

MS2681A/MS2683A/MS2687A/MS2687B
Spectrum Analyzer
Operation Manual
Vol. 3
(Programming)

11th Edition

Read this manual before using the equipment.
Keep this manual with the equipment.

ANRITSU CORPORATION

Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Insure that you clearly understand the meanings of the symbols BEFORE using the equipment. Some or all of the following five symbols may not be used on all Anritsu equipment. In addition, there may be other labels attached to products which are not shown in the diagrams in this manual.

Symbols used in manual

DANGER 

This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.

WARNING 

This indicates a hazardous procedure that could result in serious injury or death if not performed properly.

CAUTION 

This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

Safety Symbols Used on Equipment and in Manual

The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Insure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.



This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.



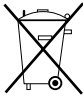
This indicates an obligatory safety precaution. The obligatory operation is indicated symbolically in or near the circle.



This indicates warning or caution. The contents are indicated symbolically in or near the triangle.



This indicates a note. The contents are described in the box.



These indicate that the marked part should be recycled.

MS2681A/MS2683A/MS2687A/MS2687B

Spectrum Analyzer

Operation Manual Vol. 3 (Programming)

20 April 2000 (First Edition)

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Printed in Japan

For Safety

WARNING



1. ALWAYS refer to the operation manual when working near locations at which the alert mark shown on the left is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced.

Moreover, this alert mark is sometimes used with other marks and descriptions indicating other dangers.

2. Measurement Categories

This instrument is designed for Measurement category I (CAT I). Don't use this instrument at the locations of measurement categories from CAT II to CAT IV.

In order to secure the safety of the user making measurements, IEC 61010 clarifies the range of use of instruments by classifying the location of measurement into measurement categories from I to IV.

The category outline is as follows:

Measurement category I (CAT I):

Secondary circuits of a device connected to an outlet via a power transformer etc.

Measurement category II (CAT II):

Primary circuits of a device with a power cord (portable tools, home appliance etc.) connected to an outlet.

Measurement category III (CAT III):

Primary circuits of a device (fixed equipment) to which power is directly supplied from the power distribution panel, and circuits from the distribution panel to outlets.

Measurement category IV (CAT IV):

All building service-line entrance circuits through the integrating wattmeter and primary circuit breaker (power distribution panel).



or



3. When supplying power to this equipment, connect the accessory 3-pin power cord to a grounded outlet. If a grounded outlet is not available, before supplying power to the equipment, use a conversion adapter and ground the green wire, or connect the frame ground on the rear panel of the equipment to ground. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.

For Safety

WARNING

Repair

WARNING 

Calibration



Falling Over

Battery Fluid

LCD

4. This equipment cannot be repaired by the user. DO NOT attempt to open the cabinet or to disassemble internal parts. Only Anritsu-trained service personnel or staff from your sales representative with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision parts.

5. The performance-guarantee seal verifies the integrity of the equipment. To ensure the continued integrity of the equipment, only Anritsu service personnel, or service personnel of an Anritsu sales representative, should break this seal to repair or calibrate the equipment. If the performance-guarantee seal is broken by you or a third party, the performance of the equipment cannot be guaranteed.

6. This equipment should be used in the correct position. If the cabinet is turned on its side, etc., it will be unstable and may be damaged if it falls over as a result of receiving a slight mechanical shock. And also DO NOT use this equipment in the position where the power switch operation is difficult.

7. DO NOT short the battery terminals and never attempt to disassemble it or dispose of it in a fire. If the battery is damaged by any of these actions, the battery fluid may leak.

This fluid is poisonous.

DO NOT touch it, ingest it, or get in your eyes. If it is accidentally ingested, spit it out immediately, rinse your mouth with water and seek medical help. If it enters your eyes accidentally, do not rub your eyes, irrigate them with clean running water and seek medical help. If the liquid gets on your skin or clothes, wash it off carefully and thoroughly.

8. This instrument uses a Liquid Crystal Display (LCD); DO NOT subject the instrument to excessive force or drop it. If the LCD is subjected to strong mechanical shock, it may break and liquid may leak.

This liquid is very caustic and poisonous.

DO NOT touch it, ingest it, or get in your eyes. If it is ingested accidentally, spit it out immediately, rinse your mouth with water and seek medical help. If it enters your eyes accidentally, do not rub your eyes, irrigate them with clean running water and seek medical help. If the liquid gets on your skin or clothes, wash it off carefully and thoroughly.

For Safety

CAUTION

Replacing Fuse

CAUTION 

1. Before Replacing the fuses, ALWAYS remove the power cord from the poweroutlet and replace the blown fuses. ALWAYS use new fuses of the type and rating specified on the fuse marking on the rear panel of the cabinet.

T6.3A indicates a time-lag fuse.

There is risk of receiving a fatal electric shock if the fuses are replaced with the power cord connected.

2. Keep the power supply and cooling fan free of dust.
 - Clean the power inlet regularly. If dust accumulates around the power pins, there is a risk of fire.
 - Keep the cooling fan clean so that the ventilation holes are not obstructed. If the ventilation is obstructed, the cabinet may overheat and catch fire.

Cleaning

Check Terminal



3. Maximum DC voltage ratings:
RF Input \pm DC 0 V
Maximum AC power (continuous wave) ratings:
RF Input +30 dBm (RF ATT \geq 10 dB)

NEVER input a over maximum ratings to RF Input, excessive power may damage the internal circuits.

For Safety

CAUTION

Replacing Memory Back-up Battery

The power for memory backup is supplied by a Poly-carbonmonofluoride Lithium Battery. This battery should only be replaced by a battery of the same type; since replacement can only be made by Anritsu, contact the nearest Anritsu representative when replacement is required.

Note: The battery used in this equipment has a maximum useful life of 7 years. It should be replaced before this period has elapsed.

External Storage Media

This equipment stores data and programs using Plug-in Memory card. Data and programs may be lost due to improper use or failure. ANRITSU therefore recommends that you backup the memory.

Anritsu Corporation will not accept liability for lost data.

Pay careful attention to the following points.

- Do not remove the memory card from equipment being accessed.
- Isolate the card from static electricity.
- The PC-ATA card or Compact Flash card operation is not guaranteed generally.

Disposing of The Product

This equipment uses chemical compound semiconductor including arsenide.

At the end of its life, the equipment should be recycled or disposed properly according to the local disposal regulations.

Equipment Certificate

Anritsu Corporation certifies that this equipment was tested before shipment using calibrated measuring instruments with direct traceability to public testing organizations recognized by national research laboratories including the National Institute of Advanced Industrial Science and Technology, and the National Institute of Information and Communications Technology, and was found to meet the published specifications.

Anritsu Warranty

Anritsu Corporation will repair this equipment free-of-charge if a malfunction occurs within 1 year after shipment due to a manufacturing fault, provided that this warranty is rendered void under any or all of the following conditions.

- The fault is outside the scope of the warranty conditions described in the operation manual.
- The fault is due to mishandling, misuse, or unauthorized modification or repair of the equipment by the customer.
- The fault is due to severe usage clearly exceeding normal usage.
- The fault is due to improper or insufficient maintenance by the customer.
- The fault is due to natural disaster including fire, flooding, earthquake, etc.
- The fault is due to use of non-specified peripheral equipment, peripheral parts, consumables, etc.
- The fault is due to use of a non-specified power supply or in a non-specified installation location.

In addition, this warranty is valid only for the original equipment purchaser. It is not transferable if the equipment is resold.

Anritsu Corporation will not accept liability for equipment faults due to unforeseen and unusual circumstances, nor for faults due to mishandling by the customer.

Anritsu Corporation Contact

If this equipment develops a fault, contact Anritsu Service and Sales offices at the address at the end of paper-edition manual or the separate file of CD-edition manual.

Notes On Export Management

This product and its manuals may require an Export License/Approval by the Government of the product's country of origin for re-export from your country.

Before re-exporting the product or manuals, please contact us to confirm whether they are export-controlled items or not.

When you dispose of export-controlled items, the products/manuals are needed to be broken/shredded so as not to be unlawfully used for military purpose.

Front Panel Power Switch

To prevent malfunction caused by accidental touching, the front power switch of this equipment turns on the power if it is pressed continuously for about one second in the standby state. If the switch is pressed continuously for one second in the power-on state, the equipment enters the standby state.

In the power-on state, if the power plug is removed from the outlet, then reinserted into it, the power will not be turned on. Also, if the lines is disconnected due to momentary power supply interruption or power failure, the power will not be turned on (enters the standby state) even if the line is recovered.

This is because this equipment enters the standby state and prevents incorrect data from being acquired when the line has to be disconnected and reconnected.

For example, if the sweep time is 1,000 seconds and data acquisition requires a long time, momentary power supply interruption (power failure) might occur during measurement and the line could be recovered automatically to power-on. In such a case, the equipment may mistake incorrect data for correct data without recognizing the momentary power supply interruption.

If this equipment enters the standby state due to momentary power supply interruption or power failure, check the state of the measuring system and press the front power switch to restore power to this equipment.

Further, if this equipment is built into a system and the system power has to be disconnected then reconnected, the power for this equipment must also be restored by pressing the front power switch.

Consequently, if this equipment is built into remote monitoring systems that use MODEMs, please install option 46 "Auto Power Recovery" to equipment.

ABOUT DETECTION MODE

This instrument is a spectrum analyzer which uses a digital storage system. The spectrum analyzer makes level measurements in frequency steps obtained by dividing the frequency span by the number of measurement data points (501). This method of measurement cannot detect the signal peak level if the spectrum of a received signal is narrower than these frequency steps.

To resolve this problem, this instrument usually operates in positive peak detection mode and normal detection mode. In the positive peak detection mode, the highest level within the frequency range between the sample points can be held and traced. In the normal detection mode, both the positive peak and the negative peak can be traced.

Positive peak detection mode should be used for almost all measurements including normal signal level measurement, pulsed noise analysis, and others. It is impossible to measure the signal level accurately in sample detection mode or in negative peak detection mode.

Use of sample detection mode is restricted to random noise measurement, occupied frequency bandwidth measurement for analog communication systems, and adjacent-channel leakage power measurement, etc.

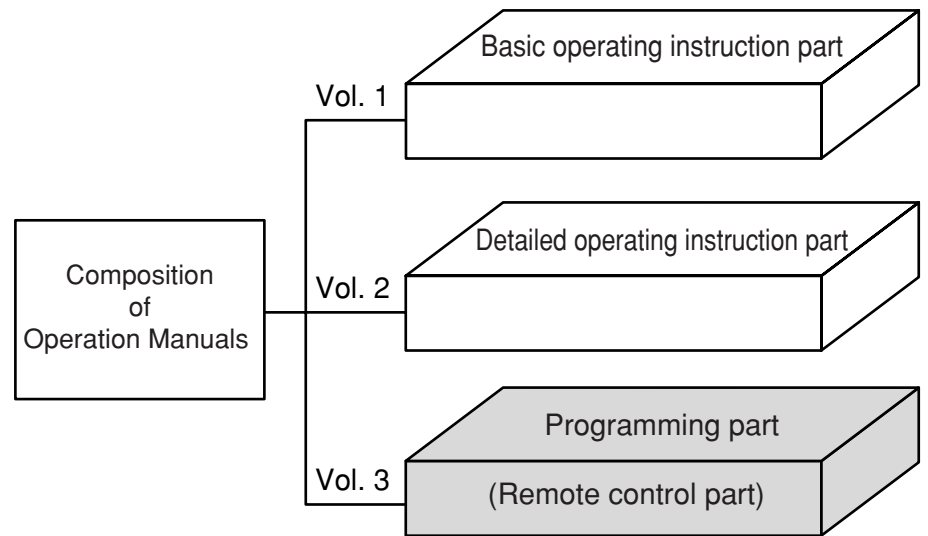
Measurement	Item
• Normal signal	POS PEAK
• Random noise	SAMPLE
• Pulsed noise	NORMAL (POSI-NEG)
• Occupied frequency bandwidth, adjacent-channel leakage power	SAMPLE
(for analog communication systems)	
• Occupied frequency bandwidth, adjacent-channel leakage power	POS PEAK or SAMPLE
(for digital communication systems)	

When a detection mode is specified as one of the measurement methods, make the measurement in the specified detection mode.

About This Manual

(1) Composition of MS2681A/MS2683A/MS2687A/MS2687B spectrum analyzer Operation Manuals

The MS2681A/MS2683A/MS2687A/MS2687B Spectrum Analyzer operation manuals of the standard type are composed of the following three documents. Use them properly according to the usage purpose.



Basic operating instruction part:

Provides information on the MS2681A/MS2683A/MS2687A/MS2687B outline, preparation before use, panel description, basic operation, soft-key menu and performance tests.

Detailed operating instruction part:

Provides information on the detailed panel operating instructions on MS2681A/MS2683A/MS2687A/MS2687B that expand on the basic operation and soft-key menu in the Basic Operating Instruction Part.

Programming part (Remote control part):

Provides information on RS-232C remote control, GPIB remote control and sample programs.

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Section 1 General

This section outlines the remote control and gives examples of system upgrades.

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General

MS2681A/MS2683A/MS2687A/MS2687B Spectrum Analyzer, when combined with an external controller (host computer, personal computer, etc.), can automate your measurement system. For this purpose, the spectrum analyzer is equipped with an RS-232C interface port, GP-IB interface bus (IEEE std 488.2-1987). Ethernet interface can be installed as Option 09.

Remote control functions

The remote control functions of the MS2681A/MS2683A/MS2687A/MS2687B are used to do the following:

- (1) Control all functions except a few like the power switch and [LOCAL] key
- (2) Read all parameter settings.
- (3) Set the RS-232C interface settings from the panel
- (4) Set the GP-IB address from the panel
- (5) Set the IP address for Ethernet interface from the panel. (Option 09)
- (6) Select the interface port application from the panel
- (7) Configure the automatic measurement system when the spectrum analyzer is combined with a personal computer and other measuring instruments.

Interface port selection functions

MS2681A/MS2683A/MS2687A/MS2687B Spectrum Analyzer has a standard RS-232C interface, and an optional GP-IB interface bus and parallel (Centro) interface. Use the panel to select the interface port to be used to connect external devices as shown below.

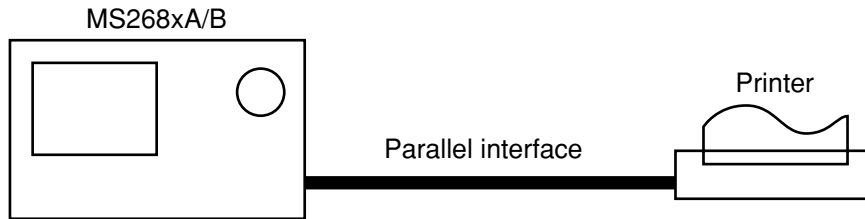
Port for the external controller: Select RS-232C, GP-IB or Ethernet (Option 09).

Port for the printer or plotter: Parallel interface.

Examples of system upgrades using RS-232C and GP-IB

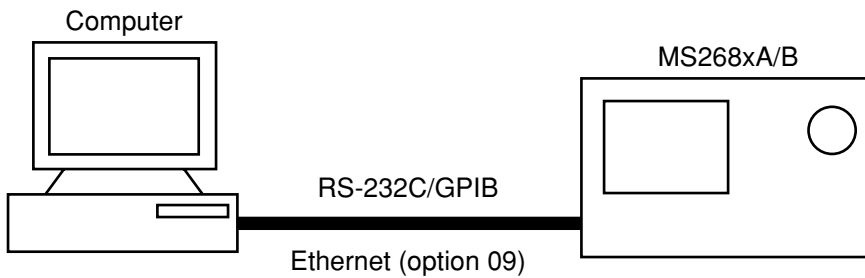
(1) Stand-alone type 1

Waveforms measured with MS2681A/MS2683A/MS2687A/MS2687B are output to the printer and plotter.



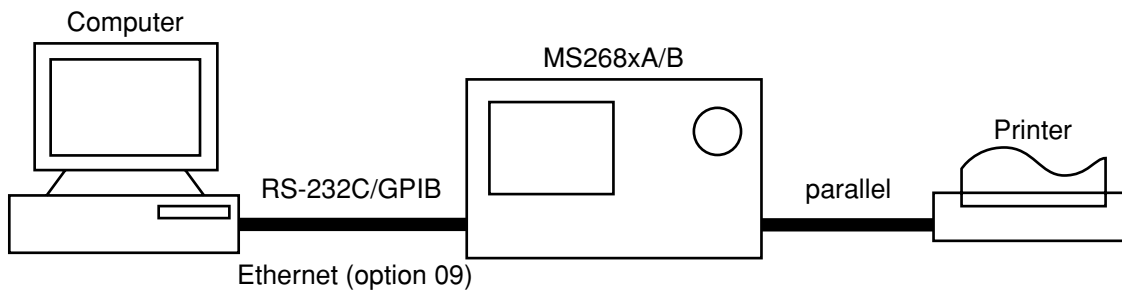
(2) Control by the host computer (1)

The spectrum analyzer is controlled automatically or remotely from the computer.



(3) Control by the host computer (2)

The waveforms measured by controlling spectrum analyzer automatically or remotely are output to the printer and plotter. The external controller, printer, and plotter must be connected using different interfaces.



Specifications of RS-232C

The table below lists the specifications of the RS-232C provided as standard in MS2681A/MS2683A/MS2687A/MS2687B.

Item	Specification
Function	Outputs printing data to the printer and plotter. Control from the external controller (except for power-ON/OFF)
Communication system	Asynchronous (start-stop synchronous system), half-duplex
Communication control system	X-ON/OFF control
Baud rate	1200, 2400, 4800, 9600, 19.2 k, 38.4 k, 56 k, 115 k (bps)
Data bits	7 or 8 bits
Parity	Odd number (ODD), even number (EVEN), none (NON)
Start bit	1 bit
Stop bit (bits)	1 or 2 bits
Connector	D-sub 9-pin, male

Specifications of GP-IB

The table below lists the specifications of the GP-IB provided for MS2681A/MS2683A/MS2687A/MS2687B.

Item	Specification and supplementary explanation
Function	<p>Conforms to IEEE488.2</p> <p>The spectrum analyzer is controlled from the external controller (except for power-on/off).</p>
Interface function	<p>SH1: All source handshake functions are provided. Synchronizes the timing of data transmission.</p> <p>AH1: All acceptor handshake functions are provided. Synchronizes the timing of data reception.</p> <p>T6: The basic talker functions and serial poll function are provided. The talk only function is not provided. The talker can be canceled by MLA.</p> <p>L4: The basic listener functions are provided. The listenonly function is not provided. The listener can be canceled by MTA.</p> <p>SR1: All service request and status byte functions are provided.</p> <p>RL1: All remote/local functions are provided.</p> <p style="padding-left: 40px;">The local lockout function is provided.</p> <p>PP0: The parallel poll functions are not provided.</p> <p>DC1: All device clear functions are provided.</p> <p>DT1: Device trigger functions are provided.</p> <p>C0: System controller functions are not provided.</p> <p>E2: Output is tri-state.</p>

Section 2 Connecting Device

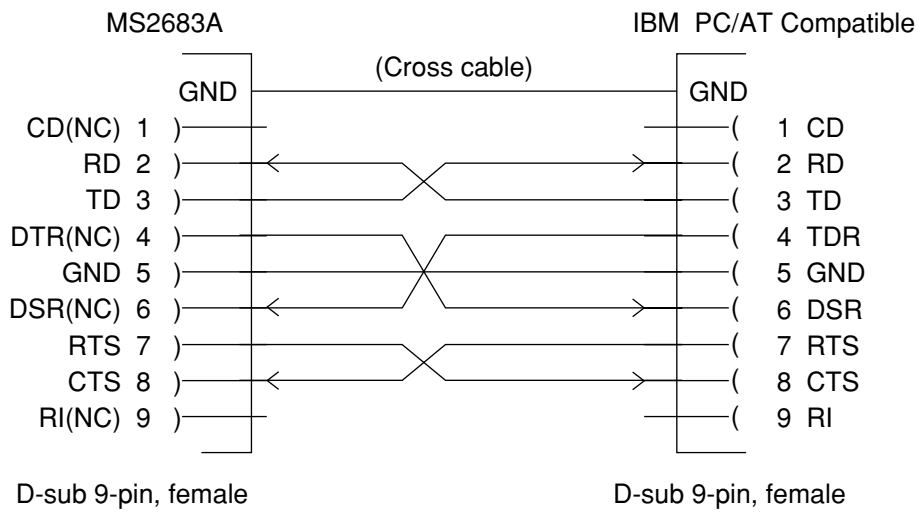
This section describes how to connect external devices such as the host computer, personal computer, and printer with RS-232C and GP-IB cables. This section also describes how to setup the interfaces of the spectrum analyzer.

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Setting the GP-IB address	2-6

Connection diagram of RS-232C interface signals

The diagram below shows the RS-232C interface signal connections between the spectrum analyzer and devices such as a personal computer.

- Connection with IBM PC/AT Compatible personal computer



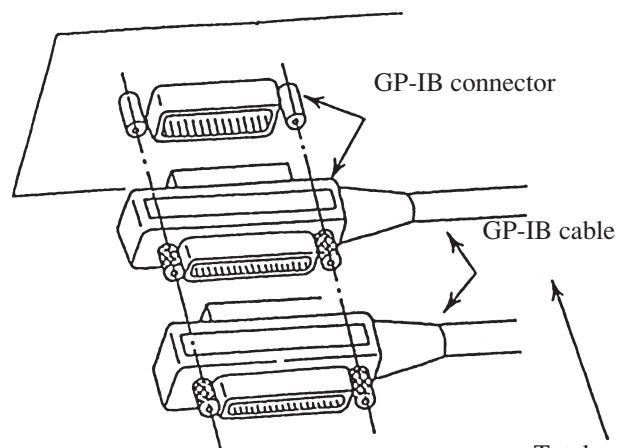
Connecting a device with a GP-IB cable

Connect the GP-IB connector on the rear panel of this equipment to the GP-IB connector of an external device with a GP-IB cable.

Note:

Be sure to connect the GP-IB cable before turning the equipment power on.

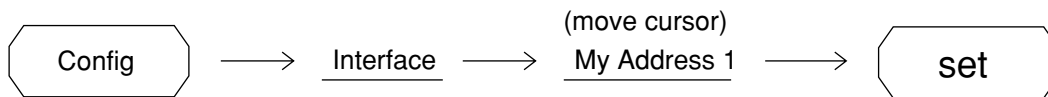
Up to 15 devices, including the controller, can be connected to one system. Connect devices as shown below.



Total cable length: Up to 20 m
Cable length between devices: Up to 4 m
Number of devices that can be connected: Up to 15

Setting the GP-IB address

Set the GPIB address of this equipment as follows:



Use the 10-key pad to enter the GP-IB address of this equipment, next press the key to confirm address. The initial value is 1.

Section 3 Device Message Format

This section describes the format of the device messages transmitted on the bus between a controller (host computer) and device MS2681A/MS2683A/MS2687A/MS2687B via the RS-232C, GP-IB or Ethernet system.

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General description

The device messages are data messages transmitted between the controller and devices, program messages transferred from the controller to this instrument (device), and response messages input from this instrument (device) to the controller. There are also two types of program commands and program queries in the program message. The program command is used to set this instrument's parameters and to instruct it to execute processing. The program query is used to query the values of parameters and measured results.

Program message format

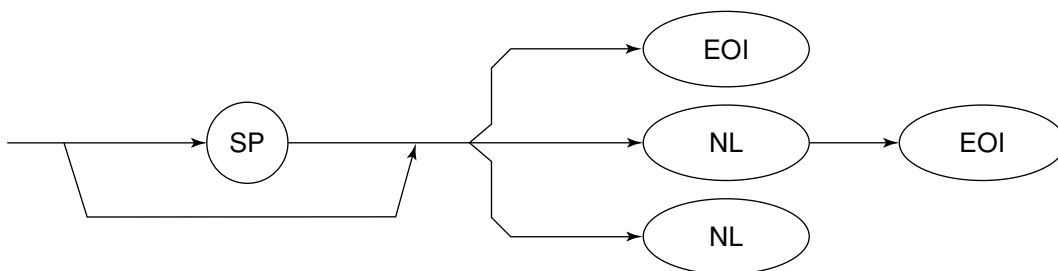
To transfer a program message from the controller program to this instrument using the WRITE statement, the program message formats are defined as follows:



WRITE #1, "CF :1GHZ"

PROGRAM MESSAGE: When the program message is transmitted from the controller to this instrument, the specified terminator is attached to the end of the program message to terminate its transmission.

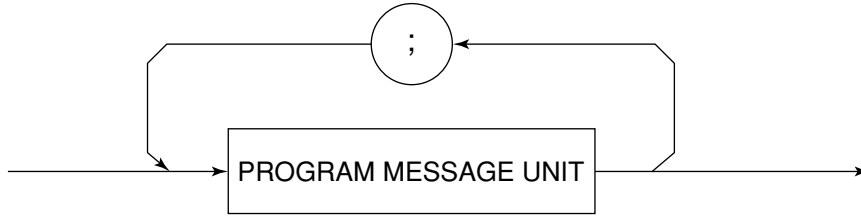
(1) PROGRAM MESSAGE TERMINATOR



NL: Called New line or LF (Line Feed)

Carriage Return (CR) is ignored and is not processed as a terminator.

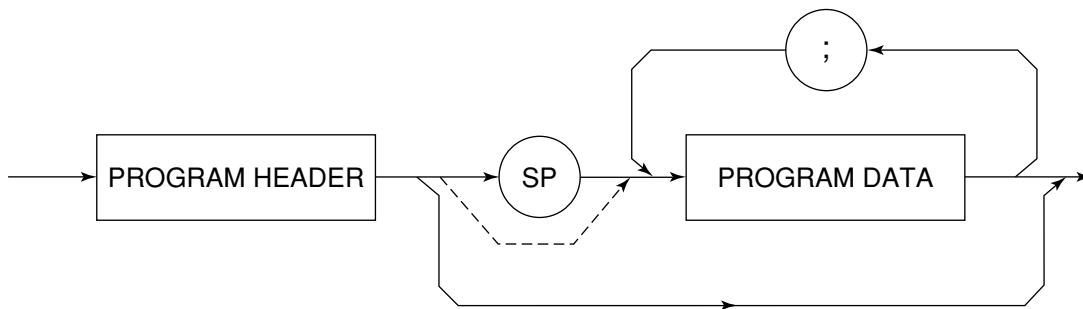
(2) PROGRAM MESSAGE



Multiple program message units can be output sequentially by separating them with a semicolon.

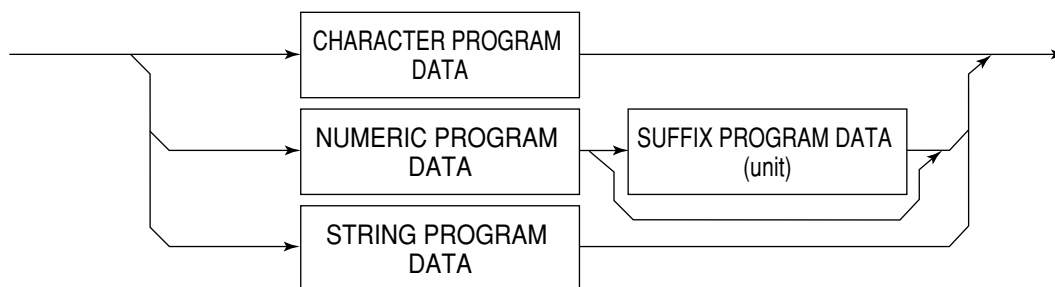
<Example> WRITE #1;"CF 1GHZ;SP 500KHZ

(3) PROGRAM MESSAGE UNIT



- The program header of an IEEE488.2 common command always begins with an asterisk.
- For numeric program data, the (SP) between the header and data can be omitted.
- The program header of a program query always ends with a question mark.

(4) PROGRAM DATA



(5) CHARACTER PROGRAM DATA

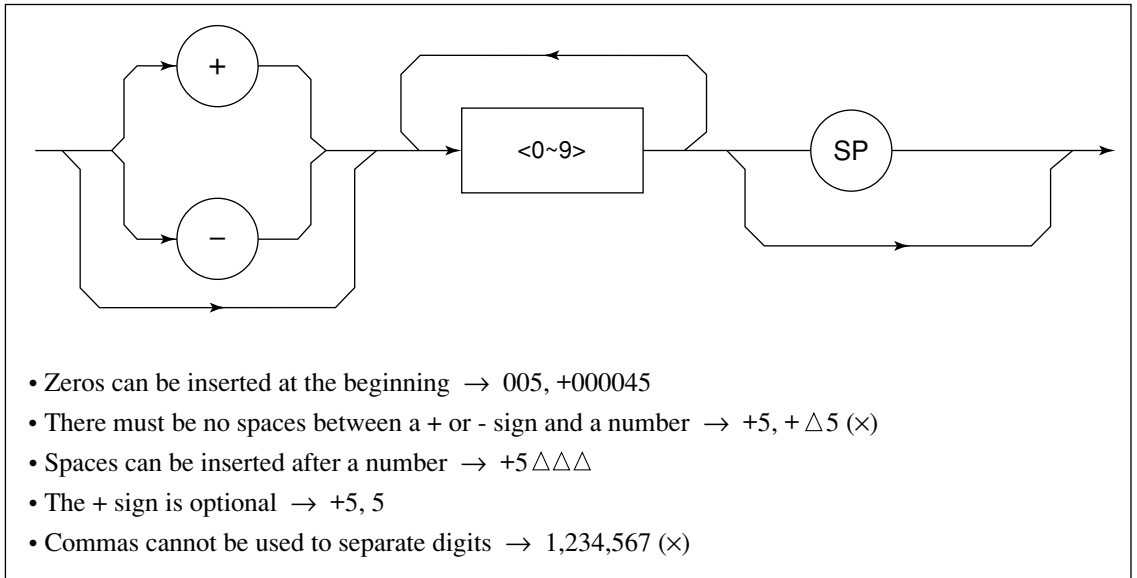
Character program data is specific character string data consisting of the uppercase alphabetic characters from A to Z, lowercase alphabetic characters from a to z, numbers 0 to 9, and underline (_).

<Example> WRITE #1;"ST AUTO" Sets Sweep Time to AUTO.

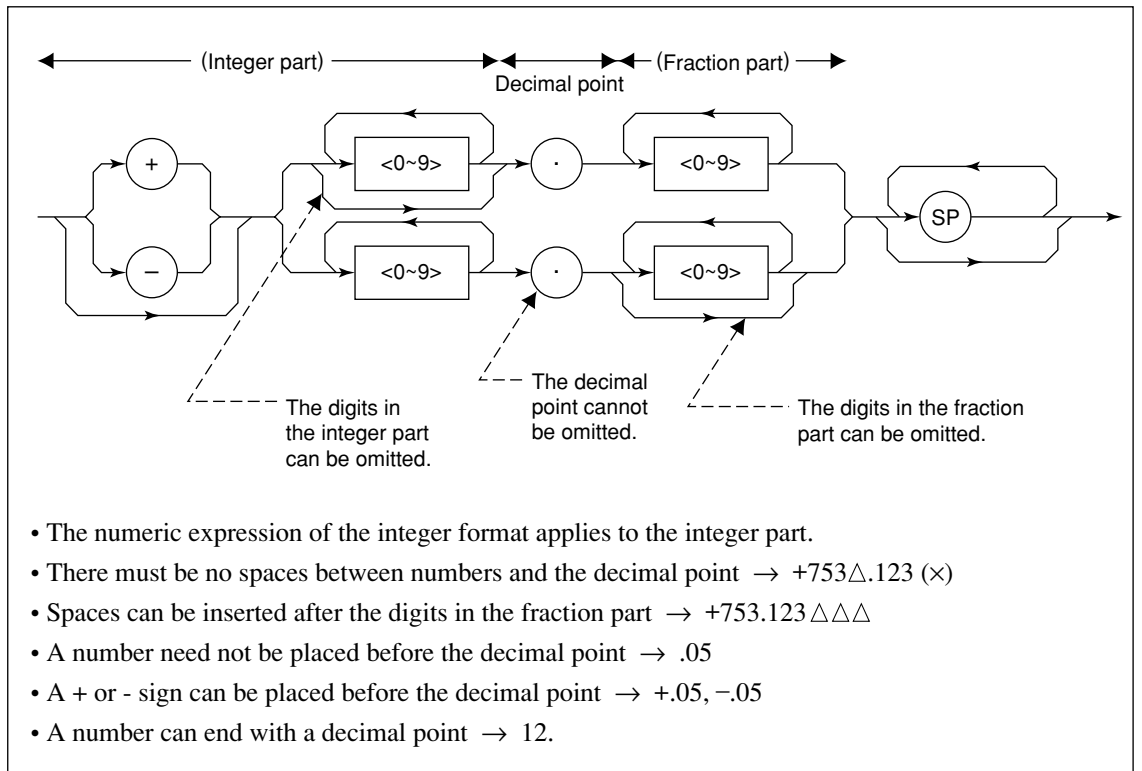
(6) NUMERIC PROGRAM DATA

Numeric program data has two types of formats: integer format (NR1) and fixed-point format (NR2).

< Integer format (NR1) >



<Fixed-point format (NR2)>



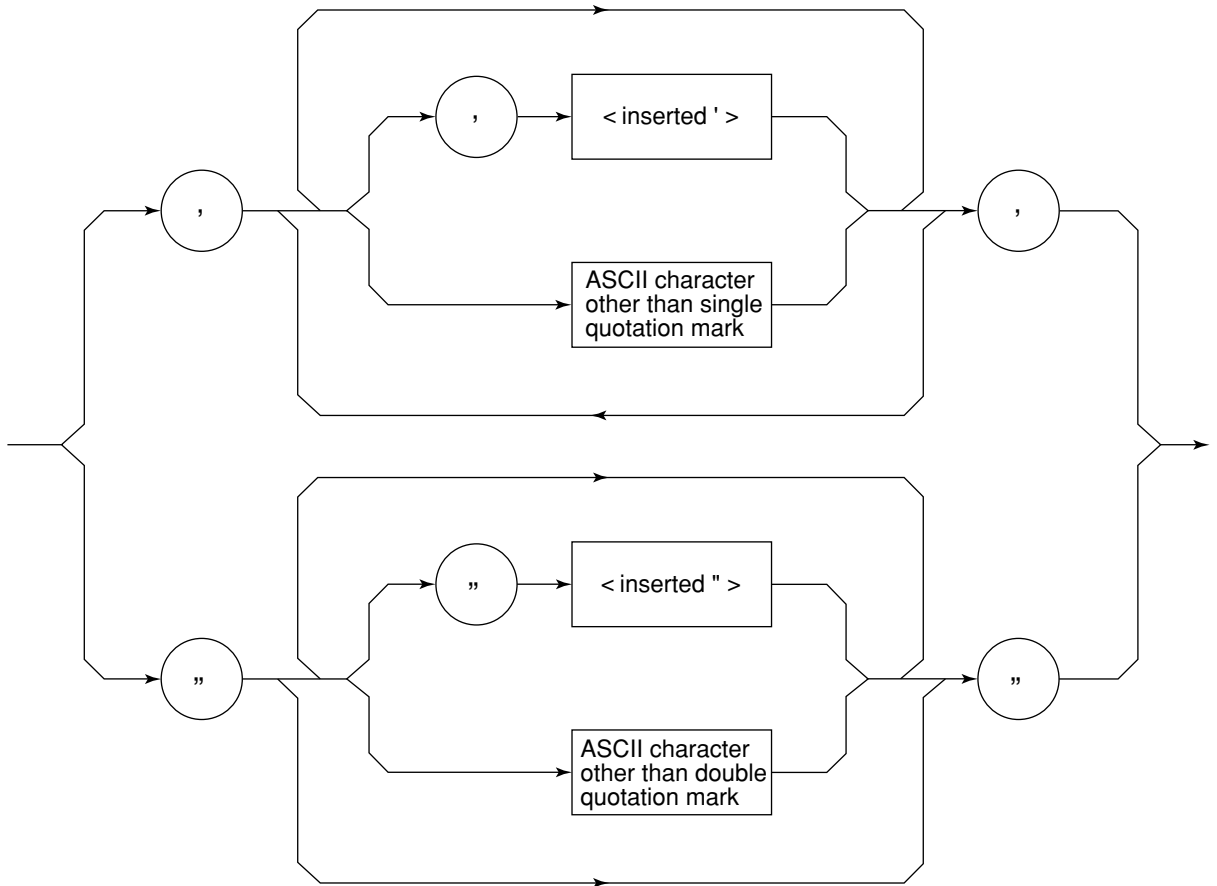
(7) SUFFIX PROGRAM DATA (unit)

The table below lists the suffixes used for MS2681A/MS2683A/MS2687A/MS2687B.

Table of Suffix Codes

Classification	Unit	Suffix code
Frequency	GHz	GHZ , GZ
	MHz	MHZ , MZ
	kHz	KHZ , KZ
	Hz	HZ
	Default	HZ
Time	second	S
	m second	MS
	μ second	US
	Default	MS
Level (dB system)	dB	DB
	dBm	DBM , DM
	dBμV	DBUV
	dBmV	DBMV
	dBμV(emf)	DBUVE
	Default	Determined in conformance with the set scale unit
Level (V system)	V	V
	mV	MV
	μV	UV
	Default	UV
Level (W system)	W	W
	mW	MW
	μW	UW
	nW	NW
	pW	PW
	fW	FW
	Default	UW

(8) STRING PROGRAM DATA



- String program data must be enclosed with single quotation marks ('...').

```
WRITE #1: "TITLE 'MS268xA' "
```

A single quotation mark used within a character string must be repeated as shown in the double quotation marks.

```
WRITE #1; "TITLE 'MS268xA' 'NOISE MEAS' ' ' "
```

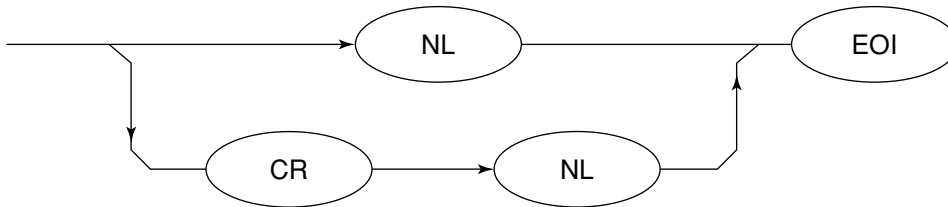
'NOISE MEAS' is set as the title.

Response message format

To transfer the response messages from this instrument to the controller using the READ statement, the response message formats are defined as follows:

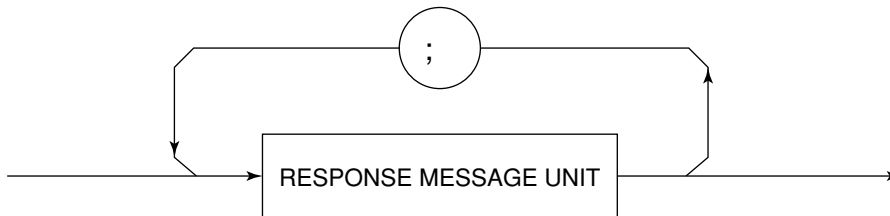


(1) RESPONSE MESSAGE TERMINATOR



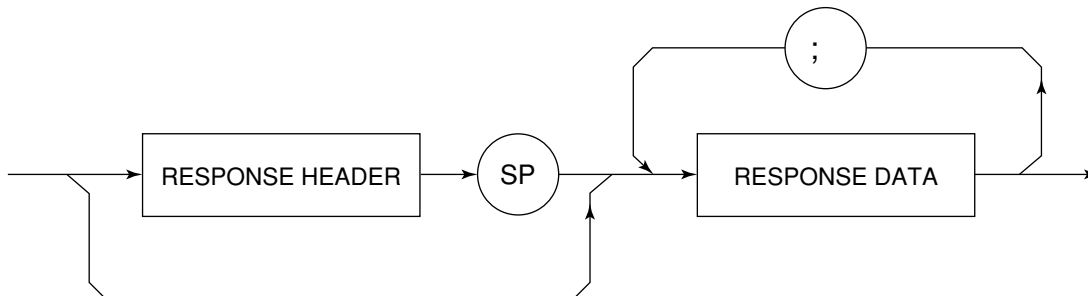
The response message terminator to be used depends on the TRM command specification.

(2) RESPONSE MESSAGE

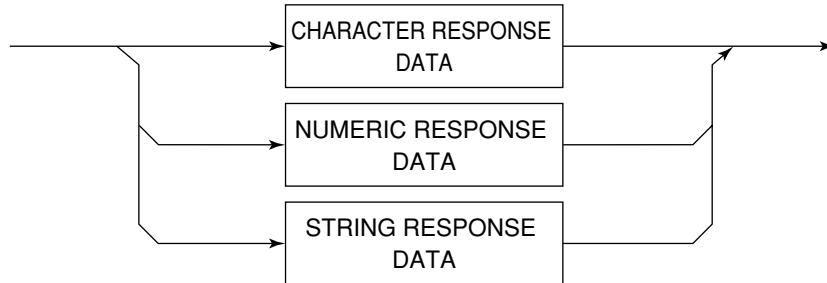


When a query is sent by the WRITE statement with one or more program queries, the response message also consists of one or more response message units.

(3) Usual RESPONSE MESSAGE UNIT



(4) RESPONSE DATA

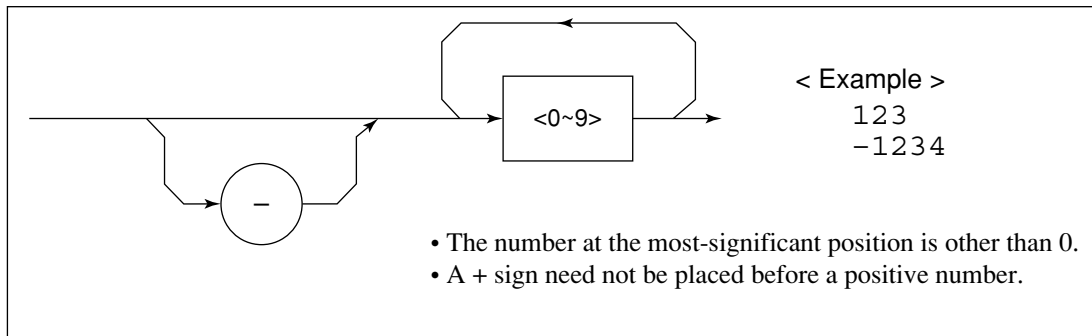


(5) CHARACTER RESPONSE DATA

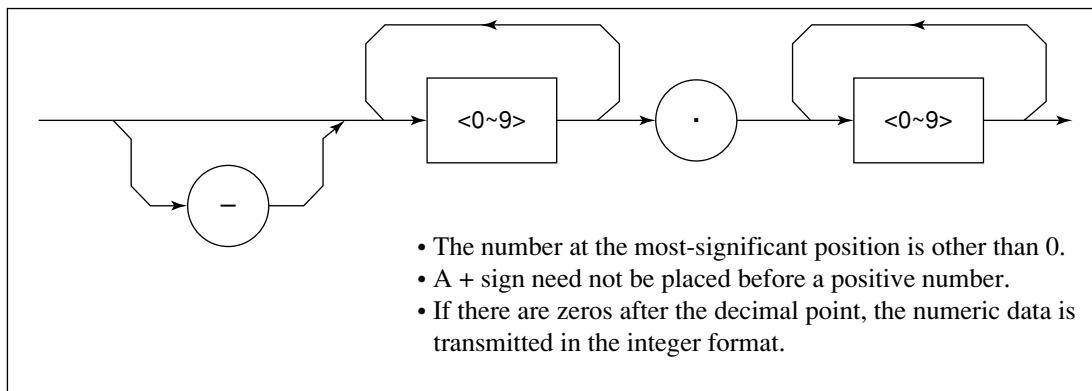
Character response data is specific character string data consisting of the uppercase alphabetic characters from A to Z, lowercase alphabetic characters from a to z, numbers 0 to 9, and underline (_).

(6) NUMERIC RESPONSE DATA

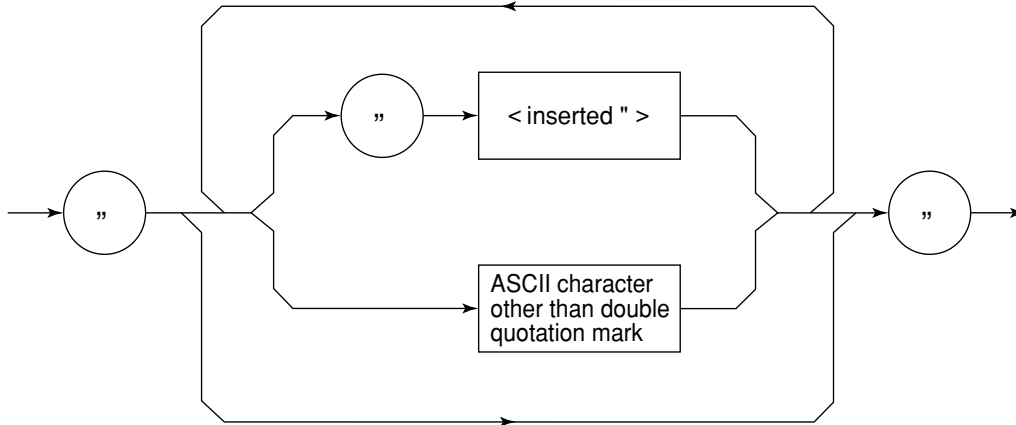
< Integer format (NR1) >



< Fixed-point format (NR2) >



(7) CHARACTER RESPONSE DATA

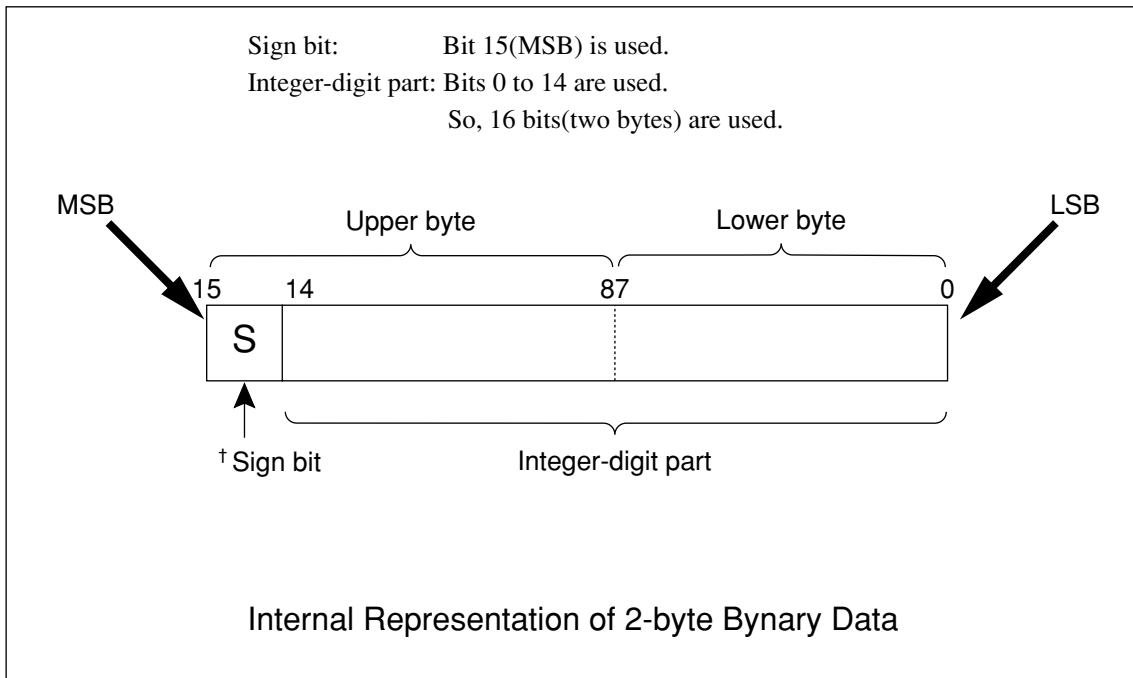


String response data is transmitted as an ASCII character enclosed with double quotation marks.

(8) Response message for input of waveform data using binary data

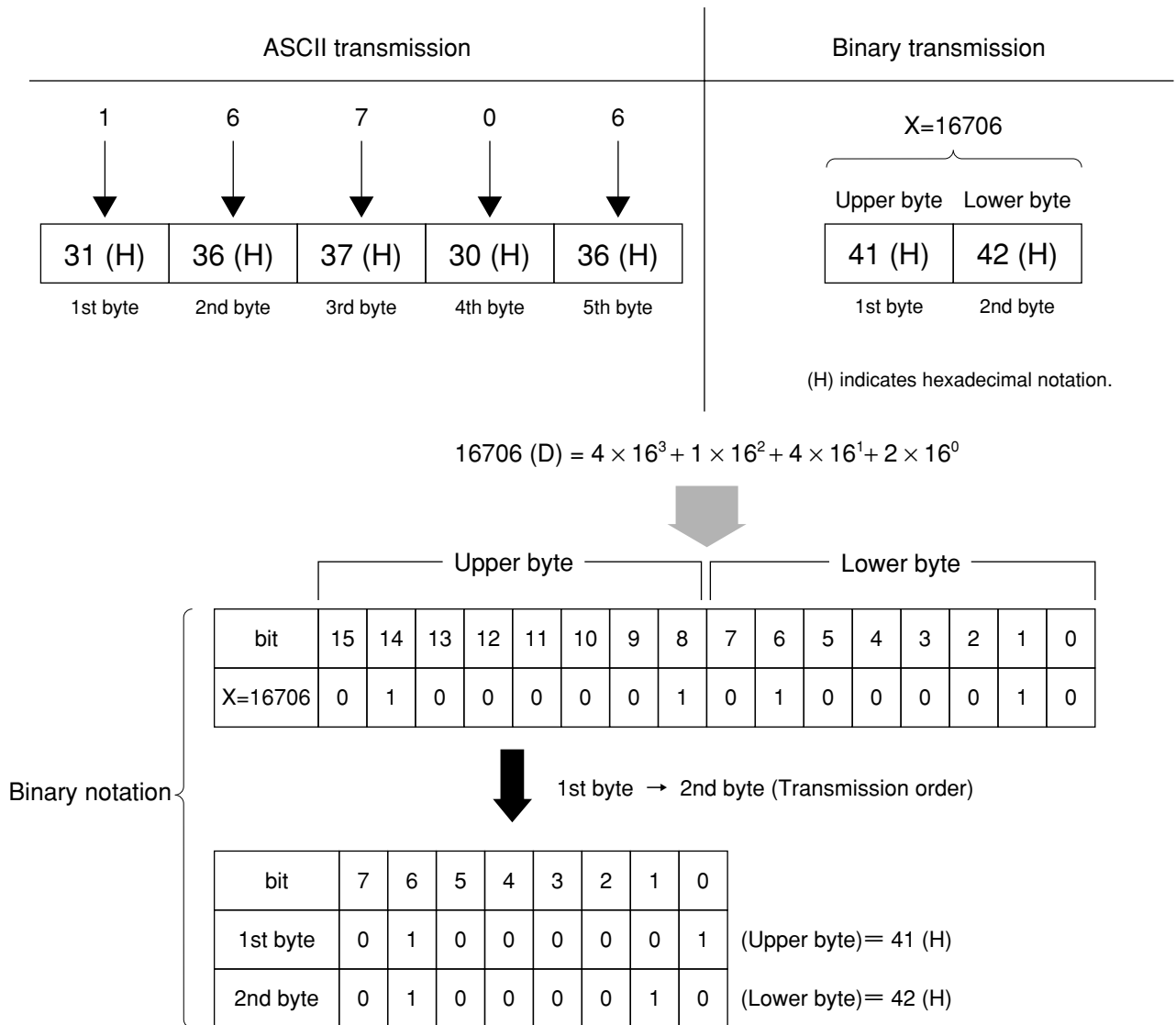
The waveform binary data is two-byte 65536 integer data from -32768 to 32767, as shown below; and sent in the sequence of upper byte and lower byte.

16-Bit Binary	With Sign	No Sign
1000000000000000	-32768	32768
1000000000000001	-32767	32769
1000000000000010	-32766	32770
1111111111111101	-3	65533
1111111111111110	-2	65534
1111111111111111	-1	65535
0000000000000000	0	0
0000000000000001	1	1
0000000000000010	2	2
0000000000000011	3	3
0111111111111101	32765	32765
0111111111111110	32766	32766
0111111111111111	32767	32767



† When a negative number is stored in a numeric variable, the sign bit 1 is set in the MSB to indicate the negative value. The value is stored in a numeric variable in a 2's complement format.

For an example, to transmit an integer of 16706, the ASCII format is compared with the Binary format, below. The ASCII format requires 5 bytes. Whereas, the Binary format requires only 2 bytes, and does not need the data format transformation. So, The Binary format is used for a high-speed transmission.



The waveform binary data has a number of bytes for

(Number of points to be specified) X 2 bytes + termination code.

Where, termination code is specified by the TRM command, and is LF(0D(H): 1 byte) or CR+LF(0A0D(H): 2 bytes).

Section 4 Status Structure

This section describes the device-status reporting and its data structure defined by the IEEE488.2 when the GP-IB interface bus is used. This section also describes the synchronization techniques between a controller and device.

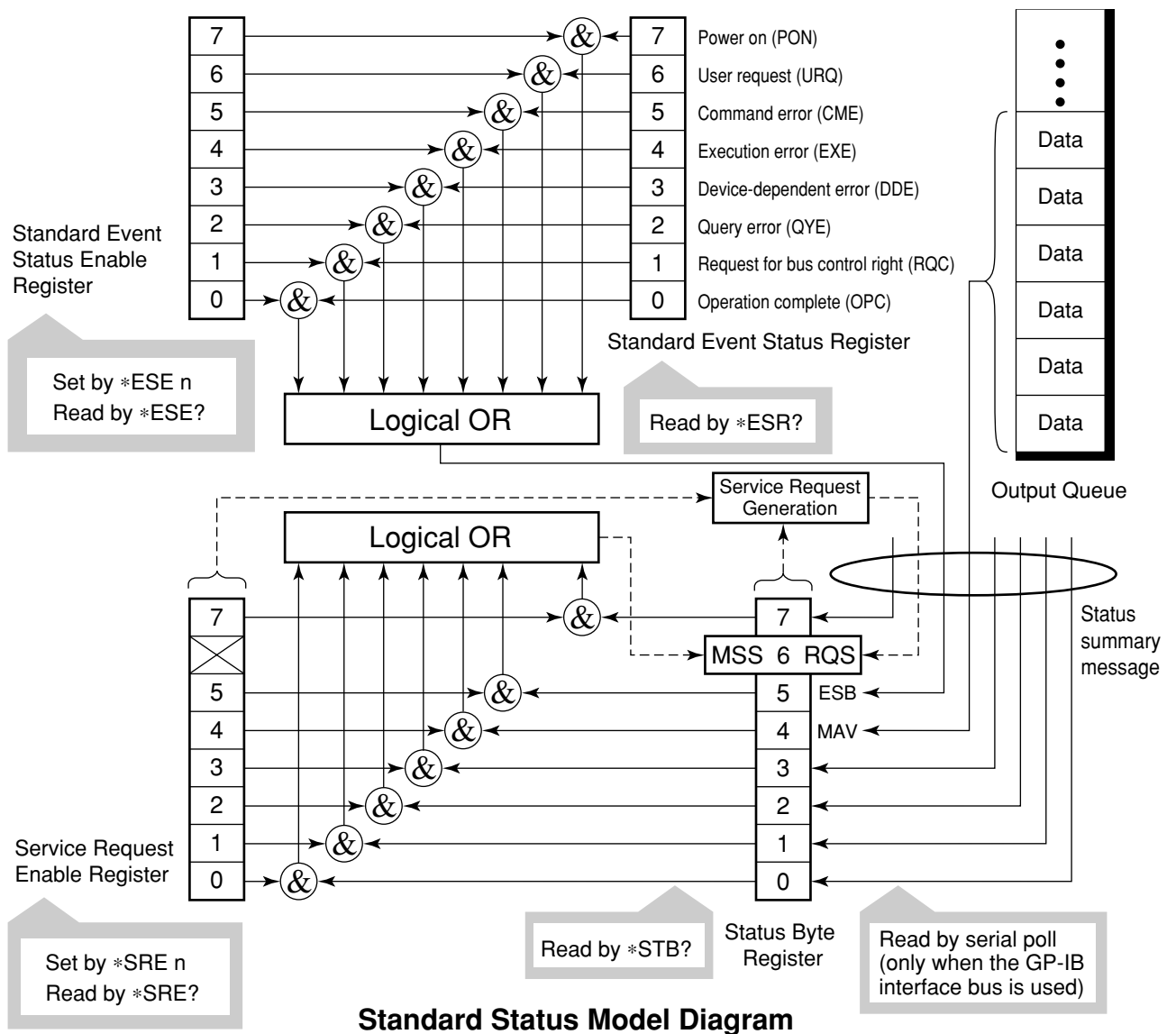
These functions are used to control a device from an external controller using the GP-IB interface bus. Most of these functions can also be used to control a device from an external controller using the RS-232C interface.

IEEE488.2 Standard Status Model	4-3
Status Byte (STB) Register	4-5
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Reading and clearing the STB register	4-7
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Standard Event Status Register	4-9
Bit definition of Standard Event Status Register	4-9
Reading, writing, and clearing the Standard Event Status Register	4-10
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Techniques for Synchronizing MS2681A/MS2683A/ MS2687A/MS2687B with a Controller	4-14
Wait for a response after the *OPC? query is sent.	4-14
Wait for a service request after *OPC is sent (only when the GP-IB interface bus is used).	4-15

The Status Byte (STB) sent to the controller is based on the IEEE488.1 standard. The bits comprising the STB are called status summary messages because they represent a summary of the current data in registers and queues.

IEEE488.2 Standard Status Model

The diagram below shows the standard model for the status data structures stipulated in the IEEE488.2 standard.



In the status model, IEEE488.1 status bytes are used for the lowest grade status. This status byte is composed of seven summary message bits from the higher grade status structure. To create these summary message bits, the status data structure is composed of two types of register and queue models.

Register model	Queue model
<p>The register model consists of two registers used for recording events and conditions encountered by a device. These two registers are the Event Status Register and Event Status Enable Register. When the results of the AND operation of both register contents are other than 0, the corresponding bit of the status bit becomes 1. In other cases, the corresponding bit becomes 0. When the result of their Logical OR is 1, the summary message bit also becomes 1. If the Logical OR result is 0, the summary message bit also becomes 0.</p>	<p>The queue in the queue model is used to sequentially record the waiting status values or information. If the queue is not empty, the queue structure summary message becomes 1. If the queue is empty, the message becomes 0.</p>

In IEEE488.2, there are three standard models for the status data structure. Two are register models and one is a queue model based on the register model and queue model described above. The three standard models are:

- [1] Standard Event Status Register and Standard Event Status Enable Register
- [2] Status Byte Register and Service Request Enable Register Output Queue

Standard Event Status Register	Status Byte Register	Output Queue
<p>The Standard Event Status Register has the same structure as the previously described register model. In this register, the bits for eight types of standard events encountered by a device are set as follows:</p> <ul style="list-style-type: none"> [1] Power on [2] User request [3] Command error [4] Execution error [5] Device-dependent error [6] Query error [7] Request for bus control right [8] Operation complete <p>The Logical OR output bit is represented by Status Byte Register bit 5 (DIO6) as a summary message for the Event Status Bit (ESB).</p>	<p>The Status Byte Register is a register in which the RQS bit and the seven summary message bits from the status data structure can be set. This register is used together with the Service Request Enable Register. When the results of the OR operation of both register contents are other than 0, SRQ becomes ON. To indicate this, bit 6 of the Status Byte Register (DIO7) is reserved by the system as the RQS bit. The RQS bit is used to indicate that there is a service request for the external controller. The mechanism of SRQ conforms to the IEEE488.1 standard.</p>	<p>The Output Queue has the structure of the queue model described above. Status Byte Register bit 4 (DIO5) is set as a summary message for Message Available (MAV) to indicate that there is data in the output buffer.</p>

Status Byte (STB) Register

The STB register consists of the STB and RQS (or MSS) messages of the device.

ESB and MAV summary messages

This paragraph describes the ESB and MAV summary messages.

(1) ESB summary message

The ESB (Event Summary Bit) is a message defined by IEEE488.2 which uses bit 5 of the STB register. When the setting permits events to occur, the ESB summary message bit becomes 1 if any one of the events recorded in the Standard Status Register becomes 1. Conversely, the ESB summary message bit becomes 0 if one of the recorded events occurs, even if events are set to occur.

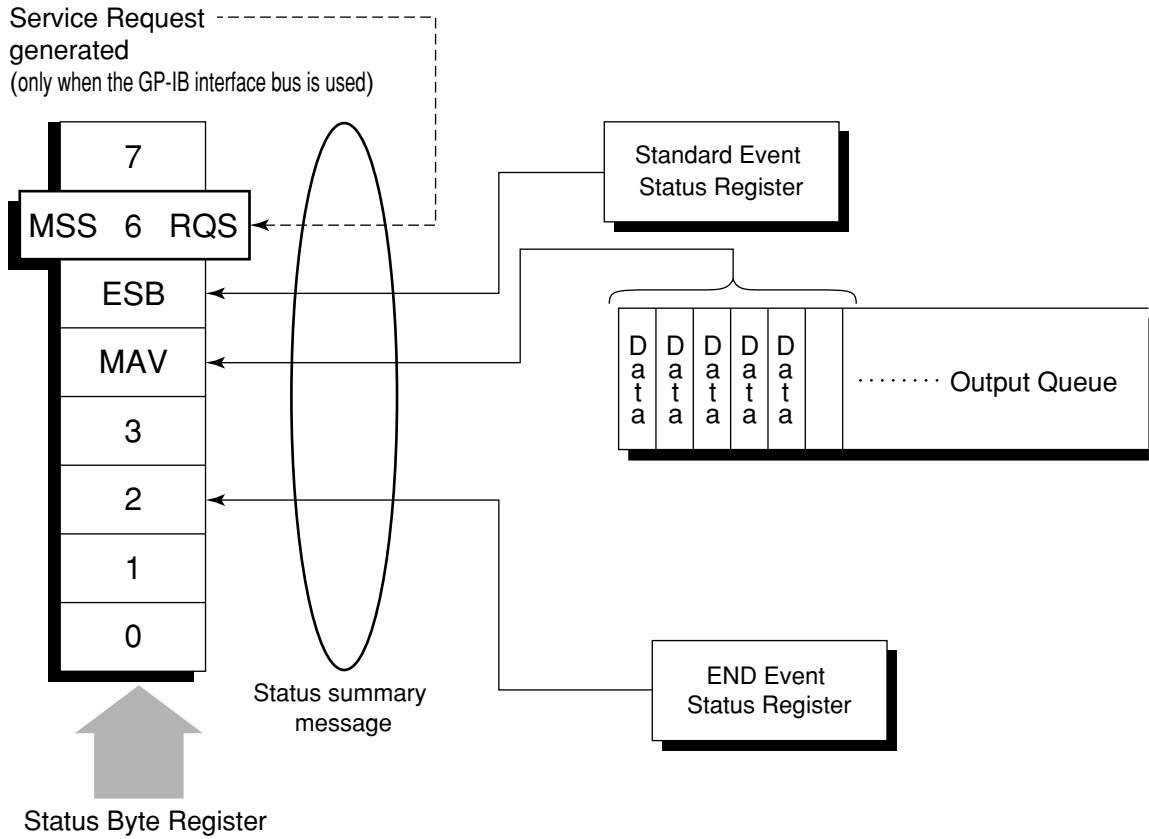
This bit becomes 0 when the ESR register is read by the *ESR? query or when it is cleared by the *CLS command.

(2) MAV summary message

The MAV (Message Available) summary bit is a message defined by IEEE488.2 which uses bit 4 of the STB register. This bit indicates whether the output queue is empty. The MAV summary message bit is set to 1 when a device is ready to receive a request for a response message from the controller. When the output queue is empty, this bit is set to 0. This message is used to synchronize the information exchange with the controller. For example, this message is available when, after the controller sends a query command to a device, the controller waits until MAV becomes 1. While the controller is waiting for a response from the device, other jobs can be processed. Reading the Output Queue without first checking MAV will cause all system bus operations to be delayed until the device responds.

Device-dependent summary messages

As shown in the diagram below, the spectrum analyzer does not use bits 0, 1, 3, and 7, and it uses bit 2 as the summary bit of the Event Status Register.



Reading and clearing the STB register

The STB register can be read using serial polling or the *STB? common query. The IEEE488.1 STB message can be read by either method, but the value sent to bit 6 (position) is different for each method.

The STB register contents can be cleared using the *CLS command.

(1) Reading by serial polling (only when the GP-IB interface bus is used)

The IEEE488.1 serial polling allows the device to return a 7-bit status byte and an RQS message bit which conforms to IEEE488.1. The value of the status byte is not changed by serial polling. The device sets the RQS message to 0 immediately after being polled.

(2) Reading by the *STB? common query

The *STB? common query requires the devices to send the contents of the STB register and the integer format response messages, including the MSS (Master Summary Status) summary message. Therefore, except for bit 6, which represents the MSS summary message, the response to *STB? is identical to that of serial polling.

(3) Definition of MSS (Master Summary Message)

MSS indicates that there is at least one cause for a service request. The MSS message is represented at bit 6 response to an *STB? query, but it is not produced as a response to serial polling. It should not be taken as part of the status byte specified by IEEE488.1. MSS is configured by the overall logical OR in which the STB register and SRQ enable (SRE) register are combined.

(4) Clearing the STB register using the *CLS common command

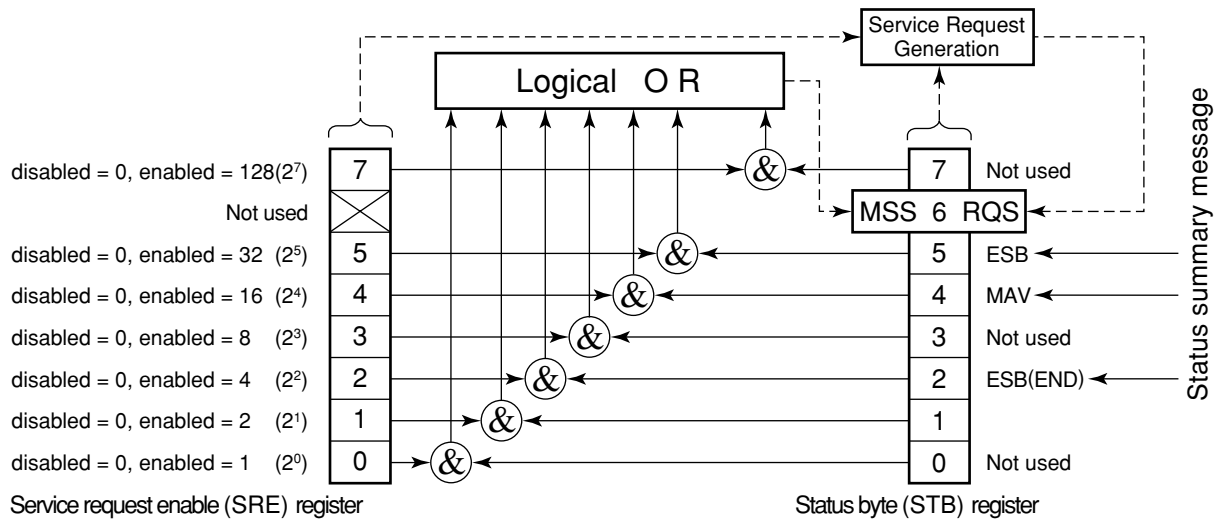
The *CLS common command clears all status data structures as well as the summary messages corresponding to them.

The *CLS command does not affect the settings in the Enable Register.

Service Request (SRQ) Enabling Operation

Bits 0 to 7 of the Service Request Enable Register (SRE) determine which bit of the corresponding STB register can generate SRQ.

The bits in the Service Request Enable Register correspond to the bits in the Status Byte Register. If a bit in the Status Byte Register corresponding to an enabled bit in the Service Request Enable Register is set to 1, the device makes a service request to the controller with the RQS bit set to 1.



(1) Reading the SRE register

The contents of the SRE register are read using the `*SRE?` common query. The response message to this query is an integer from 0 to 255 which is the sum of the bit digit weighted values in the SRE register.

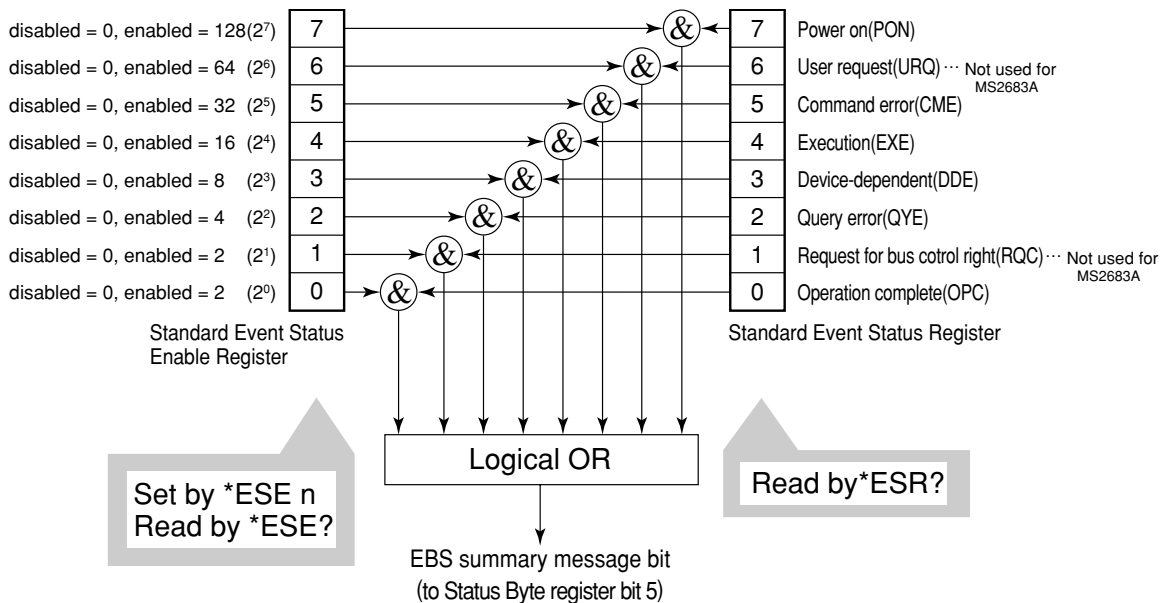
(2) Updating the SRE register

The SRE register is written using the `*SRE` common command. An integer from 0 to 255 is assigned as a parameter to set the SRE register bit to 0 or 1. The value of bit 6 is ignored.

Standard Event Status Register

Bit definition of Standard Event Status Register

The diagram below shows the operation of the Standard Event Status Register.



The Standard Event Status Enable (ESE) Register on the left is used to select which bits in the corresponding Event Register will cause a TRUE summary message when set.

Bit	Event name	Description
7	Power on (PON-Power on)	A transition from power-off to power-on occurred during the power-up procedure.
6	Not used	
5	Command error (CME-Command Error)	An illegal program message or a misspelled command was received.
4	Execution error (EXE-Execution Error)	A legal but unexecutable program message was received.
3	Device-dependent error (DDE-Device-dependent Error)	An error not caused by CME, EXE, or QYE occurred (parameter error, etc.).
2	Query error (QYE-Query Error)	An attempt was made to read data in the Output Queue when it was empty. Or, the data in the Output Queue was lost before it was read.
1	Not used	
0	Operation complete (OPC-Operation Complete)	This bit becomes 1 when this instrument has processed the *OPC command.

Reading, writing, and clearing the Standard Event Status Register

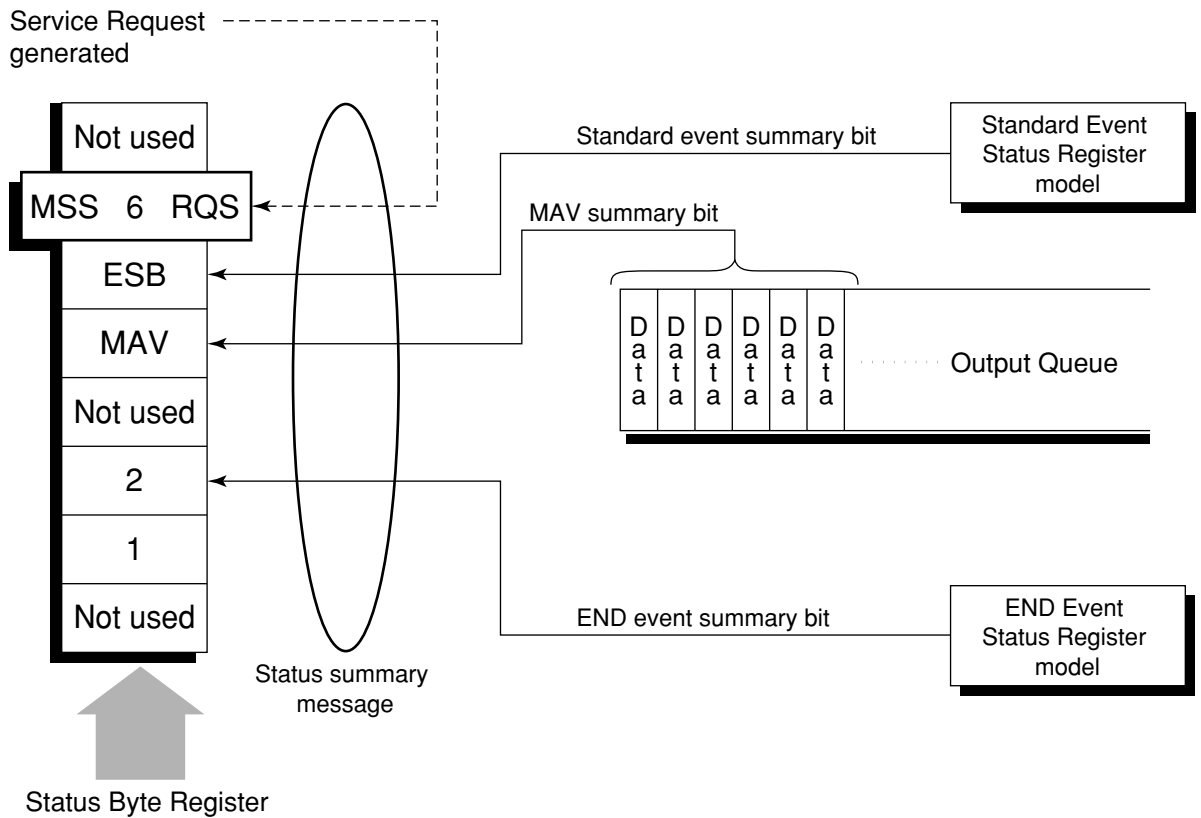
Reading	<p>The register is read using the *ESR? command query.</p> <p>The register is cleared after being read. The response message is integer-format data with the binary weight added to the event bit and the sum converted to decimal.</p>
Writing	<p>With the exception of clearing, data cannot be written to the register from outside.</p>
Clearing	<p>The register is cleared when:</p> <ul style="list-style-type: none"> [1] A *CLS command is received [2] The power is turned on Bit 7 is set to ON, and the other bits are cleared to 0 [3] An event is read for the *ESR? query command

Reading, writing, and clearing the Standard Event Status Enable Register

Reading	<p>The registers is read using the *ESE? command.</p> <p>The response message is integer-format data with the binary weight added to the event bit and the sum converted to decimal.</p>
Writing	<p>The register is written using the *ESE common command.</p>
Clearing	<p>The register is cleared when:</p> <ul style="list-style-type: none"> [1] An *EXE command with a data value of 0 is received [2] The power is turned on <p>The Standard Event Enable Register is not affected when:</p> <ul style="list-style-type: none"> [1] The device clear function status of IEEE488.1 is changed [2] An *RST common command is received [3] A *CLS common command is received

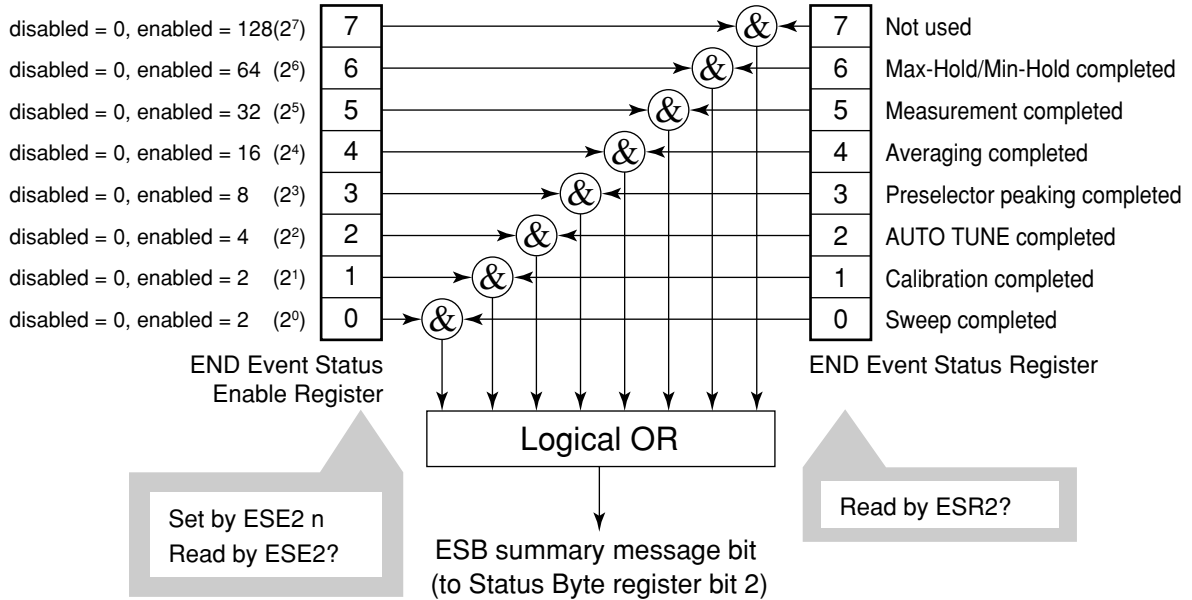
Extended Event Status Register

For MS2681A/MS2683A/MS2687A, bits 7, 3, 1, and 0 are unused. Bit 2 is assigned to the END summary bit as the status-summary bit supplied by the extended register model as shown below.



Bit definition of END Event Status Register

The diagram below shows the operation and event-bit names of the END Event Status Register.



The END Event Status Enable Register on the left is used to select which bits in the corresponding Event Register will cause a TRUE summary message when set.

Bit	Event name	Description
7	Not used	Not used
6	Max Hold/Min Hold	Sweeping according to the specified HOLD number has been completed.
5	Measurement completed	Calculation processing for measurements (frequency count, noise, etc.) has been completed.
4	Averaging completed	Sweeping according to the specified AVERAGE number has been completed.
3	Preselector peaking completed	Preselector peaking has been completed
2	AUTO TUNE completed	AUTO TUNE has been completed.
1	Calibration completed	ALL CAL, LEVEL CAL, or FREQ CAL has been completed.
0	Sweep completed	A single sweep has been completed or is in standby.

Reading, writing, and clearing the Extended Event Status Register

Reading	The ESR? common query is used to read the register. The register is cleared after being read. The response message is integer-format data with the binary weight added to the event bit and the sum converted to decimal.
Writing	With the exception of clearing, data cannot be written to the register from outside.
Clearing	The register is cleared when: [1] A *CLS command is received [2] The power is turned on [3] An event is read for the ESR2? query command

Reading, writing, and clearing the Extended Status Enable Register

Reading	The ESE2? query is used to read the register. The response message is integer-format data with the binary weight added to the event bit and the sum converted to decimals.
Writing	The ESE2 program command is used to write the register. Because bits 0 to 7 of the registers are weighted with values 1, 2, 4, 8, 16, 32, 64, and 128, respectively, the write data is transmitted as integer-format data that is the sum of the requiredbit digits selected from the weighted value.
Clearing	The register is cleared when: [1] An ESE2 program command with a data value of 0 is received [2] The power is turned on The Extended Event Status Enable register is not affected when: [1] The device clear function status of IEEE488.1 is changed [2] An *RST common command is received [3] A *CLS common command is received

Techniques for Synchronizing MS2681A/MS2683A/MS2687A/MS2687B with a Controller

MS2681A/MS2683A/MS2687A/MS2687B usually treats program messages as sequential commands that do not process newly-received commands until they complete the processing of the previous command. Therefore, no special consideration is necessary for pair-synchronization between MS2681A/MS2683A/MS2687A/MS2687B and the controller.

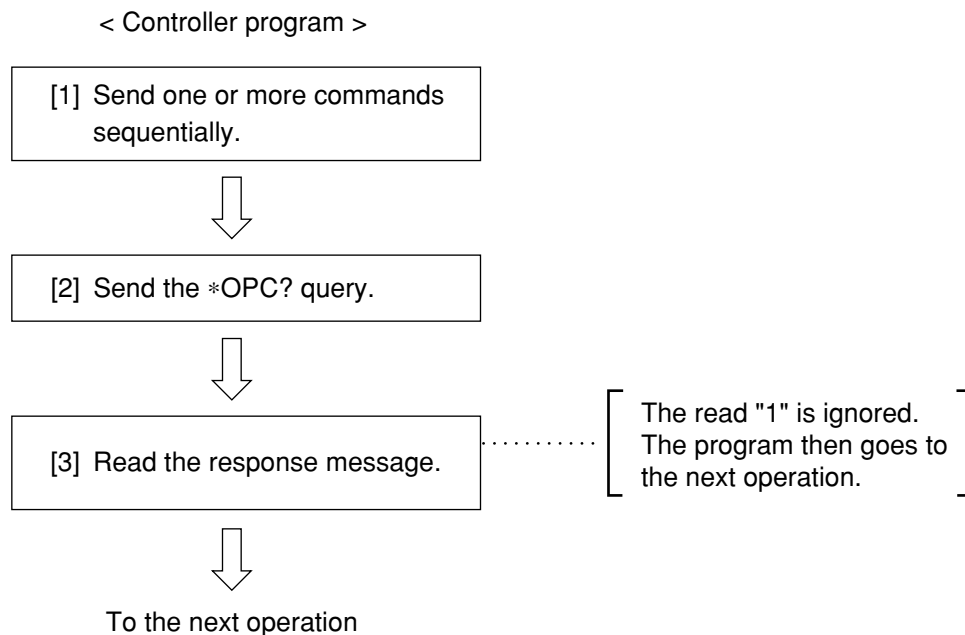
If the controller controls and synchronizes with one or more devices, after all the commands specified for MS2681A/MS2683A/MS2687A/MS2687B have been processed, the next commands must be sent to other devices.

There are two ways of synchronizing MS2681A/MS2683A/MS2687A/MS2687B with the controller:

- [1] Wait for a response after the *OPC? query is sent.
- [2] Wait for SRQ after *OPC is sent.

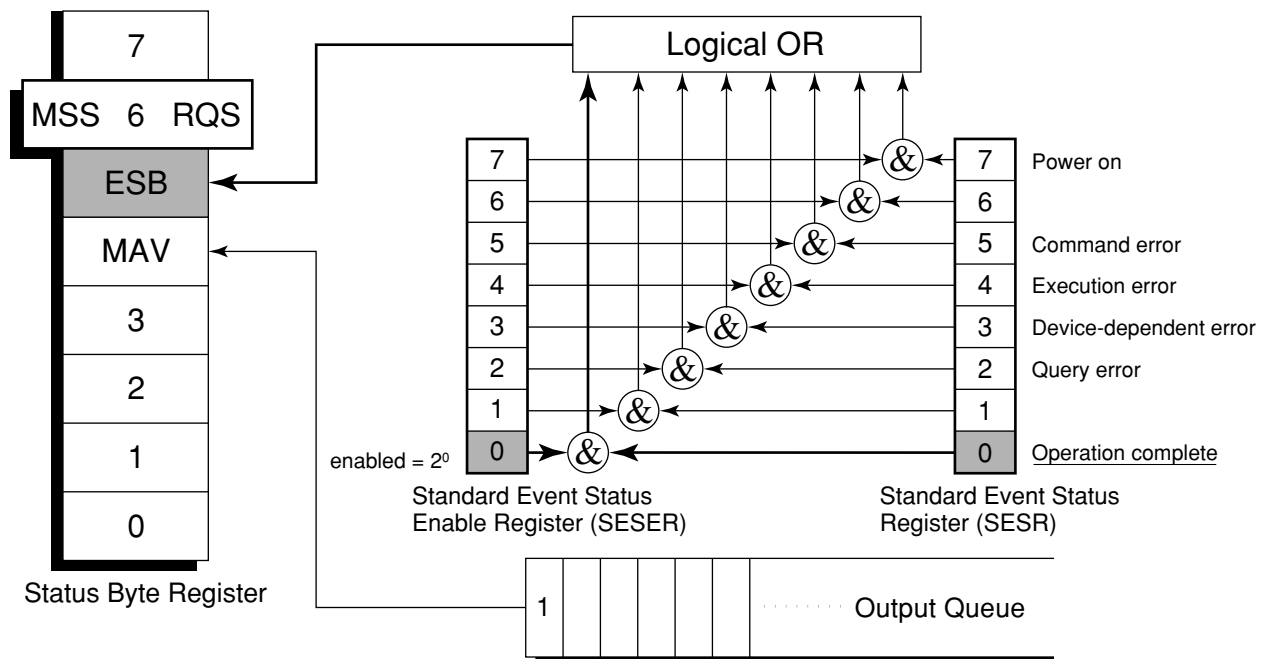
Wait for a response after the *OPC? query is sent.

MS2681A/MS2683A/MS2687A/MS2687B outputs "1" as the response message when executing the *OPC? query command. The controller is synchronized with MS2681A/MS2683A/MS2687A/MS2687B by waiting for the response message to be entered.



Wait for a service request after *OPC is sent (only when the GP-IB interface bus is used).

The MS2681A/MS2683A/MS2687A/MS2687B sets the operation-complete bit (bit 0) to 1 when executing the *OPC command. The controller is synchronized with the spectrum analyzer for SRQ when the operation-complete bit is set for SRQ.



■ < Controller program >

- | | |
|--|--|
| [1] Enable the 2^0 bit of the Standard Event Status Enable Register. | PRINT @1 ; "*ESE 1 " |
| ↓ | |
| [2] Enable the 2^5 bit of the Service Request Enable Register. | PRINT @1 ; "*SRE 32 " |
| ↓ | |
| [3] Make the device execute the specified operation. | |
| ↓ | |
| [4] Send the *OPC command. | PRINT @1 ; "*OPC " |
| ↓ | |
| [5] Wait for the SRQ interrupt (ESB summary message). | Value of status byte: $2^6 + 2^5 = 96$ |

Section 5 Initial Settings

MS2681A/MS2683A/MS2687A/MS2687B initializes the GP-IB interface system at three levels in accordance with the IEEE488.2 specifications. This section describes how these three levels of initialization are processed, and how to instruct initialization from the controller.

Bus Initialization using the IFC Statement	5-4
Initialization for Message Exchange by DCL and SDC Bus Commands	5-5
Device Initialization using the *RST Command	5-6
Device Initialization using the INI/IP Command	5-7
Device Status at Power-on	5-7

In the IEEE488.2 standard, there are three levels of initialization. The first level is "bus initialization," the second level is "initialization for message exchange," and the third level is "device initialization." This standard also stipulates that a device must be set to a known state when the power is turned on.

Level	Initialization type	Description	Level combination and sequence
1	Bus initialization	The IFC message from the controller initializes all interface functions connected to the bus.	Level 1 can be combined with other levels, but must be executed before level 2.
2	Initialization for message exchange	Message exchanges of all devices and specified devices on the GP-IB are initialized using the SDC and DCL GP-IB bus commands, respectively. These commands also nullify the function that reports operation completion to the controller.	Level 2 can be combined with other levels, but must be executed before level 3.
3	Device initialization	The *RST or INI/IP command returns a specified device to a known device-specific state, regardless of the conditions under which it was being used.	Level 3 can be combined with other levels, but must be executed after levels 1 and 2.

When using the standard RS-232C interface port or Option 09 Ethernet interface port to control MS2681A/MS2683A/MS2687A/MS2687B from the controller, the level-3 device initialization function can be used, and the level-2 initialization function cannot be used. When using the GP-IB interface bus to control MS2681A/MS2683A/MS2687A/MS2687B from the controller, the initialization functions of levels 1, 2, and 3 can be used.

The following paragraph describes the commands for initialization at levels 1, 2, and 3 and the items that are initialized. This paragraph also describes the known state which is set when the power is turned on.

Bus Initialization using the IFC Statement

■ Example

```
board% = 0
CALL SendIFC (board%)
```

■ Explanation

This function is available when using the GP-IB interface bus to control the spectrum analyzer from the controller. The IFC statement initializes the interface functions of all devices connected to the GP-IB bus line. The initialization of interface functions involves clearing the interface function states of devices set by the controller, and resetting them to their initial states. In the table below, indicates the functions which are initialized, and indicates the functions which are partially initialized.

No	Function	Symbol	Initialization by IFC
1	Source handshake	SH	○
2	Acceptor handshake	AH	○
3	Talker or extended talker	T or TE	○
4	Listener or extended listener	L or LT	○
5	Service request	SR	△
6	Remote/local	RL	
7	Parallel poll	PP	
8	Device clear	DC	
9	Device trigger	DT	
10	Controller	C	○

Bus initialization by the IFC statement does not affect the device operating state (frequency settings, LED on/off, etc.).

Initialization for Message Exchange by DCL and SDC Bus Commands

■ Example

Initializes all devices on the bus for message exchange (sending DCL).

```
board% = 0
addresslist% = NOADDR
CALL DevClearList(board%, addresslist%)
```

Initializes only the device at address 3 for message exchange (sending SDC).

```
board% = 0
address% = 3
CALL DevClear(board%, address%)
```

■ Explanation

This function is available when the GP-IB interface is used to control the spectrum analyzer from the controller. This statement executes initialization for message exchange of all devices or a specified device on the GP-IB having the specified select code.

■ Items to be initialized for message exchange

When the spectrum analyzer accepts the DCL or SDC bus command, it does the following:

- | | |
|---|---|
| [1] Input buffer and Output Queue: | Clears them and also clears the MAV bit. |
| [2] Parser, Execution Controller, and Response Formatter: | Resets them. |
| [3] Device commands including *RST: | Clears all commands that prevent these commands from being executed. |
| [4] Processing of the *OPC? command: | Puts a device in OCIS (Operation Complete Command Idle State). As a result, the operation complete bit cannot be set in the Standard Event Status Register. |
| [5] Processing of the *OPC? query: | Puts a device in OQIS (Operation Complete Query Idle State). As a result, the operation complete bit 1 cannot be set in the Output Queue. |
| [6] Device functions: | Puts all functions associated with message exchange in the idle state. The device continues to wait for a message from the controller. |

CAUTION

The following are not affected even if the DCL and SDC commands are processed:

- [1] Current data set or stored in the device
- [2] Front panel settings
- [3] Status of status byte other than MAV bit
- [4] A device operation in progress

Device Initialization using the *RST Command

■ Syntax

*RST

■ Example

For RS-232C or Ethernet

WRITE #1, "*RST" Initializes the spectrum analyzer at address 1 at level 3.

For GPIB

SPA%=1

CALL Send(0, SPA, "*RST", NLend)

■ Explanation


The *RST (Reset) command is an IEEE488.2 common command that resets a device at level 3.

The *RST (Reset) command is used to reset a device (spectrum analyzer) to a specific initial state. For details of the items that are initialized and the settings after initialization, see Appendix A.

Note:

The *RST command does not affect the following:

- [1] IEEE488.1 interface state
- [2] Device address
- [3] Output Queue
- [4] Service Request Enable register
- [5] Standard Event Status Enable register
- [6] Power-on-status-clear flag setting
- [7] Calibration data affecting device specifications
- [8] Parameters preset for control of external device, etc.

 For details of the settings of the spectrum analyzer after initialization, see Appendix A.

Device Initialization using the INI/IP Command

■ Syntax

INI

IP

■ Example (program message)

For RS-232C or Ethernet

```
WRITE #1, "INI " ..... Initializes the device (spectrum analyzer) at address 1 at level 3.
```

For GPIB

```
SPA%=1
```

```
CALL Send (0, SPA%, "INI ", NLend)
```

■ Explanation

The INI and IP commands are the spectrum analyzer device-dependent messages that initialize a device at level 3.

For details of the items that are initialized by the INI and IP commands, and the settings after initialization, see Appendix A.

Device Status at Power-on

When the power is turned on:

- [1] The device is set to the status it was in at power-off.
- [2] The Input Buffer and Output Queue are cleared.
- [3] The Parser, Execution Controller, and Response Formatter are initialized.
- [4] The device is put into OCIS (Operation Complete Command Idle State).
- [5] The device is put into OQIS (Operation Complete Query Idle State).
- [6] The Standard Event Status and Standard Event Status Enable Registers are cleared. Events can be recorded after the registers have been cleared.

As the special case of [1], when the spectrum analyzer is powered on for the first time after delivery, the spectrum analyzer settings are those listed in the Initial Settings Table (Appendix A).

Section 5 Initial Settings

Section 6 Sample Programs

This section gives some examples of the Microsoft Quick Basic program that controls the spectrum analyzer from a personal computer which is used as a controller.

Note: Microsoft Quick Basic is a registered trade mark of the Microsoft Corporation.

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Precautions on Creating the Remote Control Program

Note the following points when writing remote control programs.

No.	Precaution	Description
1	Be sure to initialize each device.	each device. When a command other than the INPUT #statement is sent to the controller before the response to a query is read, the output buffer is cleared, and the response message disappears. For this reason, write the INPUT #statement in immediate succession to a query.
2	Do not send any command (related to the device) other than the INPUT #statement immediately after sending a query.	No.2 described above is one type of exception processing of the protocol. Avoid exception processing from occurring as requested. Avoid stoppage of execution caused by an error by providing a program with exception-processing section against exceptions that can be foreseen.
3	Create a program that avoids the exception processing of the protocol.	There may be a number of the state in which each device is not proper to be actually sued due to operation on its own panel or execution of other programs. It is necessary to using individual devices with a prescribed condition resulting from initializing them. Execute initialization (INIT or *RST) of the functions proper to
4	Protect RS-232C or Ethernet buffer overflow.	The RS-232C or Ethernet interface has a 512-byte data area as the internal receive buffer. The buffer overflow may occur depending on the processing. To protect the overflow, don't send a large amount of data (i.e. control commands) at a time for remote control using RS-232C or Ethernet. After sending a command group, send *OPC? command to check the response for the synchronization before sending the next command.

Sample Programs

Initializing

<Example 1> Initializes the Spectrum Analyzer

```
'+++++
' Spectrum Analyzer Sample program
' <<Initialize>>
'+++++
'
' Setup parameter of PC Com. port
'   BAUD      :2400 BPS
'   Parity    : NONE
'   Data bit  : 8 bits
'   Stop bit  : 1 bit
'   Terminator : LineFeed
'
OPEN "COM1:2400,N,8,1,CD500,DS0,LF" FOR RANDOM AS #1
'
PRINT #1, "INI"   Initialize the Spectrum Analyzer
'
END
```

The parameters initialized by the above program are shown in Appendix A.

There is a '*RST' command in another command for executing initialization. The '*RST' command is used to execute initialization over a wider range. For the range of initialization level, refer to Section 5. The usage of the 'IP' command is identical to the 'INI' command.

For general usage of INI and *RST, first initialize the device (spectrum analyzer) functions with the IP or INI command, then use the program commands to set only the functions to be changed. This prevents the spectrum analyzer from being controlled while unnecessary functions are set.

Reading the frequency and level at marker point

<Example 2> Sets the center frequency to 500 MHz and span to 10 MHz, then displays the frequency and level reading at the peak point on the controller screen when a signal to be measured is received.

```

1  '+++++
2  ' Spectrum Analyzer Sample program
3  '  <<Read out marker frequency & level>>
4  '+++++
5  '
6  ' Setup parameter of PC Com. port
7  '
8  OPEN "COM1:2400,N,8,1,CD500,DS0,LF" FOR RANDOM AS #1
9  '
10 PRINT #1, "INI"          Initialize Spectrum Analyzer
11 '
12 PRINT #1, "CF 500MHZ"   Center frequency :500MHz
13 PRINT #1, "SP 10MHZ"   Span frequency  :10MHz
14 PRINT #1, "TS"         Take a sweep
15 '
16 PRINT #1, "PCF"        Set peak to center frequency
17 PRINT #1, "PRL"        Set peak to reference level
18 PRINT #1, "MKPK"       Search peak
19 '
20 PRINT #1, "MKF?"       Query marker frequency
21 INPUT #1, FREQ'        Input marker frequency data
22 PRINT #1, "MKL?"       Query marker level
23 INPUT #1, LEVEL'      Input marker level data
24 '
25 '                      Print out the result(Frequency/Level)
26 PRINT USING "Marker  Frequency=####.### MHz";FREQ/1000000
27 PRINT USING "Marker  LEVEL=####.## dBm";LEVEL
28 '
29 END

```

The center frequency and frequency span are set at line 12 and line 13 respectively. The TS sweep command at line 14 does not execute the next message unless the sweep is completed. This command thus prevents the peak search and other program lines from being executed before the sweep is completed.

The PCF and PRL commands at lines 16 and 17 operate as follows: The former sets the peak point on the screen to the center frequency, and the latter sets its peak level center frequency to the reference level.

The "MKF?" and "MKL?" at lines 20 and 22 query the frequency and level at the marker point respectively, and the data is read with the INPUT#statement on the next line. When a command other than the INPUT#statement is sent before the response to a query is read, the output buffer is cleared, and the response message is deleted. For this reason, write the INPUT#statement immediately after a query.

Program execution result of <Example 2>

Marker Frequency=501.251 Δ MHz
 Marker LEVEL=-15.53dBm

Note:

Δ is a space.

Reading trace data

<Example 3-1> Reads the trace level at all points when CF and SPAN are set to 500 MHz and 10 MHz respectively.

```

1 '+++++
2 ' Spectrum Analyzer Sample program
3 ' <<Read out trace data(ASCII)>>
4 '+++++
5 '
6 ' Setup parameter of PC Com. port
7 '
8 OPEN "COM1:2400,N,8,1,CD500,DS0,LF" FOR RANDOM AS #1
9 '
10 PRINT #1, "INI" ' Initialize Spectrum Analyzer
11 '
12 PRINT #1, "CF 500MHZ" ' Center fequency :500MHz
13 PRINT #1, "SP 10MHZ" ' Span frequency :10MHz
14 PRINT #1, "TS" ' Take a sweep
15 '
16 DIM TRACE(501) ' Define read data area
17 PRINT #1, "BIN 0" ' Set read out data type to ASCII
18 '
19 FOR I = 0 TO 500 ' Repeat trace(0) to trace(500):501 points
20 PRINT #1, "XMA? " + STR$(I) + ",1" ' Query trace data
21 INPUT #1, TRACE(I) ' Read out trace data
22 ' Print out trace data
23 PRINT USING "###.##dBm"; TRACE(I) / 100
24 NEXT I
25 '
26 END

```

The "BIN_0" at line 17 is a command for specifying ASCII as the response data format. The ASCII or BINARY transfer format can be specified for the "XMA?", "XMB?", "XMG?", and "XMT?" queries for reading trace data.

The example 3-2 blocks the trace data at every 10 points, and reads it.

<Example 3-2> Blocks the trace data at every 10 points, and reads it.

```

1 '+++++
2 ' Spectrum Analyzer Sample program
3 ' <<Read out trace data(ASCII) BLOCKING>>
4 '+++++
5 '
6 ' Setup parameter of PC Com. port
7 '
8 OPEN "COM1:2400,N,8,1,CD500,DS0,LF" FOR RANDOM AS #1
9 '
10 PRINT #1, "INI"      Initialize Spectrum Analyzer
11 '
12 PRINT #1, "CF 500MHZ"  Center fequency :500MHz
13 PRINT #1, "SP 10MHZ"  Span frequency :10MHz
14 PRINT #1, "TS"      Take a sweep
15 '
16 DIM TRACE(501)'      Define read data area
17 PRINT #1, "BIN 0"    Set read out data type to ASCII
18 '
19 FOR I = 0 TO 490 STEP 10
20                               Repeat trace(0) to trace(499):500 points
21                               Blocking 10 trace data
22     PRINT #1, "XMA? " + STR$(I) + ",10"  Query trace data
23                               Read out trace data
24     INPUT #1, TRACE(I), TRACE(I + 1), TRACE(I + 2), TRACE(I + 3),
TRACE(I + 4), TRACE(I + 5), TRACE(I + 6), TRACE(I + 7), TRACE(I + 8),
TRACE(I + 9)
25     PRINT TRACE(I), TRACE(I + 1), TRACE(I + 2), TRACE(I + 3), TRACE(I
+ 4), TRACE(I + 5), TRACE(I + 6), TRACE(I + 7), TRACE(I + 8),TRACE(I + 9)
26 NEXT I
27 PRINT #1, "XMA? 500,1"  Query last trace data:trace(500)
28 INPUT #1, TRACE(500)
29 '
30 FOR I = 0 TO 500'          Print out trace data
31     PRINT USING "###.##dBm"; TRACE(I) / 100
32 NEXT I
33 '
34 END

```

Delta marker

<Example 4> Using a delta marker, reads out the frequency and level differences between a peak point and the next peak point.

```

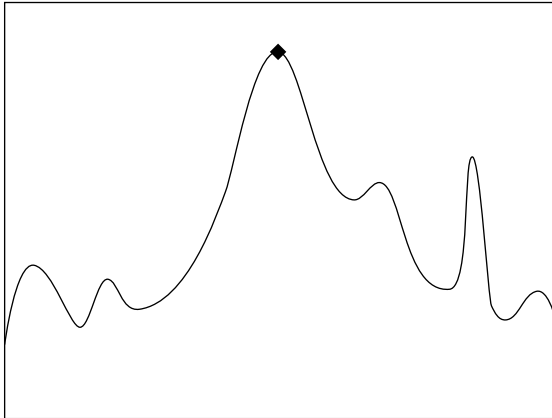
1 '+++++
2 ' Spectrum Analyzer Sample program
3 ' <<Read out delta marker frequency & level>>
4 '+++++
5 '
6 ' Setup parameter of PC Com. port
7 '
8 OPEN "COM1:2400,N,8,1,CD500,DS0,LF" FOR RANDOM AS #1
9 '
10 PRINT #1, "INI" ' Initialize Spectrum Analyzer
11 '
12 PRINT #1, "FA 50MHZ" ' Start fequency :500MHz"
13 PRINT #1, "FB 2GHZ" ' Stop frequency :2GHz
14 PRINT #1, "TS" ' Take a sweep
15 '
16 PRINT #1, "MKR 0" ' Set marker to "Normal"
17 PRINT #1, "MKPK" ' search peak
18 PRINT #1, "MKR 1" ' Set marker to "Delta"
19 PRINT #1, "MKPK NH" ' search Next peak
20 '
21 PRINT #1, "MKF?" ' Query Delta marker frequency
22 INPUT #1, DFREQ' Input Delta marker frequency data
23 PRINT #1, "MKL?" ' Query Delta marker level
24 INPUT #1, DLEVEL' Input Delta marker level data
25 ' Print out the result(Frequency/Level)
26 PRINT USING "Delta Frequency=####.### MHz"; DFREQ / 1000000
27 PRINT USING "Delta level=####.## dB"; DLEVEL
28 '
29 END

```

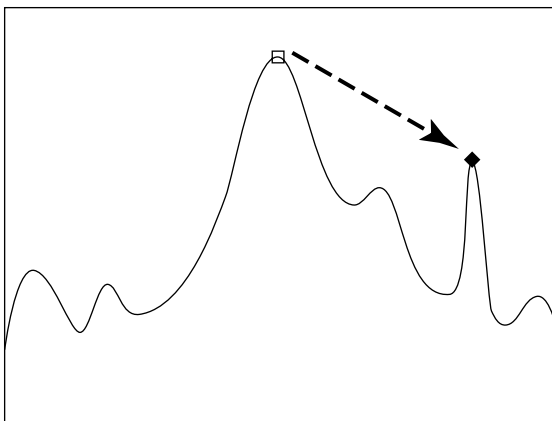
The "MKR_1" at line 18 is used to set the marker mode to DELTA, so that the reference marker can also be set together to the current marker position.

The "MKPK_NH" at line 19 sets the marker search to NEXT PEAK to move the current marker to NEXT PEAK point.

The "MKF?" and "MKL?" at lines 21 and 23 query reading the frequency and level at the current marker position while the marker mode is NORMAL. It is also used to query reading the frequency and level differences between the current marker and the reference marker while the marker mode is DELTA.

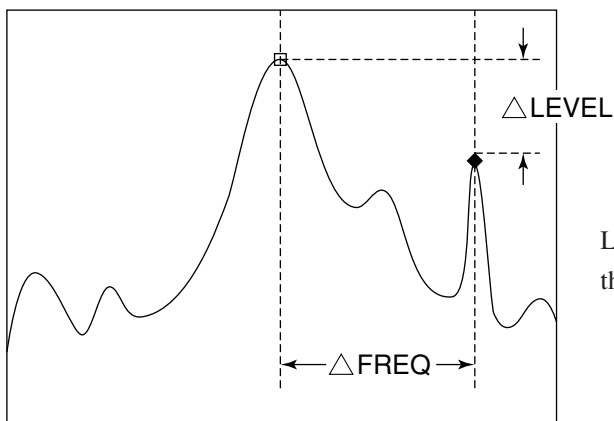


Executing PEAK SEARCH (MKPK) at line 17 allows the current marker to be set to the peak point.



Line 19 allows the reference marker to be set together to the current marker position. Executing NEXT PEAK SEARCH MKPK_NH at line 18 allows the current marker

Δ FREQ Δ LEVEL
 Δ MKR: |18.20 kHz| |-25.2dB|



Lines 21 to 24 read out the FREQ and LEVEL displayed in the upper left of screen.

Multimarker function

<Example 5-1> Using the multimarker function, measures the frequency/level at 10 points in descending order.

```

1 '+++++
2 ' Spectrum Analyzer Sample program
3 ' <<Multi Marker Highest-10>>
4 '+++++
5 '
6 ' Setup parameter of PC Com. port
7 '
8 OPEN "COM1:2400,N,8,1,CD500,DS0,LF" FOR RANDOM AS #1
9 '
10 PRINT #1, "INI"          Initialize Spectrum Analyzer
11 '
12 PRINT #1, "CF 500MHZ"   Center fequency 500MHz
13 PRINT #1, "SP 20KHZ"   Span frequency 20KHz
14 PRINT #1, "TS"        Take a sweep
15 '
16 PRINT #1, "MKMHI"      Multi marker On &
17 '                      Perform Highest-10 function
18 '
19 FOR I = 1 TO 10
20 PRINT #1, "MKMP? " + STR$(I)
21 INPUT #1, FREQ'        Input marker frequency data
22 PRINT #1, "MKML? " + STR$(I)
23 INPUT #1, LEVEL'      Input marker frequency data
24 '
25 PRINT USING "Marker No. ## #,###.####MHz ####.##dBm"; I; FREQ / 1000000;
LEVEL
26 NEXT I
27 '
28 END

```

The Spectrum Analyzer multimarker function allows up to ten markers to be set at a time. The "MKMHI" at line 130 is used to set the multimarker to HIGHEST 10 mode which sets up to ten markers in descending order.

The frequency and level at each marker are read out by lines 19 to 26.

This program allows harmonics to be observed if the program is modified. <Example 5-2> shows the program for observing the harmonics from a fundamental to the fifth order.

<Example 5-2> Harmonic frequency measurement (measures 500 MHz fundamental and up to its fifth order harmonics)

```

1 '+++++
2 ' Spectrum Analyzer Sample program
3 '  <<Multi Marker Harmonics>>
4 '+++++
5 '
6 ' Setup parameter of PC Com. port
7 '
8 OPEN "COM1:2400,N,8,1,CD500,DS0,LF" FOR RANDOM AS #1
9 '
10 PRINT #1, "INI" '           Initialize Spectrum Analyzer
11 '
12 PRINT #1, "FA 0HZ" '       Start frequency :0Hz
13 PRINT #1, "FB 3GHZ" '     Stop frequency :3GHz
14 PRINT #1, "MKZF 500MHZ" '  Marker center  :500MHz
15 PRINT #1, "TS" '          Take a sweep
16 '
17 PRINT #1, "MKMHRM" '       Multi marker On & Perform harmonics function
18 '
19 FOR I = 1 TO 5
20 PRINT #1, "MKMP? " + STR$(I)
21 INPUT #1, FREQ'           Input marker frequency data
22 PRINT #1, "MKML? " + STR$(I)
23 INPUT #1, LEVEL'         Input marker frequency data
24 '
25 PRINT USING "Marker No. ## #,###.####MHz #####.##dBm"; I; FREQ / 1000000;
LEVEL
26 NEXT I
27 '
28 END

```

This program allows the frequency to be set using the START-STOP at lines 12 and 13. The "MKZF_500MHZ" at line 14 moves the zone marker center to 500 MHz so that marker can capture a fundamental. (In the initial state, the zone is positioned in the center of the screen. The "MKMHRM" at line 17 sets the multimarker to HARMONICS mode (harmonic frequency measurement).

Respective frequencies and levels at five markers can be read out by setting the number of loops to 5 in the FOR...NEXT statement from line 19 to line 26. The other parts of this program are the same as <Example 5-1>.

Gate functions

<Example 6> Reads out spectrum data by observing the burst wave using the gate function.

```

1 '+++++
2 ' Spectrum Analyzer Sample program
3 ' <<Gate sweep>>
4 '+++++
5 '
6 ' Setup parameter of PC Com. port
7 '
8 OPEN "COM1:2400,N,8,1,CD500,DS0,LF" FOR RANDOM AS #1
10 '
11 PRINT #1, "INI" '           Initialize Spectrum Analyzer
12 '
13 DIM TRACE(501) '           Define read data area
14 PRINT #1, "CF 500MHZ" '     Center fequency :500MHz
15 PRINT #1, "SP 10MHZ" '     Span frequency  :10MHz
16 PRINT #1, "RB 100KHZ" '    Resolution BW   :100kHz
17 PRINT #1, "TRGSOURCE WIDEVID" ' Trigger source  :Wide IF video
18 PRINT #1, "GD 50US" '     Gate delay       :50 usec
19 PRINT #1, "GL 400US" '    Gate length     :400 usec
20 PRINT #1, "GE INT" '     Gate           :Internal timer
21 PRINT #1, "GATE ON" '     Gate sweep On
22 '
23 FOR TMR = 0 TO 25000
24 NEXT TMR '                 Wait
25 '
26 FOR I = 0 TO 500 '         Read out & print trace data
27     PRINT #1, "XMA? " + STR$(I) + ",1"
28     INPUT #1, TRACE(I)
29     PRINT USING "###.##dBm"; TRACE(I) / 100
30 NEXT I
31 '
32 END

```

When the burst waveform shown in Fig. 6-1 is observed, the spectrum shown in Fig. 6-2 (a) is output. This function can conveniently be used to observe the spectrum of the ON interval (interval shown by A in Fig.6-1) in this waveform. This program uses the wide IF video trigger signal as a gate source signal.

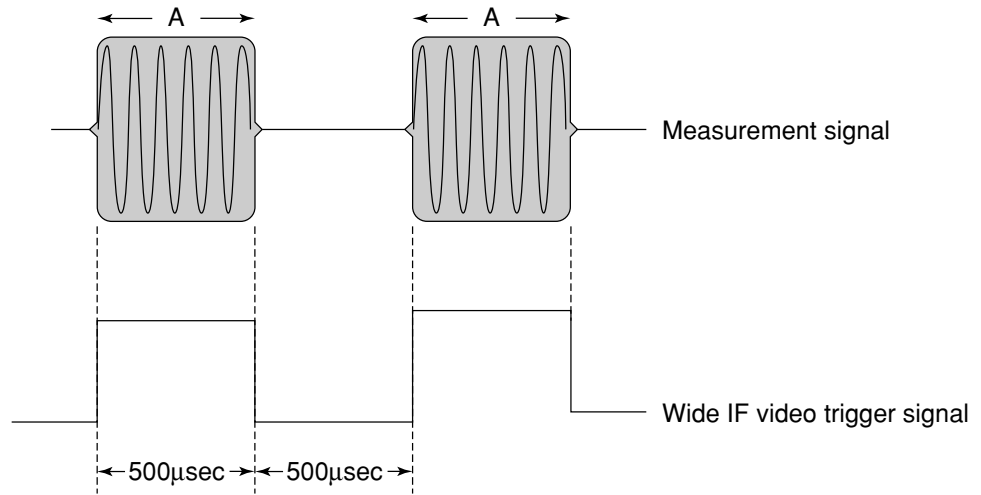


Fig. 6-1 Burst Waveform

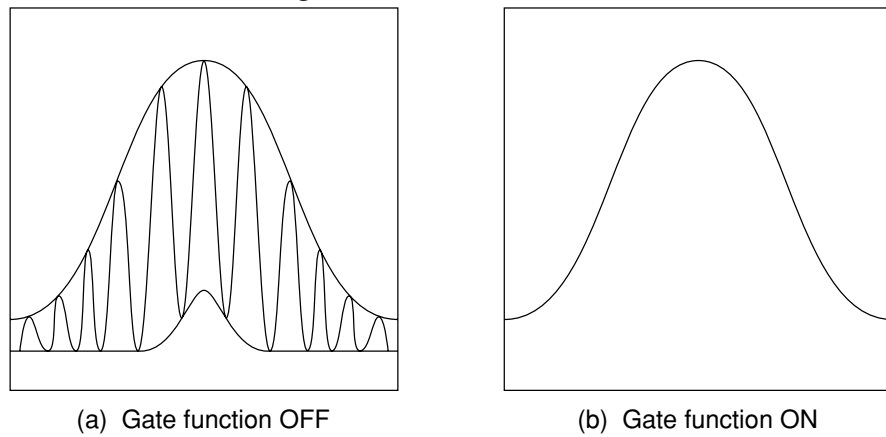


Fig. 6-2 Burst Wave Spectrum

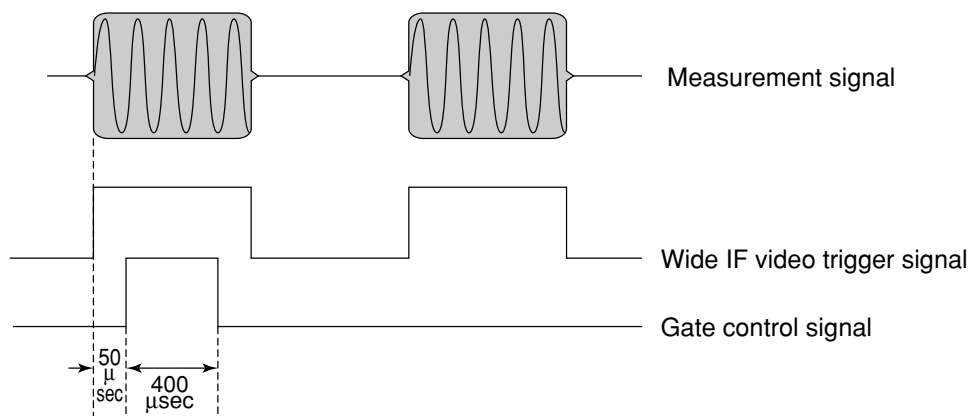


Fig. 6-3 Sample Program for Gate-Control Signal Generation Timing

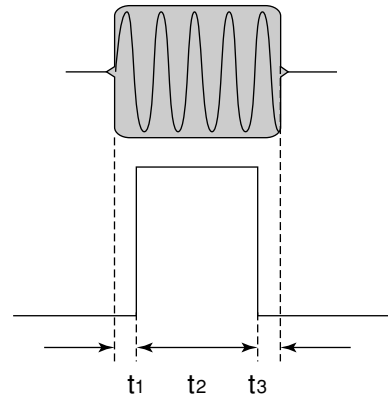
The RBW command at line 16 sets RBW to the optimum value depending on the GATE conditions (GATE DELAY: t1, GATE LENGTH: t2) as shown in Table 6-1 below.

The block from line 17 sets the trigger signal, and the block from lines 18 to 20 sets the gate conditions. The gate function is set to ON at line 21. The waiting time is granted at lines 23 and 24 because it takes time to form a perfect waveform which is fully connected.

The block from lines 26 to 30 allows trace data to be output by the "XMA?" query. The spectrum can be observed as shown in Fig. 6-2(b) by executing this program.

Table 6-1 RBW Optimum Values

RBW	t1	t2	t3
1 kHz	≥3 msec	≥20 μsec	≥1 μsec
3 kHz	≥1 ms		
10 kHz	≥230 μsec		
30 kHz	≥200 μsec		
100 kHz	≥20 μsec		
300kHz	≥15 μsec		
1 MHz 3 MHz	≥10 μsec		



Section 6 Sample Programs

```
16 RCLMEMCARD:
17 '
18 '                               Enter recall data type
19 INPUT "SELECT RECALL DATA 1=TRACE&PARAM 2=PARAM"; RCD
20 IF RCD = 2 THEN RCDATA$ = "P" ELSE RCDATA$ = "TP"
21 PRINT #1, "RDATA " + RCDATA$'    Set recall data type
22 '
23 INPUT "FILE No."; FILE'          Enter recall file No.
24 PRINT #1, "RCM" + STR$(FILE)'    Perform recall proces
25 RETURN
```

These two programs are used as subroutines called from other programs. Each subroutine can be called by placing GOSUB SAVMEMCARD or GOSUB RCLMEMCARD at the line number where the program data is to be saved or restored.

<Example>

```
.
.
200 PRINT #1, "SWP"
210 GOSUB SAVMEMCARD
.
.
.
```

The block from lines 19 and 20 of SAVMEMCARD sets the title. When the saved data is displayed if the title has been set, this title is also displayed. This can conveniently be used to find data.

FILE No. is input at line 22 and data is saved to the FILE No. at line 23.

Line 19 of RCLMEMCARD selects the data to be recalled for trace data including parameters or parameters only. Line 21 declares the item to be recalled, and the specified file is recalled at lines 23 and 24.

This ADJ program is a subroutine, which requires the center frequency and frequency span to be set to appropriate values in the main program. Then it is executed.

The block from lines 23 to 26 sets adjacent-channel measurement conditions, which is both the upper and lower channels, the 8.5 kHz channel width, 12.5 kHz channel 1 separation, and 25.0 kHz channel 2 separation. After the sweep is executed by the "TS" command at line 29, the adjacent-channel leakage power is measured at line 30. Line 32 queries reading the measured value at line 33.

The program in <Example 8> for measuring a modulated wave relative to the total power can be changed to a program for measurement relative to the reference level by rewriting line 27 as shown below:

```
PRINT #1, "MADJMOD UNMD"
```

In this case, perform the following operations before activating this subroutine.

Put the input signal in the unmodulated state and execute PEAK -> CF and PEAK -> REF. Then return to the modulated state.

Section 6 Sample Programs

Line 24 sets the N% value to set $n = 99\%$ in <Example 9> by sending the OBWN command for setting the occupied frequency bandwidth at line 23 and 24. Line 25 sets the detection mode to SAMPLE. Line 26 set the averaging count and line 27 averaging to ON respectively.

Line 29 issues the "TSAVG command to repeat the sweep by the required number of times for averaging processing. Line 31 measures the occupied frequency bandwidth of the averaging-processed waveform. Line 33 queries reading the occupied frequency bandwidth and the center frequency of the frequency bandwidth at line 34.

To make a measurement using X dB DOWN, rewrite lines 23 and 24 as shown below:

```
.  
. .  
PRINT @SPA; "OBWXDB 25 "  
PRINT @SPA; "MOBW XDB "  
. .
```



```

52 DATA "6.524MS", "0.8DBM":
53 DATA "6.524MS", "-200DBM":
54 '
55 READ N
56 FOR I = 1 TO N
57 ' Read each limit data & write to limit line area
58   READ TM$, LEV$
59   PRINT #1, "MTEMPIN" + STR$(I) + "," + TM$ + "," + LEV$
60 NEXT I
61 '
62 RETURN
63
64

```

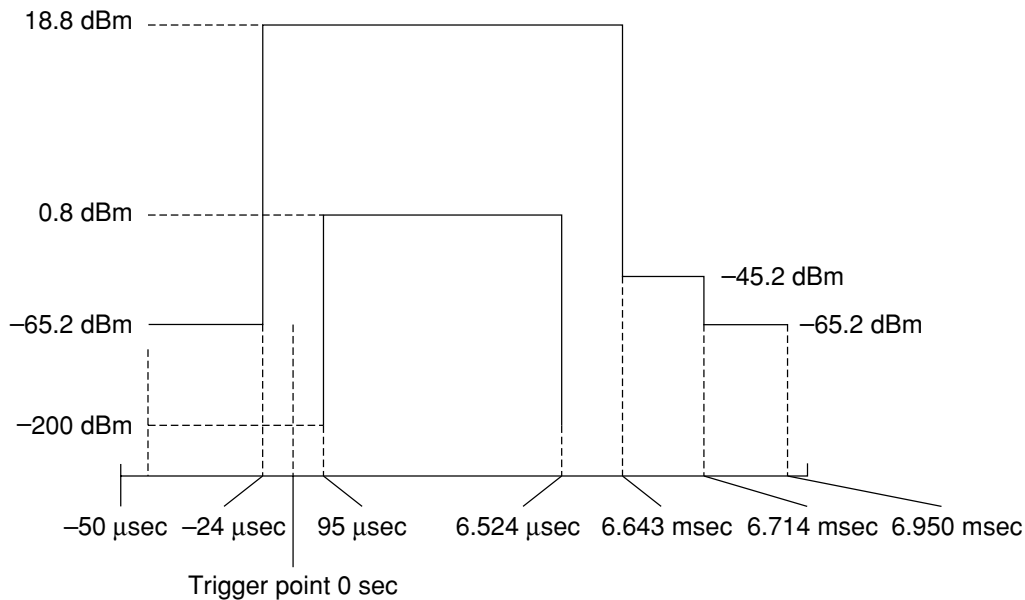


Fig. 6-4 Setting Data

The block from line 18 selects the template No. to be set. The block from line 19 specifies the template data as an absolute value. The block from lines 20 and 21 initializes the current data settings. The block from lines 23 and 37 to 42 sets LIMIT LINE 1 UPPER. Line 23 sets the data to be set in LIMIT LINE1 UPPER. Line 24 specifies the line where setting data is written.

Line 37 reads the number of data points to set the number of loops to N in the FOR ...NEXT statement at lines 38 to 42. Various data settings are read in the FOR...NEXT block.

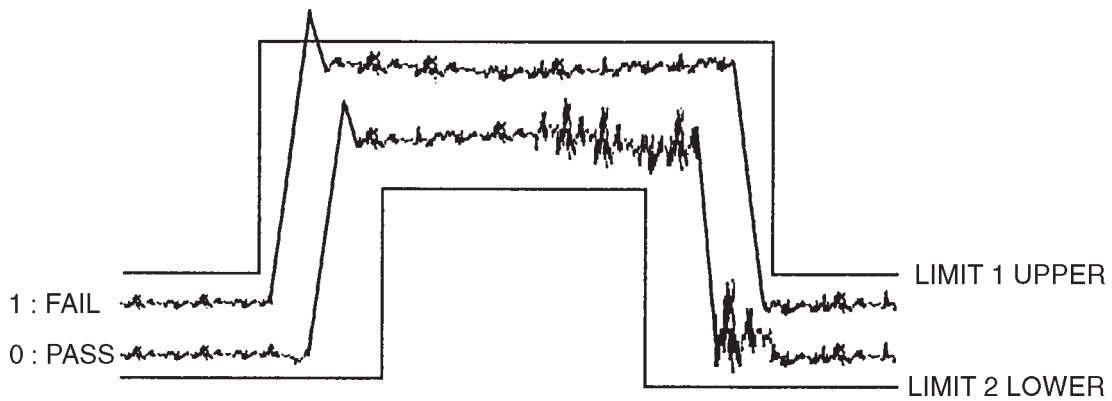
The block from lines 44 and 54 to 59 sets LIMIT LINE 1 LOWER like the block from lines 23 and 37 to 42.

The block from lines 26 to 35 and 47 to 52 contains the DATA statements for setting the data included in these lines as template data. Lines 26 and 47 are label lines for the RESTORE statement.

Each data item in lines 27 and 48 is numeric, and shows the number of data points. In the DATA statements following the DATA statement with this numeric data, the string expressions are listed as string data with units in order of time and level.

This subroutine checks whether or not a burst signal waveform satisfies the specification using the set template data.

Line 29 specifies the template No. used for a go/no-go decision. Line 30 and 31 specify LIMIT 1 UPPER and LIMIT 1 LOWER as limit lines respectively. Line 33 executes template measurement, line 35 requests data, and line 36 receives data.



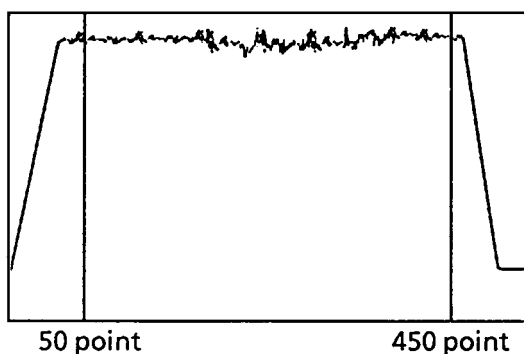
When part of a waveform is beyond LIMIT LINE, a response of "1" is generated to indicate FAIL. When the waveform is not beyond LMIT LINE, a response of "0" is generated to indicate PASS.

This program is a subroutine that measures the burst wave average power.

Lines 29 and 30 set the measurement start and stop points on the screen display.

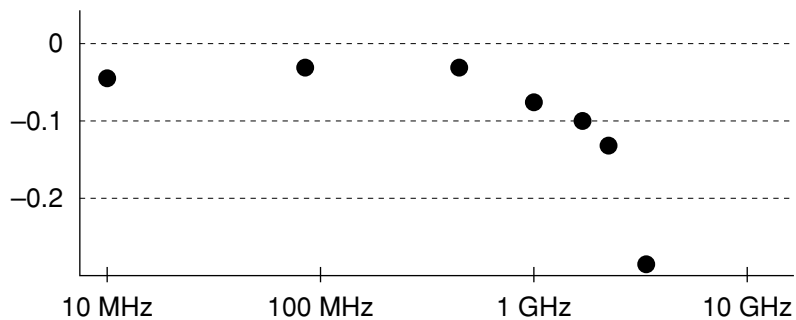
The average power is measured at line 32.

Data can be obtained as a value with dBm units or pW UNITS.



When a waveform is displayed on the screen as shown in the left diagram (TIME domain), the average power between 50 point and 450 point is measured

Before calling the subroutine, lines 12 to 18 set the center frequency, time delay, etc. to execute the sweep.



The line 18 selects the correction No. to be set.

The line 19 initializes the correction data being set currently.

The line 21 specifies the line on which data to be set is written.

The lines 25 to 31 specifies the correction data to be set together with the frequency and level data.

The lines 33 to 40 is the frequency characteristic correction data setting section.

The line 33 reads the number of data items to be set. The block from lines 34 to 40 writes the correction data in the loop of the FOR --- NEXT statement. Note that the data No. starts from 0.

When this subroutine MAKECORR executed, the set correction data is written. The frequency correction processing is validated from the subsequent sweep after setting.

Precautions on Creating the GPIB Program

Note the following points when writing remote control programs using GPIB Interface.

No.	Precaution	Description
1	Be sure to initialize each device.	There may be a number of the state in which each device is not proper to be actually used due to operation on its own panel or execution of other programs. It is necessary to using individual devices with a prescribed condition resulting from initializing them. Execute the following. [1] Initializing the interface functions (Send IFC) [2] Initializing message exchange functions of each device (DevClear) [3] Initializing the functions proper to each device (INI or *RTS)
2	Do not send any command (related to the device) other than the Receive statement immediately after sending a query.	If MLA is received when a command other than the Receive statement is sent to the controller before the response to a query is read, the output buffer is cleared, and the response message disappears. For this reason, write the Receive statement in immediate succession to a query.
3	Create a program that avoids the exception processing of the protocol.	Avoid stoppage of execution (caused by an error) by means of providing a program with exception-processing section against exceptions that can be foreseen.
4	Confirm the interface function of each device (subset).	Execution of program does not advance if necessary subset (s) has (have) not been prepared in the device. Be sure to confirm the subset (s) of each device. Also confirm that each device complies with IEEE488.2.

Initializing (GPIB)

<Example 14> Initializes the Device (Spectrum Analyzer).

```

1 '+++++
2 ' Spectrum Analyzer GPIB control sample program
3 ' <<Initialize GPIB bus & Device>>
4 '+++++
5 REM $INCLUDE: 'C:\YAT-GPIB\QBASIC\QBEDECL.BAS'
6 DECLARE SUB gpiberr (msg&)
7 '
8 SPA% = 1' Set SPA GPIB adress
9 CALL SendIFC(0)' Send GPIB bus interface clear
10 CALL DevClear(0, SPA%)' Send DeviceClear to Spectrum Analyzer
11 CALL Send(0, SPA%, "IP", NLen)' Send Initialize comand "IP"
12 END
13 '

```

Line 9: Interface-clears GPIB bus.

Line 10: Specifies Device address, and sends device-clear.

Line 11: Sends "IP" command to for initialization.

There is a '*RST' command in another GPIB command for executing initialization. The '*RST' command is used to execute initialization over a wider range. For the range of initialization level, see SECTION 5. The usage of the 'IP' command is identical to the 'INI' command.

For general usage of INI and *RST, first initialize the device functions with the IP or INI command, then use the program commands to set only the functions to be changed. This prevents the Device from being controlled while unnecessary functions are set.

Reading trace data (GPIB)

<Example 15> Performs the same operation as Example 3-1, using GPIB.

```

1 ' ++++++
2 ' Spectrum Analyzer GPIB control sample program i
3 ' <<Read out Trace data>>
4 ' ++++++
5 REM $INCLUDE: 'C : ¥AT-GPIB¥QBASIC¥QBDECL.BAS'
6 DECLARE SUB gpiberr (msg$)
7 '
8 SPA% = 1'                               Set SPA GPIB address
9 '
10 '           Initialize GPIB bus & Device
11 CALL SendIFC(0)
12 CALL DevClear(0, SPA%)
13 CALL Send(0, SPA%, "IP", NLen)
14 '
15 '
16 CALL Send(0, SPA% "CF 500MHZ", NLen)' Center frequency :500MHz
17 CALL Send(0, SPA%, "SP 10MHZ", NLen)' Span frequency :10MHz
18 CALL Send(0, SPA%, "TS", NLen)       Take a sweep
19 '
20 DIM TRACE(501)'                       Define read data area
21 CALL Send(0, SPA%, "BIN 0", NLen)'    Set read out data type to
ASCII
22 '
23 FOR I = 0 TO 500'                       Repeat trace(0) to
trace(500):501 points
24 CMD$ = "XMA?" + STR$(I) + ",1"
25 CALL Send(0, SPA%, CMD$, NLen)'       Query trace data
26 '
27 DATA$ = SPACE$(100)
28 CALL Receive(0, SPA%, DATA$, NLen)'   Read out trace data
29 '
30 TRACE(I) = VAL(DATA$)'                 Store readout data to trace
data area
31 '                                       Print out trace data
32 PRINT USING "Trace-A(###) ####.##"; I; TRACE(I)/100
33 NEXT I
34 '
35 '
36 END

```

Lines 11 to 13: Initializes GPIB bus and Device.

CALL Send() statements after line 13:

Sends Device commands. Command termination code is specified to NLEnd (line-feed code, New-Line or LF).

CALL Receive() statements at line 28:

Reads out trace data from Device.

Termination code of the read data is specified to NLEnd.

Line 30: Converts the read character-string data to numeric data, and stores it at trace-data store area.

Section 7 Tables of Device Messages

This section gives information about the device messages of the Spectrum Analyzer in the form of tables. The messages are arranged according to function, as shown below. For detailed descriptions of commands, refer to Section 8, “Detailed Descriptions of Commands.”

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How To Read the Command List

Program Messages and Query Messages

- (a) Upper case letters: Reserved word
- (b) Numerical values: Reserved word (Numerical value code)
- (c) Lower case letters in Argument

Argument	Meaning	Type	Unit/Suffix code
f	frequency	Real number with decimal point or integer	GHZ, MHZ, KHZ, HZ, GZ, MZ, KZ, None (HZ)
t	time	Real number with decimal point or integer	S, SC, MS, US, None (MS)
l	level	Real number with decimal point or integer	DB, DBM, DM, DBMV, DBUV, DBUVE, V, MV, UV, W, MW, UW, NW, None (fixed unit)
n	Non-unit integer or integer with specified unit	Decimal integer	None or specified
o	Non-unit integer	Octal integer	None
h	Non-unit integer	Hexadecimal integer	None
r	Non-unit real number or real number with specified unit	Real number	None or specified
txt	Character string	Character string enclosed within double quotation marks	None

Response Messages

- (a) Upper case letters: Reserved word
- (b) Numerical values: Reserved word (Numerical value code)
- (c) Lower case letters in Argument

Argument	Meaning	Type	Unit
f	frequency	Real number with decimal point or integer	Hz
t	time	Real number with decimal point or integer	ms
l	level	Real number with decimal point or integer	Fixed or specified
n	Non-unit integer or integer with specified unit	Decimal integer, Number of digits can be changed (valid digits output.)	None or specified
o	Non-unit integer	Octal integer	None
h	Non-unit integer	Hexadecimal integer	None
r	Non-unit real number or real number with specified unit	Real number with decimal point, Number of digits can be changed (valid digits output.)	None or specified
j	Numerical value judgment	PASS (passed) or FAIL (failed)	None
u	Unit specification	DB, DBM, DM, DBMV, DBUV, DBUVE, V, MV, UV, W, MW, UW, NW	None
txt	Character string	Character string	None

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (1 /46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Frequency/ Amplitude	<u>FREQUENCY/ AMPLITUDE</u>			
• Frequency	<u>FREQUENCY</u>			
Selects the mode fo TM r setting the frequency band.	FREQ MODE CENTER-SPAN START-STOP	FRQ△0 FRQ△2	FRQ? FRQ?	FRQ△0 FRQ△2
Sets the center frequency.	CENTER FREQ	CNF△f CF△f	CNF? CF?	CNF△f f
Steps up the center frequency.	FREQ STEP UP	FUP CF△UP	_____ _____	_____ _____
Steps down the center frequency.	FREQ STEP DOWN	FDN CF△DN	_____ _____	_____ _____
Sets the start frequency.	START FREQ	STF△f FA△f	STF? FA?	STF△f f
Sets the stop frequency.	STOP FREQ	SOF△f FB△f	SOF? FB?	SOF△f f
Sets the frequency step size.	FREQ STEP SIZE	FSS△f SS△f	FSS? SS?	FSS△f f
Sets the scroll step size.	SCROLL STEP SIZE 1 div 2 div 5 div 10 div	SSS△1 SSS△2 SSS△5 SSS△10	SSS? SSS? SSS? SSS?	SSS△1 SSS△2 SSS△5 SSS△10
Sets the maximum peak point within BG to the center frequency.	AUTO TUNE	ATUN	_____	_____
Shifts the spectrum in the left or right direction.	SCROLL LEFT RIGHT	SCR△0 SCR△LEFT SCR△1 SCR△RIGHT	_____ _____ _____ _____	_____ _____ _____ _____
Frequency offset ON and OFF in the mode	FREQUENCY OFFSET MODE OFF ON	FOFMD△0 FOFMD△OFF FOFMD△1 FOFMD△ON	FOFMD? FOFMD?	0 1
Offset frequency	OFFSET FREQUENCY	FOFFSET△f	FOFFSET?	f

Note: △ is a space.

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (2 /46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Frequency/ Amplitude	<u>FREQUENCY</u> <u>AMPLITUDE</u>			
• Span	<u>SPAN</u>			
Sets the frequency span.	FREQ SPAN	SPF△f SP△f	SPF? SP?	SPF△f f
Steps up the frequency span.	FREQ SPAN STEP UP	SPU SP△UP	_____ _____	_____ _____
Steps down the frequency span.	FREQ SPAN STEP DOWN	SPD SP△DN	_____ _____	_____ _____
Sets to full span.	FULL SPAN	FS	_____	_____
Sets to zero span.	ZERO SPAN	SPF△∅	SPF?	SPF△∅
Selection of a band (MS2683A)	BAND SELECT AUTO: 0 Hz to 7.9 GHz	BANDC△AUTO BND△∅ HNLOCK△OFF HNUNLK	BNDC? BND? HNLOCK? _____	AUTO BND△∅ OFF _____
	0: 0 Hz to 3.2 GHz	BANDC△∅ BND△1 HNLOCK△∅ HN△∅	BNDC? BND? HNLOCK? HN?	∅ BND△1 ON ∅
	1-L: 1.6 to 3.2 GHz	BANDC△1-L BND△8 HNLOCK△7 HN△7	BNDC? BND? HNLOCK? HN?	1-L BND△8 ON 7
	1-: 3.15 to 6.3 GHz	BANDC△1- BND△2 HNLOCK△1 HN△1	BNDC? BND? HNLOCK? HN?	1- BND△2 ON 1
	1+: 6.2 to 7.9 GHz	BANDC△1+ BND△3 HNLOCK△2 HN△2	BNDC? BND? HNLOCK? HN?	1+ BND△3 ON 2
Selection of a band (MS2687A)	BAND SELECT AUTO: 0 Hz to 30.0 GHz	BANDC△AUTO BND△∅ HNLOCK△OFF HNUNLK	BNDC? BND? HNLOCK? _____	AUTO BND△∅ OFF _____
	0: 0 Hz to 3.2 GHz	BANDC△∅ BND△1 HNLOCK△∅ HN△∅	BNDC? BND? HNLOCK? HN?	∅ BND△1 ON ∅

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (3 /46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Frequency/ Amplitude • Span				
	<u>FREQUENCY</u>			
	<u>AMPLITUDE</u>			
	<u>SPAN</u>			
Selection of a band (MS2687A)	1-: 3.15 to 6.3 GHz	BANDC△1- BND△2 HNLOCK△1 HN△1	BNDC? BND? HNLOCK? HN?	1- BND△2 ON 1
	1+: 6.2 to 7.9 GHz	BANDC△1+ BND△3 HNLOCK△2 HN△2	BNDC? BND? HNLOCK? HN?	1+ BND△3 ON 2
	2+: 7.8 to 15.2 GHz	BANDC△2+ BND△4 HNLOCK△3 HN△3	BNDC? BND? HNLOCK? HN?	2+ BND△4 ON 3
	3+: 15.1 to 22.5 GHz	BANDC△3+ BND△5 HNLOCK△4 HN△4	BNDC? BND? HNLOCK? HN?	3+ BND△5 ON 4
	4+: 22.4 to 30.0 GHz	BANDC△4+ BND△6 HNLOCK△5 HN△5	BNDC? BND? HNLOCK? HN?	4+ BND△6 ON 5
(MS2687A Opt22 loading)	BAND SELECT			
	AUTO: 0 Hz to 30.0 GHz	BANDC△AUTO BND△0 HNLOCK△OFF HNUNLK	BNDC? BND? HNLOCK? _____	AUTO BND△0 OFF _____
	0: 0 Hz to 3.2 GHz	BANDC△0 BND△1 HNLOCK△0 HN△0	BNDC? BND? HNLOCK? HN?	0 BND△1 ON 0
	1-: 3.15 to 5.8 GHz	BANDC△1- BND△2 HNLOCK△1 HN△1	BNDC? BND? HNLOCK? HN?	1- BND△2 ON 1
	1+(n=1): 5.7 to 7.9 GHz	BANDC△1+ BND△3 HNLOCK△2 HN△2	BNDC? BND? HNLOCK? HN?	1+ BND△3 ON 2
	1+(n=2): 7.8 to 14.05 GHz	BANDC△1++ BND△4 HNLOCK△3 HN△3	BNDC? BND? HNLOCK? HN?	1++ BND△4 ON 3

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (4 /46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Frequency/ Amplitude	<u>FREQUENCY/ AMPLITUDE</u>			
• Span	<u>SPAN</u>			
(MS2687A Opt22 loading)	2-: 14.0 to 26.5 GHz	BANDC△2 - BND△5 HNLOCK△4 HN△4	BNDC? BND? HNLOCK? HN?	2 - BND△5 ON 4
	3-: 26.4 to 30.0 GHz	BANDC△3 - BND△6 HNLOC△5 HN△5	BNDC? BND? HNLOCK? HN?	3 - BND△6 ON 5
Selection of a band (MS2687B)	BAND SELECT AUTO: 0 Hz to 30.0 GHz	BANDC△AUTO BND△∅ HNLOCK△OFF HNUNLK	BNDC? BND? HNLOCK? _____	AUTO BND△∅ OFF _____
	0: 0 Hz to 3.2 GHz	BANDC△∅ BND△1 HNLOCK△∅ HN△∅	BNDC? BND? HNLOCK? HN?	∅ BND△1 ON ∅
	1-: 3.15 to 6.3 GHz	BANDC△1 - BND△2 HNLOCK△1 HN△1	BNDC? BND? HNLOCK? HN?	1 - BND△2 ON 1
	1+: 6.2 to 7.9 GHz	BANDC△1 + BND△3 HNLOCK△2 HN△2	BNDC? BND? HNLOCK? HN?	1 + BND△3 ON 2
	2+: 7.8 to 15.3 GHz	BANDC△2 + BND△4 HNLOCK△3 HN△3	BNDC? BND? HNLOCK? HN?	2 + BND△4 ON 3
	4+: 15.2 to 30.0 GHz	BANDC△4 + BND△6 HNLOCK△5 HN△5	BNDC? BND? HNLOCK? HN?	4 + BND△6 ON 5

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (5 /46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Frequency/ Amplitude	<u>FREQUENCY/ AMPLITUDE</u>			
• Level	<u>AMPLITUDE</u>			
Sets the reference level.	REFERENCE LEVEL	RLV△1 RL△1	RLV? RL?	RLV△1 1
Steps up the reference level.	REF LEVEL STEP UP	LUP RL△UP	_____	_____
Steps down the reference level.	REF LEVEL STEP DOWN	LDN RL△DN	_____	_____
Sets the LOG scale.	LOG SCALE STEP SIZE MANUAL AUTO 1 div 2 div 5 div 10 div	LSS△1 LSSA△1 LSSA△2 LSSA△5 LSSA△10	LSS? LSSA? LSSA? LSSA? LSSA?	LSS△1 LSSA△1 LSSA△2 LSSA△5 LSSA△10
	LOG SCALE RANGE 1 dB/div 2 dB/div 5 dB/div 10 dB/div	SCL△0 LG△1DB SCL△1 LG△2DB SCL△2 LG△5DB SCL△3 LG△10DB	SCL? LG? SCL? LG? SCL? LG? SCL? LG?	SCL△0 1 SCL△1 2 SCL△2 5 SCL△3 10
	SCALE UP SCALE DOWN	LG△UP LG△DN	_____	_____
Sets the LIN scale.	SCALE LIN RANGE LIN scale switching 1%/div 2%/div 5%/div 10%/div	LN LG△0 SCL△4 SCL△5 SCL△6 SCL△7	_____	_____

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (6 /46)

Parameter		Program command	Query	Response
Outline	Control item			
<p>■ <u>Frequency/Amplitude</u></p> <p>• <u>Level</u></p> <p>Sets the display unit system.</p>	<p><u>FREQUENCY/AMPLITUDE</u></p> <p><u>AMPLITUDE</u></p> <p>DISPLAY UNIT</p> <p>dBm</p> <p>dBμV</p> <p>dBmV</p> <p>V</p> <p>dBμV(emf)</p> <p>W</p> <p>dBμV/m</p>	<p>UNT Δ 0</p> <p>AUNITS Δ DBM</p> <p>KSA</p> <p>UNT Δ 1</p> <p>AUNITS Δ DBUV</p> <p>KSC</p> <p>UNT Δ 2</p> <p>AUNITS Δ DBMV</p> <p>KSB</p> <p>UNT Δ 3</p> <p>AUNITS Δ V</p> <p>KSD</p> <p>UNT Δ 4</p> <p>AUNITS Δ DBUVE</p> <p>UNT Δ 5</p> <p>AUNITS Δ W</p> <p>UNT Δ 6</p> <p>AUNITS Δ DBUVM</p>	<p>UNT?</p> <p>AUNITS?</p> <p>_____</p> <p>UNT?</p> <p>AUNITS?</p> <p>_____</p> <p>UNT?</p> <p>AUNITS?</p> <p>_____</p> <p>UNT?</p> <p>AUNITS?</p> <p>_____</p> <p>UNT?</p> <p>AUNITS?</p> <p>_____</p> <p>UNT?</p> <p>AUNITS?</p> <p>_____</p> <p>UNT?</p> <p>AUNITS?</p> <p>_____</p> <p>UNT?</p> <p>AUNITS?</p> <p>_____</p>	<p>UNT Δ 0</p> <p>DBM</p> <p>_____</p> <p>UNT Δ 1</p> <p>DBUV</p> <p>_____</p> <p>UNT Δ 2</p> <p>DBMV</p> <p>_____</p> <p>UNT Δ 3</p> <p>V</p> <p>_____</p> <p>UNT Δ 4</p> <p>DBUVE</p> <p>_____</p> <p>UNT Δ 5</p> <p>W</p> <p>_____</p> <p>UNT Δ 6</p> <p>DBUVM</p>
<p>• <u>Display line</u></p> <p>Sets the Display line ON/OFF.</p> <p>Sets the Display line level.</p> <p>Marker level/ waveform data Absolute/relative display line</p>	<p><u>DISPLAY LINE</u></p> <p>DISPLAY LINE</p> <p>OFF</p> <p>ON</p> <p>DISPLAY LINE</p> <p>LEVEL</p> <p>ABS/REL</p> <p>ABS</p> <p>REL</p> <p>TRACE-A ABS</p> <p>REL</p> <p>TRACE-B ABS</p> <p>REL</p> <p>TRACE-TIME ABS</p> <p>REL</p> <p>TRACE-BG ABS</p> <p>REL</p>	<p>DL Δ OFF</p> <p>DL Δ ON</p> <p>DL Δ 1</p> <p>DSPLV Δ ABS</p> <p>DSPLV Δ REL</p> <p>DSPLVM Δ TRA , ABS</p> <p>DSPLVM Δ TRA , REL</p> <p>DSPLVM Δ TRB , ABS</p> <p>DSPLVM Δ TRB , REL</p> <p>DSPLVM Δ TRTIME , ABS</p> <p>DSPLVM Δ TRTIME , REL</p> <p>DSPLVM Δ TRBG , ABS</p> <p>DSPLVM Δ TRBG , REL</p>	<p>DL?</p> <p>_____</p> <p>DL?</p> <p>_____</p> <p>DSPLV?</p> <p>DSPLV?</p> <p>DSPLVM? Δ TRA</p> <p>DSPLVM? Δ TRA</p> <p>DSPLVM? Δ TRB</p> <p>DSPLVM? Δ TRB</p> <p>DSPLVM? Δ TRTIME</p> <p>DSPLVM? Δ TRTIME</p> <p>DSPLVM? Δ TRBG</p> <p>DSPLVM? Δ TRBG</p>	<p>OFF</p> <p>_____</p> <p>1</p> <p>ABS</p> <p>REL</p> <p>ABS</p> <p>REL</p> <p>ABS</p> <p>REL</p> <p>ABS</p> <p>REL</p> <p>ABS</p> <p>REL</p> <p>ABS</p> <p>REL</p>

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (7 /46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Frequency/ Amplitude	<u>FREQUENCY/ AMPLITUDE</u>			
• Reference level offset	<u>REFERENCE LEVEL OFFSET</u>			
Offset	OFFSET			
Offset value	OFF	ROFFSET Δ OFF LVO Δ 0	ROFFSET?	OFF
	ON	ROFFSET Δ ON LVO Δ 1	ROFFSET?	1
	OFFSET VALUE	ROFFSET Δ 1 LOS Δ 1	ROFFSET? LOS?	1 LOS Δ 1
• Correction factor relevant	<u>CORRECTION</u>			
Selects the type of correction factor.	CORRECTION FACTOR SELECT			
	OFF	CORR Δ OFF CORR Δ 0 CDT Δ 0	———— CORR? CDT?	———— CORR Δ 0 CDT Δ 0
	ON	CORR Δ ON CDT Δ 1	———— CDT?	———— CDT Δ 1
	CORR1	CORR Δ 1	CORR?	CORR Δ 1
	CORR2	CORR Δ 2	CORR?	CORR Δ 2
	CORR3	CORR Δ 3	CORR?	CORR Δ 3
	CORR4	CORR Δ 4	CORR?	CORR Δ 4
	CORR5	CORR Δ 5	CORR?	CORR Δ 5
Registers the correction factor.	CORRECTION FACTOR [†] ENTRY	CORD Δ n, f, l	CORD Δ n	CORD Δ f, l
Registers the correction factor name.	CORRECTION FACTOR [†] LABEL ENTRY	CORRLABEL Δ n, "text"	CORRLABEL? Δ n	"text"
Initializes the correction factor.	CORRECTION FACTOR [†] INITIALIZATION	CORC	————	————
Selects the input impedance.	INPUT IMPEDANCE			
	50 Ω	INZ Δ 50	INZ?	50
	75 Ω	INZ Δ 75	INZ?	75
75 Ω impedance transformer. (MA1621A)	IMPEDANCE TRANSFORMER			
	ON	INPTRNS Δ ON	INPTRNS?	ON
	OFF	INPTRNS Δ OFF	INPTRNS?	OFF

[†] Manual setting is unavailable because the commands are used only for GP-IB.

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (8 /46)

Parameter		Program command	Query	Response
Outline	Control item			
■ <u>Display function</u> • <u>Sample points</u> Setting Sample point	<u>DISPLAY</u> <u>SAMPLE POINTS</u> SAMPLE POINTS 501POINT 1001POINT	DPOINT△NRM DPOINT△DOUBLE	DPOINT? DPOINT?	NRM DOUBLE
• <u>Display mode</u> Selects the display format.	<u>DISPLAY FUNCTION</u> DISPLAY FORMAT TRACE-A TRACE-B TRACE-TIME TRACE-A/B (A&B) TRACE-A/B (A>B) TRACE-A/B (A<B) TRACE-A/BG (BG>A) TRACE-A/BG (BG<A) TRACE-A/TIME (TIME>A) TRACE-A/TIME (TIME<A)	DFMT△A DFMT△B DFMT△TIME DFMT△AB1 DFMT△AB2 DFMT△AB3 DFMT△ABG1 DFMT△ABG2 DFMT△ATIME1 DFMT△ATIME2	DFMT? DFMT? DFMT? DFMT? DFMT? DFMT? DFMT? DFMT? DFMT? DFMT? DFMT?	A B TIME AB1 AB2 AB3 ABG1 ABG2 ATIME1 ATIME2
• <u>Waveform writing</u> Controls writing of the waveform to trace A.	<u>WRITE SWITCH</u> TRACE-A WRITE SWITCH VEIW WRITE	AWR△∅ AWR△OFF VIEW△TRA AWR△1 AWR△ON CLRW△TRA A1	_____ AWR? _____ _____ AWR? _____ _____	_____ AWR△OFF _____ _____ AWR△ON _____ _____

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (9 /46)

Parameter		Program command	Query	Response
Outline	Control item			
<p>■ Display function</p> <p>• Waveform writing</p> <p>Controls writing of the waveform to trace B.</p> <p>Controls writing of the waveform to trace BG.</p> <p>Controls writing of the waveform to trace TIME.</p> <p>• Storage mode</p> <p>Selects the mode for processing the trace A waveform.</p>	<p><u>DISPLAY</u></p> <p><u>DISPLAY FUNCTION</u></p> <p>TRACE-B WRITE SWITCH VIEW</p> <p>WRITE</p> <p>TRACE-BG WRITE SWITCH VIEW</p> <p>WRITE</p> <p>TRACE-TIME WRITE SWITCH VIEW</p> <p>WRITE</p> <p><u>STORAGE MODE</u></p> <p>TRACE MODE (A) NORMAL MAX HOLD</p> <p>AVERAGE MIN HOLD CUMULATIVE OVER WRITE LINEAR AVERAGE</p>	<p>BWR△0 BWR△OFF VIEW△TRB BWR△1 BWR△ON CLRW△TRB B1</p> <p>BGWR△0 BGWR△OFF VIEW△TRBG BGWR△1 BGWR△ON CLRW△TRBG</p> <p>TMWR△0 TMWR△OFF VIEW△TRTIME TMWR△1 TMWR△ON CLRW△TRTIME</p> <p>AMD△0 AMD△1 MXMH△TRA A2 AMD△2 AMD△3 AMD△4 AMD△5 AMD△6</p>	<p>_____</p> <p>BWR?</p> <p>_____</p> <p>_____</p> <p>BWR?</p> <p>_____</p> <p>_____</p> <p>BGWR?</p> <p>_____</p> <p>_____</p> <p>BGWR?</p> <p>_____</p> <p>_____</p> <p>TMWR?</p> <p>_____</p> <p>_____</p> <p>TMWR?</p> <p>_____</p> <p>_____</p> <p>AMD?</p> <p>AMD?</p> <p>_____</p> <p>_____</p> <p>AMD?</p> <p>AMD?</p> <p>AMD?</p> <p>AMD?</p> <p>AMD?</p> <p>AMD?</p>	<p>_____</p> <p>BWR△OFF</p> <p>_____</p> <p>_____</p> <p>BWR△ON</p> <p>_____</p> <p>_____</p> <p>BGWR△OFF</p> <p>_____</p> <p>_____</p> <p>BGWR△ON</p> <p>_____</p> <p>_____</p> <p>TMWR△OFF</p> <p>_____</p> <p>_____</p> <p>TMWR△ON</p> <p>_____</p> <p>_____</p> <p>AMD△0 AMD△1 _____</p> <p>AMD△2 AMD△3 AMD△4 AMD△5 AMD△6</p>

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (10/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Display function	<u>DISPLAY</u>			
• Storage mode	<u>STORAGE MODE</u>			
Selects the mode for processing the trace B waveform.	TRACE MODE (B)			
	NORMAL	BMD Δ \emptyset	BMD?	BMD Δ \emptyset
	MAX HOLD	BMD Δ 1	BMD?	BMD Δ 1
		MXMH Δ TRB B2	_____	_____
	AVERAGE	BMD Δ 2	BMD?	BMD Δ 2
	MIN HOLD	BMD Δ 3	BMD?	BMD Δ 3
	CUMULATIVE	BMD Δ 4	BMD?	BMD Δ 4
Selects the mode for processing the trace TIME waveform.	TRACE MODE (TIME)			
	NORMAL	TMMD Δ \emptyset	TMMD?	TMMD Δ \emptyset
	MAX HOLD	TMMD Δ 1	TMMD?	TMMD Δ 1
	AVERAGE	TMMD Δ 2	TMMD?	TMMD Δ 2
	MIN HOLD	TMMD Δ 3	TMMD?	TMMD Δ 3
	CUMULATIVE	TMMD Δ 4	TMMD?	TMMD Δ 4
	OVER WRITE	TMMD Δ 5	TMMD?	TMMD Δ 5
LINEAR AVERAGE	TMMD Δ 6	TMMD?	TMMD Δ 6	
Average processing	AVERAGE			
	OFF	VAVG Δ \emptyset	_____	_____
		VAVG Δ OFF	_____	_____
		KSH	_____	_____
	ON	VAVG Δ 1	_____	_____
		VAVG Δ ON	_____	_____
		KSG	_____	_____
Number of trace averaged	NUMBER of TRACE AVERAGE			
	4	AVR Δ \emptyset	AVR?	AVR Δ \emptyset
	8	AVR Δ 1	AVR?	AVR Δ 1
	16	AVR Δ 2	AVR?	AVR Δ 2
	32	AVR Δ 3	AVR?	AVR Δ 3
	128	AVR Δ 4	AVR?	AVR Δ 4
	2	AVR Δ 5	AVR?	AVR Δ 5
	64	AVR Δ 6	AVR?	AVR Δ 6
	512	AVR Δ 7	AVR?	AVR Δ 7
	1024	AVR Δ 8	AVR?	AVR Δ 8
	n	VAVG Δ n	VAVG?	n
Average sweep stop mode	AVERAGE SWEEP MODE			
	CONTINUOUS	AVGPAUSE Δ OFF	AVGPAUSE?	OFF
	PAUSE	AVGPAUSE Δ ON	AVGPAUSE?	ON

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (11/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Display function • Storage mode (Cont) Hold control stop mode Selects detection mode Selects detection mode	<u>DISPLAY</u> <u>STORAGE MODE</u> HOLD SWEEP MODE CONTINUOUS PAUSE (Times specified) DETECTION MODE POS PEAK SAMPLE MEG PEAK NORMAL AVERAGE RMS TRACE-A DETECTION MODE POS PEAK SAMPLE NEG PEAK NORMAL AVERAGE RMS	HOLDPAUSE Δ \emptyset HOLDPAUSE Δ n DET Δ \emptyset DET Δ POS DET Δ 1 DET Δ SMP DET Δ 2 DET Δ NEG DET Δ 3 DET Δ NRM DET Δ 4 DET Δ AVE DET Δ 5 DET Δ RMS DETM Δ TRA, POS DETM Δ TRA, \emptyset DETM Δ TRA, SMP DETM Δ TRA, 1 DETM Δ TRA, NEG DETM Δ TRA, 2 DETM Δ TRA, NRM DETM Δ TRA, 3 DETM Δ TRA, AVE DETM Δ TRA, 4 DETM Δ TRA, RMS DETM Δ TRA, 5	HOLDPAUSE? HOLDPAUSE? _____ DET? _____ DET? _____ DET? _____ DET? _____ DET? _____ DET? _____ DET? _____ DET? _____ DETM? Δ TRA _____ DETM? Δ TRA _____ DETM? Δ TRA _____ DETM? Δ TRA _____ DETM? Δ TRA _____ DETM? Δ TRA _____ DETM? Δ TRA _____ DETM? Δ TRA _____	\emptyset n _____ POS _____ SMP _____ NEG _____ NRM _____ AVE _____ RMS _____ POS _____ SMP _____ NEG _____ NRM _____ AVE _____ RMS _____ RMS _____

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (12/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Display function • Storage mode (Cont)	<u>DISPLAY</u>			
	<u>STORAGE MODE</u>			
	TRACE-B DETECTION MODE POS PEAK	DETM△TRB, POS DETM△TRB, Ø	DETM? △TRB _____	POS _____
	SAMPLE	DETM△TRB, SMP DETM△TRB, 1	DETM? △TRB _____	SMP _____
	NEG PEAK	DETM△TRB, NEG DETM△TRB, 2	DETM? △TRB _____	NEG _____
	NORMAL	DETM△TRB, NRM DETM△TRB, 3	DETM? △TRB _____	NRM _____
	AVERAGE	DETM△TRB, AVE DETM△TRB, 4	DETM? △TRB _____	AVE _____
	RMS	DETM△TRB, RMS DETM△TRB, 5	DETM? △TRB _____	RMS _____
	TRACE-TIME DETECTION MODE POS PEAK	DETM△TRTIME, POS DETM△TRTIME, Ø	DETM? △TRTIME _____	POS _____
	SAMPLE	DETM△TRTIME, SMP DETM△TRTIME, 1	DETM? △TRTIME _____	SMP _____
	NEG PEAK	DETM△TRTIME, NEG DETM△TRTIME, 2	DETM? △TRTIME _____	NEG _____
	NORMAL	DETM△TRTIME, NRM DETM△TRTIME, 3	DETM? △TRTIME _____	NRM _____
	AVERAGE	DETM△TRTIME, AVE DETM△TRTIME, 4	DETM? △TRTIME _____	AVE _____
	RMS	DETM△TRTIME, RMS DETM△TRTIME, 5	DETM? △TRTIME _____	RMS _____

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (13/46)

Parameter		Program command	Query	Response	
Outline	Control item				
<p>■ <u>Display function</u></p> <p>• <u>Time</u></p> <p>Sets the time delay in the time axis sweep mode.</p> <p>Sets the time span in the time axis sweep mode.</p> <p>Sets the time expand mode ON/OFF.</p> <p>Sets the time expand mode ON/OFF.</p> <p>Sets the start time of the expansion.</p> <p>Sets the magnified range of time expansion.</p> <p>• <u>A/B</u></p> <p>Active marker Trace</p>	<p><u>DISPLAY</u></p>				
		<p><u>TIME</u></p>			
		<p>DELAY TIME</p>	<p>TDLYΔt DLTΔt</p>	<p>TDLY? DLT?</p>	<p>t DLTΔt</p>
		<p>TIME SPAN</p>	<p>TSPΔt</p>	<p>TSP?</p>	<p>t</p>
		<p>EXPAND ZONE OFF</p>	<p>TZONEΔ0 TZONEΔOFF TZONEΔ1 TZONEΔON</p>	<p>_____ TZONE? _____ TZONE?</p>	<p>_____ OFF _____ ON</p>
		<p>EXPAND OFF</p>	<p>TEXPANDΔ0 TEXPANDΔOFF TEXPANDΔ1 TEXPANDΔON</p>	<p>_____ TEXPAND? _____ TEXPAND?</p>	<p>_____ OFF _____ ON</p>
		<p>ZONE START</p>	<p>TZSTARTΔt TZSTARTPΔp</p>	<p>TZSTART? TZSTARTP?</p>	<p>t p</p>
		<p>ZONE SPAN</p>	<p>TZSPΔt TZSPPΔt</p>	<p>TZSP? TZSPP?</p>	<p>t p</p>
		<p>ACTIVE MARKER TRACE TRACE A TRACE B</p>	<p>MKTRACEΔTRA MKTRACEΔTRB</p>	<p>MKTRACE? MKTRACE?</p>	<p>TRA TRB</p>
	<p>■ <u>Trace move/calculation</u></p> <p>• <u>Trace move</u></p> <p>Moves trace A to B.</p>	<p><u>TRACE MOVE/CALC</u></p>			
		<p><u>TRACE MOVE</u></p>			
		<p>A \rightarrow B</p>	<p>ATB MOVΔTRA, TRB</p>	<p>_____ _____</p>	<p>_____ _____</p>

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (14/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Trace move/ calculation	<u>TRACE MOVE/CALC</u>			
• Trace move (Cont)	<u>TRACE MOVE</u>			
Moves trace B to A.	B → A	BTA MOV△TRB, TRA	_____	_____
Replaces trace A by B.	A ↔ B	AXB EX XCH△TRA, TRB XCH△TRB, TRA	_____	_____
• Trace calculation	<u>TRACE CALC</u>			
A-B → A	A-B → A OFF	AMB△∅ AMB△OFF C1	_____	_____
	ON	AMB△1 AMB△ON C2	_____	_____
Calculates A - B.	REFERENCE LINE TOP MIDDLE BOTTOM	RLN△∅ RLN△1 RLN△2	RLN? RLN? RLN?	RLN△∅ RLN△1 RLN△2
A+B → A	A+B → A	APB	_____	_____
NORMALIZE (A-B+DL → A)	NORMALIZE (A-B+DL → A) OFF	AMBPL△∅ AMBPL△OFF	_____	_____
	ON	AMBPL△1 AMBPL△ON	AMBPL? AMBPL?	OFF ON
■ Signal search	<u>SIGNAL SEARCH</u>			
Sets the maximum peak point to the center frequency.	PEAK to CF	PCF	_____	_____
Sets the maximum peak point to the REF level.	PEAK to REF	PRL	_____	_____

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (15/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Marker function	<u>MARKER</u>			
Selects the marker mode.	MARKER MODE MORMAL DELTA OFF	MKR Δ \emptyset M2 MKR Δ 1 MKD M3 MKR Δ 2 MKOFF MKOFF Δ ALL M1	MKR? _____ MKR? _____ MKR? _____	\emptyset _____ 1 _____ 2 _____ _____ _____
Specifies the zone marker center position as a point.	ZONE POSITION (point)	MKZ Δ p MKP Δ p	MKZ? MKP?	MKZ Δ p p
Specifies the zone marker center position as a frequency or time.	ZONE POSITION (freq or time) FREQ SET UP DOWN TIME SET UP DOWN	MKZF Δ f MKN Δ f MKN Δ UP MKN Δ DN MKZF Δ t MKN Δ t MKN Δ UP MKN Δ DN	MKZF? MKN? _____ _____ MKZF? MKN? _____ _____	f f _____ _____ t t _____ _____
Specifies the zone marker width as a point.	ZONE WIDTH (point)	MZW Δ p	MZW?	MZW Δ p
Specifies the zone marker width as a frequency.	ZONE WIDTH (freq)	MZWF Δ f	MZWF?	f
Specifies the zone marker width as a division.	ZONE WIDTH (div) SPOT 0.5 div 1 div 2 div 5 div 10 div	MKW Δ 1 MKW Δ \emptyset MKW Δ 5 MKW Δ 6 MKW Δ 7 MKW Δ 2	MKW? MKW? MKW? MKW? MKW? MKW?	MKW Δ 1 MKW Δ \emptyset MKW Δ 5 MKW Δ 6 MKW Δ 7 MKW Δ 2
Marker search mode	MARKER SEARCH MODE PEAK MARKER DIP MARKER	MKSRCH Δ PEAK MKSRCH Δ DIP	MKSRCH? MKSRCH?	PEAK DIP

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (16/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Marker function	<u>MARKER</u>			
• Marker function (Cont)	<u>MARKER FUNCTION</u>			
Moves the marker frequency to the center frequency.	MKR to CF	MKR Δ 3 MKCF E2	_____ _____ _____	_____ _____ _____
Sets the level at the marker point to the REF level.	MKR to REF	MKR Δ 4 MKRL E4	_____ _____ _____	_____ _____ _____
Sets the marker frequency to the CF step.	MKR to CFstep	MKR Δ 5 MKSS E3	_____ _____ _____	_____ _____ _____
Sets the delta marker frequency to the span.	Δ MKR to SPAN	MKR Δ 6 MKSP KSO	_____ _____ _____	_____ _____ _____
Sets the zone frequency to the span.	ZONE to SPAN	MKR Δ 7	_____	_____
• Multimarker	<u>MULTI MARKER</u>			
Multimarker	MULTI MARKER OFF	MKMULTI Δ 0 MKMULTI Δ OFF MLO	_____ _____ _____	_____ OFF _____
	ON	MKMULTI Δ 1 MKMULTI Δ ON	_____ _____	_____ ON _____
Multimarker mode	MULTI MARKER MODE Registers multimarkers on the peak point in descending order from the maximum level down to the tenth. Registers multimarkers on the harmonic frequency ranging from the reference multimarker frequency up to the tenth. Registers multimarkers on each the nearest 5 peak points from the current marker to the right/left sides.	MKMHI MHI MKMHRM MHM MKMPKH	_____ _____ _____ _____ _____	_____ _____ _____ _____ _____
	PEAK COUNT	_____	_____	PCOUNT? a, b
Selects the multimarker.	SELECT MULTI MARKER nth marker: Sets to OFF. Sets to ON.	MKSLCT Δ n, 0 MKSLCT Δ n, OFF MSE Δ n, 0 MKSLCT Δ n, 1 MKSLCT Δ n, ON MSE Δ n, 1	_____ _____ _____ _____ _____ _____	_____ MKSLCT? Δ n MSE? _____ MKSLCT? Δ n MSE? _____ ON MSE Δ 1

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (17/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Marker function (Cont)	<u>MARKER</u>			
• Multimarker	<u>MULTI MARKER</u>			
Selects the active marker of the multimarkers.	ACTIVE MARKER	MKACT△n MAC△n	MKACT? MAC?	n MAC△n
Specifies the frequency of the designated multimarker number.	MARKER POSITION	MKMP△n, f MPS△n, p	MKMP?△n MPS?△n	f MPS△p
Clears all registered multimarkers.	CLEAR MULTI MARKER	MKMCL MCL	_____	_____
Multimarker list	MULTI MARKER LIST OFF	MKLIST△∅ MKLIST△OFF MLI△∅	_____	_____
	ON	MKLIST△1 MKLIST△ON MLI△1	MKLIST? MLI? _____	OFF MLI△∅ _____
Multimarker list Sets the level data by distinguishing the absolute value from the relative value.	MULTI MARKER LIST LEVEL ABSOLUTE RELATIVE	MKLLVL△ABS MKLLVL△REL	MKLLVL? MKLLVL?	ABS REL
Multimarker list Sets the frequency data by distinguishing the relative value from the absolute value.	MULTI MARKER LIST FREQUENCY ABSOLUTE RELATIVE	MKLFREQ△ABS MKLFREQ△REL	MKLFREQ? MKLFREQ?	ABS REL
Reads the multimarker level.	MULTI MARKER LEVEL QUERY	_____	MKML?△n MLR?△n	l l
Reads the multimarker frequency.	MULTI MARKER FREQUENCY QUERY	_____	MFR?△n	f
Reads the multimarker all level/frequency.	MULTI MARKER ALL LEVEL/FREQ QUERY	_____	MKMFL?	f ₁ , l ₁ , f ₂ , l ₂

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (18/46)

Parameter		Program command	Query	Response
Outline	Control item			
<p>■ Marker function (Cont)</p> <p>• Peak search</p>	<p><u>MARKER</u></p> <p><u>PEAK SEARCH</u></p>			
Peak search mode	PEAK SEARCH MODE PEAK	MKS Δ \emptyset MKPK MKPK Δ HI E1	_____	_____
	NEXT PEAK	MKS Δ 1 MKPK Δ NH	_____	_____
	DIP	MKS Δ 2 MKMIN	_____	_____
	NEXT DIP	MKS Δ 1 1	_____	_____
Search resolution	SEARCH RESOLUTION	MKPX Δ 1	MKPX?	1
Search threshold value	SEARCH THRESHOLD OFF	SRCHTH Δ \emptyset SRCHTH Δ OFF	_____	_____
	ON	SRCHTH Δ 1 SRCHTH Δ ON	SRCHTH? _____	OFF _____
	ABOVE	SRCHTH Δ ABOVE	SRCHTH?	ABOVE
	BELOW	SRCHTH Δ BELOW	SRCHTH?	BELOW
• Input position	<u>INPUT POSITION</u>			
Reads the reference marker position.	REFERENCE MARKER POSITION	_____	RMK?	RMK Δ p
Reads the current marker position.	CURRENT MARKER POSITION	_____	CMK?	CMK Δ p
Reads the frequency at the marker point.	MARKER FREQ QUERY FREQ TIME	_____ _____	MKF? MKF?	f t
Reads the level at the marker point.	MARKER LEVEL	_____ _____	MKL? MKA?	1 1

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (19/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Coupled function	<u>COUPLED FUNCTION</u>			
Sets the resolution bandwidth.	RESOLUTION BANDWIDTH MANUAL AUTO	ARB Δ 0 ARB Δ 1 RB Δ AUTO CR	ARB? ARB? _____ _____	ARB Δ 0 ARB Δ 1 _____ _____
	1 Hz	RB Δ 1HZ RBW Δ 16	RB? RBW?	1 RBW Δ 16
	3 Hz	RB Δ 3HZ RBW Δ 17	RB? RBW?	3 RBW Δ 17
	10 Hz	RB Δ 10HZ RBW Δ 13	RB? RBW?	10 RBW Δ 13
	30 Hz	RB Δ 30HZ RBW Δ 0	RB? RBW?	30 RBW Δ 0
	100 Hz	RB Δ 100HZ RBW Δ 1	RB? RBW?	100 RBW Δ 1
	300 Hz	RB Δ 300HZ RBW Δ 2	RB? RBW?	300 RBW Δ 2
	1 kHz	RB Δ 1KHZ RBW Δ 3	RB? RBW?	1000 RBW Δ 3
	3 kHz	RB Δ 3KHZ RBW Δ 4	RB? RBW?	3000 RBW Δ 4
	10 kHz	RB Δ 10KHZ RBW Δ 5	RB? RBW?	10000 RBW Δ 5
	30 kHz	RB Δ 30KHZ RBW Δ 6	RB? RBW?	30000 RBW Δ 6
	100 kHz	RB Δ 100KHZ RBW Δ 7	RB? RBW?	100000 RBW Δ 7
	300 kHz	RB Δ 300KHZ RBW Δ 8	RB? RBW?	300000 RBW Δ 8
	1 MHz	RB Δ 1MHZ RBW Δ 9	RB? RBW?	1000000 RBW Δ 9
	3 MHz	RB Δ 3MHZ RBW Δ 14	RB? RBW?	3000000 RBW Δ 14
	5 MHz	RB Δ 5MHZ RBW Δ 15	RB? RBW?	5000000 RBW Δ 15
	10 MHz	RB Δ 10MHZ RBW Δ 18	RB? RBW?	10000000 RBW Δ 18
	20 MHz	RB Δ 20MHZ RBW Δ 19	RB? RBW?	20000000 RBW Δ 19
	RBW UP RBW DOWN	RB Δ UP RB Δ DN	_____ _____	_____ _____

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (20/46)

Parameter		Program command	Query	Response	
Outline	Control item				
■ Coupled function Sets the video bandwidth.	<u>COUPLED FUNCTION</u> VIDEO BANDWIDTH MANUAL AUTO	AVB Δ 0 AVB Δ 1 VB Δ AUTO CV	AVB? AVB? _____ _____	AVB Δ 0 AVB Δ 1 _____ _____	
	1 Hz	VB Δ 1HZ VBW Δ 0	VB? VBW?	1 VBW Δ 0	
	3 Hz	VB Δ 30HZ VBW Δ 8	VB? VBW?	3 VBW Δ 8	
	10 Hz	VB Δ 1HZ VBW Δ 1	VB? VBW?	10 VBW Δ 1	
	30 Hz	VB Δ 30HZ VBW Δ 9	VB? VBW?	30 VBW Δ 9	
	100 Hz	VB Δ 100HZ VBW Δ 2	VB? VBW?	100 VBW Δ 2	
	300 Hz	VB Δ 300HZ VBW Δ 10	VB? VBW?	300 VBW Δ 10	
	1 kHz	VB Δ 1KHZ VBW Δ 3	VB? VBW?	1000 VBW Δ 3	
	3 kHz	VB Δ 3KHZ VBW Δ 11	VB? VBW?	3000 VBW Δ 11	
	10 kHz	VB Δ 10KHZ VBW Δ 4	VB? VBW?	10000 VBW Δ 4	
	30 kHz	VB Δ 30KHZ VBW Δ 12	VB? VBW?	30000 VBW Δ 12	
	100 kHz	VB Δ 100KHZ VBW Δ 5	VB? VBW?	100000 VBW Δ 5	
	300 kHz	VB Δ 300KHZ VBW Δ 13	VB? VBW?	300000 VBW Δ 13	
	1 MHz	VB Δ 1MHZ VBW Δ 7	VB? VBW?	1000000 VBW Δ 7	
	3 MHz	VB Δ 3MHZ VBW Δ 14	VB? VBW?	3000000 VBW Δ 14	
	OFF	VB Δ OFF VBW Δ 6 AVB Δ 2	VB? VBW? AVB?	OFF VBW Δ 6 AVB Δ 2	
	VBW UP VBW DOWN	VB Δ UP VB Δ DN	_____ _____	_____ _____	
	Sets the VBW/RBW ratio (where VBW = AUTO).	VBW/RBW RATIO RATIO=r	VBR Δ r	VBR?	r

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (21/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Coupled function (Cont)	<u>COUPLED FUNCTION</u>			
Sets the RBW/Span ON/OFF (Where RBW=AUTO).	RBW/Span OFF ON	RBSPAN△OFF RBSPAN△0 RBSPAN△ON RBSPAN△1	RBSPAN? RBSPAN?	OFF ON
Sets the RBW/Span Ratio.	RBW/Span RATIO	RBR△r	RBR?	r
Sets the RBW mode	RBW Digital Analog FFT AUTO	RBM△DGTL RBM△NRM RBM△FFT RBM△AUTO	RBM? RBM? RBM? RBM?	DGTL NRM FFT AUTO
Sets the sweep time.	SWEEP TIME MANUAL AUTO	AST△0 AST△1 ST0 CT	AST? AST? _____ _____	AST△0 AST△1 _____ _____
	SWEEP TIME SET TIME=t UP DOWN	SWT△t ST△t ST△UP ST△DN	SWT? ST? _____ _____	SWT△t t _____ _____
Sets the RF attenuator.	RF ATTENUATOR MANUAL AUTO	AAT△0 AAT△1 AT△AUTO CA	AAT? AAT? _____ _____	AAT△0 AAT△1 _____ _____
Sets the steps of RF attenuator (MS2687A is only for 10 dB step)	RF ATTENUATOR STEPS 10 dB 2 dB 0 dB 10 dB 20 dB 30 dB 40 dB 50 dB 60 dB 70 dB	RFAT△0 RFAT△1 ATT△0 AT△0 ATT△1 AT△10 ATT△2 AT△20 ATT△3 AT△30 ATT△4 AT△40 ATT△5 AT△50 ATT△12 AT△60 ATT△13 AT△70	RFAT? RFAT? ATT? AT? ATT? AT? ATT? AT? ATT? AT? ATT? AT? ATT? AT? ATT? AT? ATT? AT?	0 1 ATT0 0 ATT△1 10 ATT△2 20 ATT△3 30 ATT△4 40 ATT△5 50 ATT△12 60 ATT△13 70

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (22/46)

Parameter		Program command	Query	Response
Outline	Control item			
	2 dB	ATT△15 AT△2	ATT? AT?	ATT△15 2
	4 dB	ATT△16 AT△4	ATT? AT?	ATT△16 4
	6 dB	ATT△17 AT△6	ATT? AT?	ATT△17 6
	8 dB	ATT△18 AT△8	ATT? AT?	ATT△18 8
	12 dB	ATT△19 AT△12	ATT? AT?	ATT△19 12
	14 dB	ATT△20 AT△14	ATT? AT?	ATT△20 14
	16 dB	ATT△21 AT△16	ATT? AT?	ATT△21 16
	18 dB	ATT△22 AT△18	ATT? AT?	ATT△22 18
	22 dB	ATT△23 AT△22	ATT? AT?	ATT△23 22
	24 dB	ATT△24 AT△24	ATT? AT?	ATT△24 24
	26 dB	ATT△25 AT△26	ATT? AT?	ATT△25 26
	28 dB	ATT△26 AT△28	ATT? AT?	ATT△26 28
	32 dB	ATT△27 AT△32	ATT? AT?	ATT△27 32
	34 dB	ATT△28 AT△34	ATT? AT?	ATT△28 34
	36 dB	ATT△29 AT△36	ATT? AT?	ATT△29 36
	38 dB	ATT△30 AT△38	ATT? AT?	ATT△30 38
	42 dB	ATT△31 AT△42	ATT? AT?	ATT△31 42
	44 dB	ATT△32 AT△44	ATT? AT?	ATT△32 44
	46 dB	ATT△33 AT△46	ATT? AT?	ATT△33 46
	48 dB	ATT△34 AT△48	ATT? AT?	ATT△34 48
	52 dB	ATT△35 AT△52	ATT? AT?	ATT△35 52
	54 dB	ATT△36 AT△54	ATT? AT?	ATT△36 54
	56 dB	ATT△37 AT△56	ATT? AT?	ATT△37 56
	58 dB	ATT△38 AT△58	ATT? AT?	ATT△38 58
	62 dB	ATT△39 AT△62	ATT? AT?	ATT△39 62
	UP	AT△UP	_____	_____
	DOWN	AT△DN	_____	_____

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (23/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Coupled function (Cont)	<u>COUPLED FUNCTION</u>			
Sets the bandwidth/ sweep time to AUTO mode.	RBW,VBW/SWEEP TIME AUTO	BSAUTO	_____	_____
Sets the coupled function to AUTO mode.	COUPLED FUNCTION AUTO	AUTO	_____	_____
Sets the coupled function at the frequency domain/ time domain.	COUPLE MODE COMMON INDEPENDENCE	VBCOUPLE△COM VBCOUPLE△IND	VBCOUPLE? VBCOUPLE?	COM IND
■ Sweep function	<u>SWEEP CONTROL</u>			
Sets the zone sweep ON/OFF.	ZONE SWEEP OFF ON	PSW△0 PSW△OFF PSW△1 PSW△ON	_____ PSW? _____ PSW?	_____ PSW△OFF _____ PSW△ON
Sets the tracking function.	TRACKING OFF ON	MKTRACK△0 MKTRACK△OFF MT0 MKTRACK△1 MKTRACK△ON MT1	_____ MKTRACK? _____ _____ MKTRACK? _____	_____ OFF _____ ON _____
Sets the sweep mode to single.	SINGLE SWEEP MODE	SNGLS S2	_____	_____
Executes/checks single sweep.	SINGLE SWEEP/ SWEEP STATUS Executing single sweep Checking the sweep status Sweep completed Sweep in progress	SWP TS _____ _____	_____	_____
Executes average sweep.	TAKE AVERAGE SWEEP	TSAVG	_____	_____
Executes hold sweep.	TAKE HOLD SWEEP	TSHOLD	_____	_____

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (24/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Sweep function	<u>SWEEP CONTROL</u>			
Continuous sweep mode.	COTINUOUS SWEEP MODE	CONTS S1	_____ _____	_____ _____
Stops the sweep.	SWEEP STOP	SWSTOP	_____	_____
Restarts the sweep.	SWEEP RESTART	SWSTART	_____	_____
■ Save/Recall	<u>SAVE/RECALL</u>			
Recalls data from the internal memory.	RECALL DATA FROM INTERNAL MEMORY	RGRC△r RC△r	_____ _____	_____ _____
Recalls data from the memory card.	RECALL DATA FROM MEMORY CARD	RCM△r	_____	_____
Recalls data from the memory card. Changes the storage mode to View.	WRITE OFF RECALL DATA	RCS△r	_____	_____
Saves data in the internal memory.	SAVE DATA INTO INTERNAL MEMORY	RGSV△s SV△s	_____ _____	_____ _____
Saves data on the memory card.	SAVE DATA INTO MEMORY CARD	SVM△s	_____	_____
Sets the recall data	RECALLED DATA TRACE&PARAM PARAM ONLY TRACE&PARAM(VIEW) PARAM(EXCEPT REF LEVEL)	RDATA△TP RDATA△P RDATA△TPV RDATA△PER	RDATA? RDATA? RDATA? RDATA?	TP P TPV PER
■ Hard copy	<u>HARD COPY</u>			
Direct plot	DIRECT PLOT START	PLS△∅ PRINT	_____ _____	_____ _____

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (25/46)

Parameter		Program command	Query	Response
Outline	Control item			
<p>■ <u>Hard copy</u> (cont)</p> <p>• <u>Controls hard copy.</u></p> <p>Selects the printer.</p>	<p><u>HARD COPY</u></p> <p><u>COPY CONTROL</u></p> <p>PRINTER</p> <p>BJ-M70(ESC/P)</p> <p>HP-815C</p> <p>BMP FORMAT (Monochrome)</p> <p>BMP FORMAT (Color)</p>	<p>PMOD△ 6</p> <p>PMOD△ 3</p> <p>PMOD△ 13</p> <p>PMOD△ 14</p>	<p>PMOD?</p> <p>PMOD?</p> <p>PMOD?</p> <p>PMOD?</p>	<p>6</p> <p>3</p> <p>13</p> <p>14</p>

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (26/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Measure function				
	<u>MEASURE</u>			
Sets the measure function to OFF.	MEASURE FUNCTION ALL OFF	MEAS△OFF	MEAS?	OFF
Display position of measured results	MEASURE WINDOW POSITION UP LEFT UP RIGHT LOW LEFT LOW RIGHT	WINDPOS△UPLEFT WINDPOS△UPRIGHT WINDPOS△LOWLEFT WINDPOS△LOWRIGHT	WINDPOS? WINDPOS? WINDPOS? WINDPOS?	UPLEFT UPRIGHT LOWLEFT LOWRIGHT
• Noise measurement				
	<u>NOISE MEASURE</u>			
Measures the noise.	NOISE MEASURE OFF ON	MEAS△NOISE, OFF NLV△0 MEAS△NOISE, ON NLV△1	_____ NLV? MEAS? NLV?	_____ 0 NOISE 1
Calculation method	ABSOLUTE executed C/N RATIO executed Transferring measured results (dBm/ch or dBm/Hz)	MEAS△NOISE, ABS MEAS△NOISE, CN _____	MEAS? MEAS? RES?	NOISE CN 1
	ABSOLUTE C/N RATIO	MNOISE△ABS MNOISE△CN	MNOISE? MNOISE?	ABS CN
• Occupied frequency bandwidth measurement				
	<u>OBW MEASURE</u>			
Measures the occupied frequency bandwidth.	OBW MEASURE Executes calculation. Executes (X dB DOWN). Executes (N%). Transferring measured results (f1: Occupied bandwidth f2: Center frequency)	MEAS△OBW, EXE MEAS△OBW, XDB MEAS△OBW, N _____	MEAS? MEAS? MEAS? RES?	OBW OBW OBW f1, f2
Calculation method	X dB DOWN method N% method	MOBW△XDB MOBW△N	MOBW? MOBW?	XDB N
Sets the conditions of occupied frequency bandwidth.	OBW VALUE x dB n%	OBWXDB△XDB OBWN△n	OBWXDB? OBWN?	x n

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (27/46)

Parameter		Program command	Query	Response
Outline	Control item			
<p>■ <u>Measure function</u> (Cont)</p> <p>• <u>Adjacent channel measurement</u></p> <p>Measures the adjacent channel.</p> <p>Selects the adjacent channel.</p> <p>Sets the adjacent channel bandwidth.</p> <p>Sets adjacent channel 1 separation.</p> <p>Sets adjacent channel 2 separation.</p> <p>Sets adjacent channel 3 separation.</p> <p>Selects the calculation method.</p> <p>Sets the graph display ON/OFF.</p> <p>Inband ch Bandwidth Setting</p>	<p><u>MEASURE</u></p> <p><u>ADJACENT CH MEASURE</u></p> <p>ADJACENT CH MEASURE Executes calculation. Executes (UNMODULATED CARRIER). Executes (MODULATED CARRIER). Executes (INBAND) Transferring measured results (lL1: CH1 lower sideband lU1: CH1 upper sideband lL2: CH2 lower sideband lU2: CH2 upper sideband lL3: CH3 lower sideband lU3: CH3 upper sideband)</p> <p>ADJACENT CH SELECT BOTH SIDES UPPER SIDE LOWER SIDE OFF</p> <p>ADJACENT CH BANDWIDTH</p> <p>ADJACENT CH1 SEPARATION</p> <p>ADJACENT CH2 SEPARATION</p> <p>ADJACENT CH3 SEPARATION</p> <p>R:TOTAL POWER(MOD) R:REF LEVEL (UNMOD) R:INBAND</p> <p>GRAPH OFF ON</p> <p>INBAND:CH BANDWIDTH</p>	<p>MEAS Δ ADJ , EXE MEAS Δ ADJ , UNMD</p> <p>MEAS Δ ADJ , MOD</p> <p>MEAS Δ ADJ , INABAND</p> <p>ADJCH Δ BOTH ADJCH Δ UP ADJCH Δ LOW ADJCH Δ OFF</p> <p>ADJCHBW Δ f</p> <p>ADJCHSP Δ f</p> <p>ADJCHSPF Δ f</p> <p>ADJCHSPFF Δ f</p> <p>MADJMOD Δ MOD MADJMOD Δ UNMD MADJMOD Δ INABAND</p> <p>MADJGRAPH Δ OFF MADJGRAPH Δ ON</p> <p>ADJINBW Δ f</p>	<p>MEAS? MEAS?</p> <p>MEAS?</p> <p>MEAS? RES?</p> <p>ADJCH? ADJCH? ADJCH? ADJCH?</p> <p>ADJCHBW?</p> <p>ADJCHSP?</p> <p>ADJCHSPF?</p> <p>ADJCHSPFF?</p> <p>MADJMOD? MADJMOD? MADJMOD?</p> <p>MADJGRAPH? MADJGRAPH?</p> <p>ADJINBW?</p>	<p>ADJ ADJ</p> <p>ADJ</p> <p>ADJ lL1, lU1 lL2, lU2 lL3, lU3</p> <p>BOTH UP LOW OFF</p> <p>f</p> <p>f</p> <p>f</p> <p>f</p> <p>MOD UNMD INBAND</p> <p>OFF ON</p> <p>f</p>

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (28/46)

Parameter		Program command	Query	Response
Outline	Control item			
<p>■ <u>Measure function</u></p> <p>• <u>Adjacent channel measurement</u> (Cont)</p> <p>Sets the channel center line display ON/OFF.</p> <p>Sets the channel range line display ON/OFF.</p> <p>Sets the Inband ch range line display ON/OFF.</p> <p>• <u>Template measurement</u></p> <p>Measures the template.</p> <p>Moves the template.</p> <p>Selects the template.</p>	<p><u>MEASURE</u></p> <p><u>ADJACENT CH MEASURE</u></p> <p>CHANNEL CENTER LINE OFF ON</p> <p>CHANNEL BAND LINE OFF ON</p> <p>INBAND CHANNEL BAND LINE OFF ON</p> <p><u>TEMPLATE</u></p> <p>TEMPLATE MEASURE OFF ON CHECK TEMP Transferring measured results (c1:LIMIT1 check result (c2:LIMIT2 check result)</p> <p>TEMPLATE MOVE MOVE X MOVE Y SAVE CANCEL</p> <p>SELECT TEMPLATE No. 1 2 3 4 5</p>	<p>MADJCTRLN△OFF MADJCTRLN△ON</p> <p>MADJBWLN△OFF MADJBWLN△ON</p> <p>MADJINBWLN△OFF MADJINBWLN△ON</p> <p>MEAS△TEMP, OFF MEAS△TEMP, ON MEAS△TEMP, CHECK _____</p> <p>TEMPMVX△t TEMPMVY△l TEMPMSV TEMPMCL</p> <p>TEMP△1 TEMP△2 TEMP△3 TEMP△4 TEMP△5</p>	<p>MADJCTRLN? MADJCTRLN?</p> <p>MADJBWLN? MADJBWLN?</p> <p>MADJINBWLN? MADJINBWLN?</p> <p>_____</p> <p>MEAS? RES?</p> <p>_____</p> <p>TEMPMVX? TEMPMVY?</p> <p>_____</p> <p>TEMP? TEMP? TEMP? TEMP? TEMP?</p>	<p>OFF ON</p> <p>OFF ON</p> <p>OFF ON</p> <p>TEMP c1, c2 (PASS=0, FAIL=1)</p> <p>t l _____ _____</p> <p>1 2 3 4 5</p>

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (29/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Measure function	<u>MEASURE</u>			
• <u>Template measurement</u> (Cont)	<u>TEMPLATE</u>			
Selects the LIMIT line.	SELECT LIMIT LINE LIMIT1 UPPER OFF ON LIMIT2 UPPER OFF ON LIMIT1 LOWER OFF ON LIMIT2 LOWER OFF ON	TEMPSLCT△UP1,∅ TEMPSLCT△UP1,OFF TEMPSLCT△UP1,1 TEMPSLCT△UP1,ON TEMPSLCT△UP2,∅ TEMPSLCT△UP2,OFF TEMPSLCT△UP2,1 TEMPSLCT△UP2,ON TEMPSLCT△LW1,∅ TEMPSLCT△LW1,OFF TEMPSLCT△LW1,1 TEMPSLCT△LW1,ON TMPSLCT△LW2,∅ TMPSLCT△LW2,OFF TMPSLCT△LW2,1 TMPSLCT△LW2,ON	_____ TEMPSLCT?UP1 _____ TEMPSLCT?UP1 _____ TEMPSLCT?UP2 _____ TEMPSLCT?UP2 _____ TEMPSLCT?LW1 _____ TEMPSLCT?LW1 _____ TEMPSLCT?LW2 _____ TEMPSLCT?LW2	_____ OFF _____ ON _____ OFF _____ ON _____ OFF _____ ON _____ OFF _____ ON
• <u>Power measurement</u>	<u>POWER MEASURE</u>			
Measures the power.	POWER MEASURE MEASURE Transferring measured results (!dBm value w: pW value) (Valid only for Trace-Time)	MEAS△POWER, EXE _____	MEAS? RES?	POWER l, w
Sets the Correction Factor.	Correction Factor	PWRFACT△l	PWRFACT?	l
Sets the point where power measurement starts.	POWER MEASURE START	PWRSTART△p	PWRSTART?	p
Sets the point where power measurement ends.	POWER MEASURE STOP	PWRSTOP△p	PWRSTOP?	p

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (30/46)

Parameter		Program command	Query	Response
Outline	Control item			
<p>■ <u>Measure function</u> (Cont)</p> <p>• <u>Mask measurement</u></p>	<p><u>MEASURE</u></p> <p><u>MASK</u></p>			
Measures the mask.	<p>MASK MEASURE OFF ON CHECK TEMP Result input c₁:LIMIT1 Check result c₂:LIMIT2 Check result</p>	<p>MEAS Δ MASK, OFF MEAS Δ MASK, ON MEAS Δ MASK, CHECK _____</p>	<p>_____ _____ MEAS? RES?</p>	<p>_____ _____ MASK C1, C2 (PASS=0 FAIL=1)</p>
Moves the mask.	<p>MASK MOVE MOVE X MOVE Y SAVE CANCEL</p>	<p>MASKMVX Δ f MASKMVY Δ l MASKMSV MASKMCL</p>	<p>MASKMVX? MASKMVY? _____ _____</p>	<p>f l _____ _____</p>
Selects the mask.	<p>SELECT MASK No. 1 2 3 4 5</p>	<p>MASK Δ 1 MASK Δ 2 MASK Δ 3 MASK Δ 4 MASK Δ 5</p>	<p>MASK? MASK? MASK? MASK? MASK?</p>	<p>1 2 3 4 5</p>

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (31/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Measure function	<u>MEASURE</u>			
• Mask measurement (Cont) Selects the LIMIT line.	<u>MASK</u> SELECT LIMIT LINE LIMIT1 UPPER OFF ON LIMIT2 UPPER OFF ON LIMIT1 LOWER OFF ON LIMIT2 LOWER OFF ON	 MASKSLCT△UP1,∅ MASKSLCT△UP1,OFF MASKSLCT△UP1,1 MASKSLCT△UP1,ON MASKSLCT△UP2,∅ MASKSLCT△UP2,OFF MASKSLCT△UP2,1 MASKSLCT△UP2,ON MASKSLCT△LW1,∅ MASKSLCT△LW1,OFF MASKSLCT△LW1,1 MASKSLCT△LW1,ON MASKSLCT△LW2,∅ MASKSLCT△LW2,OFF MASKSLCT△LW2,1 MASKSLCT△LW2,ON	 _____ MASKSLCT?UP1 _____ MASKSLCT?UP1 _____ MASKSLCT?UP2 _____ MASKSLCT?UP2 _____ MASKSLCT?LW1 _____ MASKSLCT?LW1 _____ MASKSLCT?LW2 _____ MASKSLCT?LW2	 _____ OFF _____ ON _____ OFF _____ ON _____ OFF _____ ON _____ OFF _____ ON
• Template management function Selects the template number.	<u>MANAGE</u> <u>TEMPLATE</u> SELECT TEMPLATE No. 1 2 3 4 5	 MTEMP△1 MTEMP△2 MTEMP△3 MTEMP△4 MTEMP△5	 MTEMP? MTEMP? MTEMP? MTEMP? MTEMP?	 1 2 3 4 5
Selects the LIMIT line.	SELECT LIMIT LINE LIMIT1 UPPER LIMIT2 UPPER LIMIT1 LOWER LIMIT2 LOWER	MTEMPL△UP1 MTEMPL△UP2 MTEMPL△LW1 MTEMPL△LW2	MTEMPL? MTEMPL? MTEMPL? MTEMPL?	UP1 UP2 LW1 LW2

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (32/46)

Parameter		Program command	Query	Response
Outline	Control item			
<p>■ <u>Measure function</u></p> <p>• <u>Template management function</u> (Cont)</p> <p>Sets the level data by distinguishing the relative value from the absolute value.</p> <p>Adds 1 point to template data.</p> <p>Changes 1 point of template data.</p> <p>Reads 1 point of template data.</p> <p>Deletes 1 point of template data.</p> <p>Initializes the template data.</p>	<p><u>MEASURE</u></p> <p><u>MANAGE TEMPLATE</u></p> <p>TEMPLATE LEVEL MODE</p> <p>ABSOLUTE RELATIVE</p> <p>INSERT TEMPLATE POINT DATA</p> <p>REPLACE TEMPLATE POINT DATA</p> <p>READ TEMPLATE POINT DATA</p> <p>TEMPLATE POINT DATA DELETE</p> <p>INITIATE LINE/TEMPLATE</p> <p>LIMIT1 UPPER LIMIT2 UPPER LIMIT1 LOWER LIMIT2 LOWER</p>	<p>MTEMPREL△OFF MTEMPREL△ON</p> <p>MTEMPIN△p,t,l</p> <p>MTEMPRP△p,t,l</p> <p>————</p> <p>MTEMPDEL△p</p> <p>MTEMPINI△UP1 MTEMPINI△UP2 MTEMPINI△LW1 MTEMPINI△LW2</p>	<p>MTEMPREL? MTEMPREL?</p> <p>————</p> <p>————</p> <p>MTEMPPD?△p</p> <p>————</p> <p>————</p> <p>————</p> <p>————</p>	<p>OFF ON</p> <p>————</p> <p>————</p> <p>t,l</p> <p>————</p> <p>————</p> <p>————</p> <p>————</p>

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (33/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ <u>Measure function</u>	<u>MEASURE</u>			
• <u>Template management function (Cont)</u> Specifies how the template data is displayed.	<u>MANAGE</u> <u>TEMPLATE</u> DISPLAY TEMPLATE MODE GRAPH LIST	MTEMPDSP△GRAPH MTEMPDSP△LIST	MTEMPDSP? MTEMPDSP?	GRAPH LIST
Sets the template label.	TEMP LABEL	MTEMPLABEL△n, 'text'	MTEMPLABEL?n	text
• <u>Mask management function</u> Selects the mask number.	<u>MANAGE</u> <u>MASK</u> SELECT MASK No. 1 2 3 4 5	MMASK△1 MMASK△2 MMASK△3 MMASK△4 MMASK△5	MMASK? MMASK? MMASK? MMASK? MMASK?	1 2 3 4 5
Selects the LIMIT line.	SELECT LIMIT LINE LIMIT1 UPPER LIMIT2 UPPER LIMIT1 LOWER LIMIT2 LOWER	MMASKL△UP1 MMASKL△UP2 MMASKL△LW1 MMASKL△LW2	MMASKL? MMASKL? MMASKL? MMASKL?	UP1 UP2 LW1 LW2
Sets the level data by distinguishing the relative value from the absolute value.	MASK LEVEL MODE ABSOLUTE RELATIVE	MMASKREL△OFF MMASKREL△ON	MMASKREL? MMASKREL?	OFF ON
Adds 1 point to mask data.	INSERT MASK POINT DATA	MMASKIN△p, t, l	_____	_____
Changes 1 point of mask data.	REPLACE MASK POINT DATA	MMASKRP△p, t, l	_____	_____

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (34/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Measure function	<u>MEASURE</u>			
• Mask management function (Cont)	<u>MANAGE MASK</u>			
Reads 1 point of mask data.	READ MASK POINT DATA	———	MMASKPD? Δp	t, l
Deletes 1 point of mask data.	DELETE MASK POINT DATA	MMASKDEL Δp	———	———
Initializes the mask data.	INITIATE LINE/MASK LIMIT1 UPPER LIMIT2 UPPER LIMIT1 LOWER LIMIT2 LOWER	MMASKINI ΔUP1 MMASKINI ΔUP2 MMASKINI ΔLW1 MMASKINI ΔLW2	——— ——— ——— ———	——— ——— ——— ———
Specifies how the mask data is displayed.	DISPLAY MASK MODE GRAPH LIST	MMASKDSP ΔGRAPH MMASKDSP ΔLIST	MMASKDSP? MMASKDSP?	GRAPH LIST
Sets the mask label.	MASK LABEL	MMASKLABEL Δn, 'text'	MMASKLABEL?n	text
• Channel Power Measure	Channel Power Measure			
Measuring Channel Power	ON OFF	MEAS ΔCHPWR, ON MEAS ΔCHPWR, OFF	MEAS? ———	CHPWR ———
Sets the Channel Power Average	Channel Power Average OFF ON	CHAVG Δ∅ CHAVG ΔOFF CHAVG Δ1 CHAVG ΔON	——— ——— ——— ———	——— ——— ——— ———
Average processes	n	CHAVG Δn	CHAVG?	n
Sets the graph display ON/OFF.	GRAPH OFF ON	CHPWRGRAPH ΔOFF CHPWRGRAPH ΔON	CHPWRGRAPH? CHPWRGRAPH?	OFF ON
Correction Factor	Correction Factor	CHPWRFACT Δ1	CHPWRFACT?	1

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (35/46)

Parameter		Program command	Query	Response	
Outline	Control item				
■ Calibration					
Executes calibration with the internal CAL signal. Sets the frequency calibration function ON/OFF.	<u>CALIBRATION</u>				
	CALIBRATION				
	ALL	CAL Δ 0	_____	_____	
	FREQ	CAL Δ 1	_____	_____	
	LEVEL	CAL Δ 2	_____	_____	
	FM	CAL Δ 3	_____	_____	
	QP/EMC	CAL Δ 4	_____	_____	
	FREQ CAL				
	OFF	FCAL10 Δ 0	FCAL10?	0	
	ON	FCAL10 Δ 1	FCAL10?	1	
	PRESELECTOR TUNE				
	MANUAL	PRESEL Δ a	PRESEL?	a	
	AUTO	PRESEL Δ AUTO	_____	_____	
	PP	PP	_____	_____	
PRESET	PRESEL Δ PRESET	_____	_____		
■ RS-232C					
Sets the baud rate.	<u>RS-232C</u>				
	BAUD RATE				
	1200	BAUD Δ 1200	BAUD?	1200	
	2400	BAUD Δ 2400	BAUD?	2400	
	4800	BAUD Δ 4800	BAUD?	4800	
	9600	BAUD Δ 9600	BAUD?	9600	
	19200	BAUD Δ 19200	BAUD?	19200	
	38400	BAUD Δ 38400	BAUD?	38400	
	57600	BAUD Δ 57600	BAUD?	57600	
	115200	BAUD Δ 115200	BAUD?	115200	
	Sets the parity.	PARITY			
		EVEN	PRTY Δ EVEN	PRTY?	EVEN
		ODD	PRTY Δ ODD	PRTY?	ODD
		OFF	PRTY Δ OFF	PRTY?	OFF
Sets the data bit.	DATA BIT				
	7bit	DATB Δ 7	DATB?	7	
	8bit	DATB Δ 8	DATB?	8	
Sets the stop bit.	STOP BIT				
	1bit	STPB Δ 1	STPB?	1	
	2bit	STPB Δ 2	STPB?	2	
Sets the period of reception time-out.	TIME OUT	TOUT Δ t	TOUT?	t	

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (36/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Ethernet		<u>ETHERNET</u>		
My IP address	IP ADDRESS	IPADRS△n1, n2, n3, n4	IPADRS?	n1, n2, n3, n4
Net Mask address	NET MASK ADDRESS	NETMASK△n1, n2, n3, n4	NETMASK?	n1, n2, n3, n4
Gateway address	GATEWAY ADDRESS	GATEWAY△n1, n2, n3, n4	GATEWAY?	n1, n2, n3, n4
Host address	HOST ADDRESS	HOSTADRS△n1, n2, n3, n4	HOSTADRS?	n1, n2, n3, n4
Port address	PORT ADDRESS	PORTADRS△n	PORTADRS?	n
■ Title		<u>TITLE</u>		
Title entry	TITLE ENTRY	TITLE△'text' KSE△'text' TEN△x, y, 'text'	TITLE? _____ _____	text _____ _____
Title display	TITLE DISPLAY OFF	TTL△0 TTL△OFF	_____ TTL?	_____ OFF
	ON	TTL△1 TTL△ON	_____ TTL?	_____ ON
■ CAL/UNCAL		<u>CAL/UNCAL</u>		
Couple failure	UNCAL UNCAL DISPLAY OFF	UNC△0 UNC△OFF	_____ UNC?	_____ UNC△OFF
	ON	UNC△1 UNC△ON	_____ UNC?	_____ UNC△ON
	UNCAL STATUS NORMAL	_____ _____	UCL? UCL?	UCL△0 UCL△1
	UNCAL	_____		
■ Spectrum data		<u>SPECTRUM DATA</u>		
Trace A memory	TRACE-A MEMORY	XMA△p, b	XMA?△p, b	b
Trace B memory	TRACE-B MEMORY	XMB△p, b	XMB?△p, b	b
Trace BG memory	TRACE-BG MEMORY	XMG△p, b	XMG?△p, b	b
Trace TIME memory	TRACE-TIME MEMORY	XMT△p, b	XMT?△p, b	b
Selects ASCII/ Binary.	ASCII DATA	BIN△0 _____ _____	_____ _____ _____	_____ _____ _____
	BINARY DATA	BIN△1 _____ _____	_____ _____ _____	_____ _____ _____

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (37/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Others	<u>ETC.</u>			
Terminator	TERMINATOR LF CR/LF	TRM Δ 0 TRM Δ 1	_____ _____	_____ _____
Performs level-3 initialization of measurement control parameters.	INITIALIZE	INI IP PRE	_____ _____ _____	_____ _____ _____
Partial initialization	PARTIAL PRESET PRESET ALL	PINI Δ 0	_____	_____
	PRESET SWEEP CONTROL	PINI Δ 1	_____	_____
	PRESET TRACE PARAMETER	PINI Δ 2	_____	_____
	PRESET LEVEL PARAMETER	PINI Δ 3	_____	_____
	PRESET FREQ/TIME PARAMETER	PINI Δ 4	_____	_____
Buzzer switch Sets the built-in clock.	TIMER SET DATE TIME	DATE Δ yyyy, mm, dd TIME Δ hh, mm, ss	DATE? TIME?	yyyy, mm, dd hh, mm, ss
Calculates how long the device has been powered on.	TIME COUNT READ	_____	TMCNT?	t (hr)
LCD display	LCD DISPLAY OFF ON	DISPLAY Δ OFF DISPLAY Δ ON	DISPLAY? DISPLAY?	OFF ON
Power-on state	POWER ON STATE FIXED STATE (PRESET) BEFORE POWER OFF RECALL MEMORY	POWERON Δ IP POWERON Δ LAST POWERON Δ n	POWERON? POWERON? POWERON?	IP LAST n
Sets the NLP-1200	NLP-1200 CORRECTION	EXTLPF Δ OFF EXTLPF Δ ON	EXTLPF? EXTLPF?	OFF ON
Erase error message	ERASE ERROR MESSAGE	HOLD	_____	_____

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (38/46)

Parameter		Program command	Query	Response
Outline	Control item			
Others (Cont)	ETC.			
Time display	TIME DISPLAY OFF ON	TIMEDSP△OFF TIMEDSP△ON	TIMEDSP? TIMEDSP?	OFF ON
Selects the date display mode.	DATE DISPLAY MODE YY/MM/DD DD-MM-YY MMM-DD-YY	DATEMODE△YMD DATEMODE△DMY DATEMODE△MDY	DATEMODE? DATEMODE? DATEMODE?	YMD DMY MDY
Selects the comment column display type.	COMMENT DISPLAY FULL TITLE TIME OFF	COMMENT△FULL COMMENT△TITLE COMMENT△TIME COMMENT△OFF	COMMENT? COMMENT? COMMENT? COMMENT?	FULL TITLE TIME OFF
Selects the display color pattern.	COLOR PATTERN PATTERN-1 PATTERN-2 PATTERN-3 PATTERN-4 USER PATTERN	COLORPTN△COLOR1 COLORPTN△COLOR2 COLORPTN△COLOR3 COLORPTN△COLOR4 COLORPTN△USERCOLOR	COLORPTN? COLORPTN? COLORPTN? COLORPTN? COLORPTN?	COLOR1 COLOR2 COLOR3 COLOR4 USERCOLOR
Copies the display color pattern to the user pattern.	COPY COLOR PATTERN PATTERN-1 PATTERN-2 PATTERN-3 PATTERN-4	COPYCOLOR△COLOR1 COPYCOLOR△COLOR2 COPYCOLOR△COLOR3 COPYCOLOR△COLOR4	_____ _____ _____ _____	_____ _____ _____ _____
Adjusts brightness.	BRIGHTNESS ADJUST SETTING OFF	BRIGHT△n BRIGHT△OFF	BRIGHT? BRIGHT?	n OFF
Defines the user color pattern.	DEFINE USER COLOR	COLORDEF△ n, r, g, b	COLORDEF?△	n, r, g, b
Reads the error code.	READ OUT ERROR CODE	_____	ERROR?	e1, e2
Erase Warm up message	ERASE WARM UP MESSAGE	ERASEWUP	_____ POWERON?	_____ IP
Sets sweep time, automatically.	AUTO SWEEP TIME FAST NORMAL (HI-LEVEL AC CURACY)	ASWT△FAST ASWT△SLOW	ASWT? ASWT?	FAST SLOW
RGB output on rear panel	RGB OUTPUT OFF ON	RGB△OFF RGB△ON	RGB? RGB?	OFF ON
Buzzer	BUZZER OFF ON	ALARM△OFF ALARM△ON	ALARM? ALARM?	OFF ON

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (39/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Common <u>command and event status</u>	<u>GPIB COMMON</u> <u>COMMAND:EVENT</u> <u>STATUS</u>			
Clears the Status Byte Register.	CLEAR STATUS COMMAND	*CLS	_____	_____
Sets the bit in the Service Request Enable Register.	SERVICE REQUEST ENABLE	*SRE Δ n	*SRE?	n
Returns the current value of the Status Byte.	READ STATUS BYTE	_____	*STB?	n
Executes single sweep.	TRIGGER COMMAND	*TRG	_____	_____
Executes the self test.	SELF TEST	_____	*TST	n
Keeps the next command on standby during execution of a device command.	WAIT TO CONTINUE	*WAI	_____	_____
Returns the manufacturer name, model name, etc. of the product.	IDENTIFICATION QUERY	_____	*IDN?	ANRITSU...
Perform a level-3 device reset. Synchronization mode between device and controller	RESET COMMAND	*RST	_____	_____
	OPERATION COMPLETE			
	WAITING FOR SERVICE REQUEST	*OPC	_____	_____
	WAITING FOR OUTPUT QUEUE IN DEVICE	_____	*OPC?	1
Sets or clears the Standard Event Status Enable Register. Reads the Standard Event Status Enable Register. Controls masking of the Extended Event Status. Reads the Extended Event Status.	STANDARD EVENT ENABLE STATUS	*ESE Δ n	*ESE?	n
	STANDARD EVENT STATUS REGISTER	_____	*ESR?	n
	EVENT STATUS ENABLE	ESE2 Δ n	ESE2?	n
	EVENT STATUS REGISTER	_____	ESR2?	n

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (40/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Frequency counter • Frequency measurement Measures the frequency.	<u>FREQUENCY COUNT</u>			
	<u>FREQ MEASURE</u> FREQ MEASURE OFF ON Transferring measured results	MKC△0 MC△OFF MKFC△0 MKFC△OFF MEAS△FREQ, OFF MKC△1 MC△ON MKFC△1 MKFC△ON MEAS△FREQ, ON _____	MKC? _____ MKFC? _____ _____ MKC? _____ MKFC? _____ MEAS? RES?	MKC△0 _____ 0 _____ MKC△1 _____ 1 _____ FREQ f
Sets the counter to the specified resolution.	<u>COUNT RESOLUTION</u> 1 Hz 10 Hz 100 Hz 1 kHz FREQ UP FREQ DOWN	CRS△0 MKFCR△1HZ CRS△1 MKFCR△10HZ CRS△2 MKFCR△100HZ CRS△3 MKFCR△1KHZ MKFCR△UP MKFCR△DN	CRS? MKFCR? CRS? MKFCR? CRS? MKFCR? CRS? MKFCR? _____ _____	CRS△0 1 CRS△1 10 CRS△2 100 CRS△3 1000 _____ _____

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (41/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Trigger/gate				
<u>TRIGGER/GATE SWEEP</u>				
<u>sweep</u>				
Gate function	GATE MODE OFF	GATE Δ 0 GATE Δ OFF GMD Δ 0	———— GATE? GMD?	———— OFF GMD Δ 0
	ON	GATE Δ 1 GATE Δ ON GMD Δ 1	———— GATE? GMD?	———— ON GMD Δ 1
Sets the gate delay time.	GATE DELAY TIME	GD Δ t GDL Δ t	GD? GDL?	t GDL Δ t
Sets the gate length.	GATE LENGTH	GL Δ t GLN Δ t	GL? GLN?	t GLN Δ t
Sets internal or external termination of the gate interval.	GATE END INTERNAL	GE Δ INT GED Δ 0	GE? GED?	INT GED Δ 0
	EXTERNAL	GE Δ EXT GED Δ 1	GE? GED?	EXT GED Δ 1
Sets the trigger mode (sets the trigger source/trigger switch).	TRIGGER MODE FREERUN	TM Δ FREE TRG Δ 0	TM? TRG?	FREE TRG Δ 0
	VIDEO	TM Δ VID TRG Δ 1	TM? TRG?	VID TRG Δ 1
	LINE	TM Δ LINE TRG Δ 2	TM? TRG?	LINE TRG Δ 2
	EXT	TM Δ EXT TRG Δ 3	TM? TRG?	EXT TRG Δ 3
	WIDE IF VIDEO	TM Δ WIDEVID TRG Δ 7	TM? TRG?	WIDEVID TRG Δ 7
Sets the trigger switch.	TRIGGER SWITCH FREERUN TRIGGERD	TRGS Δ FREE TRGS Δ TRGD	TRGS? TRGS?	FREE TRGD
■ Sweep function				
<u>SWEEP CONTROL</u>				
Sets the trigger source.	TRIGGER SOURCE VIDEO LINE EXT WIDE IF VIDEO	TRGSOURCE Δ VID TRGSOURCE Δ LINE TRGSOURCE Δ EXT TRGSOURCE Δ WIDEVID	TRGSOURCE? TRGSOURCE? TRGSOURCE? TRGSOURCE?	VID LINE EXT WIDEVID
Sets the external trigger level type (when the trigger source = EXT).	EXT TRIGGER TYPE \pm 10 V TTL	EXTTYPE Δ 10V EXTTYPE Δ TTL	EXTTYPE? EXTTYPE?	10V TTL

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (42/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Sweep function (Cont)	<u>SWEEP CONTROL</u>			
Sets the sweep trigger threshold level.	TRIGGER LEVEL	TRGLVL Δ l TLV Δ l	TRGLVL? TLV?	l TLV Δ l
Selects the sweep trigger slope.	TRIGGER SLOPE RISE FALL	TRGSLP Δ RISE TSL Δ 1 TRGSLP Δ FALL TSL Δ \emptyset	TRGSLP? TSL? TRGSLP? TSL?	RISE TSL Δ 1 FALL TSL Δ \emptyset
Sets the time-out period for the trigger sweep wait (this is also the time-out period of the GP-IB talker function).	SWEEP TIME OUT	GTOUT Δ t	GTOUT?	t
■ Y-OUT				
Selects the Y-Out amplitude	Y-OUT AMPLITUDE	YAMP Δ a	YAMP?	a
Selects the Y-Out polarity	Y-OUT POLARITY POS NEG	YPOL Δ POS YPOL Δ NEG	YPOL? YPOL?	POS NEG
Sets the Y-Out voltage offset	Y-OUT OFFSET	YOFFSET Δ a	YOFFSET?	a
■ RF preamplifier	<u>RF PRE-AMP</u>			
	OFF ON	PREAMP Δ OFF PREAMP Δ ON	PREAMP? PREAMP?	OFF ON
■ GP-IB interface	<u>GP-IB</u>			
Sets the period for the trigger sweep wait time-out.	GPIB TIME OUT	GTOUT Δ t	GTOUT?	t
■ Memory Card	<u>MEMORY CARD</u>			
Saves the template data file.	SAVE TEMPLATE FILE	TEMPSAVE Δ n	_____	_____
Loads the template data file.	LOAD TEMPLATE FILE	TEMPLOAD Δ n	_____	_____

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (43/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Memory Card (Cont)	<u>MEMORY CARD</u>			
Saves the template data file in CSV format	SAVE TEMPLATE CSV FILE	SVCSVTMP Δn	—	—
Loads the template data file in CSV format	LOAD TEMPLATE CSV FILE	RCCSVTMP Δn	—	—
Saves the mask data file.	SAVE MASK FILE	MASKSAVE Δn	—	—
Loads the mask data file.	LOAD MASK FILE	MASKLOAD Δn	—	—
Saves the mask data file in CSV format	SAVE MASK CSV FILE	SVCSVMSK Δn	—	—
Loads the mask data file in CSV format	LOAD MASK CSV FILE	RCCSVMSK Δn	—	—
Saves the correction data file.	SAVE CORRECTION FILE	CORRSAVE Δn	—	—
Loads the correction data file.	LOAD CORRECTION FILE	CORRLOAD Δn	—	—
Saves the correction data file in CSV format	SAVE CORRECTION CSV FILE	SVCSVCOR Δn	—	—
Loads the correction data file in CSV format	LOAD CORRECTION CSV FILE	RCCSVCOR Δn	—	—
Saves the user antenna data file.	SAVE USERANTENNA FILE	ANTSAVE Δn	—	—
Loads the user antenna data file.	LOAD USERANTENNA FILE	ANTLOAD Δn	—	—
Saves the user antenna data file in CSV format	SAVE USER ANTENNA CSV FILE	SVCSVANT Δn	—	—
Loads the user antenna data file in CSV format	LOAD USER ANTENNA CSV FILE	RCCSVANT Δn	—	—
Saves the waveform data file in CSV format	SAVE WAVEFORM CSV FILE	SVCSVWAVE Δn	—	—

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (44/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ EMC	<u>EMC</u>			
Antenna factor	ANTENNA FACTOR OFF DIPOLE LOG-PERI (1) LOG-PERI (2) LOOP USER1 USER2 USER3 USER4	ANT Δ 5 ANT Δ 0 ANT Δ 1 ANT Δ 2 ANT Δ 3 ANT Δ 4 ANT Δ 6 ANT Δ 7 ANT Δ 8	ANT? ANT? ANT? ANT? ANT? ANT? ANT? ANT? ANT?	ANT Δ 5 ANT Δ 0 ANT Δ 1 ANT Δ 2 ANT Δ 3 ANT Δ 4 ANT Δ 6 ANT Δ 7 ANT Δ 8
User antenna factor	USER ANTENNA FACTOR SET TABLE DATA CLEAR TABLE LOAD USER ANTENNA FACTOR SAVE USER ANTENNA FACTOR SELECT SETTING USER ANTENNA FACTOR TABLE NUMBER USER ANTENNA FACTOR LABEL	ANTFACT Δ n, f, l ANTFCLR ANTLOAD Δ n ANTSAVE Δ n UANTF Δ n ANTLABEL Δ n, 'text'	ANTFACT? Δ n _____ _____ _____ UNATF? ANTLABEL?	f, l _____ _____ _____ n text
■ Signal Analysis	<u>SIGNAL ANALYSIS</u>			
Change Mode	SYSTEM MODE SPECTRUM ANALYZER SIGNAL ANALYSIS CONFIGURATION	PNLMD SPECT PNLMD SYSTEM PNLMD CONFIG	PNLMD? PNLMD? PNLMD?	SPECT SYSTEM CONFIG
Change Measurement Software	SYSTEM CHANGE SYSTEM-1 SYSTEM-2 SYSTEM-3	SYS Δ 1 SYS Δ 2 SYS Δ 3	SYS? SYS? SYS?	1 2 3
Information of Measurement Software	SYSTEM VERSION	_____	MCMSV? Δ n	text1, text2

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (45/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ External Mixer (Only MS2687B)	<u>External Mixer</u>			
Selection in the mixer mode	External Mixer MIXER MODE INTERNAL EXTERNAL	MXRMODE Δ INT MXRMODE Δ EXT	MXRMODE? MXRMODE?	INT EXT
Setting mixer bias	MIXER BIAS	MBIAS Δ n	MBIAS?	n
Setting conversion loss	CONVERSION LOSS	CNVLOSS Δ l	CNVLOSS?	l
Setting external mixer band	BAND SELECT K: 18 to 26.5 GHz A: 26.5 to 40.0 GHz Q: 33.0 to 50.0 GHz U: 40.0 to 60.0 GHz V: 50.0 to 75.0 GHz E: 60.0 to 90.0 GHz W: 75.0 to 110.0 GHz F: 90.0 to 140.0 GHz D: 110.0 to 170.0 GHz G: 140.0 to 220.0 GHz J: 220.0 to 325.0 GHz	FULBAND Δ K FULBAND Δ A FULBAND Δ Q FULBAND Δ U FULBAND Δ V FULBAND Δ E FULBAND Δ W FULBAND Δ F FULBAND Δ D FULBAND Δ G FULBAND Δ J	FULBAND? FULBAND? FULBAND? FULBAND? FULBAND? FULBAND? FULBAND? FULBAND? FULBAND? FULBAND?	K A Q U V E W F D G J
Signal ID	SIGNAL IDENTIFIER OFF ON	SIGID Δ 0 SIGID Δ OFF SIGID Δ 1 SIGID Δ ON	SIGID? SIGID?	0 1

Table of MS2681A/MS2683A/MS2687A/MS2687B Device Messages (46/46)

Parameter		Program command	Query	Response
Outline	Control item			
■ Power Meter				
<u>Function</u>				
(with MS2687A/B pt21, MS2687B Opt23 supplied)				
• Power Measurement				
Power Meter ON/OFF	POWER METER ON OFF	PWRMTR△ON PWRMTR△OFF	PWRMTR? PWRMTR?	ON OFF
Measurement Range Switching	RANGE 1 2 3 4 5	PMRNG△1 PMRNG△2 PMRNG△3 PMRNG△4 PMRNG△5	PMRNG? PMRNG? PMRNG? PMRNG? PMRNG?	1 2 3 4 5
Range AUTO/HOLD Switching	RANGE HOLD HOLD AUTO	RNGHLD△HOLD RNGHLD△AUTO	RNGHLD? RNGHLD?	HOLD AUTO
Measurement Value Readout	POWER METER RESPONSE in dBm in Relative in Watt	_____ _____ _____	PMRES?△DBM PMRES?△REL PMRES?△W	n (0.01 dBm Resolution) n (0.01 dB Resolution) n (Significant figure, 3 digits)
Setting of reference value in relative	SET RELATIVE	SETREL	_____	_____
• Measurement Parameter Setting				
Cal Factor Value	CALFACTOR	PMCALF△n (n = -10.00 to +10.00)	PMCALF?	n (n = -10.00 to +10.00)
Offset Level Value	LEVEL OFFSET	PMOFFSET△n (n = -100.00 to +100.00)	PMOFFSET?	n (n = -100.00 to +100.00)
Reference Factor Value	REFERENCE FACTOR	PMREFFACT△n (n = -100.00 to +100.00)	PMREFFACT?	n (n = -100.00 to +100.00)
Surveyratio of Power Meter	DUTY	DUTY△n (n = 0.01 to +100.0)	DUTY?	n (n = 0.01 to +100.0)
Average processing	AVERAGE ON OFF	PMAVG△ON PMAVG△OFF	PMAVG? PMAVG?	ON OFF
Average count	AVERAGE COUNT	PMAVGCNT△n (n = 2 to 10)	PMAVGCNT?	n (n = 2 to 10)
Initialization of measurement Power Meter	ALL CLEAR	PMALLCLR	_____	_____
• Calibration				
Execution of Power Meter Calibration	CAL	CALADJ	_____	_____
Execution of Zero Adjust	ZERO	ZEROADJ	_____	_____
Execution of Zero Calibration	ZERO CAL	ZEROCAL	_____	_____

Section 8 Detailed Description of Commands

This section describes the usable device and response messages in alphabetic order.

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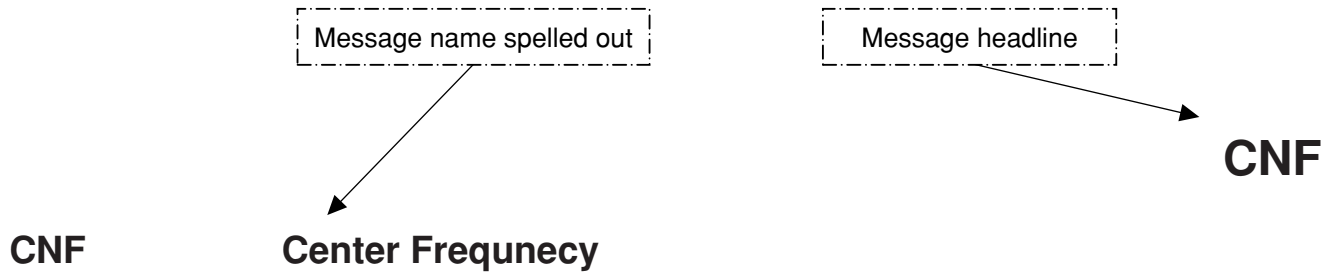
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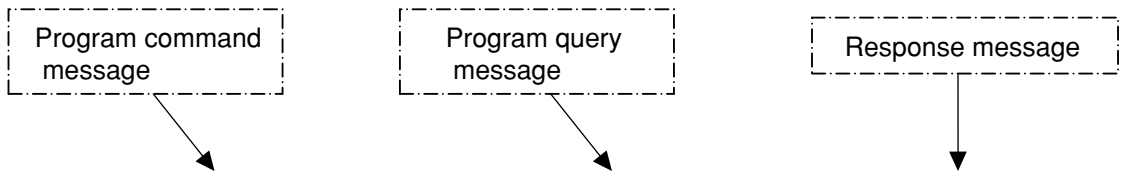
This section gives detailed descriptions of the device messages for MS2683A spectrum analyzer in alphabetical order.



CNF

Center Frequency

■ **Function** Sets the center frequency (same function as CF).



Header	Program command	Query	Response
CNF	CNF△f	CNF?	CNF△f f=-100000000 to 0 to 3000000000 Transfers the data with no suffix code in units of 1 Hz.

■ **Value of f** -100MHz to 3.0GHz

■ **Suffix code**

None:	Hz(10 ⁰)	} • The data to the left of the colon is part of the program or response data • The data is to the right of the colon.
HZ:	Hz(10 ⁰)	
KHZ, KZ:	kHz(10 ³)	
MHZ, MZ:	MHz(10 ⁶)	
GHZ, GZ:	GHz(10 ⁹)	

■ **Initial setting** Value of f=1.50 GHz

■ **Example**

CNF△123456
 CNF△50MHz
 CNF?

Device-dependent initial setting value

■ **Restrictions according to the model type and options**
 None

A1

A1 Trace A Write ON

- **Function** Clears trace A waveform data to set the write mode to ON (same function as AWR△1/CLRW△TRA).

Header	Program command	Query	Response
A1	A1	_____	_____

- **Example** A1

A2

A2 Trace A Max Hold

- **Function** Controls writing of the waveform data to trace BG.

Header	Program command	Query	Response
A2	A2	_____	_____

- **Example** A2

AAT**AAT RF Attenuator**

- **Function** Switches the RF attenuator setting mode to AUTO or MANUAL.

Header	Program command	Query	Response
AAT	AAT△sw	AAT?	AAT△sw

- **Value of sw** ∅: MANUAL
 1: AUTO
- **Suffix code** None
- **Initial setting** 1:AUTO
- **Example** AAT△1

ADJCH**ADJCH Adjacent CH Select**

- **Function** Selects the subject channel to be calculated for an adjacent channel.

Header	Program command	Query	Response
ADJCH	ADJCH△a	ADJCH?	a

- **Value of a** BOTH: BOTH SIDES
 UP: UPPER SIDE
 LOW: LOWER SIDE
 OFF: OFF
- **Suffix code** None
- **Initial setting** BOTH: BOTH SIDES
- **Example** ADJCH△BOTH
 ADJCH△LOW

ADJCHBW

ADJCHBW Adjacent CH Bandwidth

■ **Function** Sets the bandwidth of the adjacent channel.

Header	Program command	Query	Response
ADJCHBW	ADJCHBW△f	ADJCHBW?	f f=10 to 1000000000 Transfers the data with no suffix code in units of 1 Hz.

■ **Value of f** 10 Hz to 1 GHz (10 Hz resolution. Data below 10 Hz is truncated.)

■ **Suffix code**
 None: Hz(10⁰)
 HZ: Hz(10⁰)
 KHZ, KZ: kHz(10³)
 MHZ, MZ: MHz(10⁶)
 GHZ, GZ: GHz(10⁹)

■ **Initial setting** 8.5KHZ: 8.5 kHz

■ **Example** ADJCHBW△8.5KHZ

ADJCHSP

ADJCHSP Adjacent CH Sepalation

■ **Function** Sets the separation of adjacent channel 1.

Header	Program command	Query	Response
ADJCHSP	ADJCHSP△f	ADJCHSP?	f f=0 to 1000000000 Transfers the data with no suffix code in units of 1 Hz.

■ **Value of f** 0 Hz to 1 GHz (10 Hz resolution. Data below 10 Hz is truncated.)

■ **Suffix code**
 None: Hz(10⁰)
 HZ: Hz(10⁰)
 KHZ, KZ: kHz(10³)
 MHZ, MZ: MHz(10⁶)
 GHZ, GZ: GHz(10⁹)

■ **Initial setting** 12.5KHZ: 12.5 kHz

■ **Example** ADJCHSP△12.5kHz

ADJCHSPF

ADJCHSPF Adjacent CH2 Separation

- **Function** Sets the separation of adjacent channel 2.

Header	Program command	Query	Response
ADJCHSPF	ADJCHSPF△f	ADJCHSPF?	f f=0 to 1000000000 Transfers the data with no suffix code in unit of 1 Hz.

- **Value of f** 0 Hz to 1 GHz (10 Hz resolution. Data below 10 Hz is truncated.)
- **Suffix code**
 - None: Hz(10⁰)
 - HZ: Hz(10⁰)
 - KHZ, KZ: kHz(10³)
 - MHZ, MZ: MHz(10⁶)
 - GHZ, GZ: GHz(10⁹)
- **Initial setting** 12.5KHZ: 12.5 kHz
- **Example** ADJCHSPF△12.5kHz

ADJCHSPFF

ADJCHSPFF Adjacent CH3 Separation

- **Function** Sets the separation of adjacent channel 3.

Header	Program command	Query	Response
ADJCHSPFF	ADJCHSPFF△f	ADJCHSPFF?	f

- **Value of f** 0 Hz to 1 GHz (10 Hz resolution. Data below 10 Hz is truncated.)
- **Suffix code**
 - None: Hz(10⁰)
 - HZ: Hz(10⁰)
 - KHZ, KZ: kHz(10³)
 - MHZ, MZ: MHz(10⁶)
 - GHZ, GZ: GHz(10⁹)
- **Initial setting** 50KHZ: 50 kHz
- **Example** ADJCHSPFF△50kHz

ADJINBW

ADJINBW Adjacent Inband CH Bandwidth

■ **Function** Sets the bandwidth of the adjacent inband channel

Header	Program command	Query	Response
ADJINBW	ADJINBW△f	ADJINBW?	f f=10 to 1000000000 Transfers the data with no suffix code in unit of 1 Hz.

■ **Value of f** 10 Hz to 1 GHz (10 Hz resolution, Data below 10 Hz is truncated)

■ **Suffix code** None: Hz(10⁰)
 HZ : Hz(10⁰)
 KHZ , KZ : kHz(10³)
 MHZ , MZ : MHz(10⁶)
 GHZ , GZ : GHz(10⁹)

■ **Initial setting** 8 . 5KHZ : 8.5 kHz

■ **Example** ADJINBW△8 . 5kHz

ALARM

ALARM

■ **Function** Sets the buzzer that sounds when error occurs and at other times.

Header	Program command	Query	Response
ALARM	ALARM sw	ALARM?	sw

■ **Value of sw** ON : Sets the buzzer to On.
 OFF : Sets the buzzer to Off

■ **Suffix code** None

■ **Initial setting** ON : Sets the buzzer to On.

■ **Example** ALARM△ON

AMB

AMB $A - B \rightarrow A$

- **Function** Finds the difference between Trace-A and Trace B, and saves the result in Trace-A.

Header	Program command	Query	Response
AMB	AMB△sw	AMB?	sw sw=0,1

- **Value of sw** 1, ON : On
Ø, OFF : Off
- **Suffix code** None
- **Initial setting** OFF
- **Example** AMB△ON

AMBPL

AMBPL $Normalize (A - B + DL \rightarrow A)$

- **Function** Performs normalization (Trace-A - Trace-B + Display line level → Trace-A).

Header	Program command	Query	Response
AMBPL	AMBPL△sw	AMBPL?	sw

- **Value of sw** 1, ON : On
Ø, OFF : Off
- **Suffix code** None
- **Initial setting** OFF
- **Example** AMBPL△ON

AMD

AMD Trace A Storage Mode

■ **Function** Selects the mode for processing the trace A waveform.

Header	Program command	Query	Response
AMD	AMD△n	AMD	AMD△n

■ **Value of n**

- ∅: NORMAL
- 1: MAXHOLD
- 2: AVERAGE
- 3: MINHOLD
- 4: CUMULATIVE
- 5: OVERWRITE
- 6: LINEAR AVERAGE

■ **Suffix code** None

■ **Initial setting** ∅: NORMAL

■ **Example** AMD△∅

ANT

ANT Select Antenna Factor

■ **Function** Selects the antenna factor.

Header	Program command	Query	Response
ANT	ANT△n	ANT	ANT△n

■ **Value of n**

- ∅: Dipole
- 1: Log-Peri(1)
- 2: Log-Peri(2)
- 3: loop
- 4: User1
- 5: OFF
- 6: User2
- 7: User3
- 8: User4

■ **Suffix code** None

■ **Initial setting** ANT△5: OFF

■ **Example** ANT△1

ANTFACT

ANTFACT User Antenna Factor Data

- **Function** Sets the user antenna factor data.

Header	Program command	Query	Response
ANTFACT	ANTFACT Δ n, f, l	ANTFACT? Δ n	f, l

- **Value of n** 0 to 149
- **Value of f** 0 to 3.0 GHz (MS2681A)
0 to 7.9 GHz (MS2683A)
0 to 325 GHz (MS2687A/MS2687B)
- **Value of l** -100.00 to 100.00 dB (0.01 dB step)
- **Suffix code**
 - f: None: Hz(10⁰)
 - HZ: Hz(10⁰)
 - KHZ, KZ: kHz(10³)
 - MHZ, MZ: MHz(10⁶)
 - GHZ, GZ: GHz(10⁹)
 - l: None: dB
 - DB : dB

- **Example**

```
ANTFACT $\Delta$ 0.1kHz, 0DB
ANTFACT $\Delta$ 1, 10000, -0.34
```

If $f_{n-1} < f_n < f_{n+1}$ is not satisfied when $n-1 < n < n+1$, an error occurs.

ANTFCLR

ANTFCLR Clear User Antenna Factor Data

■ **Function** Initializes the user antenna factor data.

Header	Program command	Query	Response
ANTFCLR	ANTFCLR	_____	_____

■ **Example** ANTFCLR

ANTLABEL

ANTLABEL User Antenna Factor Label

■ **Function** Controls writing of the user antenna factor label.

Header	Program command	Query	Response
ANTLABEL	ANTLABEL△n, text	ANTLABEL?n	text

■ **Value of n** 1 to 4 Number of the user antenna factor data table

■ **Value of text** Character string within 30 words enclosed by single or double quotes.

■ **Suffix code** None

■ **Initial setting** (None)

■ **Example** ANTLABEL△1, "Log-peri-High"

 ANTLABEL△2, 'ANTENNAØ1 '

ANTLOAD

ANTLOAD Load User Antenna Factor

- **Function** Loads the user antenna factor data to memory card.

Header	Program command	Query	Response
ANTLOAD	ANTLOAD△n	————	————

- **Value of n** 1 to 99
- **Suffix code** None
- **Example** ANTLOAD△1

ANTSAVE

ANTSAVE Save User Antenna Factor

- **Function** Saves the user antenna factor data to memory card.

Header	Program command	Query	Response
ANTSAVE	ANTSAVE△n	————	————

- **Value of n** 1 to 99
- **Suffix code** None
- **Example** ANTSAVE△1

APB

APB $A + B \rightarrow A$

■ **Function** Adds Trace-A and Trace-B waveform data, and stores the result in Trace-A.

Header	Program command	Query	Response
APB	APB	_____	_____

■ **Example** APB

ARB

ARB Resolution Bandwidth

■ **Function** Switches the mode for setting the resolution bandwidth to AUTO or MANUAL.

Header	Program command	Query	Response
ARB	ARB Δ sw	ARB?	ARB Δ sw

■ **Value of sw** \emptyset : MANUAL
 1: AUTO

■ **Suffix code** None

■ **Initial setting** 1: AUTO

■ **Example** ARB $\Delta\emptyset$
 ARB Δ 1

AST

AST Sweep Time

- **Function** Switches the mode for setting the frequency sweep time to AUTO or MANUAL.

Header	Program command	Query	Response
AST	AST△sw	AST?	AST△sw

- **Value of sw**
 - ∅: MANUAL
 - 1: AUTO
- **Suffix code** None
- **Initial setting** 1: AUTO
- **Example**
 - AST△∅
 - AST△1

ASWT

ASWT Auto Sweep Time

- **Function** Sets auto sweep time.

Header	Program command	Query	Response
ASWT	ASWT△n	ASWT?	n

- **Value of n**
 - FAST: FAST
 - SLOW: NORMAL
- **Suffix code** None
- **Initial setting** SLOW: NORMAL
- **Example** ASWT△FAST

AT

AT RF Attenuator

■ **Function** Sets the RF attenuator.

Header	Program command	Query	Response
AT	AT△a AT△n	AT?	n

■ **Value of a** AUTO: AUTO
UP: UP
DN: DOWN

■ **Value of n** [MS2681A/MS2683A]
∅ to 62 (2step): 0 to 62 dB (2 dB step mode)
∅ to 60 (10step): 0 to 60 dB (10 dB step mode)
[MS2687A]
∅ to 70 (10step): 0 to 70 dB

■ **Suffix code** None: dB
DB : dB

■ **Initial setting** ATT=Calculated value when AUTO is selected for ATT

■ **Example** AT△1∅
AT△5∅

ATB**ATB** **Trace-A → Trace-B**

- **Function** Copies the waveform data of Trace-A onto Trace-B.

Header	Program command	Query	Response
ATB	ATB	_____	_____

- **Example** ATB

ATT**ATT** **RF Attenuator**

- **Function** Sets the RF attenuator.

Header	Program command	Query	Response
ATT	ATT△n	ATT?	ATT△n

- **Value of n**

∅:	0 dB	18:	8 dB	29:	36 dB
1:	10 dB	19:	12 dB	3∅:	38 dB
2:	20 dB	2∅:	14 dB	31:	42 dB
3:	30 dB	21:	16 dB	32:	44 dB
4:	40 dB	22:	18 dB	33:	46 dB
5:	50 dB	23:	22 dB	34:	48 dB
12:	60 dB	24:	24 dB	36:	52 dB
13:	70 dB	25:	26 dB	37:	54 dB
15:	2 dB	26:	28 dB	38:	58 dB
16:	4 dB	27:	32 dB	39:	62 dB
17:	6 dB	28:	34 dB		

- **Suffix code** None
- **Initial setting** Calculated value when AUTO is selected for ATT
- **Example** ATT△1

ATUN

ATUN Auto Tune

- **Function** Detects the maximum peak point in the specified frequency band of the BG (background) band, and displays its spectrum in the center of the screen in CENTER-SPAN mode.

Header	Program command	Query	Response
ATUN	ATUN	_____	_____

- **Example** ATUN

AUNITS

AUNITS Unit for Log Scale

- **Function** Sets the display units when the LOG scale is selected.

Header	Program command	Query	Response
AUNITS	AUNITS△a	AUNITS?	a

- **Value of a**
 - DBM : dBm
 - DBUV : dBμV
 - DBMV : dBmV
 - DBUVE : dBmV(emf)
 - V : V
 - W : W
 - DBUVM : dBμV/m
- **Suffix code** None
- **Initial setting** DBM: dBm (provided the address already allocated is not initialized)
- **Example**
 - AUNITS△DBM
 - AUNITS△V

AUTO

AUTO Coupled Function All Auto

■ **Function** Executes all coupled functions (RBW, VBW, SWT, and ATT) in AUTO mode.

Header	Program command	Query	Response
AUTO	AUTO	_____	_____

■ **Example** AUTO

AVB

AVB Video Bandwidth

■ **Function** Switches the mode for setting the video bandwidth to AUTO or MANUAL.

Header	Program command	Query	Response
AVB	AVB△n	AVB?	AVB△n

■ **Value of n** ∅: MANUAL

 1: AUTO

 2: OFF

■ **Suffix code** None

■ **Initial setting** 1: AUTO

■ **Example** AVB△∅

 AVB△1

AVGPAUSE

AVGPAUSE Average Sweep Mode

- **Function** Specifies the processing (pause or continue) executed after the specified average sweeps.

Header	Program command	Query	Response
AVGPAUSE	AVGPAUSE△sw	AVGPAUSE?	sw sw=ON,OFF

- **Value of sw** ∅, OFF : Continue
1, ON : Pause
- **Suffix code** None
- **Initial setting** ON : Pause
- **Example** AVGPAUSE△ON

AVR

AVR Number of Trace Average

- **Function** Sets the averaging rate (number of sweep repetitions).

Header	Program command	Query	Response
AVR	AVR△n	AVR?	AVR△n

- **Value of n**

∅ :	4 times	5 :	2 times
1 :	8 times	6 :	64 times
2 :	16 times	7 :	512 times
3 :	32 times	8 :	1024 times
4 :	128 times		
- **Suffix code** None
- **Initial setting** 1 : 8 times
- **Example** AVR△∅
AVR△3

AWR**AWR Trace A Write Switch**

- **Function** Controls writing of the waveform data to trace A.

Header	Program command	Query	Response
AWR	AWR△sw SW=ON,1,OFF,0	AWR?	AWR△sw sw=ON,OFF

- **Value of sw** 1, ON: TRACE A WRITE ON (same function as CLRW△TRA)
Ø, OFF: TRACE A WRITE OFF (same function as VIEW△TRA)
- **Suffix code** None
- **Initial setting** 1: TRACE A WRITE ON
- **Example** AWR△Ø

AXB**AXB Exchange Trace-A and Trace-B**

- **Function** Exchanges the waveform data of Trace-A and Trace-B.

Header	Program command	Query	Response
AXB	AXB	_____	_____

- **Example** AXB

B1

B1 Trace B Write ON

- **Function** Clears the trace B waveform data to set the write mode to ON (same function as BWR Δ 1, CLRW Δ TRB).

Header	Program command	Query	Response
B1	B1	_____	_____

- **Example** B1

B2

B2 Trace B Max Hold

- **Function** Allows the trace B waveform to be processed in MAX HOLD mode (same function as BMD Δ 1).

Header	Program command	Query	Response
B2	B2	_____	_____

- **Example** B2

BAUD

BAUD Baud rate

- **Function** Changes the baud rate of the RS232C.

Header	Program command	Query	Response
BAUD	BAUD△n	BAUD?	n

- **Value of n**
 - 1200 : 1200 BPS
 - 2400 : 2400 BPS
 - 4800 : 4800 BPS
 - 9600 : 9600 BPS
 - 19200 : 19.2 KBPS
 - 38400 : 38.4 KBPS
 - 57600 : 57.6 KBPS
 - 115200 : 115.2 KBPS
- **Suffix code** None
- **Initial setting** 9600 : 9600 BPS
- **Example** BAUD△9600

BGWR

BGWR Trace BG Write Switch

- **Function** Controls writing of the waveform data to trace BG.

Header	Program command	Query	Response
BGWR	BGWR△sw	BGWR?	BGWR△sw sw=ON,OFF

- **Value of sw**
 - 1, ON: TRACE BG WRITE ON (same function as CLRW△TRBG)
 - 0, OFF: TRACE BG WRITE OFF (same function as VIEW△TRBG)
- **Suffix code** None
- **Initial setting** ON: TRACE BG WRITE ON
- **Example** BGWR△ON

BIN

BIN ASCII / Binary Data Out

■ **Function** Sets the format of output trace data to ASCII or BINARY.

Header	Program command	Query	Response
BIN	BIN△sw	BIN?	sw sw=ON, OFF

- **Value of sw** ∅, OFF: ASCII
 1, ON: BINARY
- **Suffix code** None
- **Initial setting** ∅: ASCII
- **Example** BIN△∅
 BIN△ON

BMD

BMD Trace B Storage Mode

■ **Function** Selects the mode for processing the trace B waveform.

Header	Program command	Query	Response
BMD	BMD△n	BMD?	BMD△n

- **Value of n** ∅: NORMAL
 1: MAX HOLD
 2: AVERAGE
 3: MIN HOLD
 4: CUMULATIVE
 5: OVER WRITE
 6: LINEAR AVERAGE
- **Suffix code** None
- **Initial setting** ∅: NORMAL
- **Example** BMD△∅

BND**BND Band Select**

■ **Function** Sets the frequency band.

Header	Program command	Query	Response
BND	BND△n	BND?	BND△n

■ Value of n	[MS2683A]	∅:	BAND AUTO=	0 Hz to 7.9 GHz
		1:	BAND 0=	0 Hz to 3.2 GHz
		2:	BAND 1 ⁻ =	3.15 to 6.3 GHz
		3:	BAND 1 ⁺ =	6.2 to 7.9 GHz
		8:	BAND 1 ⁻ L=	1.6 to 3.2 GHz
	[MS2687A]	∅:	BAND AUTO=	0 Hz to 30.0 GHz
		1:	BAND 0=	0 Hz to 3.2 GHz
		2:	BAND 1 ⁻ =	3.15 to 6.3 GHz
		3:	BAND 1 ⁺ =	6.2 to 7.9 GHz
		4:	BAND 2 ⁺ =	7.8 to 15.2 GHz
		5:	BAND 3 ⁺ =	15.1 to 22.5 GHz
		6:	BAND 4 ⁺ =	22.4 to 30.0 GHz
	[MS2687A Opt22 loading]	0:	BAND AUTO=	0 Hz to 30.0 GHz
		1:	BAND 0=	0 Hz to 3.2 GHz
		2:	BAND 1 ⁻ =	3.15 to 5.8 GHz
	3:	BAND 1 ⁺ =	5.7 to 7.9 GHz	
	4:	BAND 1 ⁺⁺ =	7.8 to 14.05 GHz	
	5:	BAND 2 ⁻ =	14.0 to 26.5 GHz	
	6:	BAND 3 ⁻ =	26.4 to 30.0 GHz	
[MS2687B]	∅:	BAND AUTO=	0 Hz to 30.0 GHz	
	1:	BAND 0=	0 Hz to 3.2 GHz	
	2:	BAND 1 ⁻ =	3.15 to 6.3 GHz	
	3:	BAND 1 ⁺ =	6.2 to 7.9 GHz	
	4:	BAND 2 ⁺ =	7.8 to 15.3 GHz	
	6:	BAND 4 ⁺ =	15.2 to 30.0 GHz	

■ **Suffix code** None

■ **Initial configuration value**

[MS2683A]

0: BAND AUTO= 0 Hz to 7.9 GHz

[MS2687A/MS2687B]

0: BAND AUTO= 0 Hz to 30.0 GHz

■ **Example**

BND△∅

BND△3

■ **Restrictions by apparatus and the option**

- This command is effective about MS2683A and MS2687A/B.
- n=8 is effective when equipped with an option 03 “Extension of pre-selector lower limit to 1.6 GHz”.

BNDC

BNDC Band Select

■ **Function** Sets the frequency band.

Header	Program command	Query	Response
BNDC	BNDC△a a=AUTO,0,1 ⁻ ,1 ⁺ ,1 ^{-L} ,2 ⁺ ,3 ⁺ ,4 ⁺ 1 ⁺⁺ ,2 ⁻ ,3 ⁻	BNDC?	a a=AUTO,0,1 ⁻ ,1 ⁺ ,1 ^{-L} ,2 ⁺ ,3 ⁺ ,4 ⁺ 1 ⁺⁺ ,2 ⁻ ,3 ⁻

- **Value of n**
- | | |
|-------------------------|---|
| [MS2683A] | AUTO: BAND AUTO= 0 Hz to 7.9 GHz |
| | ∅: BAND 0= 0 Hz to 3.2 GHz |
| | 1 ^{-L} : BAND 1 ⁻ = 1.6 to 3.2 GHz |
| | 1 ⁻ : BAND 1 ⁺ = 3.15 to 6.3 GHz |
| | 1 ⁺ : BAND 1 ^{-L} = 6.2 to 7.9 GHz |
| [MS2687A] | AUTO: BAND AUTO= 0 Hz to 30.0 GHz |
| | ∅: BAND 0= 0 Hz to 3.2 GHz |
| | 1 ⁻ : BAND 1 ⁻ = 3.15 to 6.3 GHz |
| | 1 ⁺ : BAND 1 ⁺ = 6.2 to 7.9 GHz |
| | 2 ⁺ : BAND 2 ⁺ = 7.8 to 15.2 GHz |
| | 3 ⁺ : BAND 3 ⁺ = 15.1 to 22.5 GHz |
| | 4 ⁺ : BAND 4 ⁺ = 22.4 to 30.0 GHz |
| [MS2687A Opt22 loading] | AUTO: BAND AUTO= 0 Hz to 30.0 GHz |
| | 0: BAND 0= 0 Hz to 3.2 GHz |
| | 1 ⁻ : BAND 1 ⁻ = 3.15 to 5.8 GHz |
| | 1 ⁺ : BAND 1 ⁺ = 5.7 to 7.9 GHz |
| | 1 ⁺⁺ : BAND 1 ⁺⁺ = 7.8 to 14.05 GHz |
| | 2 ⁻ : BAND 2 ⁻ = 14.0 to 26.5 GHz |
| | 3 ⁻ : BAND 3 ⁻ = 26.4 to 30.0 GHz |
| [MS2687B] | AUTO: BAND AUTO= 0 Hz to 30.0 GHz |
| | ∅: BAND 0= 0 Hz to 3.2 GHz |
| | 1 ⁻ : BAND 1 ⁻ = 3.15 to 6.3 GHz |
| | 1 ⁺ : BAND 1 ⁺ = 6.2 to 7.9 GHz |
| | 2 ⁺ : BAND 2 ⁺ = 7.8 to 15.3 GHz |
| | 4 ⁺ : BAND 4 ⁺ = 15.2 to 30.0 GHz |

■ **Suffix code** None

■ **Initial configuration value**

- | | |
|-------------------|-----------------------------------|
| [MS2683A] | AUTO: BAND AUTO= 0 Hz to 7.9 GHz |
| [MS2687A/MS2687B] | AUTO: BAND AUTO= 0 Hz to 30.0 GHz |

■ **Example** BND△1⁺

■ **Restrictions by apparatus and the option**

- This command is effective about MS2683A and MS2687A/B.
- a=1^{-L} is effective when equipped with an option 03 “Extension of pre-selector lower limit to 1.6 GHz”.

BNDSP**BNDSP Pre-selector start frequency**

- **Function** Sets the start frequency of the pre-selector

Header	Program command	Query	Response
BNDSP	BNDSP△sw	BNDSP?	sw

- **Value of sw** ON: Pre-selector start frequency is 1.6 GHz
OFF: Pre-selector start frequency is 3.15 GHz
- **Suffix code** None
- **Initial Setting** OFF: Pre-selector start frequency is 3.15 GHz
- **Example** BNDSP△ON
- **Restrictions according to model type and option**

This command is effective when equipped with the option 03 “Extension of pre-selector lower limit to 1.6 GHz” of MS2683A.

BRIGHT**BRIGHT Adjust Brightness**

- **Function** Selects the LCD display brightness.

Header	Program command	Query	Response
BRIGHT	BRIGHT△n BRIGHT△OFF	BRIGHT?	n OFF

- **Value of n** 1 to 5
- **Suffix code** None
- **Initial Setting** 5
- **Example** BRIGHT△3

BSAUTO

BSAUTO **BW / SWT Auto**

■ **Function** Allows RBW, VBW, and the sweep time to be set in AUTO mode.

Header	Program command	Query	Response
BSAUTO	BSAUTO	_____	_____

■ **Example** BSAUTO

BTA

BTA **Trace-B → Trace-A**

■ **Function** Copies the data of the Trace-B waveform to Trace-A.

Header	Program command	Query	Response
BTA	BTA	_____	_____

■ **Example** BTA

BWR**BWR Trace B Write Switch**

- **Function** Controls writing of the waveform data to trace B.

Header	Program command	Query	Response
BWR	BWR Δ sw	BWR?	BWR Δ sw sw=ON,OFF

- **Value of sw** 1, ON: TRACE B WRITE ON (same function as CLRW Δ TRB)
 \emptyset , OFF: TRACE B WRITE OFF (same function as VIEW Δ TRG)
- **Suffix code** None
- **Initial setting** 1: TRACE B WRITE ON
- **Example** BWR Δ \emptyset

C1

C1 0A - B Off

■ **Function** Turns the A-B function to OFF.

Header	Program command	Query	Response
C1	C1	_____	_____

■ **Example** C1

C2

C2 A - B On

■ **Function** Turns the A-B function to ON.

Header	Program command	Query	Response
C2	C2	_____	_____

■ **Example** C2

CA

CA RF Attenuator Auto

■ **Function** Sets the attenuator to AUTO mode (same function as AAT1, AT△AUTO).

Header	Program command	Query	Response
CA	CA	_____	_____

■ **Example** CA

CAL

CAL Calibration

■ **Function** Performs calibration using the internal CAL signal.

Header	Program command	Query	Response
CAL	CAL△n	_____	_____

■ **Value of n** ∅: All
 1: Frequency
 2: Level

■ **Suffix code** None
 ■ **Example** CAL△∅

CALADJ

CALADJ Cal

- **Function** Power meter is rectified in the signal input of 50 MHz 0 dBm.

Header	Program command	Query	Response
CALADJ	CALADJ	_____	_____

- **Example** CALADJ
- **Restrictions by apparatus and the option**
This command is effective about MS2687A/B Option21/23 Power Meter.

CDT

CDT Set Correction factor on

- **Function** Controls correction of the frequency characteristics.

Header	Program command	Query	Response
CDT	CDT△sw	CDT?	CDT△sw SW=0,1

- **Value of sw** Ø, OFF: Off
1, ON: On
- **Suffix code** None
- **Initial setting** Ø: Off
- **Example** CDT△1

CF**CF Center Frequency**

- **Function** Sets the center frequency (same function as CNF).

Header	Program command	Query	Response
CF	CF△f CF△a	CF?	f f=-100000000 to 3000000000, =-100000000 to 7900000000 =-100000000 to 30000000000 Transfers the data with no suffix code in units of 1 Hz.

- **Value of f** [MS2681A] -100 MHz to 3.0 GHz
[MS2683A] -100 MHz to 7.9 GHz
[MS2687A/MS2687B] -100 MHz to 30.0 GHz
- **Value of a** UP: CENTER FREQSTEP UP (same function as FUP)
DN: CENTER FREQSTEP DOWN (same function as FDN)
- **Suffix code** f: None: Hz(10⁰)
HZ: HZ(10⁰)
KHZ, KZ: kHz(10³)
MHZ, MZ: MHz(10⁶)
GHZ, GZ: GHz(10⁹)
a: None
- **Initial configuration value** [MS2681A] 1.5 GHz
[MS2683A] 3.95 GHz
[MS2687A/MS2687B] 15 GHz
- **Example** CF△1235456
CF△50MHz
CF△UP

CHAVG**CHAVG Channel Power Average**

- **Function** Sets the Average function ON/OFF of Channel Power measurement.

Header	Program command	Query	Response
CHAVG	CHAVG△sw △n	CHAVG?	n

- **Value of sw** 0, OFF: Channel Power Average Off
1, ON: Channel Power Average On
- **Value of n** 2 to 1024 Number of average processes
- **Initial setting** 8: 8 times
- **Example** CHAVG△ON
CHAVG△128

CHPWRFACT

CHPWRFACT Channel Power Correction Factor

■ **Function** Sets the Channel power correction factor.

Header	Program command	Query	Response
CHPWRFACT	CHPWRFACT Δ l	CHPWRFACT?	l

- **Value of l** -99.99 to 99.99 dB
- **Suffix code** None: dB
DB, DBM, DM: dB
- **Initial setting** \emptyset : 0 dB
- **Example** CHPWRFACT Δ -2.5DB

CHPWRGRAPH

CHPWRGRAPH Channel Power Graph

■ **Function** Displays the Graph of Channel Power Measure.

Header	Program command	Query	Response
CHPWRGRAPH	CHPWRGRAPH Δ sw	CHPWRGRAPH?	sw

- **Value of sw** 1, ON: On
 \emptyset , OFF: Off
- **Suffix code** None
- **Initial setting** OFF
- **Example** CHPWRGRAPH Δ ON

CLRW

CLRW Clear & Write

■ **Function** Clears the trace waveform data to set the write mode to ON.

Header	Program command	Query	Response
CLRW	CLRW Δ tr	_____	_____

- **Value of tr** TRA: Trace A (same function as AWR Δ 1)
TRB: Trace B (same function as BWR Δ 1)
TRBG: Trace BG (same function as BGWR Δ 1)
TRTIME: Trace TIME (same function as TMWR Δ 1)
- **Example** CLRW Δ TRA

CMK?**CMK? Current Marker Position**

- **Function** Reads the current marker position.

Header	Program command	Query	Response
CMK?	_____	CMK?	CMK Δ p

- **Value of p** 0 to 500, 1000

- **Example** CMK?

CNF**CNF Center Frequency**

- **Function** Sets the center frequency (same function as CF).

Header	Program command	Query	Response
CNF	CNF Δ f	CNF?	CNF Δ f f=-100000000 to 3000000000, =-100000000 to 7900000000 =-100000000 to 30000000000 Transfers the data with no suffix code in units of 1 Hz.

- **Value of f** [MS2681A] -100 MHz to 3.0 GHz
[MS2683A] -100 MHz to 7.9 GHz
[MS2687A/MS2687B] -100 MHz to 30.0 GHz

- **Suffix code** None : Hz(10⁰)
HZ : HZ(10⁰)
KHZ, KZ : kHz(10³)
MHZ, MZ : MHz(10⁶)
GHZ, GZ : GHz(10⁹)

- **Initial configuration value**
[MS2681A] 1.5 GHz
[MS2683A] 3.95 GHz
[MS2687A/MS2687B] 15 GHz

- **Example** CNF Δ 123456
CNF Δ 50MHZ
CNF?

CNVLOSS

CNVLOSS Ext Mixer Conversion Loss

- **Function** Sets the conversion loss of an external mixer.

Header	Program command	Query	Response
CNVLOSS	CNVLOSS Δ l	CNVLOSS?	l l=0.00 to 99.99

- **Value of l** 0.00 to 99.99 (0.01 dB Resolution)
- **Suffix code** None: dB
DB: dB
- **Initial configuration value** 15.00: 15.00 dB
- **Example** CNVLOSS Δ 99.99DB
CNVLOSS?
- **Restrictions by apparatus and the option**
 - This command is effective about MS2687A/B.

COLORDEF

COLORDEF Define user color pattern

- **Function** Sets each frame color of user definition patterns.

Header	Program command	Query	Response
COLORDEF	COLORDEF Δ n, r, g, b	COLORDEF? Δ n	r, g, b

- **Value of n** 0 to 32: Frame number
- **Value of r,g,b** 0 to 15: Strength of the display color of r (red), g (green), and b (blue)
- **Suffix code** None
- **Initial setting** Set value of color pattern 1
- **Example** COLORDEF Δ 1, 15, 10, 5

COLORPTN

COLORPTN Color pattern

- **Function** Selects the display color from the display color patterns.

Header	Program command	Query	Response
COLORPTN	COLORPTN△a	COLORPTN?	a

- **Value of a**
 - COLOR1 : Color pattern-1
 - COLOR2 : Color pattern-2
 - COLOR3 : Color pattern-3
 - COLOR4 : Color pattern-4
 - USERCOLOR : User definition pattern
- **Suffix code** None
- **Initial setting** COLOR1 : Color pattern-1
- **Example** COLORPTN△USERCOLOR

COMMENT

COMMENT Comment display

- **Function** Sets the display method for the comment column.

Header	Program command	Query	Response
COMMENT	COMMENT△a	COMMENT?	a

- **Value of a**
 - FULL : Displays the title and time.
 - TITLE : Displays the title.
 - TIME : Displays the time.
 - OFF : No comment is displayed.
- **Suffix code** None
- **Initial setting** OFF : No comment is displayed.
- **Example** COMMENT△TITLE

CONTS

CONTS Continuous Sweep Mode

■ **Function** Sets the sweep mode to continuous mode (same function as S1).

Header	Program command	Query	Response
CONTS	CONTS	_____	_____

■ **Example** CONTS

COPYCOLOR

COPYCOLOR Copy into user pattern from Color pattern

■ **Function** Selects the display color pattern, and copies it to the user definition pattern.

Header	Program command	Query	Response
COPYCOLOR	COPYCOLOR△a	_____	_____

■ **Value of a** COLOR1: Color pattern 1
 COLOR2: Color pattern 2
 COLOR3: Color pattern 3
 COLOR4: Color pattern 4

■ **Suffix code** None

■ **Example** COPYCOLOR△COLOR4

CORC

CORC Correction Factor Initialization

■ **Function** Initializes the correction factor currently selected by the CORR command.

Header	Program command	Query	Response
CORC	CORC	_____	_____

■ **Example** CORC
 All frequency data and level data are initialized. The initialized data is used as the 0 dB correction values in each frequency range.

CORD

CORD Correction Factor Entry

■ **Function** Registers the correction factor currently selected by the CORR command.
 If the correction factor is set to OFF, it is not valid.

Header	Program command	Query	Response
CORD	CORD Δ n, f, l n=0 to 149 f=0 to 400GHz l=-100.00 to +100.00dB (incremented in 0.01 dB steps)	CORD? Δ n	CORD Δ f, l f = 0 to 400 000 000 000 (no units) l= -100.00 to +100.00 dB (incremented in 0.01 steps)

- **Value of n** 0 to 149
- **Value of f** 0 to 400 GHz
- **Value of l** -100.00 to +100.00 dB (incremented in 0.01 dB steps)
- **Suffix code**
 - f : None : Hz(10⁰)
 - HZ : HZ(10⁰)
 - KHZ, KZ : kHz(10³)
 - MHZ, MZ : MHz(10⁶)
 - GHZ, GZ : GHz(10⁹)
 - l : None : dB
 - DB : dB

■ **Example** CORD Δ 0, 1MHZ, 10
 CORD Δ 1, 2000000, 10
 If $f_n - 1 < f_n < f_n + 1$ is not satisfied when $n - 1 < n < n + 1$, an error occurs.

CORR

CORR Correction Factor Select

■ **Function** Selects the type of correction factor.

Header	Program command	Query	Response
CORR	CORR△n	CORR?	CORR△n

- **Value of n**
 - ∅, OFF: OFF
 - ON: ON
 - 1: CORR1
 - 2: CORR2
 - 3: CORR3
 - 4: CORR4
 - 5: CORR5
- **Suffix code** None
- **Initial setting** ∅: OFF (the correction factor already registered is not initialized)
- **Example**
 - CORR△∅
 - CORR△2
 - CORR△4

CORRLABEL

CORRLABEL Correction Factor Label

■ **Function** Registers the name of the correction factor currently selected by the CORR command.

Header	Program command	Query	Response
CORRLABEL	CORRLABEL△n, text	CORRLABEL?△n	"text"

- **Value of n** 1 to 5
- **Value of text** String of up to 30 characters enclosed by single or double quotes.
- **Suffix code** None
- **Example**
 - CORRLABEL△1, "CORRECTION FACTOR"
 - CORRLABEL△2, 'MS2683A'

CORRLOAD

CORRLOAD Load Correction data

- **Function** Reads the correction data from the memory card file.

Header	Program command	Query	Response
CORRLOAD	CORRLOAD△n	_____	_____

- **Value of n** 1 to 999
- **Suffix code** None
- **Example** CORRLOAD△1

CORRSAVE

CORRSAVE Save Correction data

- **Function** Saves the internal correction data to the memory card.

Header	Program command	Query	Response
CORRSAVE	CORRSAVE△n	_____	_____

- **Value of n** 1 to 999
- **Suffix code** None
- **Example** CORRSAVE△1

CR

CR Resolution Bandwidth Auto

- **Function** Sets the resolution bandwidth selection to the AUTO mode (same function as ARBV Δ 1, RB Δ AUTO).

Header	Program command	Query	Response
CR	CR	_____	_____

- **Example** CR

CRS

CRS Count Resolution

- **Function** Selects the resolution of the frequency counter.

Header	Program command	Query	Response
CRS	CRS Δ n	CRS?	CRS Δ n

- **Value of n**
 - Ø: 1Hz
 - 1: 10Hz
 - 2: 100Hz
 - 3: 1kHz
- **Suffix code** None
- **Initial setting** 3: 1kHz
- **Example**
 - CRS Δ Ø
 - CRS Δ 3

CT**CT Sweep Time Auto**

- **Function** Sets the frequency sweep time to AUTO mode (same function as $AST\Delta 1$, $ST\Delta AUTO$).

Header	Program command	Query	Response
CT	CT	_____	_____

- **Example** CT

CV**CV Video Bandwidth Auto**

- **Function** Sets the video bandwidth to AUTO mode (same function as $AVB\Delta 1$, $VB\Delta AUTO$).

Header	Program command	Query	Response
CV	CV	_____	_____

- **Example** CV

DATB

DATB Data bit

- **Function** Specifies the data length of the RS232C.

Header	Program command	Query	Response
DATB	DATB△n	DATB?	n

- **Value of n** 7 : 7 bit
8 : 8 bit
- **Suffix code** None
- **Initial setting** 8 : 8 bit
- **Example** DATB△7

DATE

DATE Date

- **Function** Sets the built-in clock of the spectrum analyzer to the specified date.

Header	Program command	Query	Response
DATE	DATE△yyyy, mm, dd	DATE?	yyyy, mm, dd

- **Value of yyyy** 1980 to 2079 (year)
- **Value of mm** 01 to 12 (month)
- **Value of dd** 01 to 31 (day)
- **Suffix code** None
- **Example** DATE△2000, 03, 31

DATEMODE

DATEMODE Date Display mode

- **Function** Sets the display method for the date display column.

Header	Program command	Query	Response
DATEMODE	DATEMODE△a	DATEMODE?	a

- **Value of a** YMD : Year/month/date
DMY : Day-month-year
MDY : Month-day-year
- **Suffix code** None
- **Initial setting** YMD : Year/month/day
- **Example** DATEMODE△MDY

DET

DET Detection Mode

- **Function** Selects the detection mode for the waveform data being displayed.

Header	Program command	Query	Response
DET	DET△d	DET?	d d=POS,SMP,NEG

- **Value of d**
 - ∅ : POSITIVE PEAK
 - 1 : SAMPLE
 - 2 : NEGATIVE PEAK
 - 3 : NORMAL
 - 4 : AVERAGE
 - 5 : RMS
 - POS : POSITIVE PEAK
 - SMP : SAMPLE
 - NEG : NEGATIVE PEAK
 - NRM : NORMAL
 - AVE : AVERAGE
 - RMS : RMS
- **Suffix code** None
- **Initial setting** ∅ : POSITIVE PEAK
- **Example** DET△∅
DET△SMP

- **Restrictions according to model type and options**
“d = 5 and RMS” are available when Option 04: Digital Resolution Bandwidth is installed.

DETM

DETM Detection Mode

■ **Function** Selects the detection mode for the specified trace.

Header	Program command	Query	Response
DETM	DETM Δ tr,a	DETM? Δ tr	a

■ **Value of tr** TRA : Trace A
 TRB : Trace B
 TRIME : Trace TIME

■ **Value of a** POS or 0 : POSITIVE PEAK
 SMP or 1 : SAMPLE
 NEG or 2 : NEGATIVE PEAK
 NRM or 3 : NORMAL
 NRM or 4 : NORMAL
 AVE or 5 : AVERAGE
 RMS or 6 : RMS

■ **Suffix code** None

■ **Initial setting** POS : POSITIVE PEAK

■ **Example** DETM Δ TRA, POS
 DETM Δ TRB, SMP
 DETM Δ TRIME, SMP

■ **Restrictions according to model type and options**
 "a = RMS" is available when Option 04: Digital Resolution Bandwidth is installed.

DFMT**DFMT Display Format**

■ **Function** Specifies the display mode/format.

Header	Program command	Query	Response
DFMT	DFMT△a	DFMT?	a

- **Value of a**
- A: Trace A
 - B: Trace B
 - TIME: Trace TIME
 - AB1: Trace A/Trace B (A & B)
 - AB2: Trace A/Trace B (A/B)
 - AB3: Trace A/Trace B (A < B)
 - ABG1: Trace A/Trace BG (BG>A)
 - ABG2: Trace A/Trace BG (BG<A)
 - ATIME1: Trace A/Trace TIME (TIME>A)
 - ATIME2: Trace A/Trace TIME (TIME<A)
- **Suffix code** None
- **Initial setting** A: Trace A
- **Example** DFMT△TIME

DISPLAY**DISPLAY LCD Display On/Off**

■ **Function** Specifies whether the LCD display is on or off.

Header	Program command	Query	Response
DISPLAY	DISPLAY△sw	DISPLAY?	sw

- **Value of sw**
- OFF: LCD display is off.
 - ON: LCD display is on.
- **Suffix code** None
- **Initial setting** ON: LCD display is on.
- **Example** DISPLAY△OFF

DL

DL Display line, Display-line Level

■ **Function** Turns the display line on or off, and sets its level.

Header	Program command	Query	Response
DL	DL△sw DL△l	DL?	OFF l: A available for the current scale unit, provided that μV units are selected for V, and W units are selected for W.

- **Value of sw** ON: ON
OFF: OFF
- **Value of l** Value equivalent to full scale of current Y-axis.
For LOG scale: RLV-100 to RLV
For LIN scale: 0 to RLV.
For A-B: -100.00 to 100.00 dB
- **Suffix code** None: Available for the current scale unit, provided V units are always selected in LIN mode.
DB, DBM, DM: dBm
DBMV: dBmV
DBUV: dBμV
DBUVE: dBμV (emf)
V: V
MV: mV
UV: uV
W: W
MW: mW
UW: μW
NW: nW
PW: pW
FW: fW
- **Initial setting** -60.00 dBm(Level equivalent to center point of the scale)
- **Example** DL△OFF
DL△-10.0DBM

DLT**DLT Time Delay**

- **Function** Sets the delay time in trace-time.

Header	Program command	Query	Response
DLT	DLT△t	DLT?	DLT△t

- **Value of t** -1000sec to 65.5ms
- **Suffix code**
 - US : μs
 - MS: ms
 - S: s
 - Ø: s
- **Initial setting** Ø: s
- **Example** DLT△-2ØMS

DPOINT**DPOINT SAMPLE POINTS**

- **Function** The number of sample points of trace data is set up.

Header	Program command	Query	Response
DPOINT	DPOINT△n	DPOINT?	n

- **Value of n**
 - NRM: 501 point
 - DOUBLE: 1001 point
- **Suffix code** None
- **Initial configuration value**
 - NRM: 501 point
- **Example of use** DPOINT△DOUBLE

DSPLV

DSPLV Marker Level Absolute ; Relative

- **Function** Specifies the marker level in the absolute value display or in the relative value display when seen from the display line.

Header	Program command	Query	Response
DSPLV	DSPLV△a	DSPLV?	a

- **Value of a** ABS: Absolute value
REL: Relative value
- **Suffix code** None
- **Initial setting** ABS: Absolute value
- **Example** DSPLV△REL

DSPLVM

DSPLVM Marker Level Absolute/Relative

- **Function** With the trace mode specified, also specifies the marker level in the absolute value display or in the relative value display when seen from the display line.

Header	Program command	Query	Response
DSPLVM	DSPLVM△tr, a	DSPLVM?△tr	a

- **Value of tr** TRA: Trace A
TRB: Trace B
TRTIME: Trace Time
TRBG: Trace BG
- **Value of a** ABS: Absolute value
REL: Relative value
- **Suffix code** None
- **Initial setting** ABS: Absolute value
- **Example** DSPLVM△TRA, REL

DUTY

DUTY

Duty

- **Function** The survey ratio of Power Meter measurement is set up and an actual output is computed.

Header	Program command	Query	Response
DUTY	DUTY△n	DUTY?	n

- **Value of n** 0.01 to +100.0
- **Suffix code** None
- **Initial setting** 100.00
- **Example** DUTY△0.01
- **Restrictions by apparatus and the option**
This command is effective about MS2687A/B Option21/23 Power Meter.

E1

E1 Peak Search

■ **Function** Executes the function for peak search (same function as MKS Δ 0, MKMP).

Header	Program command	Query	Response
E1	E1	_____	_____

■ **Example** E1

E2

E2 Marker to CF

■ **Function** Sets the marker to the center frequency (same function as MKR Δ 3, MKCF).

Header	Program command	Query	Response
E2	E2	_____	_____

■ **Example** E2

E3

E3 Marker to CF Step Size

■ **Function** Sets the marker to the frequency step size (same function as MKR Δ 5M, MKSS).

Header	Program command	Query	Response
E3	E3	_____	_____

■ **Example** E3

E4**E4 Marker to REF**

- **Function** Sets the marker to the reference level (same function as MKR△4, MKRL).

Header	Program command	Query	Response
E4	E4	_____	_____

- **Example** E4

ERASEWUP**ERASEWUP Erase warm up message**

- **Function** Erases the message of warm up.

Header	Program command	Query	Response
ERASEWUP	ERASEWUP	_____	_____

- **Example** ERASEWUP

ERROR?

ERROR? Read out error code

- **Function** Reads the contents of error codes, for example, details of an execution error.

Header	Program command	Query	Response
ERROR?	_____	ERROR?	e1 , e2

- **Value of e1,e2** Main code and subcode which indicate the error details.
 Main code
 300 to 399: Syntax error
 400 to 499: Communication error
 450 to 459: Media error
 500: Range error
 501: Inhibit error
 502: Execution error
 503: Setting condition not enough
 504: Hardware error
 600: Warning

ESE2

ESE2 Event Status Enable (END)

- **Function** Allows the END Event Status Enable Register to select which bit in the corresponding Event Register causes a TRUE ESB summary message bit 2 when set.

Header	Program command	Query	Response
ESE2	ESE2△n	ESE2?	n

- **Value of n** 0 to 255: Represents the sum of the bit-weighted values enabled by the $2^0=1, 2^1=2, 2^2=4, 2^3=8, 2^4=16, 2^5=32, 2^6=64, 2^7=128$ corresponding to bits 0, 1, 2, 3, 4, 5, 6, 7 of the END Event Status Register.
- **Suffix code** None
- **Example** ESE2△1

ESR2?**ESR2? Event Status Register (END)**

- **Function** Allows the sum of the binary-weighted event bit values of the END Event Status Register to be read out by converting them to decimal. After readout, the END Event Status Register is reset to 0.

Header	Program command	Query	Response
ESR2?	_____	ESR2?	n

- **Value of n** 0 to 255
- **Suffix code** None
- **Example** ESR2?

EX**EX Exchange Trace-A and Trace-B**

- **Function** Exchanges the trace-A and trace-B wave data.

Header	Program command	Query	Response
EX	EX	_____	_____

- **Example** EX

EXTLPF

EXTLPF External Low Pass Filter

■ Function Selects External Low Pass Filter (NLP-1200).

Header	Program command	Query	Response
EXTLPF	EXTLPF△sw	EXTLPF?	sw

- Value of a ON: External Low Pass Filter used
 OFF: External Low Pass Filter not used
- Suffix code None
- Initial setting OFF
- Example EXTLPF△ON

EXTTYPE

EXTTYPE Ext Trigger Input Type

■ Function Chooses the level of the external trigger when EXT is selected for the trigger source.

Header	Program command	Query	Response
EXTTYPE	EXTTYPE△a	EXTTYPE?	a

- Value of a 10V: ±10 V input Level
 TTL: TTL input Level
- Suffix code None
- Initial setting 10V: ±10 V input Level
- Example EXTTYPE△10V
 EXTTYPE△TTL

FA**FA Start Frequency**

- **Function** Sets the start frequency (same function as STF).

Header	Program command	Query	Response
FA	FA△f	FA?	f f=-100000000 to 0 to 3000000000, f=-100000000 to 0 to 7900000000 f=-100000000 to 0 to 30 00000000 Transfers the data with no suffix code in units of 1 Hz.

- **Value of f** [MS2681A] -100 MHz to 3.0 GHz
[MS2683A] -100 MHz to 7.9 GHz
[MS2687A/MS2687B] -100 MHz to 30.0 GHz
- **Suffix code** None: Hz(10⁰)
HZ: Hz(10⁰)
KHZ, KZ: kHz(10³)
MHZ, MZ: MHz(10⁶)
GHZ, GZ: GHz(10⁹)
- **Initial setting** Initial value of f = 0 Hz
- **Example** FA△1GHZ

FB**FB Stop Frequency**

- **Function** Sets the stop frequency (same function as SOF).

Header	Program command	Query	Response
FB	FB△f	FB?	f f=-100000000 to 0 to 3000000000, f=-100000000 to 0 to 7900000000 f=-100000000 to 0 to 30 00000000 Transfers the data with no suffix code in units of 1 Hz.

- **Value of f** [MS2681A] -100 MHz to 3.0 GHz
[MS2683A] -100 MHz to 7.9 GHz
[MS2687A/MS2687B] -100 MHz to 30.0 GHz
- **Suffix code** None: Hz(10⁰)
HZ: Hz(10⁰)
KHZ, KZ: kHz(10³)
MHZ, MZ: MHz(10⁶)
GHZ, GZ: GHz(10⁹)
- **Initial configuration value** [MS2681A] 3.0 GHz
[MS2683A] 7.9 GHz
[MS2687A/MS2687B] 30.0 GHz
- **Example** FB△2GHZ

FCAL10

FCAL10 Frequency Cal On/Off

■ **Function** Specifies whether the Freq Cal is performed.

Header	Program command	Query	Response
FCAL10	FCAL10△sw	FCAL10?	sw

- **Value of sw** 1 : On
 ∅ : Off
- **Suffix code** None
- **Initial setting** 1 : On
- **Example** FCAL10△∅

FDN

FDN Center Frequency Step Down

■ **Function** Decreases the center frequency by the frequency step size if it has been set (same function as CF△DN).

Header	Program command	Query	Response
FDN	FDN	_____	_____

■ **Example** FDN

FOFFSET

FOFFSET Frequency Offset

- **Function** Sets the frequency offset value.

Header	Program command	Query	Response
FOFFSET	FOFFSET△c	FOFFSET?	C=0 to 100GHz

- **Value of c** 0Hz to 100GHz (1MHz step)
- **Suffix code**
 - None : Hz (10⁰)
 - HZ : Hz (10⁰)
 - KHZ : kHz (10³)
 - MHZ : MHz (10⁶)
 - GHZ : GHz (10⁹)
- **Initial setting** 0Hz
- **Example**

```
FOFFSET△500MHZ
FOFFSET?
```

FOFMD

FOFMD Frequency Offset Mode

- **Function** Turns the frequency offset ON/OFF.

Header	Program command	Query	Response
FOFMD	FOFMD△a	FOFMD?	a=0, 1

- **Value of n**
 - 0, OFF : OFF
 - 1, ON : ON
- **Suffix code** None
- **Initial setting** 0 : OFF
- **Example**

```
FOFMD△0
FOFMD?
```

FRQ

FRQ Frequency Mode

■ **Function** Selects the mode for setting the FG frequency band.

Header	Program command	Query	Response
FRQ	FRQ△n	FRQ?	FRQ△n

- **Value of n** ∅: CENTER-SPAN
 2: START-STOP
- **Suffix code** None
- **Initial setting** 2: START-STOP
- **Example** FRQ△∅

FS

FS Full Span

■ **Function** Sets the frequency span to the maximum value settable in the frequency band being set.

Header	Program command	Query	Response
FS	FS	_____	_____

■ **Example** FS

FSS**FSS Frequency Step Size**

■ **Function** Sets the frequency step size for stepping up/down the frequency (same function as SS).

Header	Program command	Query	Response
FSS	FSS△f	FSS?	FSS△f f=1 to 3000000000 =1 to 7900000000 =1 to 30000000000 Transfers the data with no suffix code in units of 1 Hz.

■ **Value of f** [MS2681A] 1 Hz to 3.0 GHz
 [MS2683A] 1 Hz to 7.9 GHz
 [MS2687A/MS2687B] 1 Hz to 30.0 GHz

■ **Suffix code** None : Hz(10⁰)
 HZ : Hz(10⁰)
 KHZ , KZ : kHz(10³)
 MHZ , MZ : MHz(10⁶)
 GHZ , GZ : GHz(10⁹)

■ **Initial setting** 1GHz

■ **Example** FSS△1GHZ
 FSS△1000

FULBAND

FULBAND EXT Mixer Band Select

- **Function** Sets an external mixer's band is set up. A band can set up eleven bands from K to J.

Header	Program command	Query	Response
FULBAND	FULBAND△a	FULBAND?	A

- **Value of a**
 - K: K Band (18.0 to 26.5 GHz)
 - A: A Band (26.5 to 40.0 GHz)
 - Q: Q Band (33.0 to 50.0 GHz)
 - U: U Band (40.0 to 60.0 GHz)
 - V: V Band (50.0 to 75.0 GHz)
 - E: E Band (60.0 to 90.0 GHz)
 - W: W Band (75.0 to 110.0 GHz)
 - F: F Band (90.0 to 140.0 GHz)
 - D: D Band (110.0 to 170.0 GHz)
 - G: G Band (140.0 to 220.0 GHz)
 - J: J Band (220.0 to 325.0 GHz)
- **Suffix code** None
- **Initial configuration value** K: K Band (18.0 to 26.5 GHz)
- **Related matters** If this command is executed, external mixer function will also be set to On.
- **Example of use** FULBAND△K
FULBAND?
- **Restrictions by apparatus and the option**
 - This command is effective about MS2687A/B.

FUP**FUP** **Center Frequency Step Up**

- **Function** Increases the center frequency by the frequency step size if it has been set (same function as CF Δ UP).

Header	Program command	Query	Response
FUP	FUP	_____	_____

- **Example** FUP

GATE

GATE Gate Sweep ON / OFF

- **Function** Sets the gate function to be set to ON or OFF.

Header	Program command	Query	Response
GATE	GATE△sw	GATE?	sw sw=ON,OFF

- **Value of sw** 1, ON: ON
Ø, OFF: OFF
- **Suffix code** None
- **Initial setting** OFF: OFF
- **Example** GATE△ON

GATEWAY

GATEWAY

- **Function** Sets the Gateway address of Ethernet.

Header	Program command	Query	Response
GATEWAY	GATEWAY△n1, n2, n3, n4	GATEWAY?	n1, n2, n3, n4

- **Value of n1, n2, n3, n4** 0 to 255
- **Suffix code** None
- **Example** GATEWAY△192, 168, 0, 1
- **Restrictions according to model type and options**
This command is available when Option 09: Ethernet interface is installed.

GD**GD Gate Delay**

- **Function** Sets the delay time of the gate.

Header	Program command	Query	Response
GD	GD△t	GD?	t t=0 to 65500 Transfers the data with no suffix code in units of 1 μs.

- **Value of t** 0 to 65.5 ms
- **Suffix code**
 - None : ms
 - US : μs
 - MS : ms
 - S : s
- **Initial setting** Initial value of a = 0 s
- **Example** GD△20MS

GDL**GDL Gate Delay**

- **Function** Sets the GATE delay time.

Header	Program command	Query	Response
GDL	GDL△t	GDL?	GDL△t t=0 to 65500 Transfers the data with no suffix code in units of 1 μs.

- **Value of t** 0 to 65.5 ms
- **Suffix code**
 - None : ms
 - US : μs
 - MS : ms
 - S : s
 - Ø : 0s
- **Initial setting** Ø
- **Example** GDL△20MS

GE

GE Gate End

■ **Function** Allows the gate interval to be terminated internally or externally.

Header	Program command	Query	Response
GE	GE△a sw=INT,EXT	GE?	a

- **Value of a** INT: INTERNAL(Internal Timer)
EXT: EXTERNAL(External Signal)
- **Suffix code** None
- **Initial setting** INT: INTERNAL(Internal Timer)
- **Example** GE△INT

GED

GED Gate End

■ **Function** Sets internal or external termination of the gate interval.

Header	Program command	Query	Response
GED	GED△n	GED?	GED△n

- **Value of n** ∅: INTERNAL (Internal timer)
1: EXTERNAL (External signal)
- **Suffix code** None
- **Initial setting** ∅: INTERNAL (Internal timer)
- **Example** GED△1

GL**GL Gate Length**

- **Function** Sets the width of the gate.

Header	Program command	Query	Response
GL	GL△t	GL?	t t=2 to 65500 Transfers the data with no suffix code in units of 1 μs.

- **Value of t** 2 μsec to 65.5 msec
- **Suffix code**
 - None : ms
 - US : μs
 - MS : ms
 - S : s
- **Initial setting** Initial value of t = 1 ms
- **Example** GL△2ØMS

GLN**GLN Gate Length**

- **Function** Sets the gate width.

Header	Program command	Query	Response
GLN	GLN△t	GLN?	GLN△t t=2 to 65500 Transfers the data with no suffix code in units of 1 μs.

- **Value of t** 2 μsec to 65.5 ms
- **Suffix code**
 - US : μs
 - MS : ms
 - S : s
- **Initial setting** Initial value of t = 1 msec
- **Example** GLN△2ØMS

GMD

GMD Gate Sweep On/Off

■ **Function** Sets the gate on or off.

Header	Program command	Query	Response
GMD	GMD Δ sw	GMD?	GMD Δ sw sw=0,1

- **Value of sw** \emptyset , OFF: Off
 1, ON: On
- **Suffix code** None
- **Initial setting** \emptyset : Off
- **Example** GMD Δ 1

GTOUT

GTOUT GPIB Talker time out

■ **Function** This time-out includes the sweep wait time of trigger sweeping.

Header	Program command	Query	Response
GTOUT	GTOUT Δ t	GTOUT?	t

- **Value of t** 1 to 255: 1sec to 255 s
 \emptyset : No time-out (infinite wait state)
- **Suffix code** None
- **Initial setting** 3 \emptyset : 30 s
- **Example** GTOUT Δ 6 \emptyset

HN**HN Band Select**

■ **Function** Sets the band.

Header	Program command	Query	Response
HN	HN△sw sw=0 to 2, 7	HN?	sw sw=0 to 7 ***

- **Value of a**
- [MS2683A]
 - Ø: BAND0
 - 1: BAND1-
 - 2: BAND1+
 - 7: BAND1-L
 - [MS2687A]
 - 0: BAND0
 - 1: BAND1-
 - 2: BAND1+
 - 3: BAND2+
 - 4: BAND3+
 - 5: BAND4+
 - [MS2687A Opt22 loading]
 - 0: BAND 0
 - 1: BAND 1-
 - 2: BAND 1+
 - 3: BAND 1++
 - 4: BAND 2-
 - 5: BAND 3-
 - [MS2687B]
 - 0: BAND0
 - 1: BAND1-
 - 2: BAND1+
 - 3: BAND2+
 - 5: BAND4+

■ **Suffix code** None

■ **Initial setting** BAND AUTO

■ **Example** HN△Ø

■ **Note** If BAND is AUTO, response is "***".

■ **Restrictions according to model type and options**

This command is effective about MS2683A and MS2687A/MS2687B.

“sw = 7” is available when Option 03: Extension Pre-selector Lower Limit is installed.

HNLOCK

HNLOCK Band Select

■ **Function** Sets the frequency band.

Header	Program command	Query	Response
HNLOCK	HNLOCK△a a=0 to 2, OFF, 7	HNLOCK?	b

- **Value of a**
- [MS2683A] 0: BAND0 (It is the same function as BNDC△0)
 - 1: BAND1- (It is the same function as BNDC△1-)
 - 2: BAND1+ (It is the same function as BNDC△1+)
 - 7: BAND1-L (It is the same function as BNDC△1-L)
 - OFF: BAND AUTO (It is the same function as BNDC△AUTO)
 - [MS2687A] 0: BAND0 (It is the same function as BNDC△0)
 - 1: BAND1- (It is the same function as BNDC△1-)
 - 2: BAND1+ (It is the same function as BNDC△1+)
 - 3: BAND2+ (It is the same function as BNDC△2+)
 - 4: BAND3+ (It is the same function as BNDC△3+)
 - 5: BAND4+ (It is the same function as BNDC△4+)
 - OFF: BAND AUTO (It is the same function as BNDC△AUTO)
 - [MS2687A Opt22 loading]
 - 0: BAND 0 (It is the same function as BNDC△0)
 - 1: BAND 1- (It is the same function as BNDC△1-)
 - 2: BAND 1+ (It is the same function as BNDC△1+)
 - 3: BAND 1++ (It is the same function as BNDC△1++)
 - 4: BAND 2- (It is the same function as BNDC△2-)
 - 5: BAND 3- (It is the same function as BNDC△3-)
 - OFF: BAND AUTO (It is the same function as BNDC△AUTO)
 - [MS2687B] 0: BAND0 (It is the same function as BNDC△0)
 - 1: BAND1- (It is the same function as BNDC△1-)
 - 2: BAND1+ (It is the same function as BNDC△1+)
 - 3: BAND2+ (It is the same function as BNDC△2+)
 - 5: BAND4+ (It is the same function as BNDC△4+)
 - OFF: BAND AUTO (It is the same function as BNDC△AUTO)

■ **Suffix code** None

■ **Initial setting** OFF: BAND AUTO

■ **Example** HNLOCK△2

■ **Restrictions according to model type and options**

This command is effective about MS2683A and MS2687A/B.

“a = 7” is available when Option 03: Extension Pre-selector Lower Limit is installed.

HNUNLK**HNUNLK Band Select**

- **Function** Sets the band AUTO. (Same function as BNDC△AUTO, HNLOCK△OFF)

Header	Program command	Query	Response
HNUNLK	HNUNLK	_____	_____

- **Example** HNUNLK

HOLD**HOLD Erase Error message**

- **Function** Erase error message.

Header	Program command	Query	Response
HOLD	HOLD	_____	_____

HOLDPAUSE**HOLDPAUSE Max/Min Hold Sweep Mode**

- **Function** Specifies the processing (pause or continue) performed after the specified average sweeping is executed.

Header	Program command	Query	Response
HOLDPAUSE	HOLDPAUSE△a	HOLDPAUSE?	a

- **Value of a** ∅, OFF: Continue (∞)
2 to 1024
- **Suffix code** None
- **Initial setting** ∅: Continue (∞)
- **Example** HOLDPAUSE△32

HOSTADRS

HOSTADRS

■ **Function** Sets the Host address of Ethernet.

Header	Program command	Query	Response
HOSTADRS	HOSTADRS△n1 , n2 , n3 , n4	HOSTADRS?	n1 , n2 , n3 , n4

■ **Values of n1, n2, n3, n4**

0 to 255

■ **Suffix code** None

■ **Example** HOSTADRS△255 , 214 , 65 , 88

■ **Restrictions according to model type and options**

This command is available when Option 09: Ethernet interface is installed.

INI**INI Initialize**

- **Function** Initializes all measurement control parameters set to be initialized (same function as IP).

Header	Program command	Query	Response
INI	INI	_____	_____

- **Example** INI

INPTRNS**INPTRNS Input impedance Transformer**

- **Function** Selects 75 Ω Input Impedance Transformer (MA1621A).

Header	Program command	Query	Response
INPTRNS	INPTRNS Δ sw	INPTRNS?	sw

- **Value of sw** ON: 75 Ω Transformer used
OFF: 75 Ω Transformer not used (50 Ω)
- **Suffix code** None
- **Initial setting** OFF
- **Example** INPTRNS Δ ON

INZ

INZ Input impedance

■ **Function** Selects input impedance.

Header	Program command	Query	Response
INZ	INZ△n	INZ?	n

- **Value of n** 50: 50 Ohm
 75: 75 Ohm
- **Suffix code** None
- **Initial setting** 50: 50 Ohm
- **Example** INZ△75

IP

IP Initialize

■ **Function** Initializes all measurement control parameters set to be initialized (same function as INI).

Header	Program command	Query	Response
IP	IP	_____	_____

■ **Example** IP

IPADRS

IPADRS

- **Function** Sets the IP address of Ethernet of spectrum analyzer.

Header	Program command	Query	Response
IPADRS	IPADRS△n1 , n2 , n3 , n4	IPADRS?	n1 , n2 , n3 , n4

- **Values of n1, n2, n3, and n4**
0 to 255
- **Suffix code** None
- **Example** HOSTADRS△255 , 214 , 65 , 88
- **Restrictions according to model type and options**
This command is available when Option 09: Ethernet interface is installed.

KSA

KSA Unit for Log Scale

■ **Function** Sets the unit of LOG scale to dBm (same function as UNT△0).

Header	Program command	Query	Response
KSA	KSA	_____	_____

■ **Example** KSA

KSB

KSB Unit for Log Scale

■ **Function** Sets the unit of LOG scale to dBmV (same function as UNT△2).

Header	Program command	Query	Response
KSB	KSB	_____	_____

■ **Example** KSB

KSC**KSC Unit for Log Scale**

- **Function** Sets the unit of LOG scale to dBuV (same function as UNT△1).

Header	Program command	Query	Response
KSC	KSC	_____	_____

- **Example** KSC

KSD**KSD Unit for Log Scale**

- **Function** Sets the unit of LOG scale to V (same function as UNT△3).

Header	Program command	Query	Response
KSD	KSD	_____	_____

- **Example** KSD

KSE

KSE Title Entry

■ **Function** Registers the title character string (same function as TITLE).

Header	Program command	Query	Response
KSE	KSE△text	_____	_____

■ **Value of text** String of up to 32 characters enclosed by single or double quotes

■ **Example** KSE△"MS2683A"
KSE△'SPECTRUM ANALYZER'

KSG

KSG Average ON

■ **Function** Enables averaging.

Header	Program command	Query	Response
KSG	KSG	_____	_____

■ **Example** KSG

KSH**KSH Average OFF**

- **Function** Disables averaging to set the mode for waveform processing to NORMAL.

Header	Program command	Query	Response
KSH	KSH	_____	_____

- **Example** KSH

KSO**KSO Delta Marker to Span**

- **Function** Sets the delta marker frequency to the frequency span
(same function as MKR Δ 6, MKSP).

Header	Program command	Query	Response
KSO	KSO	_____	_____

- **Example** KSO

LDN

LDN Reference Level step down

■ **Function** Decreases the reference level by one step.

Header	Program command	Query	Response
LDN	LDN	_____	_____

■ **Example** LDN

LG

LG Scale

■ **Function** Sets the Y axis magnification and scale.

Header	Program command	Query	Response
LG	LG△1 LG△a	LG?	1

■ **Value of l**

- ∅: Sets the scaling function to linear mode.
- 1: 1 dB/div (sets the scaling function to logarithmic mode)
- 2: 2 dB/div (sets the scaling function to logarithmic mode)
- 5: 5 dB/div (sets the scaling function to logarithmic mode)
- 1∅: 10 dB/div (sets the scaling function to logarithmic mode)

■ **Value of a**

- UP: SCALE UP
- DN: SCALE DOWN

■ **Suffix code**

- None: dB/div
- DB, DBM, DM: dB/div

■ **Initial setting** 1∅: 10 dB/div

■ **Example** LG△UP
LG△5DB

LN**LN Linear Scale**

- **Function** Sets the Y axis scale to linear.

Header	Program command	Query	Response
LN	LN	_____	_____

- **Example** LN

LOS**LOS Level Offset Value**

- **Function** Sets the offset level.

Header	Program command	Query	Response
LOS	LOS Δ l	LOS?	LOS Δ l l=-100.00 to 100.00 Transfers the data with no suffix code in units of 1 dB.

- **Value of l** -100 to 100.00 dB
- **Suffix code** None : dB
DB : dB
- **Initial setting** \emptyset : 0 dB
- **Example** LOS Δ 2 . \emptyset 3DB

LSS

LSS Reference Level Step size (Manual)

■ **Function** Sets the step size (manual values) for increasing and decreasing the reference level.

Header	Program command	Query	Response
LSS	LSS Δ l	LSS?	LSS Δ l l=0.01 to 100.00 Transfers the data with no suffix code in units of 1 dB.

- **Value of l** 0.01 to 100.00 dB (0.01 dBstep)
- **Suffix code** None : dB
DB, DBM, DM: dB
- **Initial setting** Value of l = 10 dB
- **Example** LSS Δ 6
LSS Δ 1 \emptyset

LSSA

LSSA Reference Level Step Size (Auto)

■ **Function** Sets the step size (auto values) for increasing and decreasing the reference level during LOG SCALE operation.

Header	Program command	Query	Response
LSSA	LSSA Δ n	LSSA?	LSSA Δ n n=1,2,5,10

- **Value of n** 1 : 1 div
2 : 2 div
5 : 5 div
1 \emptyset : 10 div
- **Suffix code** None
- **Initial setting** 1 : 1 div
- **Example** LSSA Δ 1 \emptyset

LUP**LUP Reference Level step up**

- **Function** Increases the reference level by one step.

Header	Program command	Query	Response
LUP	LUP	_____	_____

- **Example** LUP

LVO**LVO Level Offset On/Off**

- **Function** Sets the level offset on or off.

Header	Program command	Query	Response
LVO	LVO△sw	LVO?	LVO△sw

- **Value of sw**
 - ∅: Off
 - 1: On
- **Suffix code** None
- **Initial setting** ∅: Off
- **Example** LVO△1

M1

M1 Marker Mode

■ Function Turns off the marker mode (same function as MKR Δ 2).

Header	Program command	Query	Response
M1	M1	_____	_____

■ Example M1

M2

M2 Marker Mode

■ Function Sets the marker mode to NORMAL mode (same function as MKR Δ 0).

Header	Program command	Query	Response
M2	M2	_____	_____

■ Example M2

M3

M3 Marker Mode

■ Function Sets the marker mode to delta marker mode (same function as MKR Δ 1).

Header	Program command	Query	Response
M3	M3	_____	_____

■ Example M3

MAC

MAC Marker Active

- **Function** Selects the active multi-marker.

Header	Program command	Query	Response
MAC	MAC△n	MAC?	MAC△n

- **Value of n** 1 to 10
- **Suffix code** None
- **Initial setting** 1: Marker 1
- **Example** MAC△5

MADJBWLN

MADJBWLN ADJ-CH Band Line

- **Function** Sets the display of the adjacent channel range line ON/OFF.

Header	Program command	Query	Response
MADJBWLN	MADJBWLN△sw	MADJBWLN?	sw

- **Value of sw** OFF: OFF
ON: ON
- **Suffix code** None
- **Initial setting** OFF: OFF
- **Example** MADJBWLN△OFF

MADJCTRLN

MADJCTRLN ADJ-CH Center Line

■ **Function** Sets the display of the adjacent channel center line ON/OFF.

Header	Program command	Query	Response
MADJCTRLN	MADJCTRLN△sw	MADJCTRLN?	sw

- **Value of sw** OFF: OFF
ON: ON
- **Suffix code** None
- **Initial setting** ON: ON
- **Example** MADJCTRLN△OFF

MADJGRAPH

MADJGRAPH Adjacent CH Graph

■ **Function** Sets the graph display function of ADJ-CH measure ON/OFF.

Header	Program command	Query	Response
MADJGRAPH	MADJGRAPH△sw	MADHGRAPH?	sw

- **Value of sw** OFF: Graph display function OFF
ON: Graph display function ON
- **Suffix code** None
- **Initial setting** ON: Graph display function ON
- **Example** MADJGRAPH△ON

MADJINBWLN

MADJINBWLN INBAND-CH Band Line

- **Function** Sets the display of the inband channel range line ON/OFF.

Header	Program command	Query	Response
MADJINBWLN	MADJINBWLN△sw	MADJINBWLN?	MADJINBWLN△sw

- **Value of sw** OFF: OFF
ON: ON
- **Suffix code** None
- **Initial setting** OFF: OFF
- **Example** MADJINBWLN△OFF

MADJMOD

MADJMOD ADJ-CH Measure Method

- **Function** Selects the calculation method of ADJ-CH measure.

Header	Program command	Query	Response
MADJMOD	MADJMOD△a	MADJMOD?	a

- **Value of a** MOD: Reference=Total Power (Mod method)
UNMD: Reference=Ref Level (Un-mod method)
INBAND: Reference=Inband (Inband Method)
- **Suffix code** None
- **Initial setting** MOD: Reference=Total Power (Mod Method)
- **Example** MADJMOD△MOD

MASK

MASK Select Mask

■ **Function** Selects the mask data used by the mask function.

Header	Program command	Query	Response
MASK	MASK△n	MASK?	n

- Value of n 1 to 5 (Mask No.)
- Suffix code None
- Initial setting 1
- Example MASK△1

MASKLOAD

MASKLOAD Load Mask data

■ **Function** Reads the mask data from the external file.

Header	Program command	Query	Response
MASKLOAD	MASKLOAD△n	_____	_____

- Value of n 1 to 999
- Suffix code None
- Example MASKLOAD△1

MASKMCL

MASKMCL Cancel Moving Value

- **Function** Cancels moving value of the mask.

Header	Program command	Query	Response
MASKMCL	MASKMCL	_____	_____

- **Example** MASKMCL

MASKMSV

MASKMSV Save Moved Mask Data

- **Function** Stores the moved mask data in the original mask data area.

Header	Program command	Query	Response
MASKMSV	MASKMSV	_____	_____

- **Example** MASKSV

MASKMVX

MASKMVX Mask Move X

- **Function** Moves the mask line along the X axis.

Header	Program command	Query	Response
MASKMVX	MASKMVX△f	MASKMVX?	f f=-100000000 to 3000000000 =-100000000 to 7900000000 =-100000000 to 30000000000

- **Value of f** [MS2681A] -100 MHz to 3.0 GHz
[MS2683A] -100 MHz to 7.9 GHz
[MS2687A/MS2687B] -100 MHz to 30.0 GHz
- **Suffix code** None : Hz
KHZ, KZ : KHz
MHZ, MZ : MHz
GHZ : MHz
- **Initial setting** ØHZ
- **Example** MASKMVX△1Ø6HZ

MASKMVY

MASKMVY Mask Move Y

- **Function** Moves the mask line along the Y axis.

Header	Program command	Query	Response
MASKMVY	MASKMVY△l	MASKMVY?	l

- **Value of l** -200.00 to 200.00 dB
- **Suffix code** None : dB
DB, DBM, DM : dB
- **Initial setting** Ø : 0 dB
- **Example** MASKMVY△-2.5dB

MASKSAVE

MASKSAVE Save Mask data

- **Function** Stores the interior mask data in the external file.

Header	Program command	Query	Response
MASKSAVE	MASKSAVE△n	_____	_____

- **Value of n** 1 to 999
- **Suffix code** None
- **Example** MASKSAVE△1

MASKSLCT

MASKSLCT Mask Limit Line Select

- **Function** Selects the LIMIT LINE used to evaluate the measured results using the mask functions.

Header	Program command	Query	Response
MASKSLCT	MASKSLCT△a, sw	MASKSLCT?△a	sw sw=ON,OFF

- **Value of a**
 - UP1 : Limit1 Upper
 - UP2 : Limit2 Upper
 - LW1 : Limit1 Lower
 - LW2 : Limit2 Lower
- **Value of sw**
 - ∅, OFF : Off
 - 1, ON : On
- **Suffix code** None
- **Initial setting** off
- **Example** MASKSLKT△UP1, ON

MBIAS

MBIAS EXT Mixer Bias

- **Function** Sets the external mixer's bias current.

Header	Program command	Query	Response
MBIAS	MBIAS Δ l	MBIAS?	l l=0 to 20.0

- **Value of l** 0 to 20.0 mA (0.1 mA resolution)
- **Suffix code** None
- **Initial configuration value** 0 (It is not initialized)
- **Example of use** MBIAS Δ 15.2
MBIAS?
- **Restrictions by apparatus and the option**
 - This command is effective about MS2687A/B.

MC

MC Frequency Counter

- **Function** Turns ON/OFF the function for measuring the marker frequency during display using the counter (same function as MEAS Δ FREQ).

Header	Program command	Query	Response
MC	MC Δ sw	_____	_____

- **Value of sw** ON : ON
OFF : OFF
- **Suffix code** None
- **Initial setting** OFF : OFF
- **Example** MC Δ ON
MC Δ OFF

MCL**MCL Clear Multi Marker**

- **Function** Deletes registrations of all multi-markers.

Header	Program command	Query	Response
MCL	MCL	_____	_____

- **Example** MCL

MCMSV**MCMSV System Version**

- **Function** Reads out the information of the system (measurement software) in the Signal Analysis mode.

Header	Program command	Query	Response
MCMSV	_____	MCMSV?△n	text1, text2

- **Value of n** 1 to 3 Signal Analysis system area number
- **Value of text1** the name of the measurement software (30 characters)
- **Value of text2** the revision of the measurement software
- **Example** MCMSV?△1

MEAS

MEAS Measure Function

■ **Function** Executes each item of the Measure functions when specified.

Header	Program command	Query	Response
MEAS	MEAS△data1,data2	MEAS?	data1 data1=OFF,FREQ,NOISE,OBW, ADJ,MASK,TEMP,POWER CHPWR,CN

■ **Value of data1,data2**

Format1: Specifies the measurement item and whether to switch it ON/OFF or execute it.

- OFF: Measurement off
- FREQ, ON: Frequency count ON
- FREQ, OFF: Frequency count OFF
- NOISE, ON: Noise calculation ON
- NOISE, OFF: Noise calculation OFF
- OBW, EXE: Executes the OBW calculation.
- ADJ, EXE: Executes the ADJ-CH calculation.
- TEMP, CHECK: Executes the template check.
- MASK, CHECK: Executes the mask check.
- POWER, EXE: Executes the burst power calculation.
(Valid only for Trace-Time)
- CHPWR, ON: Channel Power calculation ON
- CHPWR, OFF: Channel Power calculation OFF
- TEMP, ON: Template function ON
- TEMP, OFF: Template function OFF
- MASK, ON: Mask function ON
- MASK, OFF: Mask function OFF

Format2: Specifies the measurement item and calculation system. Then, specifies whether to switch it ON/OFF or execute it.

- NOISE, ABS: Sets the noisecalculatation (Absolute method) to ON.
- NOISE, CN: Sets the noise calculation (C/N ratio method) to ON.
- OBW, XDB: Executes the OBW calculation (X dB down method).
- OBW, N: Executes the OBW calculation (N% method).
- ADJ, UNMD: Executes the ADJ-CH calculation (R: Ref Level method).
- ADJ, MOD: Executes the ADJ-CH calculation (R: Total Power method).
- ADJ, INBAND: Executes the ADJ-CH calculation (R: Inband method).

MFR?**MFR? Multi Marker List Query (Frequency)**

- **Function** Reads the frequency data at the multi marker point.

Header	Program command	Query	Response
MFR?	_____	MFR?△n	MFR△f f=-100000000 to 3000000000 =-100000000 to 7800000000 =-100000000 to 30000000000 Transfers the data with no suffix code in units of 1 Hz.

- **Value of n** 1 to 10
- **Suffix code** None

MHI**MHI Highest 10 (Multi Marker)**

- **Function** Registers the multi markers at 10 peak points starting from the highest level.

Header	Program command	Query	Response
MHI	MHI	_____	_____

- **Example** MHI
MZWF△1MHZ

MHM

MHM Harmonics (Multi Marker)

- **Function** Registers the multi markers to the 10th harmonic max., based on the frequency of the active marker.

Header	Program command	Query	Response
MHM	MHM	_____	_____

- **Example** MHM

MKA?

MKA? Read Marker Level

- **Function** Reads out the level data at the marker point. At the delta marker point, the level differences are read out (same function as MKL?).

Header	Program command	Query	Response
MKA?	_____	MKA?	l v w

- **Value of l** No unit. Level data in units of 1 dB (when display unit system for marker level is dB). Resolution is 0.01 dB.
- **Value of v** No unit. Level data in units of 1 nV (when display unit system for marker level is V). Resolution is 0.1 nV.
- **Value of w** No unit. Level data in units of 1 μ W (when display unit system for marker level is W). Resolution is 1 aW.
- **Example** MKA?

MKACT**MKACT Marker Active**

- **Function** Selects the active multi markers.

Header	Program command	Query	Response
MKACT	MKACT△n	MKACT?	n

- **Value of n** 1 to 10 (Multi marker No.)
- **Suffix code** None
- **Initial setting** 1 : 1
- **Example** MKACT△1

MKC**MKC Frequency Counter**

- **Function** Turns ON/OFF the function for measuring the marker frequency during display using the counter (same function as MEAS△FREQ).

Header	Program command	Query	Response
MKC	MKC△sw	MKC?	MKC△sw

- **Value of sw** 0 : OFF
 1 : ON
- **Suffix code** None
- **Initial setting** 0 : OFF
- **Example** MKC△0
 MKC△1

MKCF

MKCF **Marker to CF**

■ **Function** Sets the marker to the center frequency (same function as MKR Δ 3, E2).

Header	Program command	Query	Response
MKCF	MKCF	_____	_____

■ **Example** MKCF

MKD

MKD **Delta Marker Mode**

■ **Function** Sets the marker mode to the delta marker mode.

Header	Program command	Query	Response
MKD	MKD	_____	_____

■ **Example** MKD

MKF?

MKF? Marker Frequency Read

- **Function** Reads out the frequency or time data at the marker point. In the delta marker mode, the frequency or time differences are read out.

Header	Program command	Query	Response
MKF?	_____	MKF?	f t

- **Value of f** No unit, frequency data with 1 Hz unit, Resolution 0.1 Hz
- **Value of t** No unit, time data with 1 μ s unit, Resolution 0.1 μ s
- **Example** MKF?

MKFC

MKFC Frequency Counter

- **Function** Turns ON/OFF the function for measuring the marker frequency during display using the counter (same function as MEAS Δ FREQ).

Header	Program command	Query	Response
MKFC	MKFC Δ sw	MKFC?	sw

- **Value of sw** 1, ON : ON
0, OFF : OFF
- **Suffix code** None
- **Initial setting** 0 : OFF
- **Example** MKFC Δ 0
MKFC Δ ON

MKFCR

MKFCR Count Resolution

■ **Function** Selects the resolution of the frequency counter.

Header	Program command	Query	Response
MKFCR	MKFCR△f MKFCR△a	MKFCR?	f f=1,10,100,1000 Transfers data withno suffix code in units of 1 Hz.

■ **Value of f** 1Hz
1ØHz
1ØØHz
1kHz

■ **Value of a** UP: UP
DN: DOWN

■ **Suffix code** None: Hz(10^0)
HZ: Hz(10^0)
KHZ, KZ: kHz(10^3)
MHZ, MZ: MHz(10^6)
GHZ, GZ: GHz(10^9)

■ **Initial setting** 1kHz

■ **Example** MKFCR△1HZ
MKFCR△UP

MKL?

MKL? Read Marker Level

- **Function** Reads out the level data at the marker point. In the delta marker mode, the level differences are read out.

Header	Program command	Query	Response
MKL?	_____	MKL?	l v w

- **Value of l** No unit. Level data in units of 1 dB (when display unit system for marker level is dB). Resolution is 0.01 dB.
- **Value of v** No unit. Level data in units of 1 nV (when display unit system for marker level is V). Resolution is 0.1 nV.
- **Value of w** No unit. Level data in units of 1 μ W (when display unit system for marker level is W). Resolution is 1 aW.
- **Example** MKL?

MKLFREQ

MKLFREQ Multi Marker List Freq Absolute/Relative

- **Function** Sets the multi marker list frequency (hour) display to relative or in absolute values.

Header	Program command	Query	Response
MKLFREQ	MKLFREQ Δ a	MKLFREQ?	a

- **Value of a** ABS : Absolute
REL : Relative
- **Suffix code** None
- **Initial setting** ABS : Absolute
- **Example** MKLFREQ Δ REL

MKLIST

MKLIST Multi Marker List

- **Function** Turns ON/OFF the multi marker list.

Header	Program command	Query	Response
MKLIST	MKLIST sw	MKLIST?	sw sw=ON,OFF

- **Value of sw** 1, ON: ON
Ø, OFF: OFF
- **Suffix code** None
- **Initial setting** OFF: OFF
- **Example** MKLIST ON

MKLLVL

MKLLVL Multi Marker List Level Absolute/Relative

- **Function** Sets the multi marker list level display to relative or absolute values.

Header	Program command	Query	Response
MKLLVL	MKLLVL△a	MKLLVL?	a

- **Value of a** ABS: Absolute
REL: Relative
- **Suffix code** None
- **Initial setting** ABS: Absolute
- **Example** MKLLVL△REL

MKMCL**MKMCL Clear Multi Marker**

■ **Function** Clears all the registered multi markers.

Header	Program command	Query	Response
MKMCL	MKMCL	_____	_____

■ **Example** MKMCL

MKMFL?**MKMFL? Multi Marker All level/frequency Query**

■ **Function**

Header	Program command	Query	Response
MKMFL?	_____	MKMFL?	f1, l1, f2, l2 . . . fn, ln

Multimarkers 1 to 10 sequentially output the frequency/time data and level data when they are ON.

- fi: For Trace-A or B, the frequency, no units, and Hz units are output.
For Trace-Time, the time, no units, and 1 μ s units are output.
- li: The following values are output according to the level data, no units, and marker level indication units:

For dB units.	Level data in 1 dB units, resolution:	0.01 dB
For V.	Level data in 1 nV units, resolution:	0.1 nV
For W.	Level data in 1 μ W units, resolution:	1 aW

MKMHI

MKMHI Multi Marker

- Function** Registers multi markers at the peak point from the maximum level down to the tenth in descending order. (HIGHEST 10)

Header	Program command	Query	Response
MKMHI	MKMHI	_____	_____

- Example** MKMHI

MKMHRM

MKMHRM Multi Marker

- Function** Registers multi markers at the harmonic frequency ranging from the reference active marker frequency up to the tenth. (HARMONICS)

Header	Program command	Query	Response
MKMHRM	MKMHRM	_____	_____

- Example** MKMHRM

MKMIN**MKMIN Minimum Search**

- **Function** Finds the minimum point of the spectrum being displayed and moves the marker to that point.

Header	Program command	Query	Response
MKMIN	MKMIN	_____	_____

- **Example** MKMIN

MKML?**MKML? Multi Marker List Query (Level)**

- **Function** Reads out the level data at multi markers.

Header	Program command	Query	Response
MKML?	_____	MKML?△n	l v w

- **Value of n** 1 to 10 (multi marker No.)
- **Value of l** No unit. Level data in units of 1 dB (when display unit system for marker level is dB). Resolution is 0.01 dB.
- **Value of v** No unit. Level data in units of 1 nV (when display unit system for marker level is V). Resolution is 0.1 nV.
- **Value of w** No unit. Level data in units of 1 μ W (when display unit system for marker level is W). Resolution is 1 aW.
- **Suffix code** None

MKMP

MKMP Marker Position

■ **Function** Specifies the frequency of a specified multi marker number.

Header	Program command	Query	Response
MKMP	MKMP Δ n, f	MKMP? Δ n	f f=-100000000 to 3000000000 (MS2681A) f=-100000000 to 7900000000 (MS2683A) f=-100000000 to 30000000000 (MS2687A/MS2687B) Transfers the data with no suffix code in units of 1 Hz.

- Value of n 1 to 10 (multi marker No.)
- Value of f -100 MHz to 3.0 GHz (MS2681A)
-100 MHz to 7.9 GHz (MS2683A)
-100 MHz to 30.0 GHz (MS2687A/MS2687B)
- Suffix code None: Hz(10⁰)
HZ: Hz(10⁰)
KHZ, KZ: kHz(10³)
MHZ, MZ: MHz(10⁶)
GHZ, GZ: GHz(10⁹)
- Example MKMP Δ 5, 2400KZ

MKMPKH

MKMPKH Marker Multi Peak Hold

■ **Function** Registers multimarkers on each the nearest 5 peak points from the current marker to the right/left sides.

Header	Program command	Query	Response
MKMPKH	MKMPKH	_____	_____

■ **Example** MKMPKH

MKMULTI**MKMULTI Multi Marker**

- **Function** Turns ON/OFF the multi marker.

Header	Program command	Query	Response
MKMULTI	MKMULTI△sw	MKMULTI?	sw sw=ON,OFF

- **Value of sw** 1, ON: ON
Ø, OFF: OFF
- **Suffix code** None
- **Initial setting** OFF: OFF
- **Example** MKMULTI△ON

MKN**MKN Marker Position**

- **Function** Specifies the zone marker center position on the X axis in the frequency or time unit.

Header	Program command	Query	Response
MKN	MKN△f MKN△t MKN△a	MKN?	f, t f=-100000000 to 0 to 300000000 f=-100000000 to 0 to 7900000000 f=-100000000 to 0 to 3000000000 Transfers the data with no suffix code in units of 1 Hz. t=-1000000000 to 1000000000 Transfers the data with no suffix code in units of 1 μs.

- **Value of f** [MS2681A]
-100 MHz to 3.0 GHz (It specified, when effective trace is A., B, BG)
[MS2683A]
-100 MHz to 7.9 GHz (It specified, when effective trace is A., B, BG)
[MS2687A/MS2687B]
-100 MHz to 30.0 GHz (It specified, when effective trace is A., B, BG)
- **Value of t** -1000 s to 1000 s (specified when the valid trace is TIME)
- **Value of a** UP:
DN: DOWN
- **Suffix code** f: None: Hz(10⁰)
HZ: Hz(10⁰)
KHZ, KZ: kHz(10³)
MHZ, MZ: MHz(10⁶)
GHZ, GZ: GHz(10⁹)
t: None: ms
US: μs
MS: ms
S: s
- **Example** MKN△1ØØMHZ
MKN△UP
MZWF△1

MKOFF

MKOFF Marker Mode

- Function Turns off the marker mode.

Header	Program command	Query	Response
MKOFF	MKOFF△a	_____	_____

- Value of a ALL : Marker off
None : Marker off
- Suffix code None
- Example MKOFF△ALL
MKOFF

MKP

MKP Marker Position

- Function Specifies the zone marker center position on the X axis in the point unit (same function as MKZ).

Header	Program command	Query	Response
MKP	MKP△p	MKP?	p p=0 to 500, 1000

- Value of p 0 to 500, 1000
- Suffix code None
- Initial setting Value of p=250
- Example MKP△250
MKP△500

MKPK

MKPK Peak Search

- **Function** Searches the spectrum being displayed for one of the special points, and moves the marker to that point.

Header	Program command	Query	Response
MKPK	MKPK△a	_____	_____

- **Value of a** None : SEARCH PEAK(MAX)
HI : SEARCH PEAK(MAX)
NH : SEARCH NEXT PEAK
- **Suffix code** None
- **Example** MKPK△HI

MKPX

MKPX Peak Resolution (Excursion)

- **Function** Switches the marker mode and executes the 'MKR to 'functions.

Header	Program command	Query	Response
MKPX	MKPX△l	MKPX?	l l=0.01 to 50.00, 1000 Transfers the data with no suffix code in units of 1 dB.

- **Value of l** 0.01 to 50.00 dB
- **Suffix code** None : dB
DB : dB
- **Initial setting** 5.0 : 5 dB
- **Example** MKPX△10DB

MKR

MKR Marker Mode

■ **Function** Switches the marker mode and executes the 'MKR to 'functions.

Header	Program command	Query	Response
MKR	MKR△n	MKR?	n n=0 to 7

■ **Value of n**

- ∅: NORMAL
- 1: DELTA
- 2: OFF
- 3: MKR to CF
- 4: MKR to REF
- 5: MKR to CF step size
- 6: △MKR to SPAN
- 7: ZONE to SPAN

■ **Suffix code** None

■ **Initial setting** ∅: NORMAL

■ **Example** MKR△∅

MKRL

MKRL Marker to REF

■ **Function** Sets the detection resolution of the peak point.

Header	Program command	Query	Response
MKRL	MKRL	_____	_____

■ **Example** MKRL

MKS**MKS Peak Search**

- **Function** Searches the spectrum being displayed for one of the special points, and moves the marker to that point.

Header	Program command	Query	Response
MKS	MKS△n n=0 to 2, 11	_____	_____

- **Value of n**
 - ∅ : SEARCH PEAK (MAX)
 - 1 : SEARCH NEXT PEAK
 - 2 : SEARCH DIP (MIN)
 - 11 : SEARCH NEXT DIP
- **Suffix code** None
- **Example** MKS△∅

MKSLCT**MKSLCT Select Multi Marker**

- **Function** Selects one of the multi markers (1 to 10) and sets it to ON or OFF.

Header	Program command	Query	Response
MKSLCT	MKSLCT△n, sw	MKSLCT?△n	sw sw=ON,OFF

- **Value of n** 1 to 10 (multi marker No.)
- **Value of sw**
 - 1, ON: ON
 - ∅, OFF: OFF
- **Suffix code** None
- **Initial setting** OFF: OFF
- **Example** MKSLCT△3, ON

MKSP

MKSP Delta Marker to Span

■ **Function** Sets the delta marker frequency to the span (same function as MKR Δ 6,KSO).

Header	Program command	Query	Response
MKSP	MKSP	_____	_____

■ **Example** MKSP

MKSRCH

MKSRCH Marker Search Mode

■ **Function** Sets the marker search mode.

Header	Program command	Query	Response
MKSRCH	MKSRCH Δ a	MKSRCH?	a

■ **Value of a** PEAK: Peak Marker

DIP: Dip Marker

■ **Suffix code** None

■ **Initial setting** PEAK: Peak Marker

■ **Example** MKSRCH Δ PEAK

MKSS

MKSS Marker to CF Step Size

- **Function** Sets the marker frequency as the frequency step size (same function as MKR Δ 5,E3).

Header	Program command	Query	Response
MKSS	MKSS	_____	_____

- **Example** MKSS

MKTRACE

MKTRACE Active Marker Trace

- **Function** Specifies the trace for displaying the marker when the display format is trace A on B.

Header	Program command	Query	Response
MKTRACE	MKTRACE Δ tr	MKTRACE?	tr

- **Value of tr** TRA: Trace A
TRB: Trace B
- **Suffix code** None
- **Initial setting** TRA: Trace A
- **Example** MKTRACE Δ TRB

MKTRACK

MKTRACK Tracking ON/OFF

- **Function** Sets the signal tracking function to ON/OFF.

Header	Program command	Query	Response
MKTRACK	MKTRACK△sw	MKTRACK?	sw sw=ON.OFF

- **Value of sw** 1, ON: ON
Ø, OFF: OFF
- **Suffix code** None
- **Initial setting** OFF: OFF
- **Example** MKTRACK△ON

MKW

MKW Zone Marker Width

- **Function** Specifies the zone marker width in the div unit.

Header	Program command	Query	Response
MKW	MKW△n	MKW?	MKW△n a=0 to 2,5 to 7

- **Value of n** Ø: 0.5 div
1: Spot
2: 10 div
5: 1 div
6: 2 div
7: 5 div
- **Suffix code** None
- **Initial setting** 5: 1 div
- **Example** MKW△1
MKW△5

MKZ**MKZ Zone Marker Position**

- **Function** Specifies the zone marker center position on the X axis in the point unit (same function as MKP).

Header	Program command	Query	Response
MKZ	MKZ△p	MKZ?	MKZ△p

- **Value of p** 0 to 500, 1000
- **Suffix code** None
- **Initial setting** Value of p=250
- **Example** MKZ△250
MKZ△500

MKZF

MKZF Zone Marker Position

- Function** Specifies the zone marker center position on the X axis in frequency domain or zero span mode.

Header	Program command	Query	Response
MKZF	MKZF△f MKZF△t	MKZF?	f t f=-100000000 to 3000000000 =-100000000 to 7900000000 =-100000000 to 30000000000 Transfers the data with no suffix code in units of 1 Hz. t=-1000000000 to 1000000000 Transfers the data with no suffix code in units of 1 μs.

- Value of f** [MS2681A]
 -100 MHz to 3.0 GHz (It specifies, when effective trace is A., B, BG)
 [MS2683A]
 -100 MHz to 7.9 GHz (It specifies, when effective trace is A., B, BG)
 [MS2687A/MS2687B]
 -100 MHz to 30.0 GHz (It specifies, when effective trace is A., B, BG)

- Value of t** -1000 s to 1000 s (specified when the valid trace is TIME)

- Suffix code**

f :	None :	Hz(10 ⁰)
	HZ :	Hz(10 ⁰)
	KHZ , KZ :	kHz(10 ³)
	MHZ , MZ :	MHz(10 ⁶)
	GHZ , GZ :	GHz(10 ⁹)
t :	None :	ms
	US :	μs
	MS :	ms
	S :	s

- Example**

```
MKZF△100MHZ
MKZF△1200000000
```

MLI**MLI Multi Marker List**

- **Function** Executes On/Off to the multi marker list.

Header	Program command	Query	Response
MLI	MLI△sw	MLI?	MLI△sw sw=0,1

- **Value of sw** ∅, OFF: Off
 1, ON: On
- **Suffix code** None
- **Initial setting** 1: On
- **Example** MLI△∅

MLO**MLO Multi Marker Off**

- **Function** Turns OFF the multi marker function.

Header	Program command	Query	Response
MLO	MLO	_____	_____

- **Example** MLO

MLR?

MLR? Multi Marker List Query (Level)

- **Function** Reads out the level data at the multi marker point.

Header	Program command	Query	Response
MLR?	_____	MLR?△n	MLR△l v w

- **Value of n** 1 to 10
- **Value of l** No unit. Level data in units of 1 dB (when display unit system for marker level is dB). Resolution is 0.01 dB.
- **Value of v** No unit. Level data in units of 1 nV (when display unit system for marker level is V). Resolution is 0.1 nV.
- **Value of w** No unit. Level data in units of 1 μW (when display unit system for marker level is W). Resolution is 1 aW.

MMASK

MMASK Select Mask

- **Function** Selects one of masks 1 to 5 used for mask management functions.

Header	Program command	Query	Response
MMASK	MMASK△n	MMASK?	n

- **Value of n** 1 to 5 (mask No.)
- **Suffix code** None
- **Initial setting** 1
- **Example** MMASK△1

MMASKDEL

MMASKDEL Delete MASK

- **Function** Removes one point from the mask data.

Header	Program command	Query	Response
MMASKDEL	MMASKDEL△p	_____	_____

- **Value of p** 1 to 32 (Point No.)
- **Suffix code** None
- **Initial setting** (None)
- **Example** MMASKDEL△1Ø

MMASKDSP

MMASKDSP Mask Display Mode

- **Function** Specifies how the mask management screen is displayed.

Header	Program command	Query	Response
MMASKDSP	MMASKDSP△a	MMASKDSP?	a a=GRAPH,LIST

- **Value of a** GRAPH: GRAPH
LIST: LIST
- **Suffix code** None
- **Initial setting** GRAPH
- **Example** MMASKDSP△GRAPH

MMASKIN

MMASKIN Insert Point

■ **Function** Adds one point to the mask data.

Header	Program command	Query	Response
MMASKIN	MMASKIN△p, f, l	_____	_____

- **Value of p** 1 to 32 (Point No.)
- **Value of f** [MS2681A] 0 to 3.0 GHz
 [MS2683A] 0 to 7.9 GHz
 [MS2687A/MS2687B] 0 to 325 GHz
- **Value of l** 200.00 to 200.00 dBm (ABSOLUTE)
 200.00 to 200.00 dB (RELATIVE)
- **Suffix code**
 - p: None
 - f: None: Hz
 - Hz: Hz
 - KHZ, KZ: KHz
 - MHZ, MZ: MHz
 - GHZ: GHz
 - l: None
 - DB, DBM, DM: dB or dBm
- **Initial setting** (None)
- **Example** MMASKIN△3, 100MHZ, -20.5DBM

MMASKINI**MMASKINI Initiate Line / Mask**

- **Function** Initializes the template limit line data.

Header	Program command	Query	Response
MMASKINI	MASKINI△a	_____	_____

- **Value of a**
 - UP1 : LIMIT 1 UPPER
 - UP2 : LIMIT 2 UPPER
 - LW1 : LIMIT 1 LOWER
 - LW2 : LIMIT 2 LOWER
- **Suffix code** None

MMASKL**MMASKL Select Line**

- **Function** Selects the type of limit lines used for mask management functions.

Header	Program command	Query	Response
MMASKL	MMASKL△a	MMASKL?	a

- **Value of a**
 - UP1 : LIMIT 1 UPPER
 - UP2 : LIMIT 2 UPPER
 - LW1 : LIMIT 1 LOWER
 - LW2 : LIMIT 2 LOWER
- **Suffix code** None

MMASKLABEL

MMASKLABEL Mask Label

■ **Function** Specifies the mask label (name).

Header	Program command	Query	Response
MMASKLABEL	MMASKLABEL△n, text	MMASKLABEL?n	text

- **Value of n** 1 to 5 (Mask No.)
- **Value of text** Character string within 30 words enclosed by single or double quotes.
- **Suffix code** None
- **Initial setting** (None)
- **Example** MMASKLABEL△1, "std-01"
MMASKLABEL△2, 'CHECK01'

MMASKPD?

MMASKPD? Read Limit Line Point Data

■ **Function** Reads out one point of the mask data.

Header	Program command	Query	Response
MMASKPD?	_____	MMASKPD?△p	f l f=0 to 3000000000 =0 to 7900000000 =0 to 32500000000 Transfers the data with no suffix code in units of 1 Hz. l=-200.00 to 200.00 Transfers the data with no suffix code in units of 1 dB.

- **Value of p** 1 to 32 (Point No.)
- **Suffix code** None
- **Initial setting** (None)
- **Example** MMASKPD?△1

MMASKREL

MMASKREL Template Level Mode

- **Function** Allows the mask level data to be set in relative or absolute values.

Header	Program command	Query	Response
MMASKREL	MMASKREL△sw	MMASKREL?	sw

- **Value of sw** ON: RELATIVE
OFF: ABSOLUTE
- **Suffix code** None
- **Initial setting** OFF: ABSOLUTE
- **Example** MMASKREL△ON

MMASKRP

MMASKRP Replace Point

- **Function** Replaces one point of the mask data.

Header	Program command	Query	Response
MMASKRP	MMASKRP△p, f, l	_____	_____

- **Value of p** 1 to 32 (Point No.)
- **Value of f** [MS2681A] 0 to 3.0 GHz
[MS2683A] 0 to 7.9 GHz
[MS2687A/MS2687B] 0 to 325 GHz
- **Value of l** -200.00 to 200.00 dBm (ABSOLUTE)
-200.00 to 200.00 dB (RELATIVE)
- **Suffix code** p: None
f: None: Hz
Hz: Hz
KHZ, KZ: KHz
MHZ, MZ: MHz
GHZ: GHz
l: None: dB or dBm
DB, DBM, DM: dB or dBm
- **Initial setting** (None)
- **Example** MMASKRP△10.7MHZ, -20.5DBM

MNOISE

MNOISE Noise Measure Method

■ **Function** Selects the calculation method for noise measurement.

Header	Program command	Query	Response
MNOISE	MNOISE△a	MNOISE?	a

- **Value of a** ABS : Absolute method
 CN : C/N Ratio method
- **Suffix code** None
- **Initial setting** ABS : Absolute method
- **Example** MNOISE△ABS

MOBW

MOBW OBW Measure Method

■ **Function** Selects the calculation method for OBW.

Header	Program command	Query	Response
MOBW	MOBW△a	MOBW?	a

- **Value of a** XDB : XdB Down method
 N : N% method
- **Suffix code** None
- **Initial setting** N : N% method
- **Example** MOBW△N

MOV**MOV Move Trace**

- **Function** Copies the specified trace wave data.

Header	Program command	Query	Response
MOV	MOV△tr1, tr2	_____	_____

- **Value of tr1, tr2** TRA: Trace-A
 TRB: Trace-B
- **Suffix code** None
- **Example** MOV△TRA, TRB

MPS**MPS Marker Position**

- **Function** Specifies the position of a specified multi marker.

Header	Program command	Query	Response
MPS	MPS△n, p	MPS?△n	MPS△p

- **Value of n** 1 to 10
- **Value of p** 0 to 500, 1000
- **Suffix code** None
- **Initial setting** 0: Left side of the wave display
- **Example** MPS△1, 250

MSE

MSE Select Multi Marker

■ **Function** Sets a specified multi marker on or off.

Header	Program command	Query	Response
MSE	MSE△n, sw	MSE?△n	MSE△sw sw=0,1

- **Value of n** 1 to 10
- **Value of sw** Ø, OFF: Off
1, ON: On
- **Suffix code** None
- **Initial setting** 1, 1: Marker 1: On
2 to 10, Ø: Markers 2 to 10: Off
- **Example** MSE△2, ON

MTØ

MTØ Tracking OFF

■ **Function** Sets the signal tracking function to OFF.

Header	Program command	Query	Response
MTØ	MTØ	_____	_____

■ **Example** MTØ

MT1**MT1 Tracking ON**

- **Function** Sets the signal tracking function to ON.

Header	Program command	Query	Response
MT1	MT1	_____	_____

- **Example** MT1

MTEMP**MTEMP Select Template**

- **Function** Selects one of templates 1 to 5 used for template management functions.

Header	Program command	Query	Response
MTEMP	MTEMP△n	MTEMP?	n

- **Value of n** 1 to 5 (template No.)
- **Suffix code** None
- **Initial setting** 1
- **Example** MTEMP△1

MTEMPDEL

MTEMPDEL Delete Template

■ **Function** Deletes one point of the template data.

Header	Program command	Query	Response
MTEMPDEL	MTEMPDEL△p	_____	_____

- **Value of p** 1 to 32 (Point No.)
- **Suffix code** None
- **Initial setting** (None)
- **Example** MTEMPDEL△1Ø

MTEMPDSP

MTEMPDSP Template Display Mode

■ **Function** Specifies how the template management screen is displayed.

Header	Program command	Query	Response
MTEMPDSP	MTEMPDSP△a	MTEMPDSP?	a

- **Value of a** GRAPH: GRAPH
LIST: LIST
- **Suffix code** None
- **Initial setting** GRAPH
- **Example** MTEMPDSP△GRAPH

MTEMPIN

MTEMPIN Insert Point

- Function Adds one point to the template data.

Header	Program command	Query	Response
MTEMPIN	MTEMPIN Δ p, t, l	_____	_____

- Value of p 1 to 32 (Point No.)
- Value of t -1000 to 1000 s
- Value of l -200.00 to 200.00 dBm (ABSOLUTE)
-200.00 to 200.00 dB (RELATIVE)
- Suffix code
 - p: None
 - t: None: ms
US: μ s
MS: ms
S: s
 - l: None: dB or dBm
DB, DBM, DM: dB or dBm
- Initial setting (None)
- Example MTEMPIN Δ 3.10MS, -20.5DBM

MTEMPINI

MTEMPINI Initiate Line / Template

- Function Initializes the template limit line data.

Header	Program command	Query	Response
MTEMPINI	MTEMPINI Δ a	_____	_____

- Value of a
 - UP1: LIMIT 1 UPPER
 - UP2: LIMIT 2 UPPER
 - LW1: LIMIT 1 LOWER
 - LW2: LIMIT 2 LOWER
- Suffix code None
- Initial setting UP1
- Example MTEMPINI Δ UP1

MTEMPL

MTEMPL Select Line

- **Function** Selects the type of limit lines used for template management functions.

Header	Program command	Query	Response
MTEMPL	MTEMPL△a	MTEMPL?	a

- **Value of a**
 - UP1 : LIMIT 1 UPPER
 - UP2 : LIMIT 2 UPPER
 - LW1 : LIMIT 1 LOWER
 - LW2 : LIMIT 2 LOWER
- **Suffix code** None
- **Initial setting** UP1
- **Example** MTEMPLE△UP1

MTEMPLABEL

MTEMPLABEL Template Label

- **Function** Specifies the template label (name).

Header	Program command	Query	Response
MTEMPLABEL	MTEMPLABEL△n, text	MTEMPLABEL?n	text

- **Value of n** 1 to 5 (Template No.)
- **text** Character string within 30 words enclosed by single or double quotes.
- **Suffix code** None
- **Initial setting** (None)
- **Example**
 - MTEMPLABEL△1, "RCR-28"
 - MTEMPLABEL△2, 'CHECKØ1'

note: This setting is valid only by the remote command.

MTEMPPD?

MTEMPPD? Read Limit Line Point Date

- Function Reads out one point of the template data.

Header	Program command	Query	Response
MTEMPPD?	_____	MTEMPPD? Δ p p=1 to 32	t, l t=-1000000000 to 1000000000 Transfers the data with no suffix code in units of 1 μ s. l=-200.00 to 200.00 Transfers the data with no suffix code in units of 1 dB.

- Value of p 1 to 32 (Point No.)
- Suffix code None
- Initial setting (None)
- Example MTEMPPD? Δ 1

MTEMPREL

MTEMPREL Template Level Mode

- Function Allows the template level data to be set in relative or absolute values.

Header	Program command	Query	Response
MTEMPREL	MTEMPREL Δ sw	MTEMPREL?	sw

- Value of sw ON: RELATIVE
OFF: ABSOLUTE
- Suffix code None
- Initial setting OFF ABSOLUTE
- Example MTEMPREL Δ ON

MTEMPRP

MTEMPRP Replace Point

- **Function** Replaces one point of the template data.

Header	Program command	Query	Response
MTEMPRP	MTEMPRP Δ p, t, l	_____	_____

- **Value of p** 1 to 32 (Point No.)
- **Value of t** -1000 to 1000sec
- **Value of l** -200.00 to 200.00 dBm (ABSOLUTE)
-200.00 to 200.00 dB (RELATIVE)
- **Suffix code**
 - p: None
 - t: None: msec
US: μ sec
MS: msec
S: sec
 - l: None: dB or dBm
DB, DBM, DM: dB or dBm
- **Initial setting** None
- **Example** MTEMPRP Δ 3.1 \emptyset MS, -2 \emptyset .5DBM

MXMH

MXMH Max Hold

- **Function** Sets the mode for processing the trace waveform to MAX HOLD.

Header	Program command	Query	Response
MXMH	MXMH Δ tr	_____	_____

- **Value of tr** TRA: Trace A
TRB: Trace B
- **Suffix code** None
- **Example** MXMH Δ TRA

MXRMODE

MXRMODE Mixer Mode

- **Function** Sets the mixer mode to either an internal mixer or an external mixer

Header	Program command	Query	Response
MXRMODE	MXRMODE△a	MXRMODE?	A

- **Value of a** INT: INTERNAL
EXT: EXTERNAL
- **Suffix code** None
- **Initial configuration value** INT: INTERNAL
- **Example of use** MXRMODE△INT
- **Restrictions by apparatus and the option**
 - This command is effective about MS2687A/B.

MZW

MZW Zone Marker Width

- **Function** Specifies the zone marker width on the X axis in the point unit.

Header	Program command	Query	Response
MZW	MZW△p	MZW?	MZW△p

- **Value of p** 1 to 501, 1001
- **Suffix code** None
- **Initial setting** w=51
- **Example** MZW△1
MZW△51
MZW△501

MZWF

MZWF Zone Marker Width

■ **Function** Specifies the zone marker width on the X axis in one of the frequency units.

Header	Program command	Query	Response
MZWF	MZWF Δ f	MZWF?	f f=1 to 3000000000 =1 to 7900000000 =1 to 30000000000 Transfers the data with no suffix code in units of 1 Hz

■ **Value of f**

- [MS2681A] 1 to 3.0 GHz
- [MS2683A] 1 to 7.9 GHz
- [MS2687A] 1 to 30.0 GHz

■ **Suffix code**

- None: Hz(10^0)
- HZ: Hz(10^0)
- KHZ, KZ: kHz(10^3)
- MHZ, MA: MHz(10^6)
- GHZ, GZ: GHz(10^9)

■ **Initial configuration value**

- [MS2681A] Width equivalent to 1 div (300 MHz)
- [MS2683A] Width equivalent to 1 div (790 MHz)
- [MS2687A] Width equivalent to 1 div (3 GHz)

■ **Example**

```
MZWF  $\Delta$  1 $\emptyset\emptyset$ 
MZWF  $\Delta$  1MHZ
```


NETMASK

NETMASK

- **Function** Sets the Netmask address of Ethernet.

Header	Program command	Query	Response
NETMASK	NETMASK△n1 , n2 , n3 , n4	NETMASK?	n1 , n2 , n3 , n4

- **Values of n1, n2, n3, and n4**

0 to 255

- **Suffix code**

None

- **Example**

NETMASK△255 , 255 , 255 , 0

- **Restrictions according to model type and options**

This command is available when Option 09: Ethernet interface is installed.

NLV

NLV

Noise Measure Execute

- **Function** Calculates the Noise measure after sweep.

Header	Program command	Query	Response
NLV	NLV△sw	NLV?	NLV△sw

- **Value of sw**

∅ : Off

1 : On

- **Suffix code**

None

- **Example**

NLV△1

OBWN

OBWN OBW N% Value

■ **Function** Sets the conditions of the occupied frequency bandwidth in units of 1%.

Header	Program command	Query	Response
OBWN	OBWN△n	OBWN?	n

- **Value of n** 0.01 to 99.99 (0.01 step) : 0.01 to 99.99% (0.01%step)
- **Suffix code** None
- **Initial setting** 99%
- **Example** OBWN△8Ø

OBWXDB

OBWXDB OBW XdB Value

■ **Function** Sets the conditions of the occupied frequency bandwidth in units of 1 dB.

Header	Program command	Query	Response
OBWXDB	OBWXDB△l	OBWXDB?	l

- **Value of l** 0.01 to 100 (0.01 step) : 0.01 to 100 dB (0.01 dB step)
- **Suffix code** None : dB
DB : dB
- **Initial setting** 25dB
- **Example** OBWXDB△6DB

PCF

PCF Peak to Center Frequency

- **Function** Finds the maximum point of the spectrum being displayed, and sets the center frequency to that point.

Header	Program command	Query	Response
PCF	PCF	_____	_____

- **Example** PCF

PCOUNT?

PCOUNT? Peak Count

- **Function** Investigates the number of multimarkers on each the right/left sides of the current marker, when the Peak Hold function is performed.

Header	Program command	Query	Response
PCOUNT?	_____	PCOUNT?	a, b

- **Value of a** 0 to 250, 500
- **Value of b** 0 to 250, 500
- **Suffix code** None
- **Example** PCOUNT?

PINI

PINI Partial Preset

- **Function** Executes partial initialization.

Header	Program command	Query	Response
PINI	PLNI Δ n	_____	_____

- **Value of n**
 - 0: Preset All (initializes all parameters in the same way as "IP" and "INI.")
 - 1: Preset Sweep Control (initializes sweep control items.)
 - 2: Preset Trace Parameter (initializes trace items.)
 - 3: Preset Level Parameter (initializes vertical-axis items.)
 - 4: Preset Freq/Time parameter (initializes horizontal-axis items.)
- **Example** PINI Δ 0

PLS

PLS Direct Plot Start

■ **Function** Starts direct plotting.

Header	Program command	Query	Response
PLS	PLS $\Delta\emptyset$	_____	_____

■ **Example**

PLS $\Delta\emptyset$

■ **Note:**

This command starts the next command processing after completion of the editing print data.

To wait the next command until end of the printing, use the PRINT command.

PMALLCLR

PMALLCLR All Clear

■ **Function** Cal Factor, Offset, Reference Factor, Duty, Average number of times is initialized.

Header	Program command	Query	Response
PMALLCLR	PMALLCLR	_____	_____

■ **Example**

PMALLCLR

■ **Restrictions by apparatus and the option**

This command is effective about MS2687A/B Option21/23 Power Meter.

PMAVG

PMAVG Average On/Off

- **Function** In Power Meter, On/Off of Average is switched.

Header	Program command	Query	Response
PMAVG	PMAVG△sw	PMAVG?	sw

- **Value of sw** ON : PMAVG ON
OFF : PMAVG OFF
- **Suffix code** None
- **Initial setting** Off
- **Example** PMAVG△ON
- **Restrictions by apparatus and the option**
This command is effective about MS2687A/B Option21/23 Power Meter.

PMAVGCNT

PMAVGCNT Average Count

- **Function** The Average number of times is set up.

Header	Program command	Query	Response
PMAVGCNT	PMAVGCNT△n	PMAVGCNT?	n

- **Value of n** 2 to 10
- **Suffix code** None
- **Initial setting** 2
- **Example** PMAVGCNT△3
- **Restrictions by apparatus and the option**
This command is effective about MS2687A/B Option21/23 Power Meter.

PMCALF

PMCALF Cal Factor

- **Function** Cal Factor value is set up.

Header	Program command	Query	Response
PMCALF	PMCALF Δ n	PMCALF?	n

- **Value of n** -10.00 to +10.00 dB
- **Suffix code** None : dB
DB : dB
- **Initial setting** 0 dB
- **Example** PMCALF Δ 0
- **Restrictions by apparatus and the option**
This command is effective about MS2687A/B Option21/23 Power Meter.

PMOD

PMOD Printer Type

- **Function** Selects the type of printer for direct plotting.

Header	Program command	Query	Response
PMOD	PMOD Δ n	PMOD?	n

- **Value of n** 3 : Printer HP815C (Hewlett Packard)
6 : Printer BJ-M70 (ESC/p)
13 : BMP-format file Monochrome
14 : BMP-format file Color
- **Suffix code** None
- **Initial setting** 6 : Printer BJ-M70 (ESC/P)
- **Example** PMOD Δ 6
PMOD Δ 3

PMOFFSET

PMOFFSET Level Offset

- **Function** Offset Level value is set up.

Header	Program command	Query	Response
PMOFFSET	PMOFFSET△n	PMOFFSET?	n

- **Value of n** -100.00 to +100.00 dB
- **Suffix code**
 - None : dB
 - DB : dB
- **Initial setting** 0 dB
- **Example** PMOFFSET△0
- **Restrictions by apparatus and the option**
 - This command is effective about MS2687A/B Option21/23 Power Meter.

PMREFFACT

PMREFFACT Reference Factor

- **Function** Reference Factor is set up.

Header	Program command	Query	Response
PMREFFACT	PMREFFACT△n	PMREFFACT?	n

- **Value of n** -100.00 to +100.00 dB
- **Suffix code**
 - None : dB
 - DB : dB
- **Initial setting** 0 dB
- **Example** PMREFFACT△0
- **Restrictions by apparatus and the option**
 - This command is effective about MS2687A/B Option21/23 Power Meter.

PMRES

PMRES Power Meter Response

- **Function** The measured value of Power Meter is read.

Header	Program command	Query	Response
PMRES	_____	PMRES? Δ a	a

- **Value of a**
 - DBM: Measurement result is returned with a dBm value. 0.01 dBm Resolution.
 - REL: Measurement result is returned with a relative value. 0.01 dB Resolution
 - W: Measurement result is returned with a Watt value (mW unit value). It is referred to as resolution of 3 figure of Significant figure.

- **Example** PMRES? Δ DBM

- **Restrictions by apparatus and the option** This command is effective about MS2687A/B Option21/23 Power Meter.

PMRNG

PMRNG Range

- **Function** Range is switched.

Header	Program command	Query	Response
PMRNG	PMRNG Δ n	PMRNG?	n

- **Value of n** 1 to 5
- **Suffix code** None
- **Initial setting** Off
- **Example** RMRNG Δ 1
- **Restrictions by apparatus and the option** This command is effective about MS2687A/B Option21/23 Power Meter.

PNLMD

PNLMD

- **Function** Changes the measurement mode.

Header	Program command	Query	Response
PNLMD	PNLMD△a	PNLMD?	a

- **Value of a**
 - SPECT: Spectrum analyzer mode
 - SYSTEM: Signal analysis mode
 - CONFIG: Configuration mode
- **Suffix code** None
- **Example** PNLMD△SPECT
- **Restrictions according to model type and options**
 - “a = SYSTEM” is available when the measurement software (sold separately) is installed.

PORTADRS

PORTADRS

- **Function** Sets the Port address of Ethernet.

Header	Program command	Query	Response
PORTADRS	PORTADRS△n	PORTADRS?	n

- **Values of n** 3000 to 30000
- **Suffix code** None
- **Example** PORTADRS△3111
- **Restrictions according to model type and options**
 - This command is available when Option 09: Ethernet interface is installed.

POWERON

POWERON Power on State

■ **Function** Sets the power on status.

Header	Program command	Query	Response
POWERON	POWERON△a	POWERON?	a

- **Value of a** IP: Initialized (Preset) status
LAST: Status at last power-off
- **Suffix code** None
- **Initial setting** LAST: Status at power-off
- **Example** POWERON△LAST

PP

PP Presel Auto

■ **Function** Tunes the Pre-selector peaking.

Header	Program command	Query	Response
PP	PP	_____	_____

- **Example** PP
- **Restrictions by apparatus and the option**
 - This command is effective about MS2683A and MS2687A/B.

PRE

PRE Initialize

- **Function** Initializes all measurement control parameters to be initialized.
(same function as INI, IP)

Header	Program command	Query	Response
PRE	PRE	_____	_____

- **Example** PRE

PREAMP

PREAMP Pre-amplifier

- **Function** Sets On/Off of use of a Pre-amplifier.

Header	Program command	Query	Response
PREAMP	PREAMP Δ sw	PREAMP?	sw sw=OFF, ON

- **Value of sw** 0 : Off
OFF : Off
1 : On
ON : On

- **Suffix code** None

- **Initial configuration value** OFF : Off

- **Example of use** PREAMP Δ ON

- **Restrictions by apparatus and the option**

This command is effective when the Pre-amplifier of option 08 is mounted.

PRESEL

PRESEL Presel Tune

- **Function** Sets the auto tune of preselector device.

Header	Program command	Query	Response
PRESEL	PRESEL△a	PRESEL?	a a= -128 to 127

- **Value of a**
 - AUTO: Auto tune
 - 128 to 127: MANUAL set
 - PRESET: 0 set
- **Suffix code** None
- **Initial setting** ∅ (MANUAL) (the preselect tune already registered is not initialized)
- **Example** PRESEL△AUTO
- **Restrictions by apparatus and the option**
 - This command is effective about MS2683A and MS2687A/B.

PRINT

PRINT Direct Plot

- **Function** Executes direct plotting.

Header	Program command	Query	Response
PRINT	PRINT	_____	_____

- **Example** PRINT

PRL

PRL Peak to Reference Level

- Function** Finds the maximum point of the spectrum being displayed, and sets it level to the reference level.

Header	Program command	Query	Response
PRL	PRL	_____	_____

- Example** PRL

PRTY

PRTY Parity

- Function** Sets the parity bit for RS-232C.

Header	Program command	Query	Response
PRTY	PRTY△n	PRTY?	n

- Value of n**
 - EVEN: Even
 - ODD: Odd
 - OFF: Off (None)
- Suffix code** None
- Initial setting** OFF: Off (None)
- Example** PRTY△EVEN

PSW

PSW Zone Sweep

■ **Function** Sets the zone sweep to ON/OFF.

Header	Program command	Query	Response
PSW	PSW△sw	PSW?	PSW△sw sw=ON,OFF

- **Value of sw** 1, ON: ON
Ø, OFF: OFF
- **Suffix code** None
- **Initial setting** OFF: OFF
- **Example** PSW△ON

PWRMTR

PWRMTR Power Meter On/Off

■ **Function** On/Off of Power Meter is switched.

Header	Program command	Query	Response
PWRMTR	PWRMTR△sw	PWRMTR?	sw

- **Value of sw** ON: Power Meter ON
OFF: Power Meter OFF
- **Suffix code** None
- **Initial setting** Off
- **Example** PWRMTR△ON
- **Restrictions by apparatus and the option**
This command is effective about MS2687A/B Option21/23 Power Meter.

PWRFACT

PWRFACT Power Correction Factor

- **Function** Sets the Burst power correction factor.

Header	Program command	Query	Response
PWRFACT	PWRFACT Δ l	PWRFACT?	l

- **Value of l** -99.99 to 99.99 dB
- **Suffix code** None : dB
- **Initial setting** \emptyset : 0 dB
- **Example** PWRFACT Δ -2.5DB

PWRSTART

PWRSTART Power Measure Start Point

- **Function** Specifies the point at which to start burst-power measurement.

Header	Program command	Query	Response
PWRSTART	PWRSTART Δ p	PWRSTART?	p

- **Value of p** 0 to 500, 1000
- **Suffix code** None
- **Initial setting** \emptyset point
- **Example** PWRSTART Δ 1 $\emptyset\emptyset$

PWRSTOP

PWRSTOP Power Measure Stop Point

■ **Function** Specifies the point at which to terminate burst-power measurement.

Header	Program command	Query	Response
PWRSTOP	PWRSTOP Δ p	PWRSTOP?	p

- **Valur of p** 0 to 500, 1000
- **Suffix code** None
- **Initial setting** 500point
- **Example** PWRSTOP Δ 400

RB**RB Resolution Bandwidth**

- **Function** Sets the resolution bandwidth (same function as RBW).

Header	Program command	Query	Response
RB	RB Δ f RB Δ a	RB?	f f=10 to 2000000 Transfers the data with no suffix code in units of 1 Hz

- **Value of f** 1 Hz to 3 MHz (1/3 sequence), 5 MHz, 10 MHz, 20 MHz

- **Value of a** UP: RBW UP
DN: RBW DOWN
AUTO: RBW AUTO

- **Suffix code** f: None: Hz(10⁰)
HZ: Hz(10⁰)
KHZ, KZ: kHz(10³)
MHZ, MZ: MHz(10⁶)
GHZ, GZ: GHz(10⁹)
a: None

- **Initial setting** RBW=calculated value when AUTO is selected for RBW

- **Example** RB Δ 3KHZ

- **Restrictions according to model type and options**

When the Resolution Bandwidth mode is Digital at On, “f = 10 HZ, 30 HZ and 100 HZ” is available.

Refer to “RBM” command for more detailed information.

When the Resolution Bandwidth mode is FFT at On, “f=1 Hz, 3 Hz” is available.

RBM

RBM RBW Mode

■ **Function** Sets the resolution bandwidth mode.

Header	Program command	Query	Response
RBM	RBM△a	RBM?	RBM△a

■ **Value of a** AUTO: Optimum RBW is set up by SPAN and equipment of option.
 NRM: Analog bandwidth filter (300 Hz to 20 MHz)
 DGTL: Resolution bandwidth by digital signal processing (10 Hz to 1 MHz)
 FFT: Resolution bandwidth by FFT signal processing (1 Hz to 1 kHz)

■ **Suffix code** None

■ **Initial setting** AUTO: Analog bandwidth filter (300 Hz to 20 MHz)

■ **Example** RBM△NRM

■ **Restrictions according to model type and options**

This command is available when Option 04: Digital Resolution Bandwidth or Option 02: Narrow Resolution Bandwidth is installed.

RBR**RBR Resolution Bandwidth/Span Ratio**

■ **Function** Sets the RBW/Span Ratio.

Header	Program command	Query	Response
RBR	RBR△f	RBR?	f

- Value of f 0.001 to 0.100 (resolution 0.001)
- Suffix code None
- Initial setting 0.01
- Example RBR△0.05

RBSPAN**RBSPAN Resolution Bandwidth/Span Ratio**

■ **Function** Sets the RBW according to RBW/Span Ratio.

Header	Program command	Query	Response
RBSPAN	RBSPAN△sw	RBSPAN?	sw

- Value of sw OFF: OFF
0: OFF
ON: ON
1: ON
- Initial setting OFF: OFF
- Suffix code None
- Example RBSPAN△ON

RBW

RBW Resolution Bandwidth

■ **Function** Sets the resolution bandwidth.

Header	Program command	Query	Response
RBW	RBW△n	RBW?	RBW△n

- **Value of n**
- 0 : 30 Hz
 - 1 : 100 Hz
 - 2 : 300 Hz
 - 3 : 1 kHz
 - 4 : 3 kHz
 - 5 : 10 kHz
 - 6 : 30 kHz
 - 7 : 100 kHz
 - 8 : 300 kHz
 - 9 : 1 MHz
 - 13 : 10 Hz
 - 14 : 3 MHz
 - 15 : 5 MHz
 - 16 : 1 Hz
 - 17 : 3 Hz
 - 18 : 10 MHz
 - 19 : 20 MHz

■ **Suffix code** None

■ **Initial setting** Calculated value when AUTO is selected for RBW

■ **Example** RBW△5

■ **Restrictions according to model type and options**

When the Resolution Bandwidth mode is Digital at On; “n = 0, 1 and 13 are available.

Refer to “RBM” for more detailed information.

n=0, 1, 13, 16, 17 is effective when having equipped with Option 02 ‘Narrow Resolution Bandwidth’.

RC**RC Recall Data from Internal Register**

■ **Function** Recalls trace data/parameter data from the built-in memory (same function as RGRC).

Header	Program command	Query	Response
RC	RC△n	_____	_____

■ **Value of n** 1 to 24 (Register No.)
 ■ **Suffix code** None
 ■ **Example** RC△1

RCCSVANT**RCCSVANT**

■ **Function** Loads the antenna factor in CSV format from the memory card.

Header	Program command	Query	Response
RCCSVANT	RCCSVANT△n	_____	_____

■ **Value of n** 1 to 999 (File No.)
 ■ **Suffix code** None
 ■ **Example** RCCSVANT△1

RCCSVCOR

RCCSVCOR

- **Function** Loads the correction factor in CSV format from the memory card.

Header	Program command	Query	Response
RCCSVCOR	RCCSVCOR△n	_____	_____

- **Value of n** 1 to 999 (File No.)
- **Suffix code** None
- **Example** RCCSVCOR△1

RCCSVMSK

RCCSVMSK

- **Function** Loads the mask data in CSV format from the memory card.

Header	Program command	Query	Response
RCCSVMSK	RCCSVMSK△n	_____	_____

- **Value of n** 1 to 999 (File No.)
- **Suffix code** None
- **Example** RCCSVMSK△1

RCCSVTMP

RCCSVTMP

- **Function** Loads the template data in CSV format from the memory card.

Header	Program command	Query	Response
RCCSVTMP	RCCSVTMP△n	_____	_____

- **Value of n** 1 to 999 (File No.)
- **Suffix code** None
- **Example** RCCSVTMP△1

RCM

RCM Recall Data from Memory Card

- **Function** Recalls the measurement conditions (parameters) and measured results (traces) from memory card.

Header	Program command	Query	Response
RCM	RCM△n	_____	_____

- **Value of n** 1 to 999 (File No.)
- **Suffix code** None
- **Example** RCM△2 RCM△17

RCS

RCS Write Off Recall Data

- **Function** Recalls data from memory card and sets the storage mode to "View".

Header	Program command	Query	Response
RCS	RCS△n	_____	_____

- **Value of n** 1 to 999
- **Suffix code** None
- **Example** RCS△1

RDATA

RDATA Recalled Data

- **Function** Specifies the data to be recalled.

Header	Program command	Query	Response
RDATA	RDATA△a	RDATA?	a

- **Value of a**
 - TP: Trace & Parameter
 - P: Parameter Only
 - TPV: Trace & Parameter (view)
 - PER: Parameter (except RLV)
- **Suffix code** None
- **Initial setting** TP: Trace & Parameter (provided the already set is not initialized)
- **Example** RDATA△TP

RES?

RES? Measure Result

■ **Function** Reads out the results functions.

Header	Program command	Query	Response
RES?	_____	RES?	data1 data1,data2 data1,data2,data3,data4,data5,data6

■ **Values of data1,data2,data3,data4,data5, and data6**

Measure control item (corresponding command)	Response	Value of data1	Value of data2
When the measure item or sub item is OFF	OFF	Not transferred	Not transferred
FREQ COUNT (MEASΔFREQ,ON)	f	Value of f with no suffix code in units of Hz, Resolution: 1 Hz	_____
NOISE MEASURE (MEASΔNOISE,ABS) (MEASΔNOISE,C/N)	l	Value of l with no suffix code in units of dB (dBm/ch, dBm/Hz, dBc/ch, dBc/Hz). Resolution: 0.01 dB	_____
OBW MEASURE (MEASΔOBW,XDB) (MEASΔOBW,N)	f1, f2	Occupied bandwidth of f1 with no suffix code in units of Hz. Resolution: 1 Hz	Center frequency of f2 with no suffix code in units of Hz. Resolution: 1 Hz
MASK (MEASΔMASK,CHECK)	C1, C2	Value of C1(Limit 1 check result) 0:PASS1, 1:FAIL	Value of C2(Limit 2 check result) 0:PASS1, 1:FAIL
TEMPLATE (MEASΔTEMP,CHECK)	C1, C2	Value of C1(Limit 1 check result) 0:PASS1, 1:FAIL	Value of C2(Limit 2 check result) 0:PASS1, 1:FAIL
BURST POWER MEASURE (MEASΔPOWER,EXE)	l, w	dB m value of l with no suffix code in units of dBm, Resolution: 0.01 dB	pW value of w with no suffix code in units of pW, Resolution: 1 pW
CHANNEL POWER MEASURE (MEASΔCHPWR,ON)	l1, l2 (In case of Marker not spot mode)	Value of l1 with no suffix code in units of dBm. Resolution: 0.01 dB	Value of l2 with no suffix code in units of dBm/Hz. Resolution: 0.01 dB
	l (In case of Marker spot mode)	Value of l with no suffix code in units of dBm/Hz Resolution: 0.01 dB	
ADJ CH MEASURE (MEASΔADJ,UNMD) (MEASΔADJ,MOD)	lL1, lU1, lL2, lU2, lL3, lU3	Value of data1	Value of data2
		Lower channel of CHSEPA1 of lL1 with no suffix code in units of dB Resolution: 0.01dB	Upper channel of CHSEPA1 of lU1 with no suffix code in units of dB Resolution: 0.01dB
		Value of data3	Value of data 4
		Lower channel of CHSEPA2 of lL2 with no suffix code in units of dB Resolution: 0.01dB	Upper channel of CHSEPA2 of lU2 with no suffix code in units of dB Resolution: 0.01dB
		Value of data 5	Value of data 6
		Lower channel of CHSEPA3 of lL3 with no suffix code in units of dB Resolution: 0.01dB	Upper channel of CHSEPA3 of lU3 with no suffix code in units of dB Resolution: 0.01dB

If the MEASURE function has caused a calculation error or execution error, the affected value is represented by "***".

■ **Example** RES?

RFAT

RFAT Set RF Attenuator steps

■ **Function** Sets steps (2 dB/10 dB) of RF attenuator

Header	Program command	Query	Response
RFAT	RFAT△n	RFAT?	n

■ **Value of n** ∅: 10 dB steps
 1: 2 dB steps

■ **Suffix code** None

■ **Initial Setting** ∅: 10 dB steps

■ **Example** RFAT△∅

■ **Restrictions by apparatus and the option**

- This command is effective about MS2681A and MS2683A.

RGB

RGB

■ **Function** Outputs RGB signal on the rear panel.

Header	Program command	Query	Response
RGB	RGB sw	RGB?	sw

■ **Value of sw** ON: Outputs RGB signal.
 OFF: Does not output RGB signal.

■ **Suffix code** None

■ **Initial setting** ON: Outputs RGB signal.

■ **Example** RGB△ON

RGRC**RGRC Recall Data from Internal Register**

■ **Function** Recalls trace data/parameter data from the built-in register (same function as RC).

Header	Program command	Query	Response
RGRC	RGRC△n	_____	_____

■ **Value of n** 1 to 24 (Register No.)
 ■ **Suffix code** None
 ■ **Example** RGRC△1

RGSV**RGSV Save Data into Internal Register**

■ **Function** Saves trace data/parameter data to the built-in register (same function as SV).

Header	Program command	Query	Response
RGSV	RGSV△n	_____	_____

■ **Value of n** 1 to 24 (Register No.)
 ■ **Suffix code** None
 ■ **Example** RGSV△1

RL

RL Reference Level

■ **Function** Sets the reference level (same function as RLV).

Header	Program command	Query	Response
RL	RL△l RL△a	RL?	l l: No units value depending on the current scalunit. the μV units are selected for V-unit system, and μW units are selected for W-unit system.

■ **Value of l** Value from -100 dBm to +30 dBm (0.01 dB step)

■ **Value of a** UP: LEVEL STEP UP
DN: LEVEL STEP DOWN

■ **Suffix code** None: No units value depending on the current scale unit. The V units are always selected when in LIN mode.

DB, DBM, DM: dBm

DBMV: dBmV

DBUV: dBμV

DBUVE: dBμV(emf)

V: V

MV: mV

UV: μV

W: W

MW: mW

UW: μW

NW: nW

PW: pW

FW: fW

■ **Initial setting** l = -10 dBm

■ **Example** RL△-100DBM

RL△5V

RL△-10V

RL△UP

RLN**RLN Reference Line**

■ **Function** Specifies the location of the data display standard line obtained using the A-B function.

Header	Program command	Query	Response
RLN	RLN△n	RLN?	RLN△n

- **Value of n**
 - ∅: Top
 - 1: Middle
 - 2: Bottom
- **Suffix code** None
- **Initial setting** 1: Middle
- **Example** RLN△2

RLV

RLV Reference Level

■ **Function** Sets the reference level (same function as RL).

Header	Program command	Query	Response
RLV	RLV△l	RLV?	RLV△l l: No units value depending on the current scale unit. The μ V units are selected for V-unit system, and μ W units are selected for W-unit system.

■ **Value of l** Value from -100 dBm to $+30$ dBm (0.01 dB step)

UP: LEVEL STEP UP
DN: LEVEL STEP DOWN

■ **Suffix code** None: No units value depending on the current scale unit. The V units are always selected when in LIN mode.

DB, DBM, DM: dBm
DBMV: dBmV
DBUV: dB μ V
DBUVE: dB μ V (emf)
V: V
MV: mV
UV: μ V
W: W
MW: mW
UW: μ W
NW: nW
PW: pW
FW: fW

■ **Initial setting** l = -10 dBm

■ **Example**
RL△-100DBM
RL△5V
RL△-10V

RMK?**RMK? Reference Marker Position**

- **Function** Reads out the position of the reference marker.

Header	Program command	Query	Response
RMK?	_____	RMK?	RMK△a

- **Value of a** 0 to 500, 1000
- **Example** RMK?

RNGHLD**RNGHLD Range Hold**

- **Function** AUTO/HOLD of a range is switched.

Header	Program command	Query	Response
RNGHLD	RNGHLD△sw	RNGHLD?	sw

- **Value of sw**
 - HOLD: It is set as a range hold.
 - AUTO: It is set as a auto range.
- **Suffix code** None
- **Initial setting** AUTO
- **Example** RNGHLD△HOLD
- **Restrictions by apparatus and the option**
 - This command is effective about MS2687A/B Option21/23 Power Meter.

ROFFSET

ROFFSET Ref. Level Offset

■ **Function** Turns the reference level offset ON/OFF, and sets the offset value.

Header	Program command	Query	Response
ROFFSET	ROFFSET△sw ROFFSET△l	ROFFSET?	OFF l

- **Value of sw** ON: ON
OFF: OFF
- **Value of l** -100.00 dB to +100.00 dB (0.01 dB step)
- **Suffix code** None: dB
DB, DBM, DM: dB
- **Initial setting** ∅: ∅dB
- **Example** ROFFSET△OFF
ROFFSET△2∅DB

S1**S1 Sweep Mode (Continuous)**

- **Function** Sets the sweep mode to CONTINUOUS (same function as CONTS).

Header	Program command	Query	Response
S1	S1	_____	_____

- **Example** S1

S2**S2 Sweep Mode (Single)**

- **Function** Sets the sweep mode to SINGLE (same function as SNGLS).

Header	Program command	Query	Response
S2	S2	_____	_____

- **Example** S2

SCL

SCL Log/ Linear Scale

■ **Function** Sets the Y axis magnification of the LOG/LIN scale.

Header	Program command	Query	Response
SCL	SCL△n	SCL?	SCL△n

■ **Value of n**

- ∅: 1 dB/div(LOG SCALE)
- 1: 2 dB/div(LOG SCALE)
- 2: 5 dB/div(LOG SCALE)
- 3: 10 dB/div(LOG SCALE)
- 4: 1%/dev(LIN SCALE)
- 5: 2%/dev(LIN SCALE)
- 6: 5%/dev(LIN SCALE)
- 7: 10%/dev(LIN SCALE)

■ **Suffix code** None
 ■ **Initial setting** 3: 10 dB/div (LOG SCALE)
 ■ **Example** SCL△∅
 SCL△5

SCR

SCR Scroll

■ **Function** Scrolls the displayed spectrum to the right or left by the specified scroll amount.

Header	Program command	Query	Response
SCR	SCR△a	_____	_____

■ **Value of a**

- ∅: SCROLL LEFT
- LEFT: SCROLL LEFT
- 1: SCROLL RIGHT
- RIGHT: SCROLL RIGHT

■ **Suffix code** None
 ■ **Example** SCR△∅
 SCR△RIGHT

SETREL

SETREL Set Relative

- **Function** The present Power Meter measured value is set as the fiducial point of a relative display.

Header	Program command	Query	Response
SETREL	SETREL	_____	_____

- **Example** SETREL
- **Restrictions by apparatus and the option**
This command is effective about MS2687A/B Option21/23 Power Meter.

SIGID

SIGID Signal Identifier

- **Function** Executes sweep which discriminates measured signal and image signal at the time of external mixer use.

Header	Program command	Query	Response
SIGID	SIGID△a	SIGID?	a a=0,1

- **Value of a**
 - 0 : Off
 - OFF : Off
 - 1 : On
 - ON : On

- **Suffix code** None
- **Initial configuration value**

0 : Off

- **Setting conditions**

When external mixer is Off, this setup serves as execution error.

- **Example of use** SIGID△0

- **Restrictions by apparatus and the option**

- This command is effective about MS2687A/B.

SNGLS

SNGLS Single Sweep Mode

- **Function** Sets the sweep mode to single sweep (same function as S2).

Header	Program command	Query	Response
SNGLS	SNGLS	_____	_____

- **Example** SNGLS

SOF

SOF Stop Frequency

- **Function** Sets the stop frequency (same function as FB).

Header	Program command	Query	Response
SOF	SOF Δ f	SOF?	SOF Δ f f=-100000000 to 3000000000 =-100000000 to 7900000000 =-100000000 to 3000000000 Transfers the data with no suffix code in units of 1 Hz.

- **Value of f**
 - [MS2681A] -100 MHz to 3.0 GHz
 - [MS2683A] -100 MHz to 7.9 GHz
 - [MS2687A/MS2687B] -100 MHz to 30.0 GHz

- **Suffix code**
 - None: Hz(10⁰)
 - HZ: Hz(10⁰)
 - KHZ, KZ: kHz(10³)
 - MHZ, MA: MHz(10⁶)
 - GHZ, GZ: GHz(10⁹)

- **Initial configuration value**
 - [MS2681A] 3.0 GHz
 - [MS2683A] 7.9 GHz
 - [MS2687A/MS2687B] 30.0 GHz

- **Example**
 - SOF Δ 123MHZ
 - SOF Δ 45.6KHZ

SP

SP Frequency Span

■ **Function** Sets the frequency span (same function as SPF).

Header	Program command	Query	Response
SP	SP△f SP△a	SP?	f f=0 to 3100000000 =0 to 8000000000 =0 to 30100000000 Transfers the data with no suffix code in units of 1 Hz.

- **Value of f** [MS2681A] 0 Hz to 3.1 GHz
[MS2683A] 0 Hz to 8.0 GHz
[MS2687A/MS2687B] 0 Hz to 30.1 GHz

- **Value of a** UP: FREQ SPAN STEP UP (same function as SPU)
DN: FREQ SPAN STEP DOWN(same function as SPD)

- **Suffix code** None: Hz(10⁰)
HZ: Hz(10⁰)
KHZ, KZ: kHz(10³)
MHZ, MZ: MHz(10⁶)
GHZ, GZ: GHz(10⁹)

- **Initial configuration value**
[MS2681A] 3.0 GHz
[MS2683A] 7.9 GHz
[MS2687A/MS2687B] 30.0 GHz

- **Example** SP△1GHZ

SPD

SPD Frequency Span Step Down

■ **Function** Decreases the frequency span in the 5/2/1 steps (same function as SP△DN).

Header	Program command	Query	Response
SPD	SPD	_____	_____

- **Example** SPD

SPF**SPF Frequency Span**

- **Function** Sets the frequency span (same function as SP).

Header	Program command	Query	Response
SPF	SPF△f	SPF?	SPF△f f=0 to 3100000000 =0 to 8000000000 =0 to 30100000000 Transfers the data with no suffix code in units of 1 Hz.

- **Value of f**
- | | |
|-------------------|------------------|
| [MS2681A] | 0 Hz to 3.1 GHz |
| [MS2683A] | 0 Hz to 8.0 GHz |
| [MS2687A/MS2687B] | 0 Hz to 30.1 GHz |
- **Suffix code**
- | | |
|------------|-----------------------|
| None: | Hz(10 ⁰) |
| HZ : | Hz(10 ⁰) |
| KHZ , KZ : | kHz(10 ³) |
| MHZ , MZ : | MHz(10 ⁶) |
| GHZ , GZ : | GHz(10 ⁹) |
- **Initial configuration value**
- | | |
|-------------------|----------|
| [MS2681A] | 3.0 GHz |
| [MS2683A] | 7.9 GHz |
| [MS2687A/MS2687B] | 30.0 GHz |
- **Example**
- ```
SPF△101MHZ
SPF△1.5GHZ
```

**SPU****SPU Frequency Span Step. Up**

- **Function** Increases the frequency span in the 1/2/5 steps (same function as SP△UP).

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| SPU    | SPU             | _____ | _____    |

- **Example** SPU

## SRCHTH

### SRCHTH Peak Search Threshold

- **Function** Sets the threshold function for detecting a peak point.

| Header | Program command | Query   | Response              |
|--------|-----------------|---------|-----------------------|
| SRCHTH | SRCHTH△a        | SRCHTH? | SW sw=OFF,ABOVE,BELOW |

- **Value of sw**    ∅, OFF: No threshold function  
                  1, ON: Threshold function
- **Value of a**     ABOVE: Above detection  
                  BELOW: Below detection
- **Suffix code**    None
- **Initial setting** OFF: No threshold function
- **Example**        SRCHTH△ABOVE

## SRCNORM

### SRCNORM Normalize

- **Function** Selects the ON/OFF of the normalizing processing (A-B+DL→A).

| Header  | Program command | Query    | Response     |
|---------|-----------------|----------|--------------|
| SRCNORM | SRCNORM△sw      | SRCNORM? | SW sw=ON,OFF |

- **Value of sw**    1, ON: on  
                  ∅, OFF: off
- **Suffix code**    None
- **Initial setting** OFF: off
- **Example**        SRCNORM△ON



**SS****SS Frequency Step Size**

- **Function** Sets the frequency step size for stepping up/down the frequency (same function as FSS).

| Header | Program command | Query | Response                                                                                                                    |
|--------|-----------------|-------|-----------------------------------------------------------------------------------------------------------------------------|
| SS     | SS $\Delta$ f   | SS?   | f<br>f=1 to 3000000000<br>=1 to 7900000000<br>=1 to 30000000000<br>Transfers the data with no suffix code in units of 1 Hz. |

- **Value of f** [MS2681A] 1 Hz to 3.0 GHz  
[MS2683A] 1 Hz to 7.9 GHz  
[MS2687A/MS2687B] 1 Hz to 30.0 GHz
- **Suffix code** None: Hz(10<sup>0</sup>)  
HZ : Hz(10<sup>0</sup>)  
KHZ, KZ : kHz(10<sup>3</sup>)  
MHZ, MZ : MHz(10<sup>6</sup>)  
GHZ, GZ : GHz(10<sup>9</sup>)
- **Example** SS $\Delta$ 1MHZ

**SSS****SSS Scroll Step Size**

- **Function** Sets the scroll step size.

| Header | Program command | Query | Response       |
|--------|-----------------|-------|----------------|
| SSS    | SSS $\Delta$ n  | SSS?  | SSS $\Delta$ n |

- **Value of n** 1 : 1 div  
2 : 2 div  
5 : 5 div  
10 : 10 div
- **Suffix code** None
- **Initial setting** 2 : 2 div
- **Example** SSS $\Delta$ 1

# ST

## ST Sweep Time

■ **Function** Sets the frequency sweep time/time span.

| Header | Program command | Query | Response                                                                             |
|--------|-----------------|-------|--------------------------------------------------------------------------------------|
| ST     | ST△t<br>ST△a    | ST?   | t<br>t=1.0 to 1000000000<br>Transfers the data with no suffix code in units of 1 μs. |

■ **Value of t** 1.0 μs to 1000 s (10 ms to 1000 s for frequency axis)

■ **Value of a**  
 UP: SWT UP  
 DN: SWT DOWN  
 AUTO: SWT AUTO

■ **Suffix code**  
 t: None : ms  
 US: μs  
 MS: ms  
 S: s

■ **Initial setting** a: None  
 Calculated value when AUTO is selected for SWT

■ **Example**  
 ST△AUTO  
 ST△20MS

**STF****STF Start Frequency**

- **Function** Sets the start frequency (same function as FA).

| Header | Program command | Query | Response                                                                                                                                                   |
|--------|-----------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| STF    | STF△f           | STF?  | STF△f<br>f=-100000000 to 3000000000<br>=-100000000 to 7900000000<br>=-100000000 to 30000000000<br>Transfers the data with no suffix code in units of 1 Hz. |

- **Value of f** [MS2681A] -100 MHz to 3.0 GHz  
[MS2683A] -100 MHz to 7.9 GHz  
[MS2687A/MS2687B] -100 MHz to 30.0 GHz
- **Suffix code** None: Hz(10<sup>0</sup>)  
HZ : Hz(10<sup>0</sup>)  
KHZ , KZ : kHz(10<sup>3</sup>)  
MHZ , MZ : MHz(10<sup>6</sup>)  
GHZ , GZ : GHz(10<sup>9</sup>)
- **Initial setting** f=0Hz
- **Example** STF△123MHZ  
STF△45.6KHZ

**STPB****STPB Stop bit**

- **Function** Specifies the RS232C stop bit.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| STPB   | STPB△n          | STPB? | n        |

- **Value of n** 1 : 1 bit  
2 : 2 bit
- **Suffix code** None
- **Initial setting** 1 : 1 bit
- **Example** STPB△2

# SV

## SV Save Data into Internal Register

■ **Function** Saves trace data/parameter data to the built-in register (same function as RGSV).

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| SV     | SV△n            | _____ | _____    |

- Value of n 1 to 24 (Memory No.)
- Suffix code None
- Example SV△1

# SVCSVANT

## SVCSVANT

■ **Function** Saves the antenna factor to the memory card in CSV format.

| Header   | Program command | Query | Response |
|----------|-----------------|-------|----------|
| SVCSVANT | SVCSVANT n      | _____ | _____    |

- Value of n 1 to 999 (File No.)
- Suffix code None
- Example SVCSVANT△1

## SVCSVCOR

### SVCAVCOR

- **Function** Saves the correction data to the memory card in CSV format.

| Header   | Program command | Query | Response |
|----------|-----------------|-------|----------|
| SVCSVCOR | SVCSVCOR n      | _____ | _____    |

- **Value of n** 1 to 999 (File No.)
- **Suffix code** None
- **Example** SVCSVCOR△1

---

## SVCSVMSK

### SVCAVMSK

- **Function** Saves the mask data to the memory card in CSV format.

| Header   | Program command | Query | Response |
|----------|-----------------|-------|----------|
| SVCSVMSK | SVCSVMSK n      | _____ | _____    |

- **Value of n** 1 to 999 (File No.)
- **Suffix code** None
- **Example** SVCSVMSK△1

## SVCSVTMP

### SVCAVTMP

- **Function** Saves the template data to the memory card in CSV format.

| Header   | Program command | Query | Response |
|----------|-----------------|-------|----------|
| SVCSVTMP | SVCSVTMP n      | _____ | _____    |

- **Value of n** 1 to 999 (File No.)
- **Suffix code** None
- **Example** SVCSVTMP△1

## SVCSVWAVE

### SVCAVWAVE

- **Function** Saves the waveform data to the memory card in CSV format

| Header    | Program command | Query | Response |
|-----------|-----------------|-------|----------|
| SVCSVWAVE | SVCSVWAVE n     | _____ | _____    |

- **Value of n** 1 to 999 (File No.)
- **Suffix code** None
- **Example** SVCSVWAVE△1

## SVM

### SVM Save Data into Memory Card

- **Function** Saves the measurement conditions (parameters) and measured results (traces) to memory card.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| SVM    | SVM△n           | _____ | _____    |

- **Value of n** 1 to 999 (File No.)
- **Suffix code** None
- **Example** SVM△17  
SVM△2

## SWP

### SWP Single Sweep/Sweep Status

- **Function** Executes single sweep/Responds to sweep status (sweep completed/sweep in progress). When accepted by the spectrum analyzer, the SWP command causes a single sweep to be executed by setting the sweep mode to 'SINGLE'. The next command waits without being processed until its single sweep is completed (same function as TS). The SWP? Query command is used to Query the current sweep status (sweep completed/sweep in progress).

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| SWP    | SWP             | SWP?  | SWP△sw   |

- **Value of sw** 0: Sweep completed  
1: Sweep progress
- **Example** SWP  
SWP?

## SWSTART

### SWSTART Restart Sweep

■ **Function** Restarts the sweep.

| Header  | Program command | Query | Response |
|---------|-----------------|-------|----------|
| SWSTART | SWSTART         | _____ | _____    |

■ **Example** SWSTART

## SWSTOP

### SWSTOP Stop Sweep

■ **Function** Stops the sweep.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| SWSTOP | SWSTOP          | _____ | _____    |

■ **Example** SWSTOP



# SWT

## SWT Sweep Time

- **Function** Sets the frequency sweep time/time span (same function as ST).

| Header | Program command | Query | Response                                                                               |
|--------|-----------------|-------|----------------------------------------------------------------------------------------|
| SWT    | SWT△t           | SWT?  | SWT△t<br>t=1 to 1000000000<br>Transfers the data with no suffix code in units of 1 μs. |

- **Value of t** 1 μs to 1000 s (10 ms to 1000 s for frequency domain)
- **Suffix code**
  - None : ms
  - US : μs
  - MS : ms
  - S : s
- **Initial setting** Calculated value when AUTO is selected for SWT
- **Example**
  - SWT△1S
  - SWT△2ØMS

# SYS

## SYS

- **Function** In Signal Analysis mode, changes the system (measurement software installed) to one of the three system areas.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| SYS    | SYS△n           | SYS?  | n        |

- **Value of n** 1 to 3
- **Suffix code** None
- **Example** SYS△1
- **Note**

Needed to know, in advance, what system is installed in each of the three system areas.

- **Restrictions according to model type and options**

This command is available when any measurement software is installed. When no systems installed in a specific area; the current system will be maintained as it is, and no errors will be returned.

# TDLY

## TDLY Delay Time

■ **Function** Sets the delay time from the point where trace time triggering occurs.

| Header | Program command | Query | Response                                                                                |
|--------|-----------------|-------|-----------------------------------------------------------------------------------------|
| TDLY   | TDLY△t          | TDLY? | t<br>t=-1000000000 to 65500<br>Transfers the data with no suffix code in units of 1 μs. |

■ **Value of t** -1000 sec to 65.5 ms

■ **Suffix code**  
 None : ms  
 US : μs  
 MS : ms  
 S : s

■ **Initial setting** Ø: 0s

■ **Example** TDLY△2ØMS

# TEMP

## TEMP Select Template

■ **Function** Selects one of the function templates.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| TEMP   | TEMP△n          | TEMP? | n        |

■ **Value of n** 1 to 5 (Template No.)

■ **Suffix code** None

■ **Initial setting** 1

■ **Example** TEMP△1

## TEMPLOAD

### TEMPLOAD Load Template data

■ **Function** Reads out template data from an external file.

| Header   | Program command | Query | Response |
|----------|-----------------|-------|----------|
| TEMPLOAD | TEMPLOAD△n      | _____ | _____    |

■ **Value of n** 1 to 999  
 ■ **Suffix code** None  
 ■ **Example** TEMPLOAD△1

---

## TEMPMCL

### TEMPMCL Cancel Moving Value

■ **Function** Returns a template movement to 0.

| Header  | Program command | Query | Response |
|---------|-----------------|-------|----------|
| TEMPMCL | TEMPMCL         | _____ | _____    |

■ **Example** TEMPMCL

## TEMPMSV

### TEMPMSV Save Moved Template Data

■ **Function** Stores the moved template data in the original template area.

| Header  | Program command | Query | Response |
|---------|-----------------|-------|----------|
| TEMPMSV | TEMPMSV         | _____ | _____    |

■ **Example** TEMPMSV

## TEMPMVX

### TEMPMVX Template Move X

■ **Function** Moves the template line along the X axis.

| Header  | Program command               | Query    | Response |
|---------|-------------------------------|----------|----------|
| TEMPMVX | TEMPMVX△t t=-1000 to 1000 sec | TEMPMVX? | t        |

- **Value of t** -1000 to 1000 s
- **Suffix code**
  - None: ms
  - US: μs
  - MS: ms
  - S: s
- **Initial setting** ∅: 0s
- **Example** TEMPMVX△10MS

## TEMPMVY

### TEMPMVY      Template Move Y

- **Function**            Moves the template line along the Y axis.

| Header  | Program command | Query    | Response |
|---------|-----------------|----------|----------|
| TEMPMVY | TEMPMVY△l       | TEMPMVY? | l        |

- **Value of l**            -200.00 to 200.00 dB
- **Suffix code**        None :        dB  
DB, DBM, DM : dB
- **Initial setting**    ∅ :            0 dB
- **Example**            TEMPMVY△-2.5dB

## TEMPSAVE

### TEMPSAVE      Save Template data

- **Function**            Moves the internal template data to an external file.

| Header   | Program command | Query | Response |
|----------|-----------------|-------|----------|
| TEMPSAVE | TEMPSAVE△n      | _____ | _____    |

- **Value of n**            1 to 999
- **Suffix code**        None
- **Example**            TEMPSAVE△1

# TEMPSLCT

## TEMPSLCT      Template Limit Line Select

■ **Function**                Selects the Limit Line used for evaluating the measured results using the template functions.

| Header   | Program command | Query       | Response        |
|----------|-----------------|-------------|-----------------|
| TEMPSLCT | TEMPSLCT△a, sw  | TEMPSLCT?△a | sw<br>sw=ON,OFF |

■ **Value of a**            UP1 :        LIMIT1 UPPER  
                               UP2 :        LIMIT2 UPPER  
                               LW1 :        LIMIT1 LOWER  
                               LW2 :        LIMIT2 LOWER

■ **Value of sw**            1, ON:        ON  
                               Ø, OFF:       OFF

■ **Suffix code**            None

■ **Initial setting**        OFF

■ **Example**                TEMPSLCT△UP1, ON

# TEN

## TEN                    Title Entry

■ **Function**                Registers the title character string.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| TEN    | TEN△x, y, text  | _____ | _____    |

■ **Value of x,y**            X and Y values at display start point  
 (Do not use even if specified. Display location is fixed.)

■ **Value of text**            Character string within 19 characters enclosed by double or single quotes.

■ **Suffix code**            None

■ **Example**                TEN△Ø, Ø, "TITLE SAMPLE"

# TEXPAND

## TEXPAND Time Expand

- **Function** Turns ON/OFF the trace time-expansion functions.

| Header  | Program command | Query    | Response        |
|---------|-----------------|----------|-----------------|
| TEXPAND | TEXPAND△sw      | TEXPAND? | sw<br>sw=ON,OFF |

- **Value of sw** 1, ON: ON  
Ø, OFF: OFF
- **Suffix code** None
- **Example** TEXPAND△ON

# TIME

## TIME Time

- **Function** Sets the time of the built-in clock.

| Header | Program command | Query | Response   |
|--------|-----------------|-------|------------|
| TIME   | TIME△hh, mm, ss | TIME? | hh, mm, ss |

- **Value of hh** 00 to 23 (Time)
- **Value of mm** 00 to 59 (Minute)
- **Value of ss** 00 to 59 (Second)
- **Suffix code** None
- **Example** TIME △08, 30, 00

## TIMEDSP

### TIMEDSP Time Display

■ **Function** Sets time display on or off.

| Header  | Program command | Query    | Response |
|---------|-----------------|----------|----------|
| TIMEDSP | TIMEDSP△sw      | TIMEDSP? | sw       |

- **Value of sw**      ON:            ON  
                          OFF:            OFF  
                          FULL:         Clock & Title
- **Suffix code**      None
- **Initial setting**   OFF:           Off
- **Example**            TIMEDSP△ON

## TITLE

### TITLE Title Entry

■ **Function** Registers the title character string (same function as KSE).

| Header | Program command | Query  | Response |
|--------|-----------------|--------|----------|
| TITLE  | TITLE△text      | TITLE? | text     |

- **Value of text**      Character string within 32 characters enclosed by single or double quotes.
- **Example**            TITLE△"MS2683A"  
                          TITLE△'SPECTRUM ANALYZER'



**TLV****TLV Trigger Level**

- **Function** Sets the threshold level of sweep the start trigger when the trigger source is video and Ext mode.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| TLV    | TLV△1           | TLV?  | TLV△1    |

- **Value of l**
- For EXT: -10.0 to +10.0 (0.1 V Step)
  - For video and log: -100 to 0 (1 dB Step)
  - For video and linear: 0 to 100 (1% Step)
  - For video: -100 to 100 (2% Step)
  - For video (wide): HIGH, MID, LOW
- **Suffix code**
- When the trigger source is video and the step is log
    - None: dB
    - DB: dB
  - When the trigger source is EXT
    - None: V
    - V: V
  - In other case
    - None
- **Initial setting** -4∅
- **Example** TLV△-5∅

# TM

## TM Trigger

■ **Function** Sets the trigger switch and trigger source.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| TM     | TM△a            | TM?   | a        |

■ **Value of a**

- FREE: FREERUN
- VID: VIDEO
- WIDEVID: Wide IF Video
- LINE: LINE
- EXT: EXT

■ **Suffix code** None

■ **Initial setting** FREE: FREERUN

■ **Example** TM△FREE

## TMCNT?

### TMCNT? Time Count Read

- **Function** Reads the values counted by the integrating meter which integrates the time or which electricity has been turned on.

| Header | Program command | Query  | Response                                                              |
|--------|-----------------|--------|-----------------------------------------------------------------------|
| TMCNT? | _____           | TMCNT? | t<br>t = Transfers the data with no suffix code in units of 1 minute. |

- **Example** TMCNT?

## TMMD

### TMMD Trace Time Storage Mode

- **Function** Selects the mode for processing the trace TIME waveform.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| TMMD   | TMMD△n          | TMMD? | TMMD△n   |

- **Value of n**
  - ∅: NORMAL
  - 1: MAX HOLD
  - 2: AVERAGE
  - 3: MIN HOLD
  - 4: CUMULATIVE
  - 5: OVER WRITE
  - 6: LINEAR AVERAGE
- **Suffix code** None
- **Initial setting** ∅: NORMAL
- **Example** TMMD△∅

## TMWR

### TMWR Trace Time Write Switch

■ **Function** Controls writing of the waveform to trace TIME.

| Header | Program command | Query | Response          |
|--------|-----------------|-------|-------------------|
| TMWR   | TMWR△sw         | TMWR? | TMWR△sw sw=ON,OFF |

- **Value of sw** 1, ON: ON  
 ∅, OFF: OFF
- **Suffix code** None
- **Initial setting** ON: ON
- **Example** TMWR△ON

## TOUT

### TOUT RS232C Time Out

■ **Function** Sets the time-out time for the RS232C WRITE function.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| TOUT   | TOUT△t          | TOUT? | t        |

- **Value of t** ∅: Infinite (wait infinitely)  
 1 to 255: 1 to 255 s (every 1 s step)
- **Suffix code** None
- **Initial setting** 3∅: 30 s
- **Example** TOUT△1∅

**TRG****TRG Trigger**

- **Function** Sets trigger mode.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| TRG    | TRG△n           | TRG?  | TRG△n    |

- **Value of n**
  - ∅: FREERUN
  - 1: VIDEO
  - 2: LINE
  - 3: EXT
  - 7: Wide IF Video
- **Suffix code** None
- **Initial setting** ∅: FREERUN
- **Example** TRG△1

**TRGLVL****TRGLVL Trigger Level**

- **Function** Sets the sweep-start trigger level when the trigger source = VIDEO, WIDE IF VIDEO, EXT ±10 V.

| Header | Program command | Query   | Response |
|--------|-----------------|---------|----------|
| TRGLVL | TRGLVL△l        | TRGLVL? | l        |

- **Value of l**
  - 10.0 to +10.0 (0.1 Step) : when the trigger source is EXT (±10 V) (V units)
  - 100 to +100 (1 Step) : when the trigger source is VIDEO and the scale is LOG (dB units)
  - 0 to 100 (1 step): When the trigger source is VIDEO and the scale is LIN (% units)
  - 100 to +100 (2 step): When the trigger source is VIDEO (% units)
  - HIGH, MID, LOW: When the trigger source is WIDE IF VIDEO
- **Suffix code**
  - When the trigger source is VIDEO and the scale is LOG
    - None: dB
    - DB: dB
  - When the trigger source is EXT
    - None: V
    - V: V
  - In other case
    - None
- **Initial setting** l=-40
- **Example** TRGLVL△-10.0  
TRGLVL△9.9

## TRGS

### TRGS Trigger Switch

- **Function** Switches the trigger switch to Free run or Triggered.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| TRGS   | TRGS△a          | TRGS? | a        |

- **Value of a** FREE: FREERUN  
TRGD: TRIGGERED
- **Suffix code** None
- **Initial setting** FREE: FREERUN
- **Example** TRGS△FREE

## TRGSLP

### TRGSLP Trigger Slope

- **Function** Selects the rising or falling slope of the trigger when trigger source is VIDEO or EXT mode.

| Header | Program command | Query   | Response |
|--------|-----------------|---------|----------|
| TRGSLP | TRGSLP△a        | TRGSLP? | a        |

- **Value of a** RISE: Rising edge  
FALL: Falling edge
- **Suffix code** None
- **Initial setting** RISE: Rising edge
- **Example** TRGSLP△RISE

# TRGSOURCE

## TRGSOURCE Trigger Source

- **Function** Selects the trigger source. The trigger switch setting is not changed by this command.

| Header    | Program command | Query      | Response |
|-----------|-----------------|------------|----------|
| TRGSOURCE | TRGSOURCE△a     | TRGSOURCE? | a        |

- **Value of a**
  - VID: VIDEO
  - WIDEVID: WIDE IF VIDEO
  - LINE: LINE
  - EXT: EXT
- **Suffix code** None
- **Initial setting** VID: VIDEO
- **Example** TRGSOURCE△VID

# TRM

## TRM Terminator

- **Function** Sets the terminator of the Response data transferred on the GPIB.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| TRM    | TRM△n           | TRM?  | n        |

- **Value of n**
  - ∅: LF
  - 1: CR/LF
- **Suffix code** None
- **Initial setting** ∅: LF (However, the terminator already registered is not initialized.)
- **Example**
  - TRM△∅
  - TRM△1

# TS

## TS Take Sweep

■ **Function** Executes a single sweep synchronously (same function as SWP).

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| TS     | TS              | _____ | _____    |

■ **Example** TS

# TSAVG

## TSAVG Take Sweep with Averaging

■ **Function** Performs synchronous sweeping the number of times specified in the current Averaging setting.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| TSAVG  | TSAVG           | _____ | _____    |

■ **Example** TSAVG



## TSHOLD

### TSHOLD Take Sweep with Max/Min Holding

- **Function** Performs synchronous sweeping by the number of times specified in the current holding setting.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| TSHOLD | TSHOLD          | _____ | _____    |

- **Example** TSHOLD

## TSL

### TSL Trigger Slope

- **Function** Selects triggering on the rising or falling trigger slope.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| TSL    | TSL△sw          | TSL?  | TSL△sw   |

- **Value of sw**
  - ∅: Fall
  - 1: Rise
- **Suffix code** None
- **Initial setting** 1: Rise
- **Example** TSL△∅

# TSP

## TSP Time Span

■ **Function** Sets the time span of the trace.

| Header | Program command | Query | Response                                                                         |
|--------|-----------------|-------|----------------------------------------------------------------------------------|
| TSP    | TSP△t           | TSP?  | t<br>t=1 to 100000000<br>Transfers the data with no suffix code in units of 1 μs |

- **Value of t** 1 μs to 1000 s
- **Suffix code**
  - None : ms
  - US : μs
  - MS : ms
  - S : sec
- **Initial setting** 200 msec
- **Example**
  - TSP△100
  - TSP△100S

# TTL

## TTL Title Display Switch

■ **Function** Switches the title display to ON/OFF.

| Header | Program command | Query | Response     |
|--------|-----------------|-------|--------------|
| TTL    | TTL△sw          | TTL?  | sw sw=ON,OFF |

- **Value of sw**
  - 1, ON : ON
  - ∅, OFF : OFF
- **Suffix code** None
- **Initial setting** OFF : OFF
- **Example** TTL△ON

# TZONE

## TZONE Expand Zone

- **Function** Switches the time expansion (magnified display) ON/OFF.

| Header | Program command | Query  | Response        |
|--------|-----------------|--------|-----------------|
| TZONE  | TZONE△sw        | TZONE? | sw<br>sw=ON,OFF |

- **Value of sw** 1, ON: ON  
Ø, OFF: OFF
- **Suffix code** None
- **Initial setting** OFF: OFF
- **Example** TZONE△ON

# TZSP

## TZSP Expand Zone Span

- **Function** Sets the zone for time expansion (magnified display).

| Header | Program command | Query | Response                                                                          |
|--------|-----------------|-------|-----------------------------------------------------------------------------------|
| TZSP   | TZSP△t          | TZSP? | t<br>t=1 to 1000000000<br>Transfers the data with no suffix code in units of 1 μs |

- **Value of t** 1 μs to 1000 s
- **Suffix code** None: ms  
US: μs  
MS: ms  
S: s
- **Initial setting** 200 ms
- **Example** TZSP△1ØMS

## TZSPP

### TZSPP Expand Zone Span point

■ **Function** Specifies the width of the Expand Zone in term of the number of points.

| Header | Program command | Query  | Response |
|--------|-----------------|--------|----------|
| TZSPP  | TZSPP△p         | TZSPP? | p        |

- Value of p 1 to 500, 1000
- Suffix code None
- Initial setting 1∅∅: 101 points (2 div)
- Example TZSPP△51

## TZSTART

### TZSTART Expand Zone Start

■ **Function** Sets the start time for time expansion (magnified display).

| Header  | Program command | Query    | Response                                                                               |
|---------|-----------------|----------|----------------------------------------------------------------------------------------|
| TZSTART | TZSTART△t       | TZSTART? | t<br>t=-1000000000 to 65500<br>Transfers the data with no suffix code in units of 1 μs |

- Value of t -1000 s to 65.5 ms
- Suffix code None: ms  
US: μs  
MS: ms  
S: s
- Initial setting 0 s
- Example TZSTART△1∅MS

# TZSTARTP

## TZSTARTP Expand Zone Start point

■ **Function** Specifies the start point of the Expand Zone in terms of the number of point.

| Header   | Program command | Query     | Response |
|----------|-----------------|-----------|----------|
| TZSTARTP | TZSTARTP△p      | TZSTARTP? | p        |

- **Value of p** 0 to 500, 1000
- **Suffix code** None
- **Initial setting** 200: 200 point
- **Example** TZSTARTP△100

## UANTF

### UANTF Select setting user antenna factor table number

■ Function Selects the setting user antenna factor table number.

| Header | Program command | Query  | Response |
|--------|-----------------|--------|----------|
| UANTF  | UANTF△n         | UANTF? | n        |

- Value of n 1 to 4 (user antenna factor table number)
- Suffix code None
- Initial setting 1
- Example UANTF△1

## UCL?

### UCL? Query Uncal Status

■ Function Reads out the UNCAL status.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| UCL?   | _____           | UCL?  | UCL△n    |

- Value of n
  - ∅: NORMAL
  - 1: During UNCAL
- Example UCL?

**UNC****UNC                    Uncal Display ON/OFF**

- **Function**                    Specifies whether 'UNCAL' is displayed when UNCAL occurs.

| Header | Program command | Query | Response                            |
|--------|-----------------|-------|-------------------------------------|
| UNC    | UNC△sw          | UNC?  | UNC△sw                    sw=ON,OFF |

- **Value of sw**                1, ON:        ON  
                                           ∅, OFF:      OFF
- **Suffix code**                None
- **Initial setting**            ON:            ON
- **Example**                    UNC△ON

note: This setting is valid only by the remote command.

**UNT****UNT                    Unit for Log Scale**

- **Function**                    Sets the display unit system in LOG scale mode.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| UNT    | UNT△a           | UNT?  | UNT△a    |

- **Value of a**                ∅:            dBm  
                                           1:            dBμV  
                                           2:            dBmV  
                                           3:            V  
                                           4:            dBμV(emf)  
                                           5:            W  
                                           6:            dBμV/m
- **Suffix code**                None
- **Initial setting**            ∅:            dBm
- **Example**                    UNT△∅

# VAVG

## VAVG Average

- **Function** Sets averaging ON or OFF and sets the number of averaging processes.

| Header | Program command   | Query | Response |
|--------|-------------------|-------|----------|
| VAVG   | VAVG△sw<br>VAVG△n | VAVG? | n        |

- **Value of sw** 1, ON: ON  
Ø, OFF: OFF
- **Value of n** 2 to 1024: Number of averaging processes
- **Suffix code** None
- **Initial setting** 8: 8 times
- **Example** VAVG△ON  
VAVG△128

# VB

## VB Video Bandwidth

- **Function** Sets the video bandwidth (same function as VBW).

| Header | Program command | Query | Response                                                                               |
|--------|-----------------|-------|----------------------------------------------------------------------------------------|
| VB     | VB△f<br>VB△a    | VB?   | f<br>f=1 to 3000000 or OFF<br>Transfers the data with no suffix code in units of 1 Hz. |

- **Value of f** 1 Hz to 3 MHz
- **Value of a** OFF: OFF  
AUTO: AUTO  
UP: VBW UP  
DN: VBW DOWN
- **Suffix code** f: None: Hz(10<sup>0</sup>)  
HZ: Hz(10<sup>0</sup>)  
KHZ, KZ: kHz(10<sup>3</sup>)  
MHZ, MZ: MHz(10<sup>6</sup>)  
GHZ, GZ: GHz(10<sup>9</sup>)
- **Initial setting** a: None
- **Example** VB△300HZ



## VBCOUPLE

### VBCOUPLE Couple Mode

- **Function** Sets the coupled functions to commonly settable or independently settable at the frequency domain and time domain.

| Header   | Program command | Query     | Response |
|----------|-----------------|-----------|----------|
| VBCOUPLE | VBCOUPLE△a      | VBCOUPLE? | a        |

- **Value of a** COM: Common  
IND: Independent
- **Suffix code** None
- **Initial setting** IND: Independent (The mode already registered is not initialized.)
- **Example** VBCOUPLE△COM

## VBR

### VBR VBW/ RBW Ratio

- **Function** Sets the ratio of video bandwidth to resolution bandwidth when VBW is selected for AUTO.

| Header | Program command | Query | Response             |
|--------|-----------------|-------|----------------------|
| VBR    | VBR△r           | VBR?  | r<br>r=0.0001 to 100 |

- **Value of r** 0.0001 to 100 (1/3 sequence)
- **Suffix code** None
- **Initial setting** Trace A,B,BG:VBW/RBW RATIO=1  
Trace TIME:VBW/RBW RATIO=1
- **Example** VBR△1

# VBW

## VBW Video Bandwidth

■ **Function** Sets the video bandwidth.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| VBW    | VBW△n           | VBW?  | VBW△n    |

|                     |    |         |     |         |
|---------------------|----|---------|-----|---------|
| ■ <b>Value of n</b> | ∅: | 1 Hz    | 8:  | 3 Hz    |
|                     | 1: | 10 Hz   | 9:  | 30 Hz   |
|                     | 2: | 100 Hz  | 1∅: | 300 Hz  |
|                     | 3: | 1 kHz   | 11: | 3 kHz   |
|                     | 4: | 10 kHz  | 12: | 30 kHz  |
|                     | 5: | 100 kHz | 13: | 300 kHz |
|                     | 6: | OFF     | 14: | 3 MHz   |
|                     | 7: | 1 MHz   |     |         |

■ **Suffix code** None

■ **Initial setting** Calculated value when VBW is selected for AUTO

■ **Example** VBW△3

# VIEW

## VIEW View

■ **Function** Stops writing of the waveform data.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| VIEW   | VIEW△tr         | _____ | _____    |

|                      |         |            |
|----------------------|---------|------------|
| ■ <b>Value of tr</b> | TRA:    | Trace A    |
|                      | TRB:    | Trace B    |
|                      | TRBG:   | Trace BG   |
|                      | TRTIME: | Trace TIME |

■ **Suffix code** None

■ **Example** VIEW△TRB

# WINDPOS

## WINDPOS Measure Window Position

■ **Function** Specifies the display position of measured-result display window.

| Header  | Program command | Query    | Response |
|---------|-----------------|----------|----------|
| WINDPOS | WINDPOS△a       | WINDPOS? | a        |

- **Value of n**
  - UPLEFT: Upper left
  - UPRIGHT: Upper right
  - LOWLEFT: Lower left
  - LOWRIGHT: Lowre right
- **Suffix code** None
- **Initial setting** UPLEFT: Upper left
- **Example** WINDPOS△LOWRIGHT

# XCH

## XCH Exchange Traces

■ **Function** Exchanges the specified wave data of traces.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| XCH    | XCH△tr1, tr2    | _____ | _____    |

■ **Value of tr1, tr2** TRA: Trace-A

TRB: Trace-B

■ **Suffix code** None

■ **Example** XCH△TRA, TRB

# XMA

## XMA Trace A Spectrum Data

■ **Function** Writes/reads the spectrum data to/from trace A (main trace) memory.

| Header | Program command | Query     | Response                                   |
|--------|-----------------|-----------|--------------------------------------------|
| XMA    | XMA△p, b        | XMA?△p, d | b1,b2,b3... (ASCII)<br>b1 b2 b3 • (BINARY) |

■ **Value of p** 0 to 500, 1000 (point No.)

■ **Value of b** LOG scale: Integer of 0.01 dBm unit (independent of display unit system)

$$\text{LIN scale: } b = \frac{\text{Voltage value (V)}}{\text{Reference level (V)}} \times 10000$$

When binary format is specified for response data, data for each point is composed of two bytes. The high-order byte is sent first.

■ **Value of d** 1 to 501, 1001(number of points)

■ **Example** XMA△1, -2000

XMA?△1, 2(Reads two-point data items starting from point 1.)

**XMB****XMB Trace B Spectrum Data**

■ **Function** Writes/reads the spectrum data to/from to trace B (main trace) memory.

| Header | Program command   | Query              | Response                                   |
|--------|-------------------|--------------------|--------------------------------------------|
| XMB    | XMB $\Delta$ p, b | XMB? $\Delta$ p, d | b1,b2,b3 •• (ASCII)<br>b1 b2 b3 • (BINARY) |

■ **Value of p** 0 to 500, 1000 (point No.)

■ **Value of b** LOG scale: Integer of 0.01 dBm unit (independent of display unit system)

$$\text{LIN scale: } b = \frac{\text{Voltage value (V)}}{\text{Reference level (V)}} \times 10000$$

When binary format is specified for response data, data for each point is composed of two bytes. The high-order byte is sent first.

■ **Value of d** 1 to 501, 1001 (number of points)

■ **Example** XMB $\Delta$ 1, -2000  
XMB? $\Delta$ 1, 2 (Reads two-point data items starting from point 1.)

**XMG****XMG Trace BG Spectrum Data**

■ **Function** Writes/reads the spectrum data to/from to trace BG memory.

| Header | Program command   | Query              | Response                                   |
|--------|-------------------|--------------------|--------------------------------------------|
| XMG    | XMG $\Delta$ p, b | XMG? $\Delta$ p, d | b1,b2,b3 •• (ASCII)<br>b1 b2 b3 • (BINARY) |

■ **Value of p** 0 to 500, 1000 (point No.)

■ **Value of b** LOG scale: Integer of 0.01 dBm unit (independent of display unit system)

$$\text{LIN scale: } b = \frac{\text{Voltage value (V)}}{\text{Reference level (V)}} \times 10000$$

When binary format is specified for response data, data for each point is composed of two bytes. The high-order byte is sent first.

■ **Value of d** 1 to 501, 1001 (number of points)

■ **Example** XMG $\Delta$ 1, -2000  
XMG? $\Delta$ 1, 2 (Reads two-point data items from point 1.)

# XMT

## XMT Trace TIME Spectrum Data

■ **Function** Writes/reads the spectrum data to/from the trace TIME memory.

| Header | Program command | Query     | Response                                   |
|--------|-----------------|-----------|--------------------------------------------|
| XMB    | XMT△p, b        | XMT?△p, d | b1,b2,b3 •• (ASCII)<br>b1 b2 b3 • (BINARY) |

■ **Value of p** 0 to 500, 1000 (point No.)

■ **Value of b** LOG scale: Integer of 0.01 dBm unit (independent of display unit system)

LIN scale: 
$$b = \frac{\text{Voltage value (V)}}{\text{Reference level (V)}} \times 10000$$

When binary format is specified for response data, data for each point is composed of two bytes. The high-order byte is sent first.

■ **Value of d** 1 to 501, 1001 (number of points)

■ **Example**

XMT△1, -2000

XMT?△1, 2 (Reads two-point data items starting from point 1.)

# YAMP

## YAMP Y-Out Amplitude

- **Function** Selects the Y-Out amplitude.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| YAMP   | YAMP△a          | YAMP? | a        |

- **Value of a**
  - ∅: 0.5
  - 1: 1
  - 2: 5

- **Suffix code** None

- **Example** YAMP△1

# YOFFSET

## YOFFSET Y-Out Offset

- **Function** Sets the Y-Out Offset voltage.

| Header  | Program command | Query    | Response |
|---------|-----------------|----------|----------|
| YOFFSET | YOFFSET△a       | YOFFSET? | a        |

- **Value of a** -2.0 to 2.0 [V]

- **Suffix code**
  - None: V
  - V: V
  - MV: mV
  - UV: μV

- **Example** YOFFSET△2

# YPOL

## YPOL Y-Out Polarity

■ **Function** Switches the Y-Out polarity.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| YPOL   | YPOL△a          | YPOL? | a        |

■ **Value of a** POS: Positive  
 NEG: Negative

■ **Suffix code** None

■ **Example** YPOL△POS



## ZEROADJ

### ZEROADJ      Zero

- **Function**      Zero point proofreading is performed in the state of no inputting.

| Header  | Program command | Query | Response |
|---------|-----------------|-------|----------|
| ZEROADJ | ZEROADJ         | _____ | _____    |

- **Example**      ZEROADJ
- **Restrictions by apparatus and the option**  
This command is effective about MS2687A/B Option21/23 Power Meter.

## ZEROCAL

### ZEROCAL      Zero Cal

- **Function**      Zero point proofreading is performed in the state of no inputting.  
After calibration, Power Meter is rectified in the signal input of 50 MHz, 0 dBm.

| Header  | Program command | Query | Response |
|---------|-----------------|-------|----------|
| ZEROCAL | ZEROCAL         | _____ | _____    |

- **Example**      ZEROCAL
- **Restrictions by apparatus and the option**  
This command is effective about MS2687A/B Option21/23 Power Meter.

## \*CLS

### \*CLS Clear Status Command

■ Function Clears the status byte register.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| *CLS   | *CLS            | _____ | _____    |

■ Example \*CLS

---

## \*ESE

### \*ESE Standard Event Status Enable

■ Function Sets or clears the standard status enable register.

| Header | Program command | Query  | Response |
|--------|-----------------|--------|----------|
| *ESE   | *ESE△n          | *ESE△? | n        |

■ Value of n 0 to 255

■ Example \*ESE△20  
\*ESE?

---

## \*ESR?

### \*ESR? Standard Event Status Register Query

■ Function Returns the current value in the standard event status register.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| *ESR   | _____           | *ESR? | n        |

■ Value of n 0 to 255

■ Example \*ESR?

**\*IDN?****\*IDN? Identification Query**

- **Function** Returns the manufacturer name, model number etc. of the equipment.

| Header | Program command | Query | Response             |
|--------|-----------------|-------|----------------------|
| *IDN   | —————           | *IDN? | ANRITSU, id, 0000, n |

- **Value of id** MS268\*A/B (a name of spectrum analyzer)
- **Value of n** 1 to 99 (firmware version No.)
- **Example** \*IDN?

**\*OPC****\*OPC Operation Complete Command**

- **Function** Sets bit 0 in the standard event status register when all pending selected device operations have been completed.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| *OPC   | *OPC            | ————— | —————    |

- **Example** \*OPC

## \*OPC?

### \*OPC?      **Operation Complete Query**

■ **Function**      Sets the output queue to 1 to generate a MAV summary message when all pending selected device operations have been completed.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| *OPC?  | _____           | *OPC? | 1        |

■ **Example**      \*OPC?

---

## \*RST

### \*RST      **Reset Command**

■ **Function**      Resets the device to the third level.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| *RST   | *RST            | _____ | _____    |

■ **Example**      \*RST

---

## \*SRE

### \*SRE      **Service Request Enable Command**

■ **Function**      Sets the bits in the service request enable register.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| *SRE   | *SRE△n          | *SRE? | n        |

■ **Value of n**      0 to 63, 128 to 191 (current value of the service request enable register)

■ **Example**      \*SRE△16

**\*STB?****\*STB?      Read Status Byte Command**

■ **Function**      Returns the current values of the status bytes including the MSS bit.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| *STB   | _____           | *STB? | n        |

■ **Value of n**

| Bit | Bit weight | Bit name | Condition of status byte register                          |
|-----|------------|----------|------------------------------------------------------------|
| 7   | 128        | _____    | 0= Not used                                                |
| 6   | 64         | MSS      | 0= Service not requested<br>1=Service requested            |
| 5   | 32         | ESB      | 0=Event status not generated<br>1= Event status generated  |
| 4   | 16         | MAV      | 0=No data in output queue<br>1= Data in output queue       |
| 3   | 8          | _____    | 0= Not used                                                |
| 2   | 4          | ESB(END) | 0= Event status not generated<br>1= Event status generated |
| 1   | 2          | _____    | 0= Not used                                                |
| 0   | 1          | _____    | 0= Not used                                                |

■ **Example**      \*STB?

## \*TRG

### \*TRG Trigger Command

- Function** Same function as that of IEEE488 GET-group-execute-trigger bus command. For this command, the MS2650/MS2660B/C series executes a single sweep ( same function as SWP.)

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| *TRG   | *TRG            | _____ | _____    |

- Example** \*TRG

## \*TST

### \*TST Self Test Query

- Function** Executes an internal self-test and returns the details of any errors.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| *TST   | _____           | *TST? | n        |

- Value of n**
  - ∅: Self-test completed with no errors.
  - 32767 to -1, 1 to 32767: Self-test was not completed, or was completed but with errors.

- Example** \*TST?

**\*WAI****\*WAI Wait-to-Continue Command**

■ **Function** Keeps the next command on stand-by while the device is executing a command.

| Header | Program command | Query | Response |
|--------|-----------------|-------|----------|
| *WAI   | *WAI            | _____ | _____    |

■ **Example** \*WAI





# Appendixes

Appendix A Table of MS2683A Device-Dependent Initial  
Setting ..... A-1

Appendix B ASCII\* Code Table ..... B-1

Appendix C Comparison Table of Controller's GPIB  
Instructions ..... C-1



# Appendix A Table of MS2683A Device-Dependent Initial Setting

Table A Device-Dependent Initial Settings (1/5)

| Group                    | Outline                                        | Control item          | Initial setting data         |            |            |
|--------------------------|------------------------------------------------|-----------------------|------------------------------|------------|------------|
|                          |                                                |                       | TRACE-A,B                    | TRACE-TIME | TRACE-BG   |
| Frequency                | Selects the mode for setting a frequency band. | FREQUENCY MODE        | START-STOP                   |            |            |
|                          | Sets the start frequency                       | START FREQUENCY       | 0 Hz                         | -----      | 0 Hz       |
|                          | Sets the center frequency                      | CENTER FREQUENCY      | (*1)                         |            |            |
|                          | Sets the stop frequency                        | STOP FREQUENCY        | (*2)                         | -----      | (*2)       |
|                          | Sets the frequency span                        | FREQUENCY SPAN        | (*2)                         | *0 Hz      | (*2)       |
|                          | Sets the center-frequency step size            | CENTER FREQ STEP SIZE | 1 GHz                        |            |            |
|                          | Sets the scroll step size                      | SCROLL STEP SIZE      | 2 div                        |            |            |
|                          | Select Band                                    | BAND SELECT           | AUTO                         |            |            |
| Level                    | Sets the reference level                       | REFERENCE LEVEL       | -10 dBm                      |            |            |
|                          | Set the reference level step size              | REF LEVEL STEP SOZE   | AUTO:1div                    |            |            |
|                          | Sets the scale mode                            | SCALE MODE            | LOG                          | LOG        | *LOG       |
|                          | Sets the LOG scale                             | LOG SCALE             | 10 dB/div                    | 10 dB/div  | *10 dB/div |
|                          | Sets the LIN scale                             | LIN SCALE             | 10%/div                      | 10%/div    | -----      |
|                          | Sets the LOG unit system                       | LOG SCALE UNIT        | Not initialized<br>*RST: dBm |            |            |
|                          | Sets the reference level offset                | REF LEVEL OFFSET      | OFF                          |            |            |
|                          | Sets the reference level offset value          | OFFSET VALUE          | 0 dBm                        |            |            |
|                          | Sets the display line                          | DISPLAY LINE          | OFF                          |            |            |
|                          | Sets the display line level                    | DISPLAY LINE LEVEL    | -60 dBm                      |            |            |
|                          | Selects the ABS or RELmarker level             | MARKER LEVEL ABS/REL  | A:ABS<br>B:ABS               | ABS        | ABS        |
|                          | Sets the correction factor                     | CORRECTION            | Not initialized<br>*RST: OFF |            |            |
|                          | Sets the correction factor number              | CORRECTION FACTOR No. | *RST: 1                      |            |            |
|                          | RF pre-amplifier                               | RF PREAMPL            | OFF                          |            |            |
| Sets the input impedance | INPUT INPEDANCE                                | 50Ω                   |                              |            |            |

(\*1) 1.5 GHz (MS2681A), 3.95 GHz (MS2683A), 15.0 GHz (MS2687A/MS2687B)

(\*2) 3.0 GHz (MS2681A), 7.9 GHz (MS2683A), 30.0 GHz (MS2687A/MS2687B)

Table A Device-Dependent Initial Settings (2/5)

| Group             | Outline                                               | Control item                  | Initial setting data                                |            |           |
|-------------------|-------------------------------------------------------|-------------------------------|-----------------------------------------------------|------------|-----------|
|                   |                                                       |                               | TRACE-A,B                                           | TRACE-TIME | TRACE-BG  |
| Display mode      | Selects the display mode                              | DISPLAY MODE                  | TRACE-A                                             |            |           |
|                   | Selects the display format for TRACE-A/B              | DISPLAY FORMAT (TRACE-A/B)    | A<B                                                 |            |           |
|                   | Selects the display format for TRACE-A/BG             | DISPLAY FORMAT (TRACE-A/BG)   | A<BG                                                |            |           |
|                   | Selects the display format for TRACE-A/TIME           | DISPLAY FORMAT (TRACE-A/TIME) | A<TIME                                              |            |           |
|                   | Selects the mode for processing a waveform            | TRACE STORAGE MODE            | NORMAL                                              | NORMAL     | *NORMAL   |
|                   | Number of traces averaged                             | AVERAGE No.                   | 8 times                                             |            |           |
|                   | Sets the separation of average sweep stops            | AVERAGE SWEEP MODE            | ON(PAUSE)                                           |            |           |
|                   | Sets the separation of hold sweep stops               | HOLD SWEEP MODE               | OFF(CONTINUOUS)                                     |            |           |
|                   | Selects the detection mode                            | DETECTION MODE                | PEAK                                                | SAMPLE     | *PEAK     |
|                   | Sets the delay time                                   | DELAY TIME                    | -----                                               | 0 sec      | -----     |
|                   | Sets the time span                                    | TIME SPAN                     | -----                                               | # 200 msec | -----     |
|                   | Sets the time expansion zone to ON/OFF                | EXPAND ZONE ON/OFF            | -----                                               | OFF        | -----     |
|                   | Sets the expand mode to ON/OFF                        | EXPAND ON/OFF                 | -----                                               | OFF        | -----     |
|                   | Sets the active marker when display mode is trace A/B | TRACE-A/B ACTIVE MKR          | TRACE-A                                             | -----      | -----     |
|                   | Selects the marker mode                               | MARKER MODE                   | NORMAL                                              |            |           |
|                   | Specifies the zone-marker center                      | ZONE MAKER CENTER             | 250 point                                           | 250 point  | 250 point |
|                   | Specifies the zone-marker width                       | ZONE MAKER WIDTH              | 51 point (1 div)                                    | *1 point   | 501 point |
|                   | Marker search mode                                    | MAKER SEARCH MODE             | PEAK                                                |            |           |
|                   | Sets the multi marker mode to ON/OFF                  | MULTI MARKER MODE             | OFF                                                 |            |           |
|                   | Sets the multi marker list to ON/OFF                  | MULTI MARKER LIST             | OFF                                                 |            |           |
|                   | Multi marker list frequency AES/REL                   | MULTI MARKER LOST FREQ        | ABS                                                 |            |           |
|                   | Multi marker list level ABS/REL                       | MULTI MARKER LOST LEVEL       | ABS                                                 |            |           |
|                   | Sets the 'n'th multi marker to ON/OFF (No.1~10)ON/OFF | MULTI MARKER ON/OFF           | Not initialized<br>RST: No.1 = ON, No.2 to 10 = OFF |            |           |
|                   | Selects the active multi marker                       | ACTIVE MARKER No.             | Not initialized *RST: No.1                          |            |           |
| Search resolution | SEARCH RESOLUTION                                     | 10 dB                         |                                                     |            |           |
| Search threshold  | THRESHOLD                                             | OFF                           |                                                     |            |           |

Table A Device-Dependent Initial Settings (3/5)

| Group                    | Outline                                                                                  | Control item                     | Initial setting data                                              |            |           |
|--------------------------|------------------------------------------------------------------------------------------|----------------------------------|-------------------------------------------------------------------|------------|-----------|
|                          |                                                                                          |                                  | TRACE-A,B                                                         | TRACE-TIME | TRACE-BG  |
| Trace operation          | A-B→A                                                                                    | A-B→A                            | OFF                                                               |            |           |
|                          | A-B REFERENCE LINE                                                                       | REFERENCE LINE                   | MIDDLE                                                            |            |           |
|                          | Normalize(A - B None)                                                                    | NORMALIZE                        | OFF                                                               |            |           |
| Sweep function           | Sets the sweep mode                                                                      | SWEEP MODE                       | CONTINUOUS                                                        |            |           |
|                          | Sets the zone sweep to ON/OFF                                                            | ZONE SWEEP                       | OFF                                                               | -----      |           |
|                          | Sets the tracking function to ON/OFF                                                     | TRACKING SWEEP                   | OFF                                                               | -----      |           |
|                          | Sets the gate sweep function to ON/OFF                                                   | GATE SWEEP                       | OFF                                                               |            | -----     |
|                          | Sets the gate delay time                                                                 | GATE DELAY                       | 0 sec                                                             |            | -----     |
|                          | Sets the gate length                                                                     | GATE LENGTH                      | 1 msec                                                            |            | -----     |
|                          | Sets the gate interval termination, internally or externally                             | GATE END                         | INTERNAL                                                          |            | -----     |
|                          | Sets the trigger switch mode                                                             | TRIGGER SWITCH                   | FREE RUN                                                          | FREE RUN   | *FREE RUN |
|                          | Sets the trigger source                                                                  | TRIGGER SOURCE                   | VIDEO                                                             |            | -----     |
|                          | Sets the external trigger level type                                                     | TRIGGER SOURCE(EXT)              | -10V                                                              |            | -----     |
|                          | Selects the trigger slope                                                                | TRIGGER SLOPE                    | RISE                                                              |            | -----     |
|                          | Sets the trigger level                                                                   | TRIGGER LEVEL                    | -40dB                                                             |            | -----     |
|                          | Trigger level (WIDE IF VEDEO)                                                            | TRIGGER LEVEL (WIDE IF VIDEO)    | HIGH                                                              |            |           |
| Waveform writing/reading | Sets the trace write switch to ON/OFF                                                    | TRACE WRITE SWITCH               | ON                                                                | ON         | ON        |
|                          | Sets the trace read switch to ON/OFF                                                     | TRACE READ SWITCH                | ON                                                                | ON         | ON        |
| Coupled function         | Selects the mode for setting the resolution bandwidth                                    | RESOLUTION BANDWIDTH             | AUTO                                                              | AUTO       | *AUTO     |
|                          | Selects the mode for setting the video bandwidth                                         | VIDEO BAND WIDTH                 | AUTO                                                              | AUTO       | *AUTO     |
|                          | Selects the mode for setting the sweep time                                              | SWEEP TIME                       | AUTO                                                              | AUTO       | *AUTO     |
|                          | Selects the mode for setting the RF attenuator                                           | RF ATTENUATOR                    | AUTO                                                              |            |           |
|                          | VBW/RBW ratio at VBW = AUTO                                                              | VBW/RBW RATIO                    | 1                                                                 | 1          | 1         |
|                          | RBW/Span ratio at RBW = AUTO                                                             | RBW/SPAN RATIO                   | 0.01                                                              | 0.01       | 0.01      |
|                          | Sets the coupled functions to COMMON or INDEPENDENT between the frequency or time domain | COUPLE MODE (COMMON/INDEPENDENT) | Not initialized.<br>When shipped from the factory: INDEPENDENT    |            |           |
| SAVE/RECALL              | Selects data to be recalled                                                              | RECALLED DATA                    | Not initialized. When shipped from the factory: View              |            |           |
| Hard copy                | Select the printer device mode                                                           | PRINTER MODE                     | Not initialized.<br>When shipped from the factory: BJ-M70 (ESC/P) |            |           |

Table A Device-Dependent Initial Settings (4/5)

| Group            | Outline                                                       | Control item            | Initial setting data                   |            |          |
|------------------|---------------------------------------------------------------|-------------------------|----------------------------------------|------------|----------|
|                  |                                                               |                         | TRACE-A,B                              | TRACE-TIME | TRACE-BG |
| Measure function | Selects the item to be measured                               | MEASURE ITEM            | OFF                                    |            |          |
|                  | Sets the counter to the specified resolution                  | COUNT RESOLUTION        | 1 kHz                                  |            |          |
|                  | Selects the occupied frequency bandwidth measurement method   | OBW MEASURE METHOD      | Not initialized<br>*RST: N%            |            |          |
|                  | Sets the occupied frequency bandwidth to N%                   | OBW N% VALUE            | Not initialized<br>*RST: 99%           |            |          |
|                  | Sets the occupied frequency to X dB                           | OBW XdB VALUE           | Not initialized<br>*RST: 25dB          |            |          |
|                  | Selects the adjacent channel leakage power measurement method | ADJ-CH MEASURE METHOD   | Not initialized<br>*RST: R:TOTAL POWER |            |          |
|                  | Selects the adjacent channel leakage power measurement method | ADJ-CH GRAPH            | Not initialized<br>*RST: ON            |            |          |
|                  | Selects the adjacent channel                                  | ADJACENT CH SELECT      | Not initialized<br>*RST: BOTH SIDES    |            |          |
|                  | Sets adjacent separation 1                                    | ADJACENT CH SEPARATION1 | Not initialized<br>*RST: 12.5 kHz      |            |          |
|                  | Sets the adjacent separation 2                                | ADJACENT CH SEPARATION2 | Not initialized<br>*RST: 25.0 kHz      |            |          |
|                  | Sets the adjacent channel bandwidth                           | ADJACENT CH BANDWIDTH   | Not initialized<br>*RST: 8.5 kHz       |            |          |
|                  | Sets the adjacent channel center line display                 | ADJ-CH CENTER LINE      | Not initialized<br>*RST: ON            |            |          |
|                  | Sets the adjacent channel band line display                   | ADJ-CH BAND LINE        | Not initialized<br>*RST: OFF           |            |          |
|                  | Selects the template                                          | SELECT TEMPLATE         | Not initialized<br>*RST: No.1          |            |          |
|                  | Selects the template level                                    | TEMPLATE LEVEL          | Not initialized<br>*RST: ABSOLUTE      |            |          |
|                  | Sets the template management function                         | MANEGE TEMPLATE         | Not initialized                        |            |          |
|                  | Selects the noise measurement method                          | NOISE MEASURE METHOD    | Not initialized<br>*RST: ABS           |            |          |

Table A Device-Dependent Initial Settings (5/5)

| Group                     | Outline                                | Control item                    | Initial setting data                                        |            |          |
|---------------------------|----------------------------------------|---------------------------------|-------------------------------------------------------------|------------|----------|
|                           |                                        |                                 | TRACE-A,B                                                   | TRACE-TIME | TRACE-BG |
| Measure function          | BURST POWER START POINT                | BURST POWER MEASURE START POINT | 100 point                                                   |            |          |
|                           | BURST POWER STOP POINT                 | BURST POWER MEASURE STOP POINT  | 400 point                                                   |            |          |
| Calibration               | Frequency calibration                  | FREQ CAL                        | ON                                                          |            |          |
| RS-232C                   | Band rate                              | BAUD RATE                       | 2400                                                        |            |          |
|                           | Parity                                 | PARITY                          | OFF                                                         |            |          |
|                           | Data bit                               | DATA BIT                        | 8 bit                                                       |            |          |
|                           | Stop bit                               | STOP BIT                        | 1 bit                                                       |            |          |
|                           | Time-out                               | TIME OUT                        | 30 sec                                                      |            |          |
| GPIB                      | Sets the GPIB 2 self address           | GPIB SELF ADDRESS               | Not initialized.<br>When shipped from the factory: 0        |            |          |
|                           | trigger sweep time out                 | TRIGGER SWEEP TIME OUT          |                                                             |            |          |
|                           | Sets the DSU (MC8104A) address         | DATA STORAGE UNIT ADDRESS       | Not initialized.<br>When shipped from the factory: 19       |            |          |
| Title                     | Sets the title output to ON/OFF        | TITLE ON/OFF                    | Not initialized.<br>When shipped from the factory: ON       |            |          |
|                           | Selects the title data                 | TITLE DATA                      | Not initialized.<br>When shipped from the factory: ALLSPACE |            |          |
| CAL/<br>UNCAL             | Displays couple failure                | UNCAL DISPLAY                   | Not initialized.<br>Initialized to ON at power-on.          |            |          |
| Spectrum data/<br>PMC/ETC | Sets the response data to ASCII/BINARY | RESPONSE DATA                   | Not initialized.<br>When shipped from the factory: ASCII    |            |          |
|                           | Selects the terminator for LF/CR + LF  | TERMINATOR                      | Not initialized.<br>When shipped from the factory: LF       |            |          |
| Others                    | Power input status                     | POWER ON STATE                  | BEFORE POWER OFF                                            |            |          |
|                           | Parameter display system               | PARAMETER DISPLAY TYPE          | TYPE-1                                                      |            |          |
|                           | Time display                           | TIME DISPLAY                    | OFF                                                         |            |          |
|                           | Date display system                    | DATE DISPLAY MODE               | YY/MM/DD                                                    |            |          |
|                           | Comment column display system          | COMMENT DISPLAY                 | OFF                                                         |            |          |
|                           | Display color pattern                  | COLOR PATTERN                   | COLOR1                                                      |            |          |
|                           | LCD display                            | LCD DISPLAY                     | ON                                                          |            |          |

Note: • In the above table, in place of the parameters not initialized by the INIT command or P+reset key, the initial settings (indicated by \*RST) initialized by the \*RST command are listed. In place of the parameters not initialized by the \*RST command, the values at the shipment are listed.

- An initial value marked with '\*' is a fixed value.
- An initial value marked with '#' is the value at COUPLE MODE = COMMON.





# Appendix B ASCII\* Code Table

| BITS |    |    |    | 0 0             |    | 0 0 1 |         | 0 1 0             |    | 0 1 1 |                 | 1 0 0          |   | 1 0 1        |            | 1 1 0        |  | 1 1 1 |            |                              |  |  |  |
|------|----|----|----|-----------------|----|-------|---------|-------------------|----|-------|-----------------|----------------|---|--------------|------------|--------------|--|-------|------------|------------------------------|--|--|--|
| B7   | B6 | B5 | B4 | B3              | B2 | B1    | CONTROL |                   |    |       | NUMBERS SYMBOLS |                |   |              | UPPER CASE |              |  |       | LOWER CASE |                              |  |  |  |
| 0    | 0  | 0  | 0  | 0               | 0  | 0     | NUL     | DLE               | SP | 0     | @               | P              | , | p            |            |              |  |       |            |                              |  |  |  |
| 0    | 0  | 0  | 1  | 1               | 1  | 1     | SOH     | DC1               | !  | 1     | A               | Q              | a | q            |            |              |  |       |            |                              |  |  |  |
| 0    | 0  | 1  | 0  | 0               | 0  | 0     | NUL     | DC2               | "  | 2     | B               | R              | b | r            |            |              |  |       |            |                              |  |  |  |
| 0    | 0  | 1  | 1  | 1               | 1  | 1     | ETX     | DC3               | #  | 3     | C               | S              | c | s            |            |              |  |       |            |                              |  |  |  |
| 0    | 1  | 0  | 0  | 0               | 0  | 0     | EOT     | DC4               | \$ | 4     | D               | T              | d | t            |            |              |  |       |            |                              |  |  |  |
| 0    | 1  | 0  | 1  | 1               | 1  | 1     | ENO     | NAK               | %  | 5     | E               | U              | e | u            |            |              |  |       |            |                              |  |  |  |
| 0    | 1  | 1  | 0  | 0               | 0  | 0     | ACK     | SYN               | &  | 6     | F               | V              | f | v            |            |              |  |       |            |                              |  |  |  |
| 0    | 1  | 1  | 1  | 1               | 1  | 1     | BEL     | ETB               | '  | 7     | G               | W              | g | w            |            |              |  |       |            |                              |  |  |  |
| 1    | 0  | 0  | 0  | 0               | 0  | 0     | BS      | CAN               | (  | 8     | H               | X              | h | x            |            |              |  |       |            |                              |  |  |  |
| 1    | 0  | 0  | 1  | 1               | 1  | 1     | HT      | EM                | )  | 9     | I               | Y              | i | y            |            |              |  |       |            |                              |  |  |  |
| 1    | 0  | 1  | 0  | 0               | 0  | 0     | LF      | SUB               | *  | :     | J               | Z              | j | z            |            |              |  |       |            |                              |  |  |  |
| 1    | 0  | 1  | 1  | 1               | 1  | 1     | VT      | ESC               | ÷  | ;     | K               | [              | k | {            |            |              |  |       |            |                              |  |  |  |
| 1    | 1  | 0  | 0  | 0               | 0  | 0     | FF      | FS                | ,  | <     | L               | \              | l | :            |            |              |  |       |            |                              |  |  |  |
| 1    | 1  | 0  | 1  | 1               | 1  | 1     | CR      | GS                | -  | =     | M               | ]              | m | }            |            |              |  |       |            |                              |  |  |  |
| 1    | 1  | 1  | 0  | 0               | 0  | 0     | SO      | RS                | .  | >     | N               | ^              | n | ~            |            |              |  |       |            |                              |  |  |  |
| 1    | 1  | 1  | 1  | 1               | 1  | 1     | SI      | US                | /  | ?     | O               | —              | o | RUBOUT (DEL) |            |              |  |       |            |                              |  |  |  |
|      |    |    |    | Address command |    |       |         | Universal command |    |       |                 | Listen address |   |              |            | Talk address |  |       |            | Secondary address or command |  |  |  |

KEY octal 25 PPU  
 NAK  
 hex 15 21

GPIB code  
 ASCII character  
 decimal

\*USA Standard Code for Information Interchange

Table of GPIB Interface Messages (extended)

| Bits |    |    |    |    | 0  | 0<br>MSG | 0<br>1<br>MSG | 0<br>1<br>MSG | 0<br>1<br>MSG | 1<br>0<br>MSG | 1<br>0<br>MSG | 1<br>1<br>MSG | 1<br>1<br>MSG | 1<br>1<br>MSG |     |   |   |   |   |   |     |   |   |   |     |   |
|------|----|----|----|----|----|----------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|-----|---|---|---|---|---|-----|---|---|---|-----|---|
| b7   | b6 | b5 | b3 | b2 | b1 | COLUMN   | 0             | 1             | 2             | 3             | 4             | 5             | 6             | 7             |     |   |   |   |   |   |     |   |   |   |     |   |
| ↓    | ↓  | ↓  | ↓  | ↓  | ↓  | ROW      | 0             | 1             | 2             | 3             | 4             | 5             | 6             | 7             |     |   |   |   |   |   |     |   |   |   |     |   |
| 0    | 0  | 0  | 0  | 0  | 0  | 0        | NUL           | DLE           | SP            | ↑             | 0             | ↑             | @             | ↑             | P   | ↑ | , | ↑ | p | ↑ |     |   |   |   |     |   |
| 0    | 0  | 0  | 1  | 1  | 1  | 1        | SOH           | GTL           | DC1           | LLO           | !             | ↑             | 1             | ↑             | A   | ↑ | Q | ↑ | a | ↑ | q   | ↑ |   |   |     |   |
| 0    | 0  | 1  | 0  | 1  | 0  | 2        | STX           | DC2           | "             | ↑             | 2             | ↑             | B             | ↑             | R   | ↑ | b | ↑ | r | ↑ |     |   |   |   |     |   |
| 0    | 0  | 1  | 1  | 1  | 0  | 3        | ETX           | DC3           | #             | ↑             | 3             | ↑             | C             | ↑             | S   | ↑ | c | ↑ | s | ↑ |     |   |   |   |     |   |
| 0    | 1  | 0  | 0  | 0  | 0  | 4        | EOT           | SDC           | DC4           | DCL           | \$            | ↑             | 4             | ↑             | D   | ↑ | T | ↑ | d | ↑ | t   | ↑ |   |   |     |   |
| 0    | 1  | 0  | 1  | 1  | 1  | 5        | ENQ           | PPC           | NAK           | PPU           | %             | ↑             | 5             | ↑             | E   | ↑ | U | ↑ | e | ↑ | u   | ↑ |   |   |     |   |
| 0    | 1  | 1  | 0  | 1  | 0  | 6        | ACK           | SYN           | &             | ↑             | 6             | ↑             | F             | ↑             | V   | ↑ | f | ↑ | v | ↑ |     |   |   |   |     |   |
| 0    | 1  | 1  | 1  | 1  | 1  | 7        | BEL           | ETB           |               | ↑             | 7             | ↑             | G             | ↑             | W   | ↑ | g | ↑ | w | ↑ |     |   |   |   |     |   |
| 1    | 0  | 0  | 0  | 0  | 0  | 8        | BS            | GET           | CAN           | SPE           | (             | ↑             | 8             | ↑             | H   | ↑ | X | ↑ | h | ↑ | x   | ↑ |   |   |     |   |
| 1    | 0  | 0  | 1  | 1  | 1  | 9        | HT            | TCT           | EM            | SPD           | )             | ↑             | 9             | ↑             | I   | ↑ | Y | ↑ | i | ↑ | y   | ↑ |   |   |     |   |
| 1    | 0  | 1  | 0  | 1  | 0  | A        | LF            |               | SUB           | *             | :             | ↑             | :             | ↑             | J   | ↑ | Z | ↑ | j | ↑ | z   | ↑ |   |   |     |   |
| 1    | 0  | 1  | 1  | 1  | 1  | B        | VT            |               | ESC           | +             | ;             | ↑             | ;             | ↑             | K   | ↑ | [ | ↑ | k | ↑ | {   | ↑ |   |   |     |   |
| 1    | 1  | 0  | 0  | 0  | 0  | C        | FF            |               | FS            | ,             | <             | ↑             | <             | ↑             | L   | ↑ | \ | ↑ | l | ↓ | l   | ↓ |   |   |     |   |
| 1    | 1  | 0  | 1  | 1  | 1  | D        | CR            |               | GS            | -             | =             | ↑             | =             | ↓             | M   | ↓ | ] | ↓ | m | ↓ | }   | ↓ |   |   |     |   |
| 1    | 1  | 1  | 0  | 1  | 0  | E        | SO            |               | RS            | .             | >             | ↓             | >             | ↓             | N   | ↓ | ^ | ↓ | n | ↓ | ~   | ↓ |   |   |     |   |
| 1    | 1  | 1  | 1  | 1  | 1  | F        | SI            |               | US            | /             | ?             | ↓             | ?             | ↓             | UNL | ↓ | O | ↓ | — | ↓ | UNT | ↓ | o | ↓ | DEL | ↓ |

Address command group (ACG)

Universal command group (UCG)

Listen address group (LAG)

Talk address group (TAG)

Primary command group (PCG)

Secondary command group (SCG)

**Notes:**

- ①MSG=INTERFACE MESSAGE (Sent by ATN of True: Low level.)
- ②b1=DI 01••••b7=DI 07 (b1 through b7 correspond to DI01 to DI07 sequence.)
- GTL Go to Local
- SDC Select Device Clear
- PPC Parallel Poll Configure
- GET Group Execute Trigger
- TCT Take Control
- LLO Local Lockout
- (ACG) Addressed Command Group
- (UCG) Universal Command Group
- (LAG) Listen Address Group
- (TAG) Talk Address Group
- (PCG) Primary Command Group
- (SCG) Secondary Command Group
- DCL Device Clear
- PPU Parallel Poll Unconfigure
- SPE Serial Poll Enable
- SPD Serial Poll Disable
- UNL Unlisten
- UNT Untalk

**Table of Interface Message group**

| D<br>1<br>0<br>8 | D<br>1<br>0<br>7 | D<br>1<br>0<br>6 | D<br>1<br>0<br>5 | D<br>1<br>0<br>4 | D<br>1<br>0<br>3 | D<br>1<br>0<br>2 | D<br>1<br>0<br>1 | Interface<br>message group<br>(G) |
|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|-----------------------------------|
| ×                | 0                | 0                | 0                | b4               | b3               | b2               | b1               | Addressed<br>command G            |
| ×                | 0                | 0                | 1                | b4               | b3               | b2               | b1               | Universal<br>command G            |
| ×                | 0                | 1                | b5               | b4               | b3               | b2               | b1               | Listen address<br>G               |
| ×                | 0                | 1                | 1                | 1                | 1                | 1                | 1                | Unlisten (UNL)                    |
| ×                | 1                | 0                | b5               | b4               | b3               | b2               | b1               | Talker Address<br>G               |
| ×                | 1                | 0                | 1                | 1                | 1                | 1                | 1                | Untalk (UNT)                      |
| ×                | 1                | 1                | b5               | b4               | b3               | b2               | b1               | Secondary<br>command G            |

**Table of Address Assignments**

| Address character |        | Address switch setting |    |    |    |    | Primary<br>address | Factory<br>address<br>set<br>device |
|-------------------|--------|------------------------|----|----|----|----|--------------------|-------------------------------------|
| Talk              | Listen | 5                      | 4  | 3  | 2  | 1  |                    |                                     |
| b7 b6             | b7 b6  | b5                     | b4 | b3 | b2 | b1 |                    |                                     |
| 1 0               | 0 1    | ↓                      | ↓  | ↓  | ↓  | ↓  | 10 Decimal         |                                     |
| @                 | SP     | 0                      | 0  | 0  | 0  | 0  | 0                  |                                     |
| A                 | !      | 0                      | 1  | 0  | 0  | 1  | 1                  |                                     |
| B                 | "      | 0                      | 0  | 0  | 1  | 0  | 2                  |                                     |
| C                 | #      | 0                      | 0  | 0  | 1  | 1  | 3                  |                                     |
| D                 | \$     | 0                      | 0  | 1  | 0  | 0  | 4                  |                                     |
| E                 | %      | 0                      | 0  | 1  | 0  | 1  | 5                  |                                     |
| F                 | &      | 0                      | 0  | 1  | 1  | 0  | 6                  |                                     |
| G                 | '      | 0                      | 0  | 1  | 1  | 1  | 7                  |                                     |
| H                 | (      | 0                      | 1  | 0  | 0  | 0  | 8                  |                                     |
| I                 | )      | 0                      | 1  | 0  | 0  | 1  | 9                  |                                     |
| J                 | *      | 0                      | 1  | 0  | 1  | 0  | 10                 |                                     |
| K                 | +      | 0                      | 1  | 0  | 1  | 1  | 11                 |                                     |
| L                 | ,      | 0                      | 1  | 1  | 0  | 0  | 12                 |                                     |
| M                 | -      | 0                      | 1  | 1  | 0  | 1  | 13                 | Printer<br>Plotter                  |
| N                 | .      | 0                      | 1  | 1  | 1  | 0  | 14                 |                                     |
| O                 | /      | 0                      | 1  | 1  | 1  | 1  | 15                 |                                     |
| P                 | 0      | 1                      | 0  | 0  | 0  | 0  | 16                 |                                     |
| Q                 | 1      | 1                      | 0  | 0  | 0  | 1  | 17                 |                                     |
| R                 | 2      | 1                      | 0  | 0  | 1  | 0  | 18                 |                                     |
| S                 | 3      | 1                      | 0  | 0  | 1  | 1  | 19                 |                                     |
| T                 | 4      | 1                      | 0  | 1  | 0  | 0  | 20                 |                                     |
| U                 | 5      | 1                      | 0  | 1  | 0  | 1  | 21                 |                                     |
| V                 | 6      | 1                      | 0  | 1  | 1  | 0  | 22                 |                                     |
| W                 | 7      | 1                      | 0  | 1  | 1  | 1  | 23                 |                                     |
| X                 | 8      | 1                      | 1  | 0  | 0  | 0  | 24                 |                                     |
| Y                 | 9      | 1                      | 1  | 0  | 0  | 1  | 25                 |                                     |
| Z                 | :      | 1                      | 1  | 0  | 1  | 0  | 26                 |                                     |
| [                 | ;      | 1                      | 1  | 0  | 1  | 1  | 27                 |                                     |
| \                 | <      | 1                      | 1  | 1  | 0  | 0  | 28                 |                                     |
| ]                 | =      | 1                      | 1  | 1  | 0  | 1  | 29                 |                                     |
| ^                 | >      | 1                      | 1  | 1  | 1  | 0  | 30                 |                                     |
| ?                 | —      | 1                      | 1  | 1  | 1  | 1  | 31                 | UNL,UNT                             |

Appendix B

## Appendix C Comparison Table of Controller's GPIB Instructions

| Function                                                | Controller            |                                                |                                                                                               |
|---------------------------------------------------------|-----------------------|------------------------------------------------|-----------------------------------------------------------------------------------------------|
|                                                         | IBM-PC<br>(NI-488.2)  | IBM-PC<br>(NI-488)                             | HP9000 series                                                                                 |
| Outputs data to a device                                | CALL Send( )          | CALL IBWRT( )                                  | OUTPUT device selector; data                                                                  |
| Output binary data to a device                          | CALL SEND Cmds( )     |                                                |                                                                                               |
| Assigns data entered from a device to a variable        | CALL Receive( )       | CALL IBRD( )                                   | ENTER device selector; variable                                                               |
| Assigns binary data entered from a device to a variable |                       |                                                |                                                                                               |
| Initializes an interface                                | CALL Send IFC( )      | CALL IBSIC( )                                  | ABORT select code                                                                             |
| Turns REN line on                                       | CALL Enable Remote( ) | CALL IBSRE( )                                  | REMOTE device selector (select code)                                                          |
| Turns REN line off                                      | CALL Enable Local( )  | CALL IBSRE( )<br>CALL IBLOC( )                 | LOCAL device selector (select code )<br>LOCAL device selector (select code + primary address) |
| Outputs interface message(s) and data                   |                       | CALL IBCMD( )<br>CALL IBCMDA( ) (asynchronous) | SEND select code; message string                                                              |
| Triggers a specified device                             | CALL Trigger( )       | CALL IBTRG( )                                  | TRIGGER device selector                                                                       |

| Function                                                                  | Controller                                   |                                      |                                                                                                             |
|---------------------------------------------------------------------------|----------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------|
|                                                                           | IBM-PC<br>(NI-488.2)                         | IBM-PC<br>(NI-488)                   | HP9000 series                                                                                               |
| Initializes devices                                                       | CALL DevClear( )                             | CALL<br>IBCLR( )                     | CLEAR device<br>selector<br>(select code)<br>CLEAR device<br>selector<br>(select code +<br>primary address) |
| Prevents a device<br>from being switche<br>d over from remote<br>to local | CALL SendLLO( )<br>CALL SetRWLS( )           | LOCAL<br>LOCKOUT                     |                                                                                                             |
| Transfers control<br>to a specified<br>device                             | CALL Pass Control( )                         | CALL<br>IBPCT( )                     | PASS CONTROL                                                                                                |
| Sends out a<br>service request                                            |                                              | CALL<br>IBRSV( )                     | REQUEST<br>select code                                                                                      |
| Performs serial<br>polling                                                | CALL Read Status Byte( )<br>CALL AllSpoll( ) | CALL<br>IBRSP( )                     | SPOLL<br>(device selector)<br>(function)                                                                    |
| Sets a terminator<br>code                                                 |                                              | CALL<br>IBEOS( )<br>CALL<br>IBEOT( ) |                                                                                                             |
| Sets a limit value<br>for checking a<br>time-out                          |                                              | CALL<br>IBTOM( )                     |                                                                                                             |
| Wait to SRQ                                                               | CALL WaitSRQ( )                              | CALL<br>IBWAIT( )                    |                                                                                                             |