors sample pulsed RF signal amplitude directly, therefore a duty cycle correction is not required.

Refer to Appendix B in this publication for power sensor selection and specifications data. Appendix C contains technical data for options available for the 58542.

1.1.1 Items Furnished

In addition to options and/or accessories specifically ordered, items furnished with the instrument are as follows:

- Operation & Maintenance Manual (P/N 21555)
- Two sets of power sensor cables

1.1.2 Items Required

A VXI mainframe which meets the power and cooling requirements of the modules is required. Two sensor cables are furnished with the 58542 to fit the dual-channel female output connectors.

1.1.3 Tools & Test Equipment

Test equipment required for calibration and testing is described in Chapter 4 of this publication.

1.1.4 Storage

Giga-tronics VXIbus modules should be stored in an environment free from excessive dust and dirt and in the temperature range of -40 °C to +70 °C.

1.1.5 Cooling

No special cooling is required. If the module is to be operated outside of a properly ventilated VXI frame, auxiliary air circulation is required, such as a small fan directed at the module.

1.1.6 Receiving Inspection

Use care in removing the instrument from the carton and check immediately for physical damage, such as bent or broken connectors on the front and rear panels, dents or scratches on the panels, broken extractor handles, etc. Check the shipping carton for evidence of physical damage and immediately report any damage to the shipping carrier.

Each Giga-tronics instrument must pass rigorous inspections and tests prior to shipment. Upon receipt, the instrument's performance should be promptly checked to ensure that operation has not been impaired during shipment.

1.1.7 Safety Precautions

When installing modules into the mainframe, be sure that the connectors are properly aligned before pushing the modules into place. Apply gentle but firm pressure to insert the modules and make sure they are fully seated for proper operation.

1.1.8 Reshipment Preparation

If it is necessary to return the instrument to the factory, protect the instrument during reshipment by using the best packaging materials available. If possible, use the original shipping container. If the original container is not available, use a strong carton (350 lbs./sq.in. bursting strength) or a wooden box. Wrap the instrument in heavy paper or plastic before placing it in the shipping container. Completely fill the areas on all sides of the instrument with packaging material. Take extra precaution to protect the front and rear panels. Seal the package with strong tape or metal bands. Mark the outside of the package:

FRAGILE — DELICATE INSTRUMENT

If corresponding with the factory or the local Giga-tronics sales office regarding reshipment, please provide the model and serial number. If the instrument is being returned for repair, be sure to enclose all relevant information regarding the problem that has been found.

☛ ***NOTE:*** *If returning an instrument to Giga-tronics for service, first contact Customer Service so that a return authorization number (RMA) can be assigned. Contact Giga-tronics via e-mail* ***(repairs@gigatronics.com)*** *or by phone* ***800.444.2878*** *(The 800 number is only valid within the US). Giga-tronics may also be contacted via our domestic line at 925.328.4650 or Fax at 925.328.4702.*

1.2 Specifications

Performance specifications describe the 58542 warranted performance, and apply when using the Series 80300A Power Sensors. Typical performance (shown in italics) is non-warranted.

1.2.1 Range

Frequency Range
10 MHz – 40 GHz[1]

Power Range
-70 dBm – +47 dBm (100 pW - 50 Watt)[1]

Single Sensor Dynamic Range
CW Sensors: 90 dB[1] Peak Power Sensors: 40 dB, Peak 50 dB, CW[1]

1.2.2 Accuracy

Calibrator
Power Sweep calibration signal to dynamically linearize the sensors

Frequency
50 MHz nominal

Settability
The 1 mW (0.0 dBm) level in the Power Sweep Calibrator is factory set to ±0.7% traceable to the National Institute of Standards and Technology (NIST). Measure within 15 seconds of setting calibrator to 0.0 dBm

Accuracy
±1.2% worst case for one year, over temperature range of 5 °C – 35 °C

Connector
Type N(f) connector, 50 Ω

VSWR
< 1.05 dB (Return Loss > 33 dB)

System Linearity (@ 50 MHz for Standard CW Sensors)

±0.02 dB over any 20 dB range from -70 — +16 dBm
±0.02 dB + (0 dB, -0.05 dB/dB) from +16 — +20 dBm
±0.04 dB from -70 — +16 dBm

Linearity Temperature Coefficient

< 0.1%/ °C temperature change following Power Sweep Calibration, 24-hour warm-up required
< 0.3%/ °C temperature change following Power Sweep Calibration, 24-hour warm-up required (8035XA Series Sensors)

1.2.3 Zeroing Accuracy (Standard CW Sensors)

Zero Set

< ±*50 pW*[2]

Zero Drift

< ±*100 pW* during 1 hour[2]

Noise

< ±*50 pW* measured over any 1 minute interval[2]

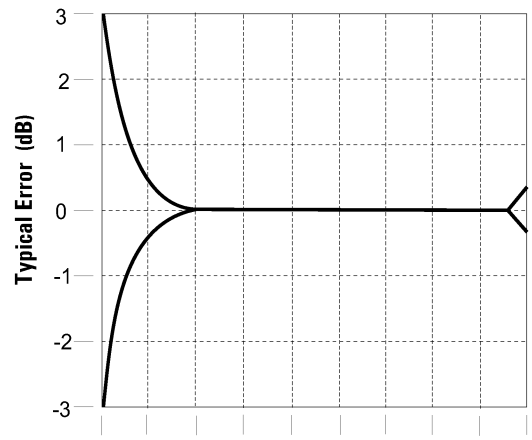
Averaging

Auto-averaging or user-selectable averaging from 1 to 512 readings per measurement

Notes:

1. Depending on sensor used.
2. Specified performance applies with maximum averaging and 24-hour warm-up at constant temperature.

Figure 1-1 illustrates the instrument Linearity plus Typical Noise and Zeroing Error vs Input Power. (The X-axis scale is sensor dependent)



SENSORS

80301A	-70	-60	-50	-40	-30	-20	-10	0	10	20
80310A	-64	-54	-44	-34	-24	-14	-4	6	16	26
80320A	-60	-50	-40	-30	-20	-10	0	10	20	30
80321A	-50	-40	-30	-20	-10	0	10	20	30	40
80322A	-40	-30	-20	-10	0	0	20	20	40	44
80325A	-40	-30	-20	-10	0	10	20	30	40	50
80330A	-30	-20	-10	0	10	20				
80401A (CW)	-67	-57	-47	-37	-27	-17	-7	3	13	
80401A (MAP, PAP)	-60	-50	-40	-30	-20	-10	0	10	20	
80401A (BAP)	(See 80401A Modulated-related uncertainty in Appendix B)									
80601A (CW)	-60	-50	-40	-30	-20	0	10	20		
80601A (MAP, PAP)	-55	-45	-35	-25	-15	-5	5	15		
80601A (BAP)	(See 80601A Modulated-related uncertainty in Appendix B)									

Figure 1-1: Instrument Linearity

1.2.4 Meter Functions

dB Offset & Relative
Allows both relative readings and offset readings. Power readings can be offset by -99.999 – +99.999 dB to account for external loss/gain

Configuration Storage Registers
Up to ten instrument configurations can be stored and recalled from non-volatile memory for fast configuration changes

Power Measurements
Any two of the following channel configurations, simultaneously: 1, 2, 1/2, 2/1, 1-2, 2-1

1.2.5 Measurement Speed

Measurement speed increases significantly using the meter's data storage capabilities. Storing data in memory for later downloading to the controller reduces word serial protocol and protocol conversion overhead. Up to 128,000 readings can be buffered. The measurement rate depends on several factors, including controller speed and number of averages. Burst Mode speed does not include bus communication time. The following lists typical maximum measurement rates for CW power sensors or Series 80340 Peak Power Sensors.

Normal Mode Non-Buffered	**Swift Mode** Buffered Data	**Burst Mode** Buffered Data
55 rdgs/sec	150 rdgs/sec	5100 rdgs/sec

Individual data points are read immediately after measurement in the Normal Mode. Swift Mode allows triggering of individual data points, and stores the data in the 58542 memory. Burst Mode also buffers measurement data: measurement timing of individual data points is controlled by setting the time interval (0.001 to 5.000 sec) between the data points following a single group burst trigger event.

1.2.6 Inputs/Outputs

Analog Output
Provides an output voltage (at the Analog Out BNC) that is configurable from -10 – +10 V from either Channel 1 or Channel 2 in either Lin or Log units[1]

Accuracy
1.0% ±32 mV, -10 – +10 V

Linearity
$<$0.3%

Trigger Input
Connects EXT trigger (at the EXT TRIG BNC). TTL level input signal for fast reading of buffered data modes

Voltage Proportional to Frequency (in GHz)
Automated Cal Factor correction. Input the analog VpropF signal level from the microwave signal source to the V_{PROP}F IN BNC[1]

Input Range
0 – 10 V

Accuracy
1.0% ±32 mV (14 bit) (0.6 mV resolution)

Note:

1. Operates in Normal Mode only.

1.2.7 Power Requirements

Requirements
+5 Vdc @ 800 mA +24 Vdc @ 250 mA -24 Vdc @ 250 mA

1.2.8 General Specifications

Temperature Range

Operating	0 °C – 50 °C (32 °F – 122 °F) Operating the 58542 Power Meter in a high level RF field (Approximately 3 V/m) may degrade performance, this degradation occurs at measured levels below -36 dBm and when the field frequency is nominally between 50 and 1000 MHz
Non-Operating	-40 °C – 70 °C (-40 °F – 158 °F)

Physical Characteristics

Dimensions	C-size, single slot VXI standard 30 mm (1.2 in) wide, 234 mm (9.2 in) high, 340 mm (13.4 in) deep
Weight	2.5 kg (5.5 lbs)

Accessories Included

Two detachable sensor cables

2

Operation

2.1 Preparation for Use

This chapter describes how to operate the 58542 VXIbus Universal Power Meter. The first part of the chapter explains how to set up and install the unit. This is followed by operating procedures using the General Purpose Interface Bus (GPIB) command reference, with the Standard Commands for Programmable Instruments (SCPI) command language.

The following topics are presented in this chapter:

- Installation (Section 2.2)
- Initial Setup (Section 2.3)
- Sensor Precautions (Section 2.4)
- Operation (Section 2.5; Error Messages, Section 2.5.34)

2.2 Installation

Before installing the power meter, ensure that the logical address and data transfer bus arbitration have been set according to the procedures in Section 2.3.

The power meter installs into any slot of a VXI mainframe except slot 0 (zero). When inserting the instrument into the mainframe, rock it gently back and forth to fully seat the connectors into the backplane receptacles. The ejectors will be at right angles to the front panel when the instrument is properly seated. The two captive screws above and below the ejectors secure the instrument into the chassis.

The power meter contains three printed circuit assemblies: (1) The Analog board, (2) VXI Processor board and (3) Digital board.

The Analog board contains the front panel connectors, the Power Sweep Calibrator (beneath the top metal cover) and the dual measurement channels (beneath the lower metal cover). The memory backup battery is attached to this lower metal cover.

The VXI Processor board contains the 68000 processor, connection to the VXIbus backplane and two EEPROMS containing communications software. The operational software must be compatible with the EEPROMs on the Digital board. The EEPROMs will be replaced whenever operational software upgrades are performed.

The Digital board connects to the VXI backplane for access to TTL triggering and the main operational software.

2.3 Initial Setup

The logical address and data transfer bus arbitration must be set up in the power meter before installing the unit in a VXI mainframe and applying power. The following procedures define how to complete the initial setup.

2.3.1 Logical Address

The VXI chassis Resource Manager identifies each unit in the system by its logical address. The VXI logical address can range from 0 to 255. Addresses 0 and 255 are reserved for special functions: Address 0 identifies the Resource Manager (slot and controller); address 255 permits the Resource Manager to dynamically address the unit based on the chassis VXI slot.

To change the logical address, set the respective sections on the eight position DIP switch. The switch is accessible after removing the right cover (See Figure 2-1).

The address is set with binary values of 0 to 255. Switch position 1 is the least significant bit of the address. Figure 2-1 illustrates logical address values of 3 (binary 00000011) and 255 (binary 11111111). Giga-tronics ships the power meter with a logical address of 255 for dynamic configuration.

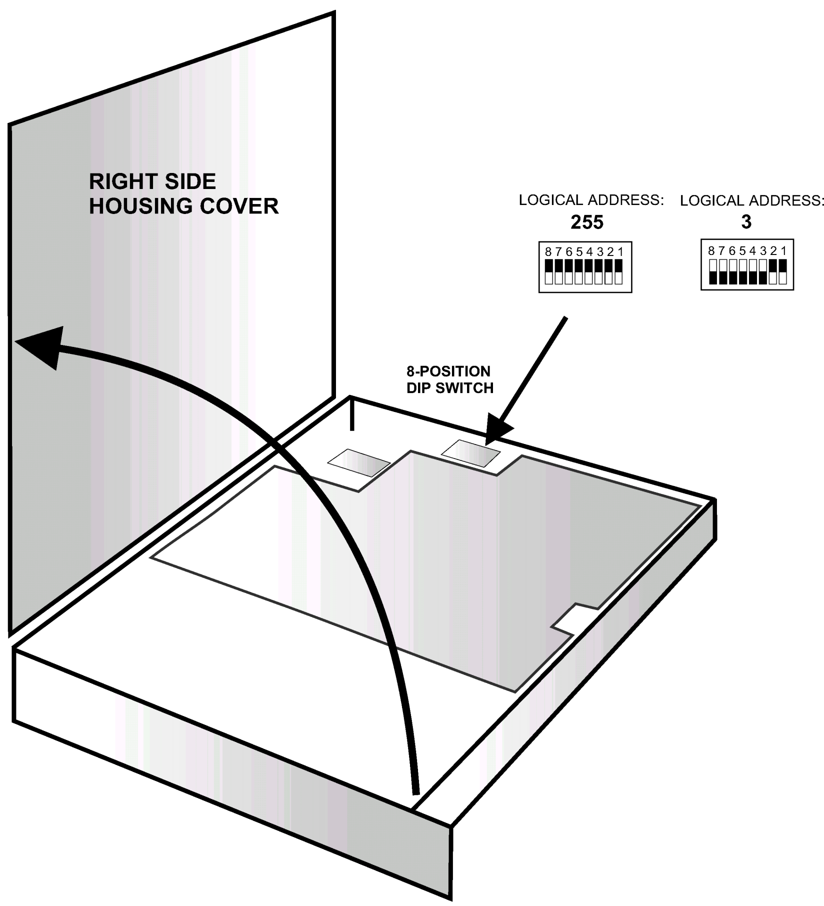


Figure 2-1: Setting the Logical Address

2.3.2 Data Transfer Bus Arbitration

The power meter has VMEbus Mastership capability. When enabled, it sends responses and events as signals (software interrupts) to its Commander Signal Register. The power meter cannot drive the interrupt lines.

The power meter is configured as a level 3 requester by the factory. The level 3 Bus Request and Bus Grant lines (BR3*, BG3IN* and BG3OUT*) are used. The other Bus Grant lines are daisy-chained by jumpers (See Figure 2-2).

The VMEbus specifications describe three priority schemes: (1) Prioritized, (2) round-robin and (3) single level. Prioritized arbitration assigns the bus according to a fixed priority scheme where each of four bus lines has a priority from highest (BR3*) to lowest (BR0*). Round-robin arbitration assigns the bus on a rotating basis. Single level arbitration accepts requests only on BR3*.

The jumpers must be changed if a different requester level is required. Figure 2-2 will aid in reconfiguring the power meter to a new level. Refer to the VMEbus specification for more information on data transfer bus arbitration.

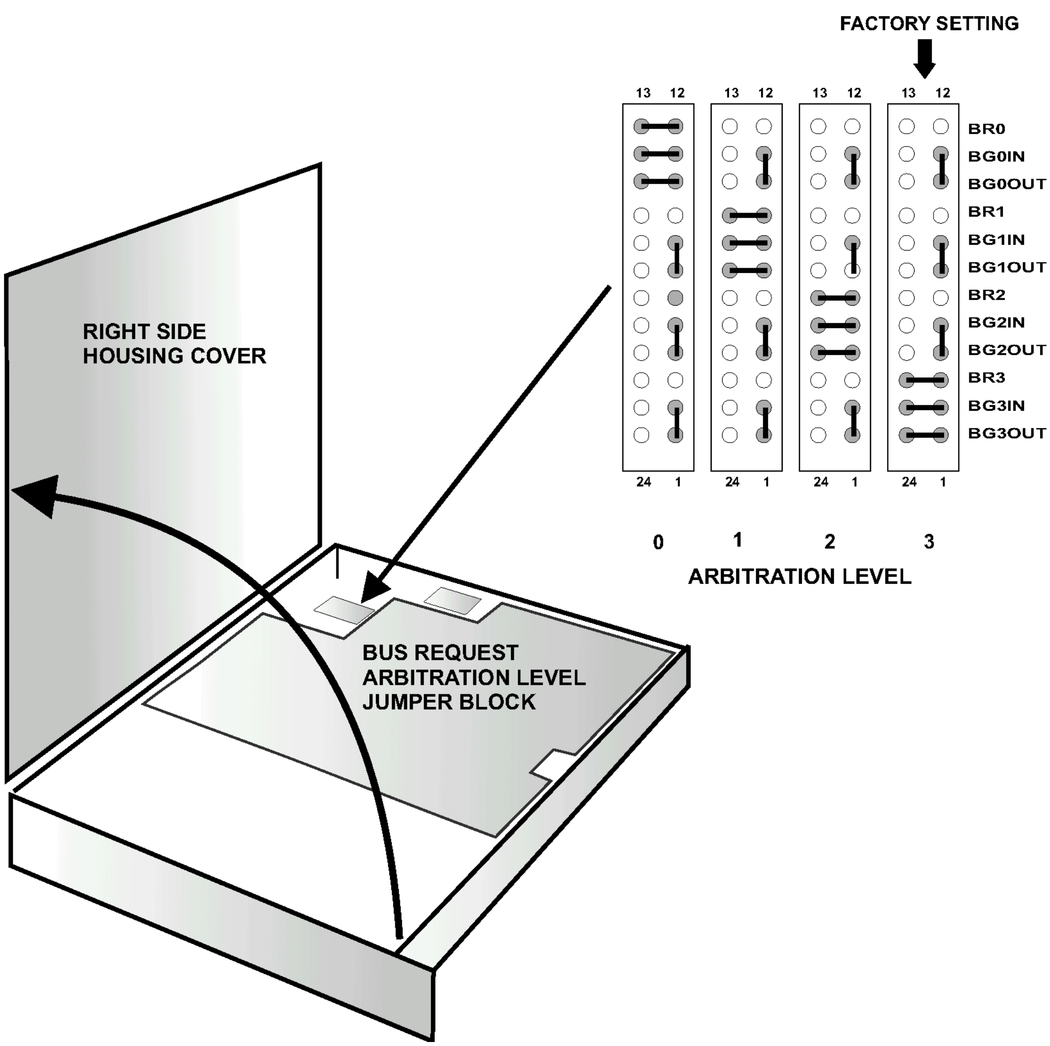


Figure 2-2: Default Bus Arbitration Settings

2.4 Sensor Precautions

Sensors used with the 58542 are configured in metal housings for superior mechanical performance as well as excellent shielding.

CAUTION

When connecting the sensors to other devices or components, the body of the sensor should never be turned to tighten the RF connection. Mechanical damage to the connector can result if improperly handled when connecting the sensors. Scratched or damaged connector mating surfaces can lead to inaccurate measurements.

If a sensor is connected to CW or peak power devices with power output in excess of +23 dBm (200 mW), degradation or destruction of the diode can occur.

Diodes degraded or destroyed in this manner will not be replaced under warranty. Destructive signal levels are higher for High Power, True$_{RMS}$ and Low VSWR sensors.

2.5 Operation

2.5.1 SCPI Command Interface

This section details operation of the 58542 VXIbus Universal Power Meter using the SCPI (Standard Communications for Programmable Instruments) interface commands. A SCPI command reference is presented in Table 2-2 and the sections that follow.

SCPI commands promote consistency in definition of a common instrument control and measurement command language. The structured approach of the SCPI standard offers test system design engineers a number of system integration advantages that achieve considerable efficiency gains during control program development.

SCPI compatible instrument commands are structured from a common functional organization or model of a test instrument (See Figure 2-3). Most of the power meter configuration and measurement functions fall within the Measurement Function Block and the Trigger Subsystem of the SCPI instrument model.

The 58542 uses the Sense Subsystem of the Measurement Function Block to implement commands that apply specifically to the individual power sensors; sensor 1 and sensor 2. For example, the SENSe2:CORRection:OFFSet command corrects for the attenuation of a signal that passes through an attenuator or coupler before it is measured by power sensor 2. Figure 2-3 illustrates the SCPI subsystem model.

☛ ***NOTE:*** *Throughout this publication, some commands will be in both upper- and lower-case, such as CALCulate and MEMory. The uppercase is the required input. The whole word can be used if desired. If the whole word is used, it must be used in its entirety. For example, CALCulat will not be recognized as a valid command.*

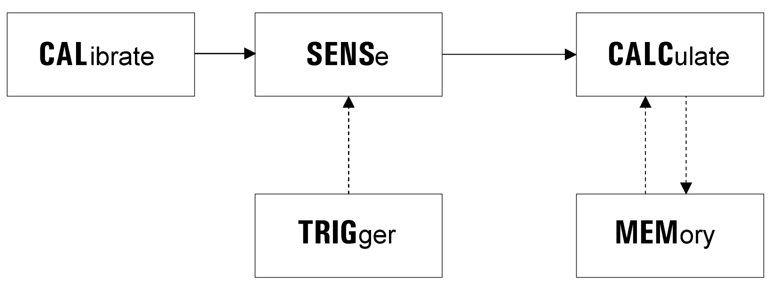


Figure 2-3: SCPI Subsystem Model

2.5.2 Sensor Calibration & Zeroing

The Calibration subsystem performs sensor calibration and zeroing. CALibrate:STATe*n* selects if the calibration data is applied or not. If STATe is ON, then the instrument uses the calibration data for correction. If STATe:OFF is selected, then no calibration using the calibration data will be made. The CALibrate:ZERO subsystem controls the autozero calibration of the sensor.

2.5.3 Sensor & Channel Configuration

The Calculate subsystem of the Measurement Function Block contains commands that define the form of the measured data from sensor 1 and sensor 2. Calculate commands define the configuration of the two Software Calculation Channels. For example, the CALC1:POW 1 command configures channel 1 to report the power level as measured by sensor 1. CALC2: RAT 2,1 configures channel 2 to report the ratio of power levels, sensor 2 over sensor 1.

2.5.4 Measurement Triggering

The power meter uses the Trigger Subsystem to trigger measurements in two different operational modes - a normal mode which maximizes the instrument's functionality, and swift and burst modes that maximize the power measurement rate.

2.5.5 Memory Functions

The MEMory commands control the configuration of the automated Voltage-Proportional-to-Frequency ($V_{PROP}F$ or VF), sensor Cal Factor correction, and the analog outputs on the rear panel. Each of these connectors is used with external devices. The $V_{PROP}F$ can be configured to match the $V_{PROP}F$ output of the microwave source. The analog outputs are used with a variety of devices including chart recorders, oscilloscopes, voltmeters and microwave source leveling inputs.

2.5.6 IEEE 488.2 Required Commands

Consistent with SCPI compliance criteria, the power meter implements all the common commands declared mandatory by IEEE 488.2 (See Table 2-1).

Table 2-1: IEEE Required Command Codes

Mnemonic	Name
*CLS	Clear Status Command
*ESE	Standard Event Status Enable Command
*ESE?	Standard Event Status Enable Query
*ESR?	Standard Event Status Register Query
*IDN?	Identification Query
*OPC	Operation Complete Command
*OPC?	Operation Complete Query
*RCL	Recall Command
*RST	Reset Command
*SAV	Save Command
*SRE	Service Request Enable Command
*SRE?	Service Request Enable Query
*STB?	Read Status Byte Query
*TRG	Trigger Command
*TST?	Self-Test Query
*WAI	Wait-to-Continue Command

2.5.7 DIAGnostic Commands

DIAGnostic commands are used for a variety of instrument specific maintenance and calibration functions. Unless performing instrument calibration functions, it is unlikely the DIAGnostic command sets will need to be used. For calibration laboratory metrology professionals, the DIAG commands will allow completely automated instrument and sensor calibration functions. The commands program EEPROMs inside the meter and individual sensors. If desired, a password function is incorporated to prevent unauthorized personnel from altering calibration information. Table 5-1 in Chapter 5 lists available Diagnostic commands.

2.5.8 Calculate Subsystem Commands

Calculate commands specify and query the configuration of power measurement channels, known in SCPI references as Software Configuration Channels, and in this publication as "channels". See Section 2.5.9 for sensor-specific configuration and measurement function control.

The query form of CALC#?, with # replaced by the channel modifier (1 or 2), returns the current configuration status for that channel. This verifies configuration commands or return current status information following data acquisition or power measurements.

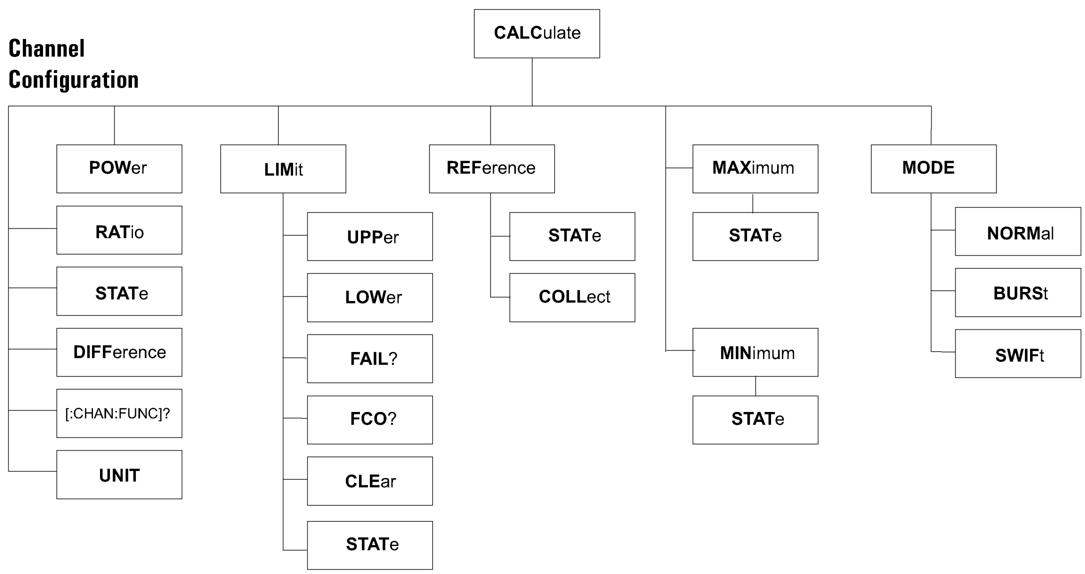


Figure 2-4: CALCulate Subsystem Commands

Limit Lines are set on a channel basis. These commands set limits, monitor the number of violations, and allow the violation counter to be cleared.

The REFerence command allows channel-based offset values. For example, using CALC#:REF:COLL automatically converts the inverse of the current channel measurement value to an offset — simplifying the 1 dB compression testing of amplifiers.

MIN and MAX commands monitor deviation of measured values over a user controllable time period.

The two software calculation channels can individually and simultaneously perform the internal instrument functions that calculate final measurement data. The final measurement data is calculated from Sense subsystem sensor data as well as the Calculate subsystem channel configuration data.

This means that only two measurement configurations can be obtained from the 58542 simultaneously. For example, the controller can obtain measurements for sensor 1 plus sensor 2/sensor 1 simultaneously, but not sensor 1 plus sensor 2 plus sensor 2/sensor 1 simultaneously.

2.5.9 Sense Subsystem Commands

The Sense subsystem configuration commands, illustrated in Figure 2-5, apply to individual sensors. These commands alter the value of the measured power level according to the sensor's characteristics. For example, measured power levels can be offset for attenuators or couplers in the measurement path so that the power data reading reflects the power level at the measurement point of interest.

Use the Sense subsystem commands for:

- Averaging power measurements in the 58542
- Offsetting power measurements for attenuation or amplification
- Entering the operating frequency of the measured signal computes and applies sensor specific Calibration Factor corrections, which compensates for sensor frequency response characteristics
- Controlling Peak Power Sensor triggering

Sense subsystem commands control functions that are related directly to the individual power sensors. For example, these commands control items that would not apply to numerical alteration of a ratio measurement of Sensor1/Sensor2. Controls that would apply to that type of a configuration are channel functions, not sensor functions, and would therefore be located in the Calculate subsystem.

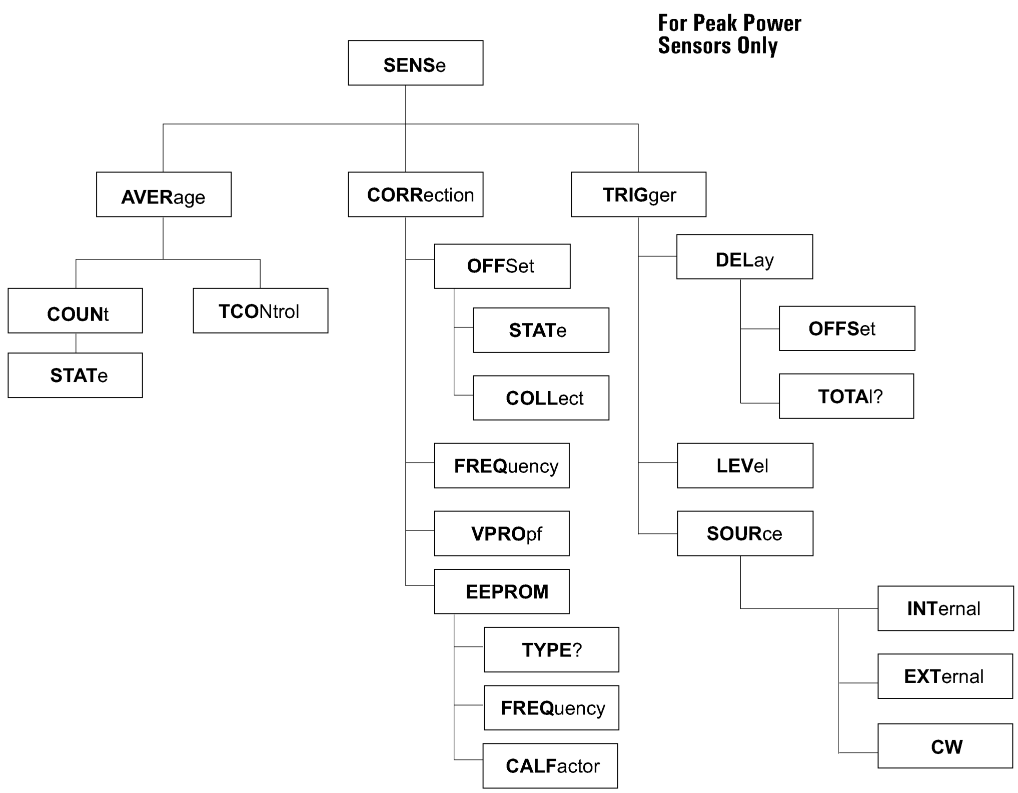


Figure 2-5: SENSe Subsystem Command Tree

SENSe:AVERage functions control the number of data samples for each measurement and the manner in which those numbers are accumulated. COUNt determines the averaging number or AUTO-averaging. TCONtrol determines whether each new sample is added to previous COUNt # of samples or if COUNt # of samples are taken each time the 58542 is triggered. Please note that the SENSe:TRIGger commands are not instrument triggers, but Peak Power Sensor configuration controls.

SENSe:TRIGger functions apply only to Giga-tronics Peak Power Sensors. The DELay and LEVel functions of these Peak Power Sensor controls apply to the 80350A Peak Power Sensors. The AVERage and CORRection commands apply to all Series 803XXA CW & Peak Power Sensors.

STATe ON OFF controls for COUNt and DELay, previous page, are not shown.

2.5.10 Trigger Subsystem Commands

The Trigger Subsystem is divided into two sections; Instrument Measurement Event Triggering and Special Triggering Configuration commands for the fast-reading buffered data modes (Burst and Swift modes). The Trigger command tree is illustrated in Figure 2-6.

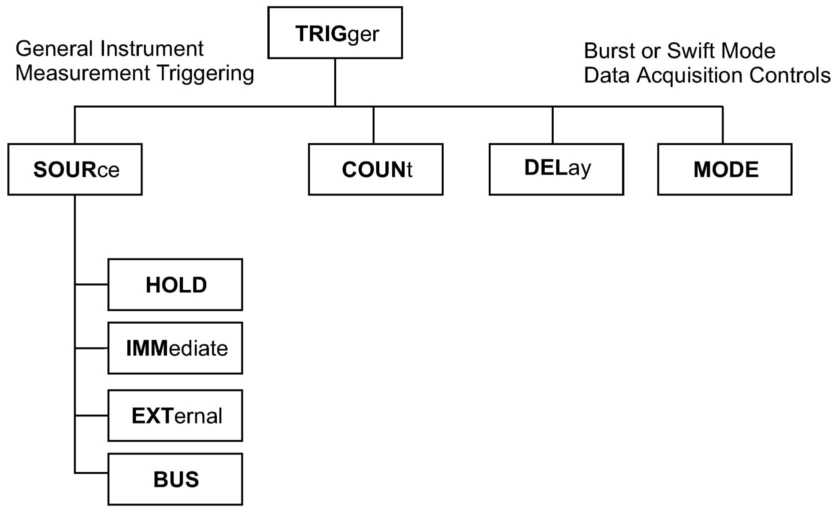


Figure 2-6: TRIGger Subsystem Command Tree

The query form of these commands, TRIGger? with the appropriate modifier inserted ahead of the ?, will return the instrument's current configuration status. This can be used to verify triggering configuration or return status information following command errors which are commonly caused by using illegal configuration commands during Swift or Burst Modes.

SOURce:IMMediate triggering allows the 58542 to control measurement triggering; this is the default configuration. External triggering is performed using a TTL signal input. BUS allows software controlled triggering.

COUNt refers to the number of data points to store in the meter's 5000 reading buffer (128,000 with option 02) before the measurement data is requested by the controller.

DELay controls the time interval between Burst Mode data samples, and the MODE command controls whether the data is taken after receipt of the instrument trigger or if data is collected (in a FIFO buffer) immediately preceding receipt of an instrument trigger.

2.5.11 GPIB Command Syntax

The following conventions are used with the GPIB commands in this publication. Some commands will be in both upper- and lower-case, such as CALCulate and MEMory. The uppercase is the required input. The whole word can be used if desired. Table 2-2 lists in alphabetical order all of the GPIB commands supported by the power meter. The basic function performed by that command is given and the page number in this chapter where a description of each command can be located. Most query command syntaxes have been provided on the description page, not in Table 2-2.

2.5.11.1 Commands in Brackets

Commands and command separators within brackets, such as [COMMand:], are optional. These portions of the commands may be used in the program command strings, but are not required for proper operation of the power meter.

2.5.11.2 Programmer Selective Parameters

Command descriptions enclosed in angle brackets (< and >) show the syntax placement of configurable parameters. A description of the necessary parameter and the range of values or mnemonics valid for that parameter are enclosed in angle brackets.

2.5.11.3 Italics in Syntax Descriptions

Some command syntax descriptions show certain words in italics such as *space* and *comma* to indicate where the character must be included within a command string.

2.5.11.4 Query Format

Except where specifically noted, all query commands are formed by adding a question mark (?) to the command header. Be sure to omit command parameters when using the query format. Some commands have only a query format. With the exception of the Calibration queries, query commands will not change the status of the power meter. The CALibration1? and CALibration1:ZERO? commands query respectively to automatically begin the calibration and zeroing process.

2.5.11.5 Linking Command Strings

The 58542 uses ASCII strings for commands. When sending more than one command in a single string, a semicolon must be used as a delimiter between commands. No spaces or other characters are necessary. Use only a semicolon to link commands in a string.

2.5.11.6 Measurement Data Output Format

The examples in this chapter are written in HTBasic™ format. Different languages will use different commands, but the string sent or received will always be the same. In HTBasic, the OUTPUT command sends a string to the GPIB bus. The number or variable after the word OUTPUT is the GPIB address of the power meter.

™HTBasic is a trademark of TransEra Corporation.

Table 2-2: VXI GPIB Command Syntax

Command Syntax	Function	Page
Required Codes		
*CLS	Clear SRQ and status byte registers	2-39
*ESE	Enable bit 4 of event status register mask	2-39
*ESE?	Query return the of the event status register mask	
*ESR?	Returns event status register value	2-39
*IDN?	Query instrument mfgr and model number	2-52
*OPC	Allows a one-time SRQ enable	2-20 2-39
*OPC?	Returns a value of 1 after an operation is completed	
*RCL	Recall 58542 register *n*	2-49
*RST	Reset 58542 configuration	2-50
*SAV	Save at 58542 register *n*	2-49
*SRE	Service Request Enable	2-40
*SRE?	Query return the status register mask value	
*STB?	Query status byte register	2-40
*TRG	BUS Trigger Event	2-22
*TST?	Query self-test result	2-55
*WAI	Wait, following command completion	2-23
Function Codes		
ABORt	Halts measurement & triggering	2-49
CALCulate<channel 1 to 2>:DATA?	Query channel 1 & 2 burst mode data	2-30
CALCulate<channel 1 to 2>[:CHANnel]:DIFFerence*space*<sensor 1 or 2*comma*sensor 2 or 1>	Configures channel 1 to measure Sensor 2 minus Sensor 1 power	2-25
CALCulate<channel 1 to 2>[:FUNCtion]?	Query channel 2 sensor mode	2-25
CALCulate<channel 1 to 2>:LIMit:CLEar[:IMMediate]	Reset channel 1 limit violation indicator to 0	2-44
CALCulate<channel 1 to 2>:LIMit:FCOunt?	Query number of channel 1 limit failures	2-44
CALCulate<channel 1 to 2>:LIMit:FAIL?	Check for channel 1 limit line violation (Output 0 = OK; 1 = fail)	2-44

Table 2-2: VXI GPIB Command Syntax (Continued)

Command Syntax	Function	Page
CALCulate<channel 1 to 2>:LIMit:LOWer*space*<numeric value in dB from -299.99 to 299.99>	Set channel 1 lower limit line to -50 dBm	2-45
CALCulate<channel 1 to 2>:LIMit:STATe*space*<ON | OFF>	Enable channel 1 upper and lower limit checking. (0 = off; 1 = on)	2-46
CALCulate<channel 1 to 2>:LIMit:UPPer*space*<numeric value in dB from -299.99 to 299.99>	Set channel 1 upper limit line to 17 dBm	
CALCulate<channel 1 to 2>[:CHANnel]:POWer*space*<sensor 1 or 2>	Configures channel 2 to measure Sensor 1 power	2-25
CALCulate<channel 1 to 2>[:CHANnel]:RATio*space*<sensor 1 or 2*comma*sensor 2 or 1>	Configures channel 1 to measure Sensor 2 over Sensor 1 power	
CALCulate<channel 1 to 2>:MODE*space*<NORMal, BURst, SWIFt Selection>	Set up time gating mode on the specified input	2-30
CALCulate<channel 1 to 2>:MAXimum:STATe*space*<ON | OFF>	Enable channel 2 maximum value monitoring	2-43
CALCulate<channel 1 to 2>:MAXimum[:MAGnitude]?	Query channel 2 maximum value in dBm	
CALCulate<channel 1 to 2>:MINimum:STATe*space*<ON | OFF>	Enable channel 1 min. value monitoring	
CALCulate<channel 1 to 2>:MINimum[:MAGnitude]?	Query channel minimum value in dBm	
CALCulate<channel 1 to 2>:REFerence:STATe*space*<ON | OFF>	Activate level reference for relative measurements	2-37
CALCulate<channel 1 to 2>:REFerence[:MAGnitude]<dB Offset value from -299.999 to 299.999>	Set channel 2 reference offset value in dB Reset channel 2 Relative meas. operation	
CALCulate<channel 1 to 2>:REFerence:COLLect	Take channel 2 reading as reference value. Reset with CALC:REF 0.0	
CALCulate<channel 1 to 2>:STATe*space*<ON | OFF>	Disable channel 1 measurement	2-26
CALCulate<channel 1 to 2>:UNIT[:POWer]*space*<data units selection, dBm or Watt>	Selects channel 1 linear units in Watts Selects channel 1 Log Units in dBm	2-26
CALibrate<sensor 1 or 2>[:SENSor]	Calibrate Sensor 1	2-17
CALibrate<sensor 1 or 2>:ZERO	Zero Sensor 1	2-18
CALibrate<sensor 1 or 2>:STATe?	Query sensor for calibration status	2-17
FETCh<channel 1 to 2>?	Read previously triggered channel 1 power, Normal, Swift, Burst mode data	2-19
INITiate[:IMMediate]	Initiate instrument triggering cycle	2-24
INITiate:CONTinuous*space*<ON | OFF>	58542 self-triggers continuously	
MEASure<channel 1 to 2>[:SCALar:POWer]?	Configure triggering and measure channel 2 power in NORMal mode	2-19
MEMory[:TABLe]:CHANnel*space*<channel 1 to 2>	Set analog out to channel 2	2-46
MEMory[:TABLe]:FREQuency< Start frequency>	Set V_{PROP}F start frequency to 1 GHz	2-28
MEMory[:TABLe]:POWer*space*<start value from -80 to +20 dBm>*comma*<stop value from -80 to +20 dBm>	Set analog out power range (in dBm) from -80 to 20 dBm	2-47

Table 2-2: VXI GPIB Command Syntax (Continued)

Command Syntax	Function	Page
MEMory[:TABLe]:POWer*space*<start value from 0 to 0.01W>*comma*<stop value from 0 to 0.01W>	Set analog out power range (in Watts) from 0 to 0.01 Watts	2-47
MEMory[:TABLe]:SELect*space*<ANALOGout,VPROPF1, VPROPF2>	Select memory table V_{PROP}F1 for editing in following lines	2-27 2-47
MEMory[:TABLe]:SLOPe*space*<Volts per Hz>	Set V_{PROP}F slope in 1V/GHz	2-27
MEMory[:TABLe]:UNIT*space*<Units for analog output configuration, dBm or Watt>	Set analog out power unit	2-47
MEMory[:TABLe]:VOLTage*space*<start value from -10 to +10 V>*comma*<stop value from -10 to +10 V>	Set analog out voltage range from -8 to 2 volts corresponding to power	2-47
OUTPut[:BNC]:ANAlog[:STATe]*space*<ON | OFF>	Enable analog out function	
OUTPut:ROSCillator[:STATe]*space*<ON | OFF>	Turn ON 0.0 dBm Calibrator Oscillator	2-53
READ<channel 1 to 2>[:POWer]?	Trigger measurement and read channel 2	2-19
SENSe<sensor 1 or 2>:AVERage:COUNt*space*<averaging value 1,2,4,8,16,32,64,128,256,or512>	Set sensor 1 average number to 16	2-36
SENSe<sensor 1 or 2>:AVERage:COUNt:AUTO*space*<ON | OFF>	Select sensor 2 Auto-average mode	
SENSe<sensor 1 or 2>:AVERage:TCONtrol*space*<data acquisition averaging method, MOVing or REPeat>	Set sensor 1 to acquire fresh measurement data before averaging	
SENSe<sensor 1 or 2>:CORRection:EEPROM:TYPE?	Query sensor 1 eeprom type	2-53
SENSe<sensor 1 or 2>:CORRection:EEPROM:FREQuency?	Query sensor 1 eeprom frequency table	
SENSe<sensor 1 or 2>:CORRection:EEPROM:CALFactor?	Query sensor 1 eeprom cal factor table	
SENSe<sensor 1 or 2>:CORRection:FREQuency[:CW-FIXed] 5e7	Set sensor 2 frequency to 50 MHz	2-27
SENSe<sensor 1 or 2>:CORRection:OFFSet:COLLect	Take sensor 1 current reading as offset value	2-38
SENSe<sensor 1 or 2>:CORRection:OFFSet [:MAGnitude]*space*<offset value in dB -99.99 to 99.99>	Compensate sensor 2 for 10.2 dB attenuation	
SENSe<sensor 1 or 2>:CORRection:OFFSet:STATe*space*<ON | OFF>	Enable sensor 2 offset correction	
SENSe<sensor 1 or 2>:CORRection:VPROpf[:STATe]*space*<ON | OFF>	Enable sensor 1 v_prop_f function	2-27
SENSe<sensor 1 or 2>:TEMPerature?	Query sensor 1 temperature (in centigrade)	2-18
SENSe<sensor 1 or 2>:TRIGger:SOURce*space*<peak sensor triggering INTernal, EXTernal or CW>	Set sensor 1 peak trigger mode to CW mode	2-34
SENSe<sensor 1 or2>:TRIGger:DELay[:MAGnitude]:*space*<Peak Sensor sample delay in seconds from -20e-9 to 104e-3>	Set sensor 2 peak delay value to 1e6 seconds	
SENSe<sensor 1 or 2>:TRIGger:DELay:STATe*space*<ON | OFF>	Enable peak sensor 1 delay function	

Table 2-2: VXI GPIB Command Syntax (Continued)

Command Syntax	Function	Page
SENSe<sensor 1or2>:TRIGger:LEVel[:MAGnitude]*space*<trigger level of peak power sensor>	Set peak sensor 1 trigger level to 1.7 volts	2-35
SENSe<sensor 1 or 2>:TRIGger:OFFSet[:MAGnitude]	Set peak sensor 1 trigger offset time to 0 second	
SENSe<sensor 1 or 2>:TRIGger:TOTAl[:MAGnitude]?	Query peak sensor 1 total trigger delay time	
STATus:OPERation[:EVENt]?	Query operation event register result	2-40
STATus:OPERation[:ENABle]	Set Status Enable Mask	
STATus:PRESet	Clears all the status register value	2-40 2-50
SYSTem:ERRor?	Query system error message	2-59
SYSTem:PRESet	Reset 58542 configuration	2-50
SYSTem:VERSion?	Query SCPI version	2-52
TRIGger[:IMMediate]	Trigger measurement cycle	2-22
TRIGger:SOURce*space*<instrument triggering source IMMediateBUS, HOLD, or EXTernal>	Set instrument measurement trigger source to IMMediate	
TRIGger:MODE*space*<burst mode data gathering POST trigger receipt or PRE trigger receipt>	Set Burst or Swift mode data collection relative to Timing of event trigger post	2-21
TRIGger:DELay*space*<delay time between buffered readings in sec 0.000 to 5.000>	Set Burst mode measurement time to 5 ms between measurements (resolution, one msec)	2-23
TRIGger:COUNt*space*<number of data values to buffer in memory from 1 to 5000 for standard 58542 from1 to 128,000 on one channel with option 02; from 1 to 64000 for two channels with option 02>	Set Burst or Swift mode buffer reading number to 100	

2.5.12 Sensor Calibration & Zeroing

- **CALibrate<sensor 1 or 2>**
- **CALibrate<sensor 1 or 2>STATe?**
- **CALibrate<sensor 1 or 2>ZERO**
- **SENSe<sensor 1 or 2>:TEMPerature?**

2.5.12.1 Sensor Calibration

The CALibration commands for sensor calibration and zeroing are important for accurate power measurement results. Be sure to perform the sensor calibration prior to beginning measurement operation or channel configuration. Sensors must be calibrated to the meter before performing measurements.

Zeroing of all active sensors should always be performed whenever a second sensor (whether calibrated or not) is added or removed. Zeroing should also be performed prior to measurement of low signal levels, generally within the lower 15 dB of a sensor's dynamic range. For standard sensors, this is -55 dBm.

CAL#

Syntax:	CALibration<sensor 1 or 2>[:SENSor]	
Example:	OUTPUT @PWR_MTR;CAL1	! CALIBRATE SENSOR 1
Description:	This command begins the sensor power sweep calibration process. Power sweep calibration can be performed only during Normal mode. The sensor must be attached to the front panel CALIBRATOR (use an adapter for high frequency sensors with Type K connectors). If the sensor is not connected or if the sensor is disconnected during the power sweep calibration procedure, the calibration automatically fails and the sensor power sweep calibration table is restored to its previous values.	

CALibrate:STATE?

Syntax:	CALibrate<sensor 1 or 2>:STATe?	
Example:	OUTPUT @PWR_MTR;CAL1:STAT?	! QUERIES SENSOR FOR CALIBRATION STATUS
Response:	1 if sensor is calibrated, or 0 if sensor is not calibrated.	
Description:	This command queries whether or not a sensor has been calibrated.	

2.5.12.2 Sensor Zero

Zeroing automatically accounts for ground noise and other noise in the measurement system. Measurements will be sensitive to noise-induced errors only in the lowest 15 dB of the sensor dynamic range. *Be sure to turn off the signal going into the sensor during zeroing, otherwise a failure will be indicated.*

CAL#:ZERO

Syntax:	CALibration<sensor 1 or 2>:ZERO	
Example:	OUTPUT @PWR_MTR;CAL1:ZERO	! ZERO SENSOR 1
Description:	This command begins the zeroing process. To offset for measurement circuit noise during zeroing, The sensor needs to remain attached to the measurement circuit during zeroing. Disable the signal source into the sensor. If disabling the signal source cannot occur, connect the sensor to a grounded connector (preferably RF grounded) or leave the sensor disconnected. Do not connect the sensor to the power meter front panel calibrator port. If the meter detects excessive RF power at the start of the zeroing process (generally above -50 dBm for standard sensors), zeroing will automatically fail.	

CAL#:ZERO?

Syntax:	CALibration<sensor 1 or 2>:ZERO?	
Example:	OUTPUT @PWR_MTR;CAL1:ZERO?	! ZERO SENSOR 1 & RETURN PASS/FAIL STATUS
Response:	0 = Pass; 1 = Fail	
Description:	This command executes the same procedure as above except a pass/fail flag is automatically output at either the completion of zeroing or detection of failure. The most common cause is not turing off the source power meter before beginning the zeroing process.	

SENS#:TEMP?

Syntax:	SENSe<sensor 1 or 2>:TEMPerature?	
Example:	OUTPUT @PWR_MTR;SENS1:TEMP?	! QUERIES SENSOR 1 TEMPERATURE (IN CENTIGRADE)
Response:	Current sensor temperature in degrees centigrade	
Description:	This command reports sensor temperature. If the temperature varies in the operating environment, monitor the relative temperature variations. If the variation since the previous power sweep calibration exceeds ±5 °C (±9 °F), perform the power sweep calibration for that sensor.	

Example programs for Sensor Calibration and Zeroing are contained in Appendix A.

2.5.13 Reading Power Measurements

- **FETCh?**
- **MEASure?**
- **READ?**
- ***OPC**
- ***OPC?**

These commands return measurement data from the 58542. During Normal mode the data will be single measurement values. During Swift or Burst modes, the data will be an array of values. Generally, it is a single array if one sensor is connected and calibrated, and a dual array if two sensors are connected and calibrated.

FETC?

Syntax:	FETCh<channel 1 to 2>?	
Example:	OUTPUT @PWR_MTR;FETC1?	! READS PREVIOUSLY TRIGGERED CHANNEL 1 POWER ! NORMAL, SWIFT, BURST MODE DATA
Response:	Whatever is in the output buffer whether it is a new measurement or an old one.	
Description:	The FETCh? query command returns post-processed measurement data from the active channels of the 58542. After receiving FETCh? the 58542 will output the contents of its active data output buffer. The data size and output format of the buffer are dependent upon channel and measurement mode configuration. For example, if channel 1 is defined as sensor 1 and channel 2 is defined as sensor 2/1, the FETCh? query command will return the power level incident upon sensor 1 and the ratio of the power levels incident upon sensor 2 and 1. FETCh? is used with NORMal mode measurements when INITiate:IMMediate is active, and for reading SWIFt, BURSt Mode measurement data from the meter's data buffer.	

MEAS?

Syntax:	MEASure<channel 1 to 2>[:SCALar:POWer]?	
Example:	OUTPUT @PWR_MTR;MEAS2?	! ARMS, TRIGGERS AND MEASURES CHANNEL 2 ! POWER IN NORMAL MODE
Response:	A power measurement.	
Description:	The MEAS? command returns measured data from the active software calculation channels of the 58542. The MEAS? command will also initiate the trigger cycle and will turn on the Auto Averaging mode; that is, measurement will be triggered and the data will be transmitted from the power meter. This is in contrast to the FETCh? command, which is capable of causing immediate output of the measurement data but not initiating the triggering cycle.	

READ?

Syntax:	READ<channel 1 to 2><channel 1 to 2><channel 1 to 2>[:POWer]?	
Example:	OUTPUT @PWR_MTR;READ2?	! TRIGGER MEASUREMENT AND READ CHANNEL 2
Response:	A power measurement.	
Description:	The READ[:POWer]? query command triggers measurement and sends the data to the controller. The READ? command enables the power meter to acquire data at the next instrument trigger and return post-processed measurement data from the active channels of the 58542. READ uses the current sensor averaging setup.	

*OPC

Example:	OUTPUT @PWR_MTR;*OPC	! *OPC ALLOWS ONE-TIME SRQ ENABLE
Description:	The *OPC command determines when an operation is completed. This command is generally used to monitor the completion of long measurement sequences. It sets the operation complete bit in the event status register upon completion of operation.	

*OPC?

Example:	OUTPUT@PWR_MTR;*OPC?	! RETURNS A VALUE OF 1 AFTER AN OPERATION IS COMPLETED
Description:	The *OPC? operation complete query allows synchronization between the controller and the test set using either the message available (MAV) bit in the status byte, or a read of the output OPC?.	

2.5.13.1 Special Errors

An unusual or non-sense numeric response, such as 9e+40, indicates an error response. For instance, not performing the power sweep calibration procedure to calibrate the sensor to the power meter, the response to a MEAS#? command will be 9.0000e+40.

Selected basic SCPI syntax and execution errors apply to these commands.

If using the READ#? measurement query and INIT:CONT is ON, a bad value is returned, 9e+40. Sending SYST:ERR? error query, -213, Init ignored will be returned. READ#? contains the low level function INIT, since INIT:CONT is ON the INIT within READ#? generates an error. Set INIT:CONT to OFF when using READ#?.

There are no device-specific errors for the preset configuration or status reset commands except the high level -300, Device-specific error response.

Example programs for Reading Power Measurements are contained in Appendix A.

2.5.14 Instrument Triggering

- *TRG
- TRIGger[:IMMediate]
- TRIGger:SOURce
- TRIGger:MODE
- TRIGger:DELay
- TRIGger:COUNt
- INITiate:CONTinuous
- INITiate[:IMMediate]
- *WAI

These SCPI commands trigger the measurement cycle. They do not configure or provide triggering for Peak Power Sensors. Those commands are defined in Section 2.5.19. For power meter operation, the TRIGger Subsystem is divided into two sections; Instrument Measurement Event Triggering, and Special Triggering Configuration commands for the fast reading buffered data, Burst, and Swift modes.

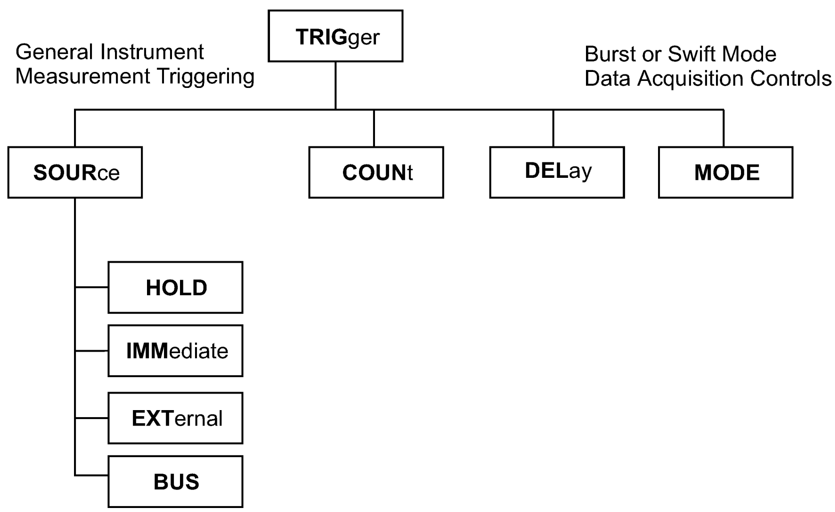


Figure 2-7: TRIGger Subsystem Command Tree

EXT triggering is performed with the rear panel BNC connector and functions only in the BURSt and SWIFt Modes. EXT triggering is not available in the NORMal Mode. Provision has been made for a hardware ready for new trigger type handshaking capability using the analog output.

BUS triggering is available for all operating modes, BURSt, SWIFt and NORMal.

IMMediate triggering allows the 58542 to free run and perform continuous measurements. This is the default setting. To INITiate on IMMediate to increase measurement speed. During Normal Mode, with both of these controls set to IMM, power measurements can be read with MEAS, READ, or FETCh. IMMediate triggering is not compatible with the BURSt Mode. To send the CALC#:MODE BURS command to enter the BURSt Mode, IMM instrument triggering for NORMal Mode will automatically be switched to TRIG:SOUR BUS. To send the CALC#: MODE SWIF command to enter the SWIFt Mode, IMM instrument triggering will remain IMM but a device-specific error will be generated whenever specifying a TRIG:COUN# higher than 1.

*TRG

Syntax:	*TRG	
Example:	OUTPUT @PWR_MTR;*TRG	! BUS TRIGGER EVENT
Description:	*TRG is an IEEE 488.2 compatible programming command to initiate BUS triggered measurements. The power meter interprets *TRG as a BUS source for instrument triggering events. This command will not trigger Peak Power Sensors. It is the same as the TRIG command.	

TRIG

Syntax:	TRIGger[:IMMediate]	
Example:	OUTPUT @PWR_MTR;TRIG	! TRIGGER MEASUREMENT CYCLE
Description:	TRIG is the SCPI command form of *TRG. The power meter interprets TRIG as a BUS source for instrument triggering events. If INIT:CONT is OFF, measurements using FETCh#? will not proceed until triggering is armed and instrument triggering is actuated.	

TRIG:SOUR

Syntax:	TRIGger:SOURce*space*<instrument triggering sourc IMMediate, BUS, HOLD, or EXTernal>	
Example:	OUTPUT @PWR_MTR;TRIG:SOUR IMM	! SETS INSTRUMENT MEASUREMENT TRIGGER ! SOURCE TO IMMEDIATE
Description:	TRIG:SOUR IMM sets trigger control to the 58542. BUS triggering sets the triggering control to the controller software using TRIG or *TRG commands. HOLD halts triggering sequences. EXTernal sets triggering control to the front panel BNC connector. The following data shows triggering and operating mode compatibility.	

Operating Mode	IMM	BUS	HOLD	EXT
NORMal	X	X	X	
SWIFt	X	X		X
BURSt		X		X

If the power meter has been configured for EXT triggering in the BURSt or SWIFt modes and the operating mode is switched to NORMal, the triggering configuration remains EXT. However, if the configuration is IMM in NORMal mode and the meter is switched to BURSt, it automatically switches to BUS. As a general rule, when a measurement subroutine switches operating modes, send the triggering configuration.

TRIG:MODE

Syntax:	TRIGger:MODE*space*<burst mode data gathering POST trigger receipt or PRE trigger receipt>	
Example:	OUTPUT @PWR_MTR;TRIG:MODE POST	! SETS BURST OR SWIFT MODE DATA COLLECTION ! RELATIVE TO TIMING OF EVENT TRIGGER POST
Description:	This command is only for BURSt Mode measurements. Send this command only immediately after CALC#:MODE BURS. TRIG:MODE controls the operation of the FIFO data buffer inside the power meter. When set to POST, the burst of data points is taken after the receipt of a valid instrument trigger. When set to PRE, the burst of data is assumed to be those data points that have arrived immediately preceding the valid instrument trigger event. Using PRE requires some caution: The single processor in the 58542 is constantly performing data acquisition. To send any configuration commands while it is collecting the PRE trigger data, the timing of the data point collection can be interrupted.	

TRIG:DEL

Syntax:	TRIGger:DELay*space* <delay time between buffered readings in sec, 0.000 to 5.000>	
Example:	OUTPUT @PWR_MTR;TRIG:DEL 5E-3	! SETS BURST MODE MEASUREMENT TIME TO ! 5 MS BETWEEN MEASUREMENTS.
Example 2:	OUTPUT @PWR_MTR;TRIG:DEL 0	! MAX. MEASUREMENT RATE (RESOLUTION, ! 1 MSEC)
Description:	This command applies only to the BURSt Mode. It sets the time interval between the measurements and is accurate to about 5%. This is the only way to control the data acquisition of individual data points in a burst measurement. Burst measurement data is taken following or just prior to a single instrument trigger event. The number of measurements taken is controlled by TRIG:COUNt. Timing can be set in 0.001 second increments from 0.000 to 5.000 seconds, inclusive. Setting this control to 0.000 activates the highest reading rate (5100 rdgs/sec) possible with the 58542. Triggering of the Peak Power Sensor occurs independently from instrument triggering. Therefore, there is a moderate ability to control triggering at the Peak Power Sensors. Generally, if controlling is required of individual data point triggering, the SWIFt mode will provide the highest measurement rates, with or without SRQ or hardware handshaking.	

TRIG:COUN

Syntax:	TRIGger:COUNt*space* <number of data values to buffer in memory from 1 to 5000 for the standard 58542; from 1 to 128,000 on one channel with option 02; and 1 to 64000 for two channels with option 02>	
Example:	OUTPUT @PWR_MTR;TRIG:COUN 100	! SETS BURST OR SWIFT MODE BUFFER READING ! NUMBER TO 100
Description:	The power meter has an internal and expandable data buffer for storing measurement data until the slot 0 controller/resource manager is ready to read the data. During the SWIFt or BURSt modes, this command controls the number of power readings that are stored in the 58542 data buffer. The value specified here applies to each individual channel. That is, if two sensors are attached and calibrated, the 58542 will perform the specified measurement and buffering for both channels. In the example shown below for this command, that would be 100 points per channel. Option 02 adds additional memory for 128,000 data point buffering. When two sensors are attached and calibrated, the maximum is 64,000 readings per channel. During BURSt mode, the COUNt# of readings will be taken with just one instrument trigger. During the SWIFt Mode however, to control the triggering of individual data points. set triggering to EXT, the power meter will perform one measurement each time it detects a TTL level signal. The value is then stored in the data buffer. This continues until the meter has received and processed a COUNt# of triggers and also read in a COUNt# of data points to the buffer.	

*WAI

Example:	OUTPUT @PWR_MTR;*WAI	! WAIT, FOLLOWING COMMAND COMPLETION
Description:	The *WAI command causes the power meter to wait until all previous commands and queries are completed before continuing operation. It functions only when using the Normal mode of operation.	

Example programs for Instrument Triggering are contained in Appendix A.

2.5.15 Arming the Triggering Cycle

■ INITiate:CONTinuous
■ INITiate[:IMMediate]

The Initiate commands enable the power meter to acquire measurement data at the next instrument trigger. In the absence of an instrument signal, the 58542 is placed in the waiting-for-trigger-state. The default configuration is continuous initiation, INIT:CONT ON.

INITiate[:IMMediate] causes the power meter to exit the idle state and causes the trigger system to initiate and complete one full trigger cycle, returning to the idle state upon completion. For example, INITiate[:IMMediate] can be used with Peak Power Sensors to measure the power level of transient or one-shot pulsed microwave signals. After execution of the triggering sequence, send the FETCh? query command to return the measurement data from the 58542.

Perform triggering configuration with the TRIGger Subsystem commands. When TRIGger:SOURce is IMMediate, the measurement will start as soon as INITiate is sent to the 58542 and executed (or INITiate:CONTinuous ON sent and executed).

INIT:CONT

Syntax:	INITiate:CONTinuous*space*< ON | OFF >	
Example:	OUTPUT @PWR_MTR;INIT:CONT ON	! CONTINUOUS TRIGGERING
Description:	This allows user control of measurement cycle arming. When INIT:CONT is set to ON, measurement cycle arming occurs automatically. The default setting is OFF. To take control of arming the triggering of the measurement cycle, set this control to OFF and use MEAS#? or INIT with READ#? to perform the measurement. Another legal measurement control option would be INIT with TRIG: IMM and FETC#? When INITiate:CONTinuous is ON, the instrument triggering cycle resets continuously. That is, upon instrument triggering, data is constantly being acquired and updated. Upon completion of a trigger cycle, the meter will immediately enter the wait-for-trigger state rather than the idle state, as is the case with INITiate:CONT OFF.	

INIT:IMM

Syntax:	INITiate[:IMMediate]	
Example:	OUTPUT @PWR_MTR;INIT	! INITIATE INSTRUMENT TRIGGERING CYCLE
Description:	This command enables the triggering cycle. Instrument triggering will not occur unless INIT has been enabled, even when sending BUS or EXT triggers to the 58542. Either this command or INIT:CONT ON performs measurements with FETCh? and READ?. MEAS? is a high level function which contains the INITiation enabling function. Arming occurs automatically when using the MEAS#? command to automatically INITiate, TRIGger and FETCh the measurement data. However, if using READ#? or FETCh#? to read data, this command arms the 58542 for triggering upon the occurrence of the next valid trigger. The INITiate[:IMMediate] command places the power meter in the wait-for-trigger-state. When used with EXT (TTL levels) instrument triggering, this command is useful for measuring signals that are asynchronous with programming (BUS triggered) sequences. When INITiate:CONTinuous is set to OFF, INITiate:[IMMediate] enables the instrument triggering cycle. Sending INITiate:[IMMediate] when INITiate:CONTinuous is set to ON will cause a -123 command error. The INITiate [:IMMediate] command is an event; no query form exists for this command.	

2.5.16 Channel Configuration

- **CALCulate:POWer**
- **CALCulate:RATio**
- **CALCulate:DIFFerence**
- **CALCulate?**
- **CALCulate:UNIT**
- **CALCulate:STATe**
- **CALCulate:STATe?**

CALC#:POW

Syntax:	CALCulate<channel 1 to 2>[:CHANnel]:POWer*space*<sensor 1 or 2>	
Example:	OUTPUT @PWR_MTR;CALC2:POW 1	! CONFIGURES CHANNEL 2 TO ! MEASURES SENSOR 1 POWER
Description:	This command configures a sensor to an individual channel, and the channel measures the sensor power level. This command does not have a query format. For the example above, the response to a CALC2? query is POW 1. This command should be executed only after the designated sensor has been calibrated.	

CALC#:RAT

Syntax:	CALCulate<channel 1 to 2>[:CHANnel]:RATio*space*<sensor 1 or 2*comma*sensor 2 or 1>	
Example:	OUTPUT @PWR_MTR;CALC1:RAT 2,1	! CONFIGURES CHANNEL 1 TO MEASURE ! SENSOR 2 OVER SENSOR 1 POWER
Description:	This command configures a channel as a ratio of the power levels present at the two sensors. When UNITs are dBm, RATio configuration produces measurements in dB. When UNITS are Watts, RATio configuration measurements are percentage. This command does not have a query format. For the above example, the response to a CALC1? query is RAT 2,1. This command should be executed only after the designated sensor has been calibrated.	

CALC#:DIFF

Syntax:	CALCulate<channel 1 to 2>[:CHANnel]:DIFFerence*space*<sensor 1 or 2*comma*sensor 2 or 1>	
Example:	OUTPUT @PWR_MTR;INIT:CONT ON	! CONFIGURES CHANNEL 1 TO MEASURE ! SENSOR 2 MINUS SENSOR 1 POWER
Description:	This command configures a channel as the difference between the power levels present at the two sensors. UNITs are dBm or Watts. This command does not have a query format. For the above example, the response to a CALC1? query is DIFF 2,1. This command should be executed only after the designated sensor has been calibrated.	

CALC#?

Syntax:	CALCulate<channel 1 to 2>[:FUNCtion]?	
Example:	OUTPUT @PWR_MTR;CALC2?	! QUERIES CHANNEL 2 SENSOR CONFIGURATION
Response:	POW #, RAT #,#, OR DIFF #,#	
Description:	This command returns the current channel configuration. This command is a query format only.	

CALC#:UNIT

Syntax:	CALCulate<channel 1 to 2>:UNIT[:POWer]*space*<data units selection, dBm or Watt>	
Example:	OUTPUT @PWR_MTR;CALC1:UNIT W	! SELECTS CHANNEL 1 LINEAR UNITS, WATTS
Example 2:	OUTPUT @PWR_MTR;CALC1:UNIT DBM	! SELECTS CHANNEL 1 LOG UNITS, DBM
Description:	This command configures a channel to report power measurements in either linear Watts units or logarithmic dBm units. When UNIT is dBm, the RATio configuration produces measurements in dB, and POWer and DIFF measurements in dBm. When UNIT is Watts, the RATio configuration measurements are percentages, and POWer and DIFF measurements are in Watts.	

CALC#:STAT

Syntax:	CALCulate<channel 1 to 2>:STATe*space*<ON | OFF>	
Example:	OUTPUT @PWR_MTR;CALC1:STAT OFF	! DISABLES CHANNEL 1 MEASUREMENT
Description:	This command turns a channel off or on. Default is ON. During Normal and Swift modes, measurement speed increases when only one sensor (Channel Configuration is CALC#:POW) is performing measurements.	

CALC#:STAT?

Syntax:	CALCulate<channel 1 to 2>:STATe?	
Example:	OUTPUT @PWR_MTR;CALC1:STAT?	! QUERIES CHANNEL 1 MEASUREMENT STATUS
Response:	0 = off, 1 = on	
Description:	This command is the query format of the command above.	

Example programs for Channel Configuration are contained in Appendix A.

2.5.17 Cal Factor Correction

- **SENS#:CORR:FREQ**
- **MEMory:FREQuency**
- **MEMory:SELect**
- **MEMory:SLOPe**

Power Sensors have a measurable frequency response. During manufacture, this response is calibrated at 1 GHz intervals. Instead of printing the data on the sensor label, each Giga-tronics power sensor includes a built-in EEPROM which has been programmed with the frequency calibration factor data for that particular power sensor.

The following SCPI commands tell the 58542 the operating frequency of the measured microwave or RF signal. Thus, the meter automatically interpolates the correct Cal Factor and applies that value to the measurement data. By performing this automatically, there is no need to read Cal Factor data from the side of sensor housings and program the data into tables within the ATE programming. Except for advanced measurement techniques using Burst Mode, there is no need to write cal factor interpolation routines; this is all done by the power meter. As shown below, sensor Cal Factor data can be read into the computer. Also see the Sensor EEPROM Commands in Section 2.5.32 for Cal Factor programming.

SENS#:CORRection:FREQ

Syntax:	SENSe<sensor 1 or 2>:CORRection:FREQuency[:CW-FIXed] 5e7	
Example:	OUTPUT @PWR_MTR;SENS2:CORR:FREQ 5E7	! SETS SENSOR 2 FREQUENCY TO 50 MHZ
Response:	0 = off, 1 = on	
Description:	This command allows correcting for sensor frequency response characteristics. The power meter uses this frequency to automatically interpolate and apply the Cal Factor for that sensor (computed from Cal Factor data points stored within each sensor's EEPROM). Unless the EEPROM has been modified subsequent to shipment, the Cal Factor is always 0.0 dB at 50 MHz, 5e7. Be sure to correct for sensor cal factor by using this command, using automated V_{PROP}F correction, sending cal factor REFerence value, or correcting for Cal Factor in the ATE system by downloading Cal Factor points for the 58542.	

Syntax:	SENSe<sensor 1 or 2>:CORRection:FREQ?	
Example:	OUTPUT @PWR_MTR;SENS2:CORR:FREQ?	! QUERIES SENSOR 2 FREQUENCY VALUE FOR 50 MHZ
Response:	+5.0000E+07	
Description:	This command reports the current operating frequency setting for a particular sensor.	

Syntax:	SENSe<sensor 1 or 2>:CORRection:VPROpf[:STATe]*space*<ON-OFF>	
Example:	OUTPUT @PWR_MTR;SENS1:CORR:VPRO ON	! ENABLES SENSOR 1 V_{PROP}F FUNCTION
Description:	Setting this control to ON activates V_{PROP}F and deactivates SENS#:CORR:FREQ.	

Syntax:	SENSe<sensor 1 or 2>:CORRection:VPROpf[:STATe]?	
Example:	OUTPUT @PWR_MTR;SENS1:CORR:VPRO?	! QUERIES V_{PROP}F FUNCTION STATUS
Description:	This command reports the ON or OFF status of the V_{PROP}F correction for the sensor.	

Frequency response variations (which are reflected in Cal Factors in Giga-tronics sensors) do not change appreciably over small frequency ranges. That is, the frequency sent to the power meter does not need to be exact. If the actual measurement frequency is within about 40 MHz of the value sent to the power meter, measurement variation due to this discrepancy will typically be less than 0.02 dB, well below typical RSS measurement accuracy levels.

☛ ***NOTE:*** *Example programs for Cal Factor Corrections are contained in Appendix A of this publication.*

MEM:FREQ

Syntax:	MEMory[:TABLe]:FREQuency*space* <Start frequency>	
Example:	OUTPUT @PWR_MTR;MEM:FREQ 1E9	! SETS V_{PROP}F FREQUENCY TO 1 GHZ
Description:	This command sets the automated V_{PROP}F correction start frequency. The frequency at which the voltage input into the 58542 is 0.0 V.	

Syntax:	MEMory[:TABLe]:FREQuency?	
Example:	OUTPUT @PWR_MTR;MEM:FREQ?	! QUERIES V_{PROP}F START FREQUENCY
Description:	This V_{PROP}F command reports the start frequency setting.	

MEM:SEL

Syntax:	MEMory[:TABLe]:SELect*space* <ANALOGout,VPROpf1,VPROpf2>	
Example:	OUTPUT @PWR_MTR;MEM:SEL VPROPF1	! SELECTS MEMORY TABLE V_{PROP}F1 ! FOR EDITING IN FOLLOWING LINES
Description:	This command selects between one of three editable tables. Using the meter's automated V_{PROP}F capability to correct for Cal Factor requires configuring the V_{PROP}F IN connector to match the signal that source will output. This is performed by setting the frequency so that source's V_{PROP}F output is 0.0 V. Then the slope relationship is entered in the form of a value representing the V/Hz relationship. If source is a Giga-tronics GT 9000 Series Signal Generator, this relationship is 0.5 V/GHz or 5e-8 V/Hz.	

Syntax:	MEMory[:TABLe]:SELect?	
Example:	OUTPUT @PWR_MTR;MEM:SEL?	! QUERIES THE SELECTED MEMORY TABLE
Response:	Tables currently editable; ANALOG, VPROPF1 or VPROPF2	
Description:	This command reports the currently active, editable table.	

2.5.17.1 V_{PROP}F Configuration

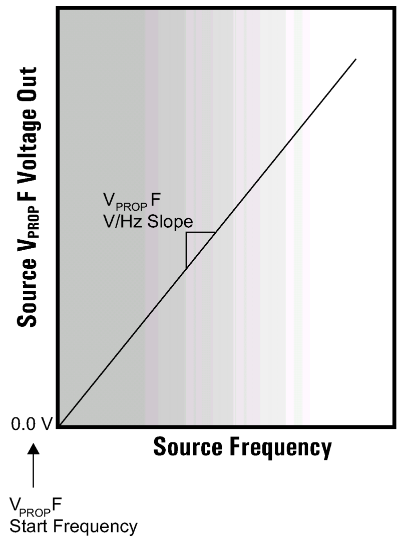


Figure 2-8: V_{PROP}F Configuration

MEM:SLOP

Syntax:	MEMory[:TABLe]:SLOPe*space* <Volts per Hz>	
Example:	OUTPUT @PWR_MTR;MEM:SLOP 1E-9	! SETS V_{PROP}F SLOPE TO 1 V/GHZ
Description:	This command sets the V/Hz relationship for automated Cal Factor correction.	

Syntax:	MEMory[:TABLe]:SLOPe?	
Example:	OUTPUT @PWR_MTR;MEM:SLOP?	! QUERIES V_{PROP}F SLOPE VALUE
Response:	The voltage to frequency value set that corresponds to source's V_{PROP}F output.	
Description:	This command sets the V/Hz slope relationship for V_{PROP}F frequency correction.	

2.5.17.2 Cal Factor Error Control

- See Error Messages in Section 2.5.34
- Selected basic SCPI syntax and execution errors apply to these commands
- Device-specific errors include the following and other -300 level errors
- A common device-specific error occurs when the frequency sent to the 58542 in the **SENS#:CORR:FREQ** ### command is outside the sensor operating frequency range. For example, sending SENS1:CORR:FREQ 18.4e9 when an 18 GHz (max) 80301A CW Power Sensor is attached will yield a device-specific error

2.5.18 High Speed Measurements

- **CALCulate:DATA?**
- **CALCulate:MODE**
- **TRIGger:MODE**
- **TRIGger:DELay**
- **TRIGger:COUNt**

Measurements in Normal mode are fastest with only one sensor attached. When two sensors are attached, the Normal mode measurement rate is reduced. This applies for all three major measurement commands, FETCh, READ and MEASure. Both of the averaging types, MOVing and REPeat, slow down when in the Normal mode. MOVing provides faster averaging; the speed is equivalent to REPeat whenever the Averaging number is 1.

When performing measurements in either Swift or Burst modes, measurement rates are the same with two sensors as with one sensor. Approximate measuring speeds are listed in Table 2-3.

CALC:DATA?

Syntax:	CALCulate<channel 1 to 2>:DATA?	
Example:	OUTPUT @PWR_MTR;CALC1:DATA?	! QUERIES CHANNEL 1 & 2 BURST MODE DATA
Description:	This command interrupts the burst measurement and dumps the measurement buffer. All empty locations will be filled with -300 before the data dump. The Burst mode remains active after this command so that a trigger will start a new measurement reference. The command returns measurement data (while the measurement is completing) during BURSt mode only. This command is not used in NORMal or SWIFt Modes. Operation is similar to using FETCh? Both are instrument (not channel) commands. That is, when both sensors are connected, calibrated, and the channel set to ON, this command will return power level data for both channels.	

2.5.18.1 Operating Mode Control

The Operating mode is controlled through the CALC#:MODE command. The choices are NORMal, BURSt and SWIFt. Sending CALC1:MODE will set the operating mode for the entire instrument, not just for channel 1. The fast mode permits more frequent return of measurement data to the host during operation in the modulated measurement modes (MAP, PAP or BAP).

CALC:MODE

Syntax:	CALCulate<channel 1 to 2>:MODE *space* <NORMal, BURSt or SWIFt selection>	
Example:	OUTPUT @PWR_MTR;CALC2:MODE NORMAL	! SETS THE MEASUREMENT TO NORMAL
Description:	This command sets the measurement mode. This is NOT a channel-specific command; it is an instrument configuration command. Selecting one channel changes both channels to the desired mode. Use this command to select the level of functionality and performance for unique applications. NORMal Mode is full functioned. SWIFt Mode allows individual data point triggering. BURSt Mode allows the fastest measurement rates.	

The following commands are duplicates of those given in the Instrument Triggering section of this chapter and are shown here for convenience. These commands must be used with BURSt mode operation.

TRIG:MODE

Syntax:	TRIGger:MODE*space*<burst mode data gathering POST trigger receipt or PRE trigger receipt>	
Example:	OUTPUT @PWR_MTR;TRIG:MODE POST	! SETS BURST OR SWIFT MODE DATA COLLECTION ! RELATIVE TO TIMING OF EVENT TRIGGER POST
Description:	This command is only for BURSt Mode measurements. Send this command only after CALC#:MODE BURS. TRIG:MODE controls the operation of the FIFO data buffer in the 58542. When set to POST, the burst of data points is taken after the receipt of a valid instrument trigger. When set to PRE, the burst of data is assumed to be those data points that have arrived immediately preceding the valid instrument trigger event. Using PRE requires some caution: the single processor inside the 58542 is performing data acquisition constantly. Sending any configuration commands while the 58542 is collecting the PRE trigger data, interrupting the timing of the data point collection can be done.	

TRIG:DEL

Syntax:	TRIGger:DELay*space*<delay time between buffered readings in sec, 0.000 to 5.000>	
Example:	OUTPUT @PWR_MTR;TRIG:DEL 5E-3	! SETS BURST MODE MEASUREMENT TIME TO ! 5 MS BETWEEN MEASUREMENTS
Example 2:	OUTPUT @PWR_MTR;TRIG:DEL 0	! MAX. MEASUREMENT RATE, 5100/SEC. (RESOLUTION, ONE MSEC)
Description:	This command applies only to BURSt Mode. It sets the time interval between the measurements; it is accurate to about 5%. This is the only way to control the meter's data acquisition of individual data points in a burst measurement. Burst measurement data is taken following or just prior to a single instrument trigger event. The number of measurements taken is controlled by TRIG:COUNt. Timing can be set in 0.001 second increments from 0.000 to 5.000, inclusive. Setting this control to 0.000 activates the highest reading rate possible with 58542; 5100 readings per second. Triggering of the Peak Power Sensor occurs independently from instrument triggering. There is a moderate ability to control triggering at the Peak Power Sensors. Generally, if requiring control of individual data point triggering, SWIFt mode will provide the highest measurement rates, with or without SRQ or hardware handshaking. The 58542 controls its gain ranges transparently by verifying internal range changes just before and just after individual measurement points. If the internal range does not remain the same, the data point will be discarded as invalid.	

TRIG:COUN

Syntax:	TRIGger:COUNt*space*<number of data values to buffer in memory from 1 to 5000>	
Example:	OUTPUT @PWR_MTR;TRIG:COUN 100	! SETS BURST OR SWIFT MODE BUFFER READING ! NUMBER TO 100
Description:	The 58542 has an internal data buffer for storing measurement data until the slot 0 controller/resource manager is ready to read the data. During SWIFt or BURSt modes, this command controls the number of power readings that are stored in the 58542 data buffer. The value specified here applies to each channel. If two sensors are attached and calibrated, the 58542 will perform the specified measurement and buffering for both channels. In the example above, that would be 100 points per channel. During BURSt mode, the COUNt # of readings will be taken with just one instrument trigger. During SWIFt Mode however, control the triggering of individual data points. Setting triggering to EXT, the 58542 will perform one measurement each time a TTL level signal is detected by the 58542. Then the value is stored in the data buffer. This continues until the 58542 has received and operated the COUNt # of triggers and also read in the COUNt # of data points to the buffer.	

Syntax:	TRIGger:COUNt?	
Example:	OUTPUT @PWR_MTR;TRIG:COUN?	! QUERY BURST OR SWIFT MODE BUFFER NUMBER
Response:	Response is a single number - the number of data points stored in memory during Burst of Swift modes.	
Description:	This query returns the current setting of the number of data points to collect in the meter's internal data buffer during BURSt or SWIFt Mode.	

2.5.18.2 Approximate Measuring Speeds

Table 2-3 lists the 58542 approximate measurement speeds in readings per second.

Table 2-3: Approximate Measurement Speeds

Range (dBm)	22 to 4	6 to –10	–7 to –21	–18 to –30	–27 to –37	–35 to –48	–46 to –66	–64 to –99
Normal 1	53	53	53	53	53	53	53	53
Normal 2	23	23	23	23	24	6.9	6.6	5.8
Normal 3	22	22	22	16	17	0.5	0.06[2]	0.06[2]
Swift IMM	71	71	71	71	71	71	71	71
Swift Bus 1	39	39	39	39	40	25	25	25
Swift Bus 2	53	53	53	53	56	24	24	24
Swift Ext	150[1]	150[1]	150[1]	150[1]	150[1]	150[1]	150[1]	150[1]
Burst[3]	5100	5100	5100	5100	5100	5100	5100	5100

Notes:

1. HP 9000-300 Computer, HP BASIC Language, HP-E1505B Controller.
2. Speed will be 0.24 for average number of 32, and 0.12 for average number of 64.

Normal 1:	SENS1:AVER:TCON MOV INIT:COUN ON FETC1
Normal 2:	SENS1:AVER:TCON MOV INIT:COUN ON MEAS1?
Normal 3:	SENS1:AVER:TCON REP MEAS1?
Swift Imm	
Swift 1:	(SRQ Handshake) Swift 2:(without SRQ Handshake) Swift 3:(without TTL Handshake)
Burst	

2.5.18.3 Triggering Notes

Refer to Instrument Triggering in Section 2.5.14 for more information.

EXT triggering is performed with the front panel BNC connector and will work only in BURSt and SWIFt Modes. EXT triggering is not available in NORMal Mode. Provision has been made for a hardware ready type handshaking capability using the analog output. This feature can be used as a loop back test when performing troubleshooting procedures.

BUS triggering is available for all operating modes, BURSt, SWIFt and NORMal.

IMMediate triggering is not compatible with BURSt and SWIFt Modes. If sending the CALC#:MODE BURS command to enter the BURSt Mode, IMM instrument triggering for NORMal Mode will automatically be switched to TRIG:SOUR BUS. If using the CALC#:MODE SWIF command to enter the SWIFt Mode, IMM instrument triggering will remain IMM, but a device-specific error will be generated whenever specifying a TRIG:COUN # higher than 1. Using the FETCh#? measurement query, taking accurate measurements can be done anyway; do not set TRIG:COUN.

Using FETCh#? when having time-dependent measurement processes can be a little tricky unless using SRQs. If the 58542 has not had enough time to process the measurement or has not received a trigger, it will return an abnormally large number — 9.e40 is common, but other obviously invalid readings can occur. Not using SRQs is fastest for measurement speed, manage the measurement/triggering timing problem closely.

2.5.18.4 Measurement Level Notes

The SWIFt Mode should not be used for measuring power in the bottom 10 dB of the CW dynamic range. At low power levels, the NORMal mode reduces the measurement speed to account for the effects of noise.

Example programs for High Speed Measurements are contained in Appendix A.

2.5.19 Peak Power Sensor Triggering

■ SENSe:TRIGger

The Peak Power Sensors sample power levels almost instantaneously. Since there is a sampler built into the Peak Power sensor housing, there are several controls to configure the source of the sensor trigger signal. These include the delay time from triggering to when the sample is to be taken (Sample Delay), and the trigger level. All Peak Power Sensors will operate in the SWIFt and BURSt modes when in the CW measurement mode (SOURce) configuration (not when using INT or EXT trigger).

SENSe:TRIGger

Syntax:	SENSe <sensor 1 or 2>:TRIGger:SOURce*space*<INTernal, EXTernal, or CW>	
Example:	OUTPUT @PWR_MTR;SENS1:TRIG:SOUR CW	! SETS SENSOR 1 PEAK TRIGGER MODE TO CW MODE
Description:	This command controls the trigger source for the sensors. Both the Series 80350A respond to this command. INTernal triggering is performed automatically by the 80350A Sensor; however, the trigger level must be set to a value of power that is lower than the power level of the pulsed signal incident upon the sensor. EXTernal triggering is performed by inputting a baseband pulse into the rear connector on the sensor housing. BNC to SMB cables have been provided for this purpose. For high speed trigger pulses, SMB to SMA adapters are available from Giga-tronics. CW triggering sets the power sensors to measure CW power and triggering is essentially disabled. CW is automatically set by the 58542 during power sweep calibration; do not apply any triggering to the peak power sensor during power sweep calibration. Be sure to set the trigger level, SENS:TRIG:LEV ##.# after the INTernal or EXTernal triggering is selected.	

Syntax:	SENSe <sensor 1 or 2>:TRIGger:DELay[:MAGnitude]:*space*<delay in seconds from -20e-9 to 105e-3>	
Example:	OUTPUT @PWR_MTR;SENS1:TRIG:DEL 1E-/6	! SETS SENSOR 2 PEAK DELAY VALUE TO 1E-6 ! SECONDS
Description:	The SENS:TRIG:DEL # is the time in seconds between the Series 80350A Peak Power Sensor's receipt of a sensor trigger (INT is auto, EXT is a trigger input) and the time that the sampler is fired. This delay is typically accurate to about 0.5%; repeatability is an order of magnitude better. There is a delay line built into the peak power sensor. Therefore, measuring the power on the leading edge of the pulsed signal even if it is the same edge on which the sensor was triggered. This also allows limited look ahead capability as identified by the allowed negative time values for this command. The other reason negative time values are allowed is due to the sample delay offset capability.	

Syntax:	SENSe <sensor 1 or 2>:TRIGger:DELay:STATe*space*<ON | OFF>	
Example:	OUTPUT @PWR_MTR;SENS1:TRIG:DEL:STAT ON	! ENABLES PEAK SENSOR 1 DELAY FUNCTION
Description:	This command activates the sample delay in the Series 80350A Peak Power Sensors.	

Syntax:	SENSe<sensor 1 or 2>:TRIGger:LEVel[:MAGnitude]*space*<R In EXT triggering use -0.1 to 5.000 V. In INT triggering use -30 to +20 dBm>	
Example:	OUTPUT @PWR_MTR;SENS1:TRIG:LEV 1.7	! SETS PEAK SENSOR 1 TRIGGER LEVEL TO1.7 VOLTS
Description:	This command sets the trigger level for the Series 80350A Peak Power Sensors. Under INTernal triggering the value is in dBm (-30 to +20 dBm, with default of -20 dBm). When EXTernal triggering is used the value is in Volts (-0.100 to 5.000 V, with a default of 1.700 V). The trigger level must be lower than the signal that is triggering the peak power sensor. Under Internal triggering, this means that a -16 dBm signal must be triggered with a setting that is less than -16 dBm. EXT responds similarly. The input impedance to the EXT trigger port on the back of the sensor housing is not 50 ohms: it is a high impedance to prevent damage from triggering inputs such as 5.0 V TTL signals. Using a high speed 50 Ω trigger source, this may cause unwanted signal reflections and noise on the trigger line. An SMB to SMB attenuator is available from Giga-tronics to alleviate this condition. The attenuation reduces the reflected noise, and reduces/eliminates the noisy trigger characteristics. Be sure to set the trigger level after the INTernal or EXTernal triggering is selected.	

Syntax:	SENSe<sensor 1 or 2>:TRIGger:OFFSet[:MAGnitude]	
Example:	OUTPUT @PWR_MTR;SENS1:TRIG:OFFS 0	! SETS PEAK SENSOR 1 TRIGGER OFFSET TIME TO 0 ! SECOND
Description:	This command sets the peak power sensor trigger offset time.	

Syntax:	SENSe<sensor 1 or 2>:TRIGger:TOTAl[:MAGnitude]?	
Example:	OUTPUT @PWR_MTR;SENS1:TRIG:TOTA?	! QUERIES PEAK SENSOR 1 TOTAL TRIGGER DELAY ! TIME
Response:	Current peak power sensor total trigger delay setting; a single value in seconds.	
Description:	This query reports the peak power sensor total trigger delay time.	

2.5.20 Averaging

■ SENSe:AVERage

Averaging is applied during normal operating mode. In the normal mode, Avg $_n$ results in $_n$ x 192 samples taken. In the Swift or Burst modes, Avg $_n$ results in 2_n samples taken. Auto averaging takes 4 samples all the time. For auto averaging in the normal mode, the averaging number is level dependent with very low averaging at +20 dBm, and many samples taken at very low levels.

SENSe:Average

Syntax:	SENSe<sensor 1 or 2>:AVERage:COUNt*space*<1,2,4,8,16,32,64,128,256,or 512>	
Example:	OUTPUT @PWR_MTR;SENS1:AVER:COUN 16	! SETS SENSOR 1 AVERAGE NUMBER TO 16
Description:	This command averages successive sensor readings in a digital averaging filter. As the measured signal level approaches the noise floor of the power sensor, measurement data values begin to fluctuate. To measure very low signal levels (within a few dB of the sensor noise floor), set a large value for averaging such as 128, 256, or 512. Be sure to zero the sensor, CALibration:ZERO, prior to critical measurements.	

Syntax:	SENSe<sensor 1 or 2>:AVERage:COUNt:AUTO*space*<ON | OFF>	
Example:	OUTPUT @PWR_MTR;SENS2:AVER:COUN:AUTO ON	! SELECTS SENSOR 2 AUTO-AVERAGING MODE
Description:	Auto-Averaging optimizes the measurement averaging value for reading stability and update rate when the measurement data is being repeatedly updated. At high power levels (measured), minimum averaging is applied to optimize measurement speed. As the power level drops, additional averaging is applied to steady the measured data reading.	

Syntax:	SENSe<sensor 1 or 2>:AVERage:TCONtrol*space*<data acquisition averaging method, MOVing or REPeat>	
Example:	OUTPUT @PWR_MTR;SENS1:AVER:TCON REP	! SETS SENSOR 1 TO ACQUIRE FRESH ! MEASUREMENT DATA BEFORE AVERAGING
Description:	The SENSe:AVERage:TCONtrol commands are instrument level commands that control the internal measurement data averaging of the power meter. Two modes are selectable, MOVing and REPeat. The MOVing control applies the current measurement to the previously measured data. That is, even if the averaging number is 16, a measurement data point every time a sample is taken will occur, not just after every 16 samples. There is some limited built in level sensing capability. For example, when Auto-Averaging is used and the power is suddenly changed from a low value to a high, MOVing averaging throws out the very low level previous data as the gain range changes and begins averaging fresh data. Thus, wide abrupt changes in power level are not masked by the MOVing averaging. The 58542 can fully range in about 4 ms. MOVing averaging is similar to TR1 mode in typical benchtop power meters. REPeat averaging performs full averaging every time the 58542 is triggering. Unless the averaging number is set to 1, REPeat is slower than MOVing averaging. REPeat control is similar to TR2 mode in typical benchtop power meters. Fresh data is measured and averaged with each complete measurement cycle.	

2.5.21 Relative or Referenced Measurements

■ CALCulate:REFerence

Relative and referenced measurements are used when one measured value needs to be compared to another measured value on the same channel. For example, this function is used when it is desired to monitor the power level variation around an initial turn on or reference set value.

Referenced measurements are performed when finding the 1 dB compression power of an amplifier or using a return loss bridge. When a stable source is used, a relative measurement is useful for measuring the loss through an attenuator with a single sensor or channel.

Due to the ability to set a specific value of reference using the CALC:REF[:MAG] # command, this reference measurement function can also be used setting personal calibration factors. Thus the channel and sensor offset functions can remain dedicated to other setup dependent controls in programming.

CALCulate:REFerence

Syntax:	CALCulate<channel 1 to 2>:REFerence:STATE*space*<ON | OFF>	
Example:	OUTPUT @PWR_MTR;CALC2:REF:STAT ON	! ACTIVATES LEVEL REFERENCE FOR RELATIVE ! MEASUREMENTS
Description:	This command activates the meter’s level reference to give it the ability to perform relative measurements.	

Syntax:	CALCulate<channel 1 to 2>:REFerence [:MAGnitude]<dB Offset value from -299.999 to 299.999>	
Example:	OUTPUT @PWR_MTR;CAL2:REF -30.11	! SETS CHANNEL 2 REFERENCE OFFSET VALUE IN DB
Description:	This command sets the value to subtract from the channel measurement value. This command applies to the channel (1, or 2, or 1/2, ...), not the sensor (1 or 2, only).	

Syntax:	CALCulate<channel 1 to 2>:REFerence:COLLect	
Example:	OUTPUT @PWR_MTR;CALC2:REF:COLL	! CURRENT RDG. ==> REF LEVEL. ! TAKE CHANNEL 2 READING AS REFERENCE VALUE
Description:	The CALCulate:REFerence:COLLect command will cause the level of the current power measurement to become the reference level. There is no query form of this command. After sending this command, the channel measurement will be zero, assuming the power levels at the sensor(s) did not change and REF:STAT is ON.	

2.5.21.1 Error Control

- Selected basic SCPI syntax and execution error apply to these commands.
- Device-specific errors include the following and other -300 level errors.
- Use **CALC:REF** commands only in the NORMal Mode. Attempts to use these commands in the SWIFt and BURSt modes will be ignored and the error, -300, Device-specific error; Normal mode is off, will be generated.

2.5.22 Offsets

■ SENSe:CORRection

Sensor power offsets apply to the individual sensor. Use sensor offsets to account for the loss of attenuators, which are commonly used during measurement to reduce standing waves to improve measurement accuracy. If measuring high power signals (>100 mW), but are not using Giga-tronics high power sensors, use a power attenuator between the high power output and the sensor input to prevent damage. Enter the value of attenuation as a sensor offset, and the 58542 will automatically respond with the actual power level output in its measurement data.

SENSe:CORRection

Syntax:	SENSe<sensor 1 or 2>:CORRection:OFFSet:COLLect	
Example:	OUTPUT @PWR_MTR;SENS1:CORR:OFFS:COLL	! TAKE SENSOR 1 CURRENT READING AS OFFSET ! VALUE
Description:	This command enters the current power level reading as the offset value.	

Syntax:	SENSe<sensor 1 or 2>:CORRection:OFFSet[:MAGnitude]*space*<offset value in dB, -99.99 to 99.99>	
Example:	OUTPUT @PWR_MTR;SENS2:CORR:OFFS 10.2	! COMPENSATE SENSOR 2 FOR 10.2 DB ! ATTENUATION
Description:	This command enters a specific sensor offset value.	

Syntax:	SENSe<sensor 1 or 2>:CORRection:OFFSet[:MAGnitude]?	
Example:	OUTPUT @PWR_MTR;SENS2:CORR:OFFS?	! QUERIES SENSOR 2 OFFSET VALUE
Response:	0.0000E+00 for 0 dB.	
Description:	This query reports the current dB sensor offset value which is being subtracted from measurements.	

Syntax:	SENSe<sensor 1 or 2>:CORRection:OFFSet:STATe*space*<ON | OFF>	
Example:	OUTPUT @PWR_MTR;SENS2:CORR:STAT ON	! ENABLES SENSOR 2 OFFSET CORRECTION
Description:	This command activates and deactivates the sensor offset function.	

Syntax:	SENSe<sensor 1 or 2>:CORRection:OFFSet:STATe?	
Example:	OUTPUT @PWR_MTR;SENS2:CORR:STAT?	! QUERIES SENSOR 2 OFFSET FUNCTION STATUS
Response:	1 for ON or 0 for OFF.	
Description:	This query reports the ON or OFf status of the sensor offset function.	

2.5.23 SRQ & Status Monitoring

- *CLS
- *ESE
- *ESR?
- *OPC
- *OPC?
- *SRE
- STATus:OPERation
- STATus:PREset
- *STB?

*CLS

Example:	OUTPUT @PWR_MTR;*CLS	! CLEARS SRQ AND STATUS BYTE REGISTERS
Description:	*CLS is the clear status command defined by IEEE 488.2. This command clears all of the status bytes to the value 0. After a service request interrupt is transmitted from the 58542 to the controller, use the *STB command to read the status byte from the 58542. Then reset the SRQ and use *CLS clear status command to reset the numeric status indication of the status byte/registers to 0 (all bits will be 0). *CLS does not affect the enabled or disabled status of the status byte/register masks. For example, having bit 8 of the operation register enabled before sending *CLS, it will remain enabled afterward. *CLS also clears the output queue (takes 0.3 sec to complete this function).	

*ESE

Syntax:	ESE*space*<event status register value, 0 to 255>	
Example:	OUTPUT @PWR_MTR;*ESE 16	! ENABLES BIT 4 OF EVENT STATUS REGISTER MASK
Description:	This command sets/clears the event status register enable mask.	

*ESR?

Example:	OUTPUT @PWR_MTR;*ESR?	! RETURNS EVENT STATUS REGISTER VALUE
Description:	This query returns the current status register value.	

*OPC

Example:	OUTPUT @PWR_MTR;*OPC	! *OPC ALLOWS ONE TIME SRQ ENABLE
Description:	*OPC determines when an operation is completed. This command is generally used to monitor the completion of long measurement sequences. It sets the operation complete bit in the event status register upon completion of operation.	

*OPC?

Example:	OUTPUT @PWR_MTR;*OPC?	! RETURNS A VALUE OF 1 AFTER AN OPERATION IS COMPLETED
Description:	The *OPC? operation complete query allows synchronization between the controller and the test set using either the message available (MAV) bit in the status byte, or a read of the output OPC?.	

*SRE

Syntax:	*SRE*space* <event status register value, 128, 64, 32, 16, 8, 4, 2, 1>	
Example:	OUTPUT @PWR_MTR;*SRE 32	! ENABLES BIT 5 OF STATUS BYTE REGISTER
Description:	This command sets the mask of the Status Byte register.	

Syntax:	*SRE?	
Example:	OUTPUT @PWR_MTR;*SRE?	! QUERIES BITS ENABLE OF STATUS BYTE REGISTER
Response:	Status register mask value.	
Description:	This query returns the mask of the Status Byte register.	

STAT:OPER

Syntax:	STATus:OPERation[:EVENt]?	
Example:	OUTPUT @PWR_MTR;STAT:OPER?	! QUERIES OPERATION EVENT REGISTER RESULT
Description:	This query returns the operation event register result.	

Syntax:	STATus:OPERation:ENABle*space* <event register value 0 through 65535>	
Example:	OUTPUT @PWR_MTR;STAT:OPER:ENAB 1	! SETS THE EVENT REGISTER ENABLE MASK
Description:	This command sets the enable mask, which allows true conditions in the event register to be reported in the summary bit.	

STAT:PRES

Syntax:	STATus:PRESet	
Example:	OUTPUT @PWR_MTR;STAT:PRES	! CLEARS ALL THE STATUS REGISTER VALUE
Description:	This command clears all status registers.	

*STB?

Example:	OUTPUT @PWR_MTR;*STB?	! QUERIES STATUS BYTE REGISTER
Description:	This query returns status byte register result. The SCPI status reporting structure includes the IEEE 488.2 Status Registers. Please note that bit 5 of the OPERation Status Register is only used during BURSt and SWIFt modes. NORMal mode does not use this function.	

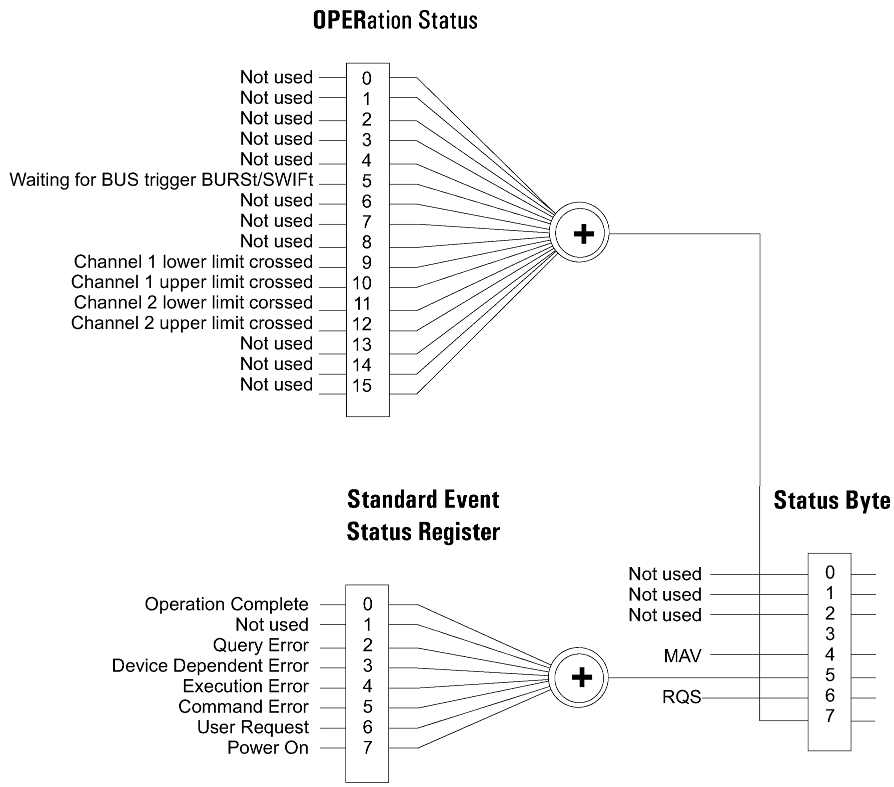


Figure 2-9: SCPI Status Structure Registers

2.5.23.1 Event Status Register

The *ESE command is used in combination with group commands that form the meter's service request system. These commands and their responses are almost identical to the IEEE 488 (GPIB) SRQ service request command structures. The *ESE command is used to enable bits of the event status register mask.

The *ESE command is one of the commands that can used to monitor the status of the power meter. Together with the status byte (also see commands *STB? or *SRE?) and the operation status register (STATus:OPERation), the event status register provides information on several critical 58542 functions and error conditions.

7	6	5	4	3	2	1	0
Power On	0	Command Error	Execution Error	Device-Dependent Error	0	0	Operation Complete
Value = 128	Value = 64	Value = 32	Value =16	Value = 8	Value = 4	Value = 2	Value = 1

☛ ***NOTE:*** *The logical value in the register is used both to enable a bit's event function and to enable that bit of the event status register mask to report the event status (Following the *ESR? command).*

The event status register is 8 bits long and is structured as follows:

Bits 1 and 6 are not used. When bit 3 is a 1, a device-dependent error has occurred. When bit 4 is a 1, an execution error has occurred. When bit 5 is a 1, a command error has occurred. Bit 7 is a 1 when the 58542 is turned ON. The 58542 does not have a standby mode; therefore, it is probably not useful to enable bit 7 of the event status register mask (by sending the command *ESE 128).

In the default state, the meter's event status register is masked, or set to off. None of the bits are enabled. If an execution error occurs, a service request will not be sent to the controller and the event status register will remain set to 0. The *ESE command is used to enable individual bits. These bits must be enabled individually. They can be cleared or turned off as a group by sending the *CLS command.

To use the event status register, bit 5 of the status byte must also be enabled by sending the command *SRE 32.

The *ESR? query returns the current value of the event status register.

☛ ***NOTE:*** *The logical value in the register is used both to enable a bit's event function and to enable that bit of the event status register mask to report the event status (Following the *ESR? command).*

2.5.23.2 Status Byte Register

7	6	5	4	3	2	1	0
Operational Status	Require Service (RQS)	Event Status	Message Available	0	0	0	0

Notes:

1. The condition indicated in bits 1 through 5 must be enabled by the Service Request Mask to cause a Service Request Condition. The mask is set with the *SRE command followed by ASCII characters. The value of the byte is determined by summing the weight of each bit to be checked.
2. The RQS (bit 6) is true when any of the conditions of bits 4, 5 and 7 are enabled and occur.
3. Bits remain set until the Status Byte is cleared.

2.5.24 Min/Max Configuration & Monitoring

■ CALCulate:MAXimum
■ CALCulate:MINimum

MIN and MAX channel monitoring records the minimum and maximum variation of channel amplitude over time. Time zero is set by setting the MIN or MAX STATe to ON. The default Preset and turn on configuration is ON. After setting to ON, the minimum and maximum value of the measured value on that channel will be recorded. To reset the MIN and MAX value back to the current value, set the STATe to ON again. The STAT OFF does not need to be sent during reset of MIN and MAX values. Individual sensor minimum and maximum power level variations can be monitored only if that sensor is defined directly to a channel with POW 1 or POW 2. MIN and MAX channel monitoring is only available in Normal Mode. BURSt and SWIFt modes do not perform MIN and MAX monitoring.

CALC:MAX

Syntax:	CALCulate<channel 1 to 2>:MAXimum:STATe*space*<ON | OFF>	
Example:	OUTPUT @PWR_MTR;CALC2:MAX:STAT ON	! ENABLES CHANNEL 2 MAXIMUM TRACKING
Description:	ON activates the MAX monitoring function. The maximum value of the channel (not sensor) is monitored until the value is reset by CALC#:MAX:STAT ON or CALC#:MAX:STAT OFF is sent.	

Syntax:	CALCulate<channel 1 to 2>:MAXimum:STATe?	
Example:	OUTPUT @PWR_MTR;CALC2:MAX:STAT?	! QUERIES CHANNEL 2 MAXIMUM MODE
Response:	1 is for ON or 0 for OFF.	
Description:	Reports ON or OFF status of MAX monitoring.	

Syntax:	CALCulate<channel 1 to 2>:MAXimum[:MAGnitude]?	
Example:	OUTPUT @PWR_MTR;CALC2:MAX?	! QUERIES CHANNEL 2 MAXIMUM VALUE IN DBM
Response:	Highest power reading since CALC2:MAX:STAT ON was sent.	
Description:	This command reports the value maintained as the maximum in the 58542 max monitor.	

CALC:MIN

Syntax:	CALCulate<channel 1 to 2>:MINimum:STATe*space*ON | OFF	
Example:	OUTPUT @PWR_MTR;CALC1:MIN:STAT ON	! ENABLES CHANNEL 1 MINIMUM TRACKING
Description:	This command activates the minimum channel value monitor.	

Syntax:	CALCulate<channel 1 to 2>:MINimum [:MAGnitude]?	
Example:	OUTPUT @PWR_MTR;CALC1:MIN?	! QUERIES CHANNEL MINIMUM VALUE IN DBM
Response:	Lowest power reading since CALC2:MIN:STAT ON was sent.	
Description:	This command reports the value maintained as the minimum in the 58542 min monitor.	

2.5.25 Limit Line Configuration & Monitoring

■ CALCulate:LIMit

The CALCulate:LIMit commands specify and query the status of power measurement limit values and limit line pass/fail checking. This allows the 58542 to monitor measured values and determine if the values are outside certain limits or above/below a single limit. The upper limit cannot be specified any lower than the lower limit; meaning that an exclusion zone of values cannot be specified.

Limit values can be specified separately for either of the two software calculation channels - 1 and 2. These channels can be specified to correspond to power sensors 1 and 2 (default) or as a combination of the power sensors. For example, set limit lines to monitor overload or under range conditions on an amplifier's output power and gain by specifying channel 1 as sensor 1 limits checking and channel 2 as Sensor 2/Sensor 1. Power sensor assignments to channel measurement definition is also part of the CALCulate Subsystem. Limit monitoring can not be performed for individual sensors unless a channel is configured for single sensor, POW 1 or POW 2 operation.

Upper and Lower limits can be active simultaneously.

Unless serial requests are enabled, the CALCulate:LIMit commands can not be configured to automatically alert the controller directly during a limit violation; the 58542 must be queried to receive information regarding pass/fail status of limit line violations.

Automatic notification of limit line violations is accomplished using the status byte and the operation register. A controller can be notified of a limit line violation via the request service, *SRE command. After the controller receives the request service, query the event status register. Check the status register for a limit line violation or send CALCulate:LIMit:FAIL? to check if a limit line is being or has been violated. 1 indicates a limit line violation. 0 indicates the channel measurement is within the limit lines.

CALCulate:LIMit

Syntax:	CALCulate<channel 1 to 2>:LIMit:CLEar[:IMMediate]	
Example:	OUTPUT @PWR_MTR;CALC1:LIM:CLE	! RESET CHANNEL 1 LIMIT VIOLATION INDICATOR TO 0
Description:	This command resets the limit line pass/fail indicator to 0.	

Syntax:	CALCulate<channel 1 to 2>:LIMit:FCOunt?	
Example:	OUTPUT @PWR_MTR;CALC1:LIM:FCO?	! QUERIES NUMBER OF CHANNEL 1 LIMIT FAILURES
Response:	Single number; the number of times the limit lines were exceeded.	
Description:	This command reports the number of times a limit line has been exceeded since the limit checking function was set to ON, or the limit line monitor was cleared with CALC#:LIM:CLE.	

Syntax:	CALCulate<channel 1 to 2>:LIMit:FAIL?	
Example:	OUTPUT @PWR_MTR;CALC1:LIM:FAIL?	! CHECK FOR CHANNEL 1 LIMIT LINE VIOLATION
Response:	0 = OK; 1 = fail	
Description:	This command reports whether or not a limit line has been exceeded since the limit checking function was set to ON, or the limit line monitor was cleared with CALC#:LIM:CLE.	

Syntax:	CALCulate<channel 1 to 2>:LIMit:LOWer*space*<numeric value in dB from -299.99 to 299.99>	
Example:	OUTPUT @PWR_MTR;CALC1:LIM:LOW -50.0	! SETS CHANNEL 1 LOWER LIMIT LINE TO -50 DBM
Description:	This command specifies the lower limit line power level. The value should allow for any offset values currently in use. The default value is -299.99 dB or dBm.	

Syntax:	CALCulate<channel 1 to 2>:LIMit:LOWer?	
Example:	OUTPUT @PWR_MTR;CALC1:LIM:LOW?	! QUERIES CHANNEL 1 LOWER LIMIT LINE SETTING
Response:	Response is a single number; the lower limit setting.	
Description:	This command queries the value of the lower limit line.	

Syntax:	CALCulate<channel 1 to 2>:LIMit:STATe*space*<ON | OFF>	
Example:	OUTPUT @PWR_MTR;CALC1:LIM:STAT ON	! ENABLES CHANNEL 1 UPPER AND LOWER LIMIT ! CHECKING
Response:	0 = off; 1 = on	
Description:	This command activates and deactivates the limit line checking. The default condition is OFF.	

Syntax:	CALCulate<channel 1 to 2>:LIMit:STATe?	
Example:	OUTPUT @PWR_MTR;CALC1:LIM:STAT?	! QUERIES CHANNEL 1 ON OR OFF STATUS
Response:	0 = off; 1 = on	
Description:	This command reports the activated or deactivated status of limit line checking.	

Syntax:	CALCulate<channel 1 to 2>:LIMit:UPPer*space*<numeric value in dBm or dB from -299.99 to 299.99>	
Example:	OUTPUT @PWR_MTR;CALC1:LIM:UPP 17.0	! SETS CHANNEL 1 UPPER LIMIT LINE TO 17 DBM
Description:	This command specifies the upper limit line power level. The value should allow for any offset values currently in use. The default value is 299.99 dB or dBm.	

Syntax:	CALCulate<channel 1 to 2>:LIMit:UPPer?	
Example:	OUTPUT @PWR_MTR;CALC1:LIM:UPP?	! QUERIES CHANNEL 1 UPPER LIMIT LINE SETTING
Response:	Response is a single value in dBm or dB, the upper limit line value.	
Description:	This query returns the value of the upper limit line.	

2.5.26 Analog Output

- **MEMory:CHANnel**
- **MEMory:SELect**
- **MEMory:UNIT**
- **MEMory:POWer**
- **MEMory:VOLTage**
- **OUTPut:ANAlog**

The ANALOG OUT BNC connector on the front panel can be configured to output a voltage that corresponds to the power levels on one of the channels. This is useful for applications such as source leveling or printing to a chart recorder. The Analog Output operates only in NORMal Mode. It is automatically deactivated during SWIFt or BURSt modes, and comes back when operation is returned to the NORMal Mode.

MEM:CHANnel

Syntax:	MEMory[:TABLe]:CHANnel*space*<channel 1 to 2>	
Example:	OUTPUT @PWR_MTR;MEM:CHAN 2	! SETS ANALOG OUT TO CHANNEL 2
Description:	This command selects which channel will be present on the analog output connector.	

Syntax:	MEMory[:TABLe]:CHANnel?	
Example:	OUTPUT @PWR_MTR;MEM:CHAN?	! QUERIES ANALOG CHANNEL NUMBER
Response:	Response is channel 1 to channel 2.	
Description:	This query reports which channel will be present on the analog output connector.	

MEM:SELect

Syntax:	MEMory[:TABLe]:SELect*space*<ANALOGout,VPROPF1,VPROPF2>	
Example:	OUTPUT @PWR_MTR;MEM:SEL VPROPF1	! SELECTS MEMORY TABLE VPROPF1 ! FOR EDITING IN FOLLOWING LINES
Description:	This command selects between one of three editable tables. Using the meter's Analog Output capability requires configuring the numerically linear power measurement to voltage output relationship by defining the corresponding end points of power and voltage.	

Syntax:	MEMory[:TABLe]:SELect?	
Example:	OUTPUT @PWR_MTR;MEM:SEL?	! QUERIES MEMORY TABLE VPROPF1 ! FOR EDITING IN FOLLOWING LINES
Response:	Response is the table currently editable: ANALOG, V_{PROP}F1, or V_{PROP}F2.	
Description:	This query reports the currently editable table in the 58542.	

MEM:UNIT

Syntax:	MEMory[:TABLe]:UNIT*space*<choice of units dBm or Watt>	
Example:	OUTPUT @PWR_MTR;MEM:UNIT DBM	! SETS ANALOG OUT POWER UNIT
Description:	This command selects between one of two configurations, log units or linear units. In either case the voltage output will be numerically linear. Be sure to set the units control properly (dBm or W) before trying to set the numeric values.	

Syntax:	MEMory[:TABLe]:UNIT?	
Example:	OUTPUT @PWR_MTR;MEM:UNIT?	! QUERIES ANALOG OUT POWER UNIT
Description:	This query reports the units used for analog output configuration.	

MEM:POWer

Syntax:	MEMory[:TABLe]:POWer*space*<start value from -80 to +20 dBm>*comma*<stop value from -80 to +20 dBm>	
Example:	OUTPUT @PWR_MTR;MEM:POW -70,20	! SETS ANALOG OUT POWER RANGE (IN DBM) ! FROM -70 TO 20 DBM
Description:	If log units are selected for analog output control, this command selects the beginning and end points of the power levels which will be assigned corresponding voltages at the analog output.	

Syntax:	MEMory[:TABLe]:POWer*space*<start value from 0 to 0.01 W>*comma*<stop value from 0 to 0.01 W>	
Example:	OUTPUT @PWR_MTR;MEM:POW 0,1E2	! SETS ANALOG OUT POWER RANGE (IN WATTS) ! FROM 0 TO 0.01 WATTS
Description:	If linear units are selected for analog output control, this command selects the beginning and end points of the power levels which will be assigned corresponding voltages at the analog output. Also see MEM:VOLT below.	

Syntax:	MEMory[:TABLe]:POWer?	
Example:	OUTPUT @PWR_MTR;MEM:POW?	! QUERIES ANALOG OUT POWER RANGE (IN DBM)
Response:	Response is two dBm values separated by a comma indicating analog output range.	
Description:	This query reports the end points of power levels of the analog output configuration. When log units are selected, the units are dB or dBm. When linear units are selected the units are Watts.	

MEM:VOLTage

Syntax:	MEMory[:TABLe:VOLTage*space*<start value from -10 to +10 V>*comma*<stop value from -10 to +10 V>	
Example:	OUTPUT @PWR_MTR;MEM:VOLT -7,2	! SETS ANALOG OUT VOLTAGE RANGE FROM ! -8 TO 2 VOLTS CORRESPONDING TO POWER
Description:	This command is not units dependent. It selects the beginning and end points of the voltage levels desired to be present at the analog output. These voltages correspond to the power end points that are defined with either MEM:VOLT or MEM:POW.	

Syntax:	MEMory[:TABLe:VOLTage?	
Example:	OUTPUT @PWR_MTR;MEM:VOLT?	! QUERIES ANALOG OUT VOLTAGE RANGE
Response:	Two voltage values separated by commas indicating analog output range.	
Description:	This query reports the end points of the voltages configured for analog output operation.	

OUTP:ANAlog

Syntax:	OUTPut[:BNC]:ANAlog[:STATe]*space* < ON | OFF >	
Example:	OUTPUT @PWR_MTR;OUTP:ANA ON	! ENABLES ANALOG OUT FUNCTION
Description:	This command activates and deactivates the analog output. The analog output will not operate unless this control is set to ON.	

Syntax:	OUTPut[:BNC]:ANAlog[:STATe]?	
Example:	OUTPUT @PWR_MTR;OUTP:ANA?	! QUERIES ANALOG OUT FUNCTION STATUS
Response:	1 for ON or 0 for OFF.	
Description:	This query reports the ON or OFF status of the analog output.	

2.5.27 Saving & Recalling Configurations

- *RCL
- *SAV

The 58542 has 21 instrument state memory registers. Registers 1 through 20 are available for store and recall. Register 0 contains the previous state of the instrument and can be used to toggle between two different instrument configuration states.

Instrument configuration can be saved to registers 1 through 20.

CAUTION

Any configuration items which are not listed under the *RST or PRESet conditions are not savable. Make sure all aspects of the configuration are savable. For example, sensor power sweep calibration curves can not be saved in the configuration memory registers. Sensors must be calibrated to the 58542 power meter each time a new sensor is attached.

*RCL

Syntax:	*RCL*space*<memory location number 0 to 20>	
Example:	OUTPUT @PWR_MTR;*RCL 19	! RECALL 58542 REGISTER 19
Description:	Recalls instrument configuration. 0 is the PRESet configuration.	

*SAV

Syntax:	*SAVe*space*<memory location number 1 to 20>	
Example:	OUTPUT @PWR_MTR;*SAV 20	! SAVES AT 58542 REGISTER 20
Description:	Saves current configuration to memory. Saving a configuration to memory position 0 cannot be done.	

2.5.28 Halting Operation

- ABORt

ABORt

Example:	OUTPUT @PWR_MTR;ABOR	! HALTS MEASUREMENT & TRIGGERING
Description:	This command stops operation, but it does not interrupt the completion of the current action. For example, sensor calibration is not interrupted. Burst mode data collection is not interrupted.	

☛ ***NOTE:*** *When using the 8035XA Peak Sensor, if a Time-Out occurs due to the sensor not triggering (i.e., Level too low) then send "Abort" to clear the meter.*

2.5.29 Preset Configuration

- ***RST**
- **STATus:PRESet**
- **SYSTem:PRESet**

*RST

Example:	OUTPUT @PWR_MTR;*RST	! RESET 58542 CONFIGURATION
Description:	This command resets the 58542 configuration to a known condition (See Table 2-4). These are not the power ON conditions. The 58542 has an internal battery which powers a non-volatile memory chip to retain configuration information. The only configuration that will change between power OFF and power ON is noted at the end of the table.	

STATus:PRESet

Example:	OUTPUT @PWR_MTR;STAT:PRES	! CLEARS ALL THE STATUS REGISTER VALUE
Description:	This command resets the 58542 Status information buffers. See Table 2-4. Note that these are not the power ON conditions.	

SYSTem:PRESet

Example:	OUTPUT @PWR_MTR;SYST:PRES	! RESET 58542 CONFIGURATION
Description:	This command resets the 58542 configuration to a known condition. SYST:PRES is identical in function to *RST (Command Default, Minimum, Maximum).	

Table 2-4: Reset & Power on Default Commands

Command	Default	Minimum	Maximum
CALCulate1[:CHANnel]: CALCulate2[:CHANnel]:	POWer 1 POWer 2	,	
CALCulate1-2:			
LIMit			
STATe	OFF		
UPPer	299.999	-299.999	299.999
LOWer	-299.999	-299.999	299.999
FAIL?	0		
FCOunt?	0		
MAXimum:			
STATe	OFF		
[MAGnitude]	299.999	-299.999	299.999
MINimum:			
STATe	OFF		
[MAGnitude]	-299.99	-29.999	29.99
MODE	NORmal		
REFerence:			
STATe	OFF		
[MAGnitude]	0	-299.99	299.99
STATe	ON		
UNIT	dBm		
INITiate:CONTinuous	OFF	,	

Table 2-4: Reset & Power on Default Commands (Continued)

Command	Default	Minimum	Maximum
MEASure1-2[:SCALar:POWer]	With Auto average on		
MEMory[:TABLe]: CHANnel FREQuency POWer SELect ANALOGout SLOPe VOLTage UNIT	 1 0 -80,20 0 -10,10 dBm	 1 0 -80,-80 0 -10,-10	 2 40e9 20,20 10e9 10,10
OUTput: ROScillator[:STATe] [BNC:]ANAlog[:STATe]	 OFF OFF		
SENSe1-2: AVERage: COUNt: AUTO TCONtrol CORRection: FREQ OFFset: STATe [MAGnitude] VPROpf[:STATe] TRIGger: DELay: STATe [MAGnitude] LEVel (if INT trig) LEVel (if EXT trig) SOURce	 1 ON MOVing 5e7 OFF 0 OFF OFF 1e-6 -20.0 1.7 IMMediate	 1 0 -99.999 -5e-8 -30.0 0.1	 512 4e10 99.999 104e-3 20.0 5.000
TRIGger: COUNt DELay MODE SOURce	 1 0.000 POST IMMediate	 0 0.000	 128000 5.000
UNIT1-2[:POWer]	dBm		
POWER ON will override the internal battery back up memory and reset only the following configuration items as shown below. All other configuration items will remain the same as was true before power OFF.			
CALCulate1-2:MODE	NORMal		
INITiate:CONTinuous	OFF		
MEMory[:TABLe]:SELect	ANALOGout		
OUTput:ROSCillator[:STATe]	OFF		
TRIGger: COUNt DELay MODE SOURce	 1 0.000 POST IMMediate	 0 0.000	 128000 5.000

2.5.30 Identification Commands

- ***IDN**
- **SENSe:CORRection:EEPROM:TYPE?**
- **SYSTem:VERSion**

Identification commands ensure that the power meter and sensor are appropriate for the test program. The sensor identification commands allow monitoring what model of sensor is attached and ensure that the sensor has been properly calibrated to the power meter.

☛ ***NOTE:*** *Example programs for Identification Commands are contained in Appendix A of this publication.*

*IDN?

Example:	OUTPUT @PWR_MTR;*IDN?	QUERY INST. MFGR & MODEL #
Response:	Giga-tronics, 58542,0,1.09 where 1.09 is software version	
Description:	The *IDN? is the identify query command defined by IEEE 488.2. Upon receipt of this command, the power meter will output a string that identifies itself as the Giga-tronics 58542 and indicates the firmware version number.	

SENS:CORR:EEPROM:TYPE?

Syntax:	SENSe<sensor 1 or 2>:CORRection:EEPROM:TYPE?	
Example:	OUTPUT @PWR_MTR;SENS1:CORR:EEPROM:TYPE?	! QUERIES SENSOR 1 EEPROM TYPE
Response:	80301,1818436 which is model number and serial number respectively	
Description:	This command returns sensor model and serial number information.	

SYST:VERSion

Syntax:	SYSTem:VERSion?	
Example:	OUTPUT @PWR_MTR;SYST:VERS?	! QUERIES SCPI VERSION
Response:	1995.0	
Description:	This query returns the compiled SCPI version.	

2.5.31 Calibrator Controls

■ OUTPut:Reference:OSCillator

The reference oscillator is the RF calibration source for the sensors.

■ OUTP:ROSC

OUTP:ROSC

Syntax:	OUTPut:ROSCillator[:STATe]*space*<ON | OFF>	
Example:	OUTPUT @PWR_MTR;OUTP:ROSC ON	! TURN ON CALIBRATOR OSCILLATOR
Description:	The reference oscillator (Calibrator port) connection is on the front panel of the power meter. The OUTPut:ROSCillator ON command turns on this 0 dBm, 50 MHz output. The reference oscillator power level should be calibrated annually. Please refer to the Calibration Procedures in Chapter 4 for additional details.	

Syntax:	OUTPut:ROSCillator[:STATe]?	
Example:	OUTPUT @PWR_MTR;OUTP:ROSC?	! QUERIES INST. MFGR & MODEL #
Description:	This query command returns the ON or OFF status of the meter's built-in reference oscillator.	

2.5.32 Sensor EEPROM Commands

■ SENSe:CORRection:EEPROM:TYPE?
■ DIAGnostic:SENSe:CORRection:EEPROM:CALFRange?
■ SENSe:CORRection:EEPROM:CALFactor?
■ SENSe:CORRection:EEPROM:FREQuency?

SENSe:CORRection:EEPROM:TYPE?

Syntax:	SENSe<sensor 1 or 2>:CORRection:EEPROM:TYPE?	
Example:	OUTPUT @PWR_MTR;SENS1:CORR:EEPROM:TYPE?	! QUERIES SENSOR 1 EEPROM TYPE
Response:	Typically, 80301,1818436 which is model number and serial number respectively	
Description:	This command allows programming to verify correct sensor usage and monitor whether power sweep calibration has been performed or not.	

DIAGnostic:SENSe:CORRection:EEPROM:CALFRange?

Syntax:	SENSe<sensor 1 or 2>:CORRection:EEPROM:TYPE?	
Example:	OUTPUT @PWR_MTR;DIAG:SENS1:EEPROM:CALFR?	! QUERIES SENSOR 1 EEPROM CAL FACTOR RANGE TABLE
Response:	Typically response is 2e9, 1e9, 17, 1 which is the start frequency, step between standard frequencies, frequency, number of standard frequencies, and number of special frequencies.	
Description:	Provides a count of standard and special cal factors for use in retrieving the data in the next two commands.	