MS2681A/MS2683A/MS2687A/MS2687B

Spectrum Analyzer
Operation Manual
Vol. 1
(Basic Operating Instructions)

17th Edition

For safety and warning information, please read this manual before attempting to use the equipment.
Keep this manual with the equipment.

ANRITSU CORPORATION

Document No.: M-W1754AE-17.0

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

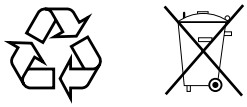
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Insure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

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. 1 (Basic Operating Instructions)

20 April 2000 (First Edition)
25 August 2006 (17th Edition)

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 ⚠

4. This equipment cannot be repaired by the operator. DO NOT attempt to remove the equipment covers or unit covers or to disassemble internal components. Only qualified service technicians 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 components.

Calibration

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.

Falling Over

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.

Battery Fluid

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.

LCD

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.

Cleaning

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.

Check Terminal

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

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

◆ MS2681A/MS2683A (plus opt.08 pre-amplifier ON)
Maximum AC power (continuous wave) ratings:
RF Input +10 dBm (RF ATT ≥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 one year after shipment due to a manufacturing fault, under the condition that this warranty is void when:

- 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

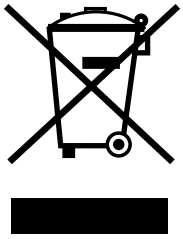
In the event that this equipment malfunctions, contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the CD version.

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.

Crossed-out Wheeled Bin Symbol

Equipment marked with the Crossed-out Wheeled Bin Symbol complies with council directive 2002/96/EC (the "WEEE Directive") in European Union.



For Products placed on the EU market after August 13, 2005, please contact your local Anritsu representative at the end of the product's useful life to arrange disposal in accordance with your initial contract and the local law.

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 (for analog communication systems)	SAMPLE
• Occupied frequency bandwidth, adjacent-channel leakage power (for digital communication systems)	POS PEAK or SAMPLE

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

CE Conformity marking

Anritsu affixes the CE Conformity marking on the following product(s) in accordance with the Council Directive 93/68/EEC to indicate that they conform with the EMC and LVD directive of the European Union (EU).

CE Marking

1. Product Model

Model:	MS2681A/MS2683A/MS2687A/MS2687B
	Spectrum Analyzer
	and
Software:	MX268701B W-CDMA Measurement software
	MX268702A GSM Measurement software
	MX268703A CDMA Measurement software
	MX268704A 1xEV-DO Measurement software
	MX268705A Pi/4DQPSK Measurement software
	MX268706A ADVANCED PHS Measurement software
	MX268730A WLAN Measurement software
	MX268732A WLAN Measurement software Limited version
	and
Accessories:	MA4601A Power Sensor
	MA4701A Power Sensor
	MA4703A Power Sensor
	MA4705A Power Sensor

2. Applied Directive

EMC: Council Directive 89/336/EEC

LVD: Council Directive 73/23/EEC

3. Applied Standards

• EMC: Emission: EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003 (Class A)

Immunity: EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003 (Annex A)

	Performance Criteria*
IEC 61000-4-2 (ESD)	B
IEC 61000-4-3 (EMF)	A
IEC 61000-4-4 (Burst)	B
IEC 61000-4-5 (Surge)	B
IEC 61000-4-6 (CRF)	A
IEC 61000-4-8 (RPFMF)	A
IEC 61000-4-11 (V dip/short)	B

*: Performance Criteria

A: During testing normal performance within the specification limits

B: During testing, temporary degradation, or loss of function or performance which is self-recovering

Harmonic current emissions:

EN 61000-3-2: 2000 (Class A equipment)

• LVD: EN 61010-1: 2001 (Pollution Degree 2)

C-tick Conformity marking

Anritsu affixes the C-tick marking on the following product(s) in accordance with the regulation to indicate that they conform with the EMC framework of Australia/New Zealand.

C-tick marking

1. Product Model

Model:	MS2681A/MS2683A/MS2687A/MS2687B
	Spectrum Analyzer
	and
Software:	MX268701B W-CDMA Measurement software
	MX268702A GSM Measurement software
	MX268703A CDMA Measurement software
	MX268704A 1xEV-DO Measurement software
	MX268705A Pi/4DQPSK Measurement software
	MX268706A ADVANCED PHS Measurement software
	MX268730A WLAN Measurement software
	MX268732A WLAN Measurement software Limited version
	and
Accessories:	MA4601A Power Sensor
	MA4701A Power Sensor
	MA4703A Power Sensor
	MA4705A Power Sensor

2. Applied Standards

EMC: Emission: EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
(ISM, Group 1, Class A equipment)

Power Line Fuse Protection

For safety, Anritsu products have either one or two fuses in the AC power lines as requested by the customer when ordering.

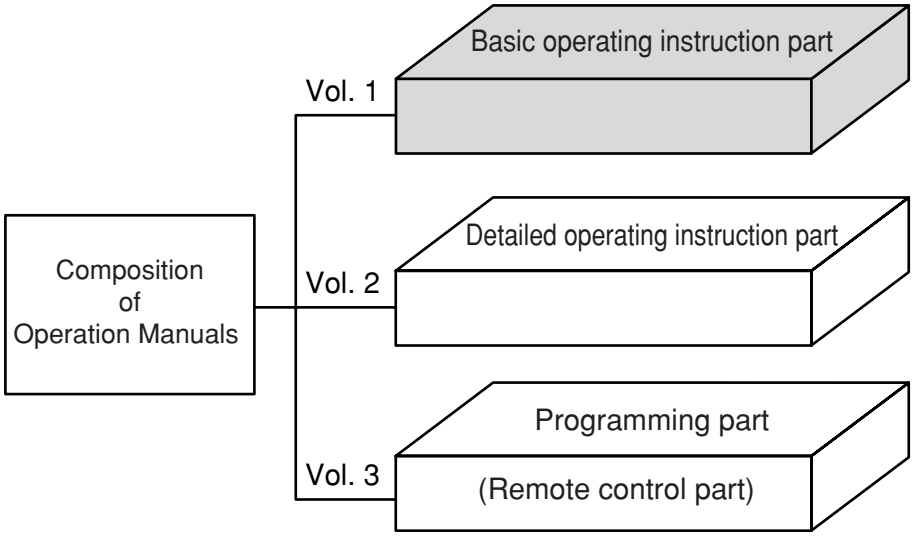
Single fuse: A fuse is inserted in one of the AC power lines.

Double fuse: A fuse is inserted in each of the AC power lines.

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.

Table of Contents

IV.

Section 1 General

This section outlines the MS2681A/MS2683A/MS2687A/MS2687B Spectrum Analyzer and explains the composition of this manual, the configuration of the MS2681A/MS2683A/MS2687A/MS2687B standard accessories, the options, the optional accessories, and peripherals for expanding the MS2681A/MS2683A/MS2687A/MS2687B capabilities, and the MS2681A/MS2683A/MS2687A/MS2687B specifications.

Product Outline

The MS2681A/MS2683A/MS2687A/MS2687B Spectrum Analyzer (hereinafter, called “this unit”) is a portable type color LCD spectrum analyzer suited for signal analysis of radio equipment where the efficiency of frequency usage is increased and equipment are increasingly speeded and digitized.
This unit adopts the synthesizer local system and covers a frequency range of 9 kHz to 3.0 GHz (MS2681A), 9 kHz to 7.8 GHz (MS2683A), and 9 kHz to 30.0 GHz (MS2687A/MS2687B).
Excellent in basic performance such as C/N, distortion, frequency/level accuracy, and easily operable following the display of the soft-key menu screen.
Excellent cost performance with rich options to cope with various applications.

This unit is equipped with high-accuracy calibration signals and an attenuator, it can accurately calibrate switching errors of LOG/LIN scales, resolution bandwidth, reference level, etc. Since frequency response is corrected by built-in calibration data, it allows high-accuracy level measurement for a wide range.
As the switching of waveforms between frequency domain and time domain can be done by a touch and two waveforms are simultaneously displayed, signal analysis of both domains can be done efficiently. Moreover, our original zone marker function and multi-marker function (up to 10 markers) are also special mention.

This unit provides the MEASURE function that can perform measurement of various applications without requiring the intervention of external controllers. Therefore, the performance evaluation of radio equipment can be easily done in terms of frequency, noise, occupied frequency bandwidth, leak power from neighboring channels, etc.
In addition, as the template measurement of burst mean power and burst waveform are also available, it is suited for evaluating the performance of digital radio equipment.

■ Application

This unit is useful for the production, building and maintenance of electronic equipment and devices in the following fields:

- AM/FM radio equipment
- Digital cellular telephone/cordless telephone
- Satellite broadcasting, CATV and TV equipment
- Small-capacity microwave equipment

Composition of Operation Manual

This Operation Manual is composed of 7 sections and appendixes A, B and C. The profile of each section is shown below.

Section composition	Explanation
Section 1 General	Product outline, standard configuration, options, applicable parts, peripheral devices, and specifications
Section 2 Preparations Before Use	Operations to be done before applying power
Section 3 Panel Description	Description of the front and rear panels
Section 4 Soft-Key Menu	Description of soft-key menus
Section 5 Basic Operation Procedure	Basic operation procedures for operation guide
Section 6 Performance Tests	Tests used for checking performance
Section 7 Storage and Transportation	Cautions on storage and transportation
Appendix A	Front and Rear Panel Layout
Appendix B	Block Diagram
Appendix C	Performance Test Record

Equipment Configuration

This paragraph describes the configuration of the MS2681A/MS2683A/MS2687A/MS2687B Spectrum Analyzer with standard accessories and the various options to expand the functions.

Standard configuration

The table below shows the configuration of the MS2681A/MS2683A/MS2687A/MS2687B Spectrum Analyzer with the standard accessories.

Standard Composition

Item	Model/Order NO.	Name	Qty.	Remarks
Main instrument	MS2681A/MS2683A/ MS2687A/MS2687B	Spectrum Analyzer		
Accessories		Power cord	1	
	F0014	Fuse	1	T6.3 A 250 V
	J0996B*	RS-232C Cable	1	1.5 m
	Z0808	Memory card	1	32 MB or more
	MX268001A	File Utility Software	1	
	W1754AE	Operation manual	1	

* Equivalent is attached

Options

The table below shows the options for MS2681A/MS2683A/MS2687A/MS2687B which are sold separately.

Model † - Order No. †	Name	Remarks
MS2681A-01/MS2683A-01/ MS2687A-01/MS2687B-01	Precision frequency reference oscillator	Aging Rate: $\leq 5 \times 10^{-10}$/day
MS2681A-02/MS2683A-02/ MS2687A-02/MS2687B-02	Narrow resolution bandwidths	1 Hz to 1 kHz
MS2683A-03	Extension of preselector lower limit to 1.6 GHz	Expands lower frequency limit of pre- selector from 3.15 to 1.6 GHz
MS2681A-04/MS2683A-04/ MS2687A-04/MS2687B-04	Digital resolution bandwidth	10 Hz to 1 MHz, RMS detection
MS2687A-05/MS2687B-05	Rubidium reference oscillator	Aging Rate $\leq 1 \times 10^{-10}$/month
MS2681A-08/MS2683A-08	Pre-amplifier	100 kHz to 3 GHz
MS2681A-09/MS2683A-09/ MS2687A-09/MS2687B-09	Ethernet interface	10 base-T
MS2681A-17/MS2683A-17	I/Q Balanced Input	Used in measurement software sold separately
MS2681A-18/MS2683A-18/ MS2687A-18/MS2687B-18	I/Q Unbalanced Input	Used in measurement software sold separately
MS2687A-21/MS2687B-21	Power Meter	Frequency range: 100 KHz to 32 GHz Level range: –20 to +20 dBm
MS2687A-22	13 GHz Low Noise	This option and MS2687A-05 (Rubidium Reference Oscillator) are exclusive.
MS2687B-23	Range expansion Power Meter Function	Frequency range: 100 KHz to 32 GHz Level range: –30 to +20 dBm
MS2681A-46/MS2683A-46/ MS2687A-46/MS2687B-46	Auto power recovery	
MS2681A-47/MS2683A-47/ MS2687A-47/MS2687B-47	Rackmount (IEC)	When using the rack mount,the tilt handle (standard accessories) should be removed.
MS2681A-48/MS2683A-48/ MS2687A-48/MS2687B-48	Rackmount (JIS)	When using the rack mount,the tilt handle (standard accessories) should be removed.

† Please specify the model/order number, name, and quantity when ordering.

Optional Accessories and Peripherals

The following table shows the optional accessories and peripherals for MS2681A/MS2683A/MS2687A/MS2687B which are all sold separately.

Optional Accessories

Model † - Order No. †	Name	Remarks
J0561	Coaxial cord, 1 m	N-P-5W · 5D-2W · N-P-5W
J0104A	Coaxial cord, 1 m	BNC-P · RG-55/U · N-P
B0329G	Front cover	3/4MW4U
MP612A	Fuse Holder	
MP613A	Fuse Element	
MA8601A	DC Block Adapter	50 Ω, 10 kHz to 2.2 GHz, ±50 V
MP614A	50 Ω↔75 Ω Impedance Transformer	10 MHz to 1.2 GHz
J0308	Coaxial cord, 1 m	BNC-P · 3C-2WS · NC-P-3W
MA1621A	50 Ω→75 Ω Impedance Transformer	9 kHz to 3 GHz, 100 V DC MAX
J0063	Fixed attenuator for high power	30 dB (10 W, DC to 12.4 GHz)
J0007	GPIB cable, 1 m	408JE-101
J0008	GPIB cable, 2 m	408JE-102
MA2507A	DC Block Adapter	50 Ω, 9 kHz to 3 GHz, ±50 V
J0078	Fixed attenuator for high power (Model 23-20-34)	20 dB (10 W, DC to 18 GHz, N-type)
J0805	DC Block Adapter (N-type, Model 7003)	50 Ω, 10 KHz to 18 GHz
MA1601A	High Pass Filter	800/900 MHz band, N-type
B0452A	Carring Case	With casters
B0452B	Carring Case	Without casters
J1047	Ethernet Cross Cable, 5 m	Cross connection

† Please specify the model/order number, name, and quantity when ordering.

Specifications

Except were noted otherwise, specified values were obtained after warming up the equipment for 30 minutes at a constant ambient temperature and then performing calibration. The typical values are given for reference, and are not guaranteed.

Model			MS2681A
Frequency	Frequency range		9 kHz to 3.0 GHz
	Setting frequency resolution		Minimum 1 Hz
	Frequency readout accuracy		± (frequency readout × reference frequency accuracy + span × span accuracy + resolution bandwidth × 0.15 + 10 Hz)
	Frequency Setting Range		0 Hz to 3.0 GHz
	Marker frequency readout accuracy		Normal: Same as frequency readout accuracy Delta: Same as frequency span accuracy
	Frequency counter	Resolution	1 Hz, 10 Hz, 100 Hz, 1 kHz
		Accuracy	± (frequency readout × reference frequency accuracy + 1 LSD + 2 Hz) (S/N ≥ 20 dB)
	Frequency span	Setting range	0 Hz, 5 kHz to 3.0 GHz
		Accuracy	±1.0% (Single band sweep)
	Resolution bandwidth (3 dB BW) (RBW)		Setting range: 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, 3 MHz, 5 MHz, 10 MHz, 20 MHz (only 0 Band) (manually or automatically settable according to frequency span) Bandwidth accuracy: ±20% (RBW = 300 Hz to 10 MHz), ±40% (RBW = 20 MHz) Selectivity (60 dB: 3 dB): ≤15:1
	Video bandwidth (VBW)		1 Hz to 3 MHz (1, 3 sequence), Off (manually or automatically settable according to resolution bandwidth)
	Signal purity		Noise side bands: ≤–108 dBc/Hz (1 GHz, 10 kHz offset) ≤–120 dBc/Hz (1 GHz, 100 kHz offset)
	Reference Oscillator		Frequency: 10 MHz Startup characteristies: $\leq 5 \times 10^{-8}$ (after 10 minutes warm-up, with frequency after 24 hours warm-up referenced) Aging rate: $\leq 2 \times 10^{-8}$/day , $\leq 1 \times 10^{-7}$/year (referred to frequency after 24 hours warm-up) Temperature characteristics: $\pm 5 \times 10^{-8}$ (0 to 50°C, referred to frequency at 25°C)
Amplitude	Level Measurement	Measuring range	Average noise level to +30 dBm Peak pulse input: +47 dBm (pulse width ≤1 µs, duty ratio ≤1% RF ATT ≥30 dB)
		Maximum input level	+30 dBm (CW average power, input attenuator: ≥10 dB), ±0 V (DC)
		Average noise level	RBW = 300 Hz, VBW = 1 Hz, RF ATT = 0 dB Option08 without pre-amplifier ≤–124 dBm + f [GHz] dB (1 MHz to 2.5 GHz) ≤–120 dBm + f [GHz] dB (2.5 to 3.0 GHz) Option08 pre-amplifier, pre-amplifier Off ≤–122 dBm + 1.5 × f [GHz] dB (1 MHz to 2.5 GHz) ≤–120 dBm + 1.5 × f [GHz] dB (2.5 to 3.0 GHz)
		Residual response	≤–100 dBm (1 MHz to 3.0 GHz) (input attenuator: 0 dB, input: 50 Ω termination)
	Reference level		Setting range Log scale: –100 to +40 dBm or equivalent level Linear scale: 2.24 µV to 22.4V Unit Log scale: dBm, dBµV, dBmV, dBµV (emf), W, dBµV/m Linear scale: V Reference level accuracy: ±0.5 dB (–49.9 to 0 dBm), ±0.75 dB (–69.9 dBm to –50 dBm, 0.1 to +30 dBm), ±1.5 dB (–80 to –70 dBm) * After calibration, at 50 MHz frequency, span 1 MHz (when input attenuator, resolution bandwidth, video bandwidth, and sweep time set to AUTO) Resolution bandwidth switching uncertainly: ±0.3 dB (300 Hz to 5 MHz), ±0.5 dB (10 MHz, 20 MHz) * After calibration,referenced to resolution bandwidth 3 kHz Input attenuator (input attenuator) Setting range: 0 to 62 dB, 2 dB step (manually or automatically settable according to reference level) Switching uncertainly: ±0.3 dB (10 to 50 dB), ±0.5 dB (52 to 62 dB) * After calibration, referenced to input attenuator 10 dB Input attenuator switching mode: 2, 10 dB step mode

(Continued)

Model		MS2681A
Frequency	Frequency response	Referred to 50 MHz frequency, input attenuator 10 dB, temperature 18 to 28˚C ±0.6 dB (9 kHz to 3.0 GHz) Referred to 50 MHz frequency,input attenuator 10 to 62 dB ±1.0 dB (9 kHz to 3.0 GHz)
	Scale Fidelity	Scale: 10 div Log scale: 10 dB/div, 5 dB/div, 2 dB/div, 1 dB/div Linear scale: 10%/div, 5%/div, 2%/div, 1%/div Linearity (after calibration) Log scale: ±0.4 dB (0 to –20 dB, RBW ≤ 1 kHz), ±1.0 dB (0 to –90 dB, RBW ≤ 1 kHz) Linear scale: ±4% of reference level Marker level resolution Log scale: 0.01 dB Linear scale: 0.02% of reference level
	Supurious response	2nd harmonic distortion: ≤–60 dBc (10 to 200 MHz, mixer input level –30 dBm) ≤–75 dBc (0.2 to 0.85 GHz, mixer input level –30 dBm) ≤–70 dBc (0.85 to 1.5 GHz, mixer input level –30 dBm) 3rd order intermodulation distortion: ≤–70 dBc (10 to 100 MHz), ≤–85 dBc (0.1 to 3.0 GHz) * Frequency reference of two signal: ≥50 kHz, mixer input level –30 dBm Image response: ≤–70 dBc
	1 dB gain compression	At mixer input level ≥0 dBm (≥100 MHz) ≥+3 dBm (≥500 MHz)
	Maximum dynamic range	RBW = 300 Hz, VBW = 1 Hz RF ATT = 0 dB [Without Option 08] ≤124 dB-f [GHz] dB typ. (0.1 to 3.0 GHz) [Pre-Amp through (off) with Option 08] ≤122 dB1.5-f [GHz] dB typ. (0.1 to 3.0 GHz)
Frequency domain	Sweep time	In frequency sweep Setting range: 10 ms to 1000 s (manual settable, or automatically settable according to span, resolution bandwidth, video bandwidth) setting resolution: 5 ms (5 ms to 1 s), most significant 3-digits (≥1 s) Accuracy: ±3%
	Sweep mode	Continuous, Single
	Trigger switch	Freerun, Triggered
	Trigger source	Wide IF Video, Line, Ext (±10 V), Ext (TTL)
	Gate mode	Off, Random sweep mode Gate delay: 0s to 65.5ms, resolution1 μs Gate length: 2 μs to 65.5ms, resolution1 μs Gate end: Internal/External
	Zone sweep	Sweeps only in frequency range indicated by zone marker
	Tracking sweep	Sweeps while tracking peak points within zone marker (zone sweep also possible)
Time domain	Sweep time	Setting range: 1 μs to 1000 s Setting resolution: 1, 2, 5 sequence (1 to 50 μs), 100 μs (100 μs to 4.9 ms), 5ms (5 ms to1s), Most significant 3-digits (1 to 1000 s) Accuracy: ±1%
	Sweep mode	Continuous, Single
	Trigger switch	Freerun, Triggered
	Trigger source	Wide IF Video, Video, Line, Ext (±10 V), Ext (TTL)
	Trigger deray	Pre-trigger: Display waveform before triggering Setting range: –(time span) to 0 s Settin resolution: bigger value between (time span)/500 and 100 ns Post-trigger: Display waveform before triggering Setting range: 0 s to 65.5 ms Setting resolution: 100 ns (sweep time ≤ 4.9 ms), 1 μs (sweep time ≥ 5 ms)

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Model		MS2681A
Function	Numbers of point	501,1001 points
	Detection mode	Normal, Positive Peak, Negative Peak, Sample, Average Normal: Simulataneously displays max. and min. points between sample points Positive Peak: Displays max. points between sample points Negative Peak: Displays min. points between sample points Sample: Displays momentary value at sample points Average: Displays average value between sample points
	Display function	Trace-A, Trace-B, Trace-Time, Trace-A/B, Trace-A/BG, Trace-A/Time
	Trace calculation	A → B, B → A, A ↔ B, A + B → A, A-B → A, A-B + DL → A
	Storage function	Normal, View, Max Hold, Min Hold, Average, Cumulative, Over Write
	Signal search	Auto Tune, Peak → CF, Peak → REF, Scroll
	Zone marker	Normal, Delta
	Marker function	Marker → CF, Marker → REF, Marker CF Step Size, ΔMarker → Span, Zone → Span
	Peak search	Peak, Next Peak, Min Dip, Next Dip
	Multi marker	Number of points: 10 max. (Highest 10, Harmonics, Manual Set)
	Measure function	Noise power: dBm/Hz, dBm/CH, dBμV/$\sqrt{Hz}$ C/N: dBc/Hz, dBc/CH Occupied bandwidth: power N% method , X dB Down method Adjacent channel leakage power: 3channels × 2, graphic display Average power of burst signal: average power in designate time range of time domain waveform Channel power: dBm/Hz, dBm Template comparison measurement: upper/lower limits × each 2, time domain MASK: upper/lower limits × each 2, time domain
	Correction	The user can correct frequency response optionally, max 150 points Auto corerction of MA1621A impedance transformer insertion loss correction accuracy (input attenuator ≥ 10 dB): ±2.5 dB (9 k to 100 kHz), ±1.5 dB (100 kHz to 2 GHz), ±2.0 dB (2 GHz to 3 GHz) Typical value
General specification	Display	Color TFT-LCD, Size: VGA 17 cm (6.5" Type), Number of colors: 4096 (RGB,16-scale settable) Brightness: 5-scale settable (include Off)
	Hard copy	Display data can be hard-copied via the parallel interface (model corresponded to PCL Level 3 or less, ESC/P-J83 or J84)
	SAVE/RECALL	Saves and recalls setting conditions and waveform data to internal memory (Max 12) or memory card
	PC Card Interface	PC-ATA card or Compact Flash card (3.3 V/5 V) can be accessed Function: Save/recall measurement settings and waveform data Save bitmap files of waveform display Connector: PC Card Type I or Type II
	RS-232C	Can be controlled as device from external controller (excluding power switch) Baud rate: 1200, 2400, 4800, 9600, 19.2 k, 38.4 k, 56 k, 115 kbps Connector: D-Sub 9 pins, jack
	GPIB	Function: Meets to IEEE488.2 Can be controlled as device from external controller (excluding power switch) Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2
	Parallel interface	Based on centoronics, output printing data to printer Connector: D-Sub 25 pins, jack
	Input connector	N-type connector 50 Ω, VSWR ≤ 1.5 typ. (input attenuator ≥ 10 dB)
	IF Output	BNC, 50 Ω nominal value Frequency: 60.69 MHz/66 MHz Output level: –10 dBm typ. (frequency 50 MHz, at upper edge of display scale)
	Wideband IF Output	BNC, 50 Ω nominal value Frequency: 60.69 MHz/66 MHz Gain: 0 dB typ. (frequency 50 MHz, input attenuator 0 dB)
	Video Output (Y)	BNC, 75 Ω nominal value Output level: 0 to 0.5 V ±0.1 V (log scale) 0 to 0.4 V ±0.1 V (linear scale) (frequency 50 MHz, at upper edge of display scales)

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Model		MS2681A
General specification	Video Output	Analog RGB Connector: D-Sub 15 pins, jack
	External reference signal input	BNC connector Frequency: 10 MHz ±10 Hz,13 MHz ±13 Hz Level: ≥0 dBm (50 Ω termination)
	Buffered Output	BNC connector Frequency: 10 MHz Output level: p-p: 2 to 5 V (200 Ω termination)
	Sweep Output (X)	BNC connector Output level: 0 to 10 V ±1 V (100 kΩ termination, from left edge to right edge in display scale, singleband sweep)
	Sweep Status Output (Z)	BNC connector Output level: TTL (when sweeping, at low level)
	Probe source	4-pin connector, +12 V, –12 V, each ±10%, each max 110 mA
	Trig/Gate input	BNC connector Input level: ±10 V (0.1 V resolution), or TTL level
Others	Dimension	177 mm (H), 320 mm (W), 411 mm (D) (exclude handle, legs, front cover, fan cover)
	Mass	≤16 kg nominal value
	Power (operating range)	85 to 132 V, 170 to 250 V (automatic voltage change), 47.5 to 63 Hz, ≤400 VA
	Temperature range	Operating 0 to 50˚C, ≤RH85% Preservation –20 to + 60˚C
	Conducted Emission	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Radiated Emission	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Harmonic Current Emission	Meets EN 61000-3-2: 2000
	Electrostatic Discharge	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Electromagnetic Field Immunity	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Fast Transient / Burst	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Surge	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Conducted RF	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Power Frequency Magnetic Field	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Voltage Dips / Short Interruptions	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Vibration	Meets MIL-STD-810D

*1: Typical value and nominal value are reference data, so that not warrant them as spec.

Model			MS2683A
Frequency	Frequency range		9 kHz to 7.8 GHz
	Frequency band		Band 0 (9 kHz to 3.2 GHz), Band 1–L: 1.6 to 3.2 GHz (Option 03), Band1– (3.15 to 6.3 GHz), Band 1 + (6.2 to 7.8 GHz)
	Pre-selector range		3.15 to 7.8 GHz (Band 1–, 1+) Option 03: 1.6 to 7.8 GHz (Band 1–L, 1–, 1+)
	Frequency Setting range		0 Hz to 7.8 GHz
	Setting frequency resolution		Minimum 1 Hz
	Frequency readout accuracy		± (frequency readout × reference frequency accuracy + span × span accuracy + resolution bandwidth × 0.15 + 10 Hz)
	Marker frequency readout accuracy		Normal: Same as frequency readout accuracy Delta: Same as frequency span accuracy
	Frequency counter	Resolution	1 Hz, 10 Hz, 100 Hz, 1 kHz
		Accuracy	± (frequency readout × reference frequency accuracy + 1 LSD + 2 Hz) (S/N ≥ 20 dB)
	Frequency span	Setting range	0 Hz, 5 kHz to 7.8 GHz
		Accuracy	±1.0% (Single band sweep)
	Resolution bandwidth (3dB BW) (RBW)		Setting range: 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, 3 MHz, 5 MHz, 10 MHz, 20 MHz (only 0 Band) (manually or automatically settable according to frequency span) Bandwidth accuracy: ±20% (RBW = 300 Hz to 10 MHz), ±40% (RBW = 20 MHz) Selectivity (60 dB: 3 dB): ≤15: 1
	Video bandwidth (VBW)		1 Hz to 3 MHz 1, 3 sequence, Off (manually or automatically settable according to resolution bandwidth)
	Signal purity		Noise side bands: ≤–108 dBc/Hz (1 GHz, 10 kHz offset) ≤–120 dBc/Hz (1 GHz, 100 kHz offset)
	Reference oscillator		Frequency: 10 MHz Startup characteristies: $\leq 5 \times 10^{-8}$ (after 10 minutes warm-up, with frequency after 24 hours warm-up referenced) Aging rate: $\leq 2 \times 10^{-8}$/day, $\leq 1 \times 10^{-7}$/year (referred to frequency after 24 hours warm-up) Temperature characteristics: 5×10^{-8} (0 to 50°C, referred to frequency at 25°C)
Amplitude	Level measurement	Measuring range	Average noise level to +30 dBm
		Maximum input level	+30 dBm (CW average power, input attenuator: ≥10 dB), ±0 V (DC) Peak pulse input: +47 dBm (pulse width ≤1 μs, duty ratio ≤1%, RF ATT≥ 30 dB)
		Average noise level	RBW = 300 Hz, VBW = 1 Hz, RF ATT = 0 dB [Without Option 08] ≤–124 dBm + f [GHz] dB (1 MHz to 2.5 GHz, Band 0) ≤–120 dBm + f [GHz] dB (2.5 to 3.2 GHz, Band 0) ≤–122 dBm + 0.5 × f [GHz] dB (3.15 to 7.8 GHz, Band 1) [Pre-amp through (off) with Option 08] ≤–122 dBm + 1.5 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0) ≤–120 dBm + 1.5 × f [GHz] dB (2.5 to 3.2 GHz, Band 0) ≤–122 dBm + 0.5 × f [GHz] dB (3.15 to 7.8 GHz, Band 1)
		Residual response	≤–100 dBm (1 MHz to 3.2 GHz, Band 0) ≤–90 dBm (3.15 to 7.8 GHz, Band 1) (RF ATT: 0 dB, input: 50 Ω, 1 MHz to 7.8 GHz)
	Reference level		Setting range Log scale: –100 dBm to +40 dBm or equivalent level Linear scale: 2.24 μV to 22.4 V Unit Log scale: dBm, dBμV, dBmV, V, dBμV (emf), W, dBμV/m Linear scale: V Reference level accuracy : ±0.5 dB (–49.9 to 0 dBm), ±0.75 dB (–69.9 to –50 dBm, 0.1 to +30 dBm), ±1.5 dB (–80 to –70 dBm) * After calibration, at 50 MHz frequency, span 1 MHz (when input attenuator, resolution bandwidth, video bandwidth, and sweep time set to AUTO) Resolution bandwidth switching uncertainty: ±0.3 dB (300 Hz to 5 MHz), ±0.5 dB (10 MHz, 20 MHz) * After calibration, referenced to resolution bandwidth 3 kHz Input attenuator (RF ATT) Setting range: 0 to 62 dB, 2 dB step (manually or automatically settable according to reference level) Switching uncertainty: ±0.3 dB (10 to 50 dB), ±0.5 dB (52 to 62 dB) * After calibration, referenced to input attenuator 10 dB Input attenuator switching mode: 2, 10 dB step mode

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Model		MS2683A
Frequency	Frequency response	Referred to 50 MHz frequency, input attenuator 10 dB, temperature 18 to 28˚C ±0.6 dB (9 kHz to 3.2 GHz, Band 0) ±1.0 dB (3.15 to 7.8 GHz, Band 1) Referred to 50 MHz frequency, input attenuator 10 to 62 dB ±1.0 dB (9 kHz to 3.2 GHz, Band 0) ±2.0 dB (3.15 to 7.8 GHz, Band 1) After executing pre-select tuning
	Scale Fidelity	Scale: 10 div Log scale: 10 dB, 5 dB, 2 dB, 1 dB/div Linear scale: 10%, 5%, 2%, 1%/div Linearity (after calibration) Log scale: ±0.4 dB (0 to –20 dB, RBW ≤ 1 kHz), ±1.0 dB (0 to –90 dB, RBW ≤ 1 kHz) Linear scale: ±4% of reference level Marker level resolution Log scale: 0.01 dB Linear scale: 0.02% of reference level
	Spurious response	2nd harmonic distortion: ≤–60 dBc (10 to 200 MHz, Band 0, mixer input level: –30 dBm) ≤–75 dBc (0.2 to 0.85 GHz, Band 0, mixer input level: –30 dBm) ≤–70 dBc (0.85 to 1.6 GHz, Band 0, mixer input level: –30 dBm) ≤–90 dBc (1.58 to 3.9 GHz, Band 1, mixer input level: –10 dBm) 3rd order intermodulation distortion: ≤–70 dBc (10 to 100 MHz), ≤–85 dBc (0.1 to 7.8 GHz) *Frequency reference of two signal: ≥50 kHz, mixer input level –30 dBm
		Image response: ≤–70 dBc Multiple response: ≤–70 dBc (Band 1)
	1 dB gain compression	At mixer input level ≥0 dBm (≥100 MHz) ≥+3 dBm (≥500 MHz, Band 0), ≥0 dBm (Band 1)
	Maximum dynamic range	1 dB gain compression vs. averaging noise level [Without Option 08] ≥124 dB – f [GHz] dB (0.1 to 3.2 GHz, Band 0, nominal) ≥122 dB – 0.5 × f [GHz] dB (3.15 to 7.8 GHz, Band 1, nominal) [Pre-Amp through (off) with Option 08] ≥122 dB – 1.5 × f [GHz] dB (0.1 to 3.2 GHz, Band 0, nominal) ≥122 dB – 0.5 × f [GHz] dB (3.15 to 7.8 GHz, Band 1, nominal)
Frequency domain	Sweep time	In frequency sweep Setting range: 10 ms to 1000 s (manual settable, or automatically settable according to span, resolution bandwidth, video bandwidth) Setting resolution: 5 ms (5 ms to 1 s), most significant 3-digits (≥1 s) Accuracy: ±3%
	Sweep mode	Continuous, single
	Trigger switch	Freerun, Triggered
	Trigger source	Wide IF Video, Line, Ext (±10 V), Ext (TTL)
	Gate mode	Off, Random sweep mode Gate delay: 0 s to 65.5 ms, resolution 1 μs Gate length: 2 μs to 65.5 ms, resolution 1 μs Gate end: Internal/External
	Zone sweep	Sweeps only in frequency range indicated by zone marker
	Tracking sweep	Sweeps while tracking peak points within zone marker (zone sweep also possible)
Time domain	Sweep time	Setting range: 1 μs to 1000 s Setting resolution: 1, 2, 5 sequence (1 to 50 μs), 100 μs (100 μs to 4.9 ms), 5 ms (5 ms to 1 s), most significant 3-digits (1 to 1000 s) Accuracy: ±1%
	Sweep mode	Continuous, single
	Trigger switch	Freerun, Triggered
	Trigger source	Wide IF Video, Video, Line, Ext (±10 V), Ext (TTL)
	Trigger delay	Pre-trigger: Display waveform before triggering Setting range: — (time span) to 0 s Setting resolution: bigger value between (time span)/500 and 100 ns Post-trigger: Display waveform before triggering Setting range: 0 s to 65.5 ms, Setting resolution: 100 ns (sweep time ≤ 4.9 ms), 1 μs (sweep time ≥5 ms)

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Model			MS2683A
Function	Numbers of point		501, 1001
	Detection mode		Normal: Simultaneously displays max. and min. points between sample points Positive Peak: Displays max. points between sample points Negative Peak: Displays min. points between sample points Sample: Displays momentary value at sample points Average: Displays average value between sample points
	Display function		Trace A, Trace B, Trace Time, Trace A/B, Trace A/BG, Trace A/Time
	Trace calculation		A→B, B→A, A↔B, A+B→A, A–B→A, A–B+DL→A
	Storage function		Normal, View, Max Hold, Min Hold, Average, Cumulative, Over Write
	Signal search		Auto Tune, Peak→CF, Peak→Ref, Scroll
	Zone marker		Normal, Delta
	Marker function		Marker→CF, Marker→Ref, Marker→CF Step Size, Δmarker→Span, Zone→Span
	Peak search		Peak, Next Peak, Min Dip, Next Dip
	Multi marker		Number of markers: 10 max. (Highest 10, Harmonics, Manual Set)
	Measure function		Noise power (dBm/Hz, dBm/ch, dBμV/$\sqrt{Hz}$), C/N (dBc/ Hz, dBc/ch), occupied bandwidth (power N% method, X dB down method), adjacent channel leakage power (REF: total power method, REF: reference level method, inband method, channel designate display: 3 channels × 2, graphic display), average power of burst signal (average power in designate time range of time domain waveform), channel power (dBm/Hz, dBm), template comparison measurement (upper/lower limits × each 2, time domain), MASK (upper/lower limits × each 2, frequency domain)
	Correction		The user can correct frequency response optionally, max 150 points Auto correction of MA1621A inpedance transformer insertion loss Correction accuracy (input attenuator ≥ 10 dB): ±2.5 dB (9 to 100 kHz), ±1.5 dB (100 kHz to 2 GHz), ±2.0 dB (2 to 3 GHz) Typical value
General specification	Display		Color TFT-LCD, Size: VGA 17 cm (6.5" Type), Number of colors: 4096 (RGB, 16-scale settable) Brightness: 5-scale settable (include OFF)
	SAVE/RECALL		Saves and recalls setting conditions and waveform data to internal memory (Max 12) or memory card
	Hard copy		Display data can be hard-copied via the parallel interface (model corresponded to PCL Level 3 or less, ESC/P-J83 or J84)
	PC Card interface		PC-ATA card or Compact Flash card (3.3 V/5 V) can be accessed Function: Save/recall measurement settings and waveform data Save bitmap files of waveform display Connector: PC Card Type I or Type II
	RS232C		Can be controlled as device from external controller (excluding power switch) Baud rate: 1200, 2400, 4800, 9600, 19.2 k, 38.4 k, 56 k, 115 kbps Connector: D-Sub 9 pins, jack
	GPIB	Function	Meets to IEEE488.2 Can be controlled as device from external controller (excluding power switch)
		Interface	SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2
	Parallel interface		Based on centoronics, output printing data to printer Connector: D-Sub 25 pins, jack
	Input connector		N-type connector 50 Ω, VSWR ≤ 1.5 typ. (Input attenuator ≥ 10 dB)
	IF Output		BNC, 50 Ω nominal value Frequency: 10.69 MHz/66 MHz Output level: –10 dBm typ. (frequency 50 MHz, at upper edge of display scale)
	Wideband IF Output		BNC, 50 Ω nominal value Frequency: 60.69 MHz/66 MHz Gain: 0 dB typ.(frequency 50 MHz, input attenuator 0 dB)
	Video Output (Y)		BNC, 75 Ω nominal value Output level: 0 to 0.5 V ± 0.1 V (log scale) 0 to 0.4 V ± 0.1 V (Linear scale) (Frequency 50 MHz, at upper edge of display scale)
	Video Output		Analog RGB Connector: D-Sub 15 pins, jack

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Model		MS2683A
General specification	External reference signal input	BNC connector Frequency: 10 MHz ±10 Hz, 13 MHz ±13 Hz Level: ≥ 0 dBm (50 Ω termination)
	Buffered Output	BNC connector Frequency: 10 MHz Output level: p-p: 2 to 5 V (200 Ω termination)
	Sweep Output (X)	BNC connector Output level: 0 to 10 V ±1 V (100 kΩ termination, from left edge to right edge in display scale, single band sweep)
	Sweep Status Output (Z)	BNC connector Output level: TTL (when sweeping, at low level)
	Probe source	4-pin connector, +12 V, –12 V, each ±10%, each max 110 mA
	Trig/Gate input	BNC connector Input level: ±10 V (0.1 V resolution), or TTL level
Others	Dimension	177 mm (H), 320 mm (W), 411mm (D) (exclude handle, legs, front cover, fan cover)
	Mass	≤16 kg nominal value
	Power (operating range)	85 to 132 V, 170 to 250 V (automatic voltage change), 47.5 to 63 Hz, ≤400 VA
	Temperature range	Operating 0 to 50˚C, ≤ RH85% Preservation –20 to +60˚C
	Conducted Emission	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Radiated Emission	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Harmonic Current Emission	Meets EN 61000-3-2: 2000
	Electrostatic Discharge	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Electromagnetic Field Immunity	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Fast Transient / Burst	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Surge	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Conducted RF	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Power Frequency Magnetic Field	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Voltage Dips / Short Interruptions	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Vibration	Meets MIL-STD-810D

*1: Typical value and nominal value are reference data, so that not warrant them as spec.

Model			MS2687A
Frequency	Frequency range		9 kHz to 30.0 GHz
	Frequency band		Band 0 (9 kHz to 3.2 GHz), Band 1 – (3.15 to 6.3 GHz), Band 1 + (6.2 to 7.9 GHz), Band 2 + (7.8 to 15.2 GHz), Band 3 + (15.1 to 22.5 GHz), Band 4 + (22.4 to 30 GHz)
	Pre-selector range		3.15 to 30 GHz (Band 1–, 1+, 2+, 3+, 4+)
	Frequency setting range		0 to 30 GHz
	Frequency readout accuracy		± (frequency readout × reference frequency accuracy + span × span accuracy + resolution bandwidth × 0.15 + 10 Hz × N)
	Marker frequency readout accuracy		Normal: Same as frequency readout accuracy Delta: Same as frequency span accuracy
	Frequency counter	Resolution	1 Hz, 10 Hz, 100 Hz, 1 kHz
		Accuracy	± (frequency readout × reference frequency accuracy + 1 LSD + 2 Hz × N) (S/N ≥20 dB)
	Frequency span	Setting range	0 Hz, 5 kHz to 30.0 GHz
		Accuracy	At single band sweep, data point 1001 ±1.0% (Band 0, 1), ±2.5% (Band 2, 3, 4)
	Resolution bandwidth (3 dB BW) (RBW)		Setting range: 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, 3 MHz, 5 MHz, 10 MHz, 20 MHz (only 0 Band) (manually or automatically settable according to frequency span) Bandwidth accuracy: ±20% (RBW = 300 Hz to 10 MHz), ±40% (RBW = 20 MHz) Selectivity (60 dB: 3 dB): ≤ 15: 1
	Video bandwidth (VBW)		1 Hz to 3 MHz (1, 3 sequence), Off (manually or automatically settable according to resolution bandwidth)
	Signal purety		Noise side bands: ≤–108 dBc/Hz (1 GHz, 10 kHz offset) ≤–120 dBc/Hz (1 GHz, 100 kHz offset)
	Reference oscillator		Frequency: 10 MHz Startup characteristies: $\leq 5 \times 10^{-8}$ (after 10 minutes warm-up, with frequency after 24 hours warm-up referenced) Aging rate: $\leq 2 \times 10^{-8}$/day, $\leq 1 \times 10^{-7}$/year (referred to frequency after 24 hours warm-up) Temperature characteristics: $\pm 5 \times 10^{-8}$ (0 to 50°C, referred to frequency at 25°C)
Amplitude	Level measuremen	Measuring range	Average noise level to +30 dBm
		Maximum input level	+30 dBm (CW average power, input attenuator: ≥10 dB), +47 dBm (Peak pulse input, pulse width ≤1 µs, duty ratio ≤1%, input attenuator ≥30 dB) ±0 V (DC),
		Average noise level	RBW = 300 Hz, VBW = 1 Hz, RF ATT = 0 dB ≤–124 dBm + f [GHz] dB (1 MHz to 2.5 GHz, Band 0) ≤–120 dBm + f [GHz] dB (2.5 to 3.0 GHz, Band 0) ≤–115 dBm (3.15 to 7.9 GHz, Band 1) ≤–107 dBm (7.8 to 15.2 GHz, Band 2) ≤–103 dBm (15.1 to 22.5 GHz, Band 3) ≤–96 dBm (22.4 to 30 GHz, Band 4)
		Residual response	(input attenuator: 0 dB, VBW: 1 Hz, detection mode: Sample) ≤–100 dBm (1 MHz to 3.2 GHz, Band 0) ≤–90 dBm (3.15 to 7.9 GHz, Band 1)
	Reference level		(input attenuator: 0 dB, input: 50 Ω termination) Setting range Log scale: –100 to +40 dBm or equivalent level Linear scale: 2.24 µV to 22.4 V Unit Log scale: dBm, dBµV, dBmV, dBµV (emf), W, dBµV/m

Model			MS2687A
Amplitude	Reference level		Reference level accuracy: ±0.5 dB (–49.9 to 0 dBm), ±0.75 dB (–69.9 to –50 dBm, 0.1 to +30 dBm), ±1.5 dB (–80 to –70 dBm) * After calibration, At 50 MHz Frequency, Span1 MHz (when input attenuator, resolution bandwidth, video bandwidth, and sweep time set to AUTO) Resolution bandwidth switching uncertainly: ±0.3 dB (300 Hz to 5 MHz), ±0.5 dB (10 MHz, 20 MHz) * After calibration, referenced to resolution bandwidth 3 kHz Input attenuator (input attenuator) Setting range: 0 to 70 dB, 10 dB step (manually or automatically settable according to reference level) Switching uncertainly: ±0.3 dB (10 to 50 dB), ±0.5 dB (60 to 70 dB) * After calibration, referenced to input attenuator 10 dB Input attenuator switching mode: 10 dB step mode
	frequency response	Relative flatness	At Input attenuator 10 dB ±1.0 dB (9 kHz to 3.2 GHz, Band 0) ±1.5 dB (3.15 to 7.9 GHz, Band 1) ±3.0 dB (7.8 to 15.2 GHz, Band 2) ±4.0 dB (15.1 to 22.5 GHz, Band 3) ±4.0 dB (22.4 to 30.0 GHz, Band 4) * At Band 1, 2, 3, 4, after pre-selector tuning
		Absolute flatness	Refered to 50 MHz frequency, input attenuator 10 dB ±5.0 dB (9 kHz to 30.0 GHz) * At Band 1, 2, 3, 4, after pre-selector tuning
	Scale Fidelity		Scale: 10 div Log scale: 10 dB/div, 5 dB/div, 2 dB/div, 1 dB/div Linear scale: 10%/div, 5%/div, 2%/div, 1%/div Linearity (after calibration) Log scale: ±0.4 dB (0 to –20 dB, RBW ≤1 kHz), ±1.0 dB (0 to –90 dB, RBW ≤1 kHz) Linear scale: ±4% of reference level Marker level resolution Log scale: 0.01 dB Linear scale: 0.02% of reference level
	Suprious response		2nd harmonic distortion: ≤–60 dBc (10 to 200 MHz, mixer input level: –30 dBm) ≤–70 dBc (0.2 to 1.6 GHz, mixer input level : –30 dBm) ≤–90 dBc (1.6 to 15 GHz, mixer input level : –10 dBm) 3rd order intermodulation distortion: ≤–70 dBc (10 to 100 MHz) ≤–85 dBc (0.1 to 3.2 GHz, Band 0) ≤–80 dBc (3.15 to 7.9 GHz, Band 1) ≤–75 dBc (7.8 to 22.5 GHz, Band 2, 3) ≤–75 dBc Typ. (22.4 GHz to 30.0 GHz, Band 4) * Frequency reference of two signal ≥ 50 kHz, mixer input level –30 dBm Image response: ≤–65 dBc (input frequency ≤ 18 GHz) ≤–60 dBc (input frequency ≤ 22 GHz) ≤–55 dBc (input frequency ≤ 30 GHz) Multiple response/response of band outside ≤–60 dBc (input frequency ≤ 22 GHz) ≤–55 dBc (input frequency ≤ 30 GHz)
	1 dB gain compression		At mixer input level 0 dBm (≥100 MHz) +3 dBm (≥500 MHz, Band 0) –5 dBm (≥3150 MHz, Band 1, 2, 3, 4)

Model		MS2687A
Frequency domain	Sweep time	Setting range: 10 ms to 1000 s (manual settable, or automatically settable according to span, resolution bandwidth, video bandwidth) Setting resolution: 5 ms (5 ms to 1 s), most significant 3-digits (≥1 s) Accuracy: ±3%
	Sweep mode	Continuous, single
	Trigger switch	Freerun, Triggered
	Trigger source	Wide IF Video, Line, Ext (±10 V), Ext (TTL)
	Gate mode	Off, Random sweep mode Gate delay: 0 s to 65.5 ms, resolution 1 μs Gate length: 2 μs to 65.5 ms, resolution 1 μs Gate end: Internal/External
	Zone sweep	Sweeps only in frequency range indicated by zone marker
	Tracking sweep	Sweeps while tracking peak points within zone marker (zone sweep also possible)
Time domain	Sweep time	Setting range: 1 μs to 1000 s Setting resolution: 1, 2, 5 sequence (1 to 50 μs), 100 μs (100 μs to 4.9 ms), 5ms (5 ms to 1 s), most significant 3-digits (1 to 1000 s) Accuracy: ±1%
	Sweep mode	Continuous, single
	Trigger switch	Freerun, Triggered
	Trigger source	Wide IF Video, Video, Line, Ext (±10 V), Ext (TTL)
	Trigger delay	Pre-trigger: Display waveform before triggering Setting range: – (time span) to 0 s Setting resolution: Bigger value between (time span)/500 and 100 ns Post trigger: Display waveform before triggering Setting range: 0 s to 65.5 ms Setting resolution: 100 ns (sweep time ≤ 4.9 ms), 1 μs (sweep time ≥ 5 ms)
Function	Numbers of point	501,1001 points
	Detection mode	Normal, Positive Peak, Negative Peak, Sample, Average Normal: Simultaneously displays max. and min. points between sample points Positive Peak: Displays max. points between sample points Negative Peak: Displays min. points between sample points Sample: Displays momentary value at sample points Average: Displays average value between sample points
	Display function	Trace-A, Trace-B, Trace-Time, Trace-A/B, Trace-A/BG, Trace-A/Time
	Trace Calculation	A → B, B → A, A ↔ B, A + B → A, A-B → A, A-B + DL → A
	Storage function	Normal, View, Max Hold, Min Hold, Average, Cumulative, Over Write
	Signal search	Auto Tune, Peak → CF, Peak → REF, Scroll
	Zone marker	Normal, Delta
	Marker function	Marker → CF, Marker → REF, Marker CF Step Size, ΔMarker → Span, Zone → Span
	Peak search	Peak, Next Peak, Min Dip, Next Dip
	Multi marker	Number of markers: 10 max. (Highest 10, Harmonics, Manual Set)
	Measure function	Noise power: dBm/Hz, dBm/CH, dBμV/√Hz C/N: dBc/Hz, dBc/CH Occupied bandwidth: power N% method , X dB Down method Adjacent channel leakage power: 3 channels × 2, graphic display Average power of burst signal: average power in designate time range of time domain waveform Channel power: dBm/Hz, dBm Template comparison measurement: upper/lower limits × each 2, time domain
	Correction	MASK: upper/lower limits × each 2, time domain The user can correct frequency response optionally, max 150 points Auto correction of MA1621A impedance transformer insertion loss correction accuracy (input attenuator ≥ 10 dB): ±2.5 dB (9 k to 100 kHz), ±1.5 dB (100 kHz to 2 GHz),

Model		MS2687A		
External mixer	frequency frequency range	18 to 110 GHz		
	Frequency band Composition	Band K Ka Q U V E W	Frequency range 18 to 26.5 GHz 26.5 to 40 GHz 33 to 50 GHz 40 to 60 GHz 50 to 75 GHz 60 to 90 GHz 75 to 110 GHz	Mixer harmonic degree [N] 4 6 8 9 or 10 11 or 12 13 or 14 16
	Span setting range	0 Hz, (100 × N) Hz to each band width		
	Amplitude Mixer Conversion loss Setting range Maximum input level Average Noise level Frequency response	10 to 85 dB Depend on external mixer Depend on external mixer Depend on external mixer		
	Input/output Adaptation mixer Local frequency IF frequency	Only 2 port mixer 4 to 7 GHz 460.69 MHz/466 MHz		
	Display gain	External mixer level –10 dBm, When mixer conversion loss 15 dB 0 ±2 dB		
General specification	Display	Color TFT-LCD, Size: VGA 17 cm (6.5" Type), Number of colors: 4096 (RGB, 16-scale settable) Brightness: 5-scale settable (include Off)		
	SAVE/RECALL	Saves and recalls seting conditions and waveform data to internal memory (Max 12) or memory card		
	Hard copy	Display data can be hard-copied via the parallel interface (model correspond to PCL Level 3 or less, ESC/P-J83 or J84)		
	PC Card Interface	PC-ATA card or Compact Flash card (3.3 V/5 V) can be accessed Function: Save/recall measurement setting and waveform data Save bitmap files of waveform display Connector: PC Card Type I or Type II		
	RS-232C	Can be controlled as device from external controller (excluding power switch) Baud rate: 1200, 2400, 4800, 9600, 19.2 k, 38.4 k, 56 k, 115 kbps Connector: D-Sub 9 pins, jack		
	GPIB	Function: Meets to IEEE488.2 Can be controlled as device from external controller (excluding power switch) Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2		
	Parallel interface	Based on centoronics, output printing data to printer Connector: D-Sub 25 pins, jack		
	Input connector	N-type connector 50 Ω, VSWR ≤ 1.5 typ. (input attenuator ≥ 10 dB)		
	IF Output	BNC, 50 Ω nominal value Frequency: 60.69 MHz/66 MHz Output level: –10 dBm typ. (frequency 50 MHz, at upper edge of display scale)		
	Wideband IF Output	BNC, 50 Ω nominal value Frequency: 60.69 MHz/66 MHz Gain: 0 dB typ. (frequency 50 MHz, input attenuator 0 dB)		
	Video Output (Y)	BNC, 75 Ω nominal value Output level: 0 to 0.5 V ± 0.1 V (log scale) 0 to 0.4 V ± 0.1 V (linear scale) (frequency 50 MHz,at upper edge of display scales)		

*1: Typical value and nominal value are reference data, so that not warrant them as spec.

Model		MS2687A
General specification	Video Output	Analog RGB connector: D-Sub 15 pins, jack
	External reference input	BNC connector Frequency: 10 MHz ± 10 Hz, 13 MHz ± 13 Hz Level: ≥0 dBm (50 Ω termination)
	Buffered Output	BNC connector Frequency: 10 MHz Output level: p-p: 2 to 5 V (200 Ω termination)
	Sweep Output (X)	BNC connector Output level: 0 to 10 V ± 1 V (100 kΩ termination, from left edge to right edge in display scale, single band sweep)
	Sweep Status Output (Z)	BNC connector Output level: TTL (when sweeping, at low level)
	Probe source	4-pin connector, +12 V, –12 V, each ±10%, each max 110 mA
	Trig/Gateinput	BNC connector Input level: ±10 V (0.1 V resolution), TTL level
Others	Dimension	177 mm (H), 320 mm (W), 411 mm (D) (exclude handle, legs, front cover, fan cover)
	Mass	≤16 kg nominal value
	Power (operating range)	85 to 132 V, 170 to 250 V (automatic voltage change), 47.5 to 63 Hz, ≤400 VA
	Temperature range	Operating 0 to 50˚C, ≤ RH85% Preservation –20 to +60˚C
	Conducted Emission	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Radiated Emission	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Harmonic Current Emission	Meets EN 61000-3-2: 2000
	Electrostatic Discharge	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Electromagnetic Field Immunity	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Fast Transient / Burst	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Surge	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Conducted RF	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Power Frequency Magnetic Field	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Voltage Dips / Short Interruptions	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Vibration	Meets MIL-STD-810D

*1: Typical value and nominal value are reference data, so that not warrant them as spec.

Model			MS2687B
Frequency	Frequency range		9 kHz to 30.0 GHz
	Frequency band		Band 0 (9 kHz to 3.2 GHz), Band 1 – (3.15 to 6.3 GHz), Band 1 + (6.2 to 7.9 GHz), Band 2 + (7.8 to 15.3 GHz), Band 4 + (15.2 to 30 GHz)
	Pre-selector range		3.15 to 30 GHz (Band 1–, 1+, 2+, 4+)
	Frequency setting range		0 to 30 GHz
	Frequency readout accuracy		± (frequency readout × reference frequency accuracy + span × span accuracy + resolution bandwidth × 0.15 + 10 Hz × N)
	Marker frequency readout accuracy		Normal: Same as frequency readout accuracy Delta: Same as frequency span accuracy
	Frequency counter	Resolution	1 Hz, 10 Hz, 100 Hz, 1 kHz
		Accuracy	± (frequency readout × reference frequency accuracy + 1 LSD + 2 Hz × N) (S/N ≥20 dB)
	Frequency span	Setting range	0 Hz, 5 kHz to 30.0 GHz
		Accuracy	At single band sweep, data point 1001 ±1.0% (Band 0, 1), ±2.5% (Band 2, 4)
	Resolution bandwidth (3 dB BW) (RBW)		Setting range: 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, 3 MHz, 5 MHz, 10 MHz, 20 MHz (only 0 Band) (manually or automatically settable according to frequency span) Bandwidth accuracy: ±20% (RBW = 300 Hz to 10 MHz), ±40% (RBW = 20 MHz) Selectivity (60 dB: 3 dB): ≤ 15: 1
	Video bandwidth (VBW)		1 Hz to 3 MHz (1, 3 sequence), Off (manually or automatically settable according to resolution bandwidth)
	Signal purety		Noise side bands: ≤–108 dBc/Hz (1 GHz, 10 kHz offset) ≤–120 dBc/Hz (1 GHz, 100 kHz offset)
	Reference oscillator		Frequency: 10 MHz Set up characteristics: $\leq 5 \times 10^{-8}$ (after 10 mintes warm-up, with frequency after 24 hours warm-up referenced) Aging rate: $\leq 2 \times 10^{-8}$/day, $\leq 1 \times 10^{-7}$/year (referred to frequency after 24 hour warm-up) Temperature characteristics: $\pm 5 \times 10^{-8}$ (0 to 50˚C, referred to frequency at 25˚C)
Amplitude	Level measurement	Measuring range	Average noise level to +30 dBm
		Maximum input level	+30 dBm (CW average power, input attenuator: ≥10 dB), +47 dBm (Peak pulse input, pulse width ≤1 μs, duty ratio ≤1%, input attenuator ≥30 dB) ±0 V (DC),
		Average noise level	RBW = 300 Hz, VBW = 1 Hz, RF ATT = 0 dB ≤–124 dBm + f [GHz] dB (1 MHz to 2.5 GHz, Band 0) ≤–120 dBm + f [GHz] dB (2.5 to 3.2 GHz, Band 0) ≤–115 dBm (3.15 to 7.9 GHz, Band 1) ≤–113 dBm (7.8 to 15.3 GHz, Band 2) ≤–103 dBm (15.2 to 30 GHz, Band 4)
		Residual response	≤–100 dBm (1 MHz to 3.2 GHz, Band 0) ≤–90 dBm (3.15 to 7.9 GHz, Band 1) (input attenuator: 0 dB, input: 50 Ω termination)
	Reference level		Setting range Log scale: –100 to +40 dBm or equivalent level Linear scale: 2.24 μV to 22.4 V Unit Log scale: dBm, dBμV, dBmV, dBμV (emf), W, dBμV/m Linear scale: V

Model			MS2687B
Amplitude	Reference level		Reference level accuracy: ±0.5 dB (–49.9 to 0 dBm), ±0.75 dB (–69.9 to –50 dBm, 0.1 to +30 dBm), ±1.5 dB (–80 to –70 dBm) * After calibration, At 50 MHz Frequency, Span1 MHz (when input attenuator, resolution bandwidth, video bandwidth, and sweep time set to AUTO) Resolution bandwidth switching uncertainly: ±0.3 dB (300 Hz to 5 MHz), ±0.5 dB (10 MHz, 20 MHz) * After calibration, referenced to resolution bandwidth 3 kHz Input attenuator (input attenuator) Setting range: 0 to 70 dB, 10 dB step (manually or automatically settable according to reference level) Switching uncertainly: ±0.3 dB (10 to 50 dB), ±0.5 dB (60 to 70 dB) * After calibration, referenced to input attenuator 10 dB Input attenuator switching mode: 10 dB step mode
	frequency response	Relative flatness	At Input attenuator 10 dB ±1.0 dB (9 kHz to 3.2 GHz, Band 0) ±1.5 dB (3.15 to 7.9 GHz, Band 1) ±3.0 dB (7.8 to 15.3 GHz, Band 2) ±4.0 dB (15.2 to 30.0 GHz, Band 4) * At Band 1, 2, 4, after pre-selector tuning Referred to 50 MHz frequency, input attenuator 10 dB
		Absolute flatness	±5.0 dB (9 kHz to 30.0 GHz) * At Band 1, 2, 4, after pre-selector tuning
	Scale Fidelity		Scale: 10 div Log scale: 10 dB/div, 5 dB/div, 2 dB/div, 1 dB/div Linear scale: 10%/div, 5%/div, 2%/div, 1%/div Linearity (after calibration) Log scale: ±0.4 dB (0 to –20 dB, RBW ≤1 kHz), ±1.0 dB (0 to –70 dB, RBW ≤1 kHz) ±1.2 dB (0 to –90 dB, RBW ≤1 kHz) Linear scale: ±4% of reference level Marker level resolution Log scale: 0.01 dB Linear scale: 0.02% of reference level
	Spurious response		2nd harmonic distortion: ≤–60 dBc (10 to 200 MHz, mixer input level: –30 dBm) ≤–70 dBc (0.2 to 1.6 GHz, mixer input level : –30 dBm) ≤–90 dBc (1.6 to 15 GHz, mixer input level : –10 dBm) 3rd order intermodulation distortion: ≤–70 dBc (10 to 100 MHz) ≤–85 dBc (0.1 to 3.2 GHz, Band 0) ≤–80 dBc (3.15 to 7.9 GHz, Band 1) ≤–75 dBc (7.8 to 22.5 GHz, Band 2) ≤–75 dBc Typ. (22.4 GHz to 30.0 GHz, Band 4) * Frequency reference of two signal ≥ 50 kHz, mixer input level –30 dBm Image response: ≤–65 dBc (input frequency ≤ 18 GHz) ≤–60 dBc (input frequency ≤ 22 GHz) ≤–55 dBc (input frequency ≤ 30 GHz) Multiple response/response of band outside ≤–60 dBc (input frequency ≤ 22 GHz) ≤–55 dBc (input frequency ≤ 30 GHz)
	1 dB gain compression		At mixer input level ≥0 dBm (≥100 MHz) ≥+3 dBm (≥500 MHz, Band 0) ≥–5 dBm (≥3150 MHz, Band 1, 2, 4)

Model		MS2687B
Frequency domain	Sweep time	Setting range: 10 ms to 1000 s (manual settable, or automatically settable according to span, resolution bandwidth, video bandwidth) Setting resolution: 5 ms (10 ms to 1 s), most significant 3-digits (≥1 s) Accuracy: ±3%
	Sweep mode	Continuous, single
	Trigger switch	Freerun, Triggered
	Trigger source	Wide IF Video, Line, Ext (±10 V), Ext (TTL)
	Gate mode	Off, Random sweep mode Gate delay: 0 s to 65.5 ms, resolution 1 μs Gate length: 2 μs to 65.5 ms, resolution 1 μs Gate end: Internal/External
	Zone sweep	Sweeps only in frequency range indicated by zone marker
	Tracking sweep	Sweeps while tracking peak points within zone marker (zone sweep also possible)
Time domain	Sweep time	Setting range: 1 μs to 1000 s Setting resolution: 1, 2, 5 sequence (1 to 50 μs), 100 μs (100 μs to 4.9 ms), 5ms (5 ms to 1 s), most significant 3-digits (1 to 1000 s) Accuracy: ±1%
	Sweep mode	Continuous, single
	Trigger switch	Freerun, Triggered
	Trigger source	Wide IF Video, Video, Line, Ext (±10 V), Ext (TTL)
	Trigger delay	Pre-trigger: Display waveform before triggering Setting range: – (time span) to 0 s Setting resolution: Bigger value between (time span)/500 and 100 ns Post trigger: Display waveform before triggering Setting range: 0 s to 65.5 ms
Function		Setting resolution: 100 ns (sweep time ≤ 4.9 ms), 1 μs (sweep time ≥ 5 ms)
	Numbers of point Detection mode	501,1001 points Normal, Positive Peak, Negative Peak, Sample, Average Normal: Simultaneously displays max. and min. points between sample points Positive Peak: Displays max. points between sample points Negative Peak: Displays min. points between sample points Sample: Displays momentary value at sample points Average: Displays average value between sample points
	Display function	Trace-A, Trace-B, Trace-Time, Trace-A/B, Trace-A/BG, Trace-A/Time
	Trace Calculation	A → B, B → A, A ↔ B, A + B → A, A-B → A, A-B + DL → A
	Storage function	Normal, View, Max Hold, Min Hold, Average, Cumulative, Over Write
	Signal search	Auto Tune, Peak → CF, Peak → REF, Scroll
	Zone marker	Normal, Delta
	Marker function	Marker → CF, Marker → REF, Marker CF Step Size, ΔMarker → Span, Zone → Span
	Peak search	Peak, Next Peak, Min Dip, Next Dip
	Multi marker	Number of markers: 10 max. (Highest 10, Harmonics, Manual Set)
	Measure function	Noise power: dBm/Hz, dBm/CH, dBμV/$\sqrt{\text{Hz}}$ C/N: dBc/Hz, dBc/CH Occupied bandwidth: power N% method , X dB Down method Adjacent channel leakage power: 3 channels × 2, graphic display Average power of burst signal: average power in designate time range of time domain waveform Channel power: dBm/Hz, dBm Template comparison measurement: upper/lower limits × each 2, time domain MASK: upper/lower limits × each 2, time domain
	Correction	The user can correct frequency response optionally, max 150 points Auto correction of MA1621A impeadance transformer insertion loss correction accuracy

Model		MS2687B		
External mixer	frequency frequency range	18 to 110 GHz		
	Frequency band Composition	Band K Ka Q U V E W	Frequency range 18 to 26.5 GHz 26.5 to 40 GHz 33 to 50 GHz 40 to 60 GHz 50 to 75 GHz 60 to 90 GHz 75 to 110 GHz	Mixer harmonic degree [N] 4 6 8 9 or 10 11 or 12 13 or 14 16
	Span setting range	0 Hz, (100 × N) Hz to each band width		
	Amplitude Mixer Conversion loss Setting range Maximum input level Average Noise level Frequency response	 15 to 85 dB Depend on external mixer Depend on external mixer Depend on external mixer		
	Input/output Adaptation mixer Local frequency IF frequency	 Only 2 port mixer 4 to 7 GHz 460.69 MHz/466 MHz		
	Display gain	External mixer level 10 dBm, When mixer conversion loss 15 dB 0 ±2 dB		
General specification	Display	Color TFT-LCD, Size: VGA 17 cm (6.5" Type), Number of colors: 4096 (RGB, 16-scale settable) Brightness: 5-scale settable (include Off)		
	SAVE/ RECALL	Saves and recalls setting conditions and waveform data to internal memory (Max 12) or memory card		
	Hard copy	Display data can be hard-copied via the parallel interface (model correspond to PCL Level 3 or less, ESC/P-J83 or J84)		
	PC Card Interface	PC-ATA card or Compact Flash card (3.3 V/5 V) can be accessed Function: Save/recall measurement setting and waveform data Save bitmap files of waveform display Connector: PC Card Type I or Type II		
	RS-232C	Can be controlled as device from external controller (excluding power switch) Baud rate: 1200, 2400, 4800, 9600, 19.2 k, 38.4 k, 56 k, 115 kbps Connector: D-Sub 9 pins, jack		
	GPIB	Function: Meets to IEEE488.2 Can be controlled as device from external controller (excluding power switch) Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2		
	Parallel interface	Based on centoronics, output printing data to printer Connector: D-Sub 25 pins, jack		
	Input connector	N-type connector 50 Ω, VSWR ≤ 2.3 typ. (input attenuator ≥ 10 dB)		
	IF Output	BNC, 50 Ω nominal value Frequency: 60.69 MHz/66 MHz Output level: –10 dBm typ. (frequency 50 MHz, at upper edge of display scale)		
	Wideband IF Output	BNC, 50 Ω nominal value Frequency: 60.69 MHz/66 MHz Gain: 0 dB typ. (frequency 50 MHz, input attenuator 0 dB)		
	Video Output (Y)	BNC, 75 Ω nominal value Output level: 0 to 0.5 V ± 0.1 V (log scale) 0 to 0.4 V ± 0.1 V (linear scale) (frequency 50 MHz,at upper edge of display scales)		

*1: Typical value and nominal value are reference data, so that not warrant them as spec.

Model		MS2687B
General specification	Video Output	Analog RGB connector: D-Sub 15 pins, jack
	External reference input	BNC connector Frequency: 10 MHz ± 10 Hz, 13 MHz ± 13 Hz Level: ≥0 dBm (50 Ω termination)
	Buffered Output	BNC connector Frequency: 10 MHz Output level: p-p: 2 to 5 V (200 Ω termination)
	Sweep Output (X)	BNC connector Output level: 0 to 10 V ± 1 V (100 kΩ termination, from left edge to right edge in display scale, single band sweep)
	Sweep Status Output (Z)	BNC connector Output level: TTL (when sweeping, at low level)
	Probe source	4-pin connector, +12 V, –12 V, each ±10%, each max 110 mA
	Trig/Gateinput	BNC connector Input level: ±10 V (0.1 V resolution), TTL level
Others	Dimension	177 mm (H), 320 mm (W), 411 mm (D) (exclude handle, legs, front cover, fan cover)
	Mass	≤16 kg nominal value
	Power (operating range)	85 to 132 V, 170 to 250 V (automatic voltage change), 47.5 to 63 Hz, ≤400 VA
	Temperature range	Operating 0 to 50˚C, ≤ RH85% Preservation –20 to +60˚C
	Conducted Emission	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Radiated Emission	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Harmonic Current Emission	Meets EN 61000-3-2: 2000
	Electrostatic Discharge	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Electromagnetic Field Immunity	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Fast Transient / Burst	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Surge	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Conducted RF	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Power Frequency Magnetic Field	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Voltage Dips / Short Interruptions	Meets EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
	Vibration	Meets MIL-STD-810D

*1: Typical value and nominal value are reference data, so that not warrant them as spec.

• Option 01: Precision frequency reference oscillator

Frequency	10 MHz
Aging rate	≤ 5×10^{-10}/day (referred to frequency after 24 houres warm-up)
Temperature stability	≤ 5×10^{-10} (0 to 50˚C, referred to frequency at 25˚C)
Warm-up time within ≤ 5×10^{-8}	≤ 7 minutes Typ. (at 25˚C)

• Option 02: Narrow resolution bandwidth

Resolution bandwidth		Setting range: 1 Hz to 1 kHz Switching uncertainly: ±0.5 dB *reference to RBW 3 kHz (analog)	
		Resolution bandwidth accuracy	±10% (RBW = 30 Hz, 300 Hz) ±10% Typ. (RBW = 1, 3, 10, 100, 1 kHz)
		Selectivity (60 dB: 3 dB)	≤5: 1
Span		Minimum span setting: 100 Hz	
Average noise level		At Input attenuator: 0 dB, RBW: 1 Hz, Detection mode: Sample	
	MS2681A	[without Option 08 Pre-amplifier] ≤–146.5 dBm+f [GHz] dB Typ. (1 MHz to 2.5 GHz) ≤–142.5 dBm+f [GHz] dB Typ. (2.5 to 3.0 GHz) [with Option08 Pre-amplifier, when Pre-amplifier Off] ≤–144.5 dBm + 1.5 × f [GHz] dB Typ. (1 MHz to 2.5 GHz) ≤–140.5 dBm + 1.5 × f [GHz] dB Typ. (2.5 to 3.0 GHz)	
	MS2683A	[without Option08 Pre-amplifier] ≤–146.5 dBm + f [GHz] dB Typ. (1 MHz to 2.5 GHz, Band 0) ≤–142.5 dBm + f [GHz] dB Typ. (2.5 to 3.2 GHz, Band 0) ≤–144.5 dBm + 0.5 × f [GHz] dB Typ. (3.15 to 7.8 GHz, Band 1) [with Option 08 Pre-amplifier, when Pre-amplifier Off] ≤–144.5 dBm+1.5 × f [GHz] dB Typ. (1 MHz to 2.5 GHz, Band 0) ≤–140.5 dBm+1.5 × f [GHz] dB Typ. (2.5 to 3.2 GHz, Band 0) ≤–138.5 dBm + 0.5 × f [GHz] dB Typ. (3.15 to 7.8 GHz, Band 1)	
	MS2687A	≤–146.5 dBm + f [GHz] dB Typ. (1 MHz to 2.5 GHz, Band 0) ≤–142.5 dBm + f [GHz] dB Typ. (2.5 to 3.2 GHz, Band 0) ≤–137.5 dBm Typ. (3.15 to 7.9 GHz, Band 1) ≤–129.5 dBm Typ. (7.8 to 15.2 GHz, Band 2) ≤–125.5 dBm Typ. (15.1 to 22.5 GHz, Band 3) ≤–118.5 dBm Typ. (22.4 to 30 GHz, Band 4)	
	MS2687B	≤–146.5 dBm + f [GHz] dB Typ. (1 MHz to 2.5 GHz, Band 0) ≤–142.5 dBm + f [GHz] dB Typ. (2.5 to 3.2 GHz, Band 0) ≤–137.5 dBm Typ. (3.15 to 7.9 GHz, Band 1) ≤–135.5 dBm Typ. (7.8 to 15.3 GHz, Band 2) ≤–125.5 dBm Typ. (15.2 to 30 GHz, Band 4)	

• Option 03: Extension of preselector lower limit to 1.6 GHz [Only MS2683A]

Outline	Expands lower frequency limit of pre-selector from 3.15 to 1.6 GHz.
Frequency band	Band 0: 9 kHz to 3.2 GHz, Band 1–L: 1.6 to 3.2 GHz, Band 1–: 3.15 to 6.3 GHz Band 1+: 6.2 to 7.8 GHz
Pre-selector range	1.6 to 7.8 GHz (Band 1–L, 1–, 1+)
Average noise level	≤–122 dBm + 0.5 × f [GHz] dB (1.6 to 7.8 GHz, Band 1, RF ATT: 0 dB, RBW: 300 Hz, VBW: 1 Hz)
Residual response	≤–90 dBm (1.6 to 7.8 GHz, Band 1, RF ATT: 0 dB, Input: 50 Ω termination)
Frequency response	±1.0 dB (1.6 to 7.8 GHz, Band 1, referred to 50 MHz, RF ATT: 10 dB, 18 to 28˚C) ±2.0 dB (1.6 to 7.8 GHz, Band 1, referred to 50 MHz, RF ATT: 10 to 62 dB) *After executing pre-select tuning.
2nd harmonic distortion	≤–90 dBc (0.8 to 3.9 GHz, Band 1, mixer input level: –10 dBm)
1 dB gain compression	≥0 dBm (1.6 to 7.8 GHz, Band 1)
Maximum dynamic range	≥122 dB –0.5 × f [GHz] dB (1.6 to 7.8 GHz, Band 1)

• Option 04: Digital Resolution Bandwidth

Resolution Bandwidth		Setting Range: 10 Hz to 1 MHz(1, 3 sequence) Resolution Bandwidth Accuracy: ±10% (RBW≥100 Hz), ±10% nominal (RBW≤30 Hz) Resolution Bandwidth Selectivity: ≤5:1 (RBW≥100 Hz), ≤5:1 nominal (RBW≤30 Hz) Resolution Switching Deviation: ±0.5 dB (Referenced to RBW = 3 kHz)
Detection Mode		Normal, Positive Peak, Negative Peak, Sample, RMS RMS: Displays RMS Value between sample points
Span		Setting Range: Minimum 1 kHz
Average noise level		At Input RF attenuator: 0 dB, RBW: 10 Hz, Detection mode: Sample
	MS2681A	[without Option 08 Pre-amplifier] ≤ –136.5 dBm + f [GHz] dB Typ. (1 MHz to 2.5 GHz) ≤–132.5 dBm + f [GHz] dB Typ. (2.5 to 3.0 GHz) [with Option 08 Pre-amplifier, when Pre-amplifier Off] ≤–134.5 dBm + 1.5 × f [GHz] dB Typ. (1 MHz to 2.5 GHz) ≤–130.5 dBm + 1 .5 × f [GHz] dB Typ. (2.5 to 3.0 GHz)
	MS2683A	[without Option 08 Pre-amplifier] ≤–136.5 dBm + f [GHz] dB Typ. (1 MHz to 2.5 GHz, Band 0) ≤–132.5 dBm + f [GHz] dB Typ. (2.5 to 3.2 GHz, Band 0) ≤–134.5 dBm + 0.5 × f [GHz] dB Typ. (3.15 to 7.8 GHz, Band 1) [with Option08 Pre-amplifier, when Pre-amplifier Off] ≤–134.5 dBm + 1.5 × f [GHz] dB Typ. (1 MHz to 2.5 GHz, Band 0) ≤–130.5 dBm + 1.5 × f [GHz] dB Typ. (2.5 to 3.2 GHz, Band 0) ≤–134.5 dBm + 0.5 × f [GHz] dB Typ. (3.15 to 7.8 GHz, Band 1)
	MS2687A	≤–136.5 dBm + f [GHz] dB Typ. (1 MHz to 2.5 GHz, Band 0) ≤–132.5 dBm + f [GHz] dB Typ. (2.5 to 3.2 GHz, Band 0) ≤–137.5 dBm Typ. (3.15 to 7.9 GHz, Band 1) ≤–119.5 dBm Typ. (7.8 to 15.2 GHz, Band 2) ≤–115.5 dBm Typ. (15.1 to 22.5 GHz, Band 3) ≤–108.5 dBm Typ. (22.4 to 30 GHz, Band 4)
	MS2687B	≤–136.5 dBm + f [GHz] dB Typ. (1 MHz to 2.5 GHz, Band 0) ≤–132.5 dBm + f [GHz] dB Typ. (2.5 to 3.2 GHz, Band 0) ≤–127.5 dBm Typ. (3.15 to 7.9 GHz, Band 1) ≤–125.5 dBm Typ. (7.8 to 15.3 GHz, Band 2) ≤–115.5 dBm Typ. (15.2 to 30 GHz, Band 4)

• Option 05: Rubidium reference oscillator [Only MS2687A/MS2687B]

Frequency	10 MHz
Start characteristic	$\pm 1 \times 10^{-9}$ * referred to Frequency, temperature 25˚C after power on 7 min, 60 min
Aging rate	$\pm 1 \times 10^{-10}$/month referred to Frequency, after power on 60 min
Temperature characteristic	$\pm 1 \times 10^{-9}$ (0 to 45˚C, referred to Frequency, temperature 25˚C)
Appendant	J1066: coaxial code, 0.15 m (BNC211-LP4)

• Option 08: Pre-Amplifier*1 [MS2681A/MS2683A]

Frequency Range	100 kHz to 3 GHz
Gain*1	20 dB typical
Noise Figure*1	6.5 dB typical (Input frequency ≤2 GHz), 12 dB typical (Input frequency >2 GHz)
Frequency Band	Band 0: 100 kHz to 3 GHz, Band 1–: 3.15 to 6.3 GHz Band 1+: 6.2 to 7.8 GHz Pre-amplifier is available in the band 0.
Amplitude	
Measurement Range	Average noise level to +10 dBm
Max. Input Level	CW average power: +10 dBm, DC: 0 Vdc
Average Noise Level	≤–137 dBm + 2.0 × f [GHz] dB (1 MHz to 2.5 GHz, band 0) *RBW = 300 Hz, VBW = 1 Hz, RF ATT = 0 dB
Reference level	
Setting Range	Log scale: –120 dBm to +10 dBm or equivalent level Linear scale: 2.24 µV to 707 mV
Reference Level accuracy	±0.90 dB (–69.9 to +10 dBm), ±1.5 dB (–90 to –70 dBm) *After calibration, referenced to 50 MHz, 1 MHz span (RF ATT, RBW, VBW, Sweep Time set to Auto)
RBW switching uncertainty	±0.5 dB (300 Hz to 5 MHz), ±0.75 dB (10 MHz, 20 MHz) *After calibration, referenced to 3 kHz RBW
RF ATT switching Uncertainty	±0.5 dB (10 to 50 dB), ±0.75 dB (52 to 62 dB) *After calibration, referenced to 50 MHz, RF ATT = 10 dB
Frequency Response	±2.0 dB (100 kHz to 3 GHz, band 0) *Referenced to 50 MHz, RF ATT = 10 to 50 dB, 18 to 28˚C
Linearity of Waveform display	Log mode: ±0.5 dB (0 to –20 dB, RBW ≤1 kHz), ±1.0 dB (0 to –60 dB, RBW ≤1 kHz), ±1.5 dB (0 to –75 dB, RBW ≤1 kHz) Linear mode: ±5%*, Referenced to Reference level
Spurious Response	Two tone third order inter-modulation distortion: ≤–70 dBc (10 MHz to 3 GHz) *Frequency difference ≥50 kHz, Pre-amplifier input*2 : –55 dBm
1-dB Gain Compression	≥–35 dBm (≥100 MHz, at Pre-amplifier input*2)

*1 Overall specification with Pre-amplifier On
(Gain and noise figure are the performance when used as a stand-alone equipment.)

*2 Pre-amplifier input level = RF input level - RF ATT setting

• Option 09: Ethernet interface

Function	Controlled by the external computer
Connector	10 base-T

• Option 17: I/Q Balanced input* [MS2681A/MS2683A]

Connector	BNC
Impedance	1 MΩ (shunt capacitance <100 pF) or 50 Ω, selectable
Input level	Differential voltage: 0.1 to 1 $V_{(p-p)}$ Common-mode voltage: ±2.5 V

* This function is available with the measurement software, sold separately

• Option 18: I/Q Unbalanced input*

Connector	BNC
Impedance	1 MΩ (shunt capacitance <100 pF) or 50 Ω, selectable
Input level	0.1 to 1 $V_{(p-p)}$ AC/DC coupling, switchable

* This function is available with the measurement software, sold separately.

• Option 21: Power Meter [Only MS2687A/MS2687B]

Outline		High accuracy electric power measurement in frequency range of 100 kHz to 32 GHz can be performed.
Conformity Power Sensor		MA4601A, MA4701A, MA4703A, MA4705A
Frequency range		100 kHz to 32 GHz (According to the Power Sensor in use.)
Level range		–20 to +20 dBm
Readout		Selection of W, dBm, and dB (Relative) is possible. Digital 4 figure display, 20% of over range
Power range		4 range/10 dB step (The measurement level range is indicated to the standard of Power sensor.)
Change of range		Automatic, Manual (A setup to ranges arbitrary regardless of Range hold and Input level is possible.)
Equipment accuracy		±0.7% (W mode) ±0.03 dB (dBm mode, dB (Relative) mode) * If ZERO ADJ key is pushed, it will adjust to a zero point automatically.
Zero set		±0.5% of full scale typical. (100 µW range of the highest sensitivity)
Zero movement Between ranges		±0.2% of full scale (It is 100 µW range of the highest sensitivity and is after zero set.)
Oscillator for Calibration		
	Frequency	50 MHz
	Level	1 mW ±1.2% (For one year)
	Averaging	Available to set Average Count to 2 to 10.

• Option 23: Range expansion Power Meter function [Only MS2687B]

Outline		High accuracy electric power measurement in frequency range of 100 kHz to 32 GHz can be performed.
Conformity Power Sensor		MA4601A, MA4701A, MA4703A, MA4705A
Frequency range		100 kHz to 32 GHz (According to the Power Sensor in use.)
Level range		–30 to +20 dBm (According to the Power Sensor in use.)
Readout		Selection of W, dBm, and dB (Relative) is possible. Digital 4 figure display, 20% of over range
Power measurement range		5 range/10 dB step (The measurement level range is indicated to the standard of Power sensor.) Full scall: –20, –10, 0, +10, +20 (10 µW to 100 mW)
Change of range		Automatic, Manual (A setup to ranges arbitrary regardless of Range hold and Input level is possible.)
Equipment accuracy		±0.6% (W mode) ±0.026 dB (dBm mode, dB (Relative) mode) However, a value when the zero drift is included in Range1 (10 µWrange) is as follows: ±1.2% (W mode), ±0.052 dB (dBm mode, dB (Relative) mode) * If ZERO ADJ key is pushed, it will adjust to a zero point automatically.
Zero set		±0.6% of full scale typical. (10 µW range of the highest sensitivity)
Zero movement Between ranges		±0.2% of full scale (It is 10 µW range of the highest sensitivity and is after zero set.)
Oscillator for Calibration		
	Frequency	50 MHz
	Level	1 mW ±1.2% (For one year)
	Averaging	Available to set Average Count to 2 to 10.

• Option 22: 13 GHz Low Noise [Only MS2687A]

Outline	Average noise level of a frequency of 7.9 GHz or more is improved. The following items are separately specified to standard model.			
Frequency band composition	Band	Frequency range	Mixer Harmonic Degree [N]	LO Harmonic Degree (n)
	0	9 kHz to 3.2 GHz	1	1
	1-	3.15 to 5.8 GHz	1	1
	1+(n=1)	5.7 to 7.9 GHz	1	1
	1+(n=2)	7.8 to 14.05 GHz	1	2
	2-	14.0 to 26.5 GHz	2	4
	3-	26.4 to 30 GHz	3	6
Pre-selector range	3.15 to 30 GHz (Band 1-, 1+ (n=1), 1+ (n=2), 2-, 3-)			
Span accuracy	Single band sweep, Data point 1001 ±1% (Band 0, 1-, 1+ (n=1)) ±2.5% (Band 1+ (n=2), 2-, 3-)			
Level measurement	RBW: 300 Hz, VBW: 1 Hz, RF ATT: 0 dB, Detection mode Sample			
Average Noise Level	≤–124 dBm + f [GHz] dB (1 MHz to 2.5 GHz, Band 0) ≤–120 dBm + f [GHz] dB (2.5 to 3.2 GHz, Band 0) ≤–115 dBm (3.15 to 7.9 GHz, Band 1) ≤–113 dBm (7.8 to 14.05 GHz, Band 1+ (n=2)) ≤–105 dBm (14.0 to 26.5 GHz, Band 2-) ≤–101 dBm (26.4 to 30 GHz, Band 3-)			
Frequency response				
Relative Flatness	RF ATT: 10 dB ±1.0 dB (9 kHz to 3.2 GHz, Band 0) ±1.5 dB (3.15 to 7.9 GHz, Band 1) ±3.0 dB (7.8 to 14.05 GHz, Band 1+(n=2)) ±4.0 dB (14.0 to 26.5 GHz, Band 2-) ±4.0 dB (26.4 to 30 GHz, Band 3-) * At Band 1, 2, 3, after pre-selector tuning			
Absolute Flatness	Refered to 50 MHz, input attenuator=10 dB ±5.0 dB (9 kHz to 30 GHz) * At Band 1, 2, 3, after pre-selector tuning			
Spurious response				
Second harmonic distortion	At mixer input level –30 dBm ≤–60 dBc (input frequency 10 to 200 MHz) ≤–70 dBc (0.2 to 1.6 GHz, Band 0) ≤–90 dBc or below average noise level (1.6 to 15 GHz, Band 1, 2, 3)			
Two tone third order distortion	At mixer input level –30 dBm, frequency difference of 2signals ≥50 kHz ≤–70 dBc (input frequency 10 to100 MHz) ≤–85 dBc (0.1 to 3.2 GHz, Band 0) ≤–80 dBc (3.15 to 14.05 GHz, Band 1) ≤–75 dBc or below average noise level (14.0 to 26.5 GHz, Band 2) ≤–75 dBc or below average noise level Typ. (26.4 to 30 GHz, Band 3)			

Notes:

This option becomes impossible [simultaneous attachment with MS2687A-05 (Rubidium Reference Oscillator)].

• Option 34: Lo Output at 4 GHz

Frequency	4 GHz
Frequency accuracy	±(4 GHz × reference frequency accuracy) ±1 Hz
Output level	–10 dBm typ.
Sprious	≤–40 dBc typ.

• Option 46: Auto power recovery

Outline	Cancels the power switch on front panel and automatically recovers to power-on after power failure.

* This equipment enters the standby state when the line has to be disconnected and reconnected, because power switch on front panel doesn't have latch function.
  If this equipment is built into remote systems, please install this option.

• Option 47: Rack mount (IEC)

Outline	Attachment of rack mount which meets IEC spec The standard tilt handle is eliminated when rack mount kit is attached.

• Option 48: Rack mount (JIS)

Outline	Attachment of rack mount which meets JIS spec The standard tilt handle is eliminated when rack mount kit is attached.

Section 2 Preparations Before Use

This section explains the preparations and safety procedures that should be performed before using the MS2681A/MS2683A/MS2687A/MS2687B Spectrum Analyzer. The safety procedures are to prevent the risk of injury to the operator and damage to the equipment. Ensure that you understand the contents of the pre-operation preparations before using the Spectrum Analyzer.
For connecting the GPIB cable and setting the GPIB address, refer to the Remote Control part of the separate Operation Manual Vol.3.

Installation Site and Environmental Conditions

Locations to be avoided

The MS2681A/MS2683A/MS2687A/MS2687B Spectrum Analyzer (hereinafter, called “this unit”) operates normally at temperatures from 0 to 50°C and below RH 85%. However, for the best performance, the following locations should be avoided.

- Where there is severe vibration
- Where the humidity is high
- Where the equipment will be exposed direct sunlight
- Where the equipment will be exposed active gases

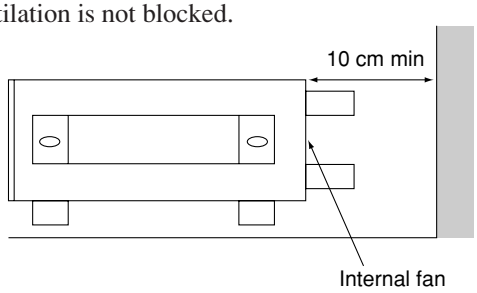
In addition to meeting the above conditions, to ensure long-term trouble-free operation, the equipment should be used at room temperature and in a location where the power supply voltage does not fluctuate greatly.

CAUTION ⚠

If the MS2681A/MS2683A/MS2687A/MS2687B Spectrum Analyzer is used at normal temperatures after it has been used or stored for a long time at low temperatures, there is a risk of short-circuiting caused by condensation. To prevent this risk, do not turn the spectrum analyzer on until it has been allowed to dry out sufficiently.

Fan clearance

To suppress any internal temperature increase, the spectrum analyzer has a fan on the rear panel as shown in the diagram below. Leave a gap of at least 10 cm between the rear panel and the wall, nearby equipment or obstructions so that fan ventilation is not blocked.



Safety Measures

This paragraph explains the safety procedures which should be followed under all circumstances not to encounter the risk of an accidental electric shock, damage to the equipment or a major operation interruption.

Power-on

WARNING ⚠

• Before power-on:	The MS2681A/MS2683A/MS2687A/MS2687B Spectrum Analyzer must be connected to protective ground. If the power is switched on without taking this countermeasure, there is a risk of receiving a accidental electric shock. In addition, it is essential to check the power supply voltage. If an abnormal voltage that exceeds the specified value is input, there is accidental risk of damage to this MS2681A/MS2683A/MS2687A/MS2687B Spectrum Analyzer and fire.
• During power-on	To maintain the MS2681A/MS2683A/MS2687A/MS2687B Spectrum Analyzer, sometimes it is necessary to make internal checks and adjustments with the covers removed while power is supplied. Very-high, dangerous voltages are used in this spectrum analyzer, if insufficient care is taken, there is a risk of a accidental electric shock being received or of damage to the equipment. To maintain the MS2681A/MS2683A/MS2687A/MS2687B Spectrum Analyzer, request service by a service personnel who has received the required training.

Input level to RF Input

Frequency range:	9 kHz to 7.8 GHz (MS2681A: 3 GHz, MS2687A/MS2687B: 30 GHz)
Measurement level:	Apply the measured signal with average noise level of up to +30 dBm to the N-type connector RF Input of 50 Ω input impedance

CAUTION ⚠

The RF Input circuit is not protected against excessive power.
If a signal exceeding +30 dBm is applied with input attenuator setting ≥10 dB, the input attenuator and input mixer may be burned.
⚠ is a warning mark to prevent such damage.

Connector of RF Input

MS2681A:	N-J
MS2683A:	N-J
MS2687A/MS2687B:	K-J

CAUTION ⚠

In case of MS2681A/MS2683A/MS2687A/MS2687B, when you connect N type connector to RF Input, use the coaxial adaptor 34 AKNF50 (K·P-N·J) (sold separately).

Installation

Rack mounting

The Option 47 or Option 48 Rack Mount (sold separately) is required to mount this unit in a rack. The installation method is included in the rack mount kit diagram.

Preparations before Power-on

This unit operates normally when it is connected to an 85 to 132 Vac, or 170 to 250 Vac (automatic voltage change) 47.5 to 63 Hz AC power supply. To prevent the following problems, take the necessary procedures described on the following pages before power is supplied.

- Accidental electric shock
- Damage caused by abnormal voltage
- Ground current problems

Note:

- The voltage and current rating are indicated on the rear panel when the instrument is shipped from the factory.
- In this manual, the power supply voltage and current ratings are represented by ** Vac and *** A, respectively.

To protect the operator, the following WARNING and CAUTION notices are attached to the rear panel of the MS2681A/MS2683A/MS2687A/MS2687B.

WARNING ⚠
NO OPERATOR SERVICE-
ABLE PARTS INSIDE.
REFER SERVICING TO
QUALIFIED PERSONNEL.

CAUTION ⚠
FOR CONTINUED FIRE
PRORECTION REPLACE
ONLY WITH SPECIFIED
TYPE AND RATED FUSE.

WARNING ⚠

Disassembly, adjustment, maintenance, or other access inside this instrument by unqualified personal should be avoided. Maintenance of this instrument should be performed only by Anritsu trained service personnel who are familiar with the risk involved of fire and electric shock. Potentially lethal voltages existing inside this instrument, if contacted accidentally, may result in personal injury or death, or in the possibility of damage to precision components.

Always follow the instructions on the following pages.

Connecting the Power Cord

Check that the main [Line] on the rear panel is turned off.
Insert the power plug into an outlet, and connect the other end to the power inlet on the rear panel. To ensure that the instrument is grounded, always use the supplied 3-pin power cord, and insert the plug into an outlet with a ground terminal.

WARNING ⚠

If the power cord is connected without the instrument grounded, there is a risk of receiving a fatal electric shock. In addition, the peripheral devices connected to the instrument may be damaged.
When connecting to the power supply, DO NOT connect to an outlet without a ground terminal. Also, avoid using electrical equipment such as an extension cord or a transformer.

CAUTION ⚠

If an emergency arises causing the instrument to fail or malfunction, disconnect the instrument from the power supply by either turning off the [Line] switch on the rear panel, or by pulling out the power cord or the power inlet.
When installing the instrument, place the instrument so that an operator may easily operate the [Line] switch.
If the instrument is mounted in a rack, a power switch for the rack or a circuit breaker may be used for power disconnection.

It should be noted that, the [Power] switch on the front panel of the instrument is a standby switch, and cannot be used to cut the main power.

Replacing fuse

WARNING ⚠

- If the fuses are replaced while power is supplied, there is a serious risk of electric shock. Before replacing the fuses, set the power switch to OFF and remove the power cord from the power outlet.
- If power is supplied without protective grounding, there is a risk of accidental electric shock. In addition, if the AC power supply voltage is unsuitable, there is a risk of the internal circuits of the MS2681A/MS2683A/MS2687A/MS2687B Spectrum Analyzer being damaged by the abnormal voltage. Before supplying power again after changing the fuses, check that the protective grounding described previously is still connected, and check that the AC power supply voltage is suitable. Then, set the power switch to ON.

CAUTION ⚠

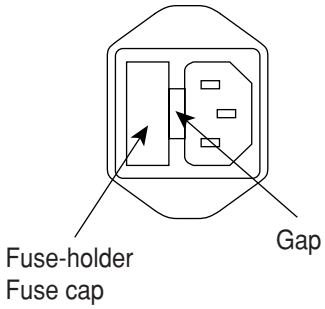
When there are no supplied spare fuses, the replacement fuses must have the same rated voltage and current as the fuses in the fuse holders.

- If the replacement fuses are not of the same type, they may not fit correctly, there may be a faulty connection, or the time taken to for the fuses to blow may be too long.
- When an abnormality occurs again, if the voltage and current rating of the fuses is incorrect, the fuses may not blow with a consequent risk of damage to the equipment by fire.

This unit with standard accessories has a spare 6.3 A fuse. The fuse is mounted in the fuse holder and must be replaced if they blow. Before replacing the blown fuse, locate and remedy the cause .

After performing the safety procedures described on the preceding page, replace the fuse according to the following procedure:

Step	Procedure
1	Set the front-panel [Power] switch to Stby and the rear-panel [Line] switch to OFF. Then, remove the power cord from the power-supply outlet.
2	Catche the gap with pen point, and remove the fuse-holder to pull forward. The cap and fuse are removed as a unit from the fuse holder.
3	Remove the fuse from the fuse cap and replace it with a spare fuse. (The direction does not matter.)
4	Return the fuse cap with fuse to the fuse holder.



Precaution for Handling Memory Card

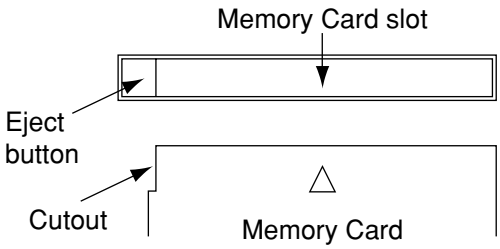
Notes on using the memory card are given bellow:

- Never remove the memory card while it is being accessed. If it is removed while it is being accessed, data on it will be lost and the card may be damaged.
- The memory card may be damaged if static electricity is applied to it.

Therefore, it is recommended that you make a back up of the memory card.
Anritsu accepts no liability for the loss of data on the memory card.

- Installing Memory Card

  Install the memory card to this instrument, with the cutout of the card at the position as shown below. One card can be installed.



- Removing Memory Card

  Push the left eject button to remove the memory card.

ATA card list

<Name>	<Model No.>
ADTEC Compact Flash Card 16M	AD-CFD16
EPPSON ATA-Card 10M	SEATA-10M
EPPSON ATA-Card 15M	SEATA-20M
FUJISOKU ATA-Card 12M	JT12MA3-BD
FUJISOKU ATA-Card 20M	JT20MA3-BD
FUJISOKU ATA-Card 40M	JT40MA3-BD
Panasonic ATA-Card 8M	BN-008AB
TDK Compact Flash 16MB	TOC16H
BUFFALO Compact Flash Card 15MB	RCF-C
ScanDisk Compact Flash Card 32MB	SDCFB

- Confirmed Memory Card

<ATA Card>

Manufacturer	Model number
EPSON	SEATA-10M
	SEATA-20M
FUJISOKU	JT12MA-BD
	JT20MA-BD
	JT32MA-BD
	JT40MA-BD

<Compact Flash Card>

Manufacturer	Model number
SanDisk	SDCFB-32-801
	SDCFB-64-801
	SDCFB-128-801
	SDCFB-256-801
	SDCFB-64-J60
	SDCFB-128-J60
HAGIWARA	HPC-CF32V
	HPC-CF64V
	HPC-CF128V
	HPC-CF256V
	HPC-CF128ZP
IO Data	CFS-128MX
	CFS-256MX
	CFX-128M

Note: When the Compact Flash card is used, card adapter is required.

Section 3 Panel Description

In this section, the front and rear panels are described assuming the case in which all the options are attached to.

Table of Front and Rear Panel Features

No.	Panel Marking	Explanation of Function
1	(LCD)	This is a 17 cm (6.5” Type) color TFT liquid crystal display (LCD). It displays the trace waveforms, the parameter settings, the values of marker, and the soft menu keys, etc.
2	Spectrum	This sets the MS2681A/MS2683A/MS2687A/MS2687B to a normal spectrum analyzer mode.
3	Signal Analysis	This sets the MS2681A/MS2683A/MS2687A/MS2687B to the signal analysis mode in which the measurement software operates.
4	Config	This displays the setup menu for GPIB interface or printer, etc.
5	F 1 - F 6	These are the soft keys for selecting the soft-key menus linked to the panel key operation. [More] This displays the next page of soft-key menus.
6	Freq/Ampl	This is the frequency and level parameter data input section. [Frequency] Sets frequency. [Span] Sets frequency span. [Amplitude] Sets reference level. [–> CF] Sets peak level signal frequency on screen to center frequency. [–> RLV] Sets peak level on screen to reference level.
7	Marker	This section is related to operation of marker functions. [Marker] Sets marker. [Multi Mkr] Sets multimarkers. Press this key after pressing the [Shift] key. [Peak Search] Moves marker to currently-displayed peak level. [Marker –>] Sets parameter according to marker value. Press this key after pressing the [Shift] key.
8	System	This switches the measurement software in the signal analysis mode.

No.	Panel Marking	Explanation of Function
9	Single	This sets the sweep mode. [Single] Executes single sweep. [Continuous] Executes continuous sweeping. Press this key after pressing the [Shift] key. The initial default is continuous sweeping.
10	Recall	This executes recall/save. [Recall] Reads measurement parameters and waveform data from internal memory or memory card. [Save] Saves measurement parameters and waveform data to internal memory or memory card.
11	Measure	This menu is for performing the various application measurements including frequency measurement, noise measurement, adjacent-channel leakage power measurement, etc.
12	Display	This section is for selecting the trace waveform. Normally, in the frequency domain, up to two trace waveforms can be displayed. The zero-span (Time Domain) mode is selected simply by pressing the [Time] key. [A, B] Displays trace A or B waveform in frequency domain. [A/B, A/BG] Displays trace A and B waveforms simultaneously, or displays trace A and BG (background frequency spectrum including trace A) simultaneously. [Time] Switches to zero span (Time domain) mode to display time domain waveforms. [A/Time] Displays trace A and the time domain waveform simultaneously.
13	Trig/Gate	This sets the trigger/gate functions. [Trig/Gate] Sets the sweep-start trigger and gate (to control waveform-data write timing) functions.
14	Coupled Function	This sets the RBW, VBW, sweep time and input attenuator.

No.	Panel Marking	Explanation of Function
15	Entry	These keys set the numeric data, units and special functions. [Rotary knob] Used for moving marker and inputting data. [∨ , ^] Increments and decrements input data. [Shift] To execute panel functions indicated by blue letters, press this key and then press the blue-lettered key. [BS] Backspace key for correcting input mistakes. [0-9, . , +/–] Numeric-data setting keys. [GHz, MHz, kHz, Hz] Units keys for frequency, level, time, etc. [set] Key for setting parameters in Config screen. [Cancel] This cancels the entry that be able to set with [set] key.
16	Preset	This sets the measurement parameters to the default values.
17	Local	This changes the remote status to the local status.
18	Disp On/Off	This sets the liquid crystal display On/Off.
19	Copy	This outputs a hard copy of the screen to a printer or memory Card.
20	Stby/On	This is the power switch. It can be used when the back-panel power switch is on. The power-on condition is fetched from the Stby condition when the key is pressed for about 1 seconds. The equipment is returned to the Stby condition from the power-on condition when the key is pressed again for about 1 seconds.
21	RF Input	This is the RF input connector.
22	I/Q Input	This is the I/Q Input connector. (If option is not attached, this connector is not provided.)
23	TG Output	This is the tracking generator output connector. (If Option is not attached to, this connector is not provided.)
24	Probe Power	This is the connector that supplies ±12 V for a FET probe.
25	Memory Card	This is the slot to set memory cards which save/load the waveform data and measurement parameters etc.
50	(Fan)	This is the cooling fan for ventilating internally-generated heat. Leave a clearance of at least 10 cm around the fan.

No.	Panel Marking	Explanation of Function
51	10 MHz STD	They are the input connector for an external reference crystal oscillator and the output connector of the 10 MHz Reference signal. When an external reference signal is input, the equipment switches automatically from the internal signal to the external signal. If an external signal is input, the heater of the internal OCXO is switched off.
52	IF Output	This is the IF output connector. This signal is bandwidth controlled by the RBW setting.
53	Wideband IF Output	This is the wideband IF output connector. This signal is not bandwidth controlled by the RBW setting.
54	Sweep (X)	This is a output connector for sweep signal (X).
55	Video (Y)	This connector output a Y-axis signal that is proportional to the video detection signal output and is logarithmically compressed at log scale.
56	Sweep Status (Z)	This is a output connector for sweep status signal (Z).
57	Trig/Gate In (±10 V)	This is a input connector for external trigger/gate signal.
58	Off/On	This is the AC line power switch.
59	(Inlet)	This is the fused AC power inlet to which the supplied power cord is connected. It contains a time-lag fuse.
60	(Ground Terminal)	Connect this frame ground terminal to ground to prevent risk of an accidental electric shock.
61	Parallel	This is the Parallel connector. Connect it to a printer.
62	VGA Out	This is the VGA signal output connector.
63	GPIB	This connector is for use with a GPIB interface. It is connected to an external system controller.
64	RS-232C	This is the RS-232C connector. Connect it to an external system controller.
65	Name plate	This shows a production number and options.
66	Ethernet	This is the 10 base-T connector for Ethernet, and it connects the MS2681A/MS2683A/MS2687A/MS2687B to the external system controller.

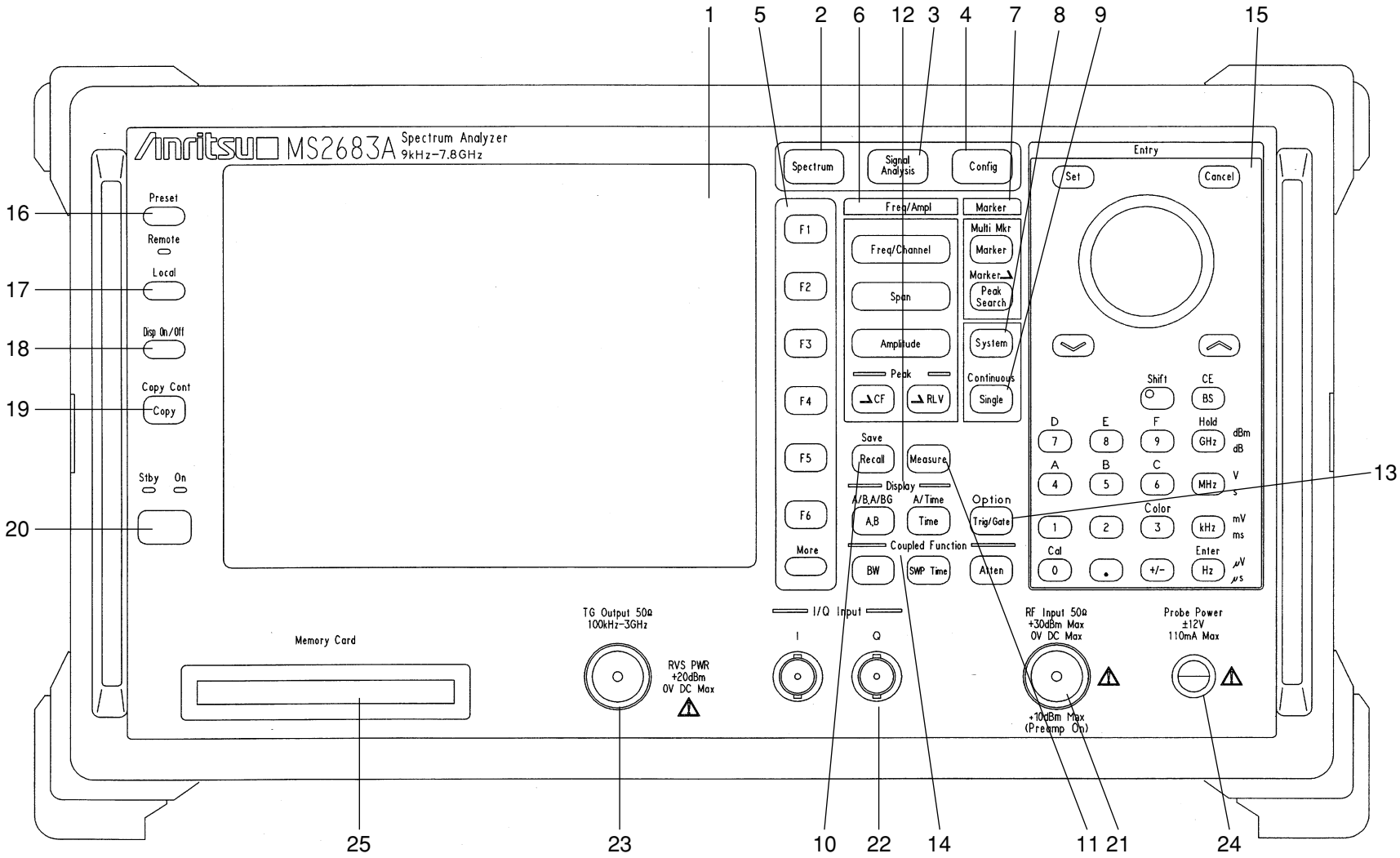


Fig. 3-1 Front Panel

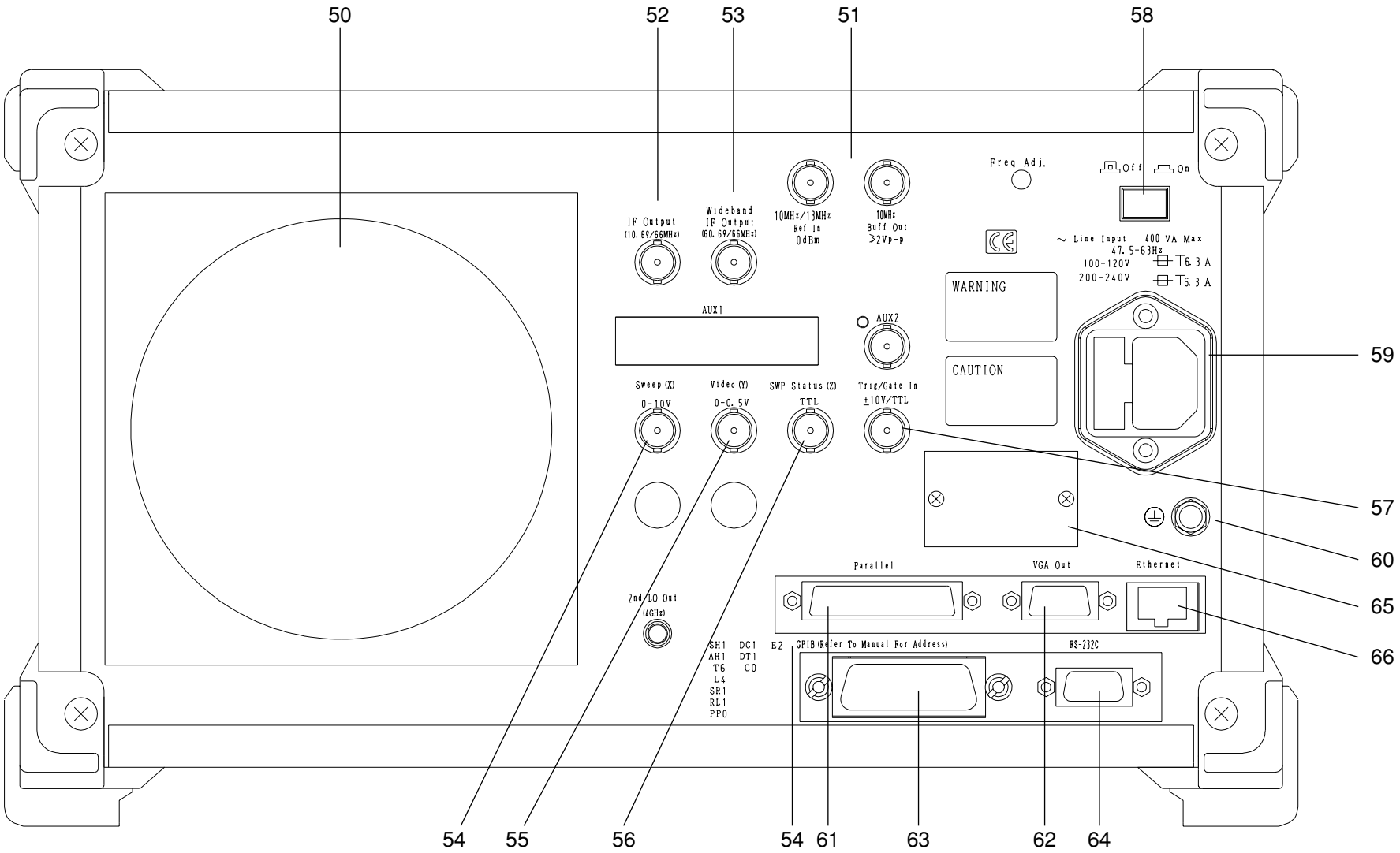


Fig. 3-2 Rear Panel

Section 4 Soft-Key Menu

In this section, soft-key menu functions and its hierarchical system are described using a tree.

In this section, soft-key menu functions and its hierarchical system are described using a tree.
Matters to be noted about the tree are shown below.

(1) Panel Key indicates a hard key on the front panel.

(2) Top menus are the menus at the top level which are displayed on the screen when the panel key is pressed. Lower menus indicate other menus below the top menus.

(3) When a soft key with an appended asterisk (*) is pressed in these menus, the menu moves to the lower menu indicated by the arrow symbol (->). However, if any not-supported-function soft key in an Option is pressed, an error message appears.

(4) When the Return key is pressed at a lower menu, the next-higher menu returns.

(5) Menus with more than six items are split into several pages.

(6) The menu page construction and currently-displayed page are indicated in the lower part of the menu. To move to the next page, press the [More] key.

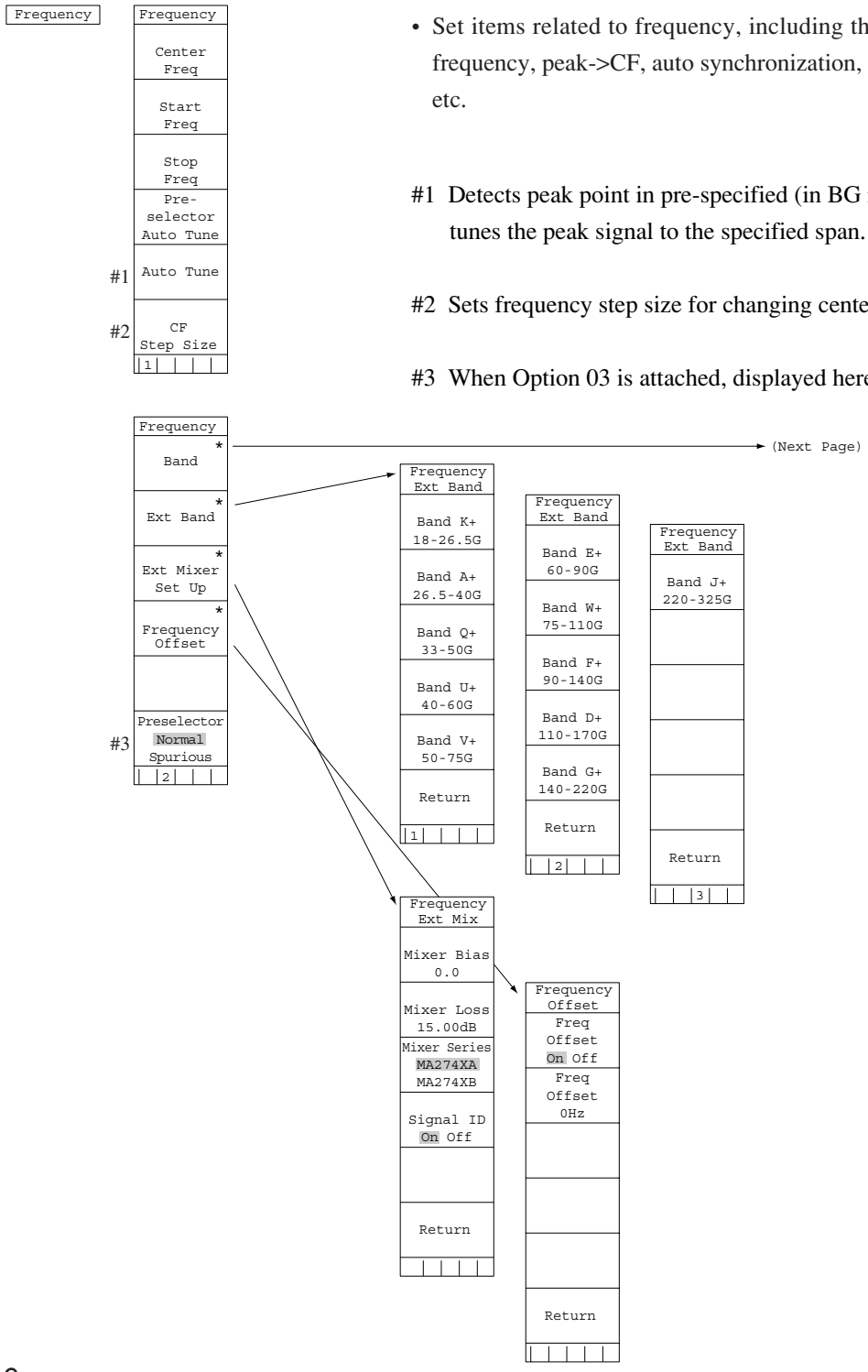
(7) Panel keys and soft keys prefixed by a sharp symbol (#) at the left of the menu frame, give an outline explanation of the function.

Soft-key Menu List

Spectrum mode Menu Tree

Menu Tree (1 /24)

Panel Key — Top menu — Lower menues



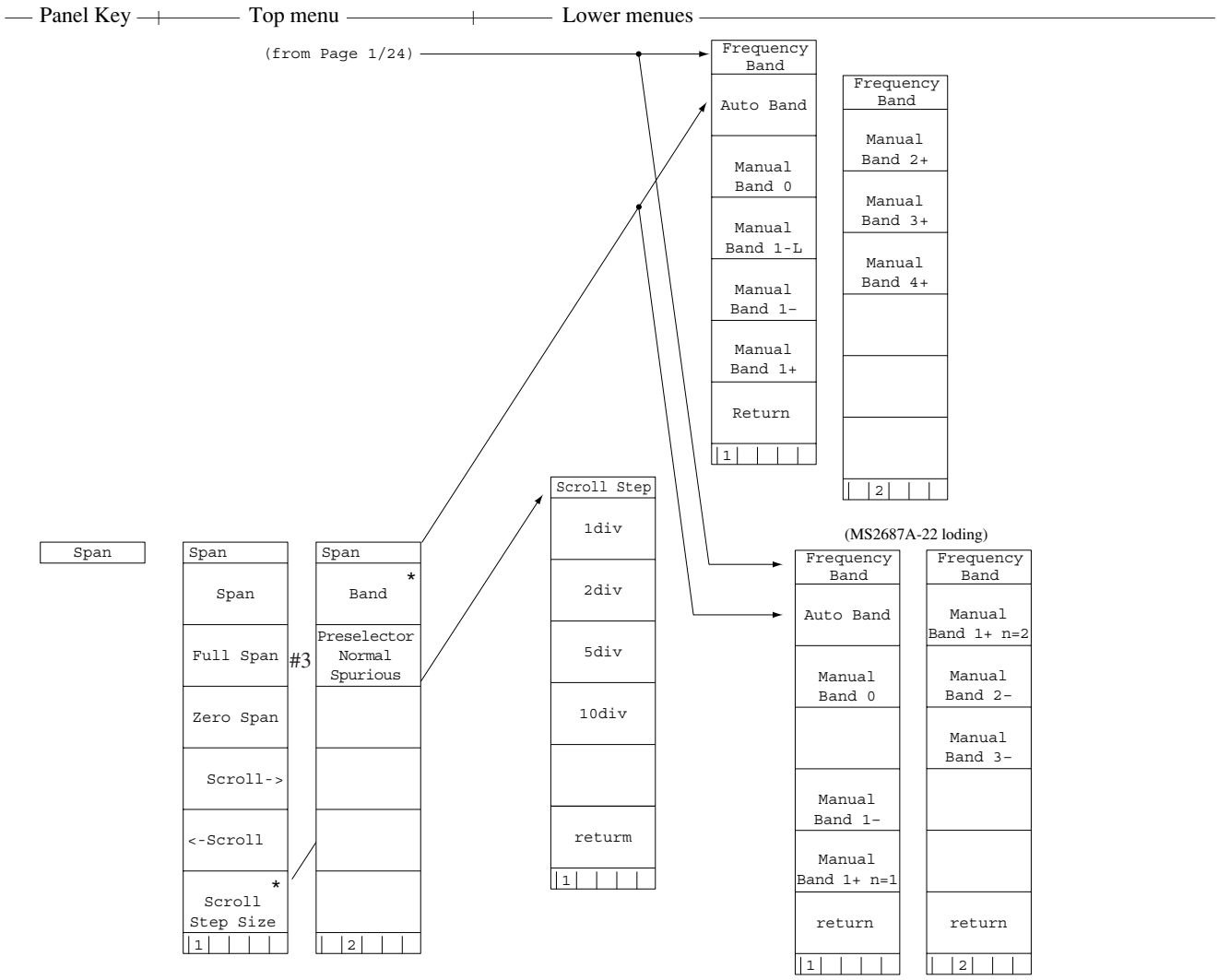
- Set items related to frequency, including the center frequency, start/stop frequency, peak->CF, auto synchronization, and frequency scroll step size, etc.

#1 Detects peak point in pre-specified (in BG range) span and automatically tunes the peak signal to the specified span.

#2 Sets frequency step size for changing center frequency.

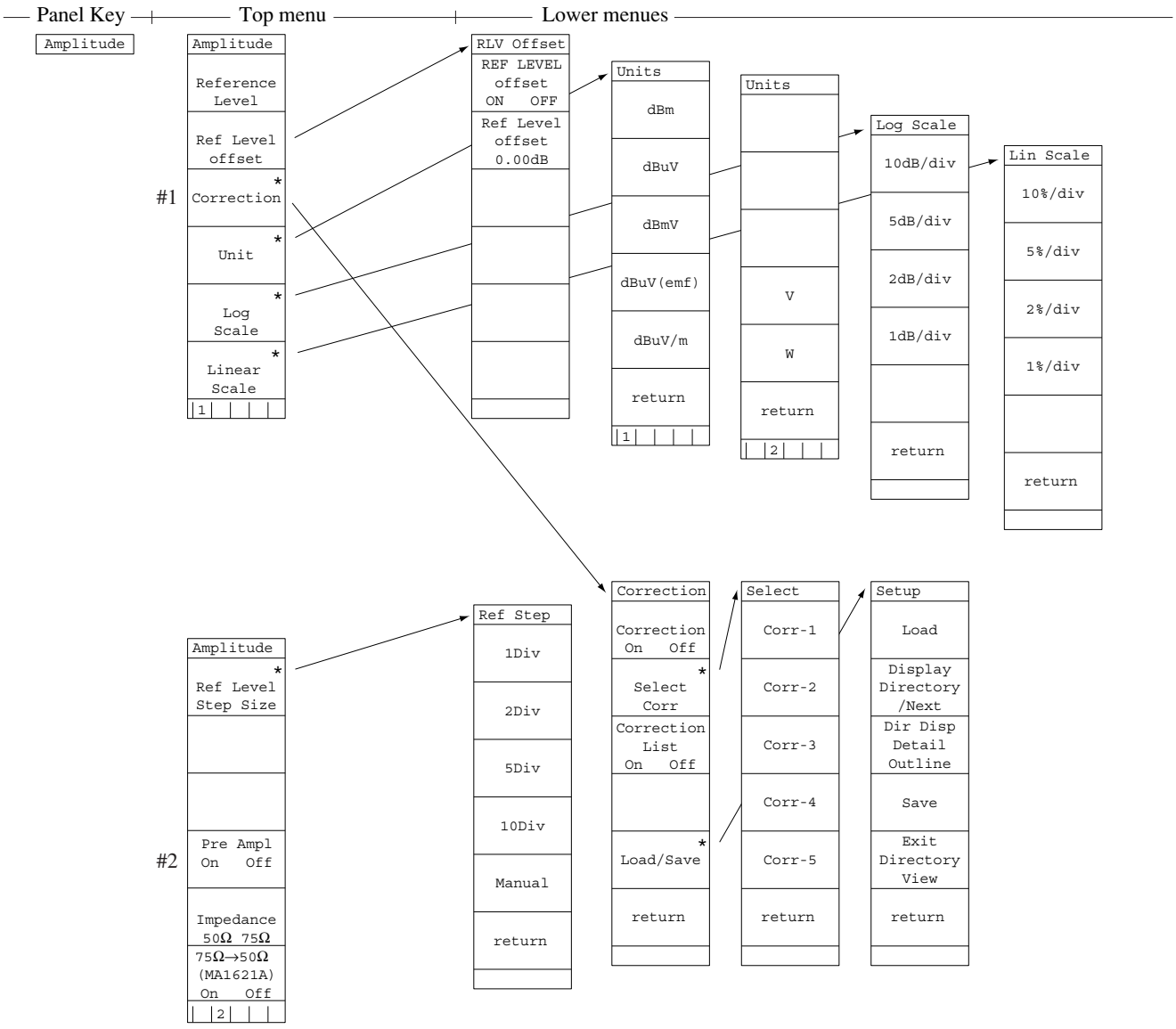
#3 When Option 03 is attached, displayed here.

Menu Tree (2/24)



- Set frequency span items, including frequency span, full span, zero span, frequency span scroll, etc.

Menu Tree (3/24)



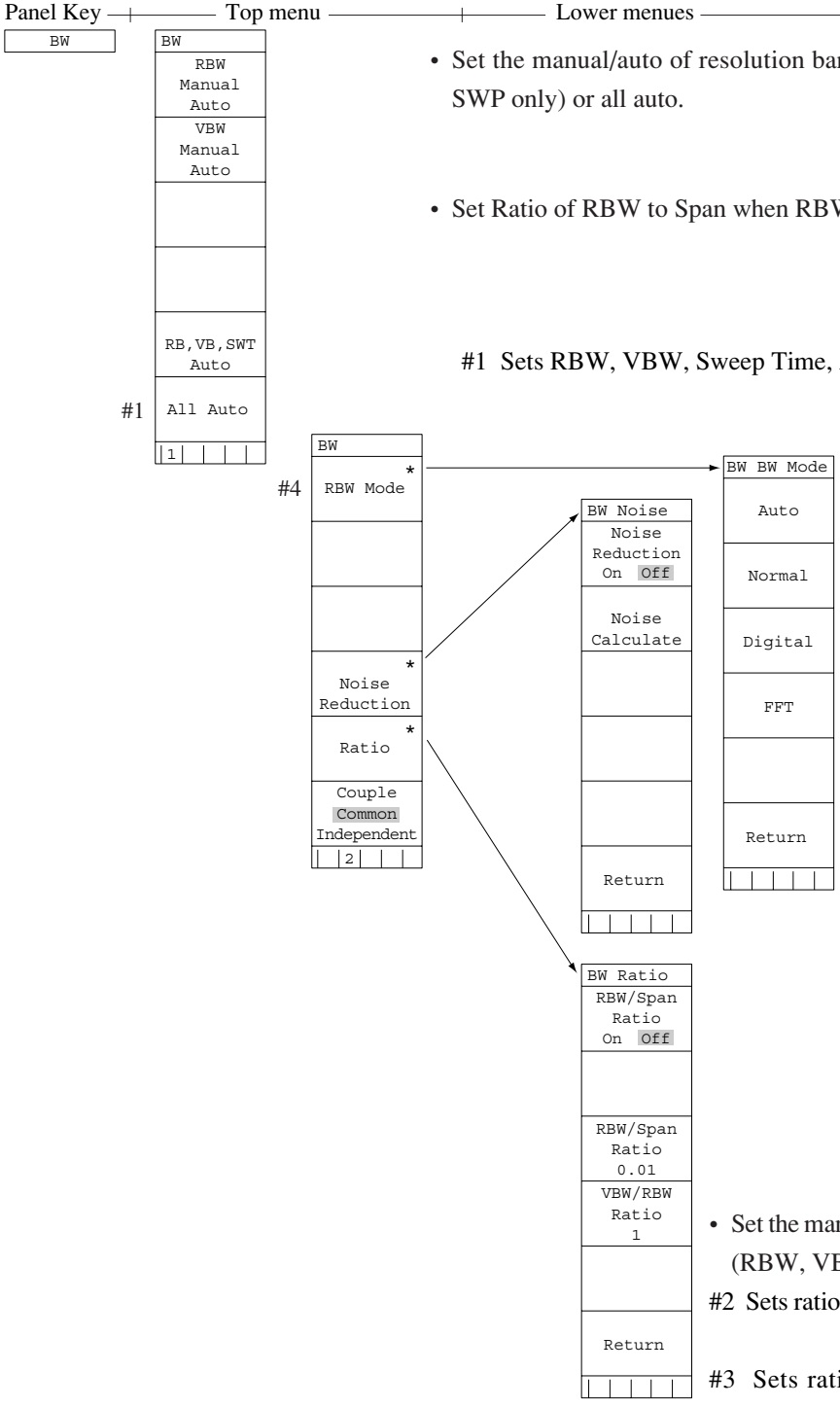
#1 Sets correction (frequency-response characteristics correction) function.

#2 Switches the 20 dB pre-amplifier On/Off.

- Set items along the vertical axis of the screen, including reference level, Peak->RLV, reference level offset, measurement level unit, Log/Lin scale switching, reference level step size, display line, attenuator, pre-amplifier On/Off, 75 Ω impedance, transformer, frequency-response correction, etc.

Menu Tree (4/24)

Panel Key — Top menu — Lower menues



- Set the manual/auto of resolution bandwidth, and auto (RBW, VBW and SWP only) or all auto.

- Set Ratio of RBW to Span when RBW is Auto and Ratio Mode is “on”.

#1 Sets RBW, VBW, Sweep Time, Atten all to Auto.

- Set the manual/auto of video bandwidth, and auto (RBW, VBW and SWT only) or all auto.

#2 Sets ratio of RBW to Span when RBW is Auto.

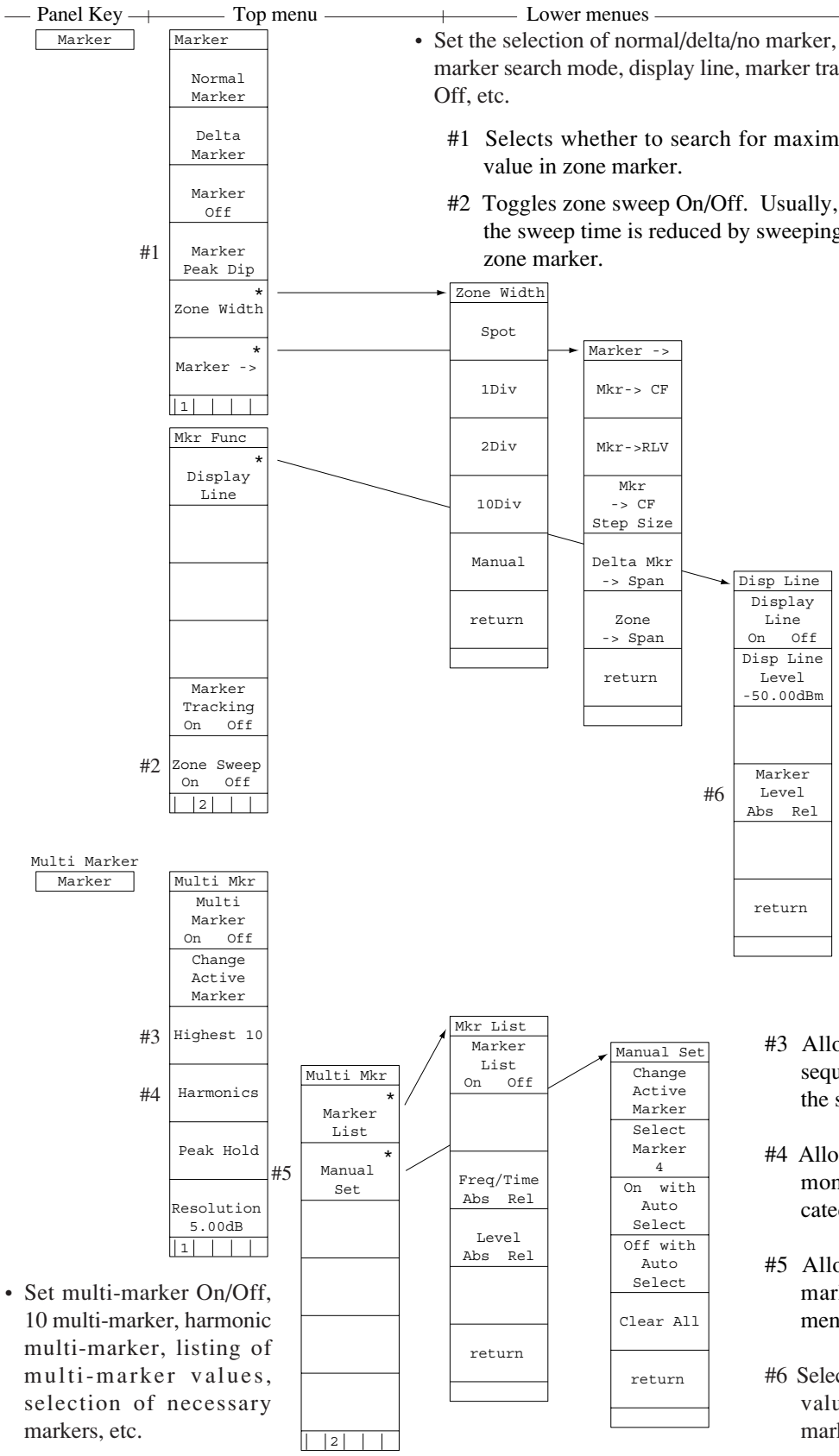
#3 Sets ratio of VBW to RBW when VBW is Auto.

#4 Sets RBW mode to normal (Analog) or Digital.

Menu Tree (5/24)

Panel Key	Top menu	Lower menues
Sweep Time	Sweep Time	• Set the manual/auto of sweep time, and auto (RBW, VBW and SWT only) or all auto.
	Sweep Time Manual Auto	
	Auto SWT Hi-Lvl-Acc Fast	
	RB,VB,SWT Auto	
	All Auto	
Atten	Attenuator	• Set the manual/auto of the input attenuator, On/Off of the pre-amplifier and all auto.
	Attenuator Manual Auto	
#1	Step Size 2dB 10dB	#1 Not displayed for MS2687A/B.
	Pre Ampl On Off	
	All Auto	

Menu Tree (6/24)



- Set the selection of normal/delta/no marker, zone marker width, marker->, marker search mode, display line, marker tracking On/Off, zone sweep On/Off, etc.

  #1 Selects whether to search for maximum (Peak) or minimum (Dip) value in zone marker.

  #2 Toggles zone sweep On/Off. Usually, the zone sweep is Off. At On, the sweep time is reduced by sweeping only the zone specified by the zone marker.

- Set multi-marker On/Off, 10 multi-marker, harmonic multi-marker, listing of multi-marker values, selection of necessary markers, etc.

  #3 Allocates up to 10 multi-markers sequentially from the peak level of the signal displayed on screen.

  #4 Allocates multi-markers to the harmonic signals of frequency indicated by current marker.

  #5 Allows user to select only multi-markers necessary for measurement.

  #6 Selects “absolute value” or “relative value (display line)” to display marker level.

Menu Tree (7/24)

Panel Key — Top menu — Lower menues

Peak Search

Peak Search
Peak Search
Next Peak
#1 Dip Search
Next Dip
#2 Resolution 5.00dB
* Threshold

- Set maximum level search, next peak, next right peak, next left peak, Marker->, minimum level search, next minimum level, search level resolution, threshold level On/Off, etc.

Threshold
Threshold On Off
Search Above Below
Threshold Level -50.00dBm
return

#1 Searches for minimum (Dip) level.

#2 Sets peak-search level resolution.

Makrer ->

Peak Search

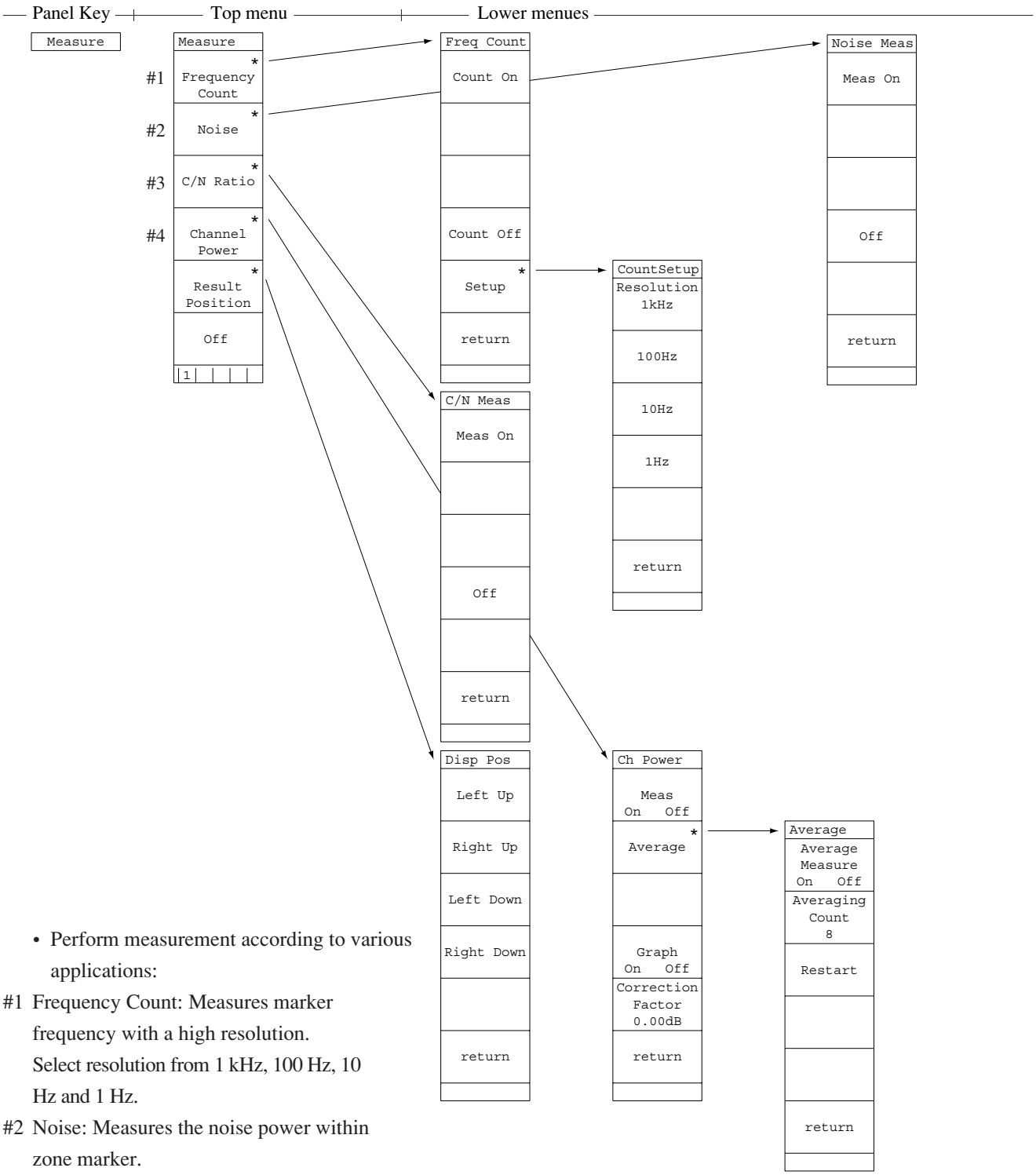
Marker ->
Mkr-> CF
Mkr->RLV
Mkr -> CF Step Size
Delta Mkr -> Span
Zone -> Span

- Set marker value -> center frequency, marker value -> reference level, marker value -> CF step size, delta marker-> span, zone marker -> span, etc.

Menu Tree (8/24)

Panel Key	Top menu	Lower menues
	Peak →cf	
	Peak →RLV	
	Single	
	Continuous	
	Single	

Menu Tree (9/24)



- Perform measurement according to various applications:

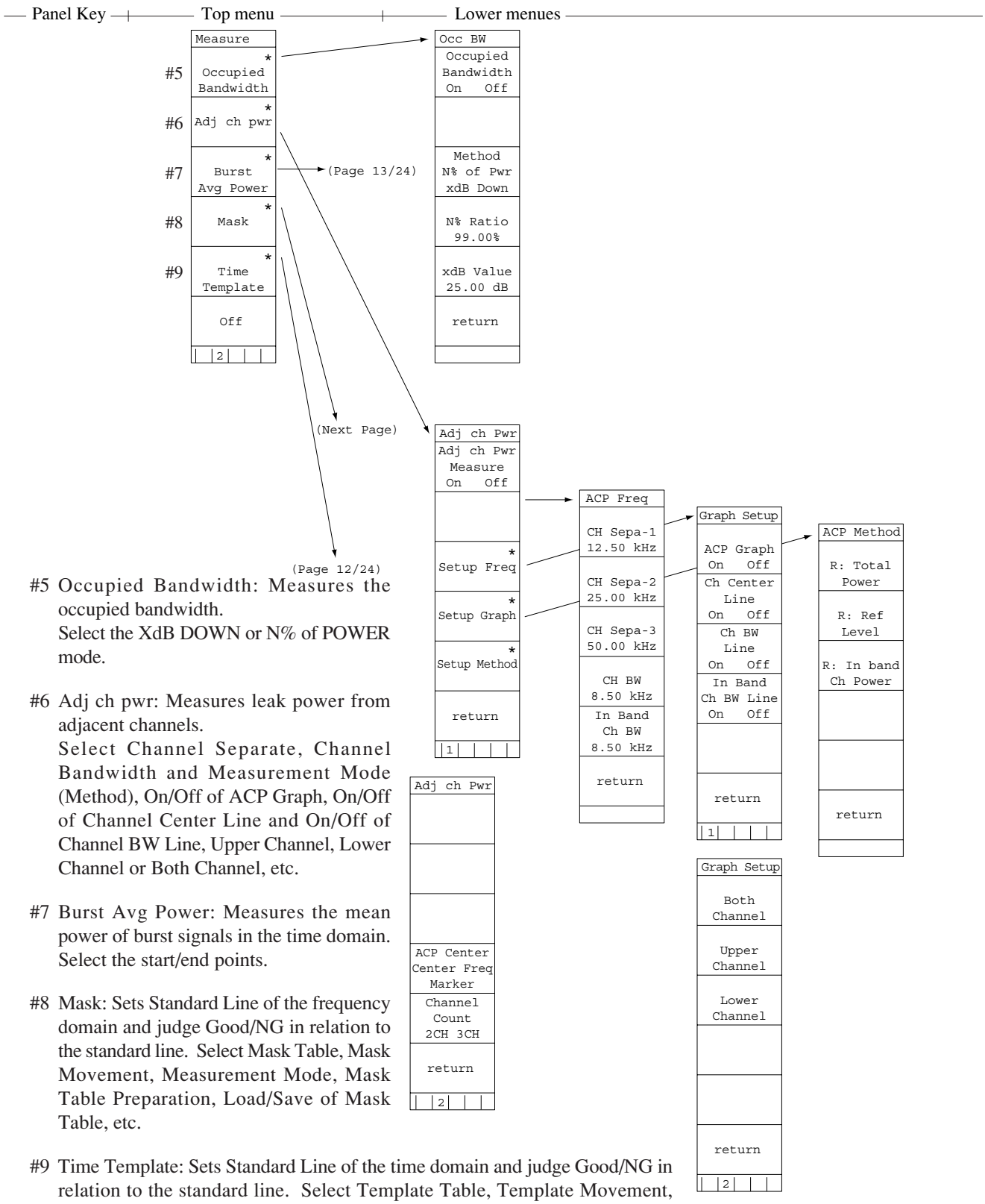
#1 Frequency Count: Measures marker frequency with a high resolution. Select resolution from 1 kHz, 100 Hz, 10 Hz and 1 Hz.

#2 Noise: Measures the noise power within zone marker.

#3 C/N Ratio: Measures the ratio of carrier signal and noise power. Reference marker of the delta marker shall be set to the carrier, and marker's zone width specifies the power measured.

#4 Channel Power: Measures power with in the band indicated by zone marker. It is possible to set an arbitrary calibration value.

Menu Tree (10/24)



#5 Occupied Bandwidth: Measures the occupied bandwidth.
Select the XdB DOWN or N% of POWER mode.

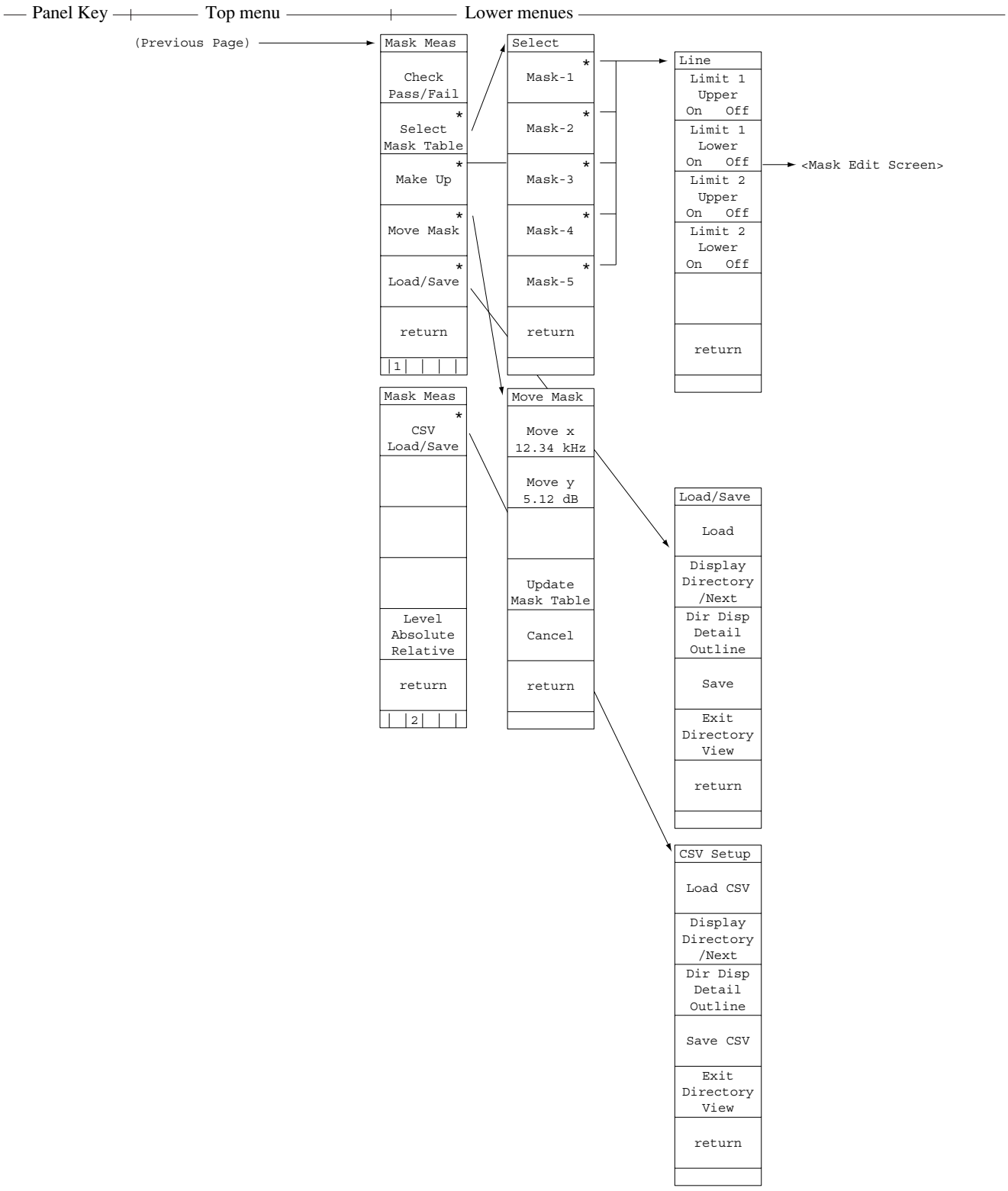
#6 Adj ch pwr: Measures leak power from adjacent channels.
Select Channel Separate, Channel Bandwidth and Measurement Mode (Method), On/Off of ACP Graph, On/Off of Channel Center Line and On/Off of Channel BW Line, Upper Channel, Lower Channel or Both Channel, etc.

#7 Burst Avg Power: Measures the mean power of burst signals in the time domain.
Select the start/end points.

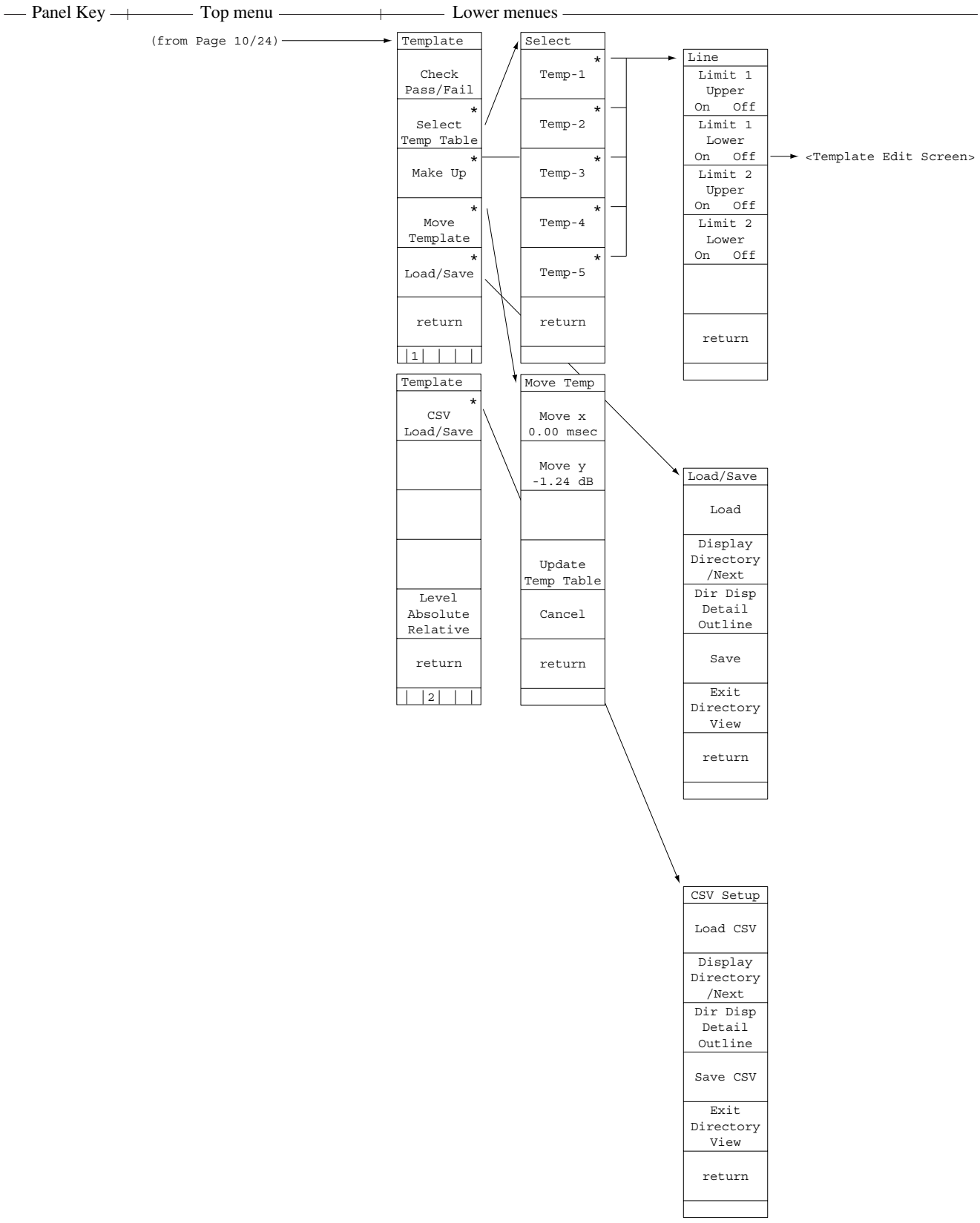
#8 Mask: Sets Standard Line of the frequency domain and judge Good/NG in relation to the standard line. Select Mask Table, Mask Movement, Measurement Mode, Mask Table Preparation, Load/Save of Mask Table, etc.

#9 Time Template: Sets Standard Line of the time domain and judge Good/NG in relation to the standard line. Select Template Table, Template Movement, Measurement Mode, Template Table Preparation, Load/Save of Mask Table, etc.

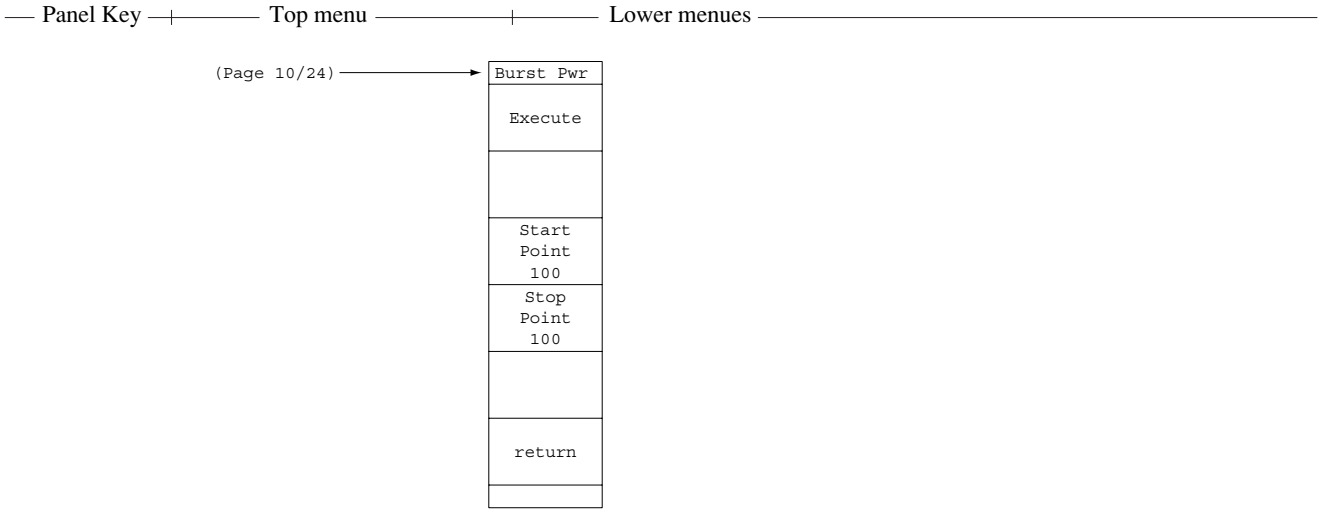
Menu Tree (11/24)



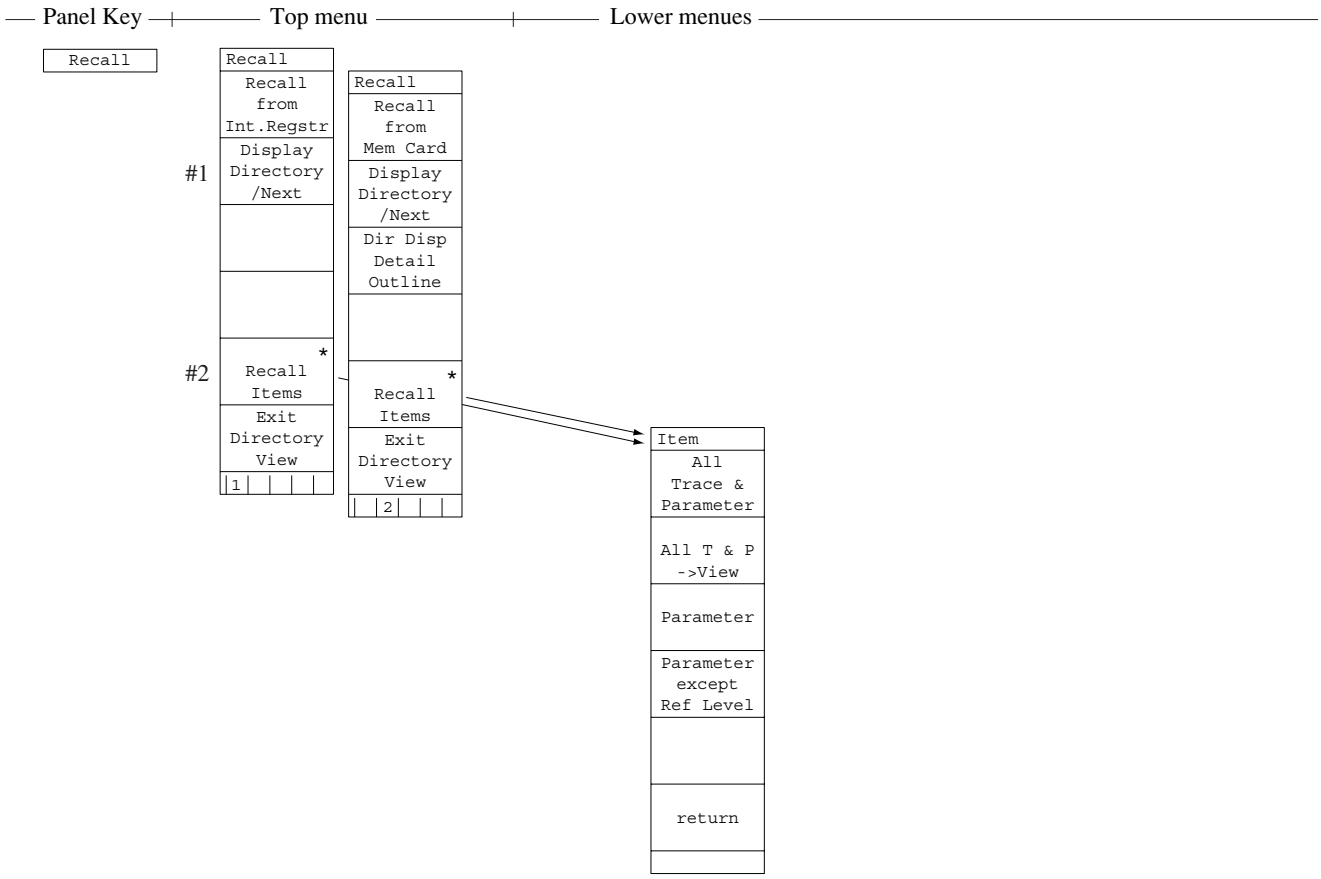
Menu Tree (12/24)



Menu Tree (13/24)



Menu Tree (14/24)



- Read out trace waveform/parameters from the internal memory or memory card.
  Select recall addresses and media/items, and display file directories.

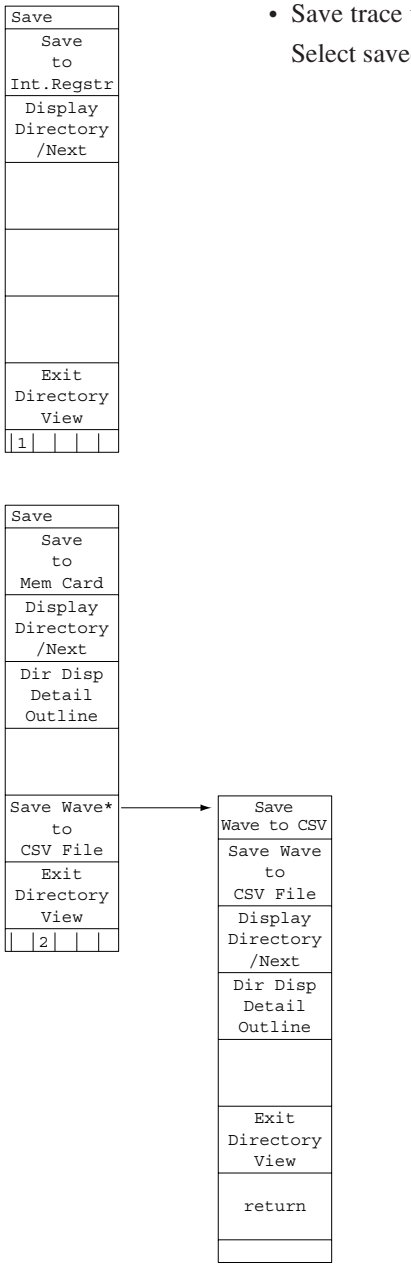
  #1 Displays list of internal-memory directories.

  #2 Specifies items to be recalled
  (trace waveform, parameter, etc.).

Menu Tree (15/24)

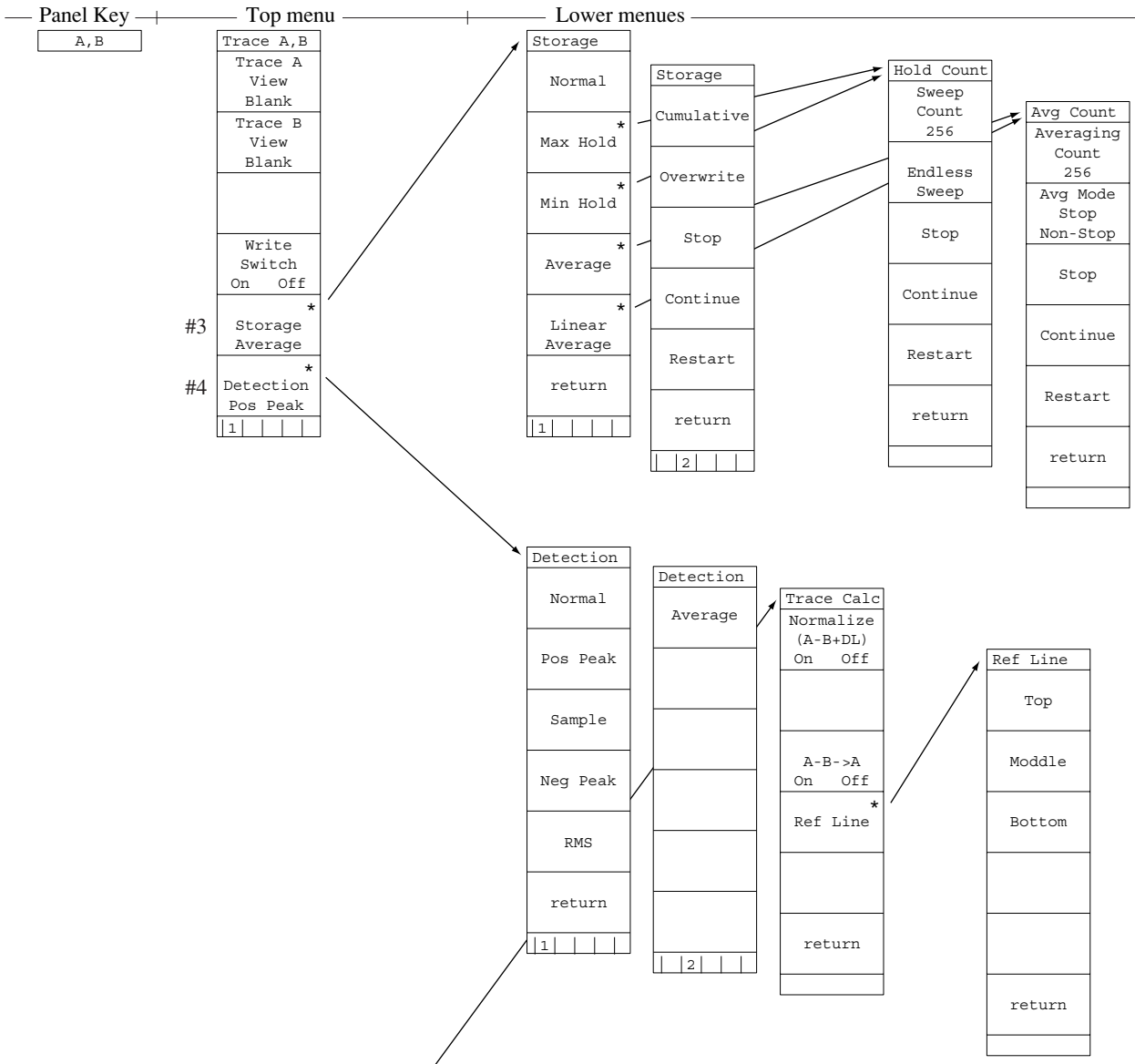
Panel Key — Top menu — Lower menues

Save
Recall



- Save trace waveform/parameters to the internal memory or memory card. Select saved media, and display file directories.

Menu Tree (16/24)



#1 Trace Move: Conducts movements A->B and B->A, switching between A and B, and A+B operation.

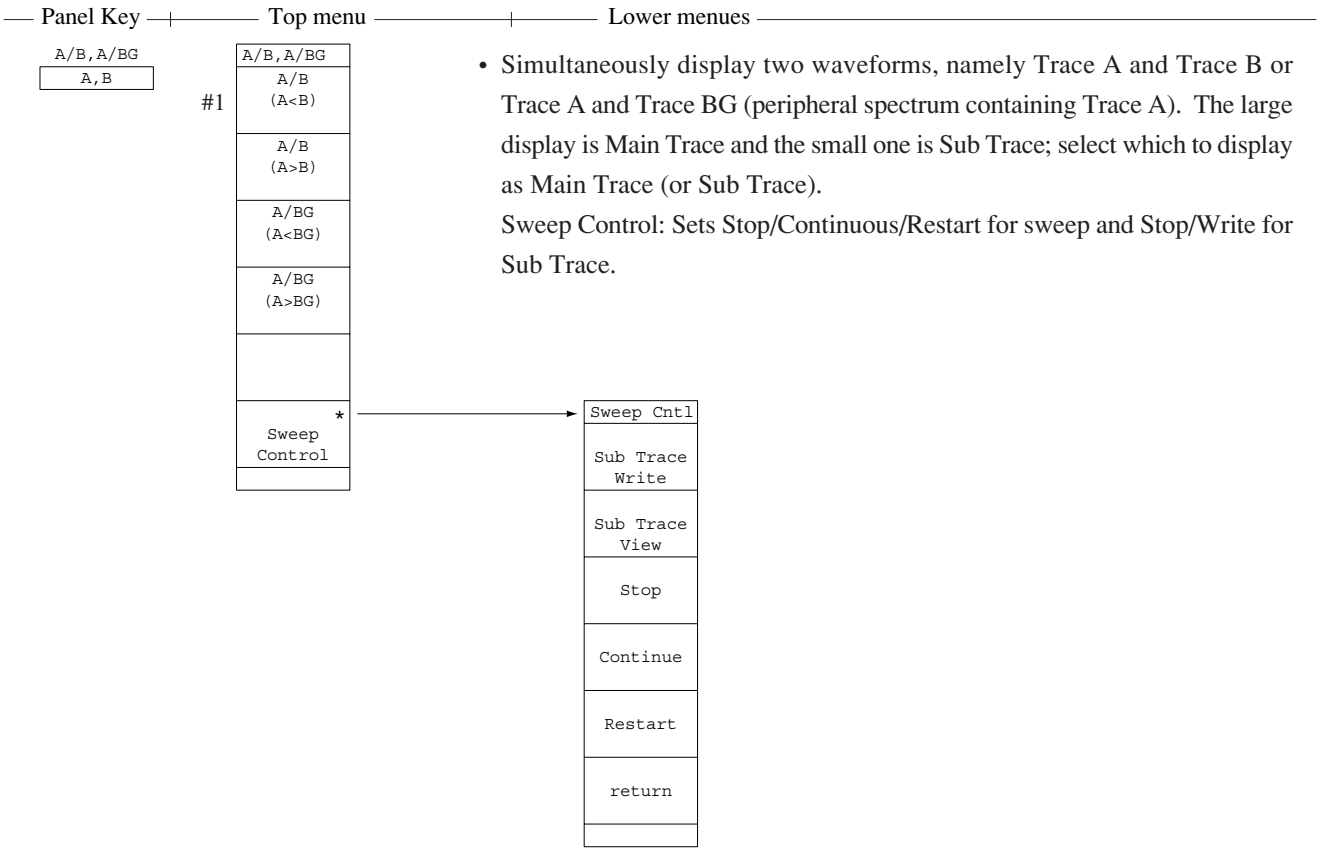
#2 Trace Calc: Selects A-B+DL corrective operation, A-B operation and Ref Line.

#3 Storage: Selects a storage mode from Normal/Max Hold/Min Hold/Average. Set Sweep Count, Rewrite/ Overwrite, Stop Continue, Restart, etc.

#4 Detection: Selects a detection mode from Normal/Pos Peak/Neg Peak/Sample/Average.

- Select Trace A/B, movement between Trace A/B, sum/ difference operation between Trace A/B and Ref Line, and designate the storage and detection modes and Active Trace.

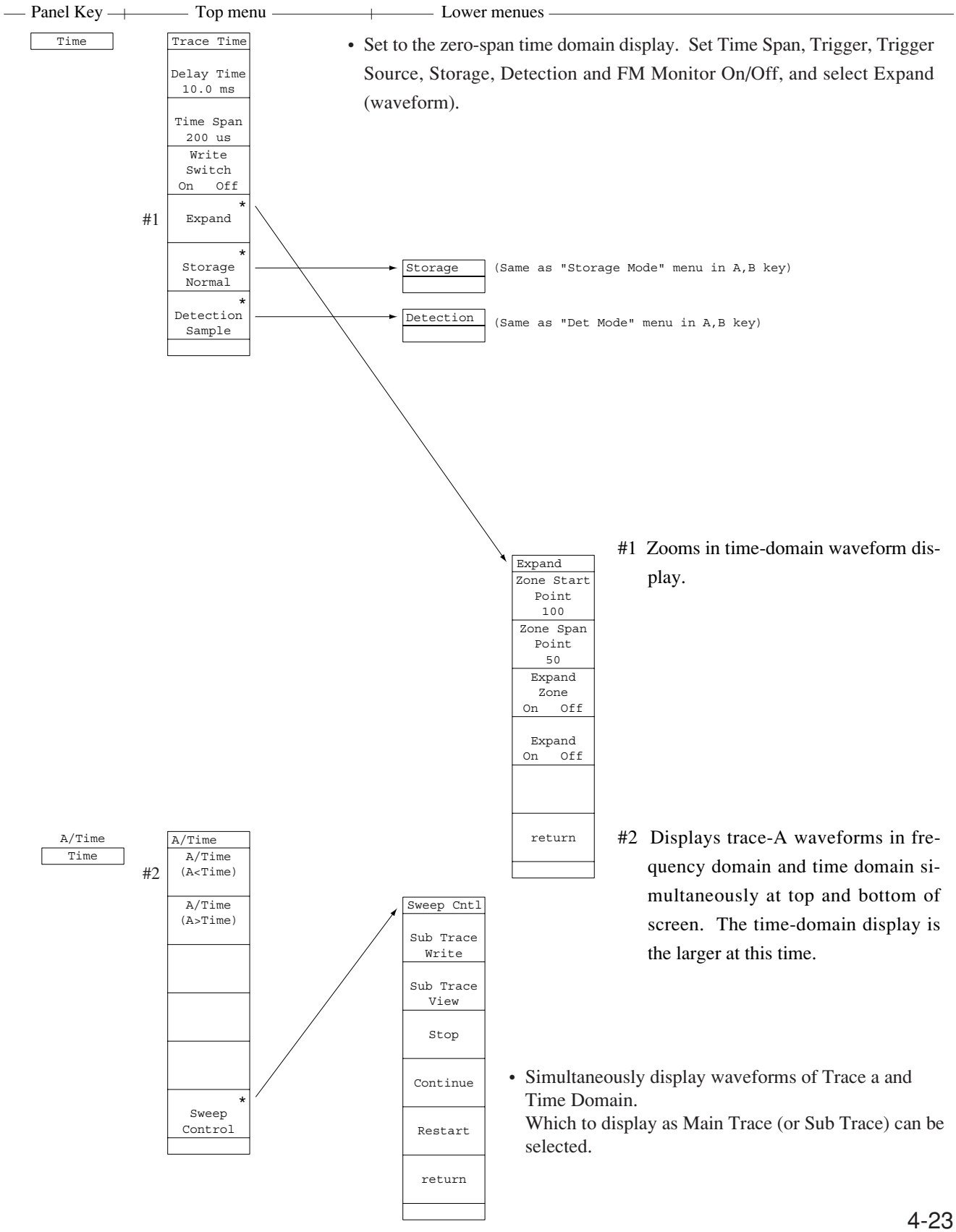
Menu Tree (17/24)



- Simultaneously display two waveforms, namely Trace A and Trace B or Trace A and Trace BG (peripheral spectrum containing Trace A). The large display is Main Trace and the small one is Sub Trace; select which to display as Main Trace (or Sub Trace).
  Sweep Control: Sets Stop/Continuous/Restart for sweep and Stop/Write for Sub Trace.

#1 Displays two traces A and B simultaneously at top and bottom of screen. The trace-B display is the larger at this time.

Menu Tree (18/24)



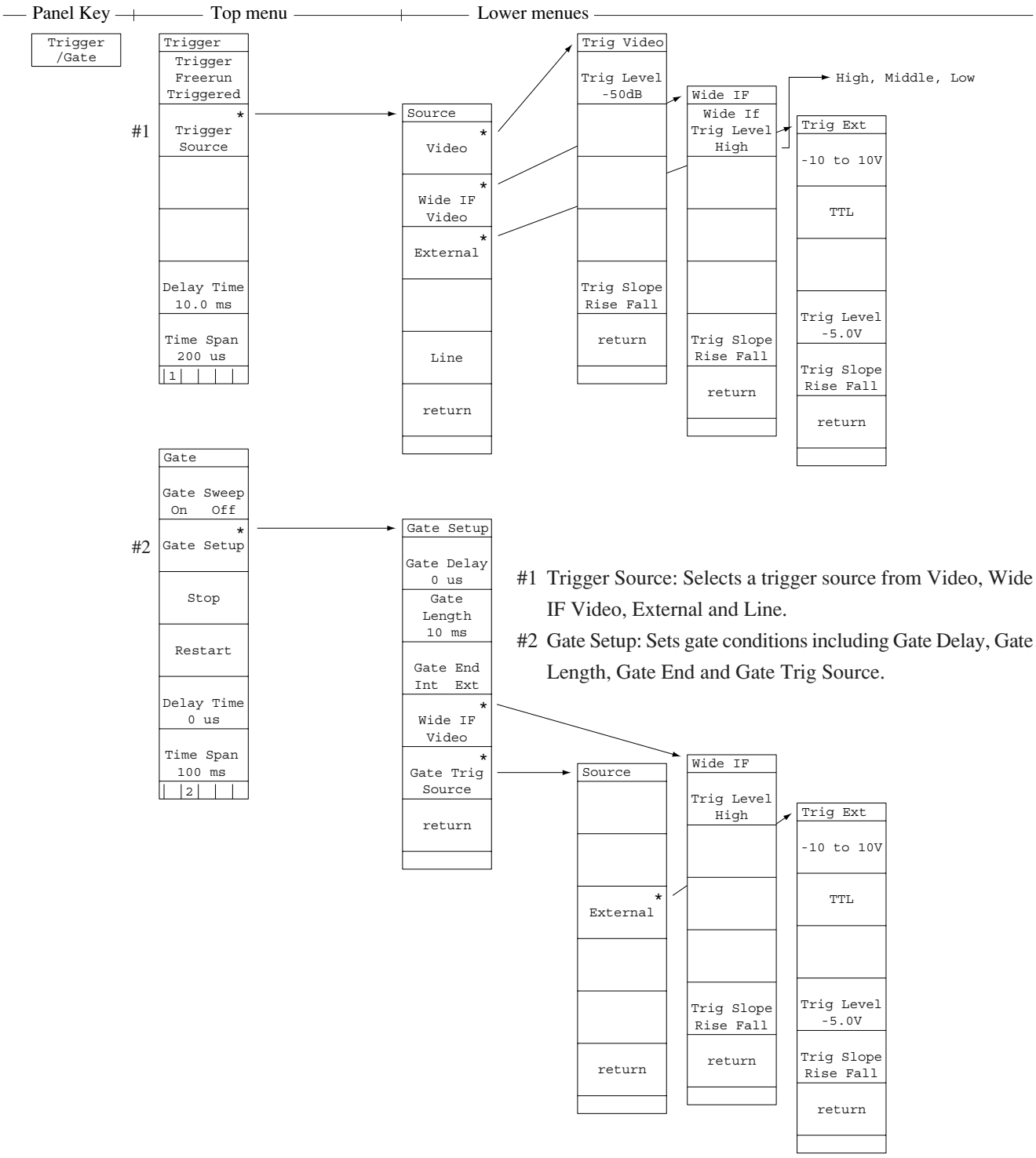
- Set to the zero-span time domain display. Set Time Span, Trigger, Trigger Source, Storage, Detection and FM Monitor On/Off, and select Expand (waveform).

#1 Zooms in time-domain waveform display.

#2 Displays trace-A waveforms in frequency domain and time domain simultaneously at top and bottom of screen. The time-domain display is the larger at this time.

- Simultaneously display waveforms of Trace a and Time Domain.
  Which to display as Main Trace (or Sub Trace) can be selected.

Menu Tree (19/24)

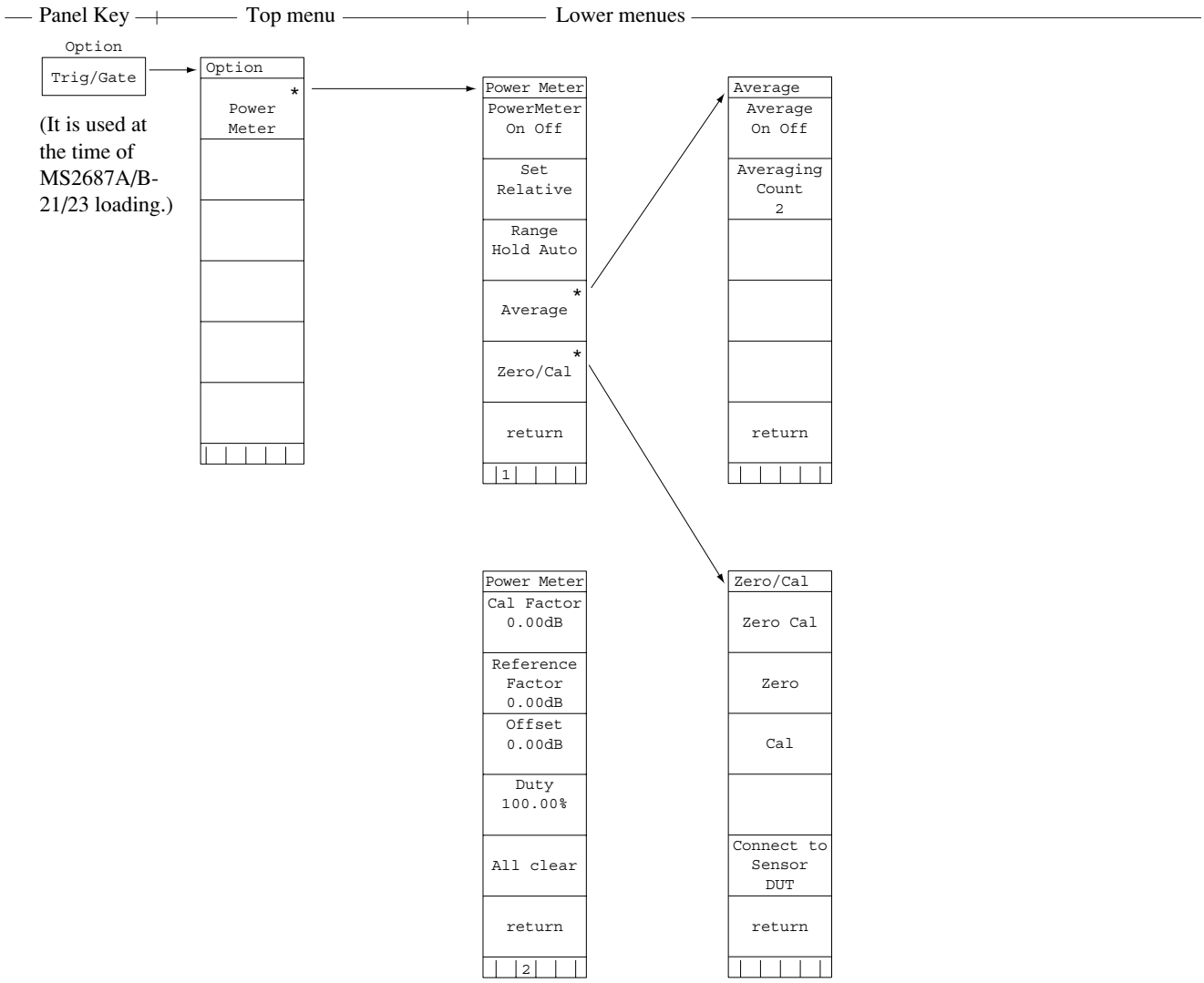


#1 Trigger Source: Selects a trigger source from Video, Wide IF Video, External and Line.

#2 Gate Setup: Sets gate conditions including Gate Delay, Gate Length, Gate End and Gate Trig Source.

- Set gate functions for controlling the sweep start trigger and the writing of waveform data. Set the trigger mode, trigger source, trace time, delay time and time span. Select On/Off, Stop and Restart of Gate Sweep.

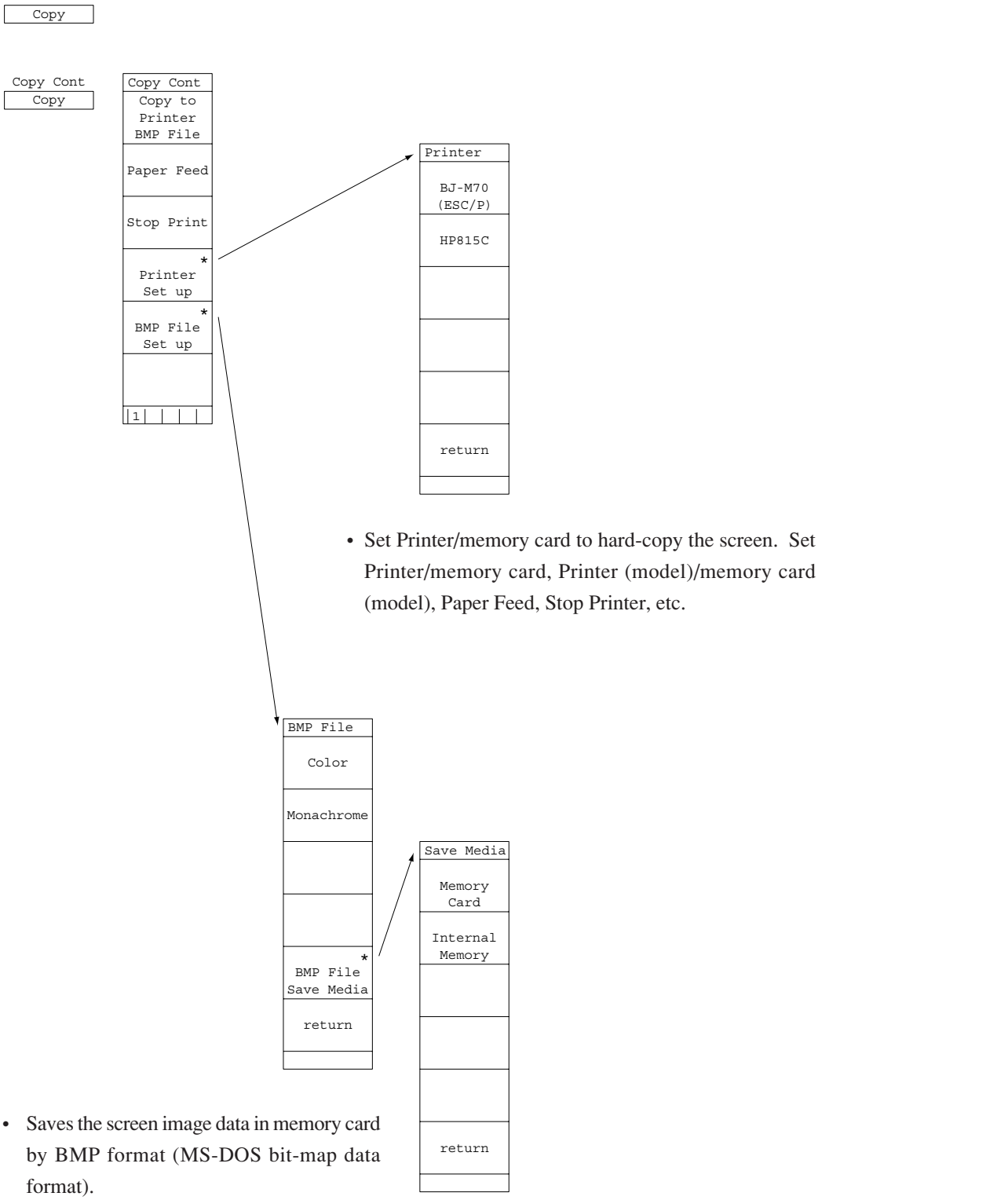
Menu Tree (20/24)



- In the time of MS2687A/B-21/23 loading, high accuracy electric power measurement in the frequency range of 100 kHz to 32 GHz can be performed.

Menu Tree (21/24)

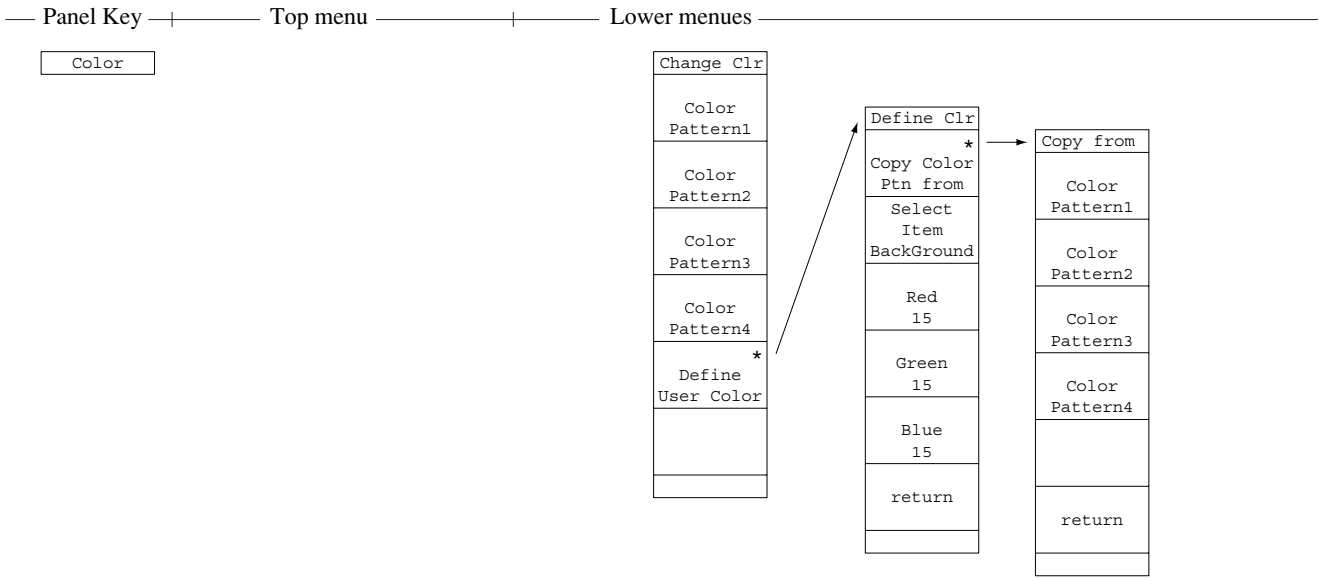
Panel Key — Top menu — Lower menues



- Set Printer/memory card to hard-copy the screen. Set Printer/memory card, Printer (model)/memory card (model), Paper Feed, Stop Printer, etc.

- Saves the screen image data in memory card by BMP format (MS-DOS bit-map data format).

Menu Tree (22/24)

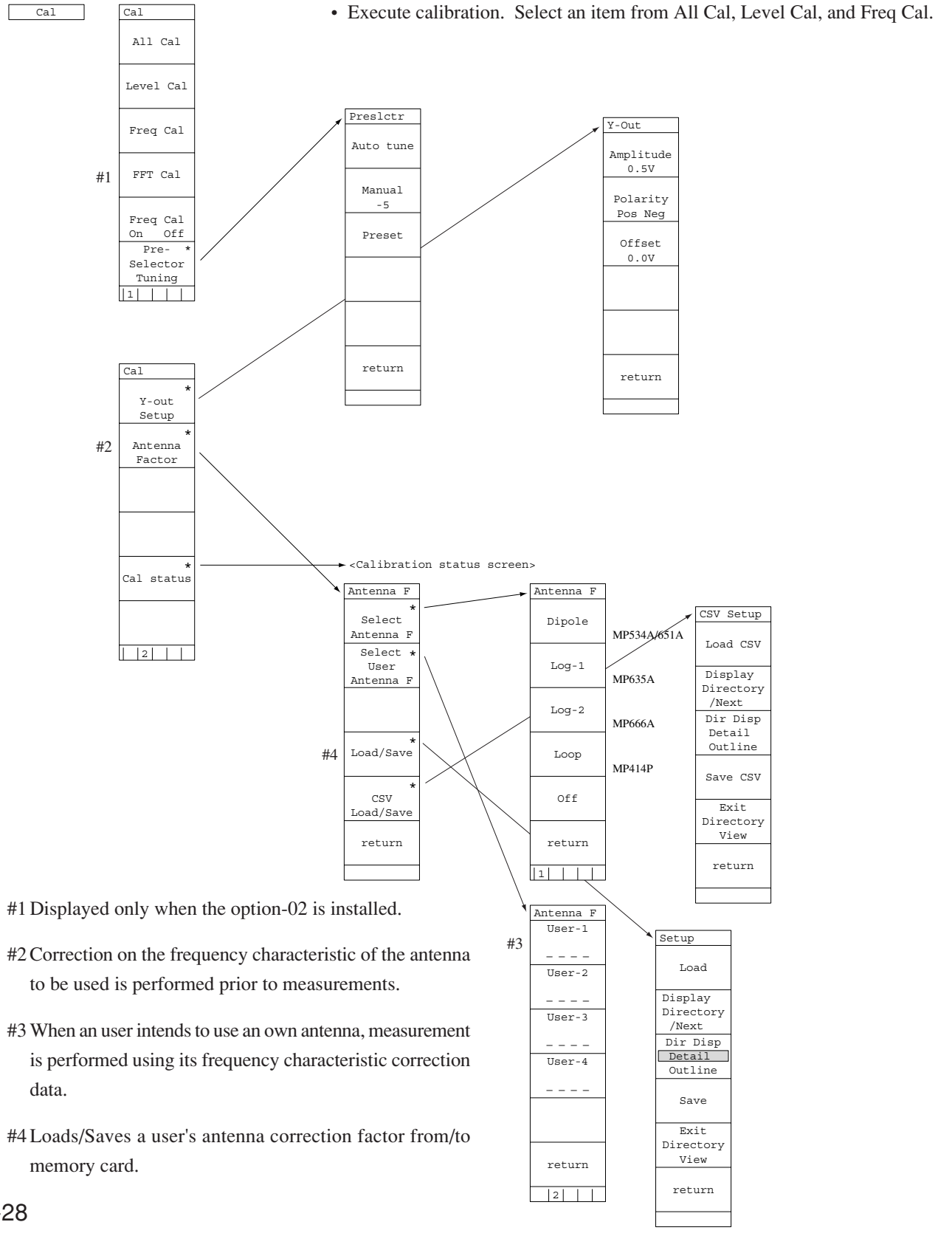


Menu Tree (23/24)

Panel Key — Top menu — Lower menues

Cal

• Execute calibration. Select an item from All Cal, Level Cal, and Freq Cal.



#1 Displayed only when the option-02 is installed.

#2 Correction on the frequency characteristic of the antenna to be used is performed prior to measurements.

#3 When an user intends to use an own antenna, measurement is performed using its frequency characteristic correction data.

#4 Loads/Saves a user's antenna correction factor from/to memory card.

Menu Tree (24/24)

Panel Key	Top menu	Lower menues
Preset	Preset	• Initialize measurement parameters. Select one from All, Sweep, Trace, Level and Freq/Time.
	Preset All	
	Preset Sweep controll	
	Preset Trace Parameters	
	Preset Level Parameters	
	Preset Freq/Time Parameters	
Local		
Disp On/Off		
System	System	
	Erase Warm up Message	
	Data Points 1001 501	
	NLP-1200 Correction On Off	

Config mode Menu Tree

MS2681A/MS2683A/MS2687A/MS2687B Config Menu Tree (1 /2)

Panel Key — Top Menu — Lower Menu & Entry

Config

-Display-

[Comment]

- Title
- Clock
- Clock & Title
- Off

[Title]

[Date Format]

- YYYY/MM/DD
- MMM-DD-YYYY
- DD-MMM-YYYY

-Setting-

[Date]

- Year
- Month
- Date

[Time]

- Hour
- Minute
- Second

[RGB Output]

- On
- Off

[LCD Brightness]

- 1 to 5

[Buzzer]

- On
- Off

[Window Cursor Mode]

- Turn
- Stop

-Power On-

[Screen]

- Spectrum
- System
- Last

[Initial]

- Before Power Off
- Fixed State

1) Press Set key to select Top menu in Config menu after moving the cursor with knob or step key.
Press Set key to select Lower menu after moving the cursor.

MS2681A/MS2683A/MS2687A/MS2687B Config Menu Tree (2/2)

Panel Key — Top Menu — Lower Menu & Entry

-Copy Control-

[Copy To]

- Printer
- BMP File To Mem Card

[Printer Set up]

- BJ-M70 (ESC/P)
- HP815C (HP)

[BMP File Set up]

- Color
- Monochrome

Interface

-Interface-

[Connect To Controller]

- GPIB
- RS232C

-GPIB-

[My Address]

- 00 to 30

-RS232C-

[Band Rate]

- 1200 to 115200 bps

[Parity]

- Even
- Odd
- Off

[Data Bits]

- 7 bits
- 8 bits

[Stop Bit]

- 1 bit
- 2 bits

[XON/XOFF Flow Control]

- On

File Operation

- Refresh Screen
- Sort
- Format
- Delete
- Write Protect
- Back Screen →

Section 5 Basic Operation Procedure

The basic operation procedure of this equipment is explained here. The operations are listed on the right. Also, the explanation will advance assuming that a 500 MHz signal is applied to the input connector. Please read this manual while operating this equipment.

([ ] : Panel key, ____ : Soft key)

<Actual operations>

(I) Signal display
  1) Turn the power on,
  2) execute automatic calibration,
  3) set the signal to the center of the screen, and
  4) enlarge and display the signal.

(II) Marker operation
  Check of the zone marker function.
  The "marker → CF" function check.

(III) "Measure" function check

(IV) Screen hard copy

Signal Display

Turn the power on

Press the standby button on the rear panel, then press the power switch on the front panel. In this case, continue pressing the power switch for one second or more.

Press [Preset] key.

Press Preset All key in the menu.

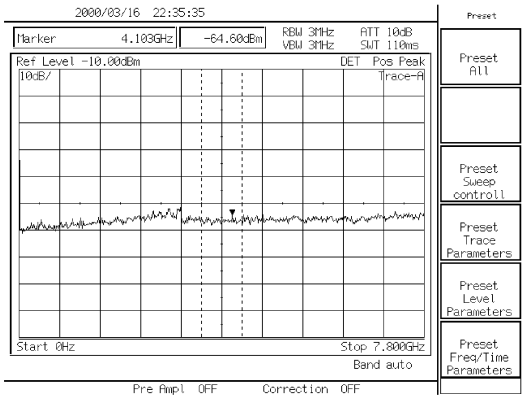


Fig. 5-1

The power is turned on/off only when the power switch is pressed for one second or more. This prevents the power from being turned on/off easily by mistake.

When the [panel] key (hard key) is pressed, the related soft key menu is displayed.

Partial resettings are enabled. This resetting includes only the display-related resetting or the resetting of special modes such as zone sweep.

Execute automatic calibration

Wait after switching on the power supply of the machine (warm up period) till the internal temperature becomes stable. This period is approximately 10 minutes.

After warm up, execute automatic calibration.

Press the [Shift] key then the [CAL / 0] key.

Select All Cal from the menu displayed on the display.

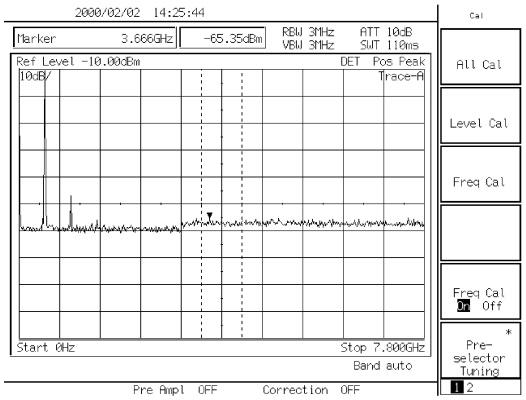


Fig. 5-2

Automatic Calibration is carried out by using an internal source without need for any external cable connection.
See “Detailed Operating Instruction Part” for detail information about contents of calibration.

Set the signal to the center of the screen

Press the [Frequency] key.

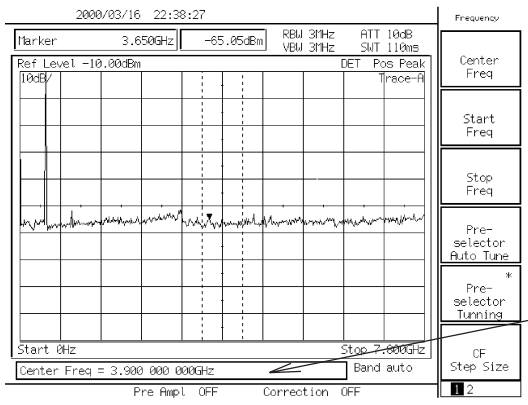


Fig. 5-3

When pressing Frequency, Span, Amplitude or Coupled Function key (s) which is used frequently, Center Frequency, Span, Reference Level, RBW or VBW function is selected and numeric value for the function can be entered into Entry area. This reduce key operation times.

This display section is called Entry area. Selecting the menu displays the current set value of the parameter. The set value can be changed by entering data in Entry area.

Press the Shift GHZ (Hold) key

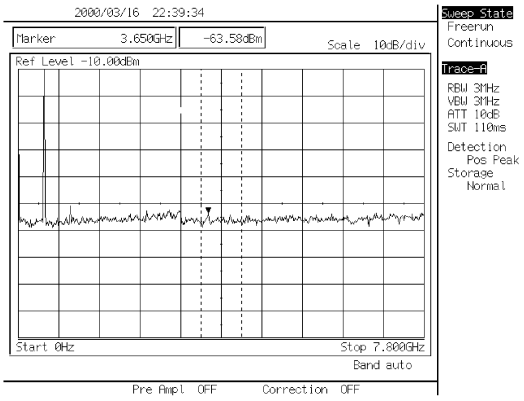


Fig. 5-4

The display of the soft key menu can be switched on/off using the Shift GHZ (Hold) key. When the menu disappears, the set up parameters are displayed.

Press the Frequency key, then use the ten-key pad (numeric keys) to enter 500 MHz.

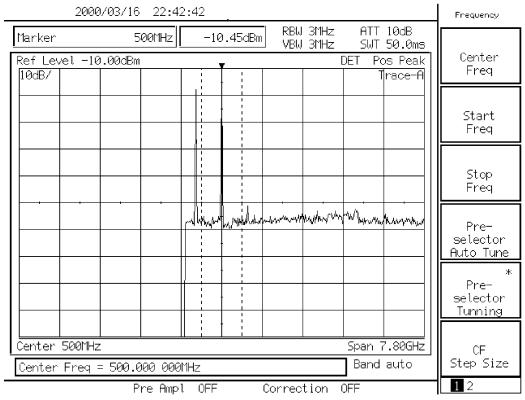


Fig. 5-5

The following three methods to input numeric values to parameters are provided: direct input by the ten-key pad (numeric keys), up/down keys, and rotary knob.

Enlarge and display the signal

Press the Span key , then press the ∨ down key several times to enlarge the signal display.

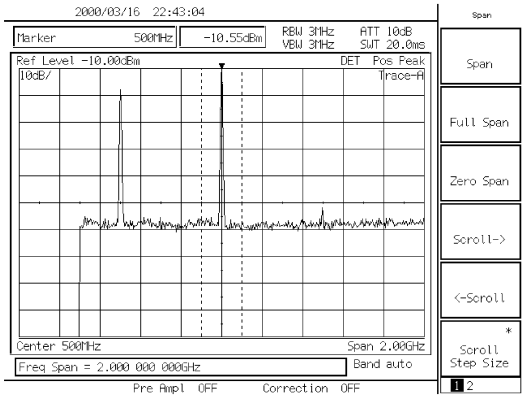


Fig. 5-6

Marker Operation

Here, check that the signal frequency and level are displayed in a marker display area. The zone marker automatically fetches the highest level signal within the zone and displays the frequency and level.

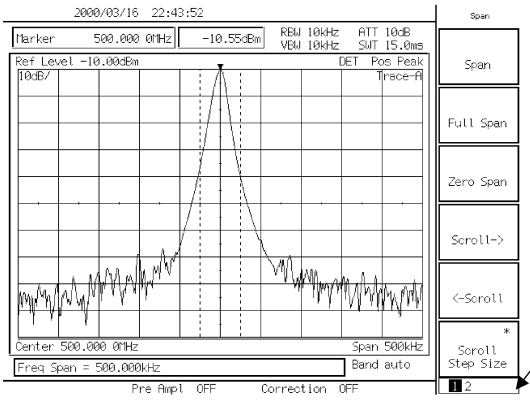


Fig. 5-7

The following items can easily be checked by the soft key menu tab: How many pages of the soft key menu being displayed currently are there?, and what page is displayed now?

To turn over the page, press the More key.

To check Marker → CF function, shift the signal from the center intentionally.
Press the Span key, and then the Scroll → key two times.

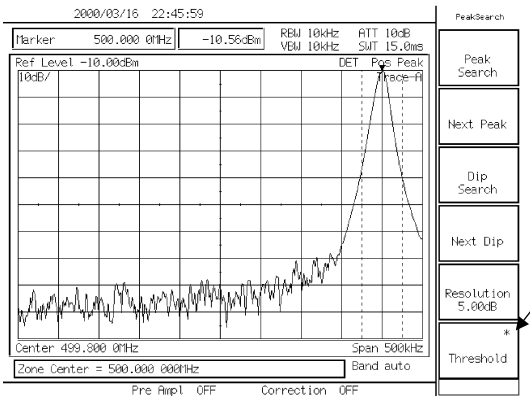


Fig. 5-8

The soft key menu marked by an asterisk on the upper right indicates that the menu can further be opened by pressing the key. Adversely, the soft key menu not marked indicates that the menu cannot be opened any more, so to speak, the end of menu opening.

Press the [Peak Search] key.

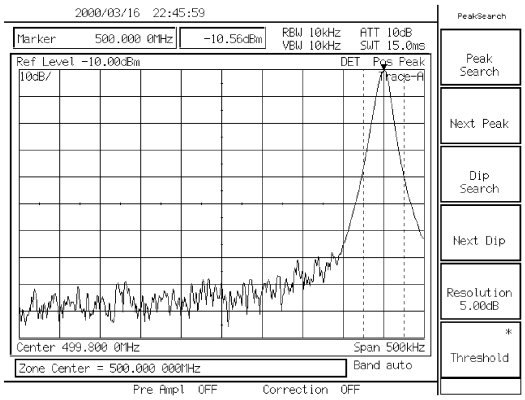


Fig. 5-9

Advanced operation memo: It is convenient that the page can also be turned over by repeatedly pressing the panel key. This method is used when key (s), such as the [Measure] key, has a number of pages. Besides, the Freq/Ampl and Marker-related keys do not turn over the page by repeatedly pressing the panel key. For these keys, because the first page is important specially, it should always be displayed when the panel key is pressed.

The marker fetches the signal.

Press the [Shift] [Marker → / Peak Search] key.

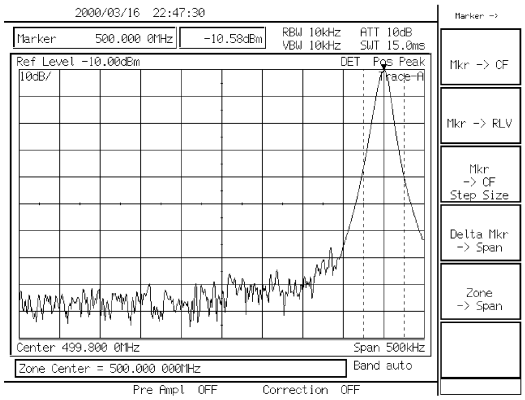


Fig. 5-10

Press marker → CF key.

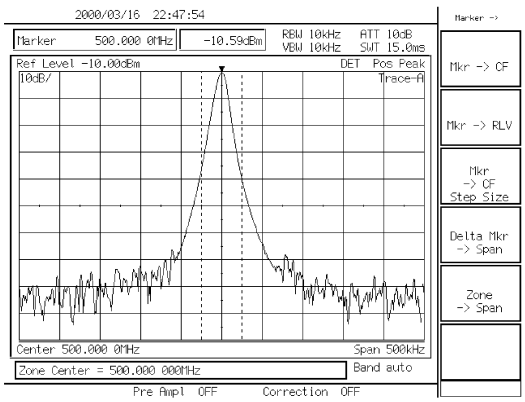


Fig. 5-11

The page opened by pressing the soft key can return to the preceding page by the Return key. Besides, it can be checked that which soft key menu was pressed previously to open the current menu, as the menu title is displayed on the upper row of the soft key.

Here, return to the screen of Fig. 5-8 and ensure that the screen changes to that of Fig. 5-11 only by pressing the [→ CF] key.

“Measure” Function Check

Press the [Preset] key and the Preset All key in order.
Press the [Peak Search] key.
If the zero beat signal level (local feed through) is larger than the signal level and the marker fetches the zero beat level, press the “Next peak” key and put the marker on the signal.

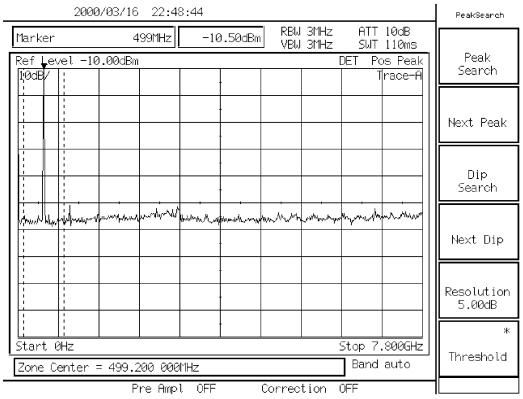


Fig. 5-12

Press the [Measure] key and the Frequency Count key to set the function of high accuracy frequency measurement of the marker points.
Then, press the Count On key and start measurement.

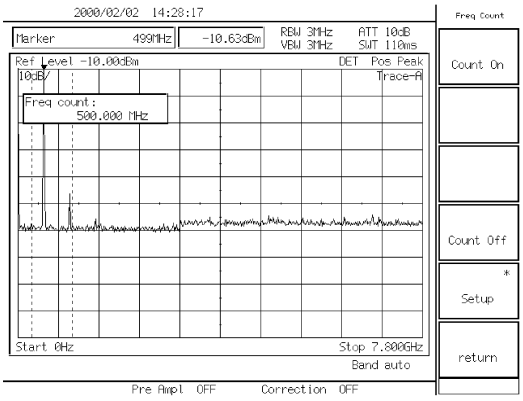


Fig. 5-13

From the screen after executing measurement, press another panel key and change parameters, and then, pressing again the [Measure] key will automatically return to the menu of this screen and not to page 1 of the menu (page learning function).
It is a useful function when repeating measurement.

The frequency of marker point is displayed at the top left of the screen.
Incidentally, the internal counter correctly operates even at the full span condition, so an operation to reduce frequency span otherwise required is not necessary in this model.

Shifting of result position

Press the [Measure] key and the Result Position* key in order.
User can select a displayed position of measured result from 4 patterns. Displayed position is upper right, upper left, lower right, or lower left.

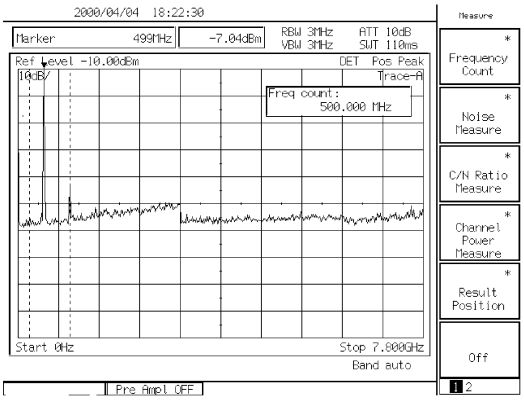


Fig. 5-14

Screen Hard Copy

The screen can be hard-copied with the BJ-M70 printer (Canon) via a Centronics interface, and the procedures are described below:

1) As illustrated below, connect the Parallel connector and printer with an attached Parallel cable.

2) Press the [Copy] key, and the currently displayed screen is hard-copied.
If the printed copy is improper, check if the interface is correctly set in the following sequence.

3) Press the [Config] key.

4) Press the STEPDOWN [∨] key several times to get Copy Control, and check if the copy to is Printer.
If the copy to is not Printer, set the cursor to Printer with the knob and press the [set] key .

5) Check if the printer setup is BJ-M70 (ESC/P).

6) Press the [Spectrum] key and return to the spectrum screen.

7) Press the [Copy] key, and the currently displayed screen is hard-copied.

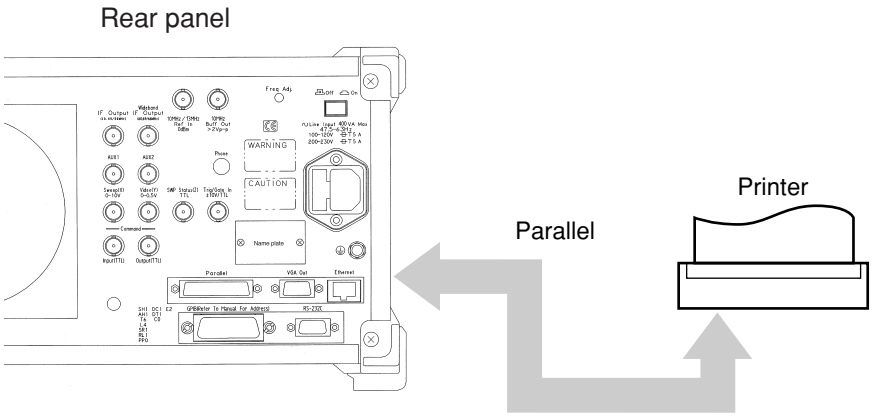


Fig. 5-14

Section 6 Performance Test

In this chapter, measuring instruments, setup and operations necessary for conducting performance tests of MS2681A/MS2683A/MS2687A/MS2687B are explained.

Requirement for Performance Test

Performance tests are used as preventive maintenance to prevent degradation of the performance of MS2681A/MS2683A/MS2687A/MS2687B Spectrum Analyzer (hereinafter, called “this unit”) before it occurs.
Use the performance tests whenever necessary such as at acceptance and periodic inspection of this unit and to verify performance after repair. Execute the performance tests listed below to verify the performance of this unit at acceptance inspection, periodic inspection and after repair.

- Reference oscillator frequency stability
- Frequency readout accuracy
- Frequency span readout accuracy
- Resolution bandwidth and selectivity
- Sideband phase noise
- Frequency measurement accuracy
- Amplitude display linearity
- Frequency response
- Reference level accuracy
- Average noise level
- Second harmonic distortion
- Resolution bandwidth (RBW) switching uncertainty
- Input attenuator switching uncertainty
- Sweep time and time span accuracy

Execute the performance tests at regular intervals as preventive maintenance for important evaluation items. We recommend that the performance be inspected regularly once or twice a year.

If the specifications are not met at the performance tests, please contact Anritsu Corporation.

Instruments Required for Performance Test

A list of instruments required for performance test is shown below.

Instruments Required for Performance Test (1/2)

Recommended instrument name (Model name)	Required Performance †	Test item
Frequency standard (HP5071A with Option 001)	• Aging Rate $\leq 3 \times 10^{-14}$/day	Reference oscillator frequency stability Frequency read out accuracy Frequency measurement accuracy
Synthesized signal generator (MG3633A)	• Frequency range 100 MHz to 1 GHz Resolution of 1 Hz possible • Output level range –20 to 0 dBm Resolution of 0.1 dB possible • SSB phase noise ≤–130 dBc/Hz (at 10 kHz offset) • Second harmonic ≤–30 dBc • Amplitude modulation (0 to 100%, 0.1 to 400 Hz) possible • External reference input (10 MHz) possible	Resolution bandwidth, selectivity Sideband noise Amplitude display linearity Reference-level accuracy Second-harmonic distortion Resolution-bandwidth switching error Input-attenuator switching error
Swept Frequency Synthesizer (69269A with Option 2B)	• Frequency range 10 MHz to 30 GHz Resolution of 2 kHz possible • Output level range –20 to 0 dBm Resolution of 0.1 dB possible • Pulse modulation possible Pulse width: 0.5 to 10 µsec Repetitive cycle: 5 µsec to 5 msec • External reference input (10 MHz) possible	Frequency readout accuracy Frequency-span display accuracy Frequency measurement accuracy Frequency response Time-span accuracy Frequency domain sweep time accuracy Time domain sweep time accuracy
Attenuator (MN510C)	• Frequency 100 MHz • Maximum attenuation 70 dB (resolution 0.1 dB) possible with calibrated data	Amplitude display linearity Input-attenuator switching error

† Extracts part of performance which can cover the measurement range of the test item.

Instruments Required for Performance Test (2/2)

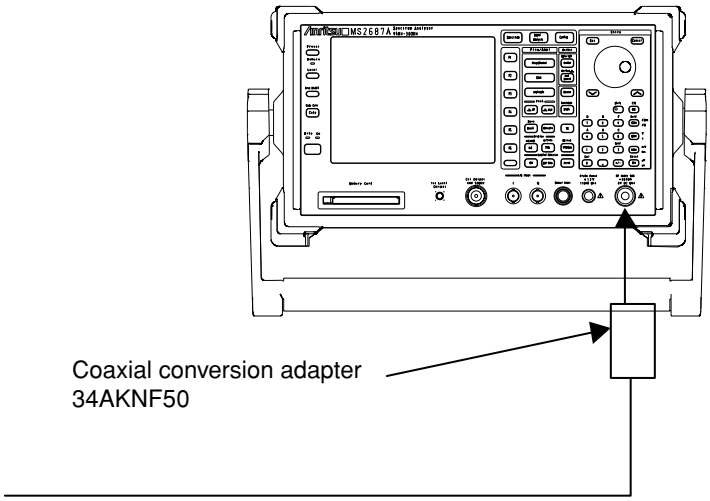
Recommended instrument name (Model name)	Required Performance †	Test item
Power meter (ML4803A)	• Main instrument accuracy ±0.02 dB • Frequency range 100 kHz to 30 GHz (depending on the power sensor type)	Frequency response Reference-level accuracy Input-attenuator switching error
Power sensor (MA4701A)	• Frequency range 10 MHz to 30 GHz • Measurement power range –30 to +10 dBm • Input connector N type	Frequency response Reference-level accuracy Input-attenuator switching error
50Ω terminator (MP752A)	• Frequency range DC to 8.1 GHz • VSWR ≤1.2	Average noise level
Low-pass filter • VLF-141 (fp = 50 MHz) • VLF-141 (fp = 100 MHz) • VLF-141 (fp = 200 MHz) • VLF-141 (fp = 400 MHz) • VLF-141 (fp = 800 MHz) • VLF-141 (fp = 1600 MHz) • VLF-141 (fp = 3200 MHz) • VLF-141 (fp = 4000 MHz)	• Attenuation ≥40 dB (at frequency 2× fp)	Second-harmonic distortion
Frequency counter (MF1601A)	10 MHz measurement possible Number of display digits: 10 • External reference input (10 MHz) possible	Reference-oscillator frequency stability Frequency domain sweep time accuracy Time domain sweep time accuracy

† Extracts part of performance which can cover the measurement range of the test item.

Performance Test

The warm-up time depends on the test item. For test item other than oscillator frequency, warm-up the equipment for at least thirty minutes and test the performance after the MS2681A/MS2683A/MS2687A/MS2687B series stabilizes completely. Also, begin measurement after taking the warm-up time of the calibration instrument into full consideration. In addition, the test must be conducted at room temperature; there must be little AC power supply voltage fluctuation, and no noise, vibration, dust, humidity, etc.

When the object of a performance test is MS2687A/MS2687B, while the coaxial cable for performance tests is using N type connector, connect with MS2687A/MS2687B using an optional coaxial conversion adapter 34KNF50 (DC to 20 GHz) as shown in a lower figure.



Reference oscillator frequency stability

Test the frequency stability of the 10 MHz reference oscillator.
Stability is determined by measuring frequency variation after 24 hours and after 48 hours of power on at ambient temperatures of 0°C and 50°C.

(1) Specifications

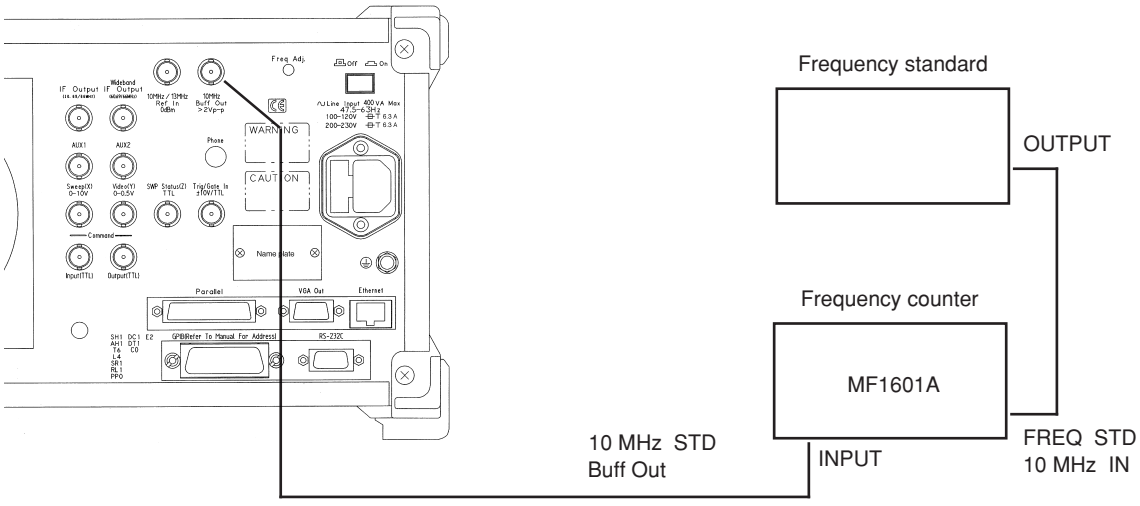
■ Reference oscillator

- Frequency: 10 MHz
- Aging rate: $\leq \pm 2 \times 10^{-8}$/day
  After 24 hour warm-up at 25°C ± 5°C
- Temperature stability: $\leq \pm 5 \times 10^{-8}$ at 0 and 50°C referred to frequency at 25°C

(2) Test instruments

- Frequency counter: MF1601A
- Frequency standard: with stability of $\leq \pm 3 \times 10^{-14}$/day

(3) Setup



Reference Oscillator Frequency Stability Test

(4) Procedure

Aging rate/day: Test this at the ambient temperature ±2°C in a vibration-free place.

Step	Procedure
1	Set the change over switch (FREQ STD: INT/EXT) on the MF1601A counter rear panel to EXT.
2	Set the power supply switch on the spectrum analyzer rear panel to On and then the Power switch on the spectrum analyzer front panel to On.
3	Measure the frequency using the counter after 24 hours has passed after turning the power on. (Sample rate of the counter: >20 sec, read out 0.1 mHz resolution)
4	Measure the frequency using the counter after 24 more hours have passed from the step 3 measurement.
5	Calculate the stability by using the following equation. $$\text{Frequency stability} = \frac{(\text{2nd reading of the counter}) - (\text{1st reading of the counter})}{(\text{1st reading of the counter})}$$

Temperature stability: Test this performance in a vibration-free constant-temperature chamber.

Step	Procedure
1	Set up the spectrum analyzer in a constant-temperature chamber at 25°C in the same setup.
2	Set the LINE and Power switches on the spectrum analyzer to On and wait until the spectrum analyzer internal temperature stabilizes (approx. 1.5 hours after the chamber temperature stabilizes).
3	When the internal temperature stabilizes, measure the frequency by using the counter with 0.1 mHz resolution.
4	Change the chamber temperature to 50°C.
5	When the chamber temperature and the spectrum analyzer internal temperature re-stabilize, measure the frequency by using the counter.
6	Calculate the stability by using the following equation. $$\text{Temperature stability} = \frac{(\text{counter reading at } 50°C) - (\text{counter reading at } 25°C)}{(\text{counter reading at } 25°C)}$$
7	Change the chamber temperature to 0°C and repeat steps 5 and 6.

Frequency readout accuracy

Add the known frequency which serves as the center frequency reference to the spectrum analyzer as shown in the figure below and set CF (same value as the known reference frequency) and SPAN. At this time, check that the difference between the reading of the marker readout frequency (thick arrow in the figure) of the center frequency peak point.

As shown in the figure, the Synthesized Signal Generator uses the signal source phase-locked with the same accuracy as the 10 MHz reference oscillator of the spectrum analyzer.

(1) Specification

[MS2681A/MS2683A]

Frequency readout accuracy: ± (readout frequency × reference frequency accuracy + span × span accuracy + resolution bandwidth × 0.15 + 10 Hz)

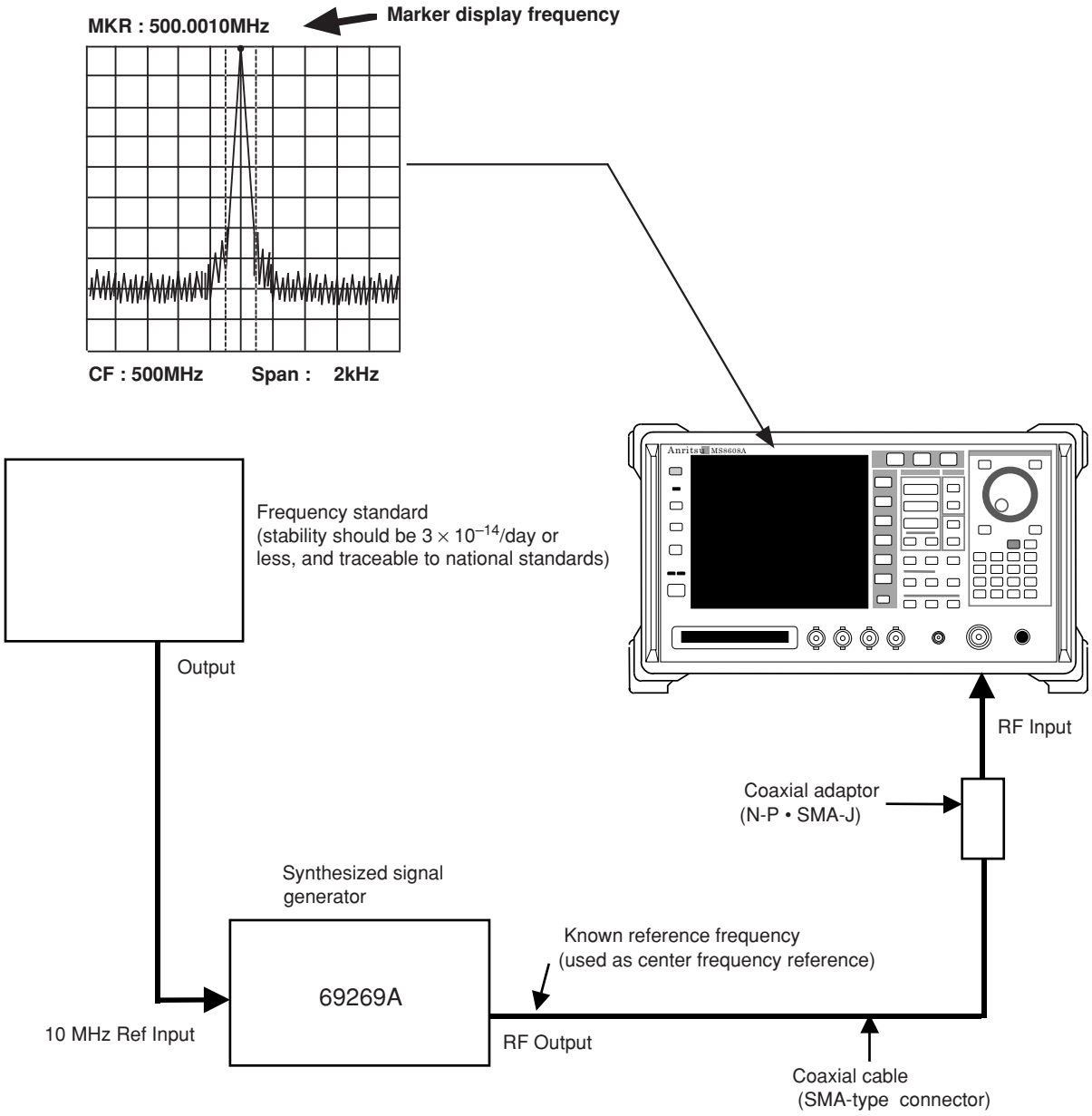
[MS2687A/MS2687B]

Frequency readout accuracy: ± (readout frequency × reference frequency accuracy + span × spna accuracy + resolution bandwidth × 0.15 + 10 Hz × N)

(2) Test instrument

- Synthesized signal generator: 69269A
- Frequency standard

(3) Setup



Center-Frequency Readout-Accuracy Test

Note:

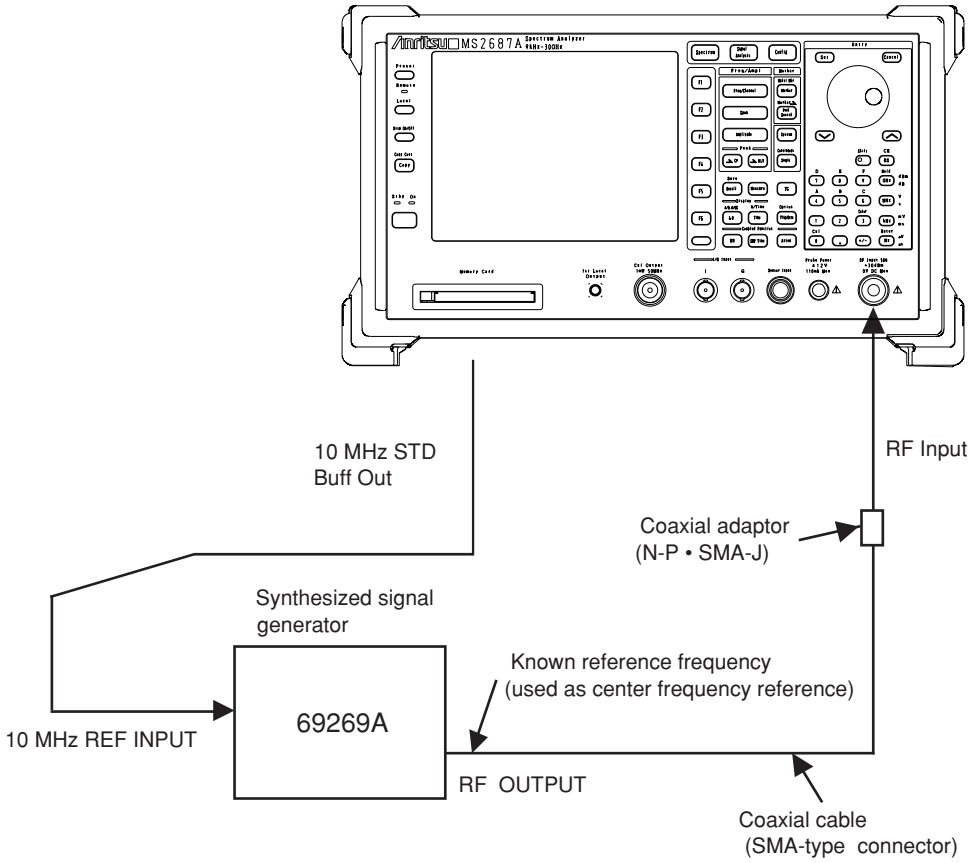
Even if there is not a Frequency standard, simplified measurement can be performed by setting up as shown in the figure below. In this case, the following specification is applied:

[MS2681A/MS2683A]

± (span × span accuracy + resolution bandwidth × 0.15 + 10 Hz)

[MS2687A/MS2687B]

± (span × span accuracy + resolution bandwidth × 0.15 + 10 Hz × N)



Center-Frequency Readout-Accuracy Test

(4) Precaution

Set the signal generator output level to approximately –10 to –20 dBm.

(5) Procedure

Step	Procedure
1	Press the [Preset] key of this unit.
2	Operate Freq Cal.
3	Set the signal generator output frequency equal to the center frequency (500 MHz) in the following table.
4	Set the center frequency referring to the following table.
5	Set the span (10 kHz) that corresponds to the center frequency (500 MHz) in the following table by using the numeric/unit keys.
6	Read the marker frequency (indicated by thick arrow in the figure on the previous page) and check that the value is within the range between the maximum and minimum values shown in the following table.
7	Repeat steps 3 to 6 for other combination of the center frequency and span according to the combinations shown in the following table.

Frequency readout accuracy test

Signal generator	Spectrum analyzer			
Output frequency	Center frequency	Span frequency	Resolution bandwidth	Readout frequency
500 MHz	500 MHz	10 kHz	300 Hz	
		200 kHz	3 kHz	
		100 MHz	300 kHz	
5 GHz	5 GHz	10 kHz	300 Hz	
		200 kHz	3 kHz	
		100 MHz	300 kHz	
7 GHz	7 GHz	10 kHz	300 Hz	
		200 kHz	3 kHz	
		100 MHz	300 kHz	

Frequency span readout accuracy

Using the setup shown in the figure below, set the frequencies corresponding the 1st and 9th divisions from the left side of the screen scale with the SG. The frequency difference between the peak levels at the 1st and 9th divisions is equal to the frequency span × 0.8.

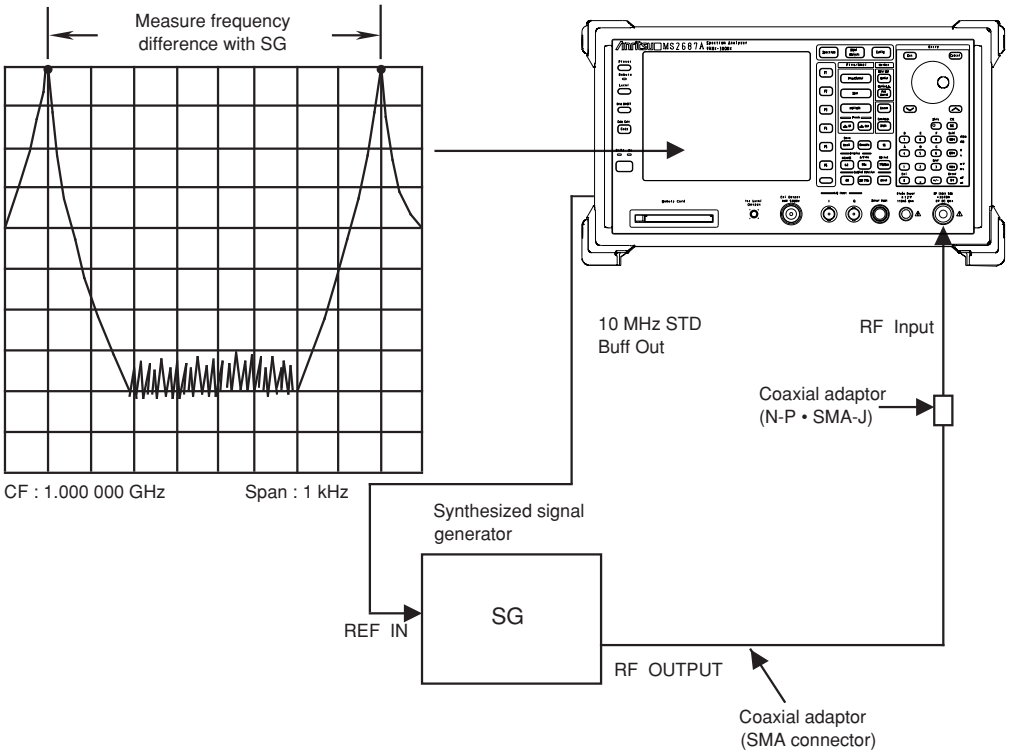
(1) Specification

[MS2681A/MS2683A]
Frequency span accuracy: ±1.0% (Single band sweep, data point 1001)
[MS2687A]
Frequency span accuracy: ±1.0% (band 0, 1), ±2.5% (band 2, 3, 4)
(Single band sweep, data point 1001)
[MS2687A-22 [13 GHz Low Noise] loading]
Frequency Spna accuracy:±1% (Band 0, 1-, 1+ (n=1)), ±2.5% (Band 1+ (n=2), 2-, 3-)
(Single band sweep, data point 1001)
[MS2687B]
Frequency span accuracy: ±1.0% (band 0, 1), ±2.5% (band 2, 4)
(Single band sweep, data point 1001)

(2) Test instrument

- Synthesized signal generator: 69269A

(3) Setup



Frequency Span Readout Accuracy Test

(4) Precaution

Set the signal generator output level to approximately –10 to –20 dBm.

(5) Procedure

Step	Procedure
1	Press the [Preset] key.
2	Operate Freq Cal.
3	Connect the 69269A output to the spectrum analyzer RF Input.
4	Set the spectrum analyzer as shown below: Span ..... 20 kHz Center Freq ..... 1000 MHz
5	Set the 69269A output frequency to the f_1 frequency (999.992 MHz) shown in the table on the next page.
6	Adjust the 69269A output frequency to set the spectrum peak at the 1st division from the left end of the screen scale. Remember the frequency as f_1'.
7	After setting the 69269A output frequency to the f_2 frequency (1000.008 MHz), adjust it to set the spectrum peak at the 9th division. Remember the frequency as f_2'.
8	Calculate (f_2'–f_1')/0.8 and check that the value is within the specified range (minimum to maximum values) shown in the table on the next page.
9	Repeat steps 4 through 8 for each frequency span with 1 GHz center frequency shown in the table on the next page.

Frequency-Span Readout-Accuracy Test

Spectrum analyzer		Signal generator		Measured result
Center frequency	Span frequency	f1	f2	(f2' – f1')/0.8
1.5 GHz	20 kHz	1499992000 Hz	1500008000 Hz	
	200 kHz	1499920000 Hz	1500080000 Hz	
	2 MHz	1499200000 Hz	1500800000 Hz	
	20 MHz	1492000000 Hz	1508000000 Hz	
	200 MHz	1420000000 Hz	1580000000 Hz	
	2 GHz	700000000 Hz	2300000000 Hz	
5 GHz	20 MHz	4992000000 Hz	5008000000 Hz	
	200 MHz	4920000000 Hz	5080000000 Hz	
	2 GHz	4200000000 Hz	5800000000 H	

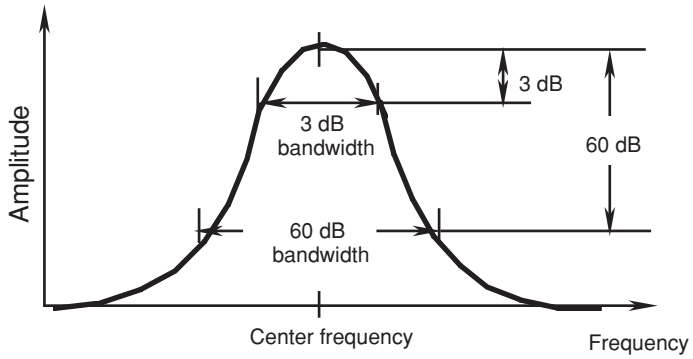
Resolution bandwidth (RBW) and selectivity

If there are two input signals with the frequency difference corresponding to 3 dB bandwidth (of IF final stage), these signals can be resolved as two spectrum waveforms.

This is called the resolution bandwidth.

Selectivity can be improved by narrowing the 60 dB bandwidth. The selectivity is defined by the ratio of the filter width, in Hz, at the –60 dB point, to the filter width, in Hz, at the –3 dB point, as shown in the formula below.

$$\text{Selectivity} = \frac{\text{60 dB bandwidth (Hz)}}{\text{3 dB bandwidth (Hz)}}$$



To test the resolution bandwidth and selectivity, first measure the resolution bandwidth (3 dB bandwidth), then the 60 dB bandwidth and calculate the 60 dB/3 dB bandwidth ratio.

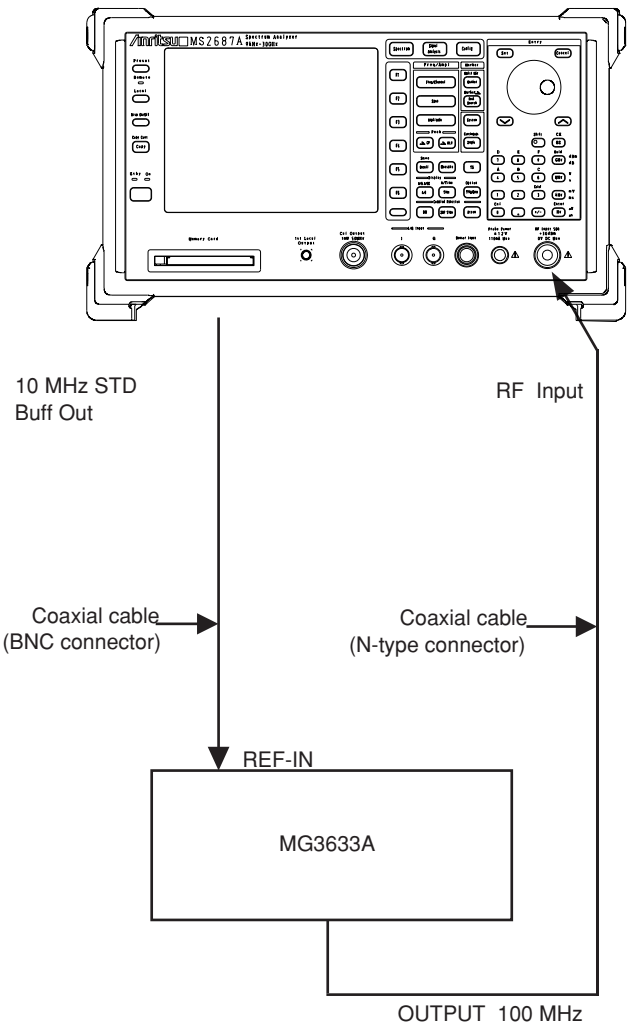
(1) Specifications

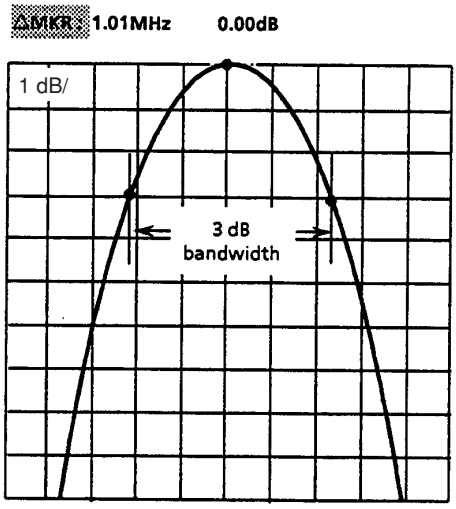
- Resolution bandwidth accuracy: ±20% (RBW=300 Hz to 10 MHz)
  ±40% (RBW=20 MHz)
- Selectivity (60 dB/3 dB bandwidth): ≤15:1

(2) Test instrument

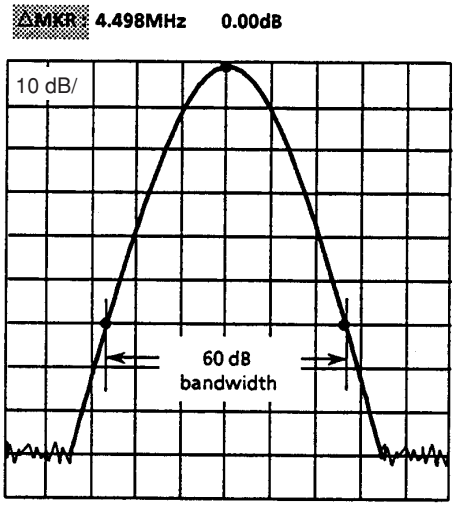
- Synthesized signal generator: MG3633A

(3) Setup





(a) Resolution bandwidth



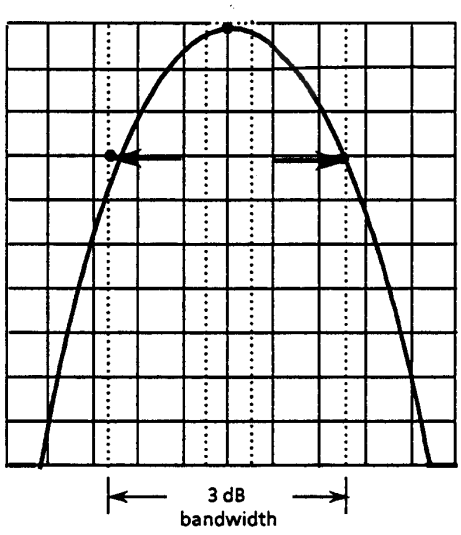
(b) 60 dB dropped bandwidth

Resolution Bandwidth/Selectivity Test

(4) Procedure

(a) Resolution bandwidth accuracy

Step	Procedure
1	Press the [Preset] key.
2	Perform all calibration.
3	Set the spectrum analyzer as shown below: Center Freq ..... 100 MHz Span ..... 1 kHz RBW (MANUAL) ..... 300 Hz Scale ..... LOG 1 dB/div
4	Press the [→ RLV] key and match the peak of the signal trace to the top line (REF LEVEL) on the screen.
5	Press the [Single] key to execute a single sweep, then check that the single sweep has been completed.
6	After pressing the Measure key, selects Occ BW Measure.
7	After selecting X dB Down method, set X dB value to 3 dB.
8	Set the Occupied Bandwidth to on state by operating menu key.
9	The 3 dB resolution bandwidth value is displayed in the upper left-hand corner of the screen. Fill in this value in the table on the next page.
10	Repeat steps 3 to 9 for the frequencies other than the resolution bandwidth 300 Hz and the frequency span 1 kHz according to the combinations of resolution bandwidth and frequency span shown in the table on the next page.



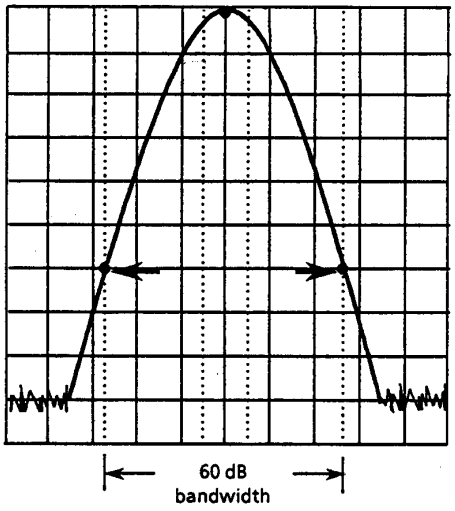
Bandwidth Measurement

Resolution Bandwidth (3 dB)

Resolution bandwidth	Span frequency	3 dB bandwidth
300 Hz	1 kHz	
1 kHz	3 kHz	
3 kHz	10 kHz	
10 kHz	30 kHz	
30 kHz	100 kHz	
100 kHz	300 kHz	
300 kHz	1 MHz	
1 MHz	3 MHz	
3 MHz	10 MHz	
5 MHz	15 MHz	
10 MHz	30 MHz	
20 MHz	60 MHz	

(b) Resolution bandwidth selectivity

Step	Procedure
1	Set the spectrum analyzer as shown below: Center Freq ..... 200 MHz Span ..... 10 kHz RBW (MANUAL) ..... 300 Hz Scale ..... LOG 10 dB/div VBW ..... 100 Hz Marker ..... NORMAL Zone Width ..... 1 div
2	Press the [→ RLV] key to match the peak of the signal trace to the top line (REF LEVEL) on the screen.
3	Press the [Single] key to execute a single sweep, then check that the single sweep has been completed.
4	After pressing the Measure key, selects Occ BW Measure.
5	After selecting X dB Down method, set it to 60 dB.
6	Set the Occupied Bandwidth to on state by operating menu key.
7	The 60 dB resolution bandwidth value is displayed in the upper left-hand corner of the screen. Fill in this value in the table on the next page.
8	Repeat steps 1 to 7 for the frequencies other than the resolution bandwidth 300 Hz and the frequency span 10 kHz according to the combinations of resolution bandwidth and frequency span shown in the table on the next page.
9	For the 3 dB bandwidth, too, write the value of the Resolution Bandwidth (3 dB) table on the preceding page in the table on the next page. And for each resolution bandwidth in the table on the next page, confirm that the value calculated from (60 dB BW/3 dB BW) is ≤15.



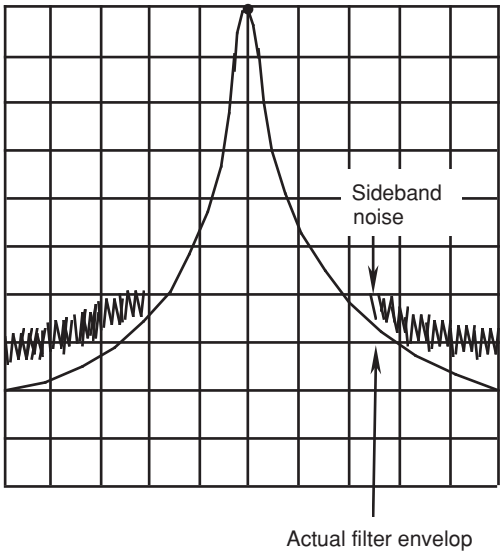
60 dB Bandwidth Measurement

Selectivity Test (60 dB/3 dB Bandwidth Ratio)

Setting the spectrum analyzer		Measured result		Calculated result
Resolution bandwidth	Span frequency	60 dB bandwidth	3 dB bandwidth	Selectivity (60 dB BW ÷ 3 dB BW)
300 Hz	10 kHz			
1 kHz	30 kHz			
3 kHz	100 kHz			
10 kHz	300 kHz			
30 kHz	1 MHz			
100 kHz	3 MHz			
300 kHz	10 MHz			
1 MHz	30 MHz			
3 MHz	100 MHz			
5 MHz	150 MHz			
10 MHz	200 MHz			
20 MHz	200 MHz			

Sideband phase noise

When the resolution bandwidth is set to a fixed value and a signal that has far less sideband-noise level than the equipment to be tested is input, check the level of the noise as compared to the peak signal (dBc) at the specified frequency away from the peak.



Since the average value is measured for noise level, use a video filter for measurement.

This sideband noise is a spectrum response which is modulated by the internal noise of the spectrum analyzer. If this response is large, the actual filter envelope is masked by the noise as shown, which makes measurement impossible.

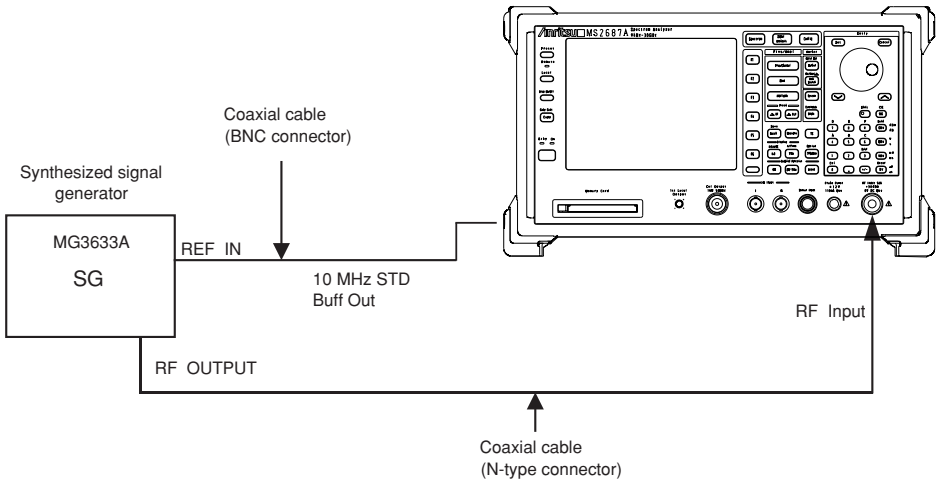
(1) Specification

• Sideband noise: ≤–108 dBc/Hz (Frequency: 1 GHz, 10 kHz offset)
≤–120 dBc/Hz (Frequency: 1 GHz, 100 kHz offset)

(2) Test instrument

• Signal generator: MG3633A Synthesized Signal Generator

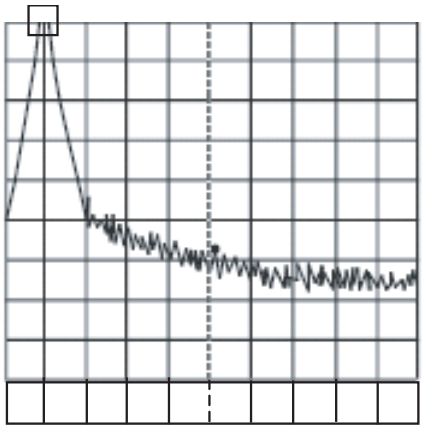
(3) Setup



Sideband Noise Test

(4) Procedure

Step	Procedure
1	Press the [Preset] key.
2	Operate All Cal.
3	Set the MG3633A output to 1000 MHz and 0 dBm.
4	Set the spectrum analyzer as shown below: Center Freq ..... 1.000 010 GHz Span ..... 25 kHz Reference Level ..... 0 dBm Attenuator ..... 10 dB RBW ..... 300 Hz VBW ..... 10 Hz DET MODE ..... SAMPLE
5	Press the [Peak Search] key to search for a peak point so that the peak point on the signal trace is included in the zone marker.
6	Press the [→ RLV] key to match the peak of the signal trace to the top line (REF LEVEL) on the screen.
7	After pressing the Measure key, select C/N Ratio Measure.
8	Press the Meas On key to start C/N measurement.
9	Set Zone Width of Marker to Spot.
10	Press the [Marker] key, then turn the rotary knob to move the zone marker to the right so that the zone center frequency is 10.0 kHz.
11	Set Reference Level to –10 dBm.
12	Repeat steps 4 to 11 for offset frequency 100 kHz according to the setup table below.



Sideband Noise Measurement

Frequency offset	Setting the spectrum analyzer				Measured result
	Center frequency	Span	RBW	VBW	
10 kHz	1.00001 GHz	25 kHz	300 Hz	10 Hz	
100 kHz	1.0001 GHz	250 kHz	10 kHz	10 Hz	

Frequency measurement accuracy

Set the marker point to the position at least 20 dB higher than the noise (or adjacent interference signal) to operate the built-in counter with the higher-S/N signal, and test the frequency measurement accuracy using Count On mode.

(1) Specifications

When S/N ≥ 20 dB, RBW ≤ 3 MHz

- Resolution: 1 Hz, 10 Hz, 100 Hz, 1 kHz

[MS2681A/MS2683A]

Accuracy: ≤ (Readout frequency × reference oscillator accuracy ± (1 count) ± 2 Hz)

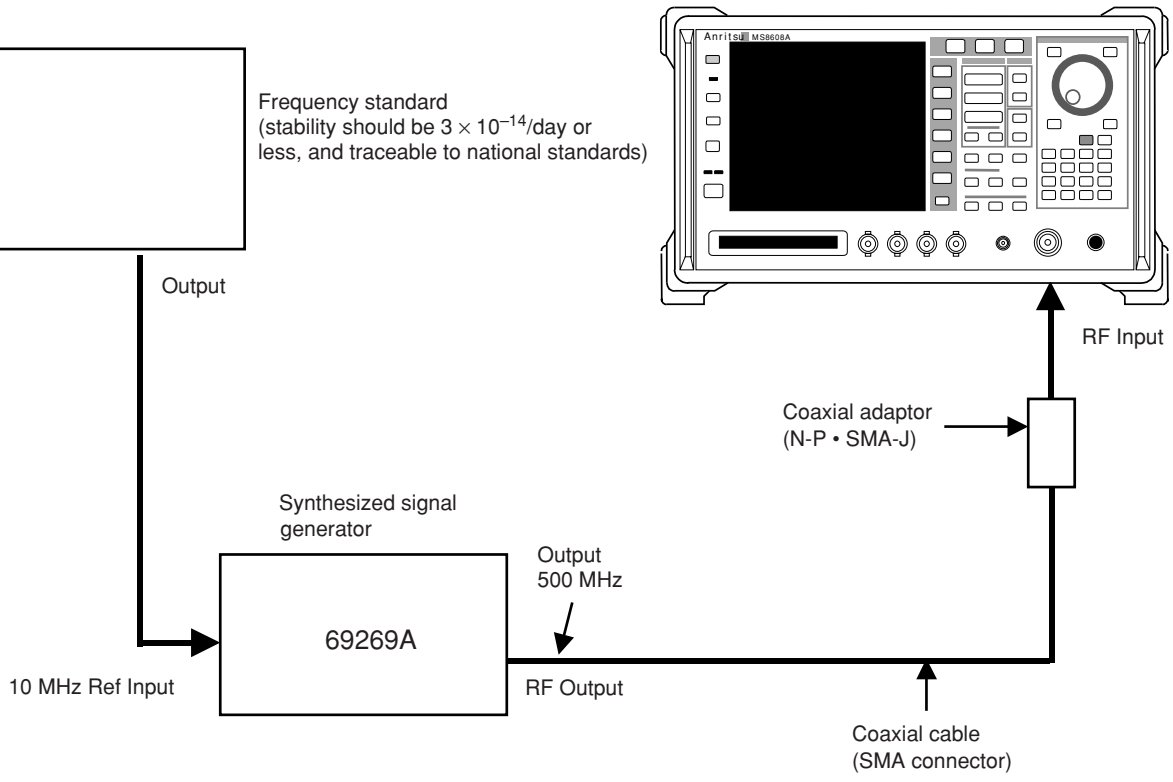
[MS2687A/MS2687B]

Accuracy: ≤ (Readout frequency × reference oscillator accuracy ± (1 count) ± 2 Hz × N)

(2) Test instrument

- Signal generator: 69269A
- Frequency standard

(3) Setup



Frequency Measurement Accuracy Test

Note:

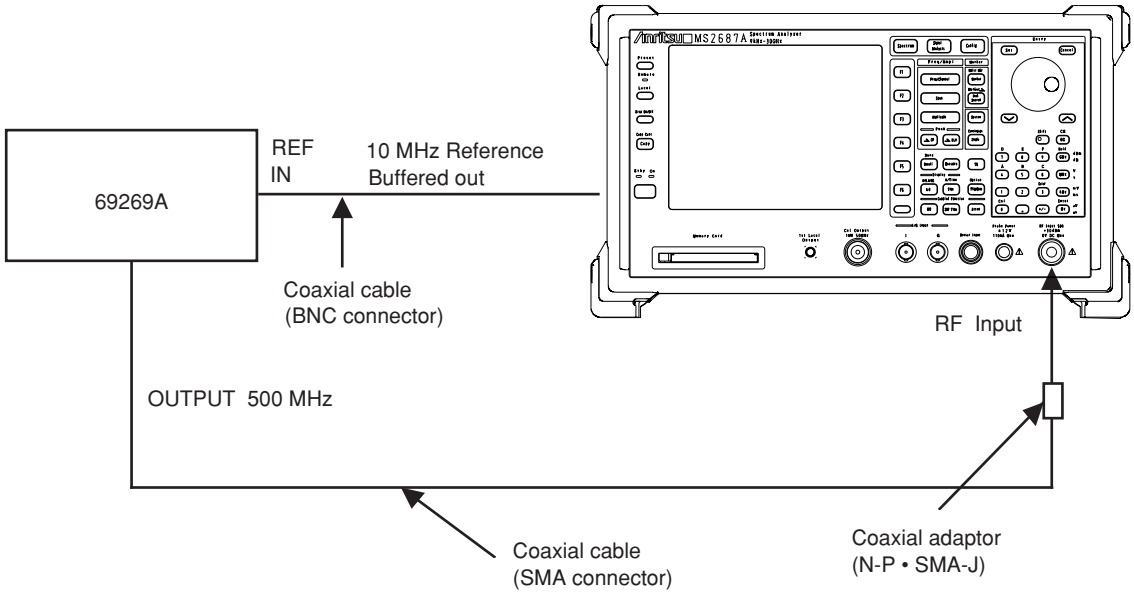
Even if there is not a Frequency standard, simplified test can be performed by setting up as shown in the figure below. In this case, the following specification is applied:

[MS2681A/MS2683A]

(± 1 count ± 2 Hz)

[MS2687A/MS2687B]

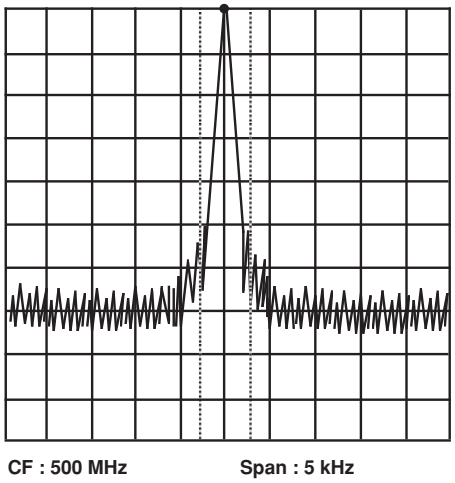
(± 1 count ± 2 Hz × N)



Frequency Measurement Accuracy Test

(4) Procedure

Step	Procedure
1	Press the [Preset] key.
2	Set the 69269A to 500 MHz and –10 dBm.
3	Set the spectrum analyzer as shown below: Center Freq ..... 500 MHz Span ..... 5 kHz
4	Press the [Measure] key and set to Frequency Count. Press Setup and set Resolution to 1 Hz. Then, press the Return key and set to Count On.
5	Confirm that the FREQ reading at the upper-left of the screen is the RF INPUT frequency 500 MHz ± 3 Hz or less.
6	Change the counter resolution to 10 Hz and confirm that the Freq reading is 500 MHz ±10 Hz or less.
7	• Change the counter resolution to 100 Hz and confirm that the Freq reading is 500 MHz ±100 Hz or less. • Change the counter resolution to 1 kHz and confirm that the Freq reading is 500 MHz ±1 kHz or less.



Frequency Measurement

Amplitude display linearity

Test the error per vertical graduation for the LOG display. For the LOG display linearity, test that the graduation is equal to the logarithm (dB) of the input signal level.

Input the correct level signal to the RF Input via an external attenuator and calculate the error from the attenuation of the attenuator and the Δ marker reading at the trace waveform peak.

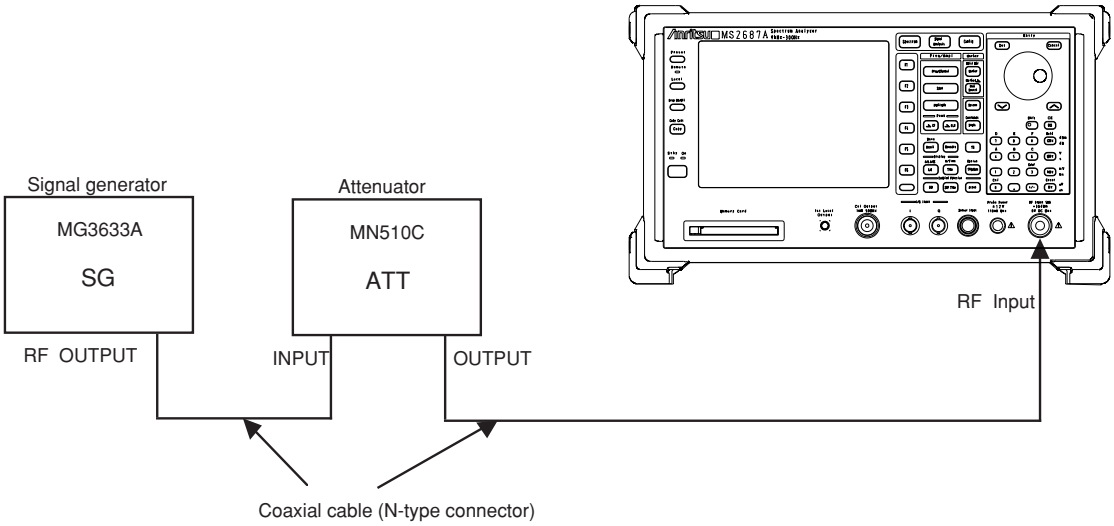
(1) Specification

- Amplitude display linearity: After automatic calibration
  LOG: ±1.0 dB for 0 to –90 dB, RBW ≤1 kHz
  ±0.4 dB for 0 to –20 dB, RBW ≤1 kHz

(2) Test instruments

- Signal generator: MG3633A
- Attenuator: MN510C

(3) Setup



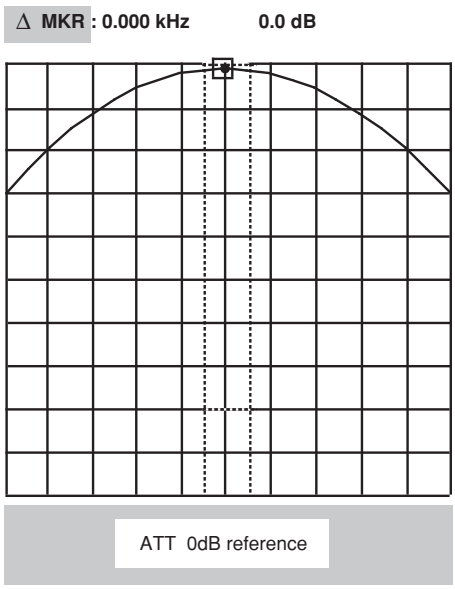
Amplitude Display Linearity Test

(4) Procedure

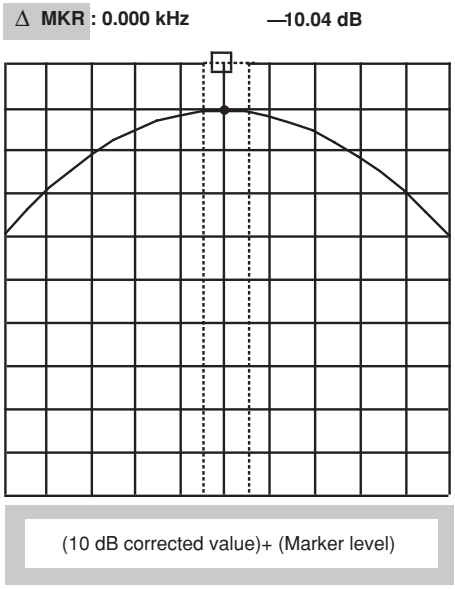
LOG display linearity

Step	Procedure
1	Press the [Preset] key.
2	Operate All Cal.
3	Set the MG3633A to 100 MHz, 0 dBm.
4	Set the MN510C to 0 dB.
5	Set the spectrum analyzer as shown below: Center Freq ..... 100 MHz Span ..... 10 kHz Reference Level ..... 0 dBm Attenuator ..... 10 dB RBW ..... 3 kHz VBW ..... 300 Hz
6	Press the [→ CF] key to set the spectrum waveform peak to the center of the screen.
7	Adjust the MG3633A output level so that the marker level reading is 0.0 dBm.
8	Press the [Marker] key sequentially to set the marker to Δ marker after the sweep is completed.

Step	Procedure
9	As shown on Fig. (b), read the level of the current marker when ATT is set at 10 dB. An error is determined as calibrated ATT 10 dB value +Δ marker level.
10	Add a marker level corresponding to the calibrated ATT value when ATT is set as 10 to 90 DB (with 10 dB steps) and determine the error.



(a) Reference Point Setting



(b) Δ Marker Level when ATT is 10

Log Display Linearity (10 dB/div)

ATT setting (dB)	A	B	Error (dB)=A+B
	ATT calibration value (dB)	Δ marker level (dB)	
0	0 (reference)	0 (reference)	0 (reference)
10	—	—	—
20	—	—	—
30	—	—	—
40	—	—	—
50	—	—	—
60	—	—	—
70	—	—	—
80	—	—	—
90	—	—	—

Frequency response

Generally, when one or more signals with a different frequency but the same amplitude are input, the spectrum analyzer displays the same amplitude for each spectrum on the screen.

(1) Specifications

[MS2681A]

- Frequency response
  Referred to 50 MHz, input attenuator = 10 dB, temperature range 18 to 28˚C
  ±0.6 dB (9 kHz to 3.0 GHz)
  Referred to 50 MHz, input attenuator = 10 to 62 dB
  ±1.0 dB (9 kHz to 3.0 GHz)

[MS2683A]

- Frequency response
  Referred to 50 MHz, input attenuator = 10 dB, temperature range 18 to 28˚C
  ±0.6 dB (9 kHz to 3.2 GHz, band 0)
  ±1.0 dB (3.15 to 7.8 GHz, band 1)
  Referred to 50 MHz, input attenuator = 10 to 62 dB
  ±1.0 dB (9 kHz to 3.0 GHz, band 0)
  ±2.0 dB (3.15 to 7.8 GHz, band 1)
  *At Band 1, after pre-selector tuning

[MS2687A]

- Relative flatness
  At input attenuator = 10 dB, refered to center point of maximum deviation movement point and minimum deviation movement point within band.
  ±1.0 dB (9 kHz to 3.2 GHz, band 0), ±1.5 dB (3.15 to 7.9 GHz, band 1)
  ±3.0 dB (7.8 to 15.2 GHz, band 2), ±4.0 dB (15.1 to 22.5 GHz, band 3)
  ±1.5 dB (22.4 to 30.0 GHz, band 4)
- Absolute flatness
  Referred to 50 MHz, input attenuator = 10 dB
  ±5.0 dB (9 kHz to 30.0 GHz)
  * At Band 1, 2, 3, 4, after pre-selector tuning

[MS2687A-22 [13 GHz Low Noise] loading]

- Relatice flatness
  At input attenuator=10 dB
  ±1.0 dB (9 kHz to 3.2 GHz, Band 0)
  ±1.5 dB (3.15 to 7.9 GHz, Band 1)
  ±3.0 dB (7.8 to 14.05 GHz, Band 1+ (n=2))
  ±4.0 dB (14.0 to 26.5 GHz, Band 2-)
  ±4.0 dB (26.4 to 30 GHz, Band 3-)
  * At Band1, 2, 3, after pre-selector tuning
- Absolute flatness
  Referred to 50 MHz, input attenuator=10 dB
  ±5.0 dB (9 kHz to 30 GHz)
  * At Band1, 2, 3, after pre-selector tuning

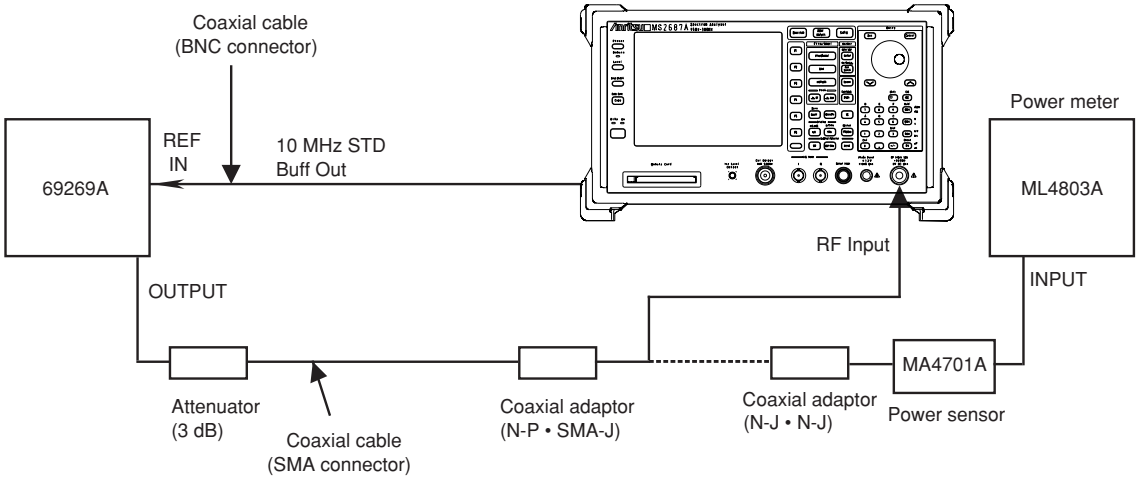
[MS2687B]

- Relative flatness
  At input attenuator = 10 dB, refered to center point of maximum deviation movement point and minimum deviation movement point within band.
  ±1.0 dB (9 kHz to 3.2 GHz, band 0), ±1.5 dB (3.15 to 7.9 GHz, band 1)
  ±3.0 dB (7.8 to 15.3 GHz, band 2)
  ±1.5 dB (15.2 to 30.0 GHz, band 4)
- Absolute flatness
  Referred to 50 MHz, input attenuator = 10 dB
  ±5.0 dB (9 kHz to 30.0 GHz)
  * At Band 1, 2, 4, after pre-selector tuning

(2) Test instruments

- Signal generator: 69269A
- Power meter: ML4803A
- Power sensor: MA4701A

(3) Setup



Frequency Response Test

(4) Precaution

This test should be performed at an ambient temperature of 10 to 28°C after allowing the instrument to warm up for 60 minutes or more.

(5) Procedure

(a) Calibration of signal-generator 69269A

Step	Procedure
1	Set the 69269A as shown below: OUTPUT FREQ ..... 50 MHz OUTPUT LEVEL ..... –6 dBm
2	Connect the 69269A output to the power sensor input with a coaxial cable.
3	Read the power meter display.
4	Change the 69269A output frequency as shown in the tables on the next page and read the power meter display with level at 50 MHz as reference. This data is the calibration data.

(b) Readout of measured amplitude deviation (frequency response)

Step	Procedure
1	Connect the 69269A OUTPUT to the spectrum analyzer RF Input with a coaxial cable.
2	Press the [Preset] key of the spectrum analyzer.
3	Perform all calibration.
4	Set the spectrum analyzer as shown below: Center Freq ..... 50 MHz Span ..... 200 kHz Reference Level ..... –10 dBm
5	Press the [→ CF] key.
6	Set the marker mode to delta marker.
7	Set the spectrum analyzer center frequency as shown in the tables on the next page, then obtain the deviation from the formula below by reading the delta marker level at each frequency. Deviation = Delta marker level reading - Measurement frequency calibration value For Band 1- and 1+, the pre-selector is peaked. (See Chapter 8 of Vol.2, “Detailed Panel Operation.”)

Frequency Response (Band 0)

Frequency	Calibration value (dBm)	Marker level (dB)	Deviation (dB)
50 MHz	0 (reference)	0 (reference)	0 (reference)
200 MHz	_____	_____	_____
500 MHz	_____	_____	_____
1 GHz	_____	_____	_____
1.5 GHz	_____	_____	_____
2 GHz	_____	_____	_____
3 GHz	_____	_____	_____

Frequency Response (Band 1-)

Frequency	Calibration value (dBm)	Marker level (dB)	Deviation (dB)
3.2 GHz	_____	_____	_____
4 GHz	_____	_____	_____
5 GHz	_____	_____	_____
6 GHz	_____	_____	_____
6.2 GHz	_____	_____	_____

Frequency Response (Band 1+)

Frequency	Calibration value (dBm)	Marker level (dB)	Deviation (dB)
6.3 GHz	_____	_____	_____
7 GHz	_____	_____	_____
7.5 GHz	_____	_____	_____
7.8 GHz	_____	_____	_____

Reference level accuracy

Here the absolute amplitude level at 50 MHz is tested. Confirm the level accuracy after inputting an SG output (calibrated by a standard power meter) to this unit.

(1) Specification

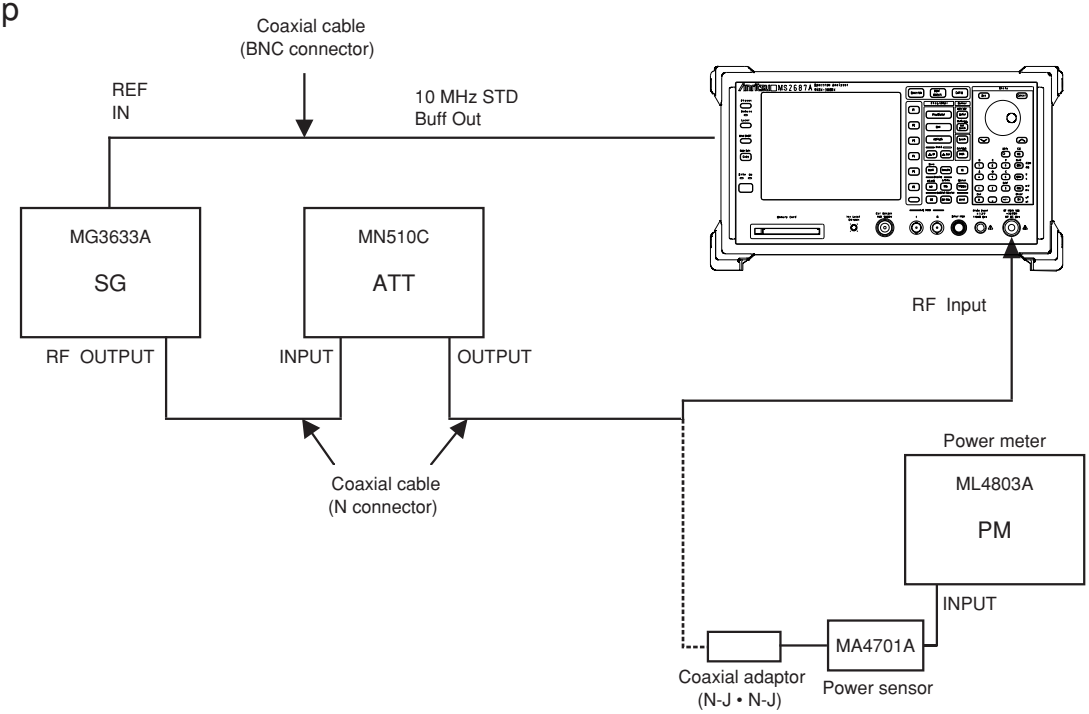
- Reference level accuracy: At 50 MHz frequency and 1 MHz span after automatic calibration (Resolution bandwidth, video bandwidth, RF ATT and sweep time set to AUTO)

  ≤ ± 0.5 dB (0 to –49.9 dBm)
  ≤ ± 0.75 dB (–69.9 to –50 dBm, 0.1 to +30 dBm)
  ≤ ± 1.5 dB (–80 to –70 dBm)

(2) Test instruments

- Signal generator: MG3633A
- Attenuator: MN510C
- Power sensor: MA4701A
- Power meter: ML4803A

(3) Setup



Reference Level Accuracy Test

(4) Precautions

1) Set the resolution bandwidth, video bandwidth, RF ATT and sweep time to Auto.
2) This test should be performed after warming up this instrument for 60 minutes or more.

(5) Procedure

Step	Procedure
1	Press the spectrum analyzer [Preset] key.
2	Operate All Cal.
3	Connect the attenuator OUTPUT to the power sensor input.
4	Set the SG frequency to 50 MHz and adjust the SG level so that the power meter indication is 0 dBm. At this time, set the attenuator to 0 dB.
5	Connect the attenuator OUTPUT to the spectrum analyzer RF Input connector.
6	Set the spectrum analyzer as shown below: Center Freq ..... 50 MHz Span ..... 1 MHz Reference Level ..... 0 dBm
7	Press the [→ CF] to move the peak point of the spectrum waveform to the center of the screen.
8	Read the marker level.

Step	Procedure

9 Change the attenuator in 10 dB steps, set the reference level as shown in the table below and read the marker level each time.

Reference level setting	Marker readout	Correction factor of ATT	Error
0 dBm	dBm	dB	dB
–10 dBm	dBm	dB	dB
–20 dBm	dBm	dB	dB
–30 dBm	dBm	dB	dB
–40 dBm	dBm	dB	dB
–50 dBm	dBm	dB	dB
–60 dBm	dBm	dB	dB
–70 dBm	dBm	dB	dB
–80 dBm	dBm	dB	dB

10 Calculate the error from the following equation.

Error = Marker readout - reference level set value - correction factor of ATT

Average noise level

The internal noise distributed evenly in proportion to the resolution bandwidth over the whole measurement frequency band is called the average noise level.

(1) Specification

- Average noise level

  At RBW=300 Hz, VBW = 1 Hz, Detection mode: Sample, input attenuator = 0 dB

[MS2681A]

≤–124 dBm + f [GHz] dB (1 MHz to 2.5 GHz, band 0)

≤–120 dBm + f [GHz] dB (2.5 to 3.0 GHz)

[MS2683A]

≤–124 dBm + f [GHz] dB (1 MHz to 2.5 GHz, band 0)

≤–120 dBm + f [GHz] dB (2.5 to 3.2 GHz, band 0)

≤–122 dBm + 0.5 × f [GHz] dB (3.15 to 7.8 GHz, band 1)

[MS2687A]

≤–124 dBm + f [GHz] dB (1 MHz to 2.5 GHz, band 0)

≤–120 dBm + f [GHz] dB (2.5 to 3.2 GHz, band 0)

≤–115 dBm (3.15 to 7.9 GHz, band 1), ≤ –107 dBm (7.8 to 15.2 GHz, band 2)

≤–103 dBm (15.1 to 22.5 GHz, band 3), ≤–96 dBm (22.4 to 30.0 GHz, band 4)

[MS2687A-22 [13 GHz Low Noise] loading]

≤–124 dBm + f [GHz] dB (1 MHz to 2.5 GHz, Band 0)

≤–120 dBm + f [GHz] dB (2.5 to 3.2 GHz, Band 0)

≤–115 dBm (3.15 to 7.9 GHz, Band 1)

≤–113 dBm (7.8 to 14.05 GHz, Band 1+ (n=2))

≤–105 dBm (14.0 to 26.5 GHz, Band 2-)

≤–101 dBm (26.4 to 30 GHz, Band 3-)

[MS2687B]

≤–124 dBm + f [GHz] dB (1 MHz to 2.5 GHz)

≤–120 dBm + f [GHz] dB (2.5 to 3.2 GHz, band 0)

≤–115 dBm (3.15 to 7.9 GHz, band 1)

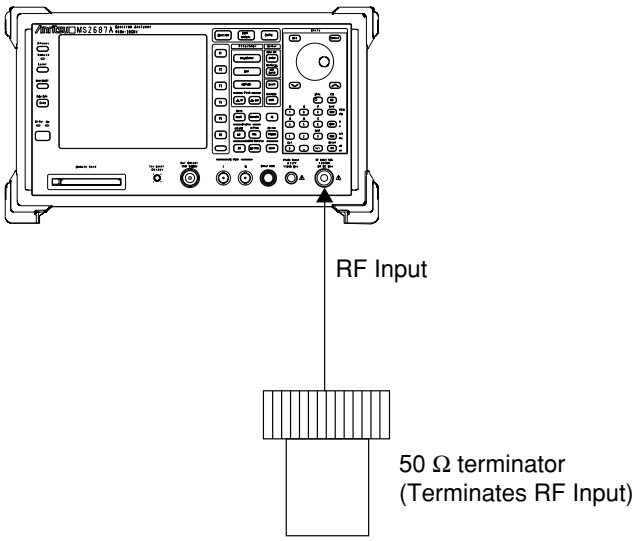
≤–112 dBm (7.8 to 15.3 GHz, band 2)

≤–103 dBm (15.2 to 30 GHz, band 4)

(2) Test instrument

- 50 Ω terminator: MP752A

(3) Setup



Average Noise Level Test

(4) Procedure

Step	Procedure
1	Press the [Preset] key of the spectrum analyzer.
2	Operate All Cal.
3	Terminate the RF Input with a 50 Ω terminator.
4	Set the spectrum analyzer as shown below (Time Domain): Band ..... 0 Center Freq ..... 1 MHz Span ..... 0 Hz Reference Level ..... –100 dBm RBW ..... 300 Hz VBW ..... 1 Hz Attenuator ..... 0 dB Detection ..... Sample
5	Press [Time], Storage, Average and Average Count keys in order and set the average count to 16.
6	Press the Continue key to start the averaging, and wait until the 16-time averaging sweep is completed.
7	Press the [Peak Search] key to execute peak search. At this point, read the level value at the marker.

Step	Procedure

8 The marker reading is the average noise level.

Setting the spectrum analyzer		Measured result
Band	Center frequency	
0	1 MHz	
	99 MHz	
	499 MHz	
	999 MHz	
	1499 MHz	
	1999 MHz	
	2499 MHz	
	2999 MHz	
	3199 MHz	
1-	3201 MHz	
	3499 MHz	
	3999 MHz	
	4499 MHz	
	4999 MHz	
	6299 MHz	
1+	6201 MHz	
	6499 MHz	
	6999 MHz	
	7799 MHz	
2+	7701 MHz	
	8499 MHz	
	9499 MHz	
	10499 MHz	
	11499 MHz	
	12499 MHz	
	13499 MHz	
	14499 MHz	
	15299 MHz	
4+ (or 3+ for MS2687A)	15201 MHz	
	15499 MHz	
	16499 MHz	
	17499 MHz	
	18499 MHz	
	19499 MHz	
1+	20499 MHz	
	21499 MHz	
	22499 MHz	
	23499 MHz	
4+	24499 MHz	
	25499 MHz	
	26499 MHz	
	27499 MHz	
	28499 MHz	
	29499 MHz	
	29999 MHz	

Note:

Center frequency is in the range from 1 to 7799 MHz for the 2683A, and from 1 to 2999 MHz for the MS2687A/MS2687B.

9 Repeat steps 4 to 7 while setting Band and Center Freq from the below table so that the average noise level can be obtained.

Second harmonic distortion

Even if a signal without harmonic distortion is input to a spectrum analyzer, the higher harmonics are generated by the analyzer input-mixer non-linearity and are displayed on the screen.

The second harmonic level is the highest harmonic displayed on this unit. The main point of the test is to apply a signal (with a distortion that is lower than the spectrum analyzer internal harmonic distortion [at least 20 dB below]) to the spectrum analyzer and measure the level difference between the fundamental wave and the second harmonic. If a low-distortion signal source cannot be obtained, apply a low-distortion signal to the spectrum analyzer after passing the signal through a low-pass filter (LPF).

(1) Specification

- Second harmonic distortion:

[MS2681A/MS2683A]

At mixer input level –30 dBm:

≤–60 dBc (10 to 200 MHz, Band 0)

≤–75 dBc (0.2 to 0.85 GHz, Band 0)

≤–70 dBc (0.85 to 1.6 GHz, Band 0)

At mixer input level –10 dBm:

≤–90 dBc (1.6 to 3.9 GHz, Band 1-/1+)

[MS2687A/MS2687B]

At mixer input level –30 dBm:

≤–60 dBc (input frequency 10 to 200 MHz, Band 0)

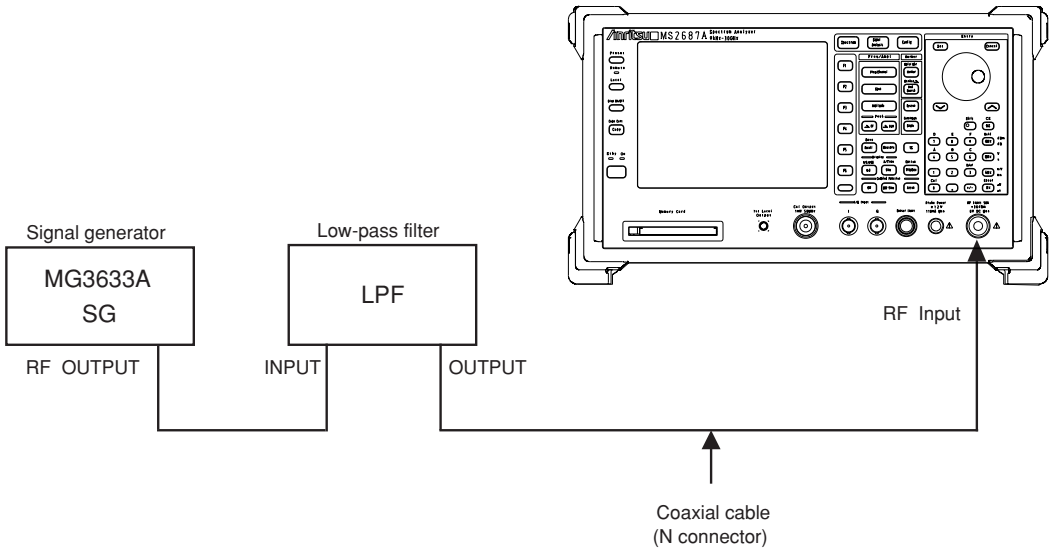
≤–70 dBc (0.2 to 1.6 GHz, Band 0)

≤–90 dBc or below average noise level (1.6 to 15 GHz)

(2) Test instruments

- Signal generator: MG3633A
- LPF: With attenuation of 70 dB or more at twice the fundamental frequencies

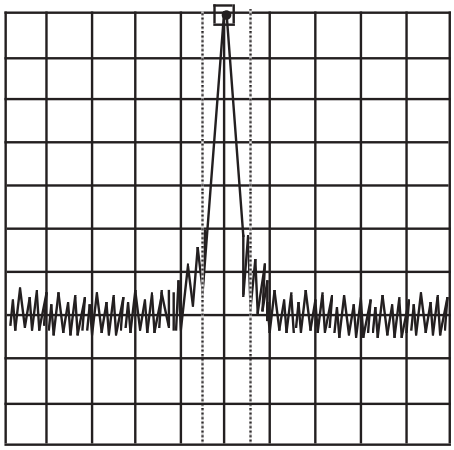
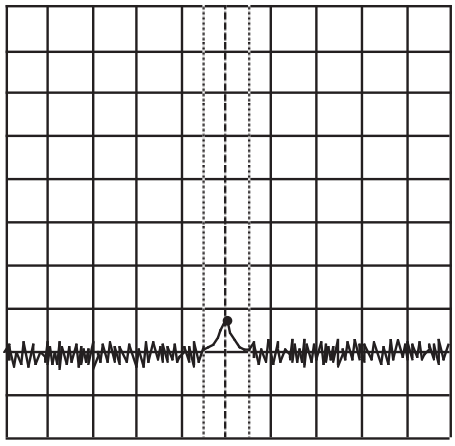
(3) Setup



Second Harmonic Distortion Test

(4) Procedure

Step	Procedure
1	Press the [Preset] key.
2	Operate All Cal.
3	Connect the LPF VLF-141 (fp=50 MHz)
4	Set the SG output frequency to 48 MHz and the output level to –20 dBm.
5	Set the spectrum analyzer as shown below: Center Freq ..... 48 MHz Span ..... 10 kHz Reference Level ..... –20 dBm Attenuator ..... 10 dB
6	Adjust the SG output level so that peak of the spectrum waveform is at the REF LEVEL (the top horizontal line of the screen).

Step	Procedure
7	Move the marker to the peak of the spectrum waveform and make the marker the Δ marker. 
8	Set the center frequency to twice the fundamental wave frequency to display the second harmonic on the screen. The Δ marker reading indicates the level difference between the fundamental wave and the second harmonic. If the level difference is 80 dB or more, set the REF LEVEL to –50 dBm. Confirm that the ATT set value is 0 dB. 
9	Connect the LPF VLF-141 (fp=800 MHz)
10	Set the SG as follows: OUTPUT FREQ ..... 780 MHz OUTPUT LEVEL ..... –20 dBm
11	Set the spectrum analyzer as follows: Center Freq ..... 780 MHz Span ..... 10 kHz Reference Level ..... –20 dBm Attenuator ..... 10 dB
12	Repeats steps 6 to 8.

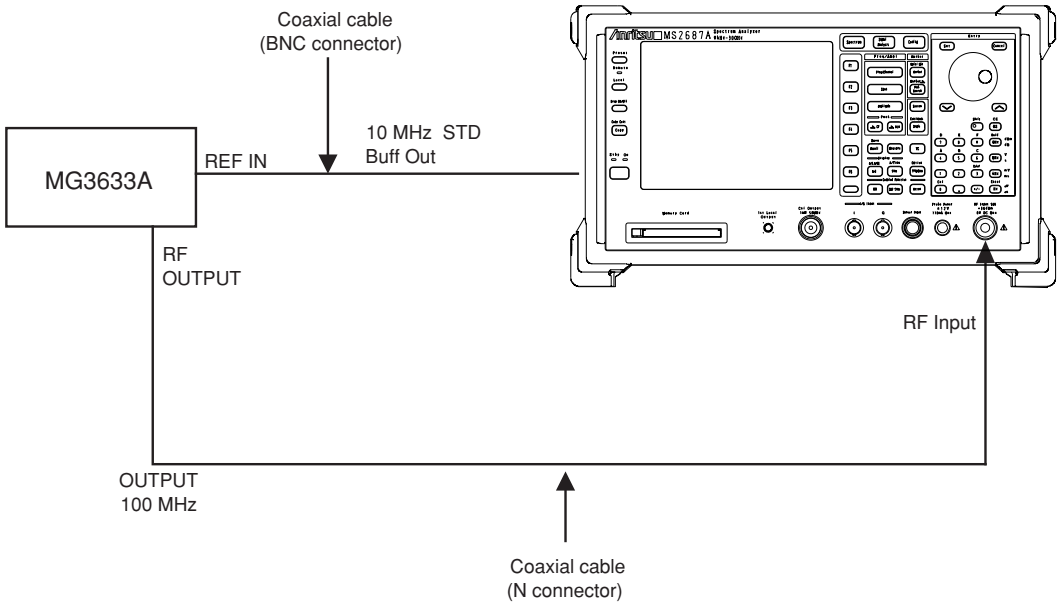
Resolution bandwidth (RBW) switching uncertainty

When the resolution bandwidth (RBW) is switched, its level error at the peak point is measured.

(1) Specification

- Resolution bandwidth switching uncertainty: ± 0.3 dB (RBW=300 Hz to 5 MHz)
  (referenced to RBW: 3 kHz)
  ± 0.5 dB (RBW=10 MHz, 20 MHz)

(2) Setup



Resolution Bandwidth Switching Error Test

(4) Procedure

Step	Procedure
1	Press the [Preset] key of the spectrum analyzer.
2	Operate All Cal.
3	Set the signal generator MG3633A as shown below. OUTPUT FREQ ..... 100 MHz OUTPUT LEVEL ..... 0 dBm
4	Set the spectrum analyzer as shown below. Center Freq ..... 100 MHz Span ..... 15 kHz Reference Level ..... 0 dBm RBW ..... 3 kHz
5	Press the [→ CF] key to move the signal spectrum peak to the center.
6	Press the [Marker] key in that order to set the marker to Δ marker.
7	Set RBW and SPAN as shown in the table on the next page and measure the level deviation (error) of each RBW by following steps 8 and 9 below.
8	Press the [Peak Search] key to conduct peak search and move the current marker to the peak point of the signal spectrum.
9	Read the Δ marker level value.

Resolution bandwidth (RBW) switching uncertainty

Setting the spectrum analyzer		Measured result
Resolution bandwidth	Frequency span	Δ marker readout
300 Hz	2 kHz	
1 kHz	5 kHz	
3 kHz	15 kHz	
10 kHz	50 kHz	
30 kHz	150 kHz	
100 kHz	500 kHz	
300 kHz	1.5 MHz	
1 MHz	5 MHz	
3 MHz	15 MHz	
5 MHz	25 MHz	
10 MHz	50 MHz	
20 MHz	100 MHz	

Input attenuator (RF ATT) switching uncertainty

At this point, measure the switching error when the amount of attenuation in the RF input section is switched. When the input attenuator is switched, IF-section step-amplifier gain is switched. To keep this step-amplifier gain constant, the reference level is switched according to the amount of input attenuator attenuation.

(1) Specification

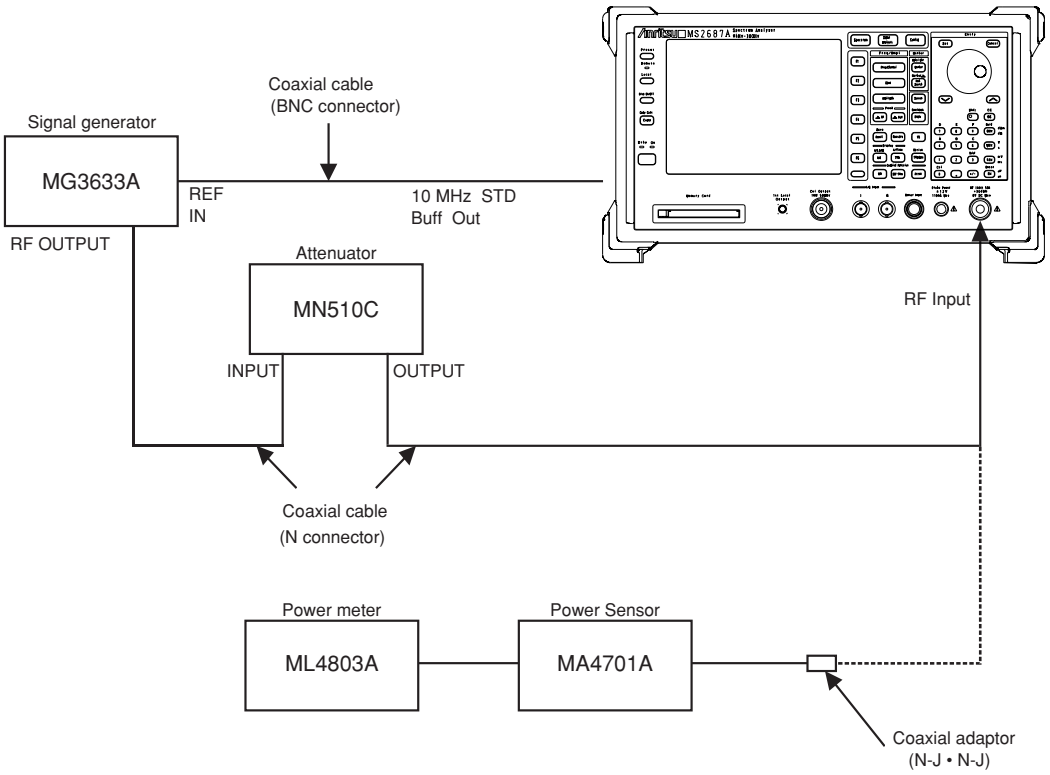
Referenced to 50 MHz, RF ATT 10 dB

- Input attenuator switching error: ±0.3 dB (at 10 to 50 dB)
  ±0.5 dB (at 52 to 62 dB)

(2) Test instruments

- Signal generator: MG3633A
- Attenuator: MN510C
- Power meter: ML4803A
- Power sensor: MA4701A

(3) Setup



Input Attenuator Switching Error Test

(4) Procedure

Step	Procedure
1	Press the [Preset] key of the spectrum analyzer.
2	Operate All Cal.
3	Set the spectrum analyzer as shown below: Center Freq ..... 100 MHz Span ..... 200 kHz
4	Set the signal generator MG3633A as shown below: OUTPUT FREQ ..... 100 MHz OUTPUT LEVEL ..... –10 dBm
5	Set the amount of attenuation of the attenuator MN510C to 0 dB.
6	Connect the output of the attenuator MN510C to the power meter via coaxial cable.
7	Adjust the signal-generator output level so that the indicated value of the power meter is –10.0 dBm.
8	Connect the coaxial cable of the attenuator output to the spectrum analyzer RF Input.
9	Press the [→ CF] key.
10	Set the reference level to –10 dBm and attenuation to 50 dB.
11	Read the marker level.
12	Set Reference Level, RF ATT of this device and the external ATT as shown in the table on the next page, and read the level of each marker.
13	Find the error by the formula below: Error = marker readout - Reference Level - correction factor of attenuator
14	Find the deviation by the formula below: Deviation = Error - error when RF ATT at 10 dB

Setting MS2683A		Attenuator		Measured result	Calculated result	
Ref Level	Input attenuator	Setting	Correction	Marker level	Error	Deviation
–10 dBm	60 dB	0 dB				
–20 dBm	50 dB	10 dB				
–30 dBm	40 dB	20 dB				
–40 dBm	30 dB	30 dB				
–50 dBm	20 dB	40 dB				
–60 dBm	10 dB	50 dB				0 dB(reference)

Frequency domain sweep time accuracy

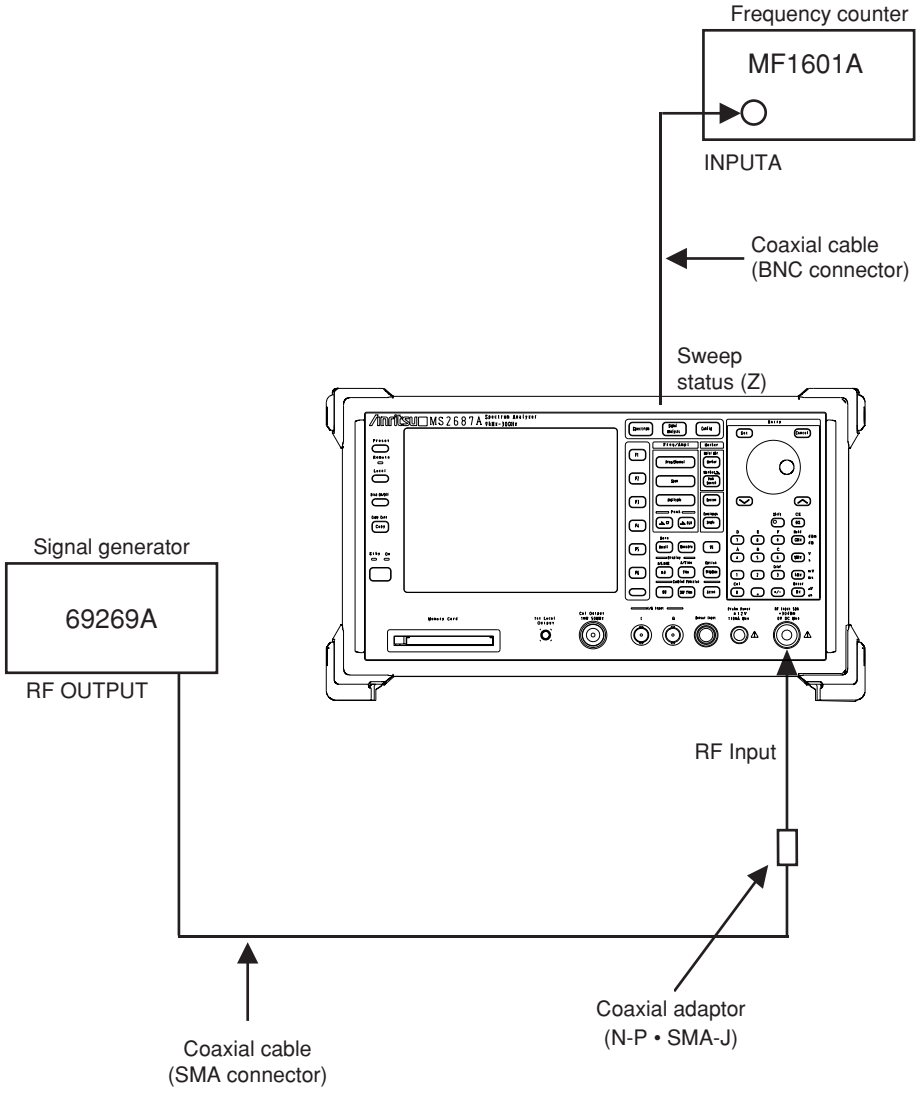
(1) Specification

- Sweep time accuracy: ±3% (10 msec to 100 sec)

(2) Test instruments

- Signal generator: 69269A
- Frequency counter: MF1601A

(3) Setup



Sweep Time Accuracy

(4) Procedure

Test procedure 1: sweep time ≥100 ms

Step	Procedure
1	Press the [Preset] key of the spectrum analyzer.
2	Operate All Cal.
3	Connect the Sweep Status (Z) output of spectrum analyzer to Input A of MF1601A.
4	Set the MS2681A/MS2683A/MS2687A/MS2687B spectrum analyzer as shown below: Center Frequency ..... 300 MHz Span ..... 2 MHz Ref Level ..... 0 dBm RBW ..... 3 MHz VBW ..... Auto Detection ..... Sample Sweep Time ..... 100 ms
5	Set the MF1601A as shown below: Input ..... A Function ..... Pulse width Couple ..... DC Slope ..... Rise
6	Press the [Single] key of the spectrum analyzer.
7	Reset the MF1601A.
8	Press the [Single] key of the spectrum analyzer, and measure the pulse width of sweep status output.
9	Repeats steps 6 to 8 at each sweep time of below table.

Setting the spectrum analyzer Sweep time	Measured result
100 ms	
500 ms	
10 s	
100 s	

Test procedure 2: sweep time <100 ms

Step	Procedure
1	Press the [Preset] key of the spectrum analyzer.
2	Operate All Cal.
3	Connect the output of 69269A to the spectrum analyzer according to setup figure.
4	Set the MS2681A/MS2683A/MS2687A/MS2687B spectrum analyzer as shown below: Center Frequency ..... 300 MHz Span ..... 2 MHz Ref Level ..... 0 dBm RBW ..... 3 MHz VBW ..... Auto Detection ..... Sample Sweep Time ..... 50 ms Marker Zone Width ..... 100 kHz
5	Set the 69269A as shown below. Frequency ..... 300 MHz Pulse Modulation ..... On Period ..... 5 ms Width ..... 20 µs Output Level ..... 0 dBm
6	Press the [Single] key of the spectrum analyzer.
7	Move the marker to the left most peak of the screen.
8	Set the marker mode to Δ marker and move the current Δ marker to the right.
9	Move the Δ marker to the 8th peak point and read the frequency difference of the Δ marker.
10	Calculate the actual sweep time using the below equation. (Actual sweep time) = ((frequency difference) ÷ (2 MHz)) × (Pulse Period)) ÷ 0.8
11	Repeats steps 6 to 10 at each sweep time and setting the pulse period of below table.

Setting the spectrum analyzer	Signal generator	Measured result	Calculated result
Sweep time	Pulse Period	Frequency difference	Actual sweep time
50 ms	5 ms		
20 ms	2 ms		
10 ms	1 ms		

Time domain sweep time accuracy

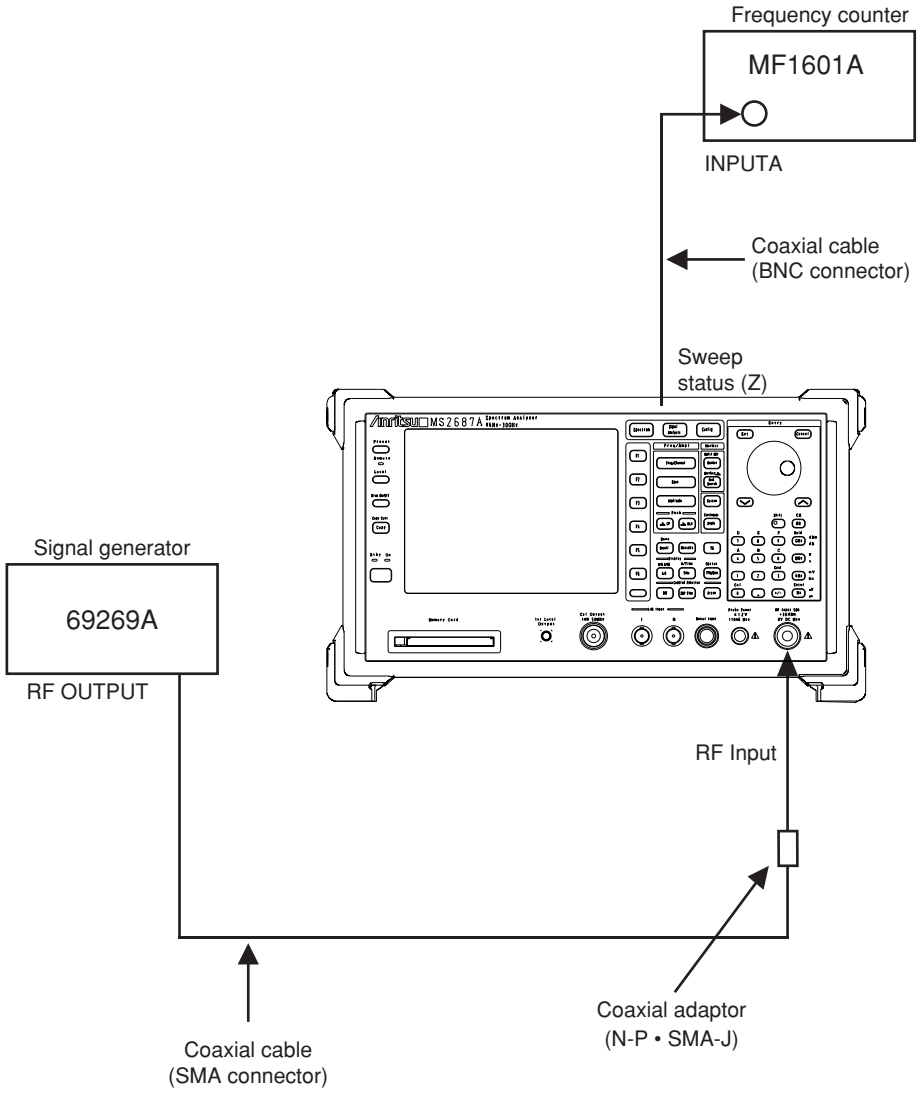
(1) Specification

- Time domain sweep time accuracy: ±1.0%

(2) Test instruments

- Signal generator: 69269A
- Frequency counter: MF1601A

(3) Setup



Sweep Time Accuracy

Test procedure 1: Sweep time ≥100 ms

Step	Procedure
1	Press the [Preset] key of the spectrum analyzer.
2	Operate All Cal.
3	Connect the Sweep Status (Z) output of spectrum analyzer to Input A of MF1601A.
4	Set the MS2681A/MS2683A/MS2687A/MS2687B spectrum analyzer as shown below: Center Frequency ..... 300 MHz Span ..... 0 MHz Ref Level ..... 0 dBm RBW ..... 5 MHz VBW ..... Off Detection ..... Sample Sweep Time ..... 100 ms
5	Set the MF1601A as shown below: Input ..... A Function ..... Pulse width Couple ..... DC Slope ..... Rise
6	Press the [Single] key of the spectrum analyzer.
7	Reset the MF1601A.
8	Press the [Single] key of the spectrum analyzer, and measure the pulse width of sweep status output.
9	Repeats steps 6 to 8 at each sweep time of below table.

Setting the spectrum analyzer	Measured result
Sweep time	Pulse width
100 ms	
500 ms	
10 s	
100 s	

Test procedure 2: Sweep time <100 ms

Step	Procedure
1	Press the [Preset] key of the spectrum analyzer.

2 Operate All Cal.

3 Connect the output of 69269A to the spectrum analyzer according to setup figure.

4 Set the MS2681A/MS2683A/MS2687A/MS2687B spectrum analyzer as shown below:

Center Frequency ..... 300 MHz
Span ..... 0 MHz
Ref Level ..... 0 dBm
RBW ..... 5 MHz
VBW ..... Off
Detection ..... Sample
Sweep Time ..... 50 ms
Display Line ..... On, Absolute
Display Line ..... –20 dB

5 Set the 69269A as shown below.
Pulse Modulation ..... On
Period ..... 5 ms
Width ..... 2.5 ms
Output Level ..... 0 dBm

6 Press the [Single] key of the spectrum analyzer.

7 As shown below figure, shift the marker to the point which is most left of the screen, and where intersect display line and up-slope of wave.

8 Set the marker mode to Δ marker.

9 Move the current Δ marker to the right and the 8th point where intersect display line and up-slope of wave, and read the difference time of the Δ marker.

10 Repeats steps 6 to 9 at each sweep time and setting the pulse period, width of the table below.

Spectrum analyzer	Signal generator		Measured result
Sweep time	Pulse Period	Pulse Width	
50 ms	5 ms	2.5 ms	
20 ms	2 ms	1 ms	
10 ms	1 ms	0.5 ms	
5 ms	0.5 ms	0.25 ms	
1 ms	0.1 ms	50 µs	
100 µs	10 µs	5 µs	
10 µs	1 µs	0.5 µs	

Service

If the instrument is damaged or does not operate as specified, contact your nearest Anritsu dealer or business office for repair. When you request repair, provide the following information:

(a) Model name and serial number on rear panel

(b) Fault description

(c) Name of a personnel-in-charge and address for contact when fault confirmed or at a completion of repair

Section 7 Storage and Transportation

This section describes the long-term storage, repacking and transportation of MS2681A/MS2683A/MS2687A/MS2687B as well as the regular care procedures and the timing.

Cleaning Cabinet

Always turn the spectrum analyzer POWER switch OFF and disconnect the power plug from the AC power inlet before cleaning the cabinet. To clean the external cabinet:

- Use a soft, dry cloth for wiping off.
- Use a cloth moistened with diluted neutral cleaning liquid if the instrument is very dirty or before long-term storage.
  After ensuring that the cabinet has been thoroughly dried, use a soft, dry cloth for wiping off.
- If loose screws are found, tighten them with the appropriate tools.

CAUTION ⚠

Never use benzene, thinner, or alcohol to clean the external cabinet; it may damage the coating, or cause deformation or discoloration.

Storage Precautions

This paragraph describes the precautions to take for long-term storage of the MS2681A/MS2683A/MS2687A/MS2687B Spectrum Analyzer.

Precautions before storage

(1) Before storage, wipe dust, finger-marks, and other dirt off the spectrum analyzer.

(2) Avoid storing the spectrum analyzer where:

1) It may be exposed to direct sunlight or high dust levels.
2) It may be exposed to high humidity.
3) It may be exposed to active gases.
4) It may be exposed to extreme temperatures (>60°C , <–20°C) or high humidity (≥90%).

Recommended storage precautions

The recommended storage conditions are as follows:

- Temperature ..... 0 to 30°C
- Humidity ..... 40% to 80%
- Stable temperature and humidity over 24-hour period

Repacking and Transportation

The following precautions should be taken if the MS2681A/MS2683A/MS2687A/MS2687B Spectrum Analyzer must be returned to Anritsu Corporation for servicing.

Repacking

Use the original packing materials. If the spectrum analyzer is packed in other materials, observe the following packing procedure:

(1) Wrap the spectrum analyzer in a plastic sheet or similar material.
(2) Use a cardboard, wooden box, or aluminum case which allows shock-absorbent material to be inserted on all sides of the equipment.
(3) Use enough shock-absorbent material to protect the spectrum analyzer from shock during transportation and to prevent it from moving in the container.
(4) Secure the container with packing straps, adhesive tape or bands.

Transportation

Do not subject the spectrum analyzer to severe vibration during transport. It should be transported under the storage conditions recommended before.

Appendixes

Appendix A Front and Rear Panel Layout

This appendix shows the front and rear panel layout.

Fig. NO.	Name
Fig. A-1	MS2681A Front Panel
Fig. A-2	MS2681A Rear Panel
Fig. A-3	MS2683A Front Panel
Fig. A-4	MS2683A Rear Panel
Fig. A-5	MS2687A Front Panel
Fig. A-6	MS2687A Rear Panel
Fig. A-7	MS2687B Front Panel
Fig. A-8	MS2687B Rear Panel

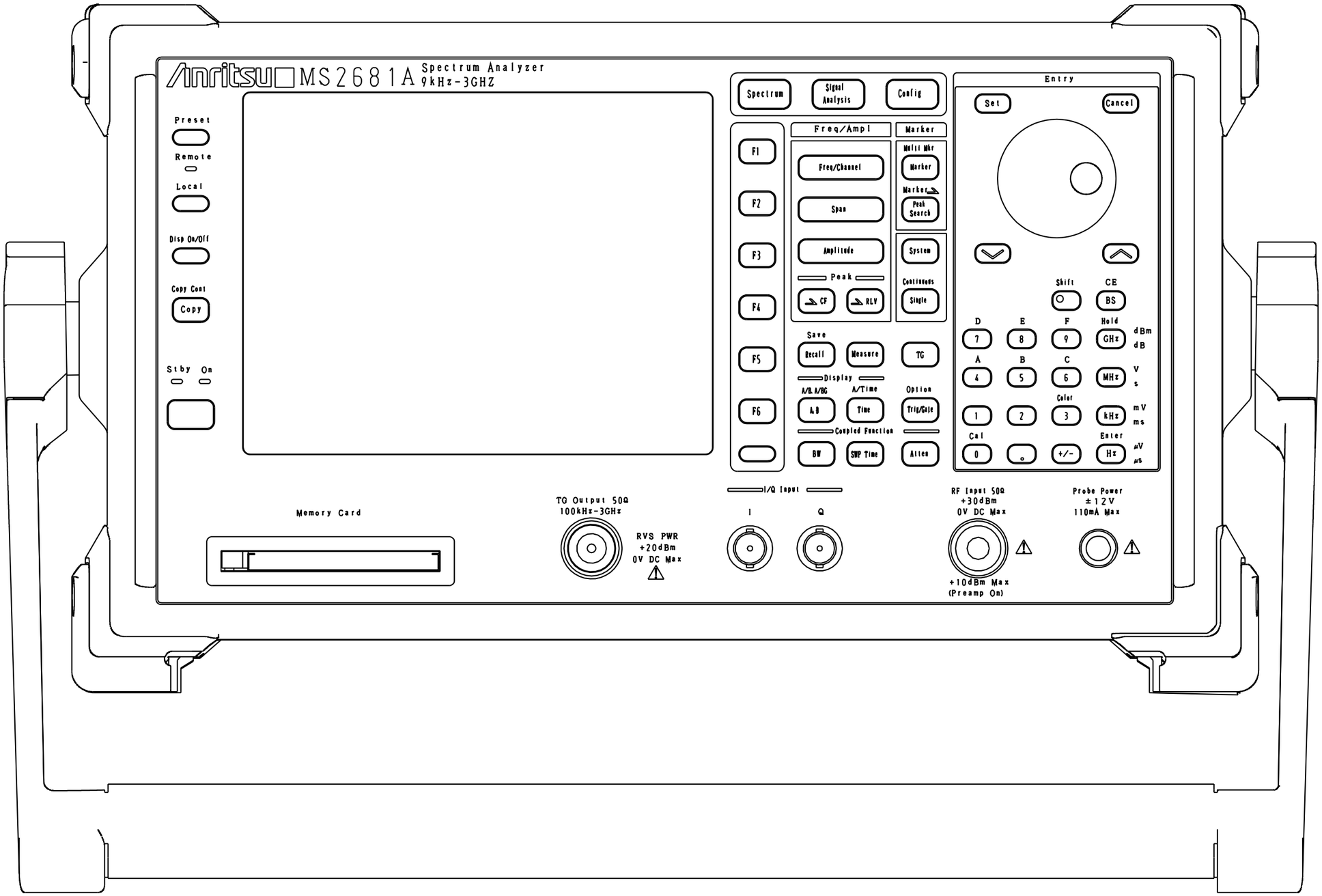


Fig. A-1 MS2681A Front Panel

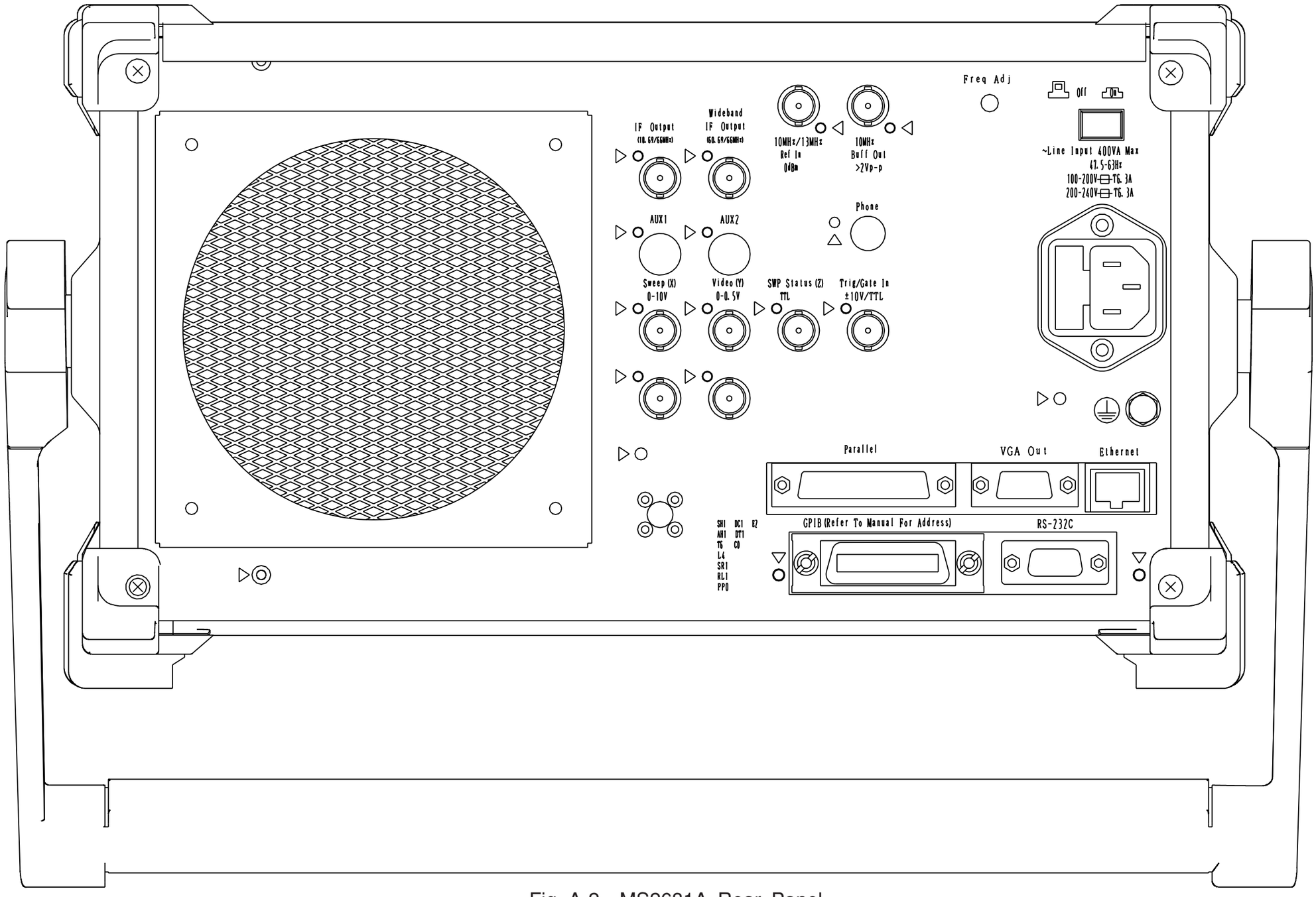


Fig. A-2 MS2681A Rear Panel

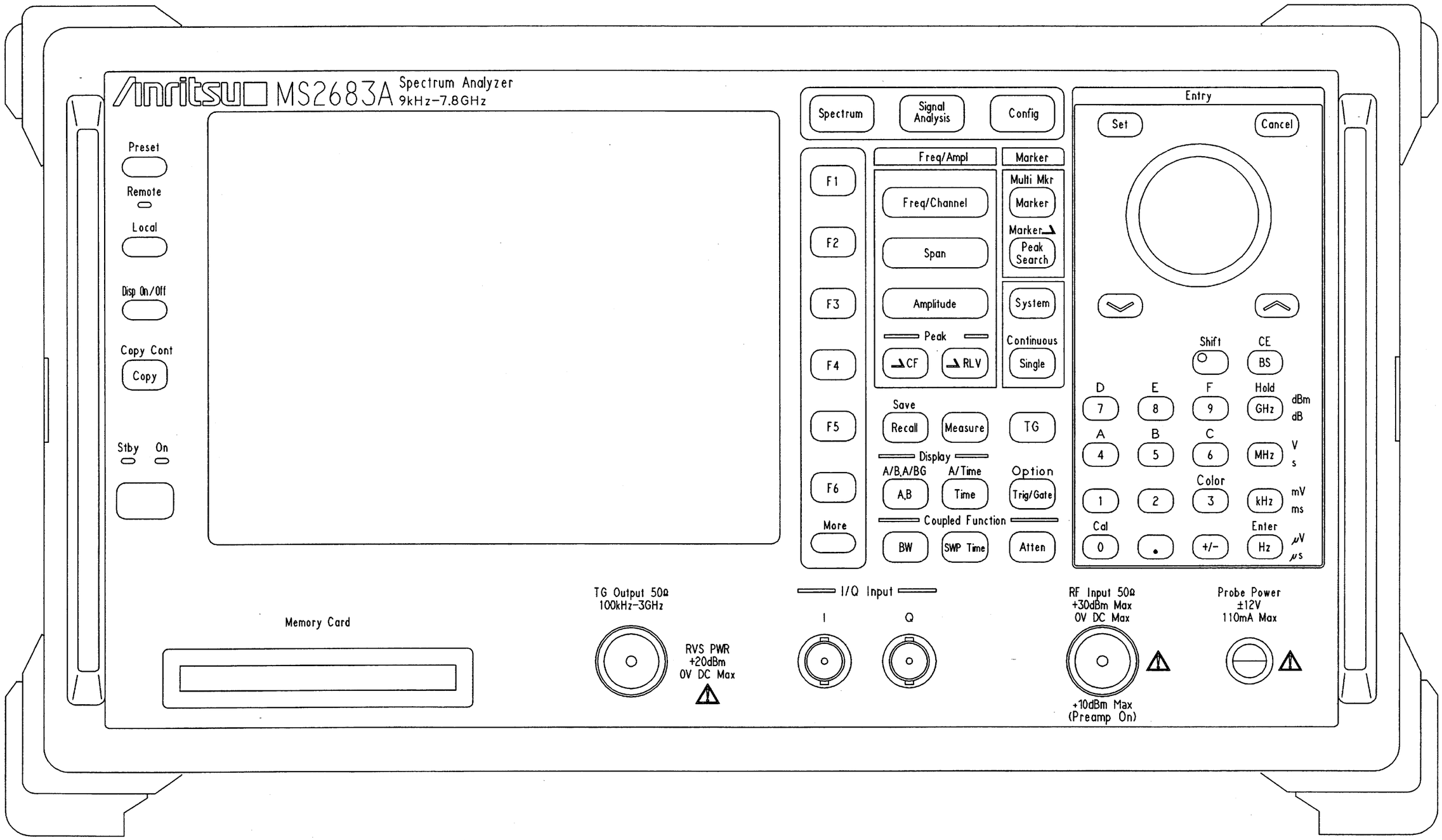


Fig. A-3 MS2683A Front Panel

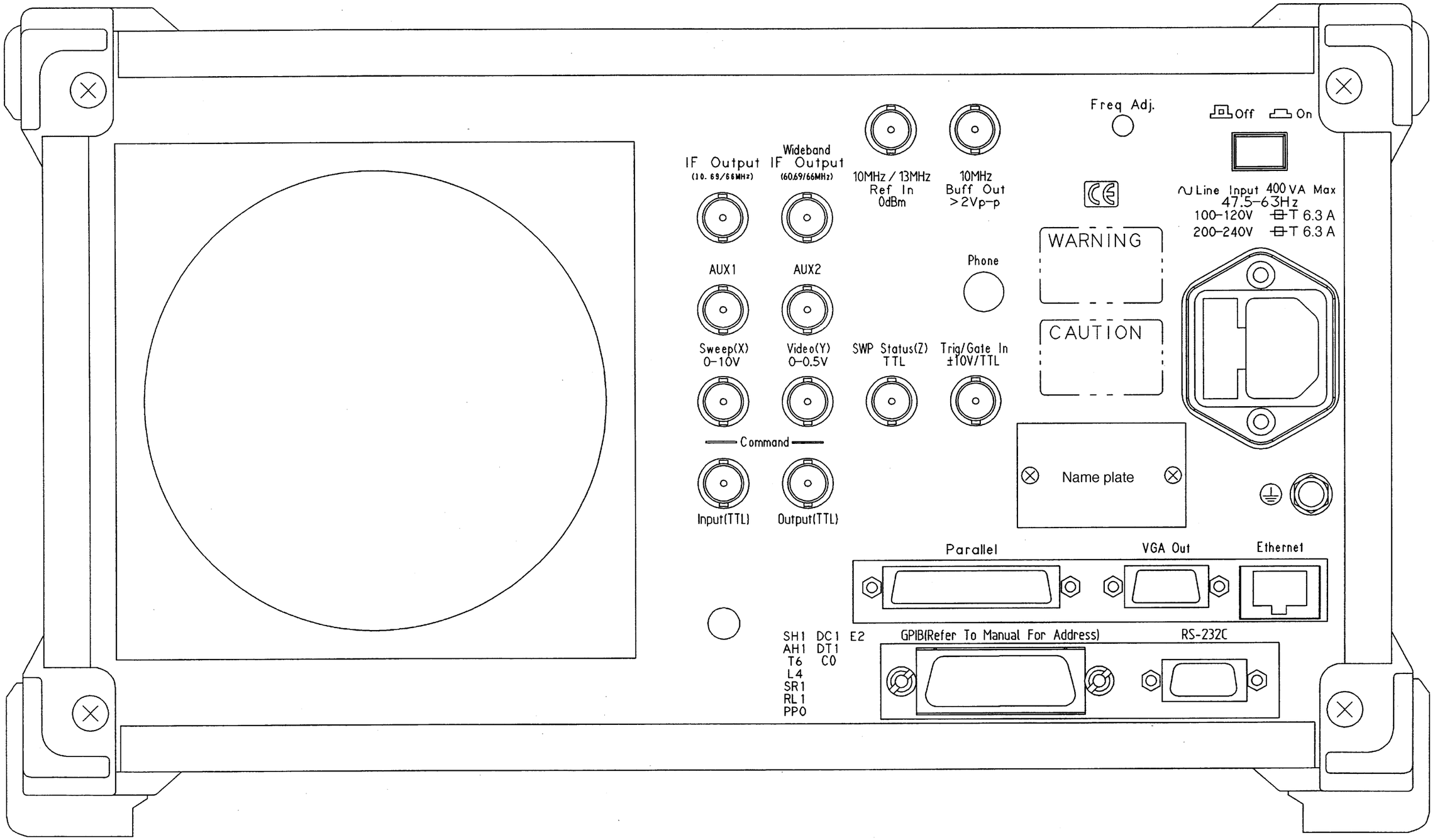


Fig. A-4 MS2683A Rear Panel

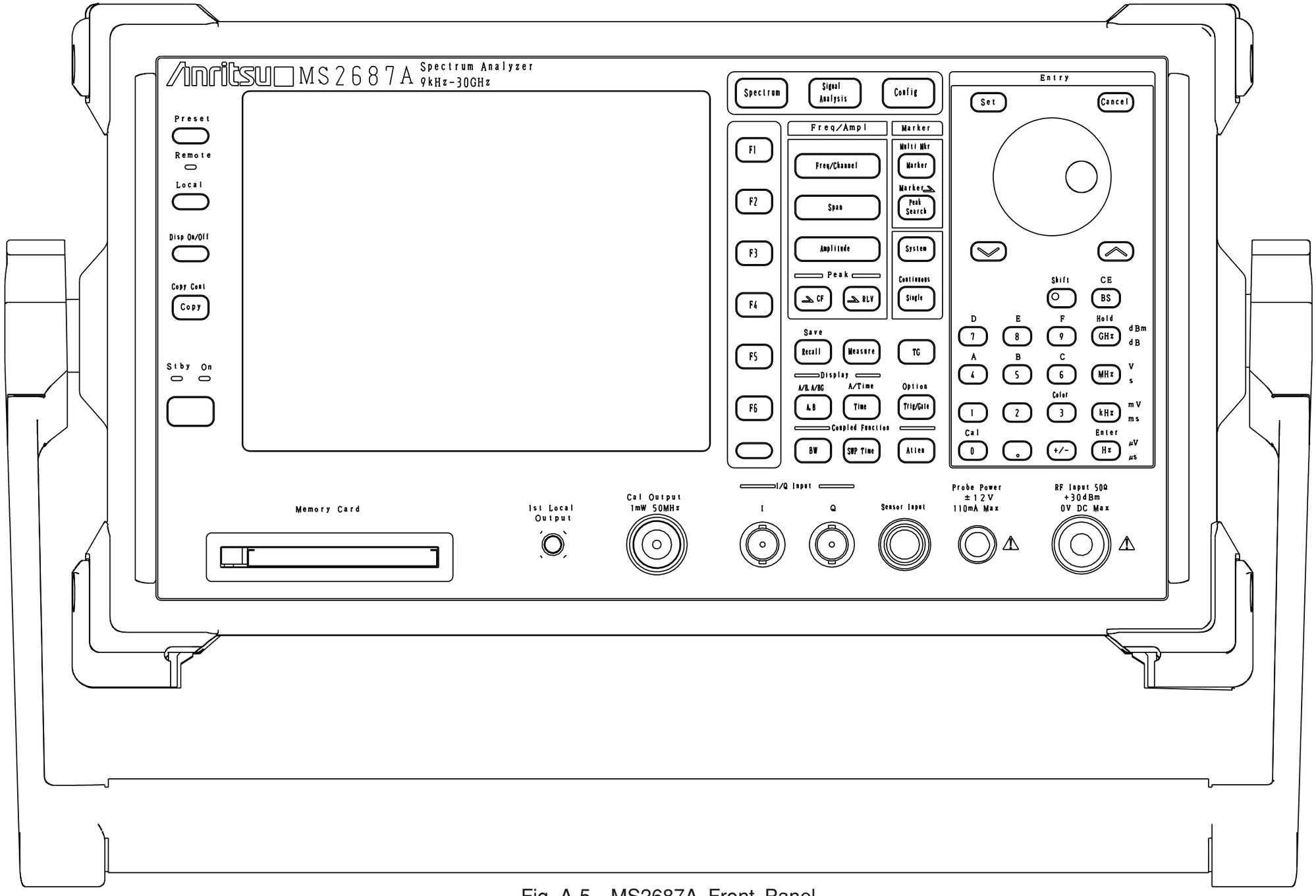


Fig. A-5 MS2687A Front Panel

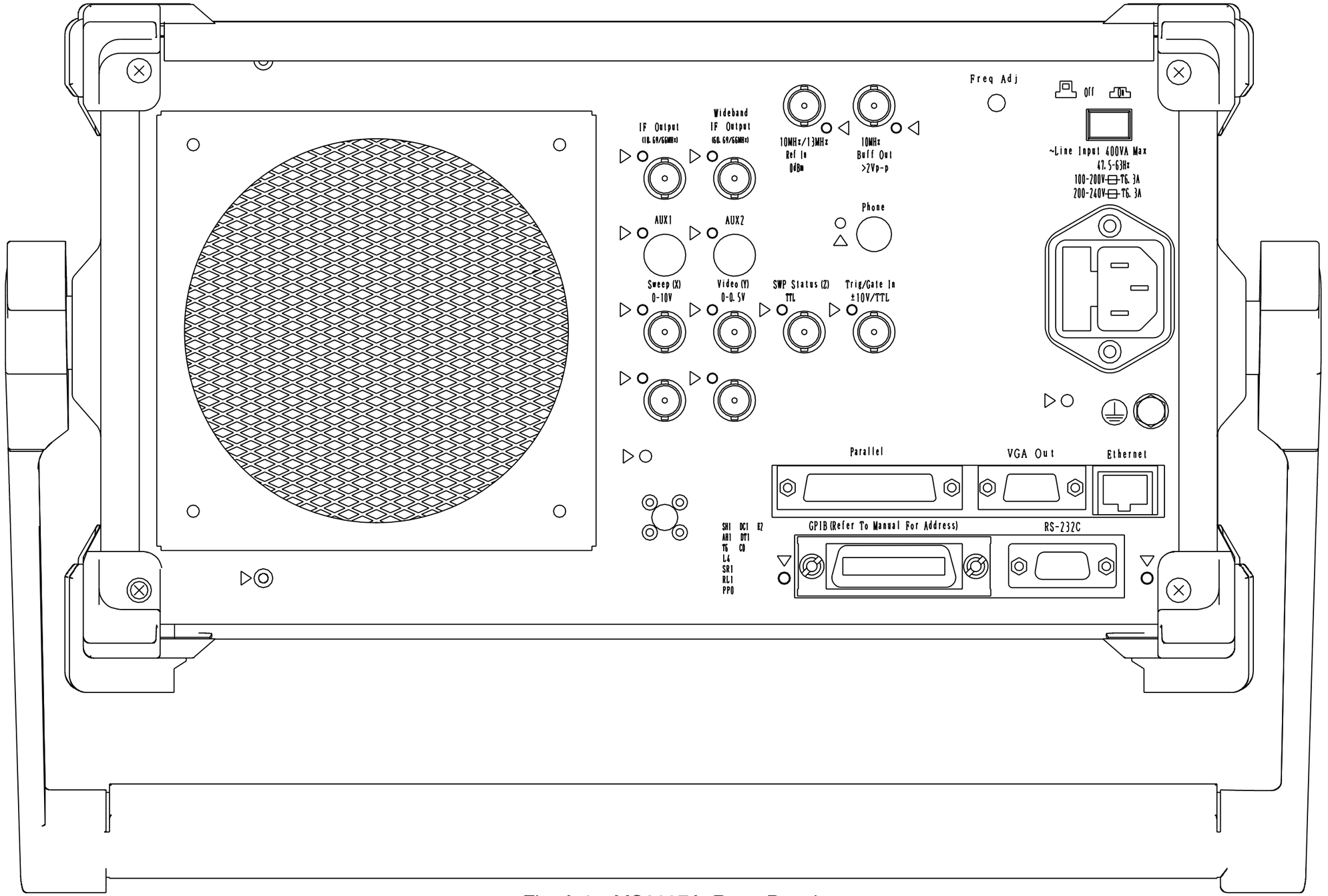


Fig. A-6 MS2687A Rear Panel

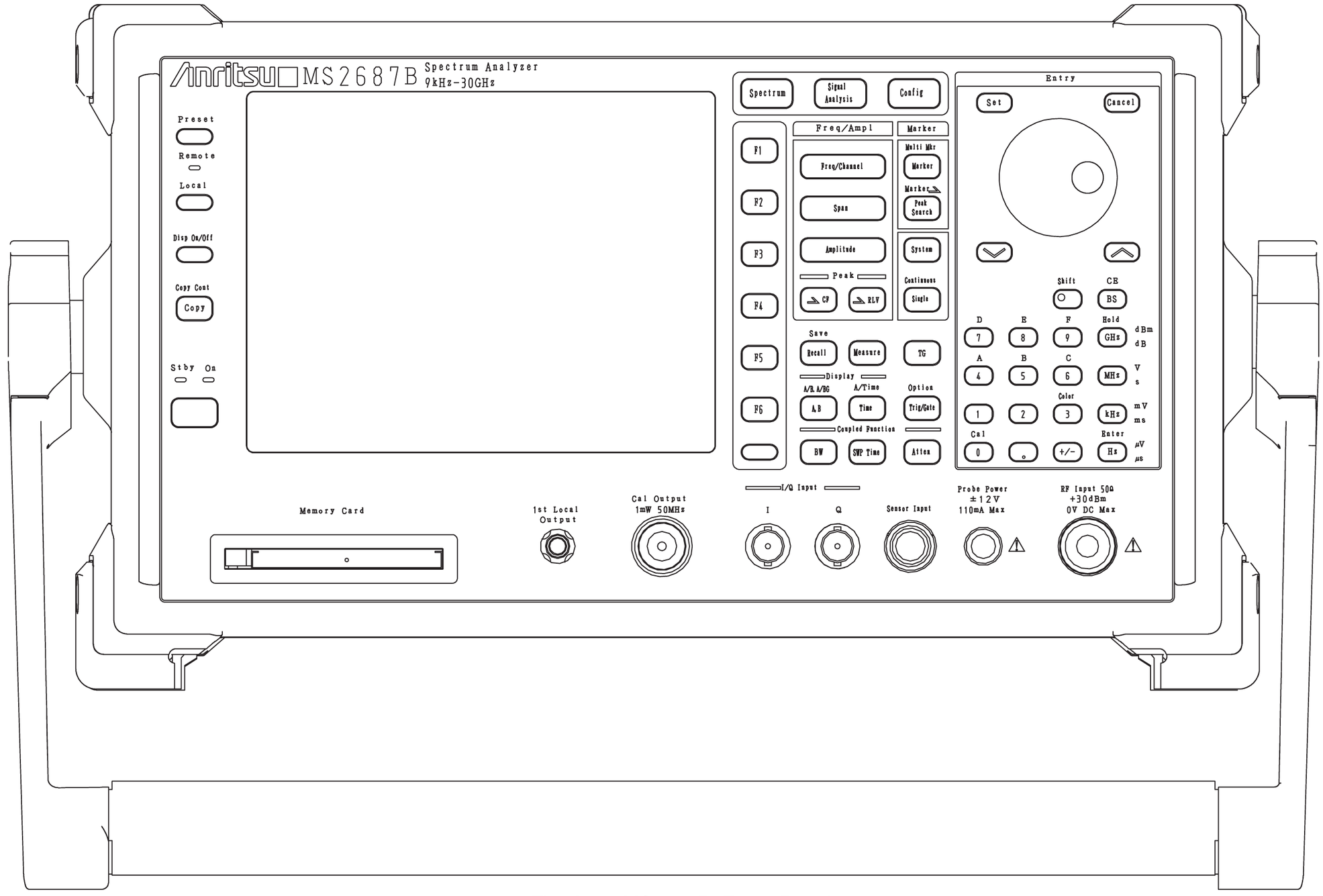


Fig. A-7 MS2687B Front Panel

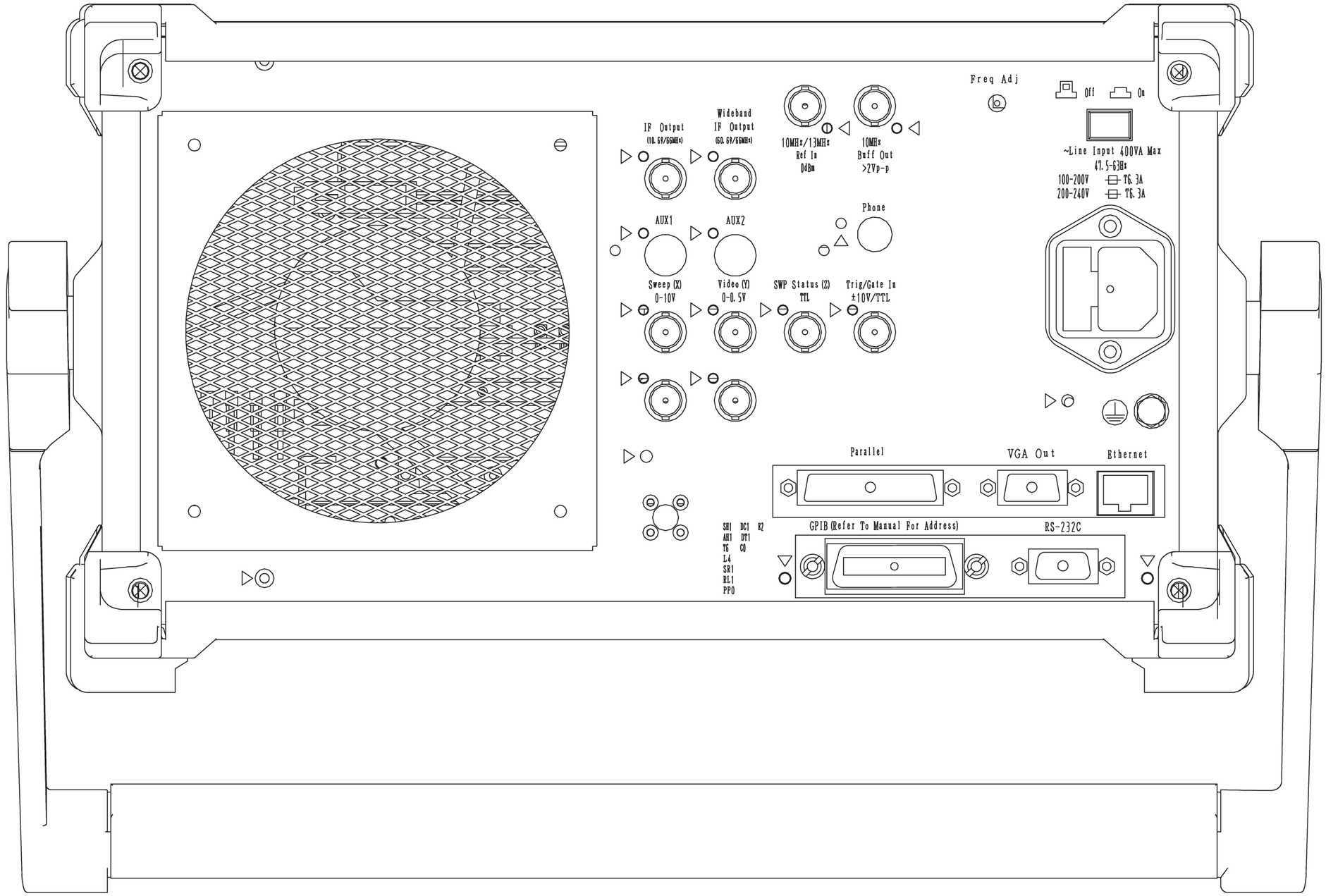


Fig. A-8 MS2687B Rear Panel

Appendix B Block Diagram

This appendix shows the Block Diagram of the MS2681A/MS2683A/MS2687A.

APPLICATIŌN

REVISIŌNS

RF INPUT 9k to 3GHz

8GHz Step Attenuator

RF ATTN

CAL ŌSC

ATT:0 to 62dB (2dB step)

PRE AMP(option)

~3.2GHz

A10 3GHZ CŌNVERTER

0~3.2GHz CŌNVIN

1st IF 4960.69/4966MHz

CAVITY 4966MHz

DRF

4966MHz

MIX

DF

DPX

60.69/66MHz_IF

2B1

1st LŌCAL

3.5~7.5GHz

YTŌ

4GHz

VCŌ

SAMPLER

PFD

SAMPLING PD

CAL ŌSC

625kHz or 50MHz

CAL ATT

ATT:0~80dB

100MHz

194~206MHz

26~32MHz

SPAN ATT

SWEEP

SCAN

1C4 1E8 2B1 2C1 3F1

A08 LŌCAL02

776~824MHz

DDS

200MHz

•2

MIX

PD

899MHz

•2

400MHz

•4

100MHz VCXŌ

1MHz

PFD

1MHz

N=10 or 13(automatic)

Ext REF IN

10MHz

ŌCXŌ 10MHz

BUFFERED ŌUT

100MHz

1B8 1C4 2B1 2C1

DEP

TITLE

MS2681A

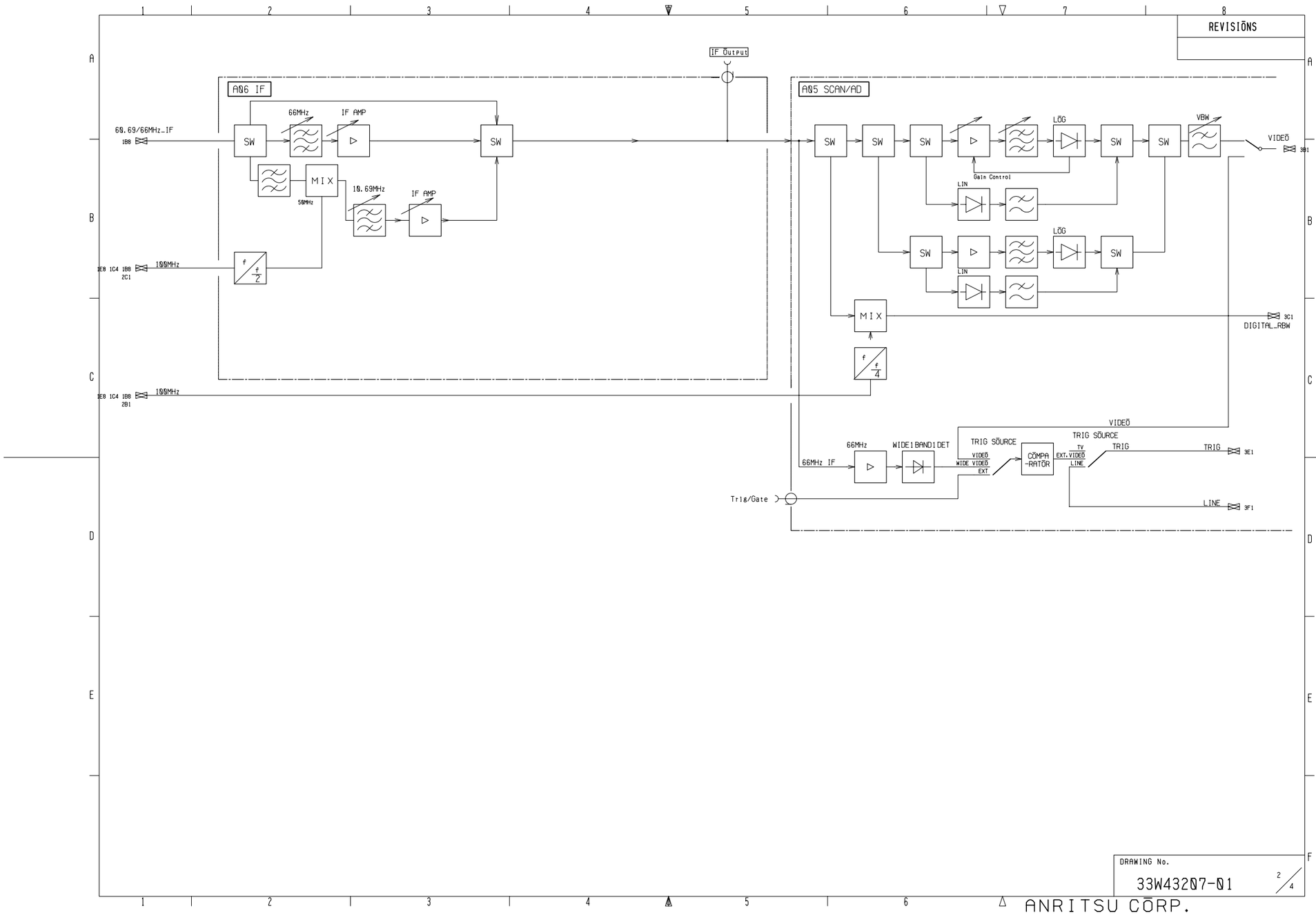
ŌVERALL BLŌCK DIAGRAM

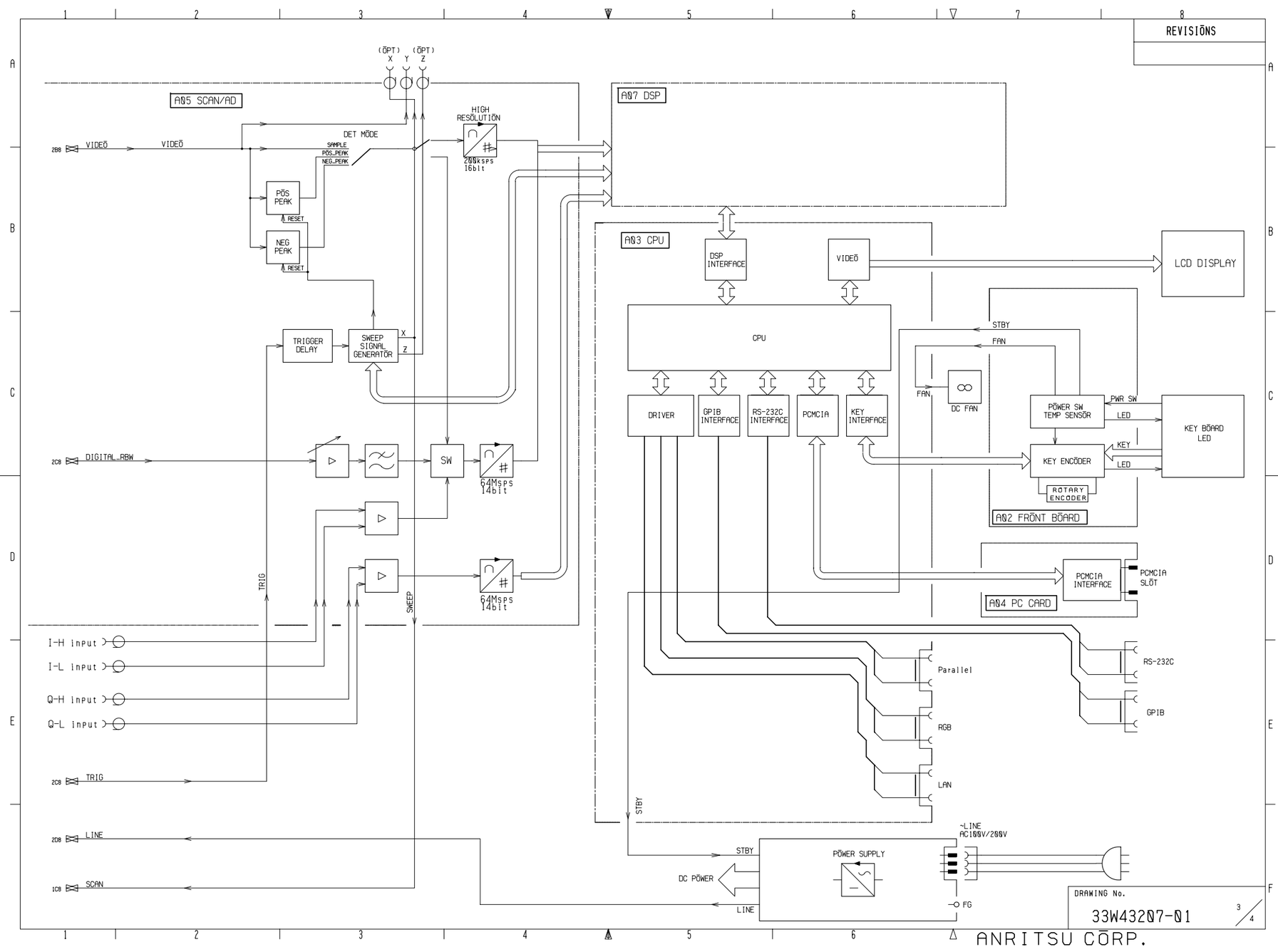
DRAWING No.

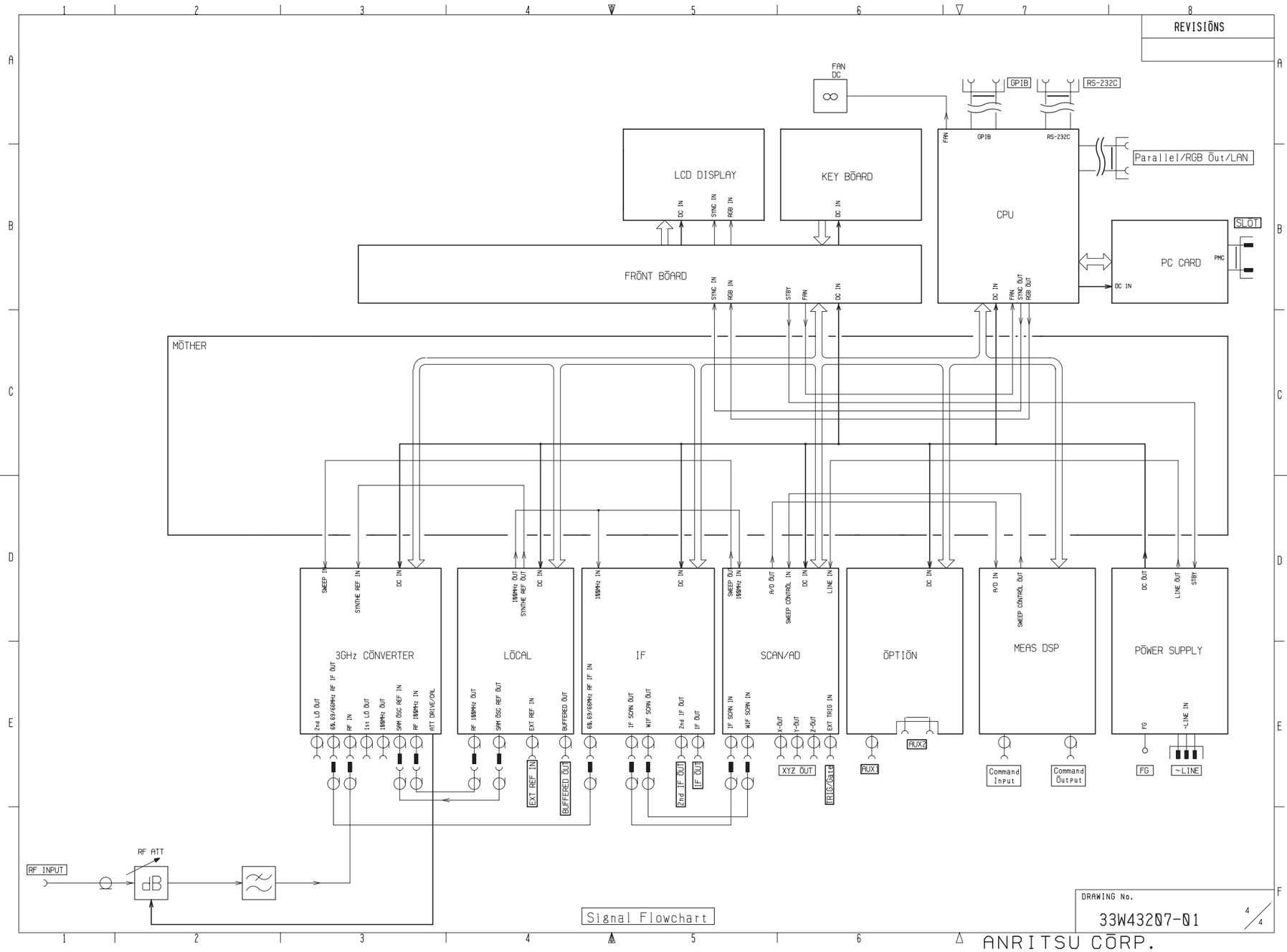
33W43207-01

•1/4

ANRITSU CŌRP.


REVISIÕNS
IF Output
AØ6 IF
AØ5 SCAN/AD
68.69/66MHz_IF
1B8
66MHz
IF AMP
SW
MIX
50MHz
10.69MHz
IF AMP
f
f/2
1ØØMHz
1E8 1C4 1B8
2C1
1ØØMHz
1E8 1C4 1B8
2B1
LÕG
VBW
VIDEÕ
3B1
Gain Control
LIN
LÕG
LIN
MIX
f
f/4
3C1
DIGITAL_RBW
VIDEÕ
66MHz IF
66MHz
WIDE1BAND1DET
TRIG SÕURCE
VIDEÕ
WIDE VIDEÕ
EXT
CÕMPA
-RATÕR
TRIG SÕURCE
TV
EXT.VIDEÕ
LINE
TRIG
TRIG
3E1
LINE
3F1
Trig/Gate
DRAWING No.
33W432Ø7-Ø1
2/4
ANRITSU CÕRP.


REVISIŌNS
A05 SCAN/AD
A07 DSP
A03 CPU
A02 FRŌNT BŌARD
A04 PC CARD
(ŌPT) X
Y
(ŌPT) Z
HIGH RESŌLUTIŌN
DET MŌDE
SAMPLE
PŌS_PEAK
NEG_PEAK
200ksps 16bit
2B8 VIDEŌ
VIDEŌ
PŌS PEAK
NEG PEAK
RESET
TRIGGER DELAY
SWEEP SIGNAL GENERATŌR
X
Z
2C8 DIGITAL_RBW
SW
64Msps 14bit
64Msps 14bit
TRIG
SWEEP
I-H inPut
I-L inPut
Q-H inPut
Q-L inPut
2C8 TRIG
2D8 LINE
1C8 SCAN
DSP INTERFACE
VIDEŌ
LCD DISPLAY
CPU
STBY
FAN
FAN
DC FAN
DRIVER
GPIB INTERFACE
RS-232C INTERFACE
PCMCIA
KEY INTERFACE
PŌWER SW TEMP SENSŌR
PWR SW
LED
KEY BŌARD LED
KEY ENCŌDER
KEY
LED
ROTARY ENCODER
PCMCIA INTERFACE
PCMCIA SLŌT
Parallel
RS-232C
RGB
GPIB
LAN
STBY
LINE AC100V/200V
STBY
DC PŌWER
LINE
PŌWER SUPPLY
FG
DRAWING No.
33W4320Ø7-Ø1
3/4
ANRITSU CŌRP.


REVISIONS
FAN DC
GPIB
RS-232C
LCD DISPLAY
KEY BOARD
CPU
Parallel/RGB Out/LAN
SLOT
PC CARD
PMC
FRONT BOARD
MOTHER
3GHz CONVERTER
LOCAL
IF
SCAN/AD
OPTION
MEAS DSP
POWER SUPPLY
RF INPUT
RF ATT
dB
Signal Flowchart
DRAWING No.
33W43207-01
4/4
ANRITSU CORP.

APPLICATIŌN

REVISIŌNS

8GHz Step Attenuator

RF ATTN

RF INPUT
9k to 7.8GHz

CAL ŌSC

ATT:0 to 62dB
(2dB step)

~3.2GHz

A10 3GHZ CŌNVERTER

0~3.2GHz CŌNVIN

1st IF 4969.69/4066MHz

CAVITY 4966MHz

DRF

4966MHz

MIX

DPX

60.69/66MHz_IF

2B1

3.5~7.5GHz

1st LŌCAL

3.5~7.5GHz

YTŌ

4GHz

VCŌ

SAMPLING PD

1.6GHz
YTF/SW

YTF

0~3.2GHz

PRE AMP(ŌPTIŌN)

CAL ŌSC

SAMPLER

PFD

625kHz or 50MHz

CAL ATT

ATT:0-80dB

100MHz

194~206MHz

11~14MHz

SPAN ATT

SWEEP

100MHz

SCAN

1E3 1E8
2B1 2C1
3F1

3.15~7.8GHz

A14 1ST LŌ AMP

8GHz Mixer

MIX

460.69/466MHz

SW

MIX

400MHz

f/2

VCŌ

f/4

MIX

A13 2ND CŌNVERTER

60.69/66MHz

2C1 2B1 1E8 1B8 100MHz

N=10 or 13(automatic)

Ext REF IN

ŌCXŌ 10MHz

BUFFERED ŌUT

100MHz VCXŌ

1MHz

PFD

1MHz

10MHz

194~206MHz

776~824MHz

VCŌ

MIX

PD

800MHz

*2

400MHz

*4

100MHz

26~32MHz

DDS

200MHz

*2

100MHz

A08 LŌCAL02

100MHz

100MHz

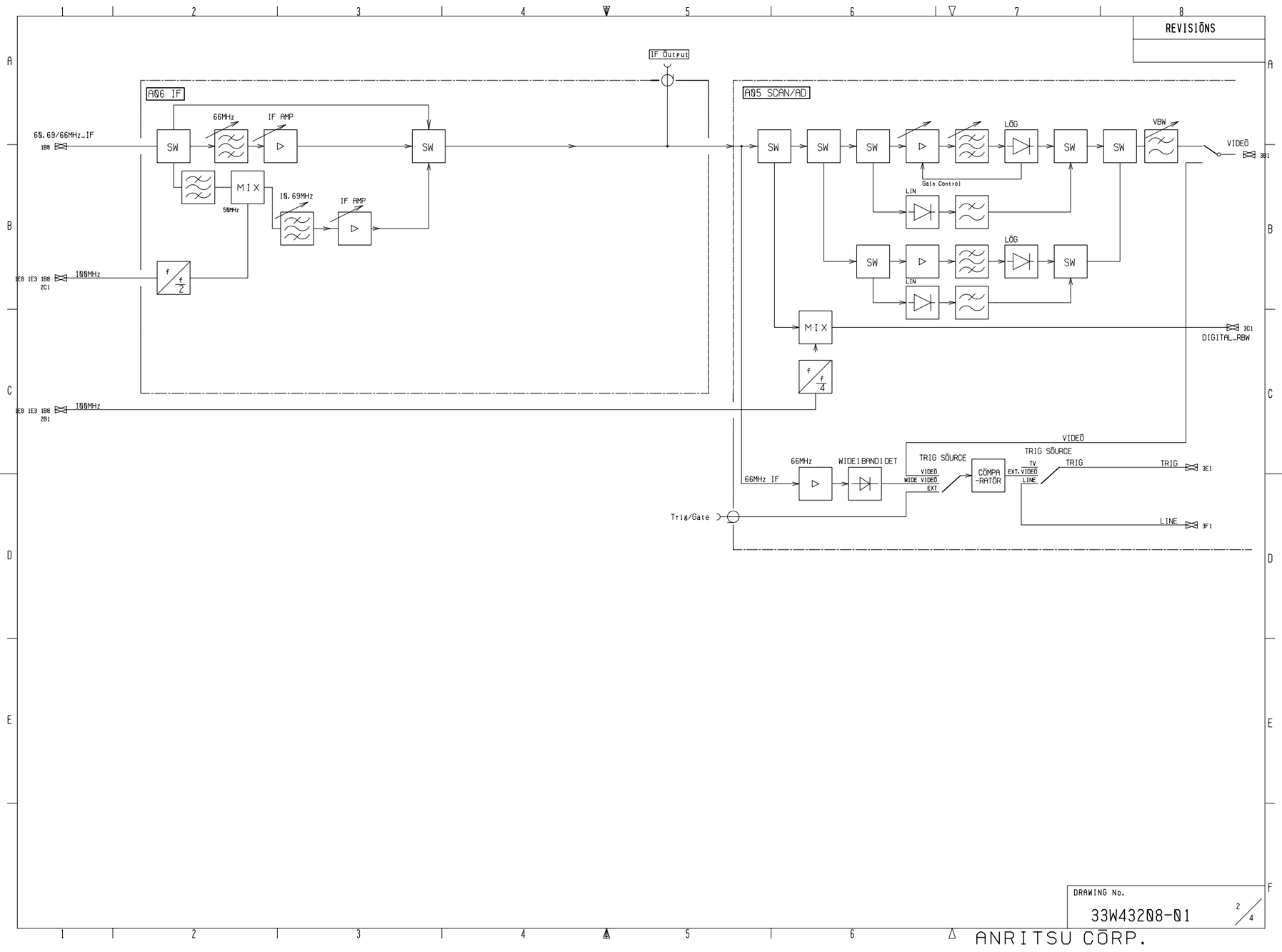
1B8 1E3
2B1 2C1

DEP

QTY	ITEM	PART No.	DESCRIPTIŌN	MATERIAL	FINISH	NŌTE

CHECKED BY	DRAWN BY	SCALE	
APPRŌVED BY	DESIGNED BY		
TITLE: MS2683A ŌVERALL BLŌCK DIAGRAM		DRAWING No. 33W43208-01	*1 / 4

ANRITSU CŌRP.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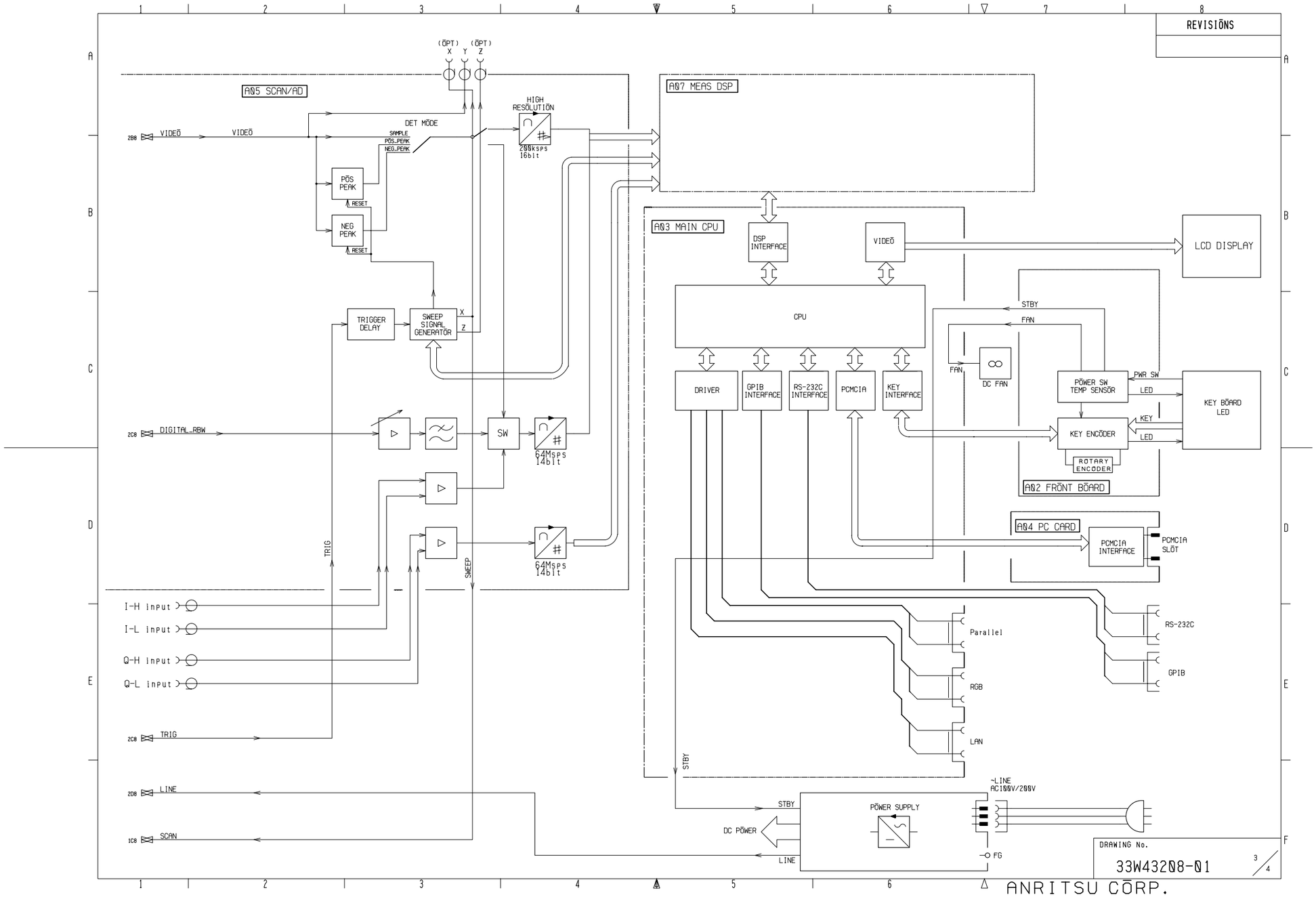
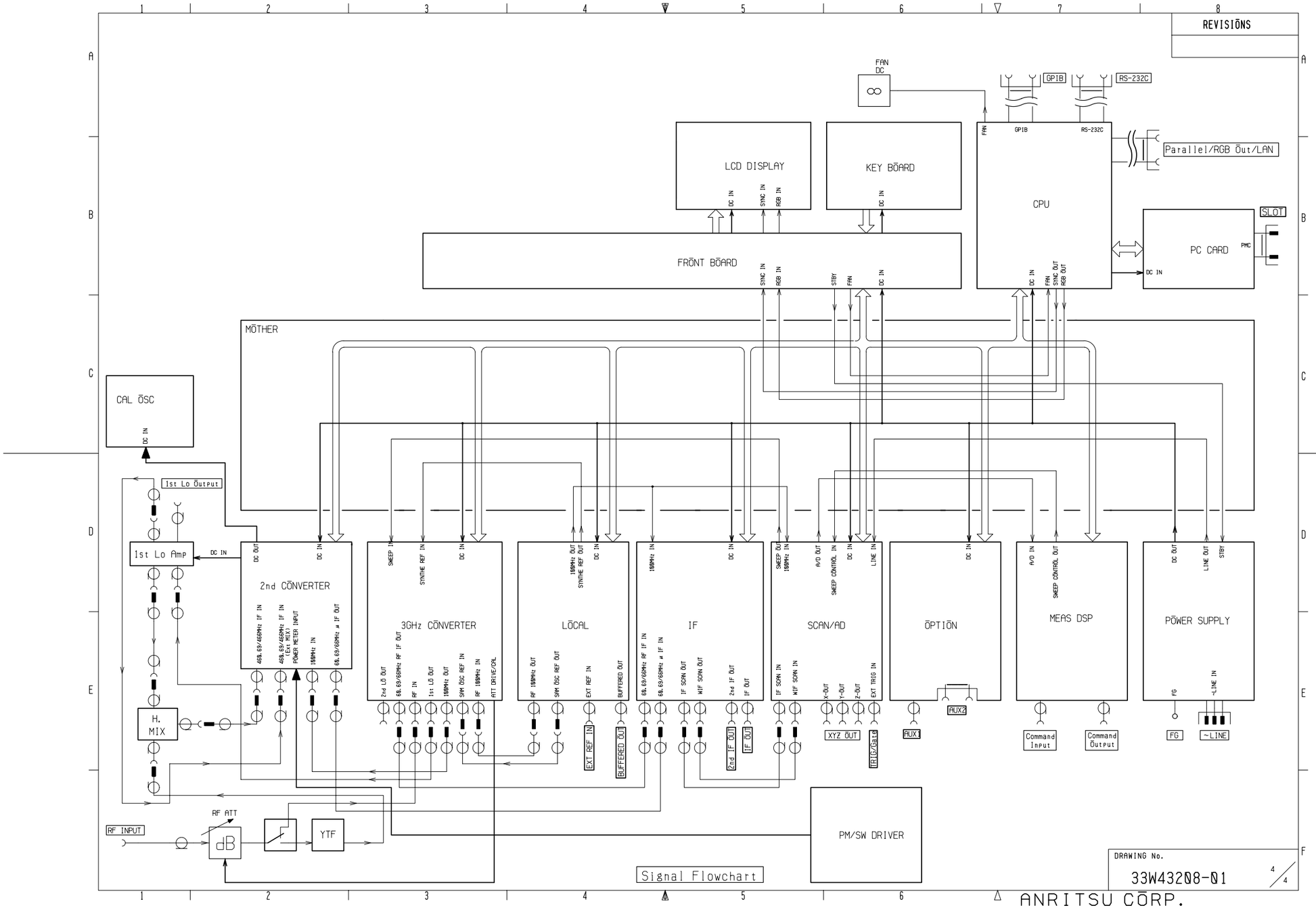
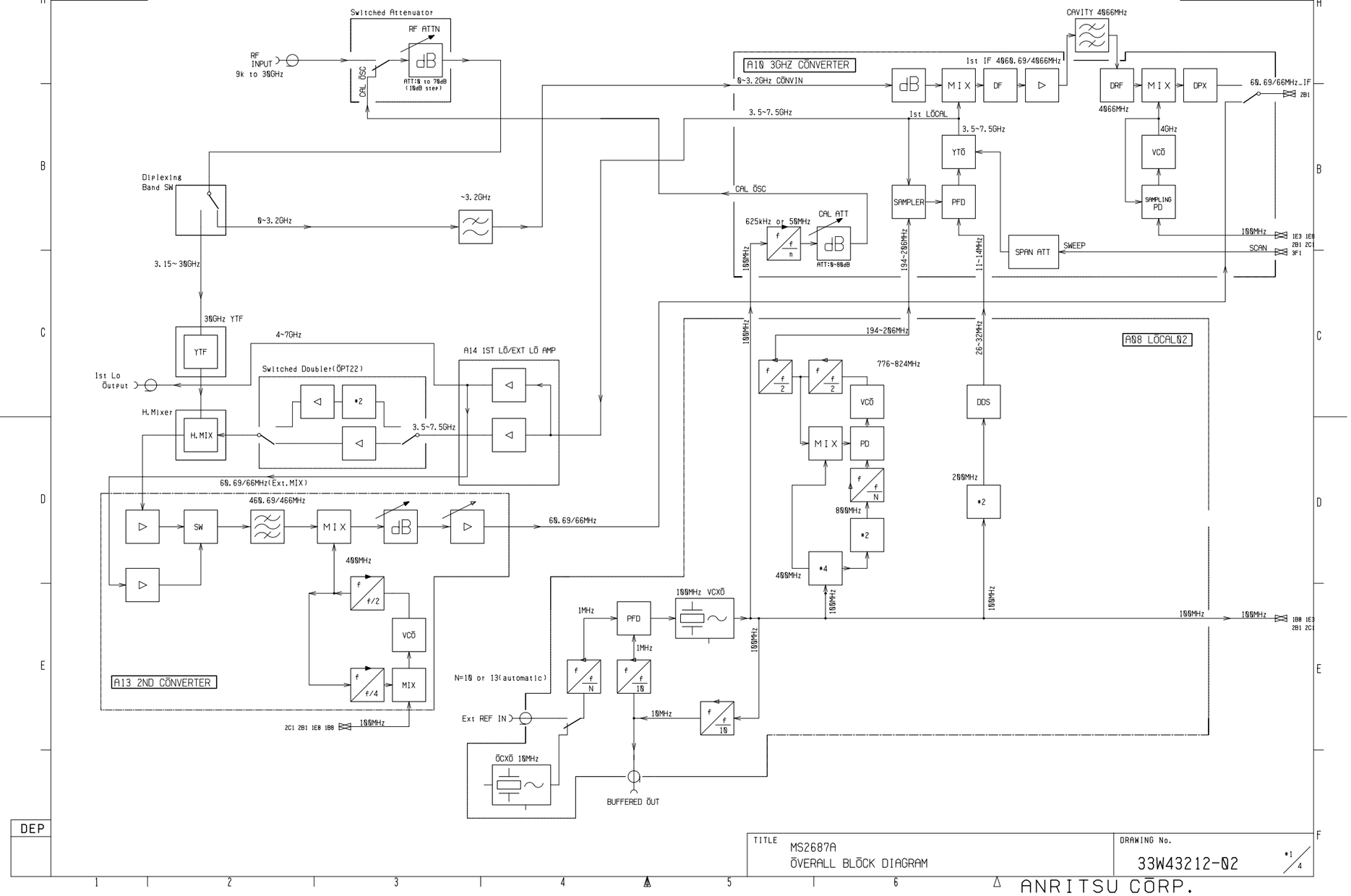
A06 IF
A05 SCAN/AD
IF Output
60.69/66MHz_IF
1B8
66MHz
IF AMP
SW
MIX
5ØMHz
10.69MHz
IF AMP
1ØØMHz
1E8 1E3 1B8
2C1
1ØØMHz
1E8 1E3 1B8
2B1
LØG
VBW
VIDEŌ
3B1
Gain Control
LIN
LØG
LIN
MIX
3C1
DIGITAL_RBW
VIDEŌ
66MHz IF
66MHz
WIDE!BAND!DET
TRIG SØURCE
VIDEŌ
WIDE VIDEŌ
EXT
CŌMPA
-RATŌR
TRIG SØURCE
Tv
EXT. VIDEŌ
LINE
TRIG
TRIG
3E1
LINE
3F1
Trig/Gate
DRAWING No.
33W432Ø8-Ø1
2/4
ANRITSU CŌRP.


REVISIONS
A05 SCAN/AD
A07 MEAS DSP
A03 MAIN CPU
A02 FRONT BOARD
A04 PC CARD
(OPT) X
(OPT) Y
(OPT) Z
VIDEO
DET MODE
SAMPLE
POS-PEAK
NEG-PEAK
HIGH RESOLUTION
200ksps 16bit
POS PEAK
NEG PEAK
RESET
TRIGGER DELAY
SWEEP SIGNAL GENERATOR
DIGITAL-RBW
SW
64Msps 14bit
TRIG
SWEEP
I-H input
I-L input
Q-H input
Q-L input
LINE
SCAN
DSP INTERFACE
CPU
DRIVER
GPIB INTERFACE
RS-232C INTERFACE
PCMCIA
KEY INTERFACE
LCD DISPLAY
STBY
FAN
DC FAN
POWER SW TEMP SENSOR
PWR SW
LED
KEY
KEY BOARD LED
KEY ENCODER
ROTARY ENCODER
PCMCIA INTERFACE
PCMCIA SLOT
Parallel
RS-232C
GPIB
RGB
LAN
POWER SUPPLY
~LINE AC100V/200V
DC POWER
FG
DRAWING No.
33W43208-01
3/4
ANRITSU CORP.


REVISIONS
FAN DC
GPIB
RS-232C
LCD DISPLAY
KEY BOARD
CPU
Parallel/RGB Out/LAN
SLOT
PC CARD
PMC
FRONT BOARD
MOTHER
CAL OSC
1st Lo Output
1st Lo Amp
2nd CONVERTER
3GHz CONVERTER
LOCAL
IF
SCAN/AD
OPTION
MEAS DSP
POWER SUPPLY
H. MIX
RF ATT
RF INPUT
YTF
PM/SW DRIVER
EXT REF IN
BUFFERED OUT
2nd IF OUT
IF OUT
XYZ OUT
AUX1
AUX2
Command Input
Command Output
FG
~LINE
Signal Flowchart
DRAWING No.
33W43208-01
4/4
ANRITSU CORP.

APPLICATIÕN

REVISIÕNS

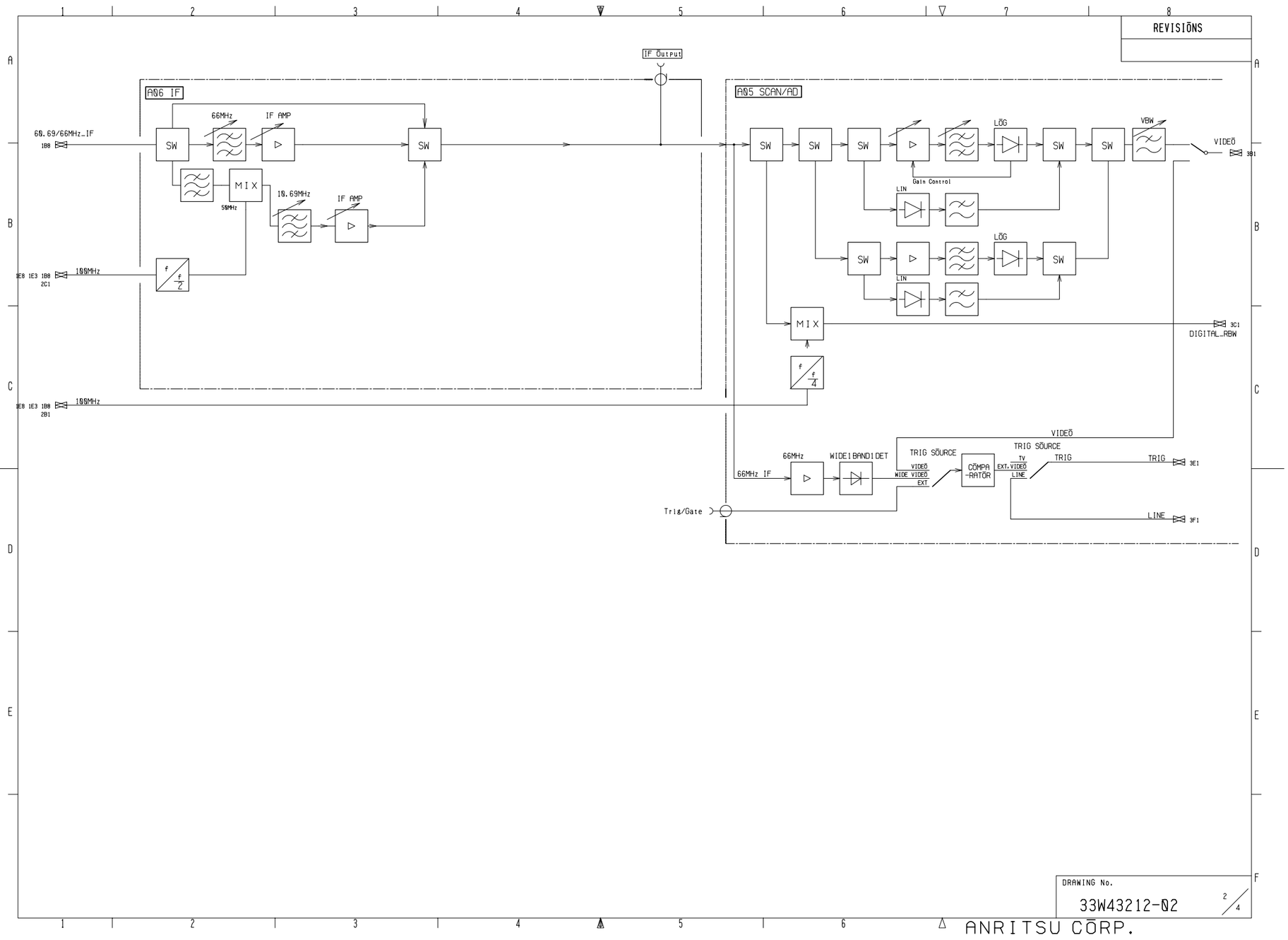


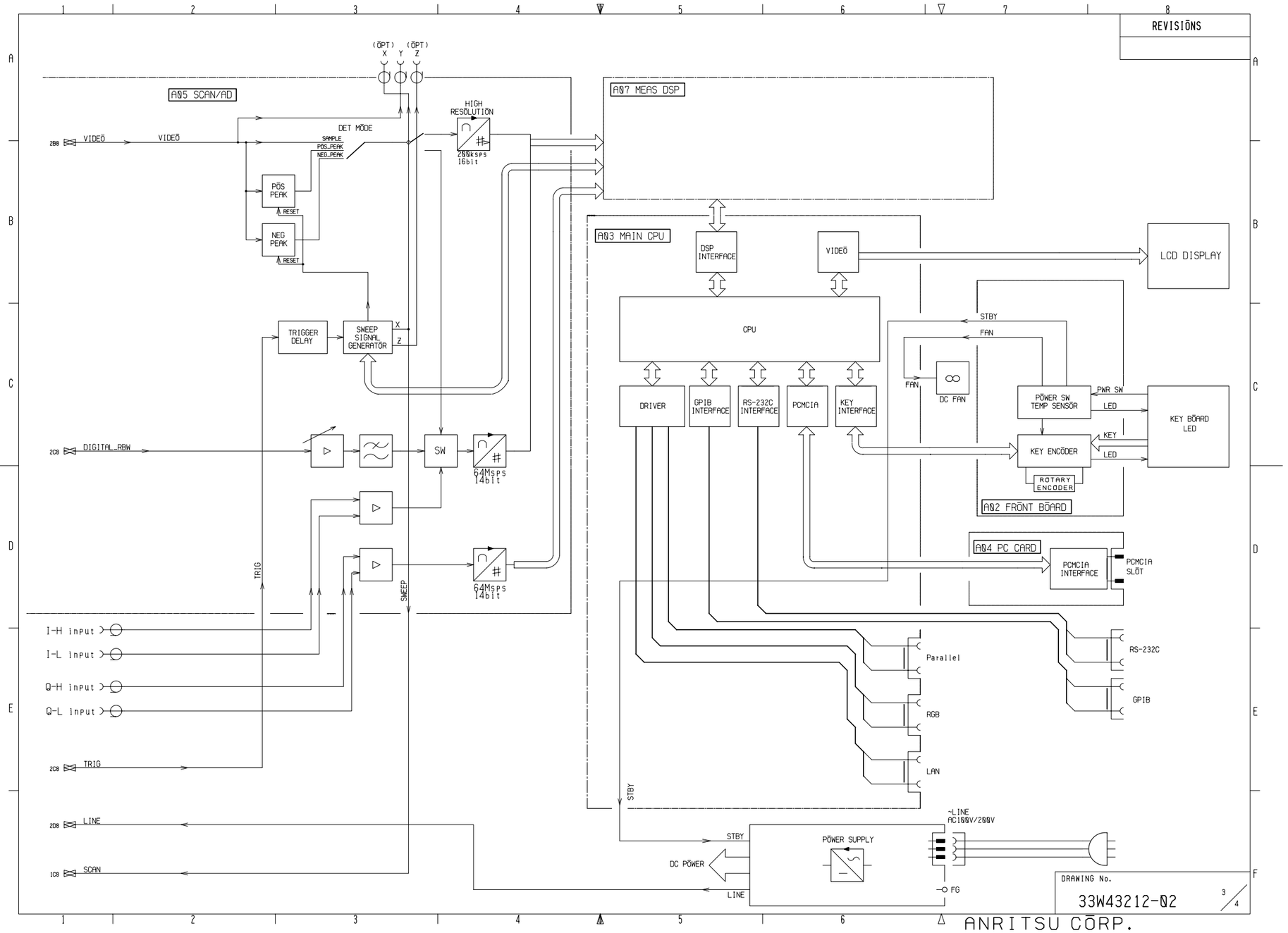
DEP

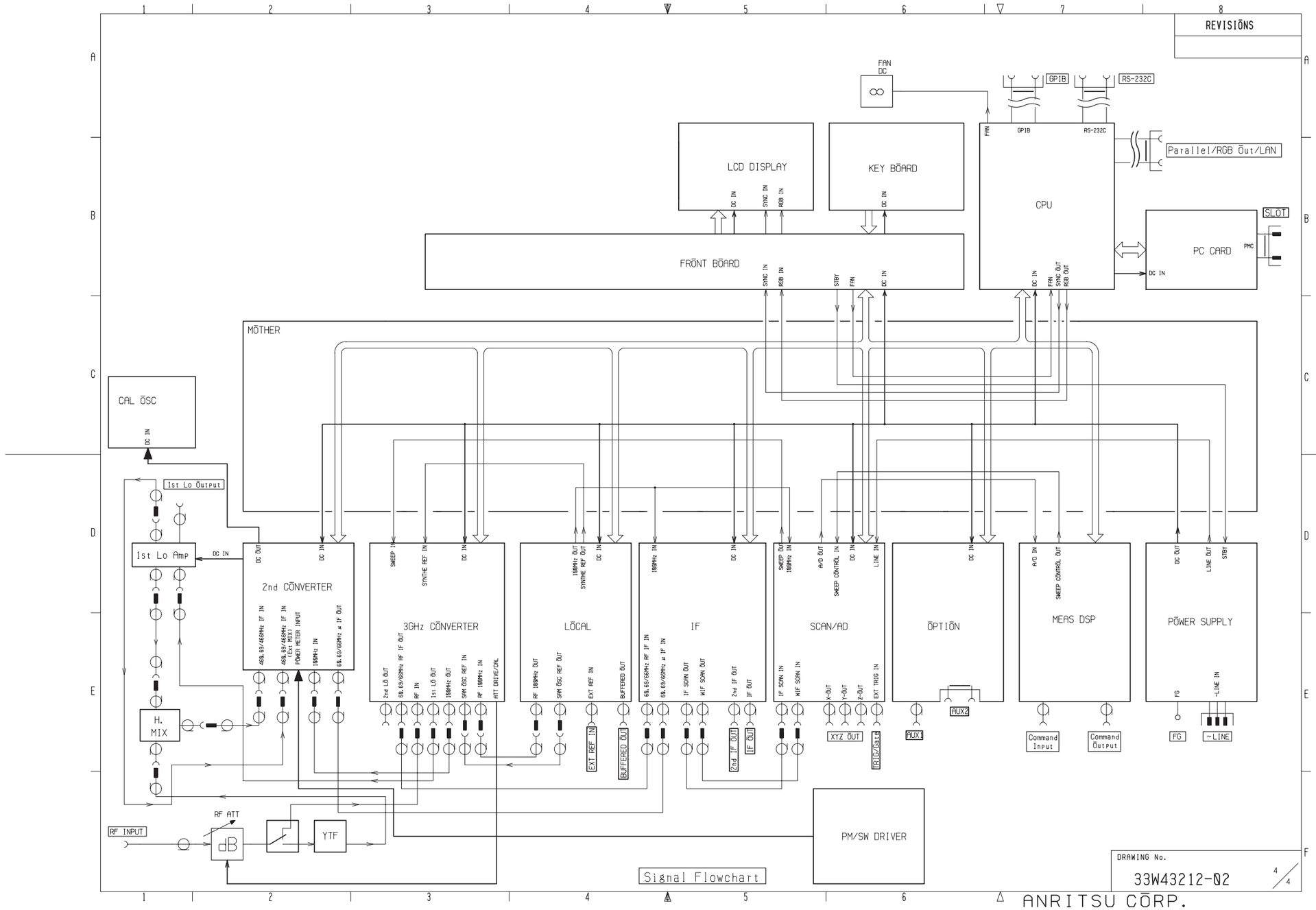
TITLE
MS2687A
ÕVERALL BLÕCK DIAGRAM

DRAWING No.
33W43212-Ø2
*1/4

ANRITSU CÕRP.

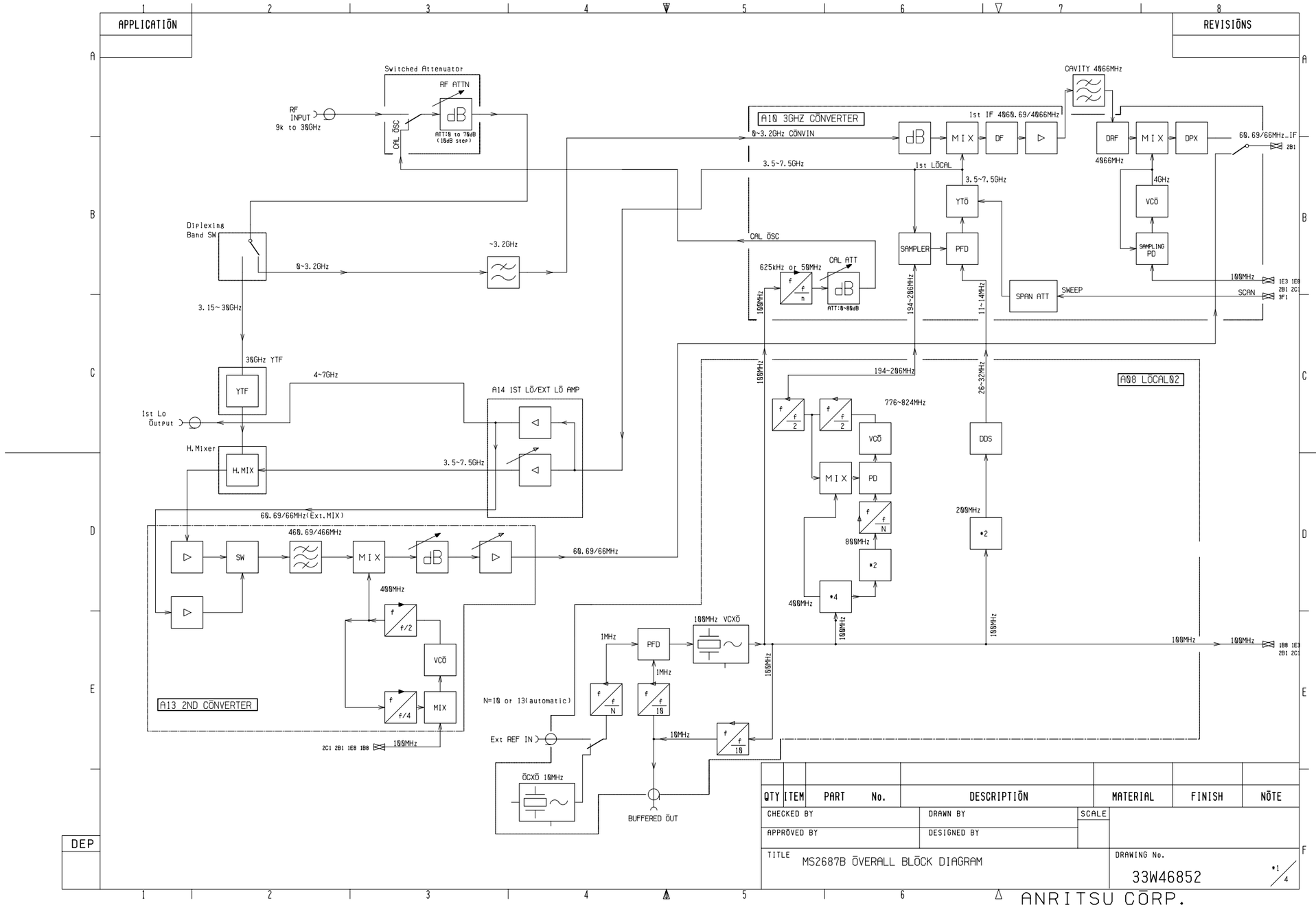

REVISIŌNS
IF Output
AQ6 IF
AQ5 SCAN/AD
60.69/66MHz_IF
1B8
66MHz
IF AMP
SW
MIX
10.69MHz
50MHz
IF AMP
1E8 1E3 1B8
2C1
10MHz
1E8 1E3 1B8
2B1
10MHz
LOG
VBW
VIDEO
3B1
Gain Control
LIN
LOG
LIN
MIX
3C1
DIGITAL_RBW
VIDEO
66MHz
WIDE1BAND1DET
66MHz IF
TRIG SOURCE
VIDEO
WIDE VIDEO
EXT
COMPA
-RATOR
TRIG SOURCE
TV
EXT.VIDEO
LINE
TRIG
TRIG
3E1
LINE
3F1
Trig/Gate
DRAWING No.
33W43212-02
2/4
ANRITSU CORP.


REVISIÕNS
A05 SCAN/AD
A07 MEAS DSP
A03 MAIN CPU
A02 FRONT BOARD
A04 PC CARD
(ÕPT) X
(ÕPT) Y
(ÕPT) Z
HIGH RESOLUTIÕN
DET MÕDE
SAMPLE
PÕS_PEAK
NEG_PEAK
2C8 VIDEÕ
VIDEÕ
200ksps 16bit
PÕS PEAK
NEG PEAK
RESET
TRIGGER DELAY
SWEEP SIGNAL GENERATÕR
X
Z
2C8 DIGITAL_RBW
SW
64Msps 14bit
64Msps 14bit
TRIG
SWEEP
I-H inPut
I-L inPut
Q-H inPut
Q-L inPut
2C8 TRIG
2C8 LINE
1C8 SCAN
DSP INTERFACE
VIDEÕ
LCD DISPLAY
CPU
DRIVER
GPIB INTERFACE
RS-232C INTERFACE
PCMCIA
KEY INTERFACE
STBY
FAN
FAN
DC FAN
PÕWER SW TEMP SENSÕR
PWR SW
LED
KEY BÕARD LED
KEY ENCÕDER
KEY
LED
ROTARY ENCODER
PCMCIA INTERFACE
PCMCIA SLÕT
Parallel
RS-232C
RGB
GPIB
LAN
STBY
LINE AC100V/200V
STBY
DC PÕWER
LINE
PÕWER SUPPLY
FG
DRAWING No.
33W43212-02
3/4
ANRITSU CÕRP.


REVISIONS
FAN
DC
GPIB
RS-232C
LCD DISPLAY
KEY BOARD
CPU
Parallel/RGB Out/LAN
SLOT
PC CARD
PMC
FRONT BOARD
MOTHER
CAL OSC
1st Lo Output
1st Lo Amp
2nd CONVERTER
3GHz CONVERTER
LOCAL
IF
SCAN/AD
OPTION
MEAS DSP
POWER SUPPLY
H.
MIX
RF ATT
RF INPUT
YTF
PM/SW DRIVER
AUX1
AUX2
XYZ OUT
TRIG/Gate
Command Input
Command Output
FG
~LINE
Signal Flowchart
DRAWING No.
33W43212-02
4/4
ANRITSU CORP.

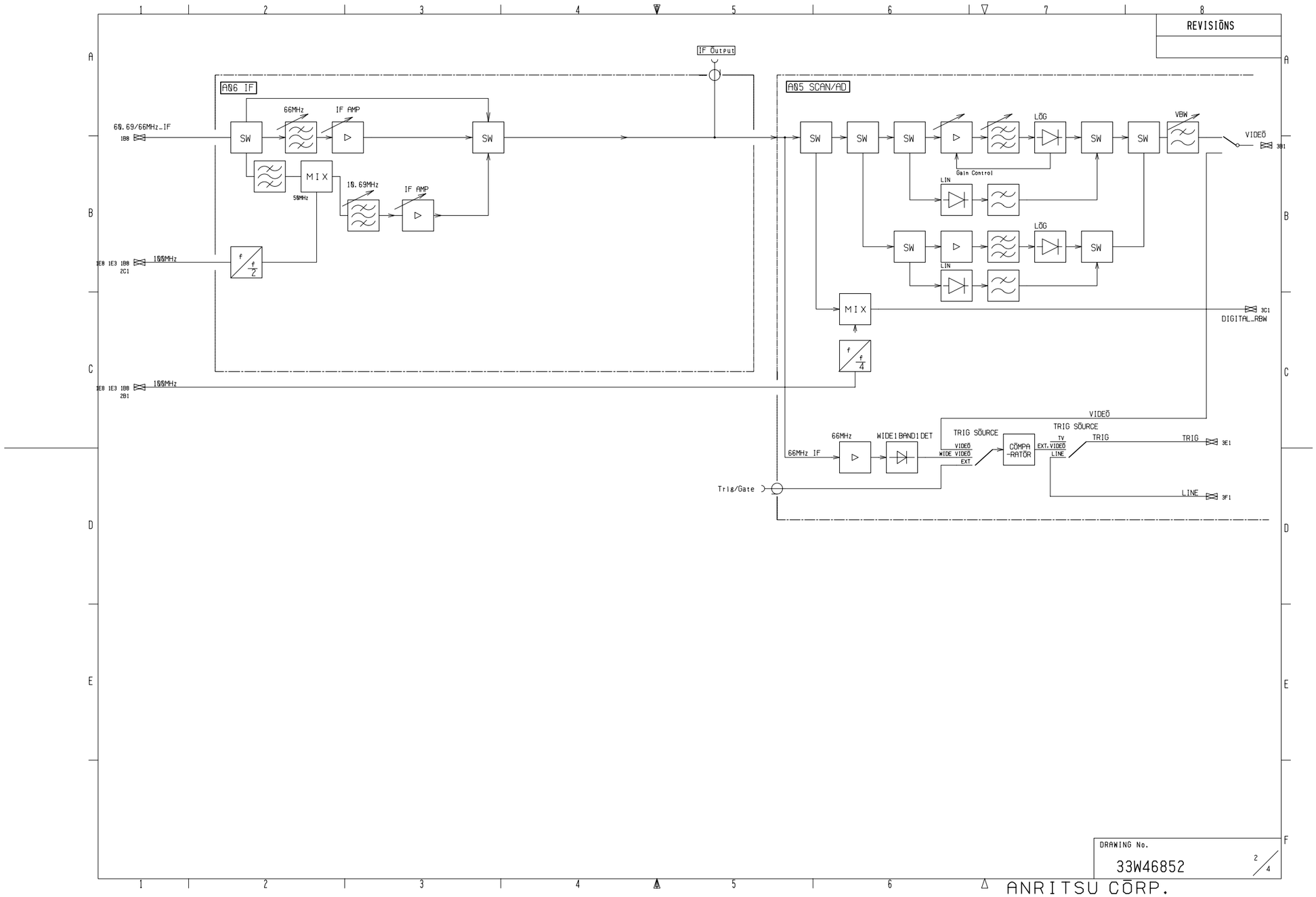
APPLICATIŌN

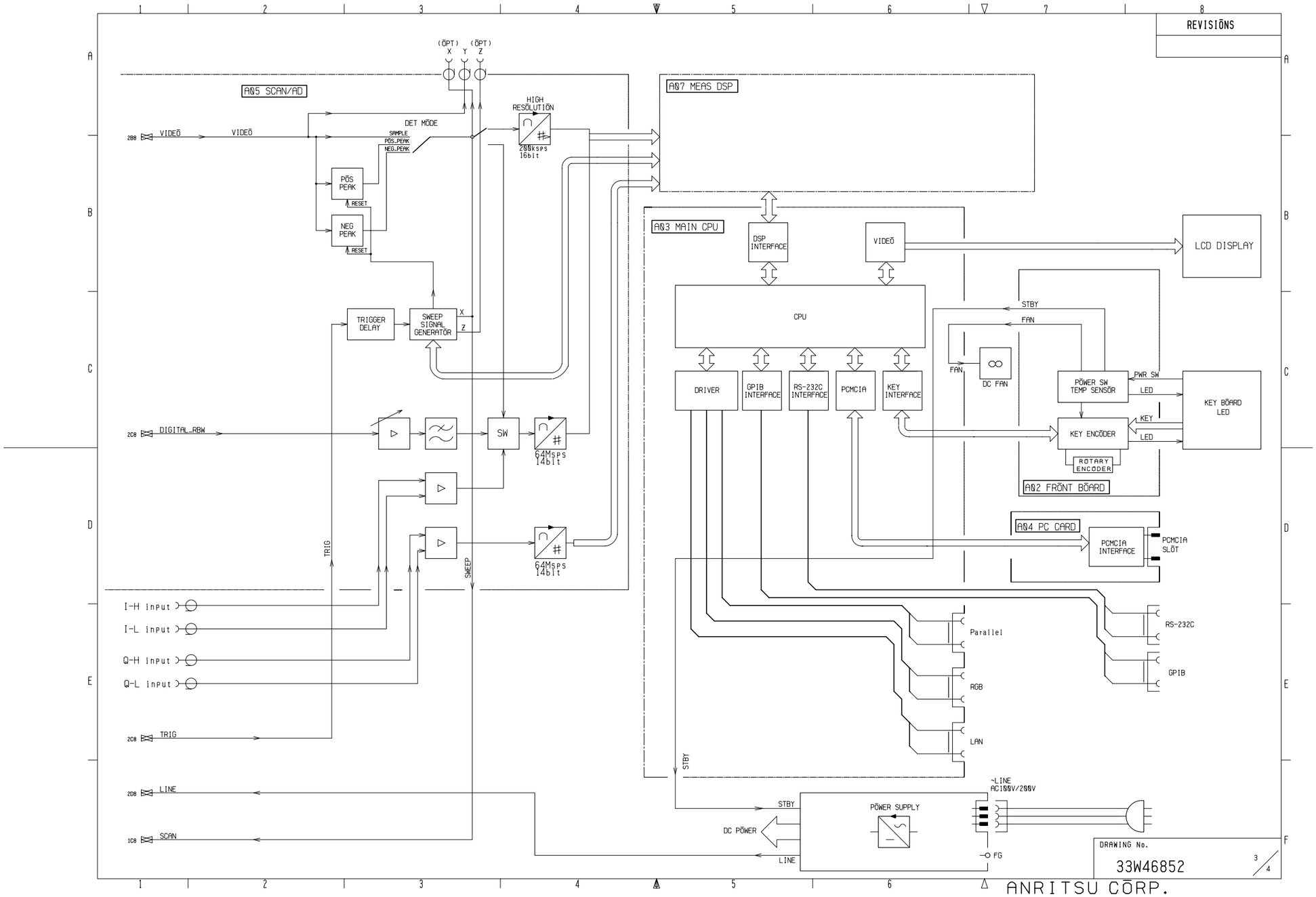
REVISIŌNS

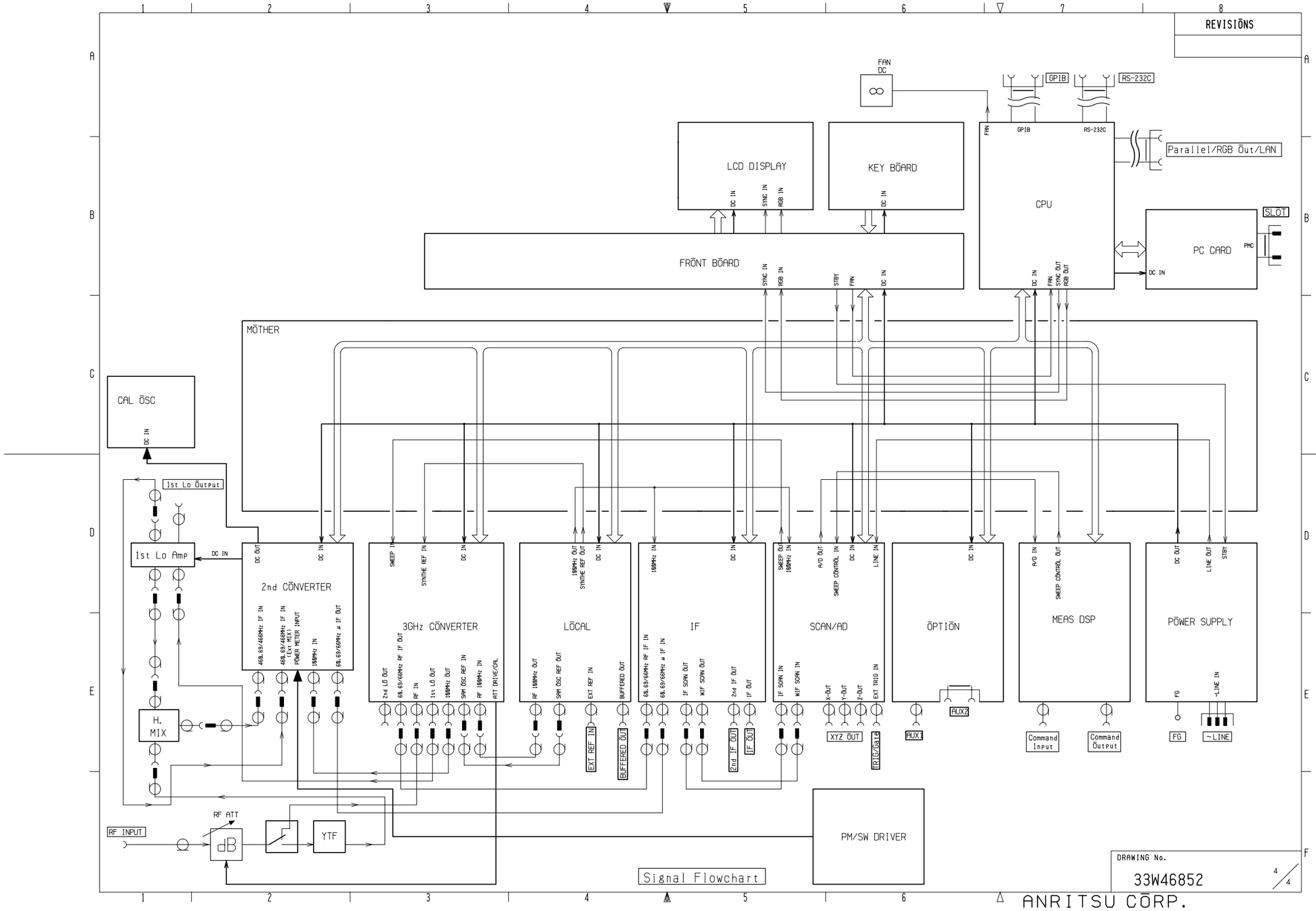


QTY	ITEM	PART No.	DESCRIPTIŌN	MATERIAL	FINISH	NŌTE
CHECKED BY		DRAWN BY		SCALE		
APPRŌVED BY		DESIGNED BY				
TITLE	MS2687B ŌVERALL BLŌCK DIAGRAM		DRAWING No.	33W46852	*1	4

ANRITSU CŌRP.


REVISIŌNS
A06 IF
A05 SCAN/AD
IF Output
60.69/66MHz_IF
1B8
66MHz
IF AMP
SW
MIX
50MHz
10.69MHz
IF AMP
100MHz
1E8 1E3 1B8
2C1
100MHz
1E8 1E3 1B8
2B1
LOG
VBW
VIDEO
3B1
Gain Control
LIN
LOG
LIN
MIX
3C1
DIGITAL_RBW
VIDEO
66MHz
WIDE1BAND1DET
TRIG SOURCE
VIDEO
WIDE VIDEO
EXT
66MHz IF
COMPA
-RATOR
TRIG SOURCE
TV
EXT.VIDEO
LINE
TRIG
TRIG
3E1
LINE
3F1
Trig/Gate
DRAWING No.
33W46852
2/4
ANRITSU CORP.


REVISIÕNS
A05 SCAN/AD
A07 MEAS DSP
A03 MAIN CPU
A02 FRÕNT BÕARD
A04 PC CARD
(ÕPT) X
(ÕPT) Y
(ÕPT) Z
VIDEÕ
2B8
VIDEÕ
DET MÕDE
SAMPLE
PÕS-PEAK
NEG-PEAK
HIGH RESOLUTIÕN
280ksps 16bit
PÕS PEAK
NEG PEAK
RESET
RESET
TRIGGER DELAY
SWEEP SIGNAL GENERATÕR
X
Z
DIGITAL-RBW
2C8
SW
64Msps 14bit
64Msps 14bit
TRIG
SWEEP
I-H input
I-L input
Q-H input
Q-L input
2C8
TRIG
2D8
LINE
1C8
SCAN
DSP INTERFACE
VIDEÕ
LCD DISPLAY
CPU
STBY
FAN
FAN
DC FAN
DRIVER
GPIB INTERFACE
RS-232C INTERFACE
PCMCIA
KEY INTERFACE
PÕWER SW TEMP SENSÕR
PWR SW
LED
KEY BÕARD LED
KEY ENCÕDER
KEY
LED
ROTARY ENCODER
PCMCIA INTERFACE
PCMCIA SLÕT
Parallel
RS-232C
RGB
GPIB
LAN
STBY
~LINE AC100V/200V
STBY
PÕWER SUPPLY
DC PÕWER
LINE
FG
DRAWING No.
33W46852
3/4
ANRITSU CÕRP.


REVISIONS
FAN
DC
GPIB
RS-232C
LCD DISPLAY
KEY BOARD
CPU
Parallel/RGB Out/LAN
SLOT
PC CARD
PMC
FRONT BOARD
MOTHER
CAL OSC
1st Lo Output
1st Lo Amp
2nd CONVERTER
3GHz CONVERTER
LOCAL
IF
SCAN/AD
OPTION
MEAS DSP
POWER SUPPLY
H.
MIX
RF INPUT
RF ATT
YTF
PM/SW DRIVER
EXT REF IN
BUFFERED OUT
2nd IF OUT
IF OUT
XYZ OUT
TRIG/Gate
AUX1
AUX2
Command Input
Command Output
FG
~LINE
Signal Flowchart
DRAWING No.
33W46852
4/4
ANRITSU CORP.

Appendix C Performance Test Record

MS2681A
Performance Test Record

NO. _____

DATE _____

Model MS2681A

Serial NO. _____

Options _____

Date _____

Tested by _____

Ambient temparature _____ ˚C

Relative humidity _____ %

Perwer mains line voltage (nominal) _____ Vac

Powermains line frquency (nominal) _____ Hz

Test Equipment used

Descriptions	MODEL NO.	Cal Date
Synthesized signal generator		
Synthesized Sweeper		
Attenuator		
Power meter		
Power senser		
50 Ω Termination		
Low pass filter		
Frequency counter		
Frequency standard		

Model Name MS2681A date _____

Serial NO. _____

Tested by _____

Reference oscillator frequency stability

• Frequency stability

Referred to the frequency after 24 hour warm-up

$\pm 2 \times 10^{-8}$

	Min.	Result	Max.	Cumulative error
Frequency stability/day	-2×10^{-8}		$+2\times10^{-8}$	$+2\times10^{-10}$

• Temperature stability

Referred to the frequency at 25°C

$\pm 5 \times 10^{-8}$

Ambient temperature	Min.	Result	Max.	Cumulative error
0°C	-5×10^{-8}		$+5\times10^{-8}$	$+2\times10^{-10}$
50°C	-5×10^{-8}		$+5\times10^{-8}$	$+2\times10^{-10}$

Frequency readout accuracy

± ((Displayed frequency) × (reference frequency accuracy) + (span) × (span accuracy) + (resolution bandwidth) × 0.15 + 10 Hz)

Center frequency	Span frequebcy	Resolution bandwidth	Min. (Hz)	Result (Hz)	Max. (Hz)	Cumulative error (Hz)
500 MHz	10 kHz	300 Hz	-110		+110	21
	200 kHz	3 kHz	-2 010		+2 010	401
	100 MHz	300 kHz	-1 000 010		+1 000 010	20 000
1.5 GHz	10 kHz	300 Hz	-110		+110	21
	200 kHz	3 kHz	-2 010		+2 010	401
	100 MHz	300 kHz	-1 000 010		+1 000 010	20 000

(3/10)

Model Name MS2681A date _____

Serial NO. _____

Tested by _____

Frequency span readout accuracy

Single band sweep

±1.0%

MS2681A		Min.	Result	Max.	Cumulative
Center frequency	Span frequency	(Hz)	(Hz)	(Hz)	error (Hz)
1.5 GHz	20 kHz	-200		+200	40
	200 kHz	-2 000		+2 000	400
	2 MHz	-20 000		+20 000	4 000
	20 MHz	-200 000		+200 000	40 000
	200 MHz	-2 000 000		+2 000 000	400 000
	2 GHz	-20 000 000		+20 000 000	4 000 000

(4/10)

Model Name MS2681A date _____

Serial NO. _____

Tested by _____

Resolution bandwidth accuracy and selectivity

• Resolution bandwidth accuracy

±20% (300 Hz to 10 MHz)

±40% (20 MHz)

MS2681A		Min. Cumulative error (Hz)	Min. (Hz)	Result (Hz)	Max. (Hz)	Max. Cumulative error (Hz)
Resolution bandwidth	Span frequency					
300 Hz	10 kHz	+8	240		360	-8
1 kHz	30 kHz	+22	800		1 200	-24
3 kHz	100 kHz	+80	2 400		3 600	-80
10 kHz	300 kHz	+220	8 000		12 000	-240
30 kHz	1 MHz	+800	24 000		36 000	-800
100 kHz	3 MHz	+2 200	80 000		120 000	-2 400
300 kHz	10 MHz	+8 000	240 000		360 000	-8 000
1 MHz	30 MHz	+22 000	800 000		1 200 000	-24 000
3 MHz	100 MHz	+80 000	2 400 000		3 600 000	-80 000
5 MHz	150 MHz	+110 000	4 000 000		6 000 000	-120 000
10 MHz	200 MHz	+220 000	8 000 000		1 200 000	-240 000
20 MHz	200 MHz	+480 000	12 000 000		28 000 000	-520 000

• Resolution bandwidth selectivity

≤15 : 1

MS2681A		Result		Calculated result	Spec.	Max. Cumulative error (Hz)
Resolution bandwidth	Span frequency	60 dB bandwidth (Hz)	3 dB bandwidth (Hz)	Selectivity		
300 Hz	10 kHz				≤15:1	+0.14
1 kHz	30 kHz				≤15:1	+0.12
3 kHz	100 kHz				≤15:1	+0.14
10 kHz	300 kHz				≤15:1	+0.12
30 kHz	1 MHz				≤15:1	+0.14
100 kHz	3 MHz				≤15:1	+0.12
300 kHz	10 MHz				≤15:1	+0.14
1 MHz	30 MHz				≤15:1	+0.12
3 MHz	100 MHz				≤15:1	+0.14
5 MHz	150 MHz				≤15:1	+0.12
10 MHz	200 MHz				≤15:1	+0.08
20 MHz	200 MHz				≤15:1	+0.08

(5/10)

Model Name MS2681A date _____

Serial NO. _____

Tested by _____

Sideband phase noise

≤–108 dBc/Hz (Frequency: 1 GHz, frequency offset: 10 kHz)

≤–120 dBc/Hz (Frequency: 1 GHz, frequency offset: 100 kHz)

Frequency offset	MS2683A Span frequency	Result	Spec	Cumulative error
10 kHz	25 kHz		-108 dBc/Hz	-1.1 dB
100 kHz	250 kHz		-120 dBc/Hz	-1.1 dB

Frequency measurement accuracy

≤± (displayed frequency × reference oscillator accuracy ± 1 count ± 2 Hz)

Signal generator Output frequency	MS2683A Count resolution	Min.	Result	Max.
500 MHz	1 Hz	499.999 997 MHz		500.000 003 MHz
500 MHz	10 Hz	499.999 99 MHz		500.000 01 MHz
500 MHz	100 Hz	499.999 9 MHz		500.000 1 MHz
500 MHz	1 kHz	499.999 MHz		500.001 MHz

Amplitude display accuracy

After executing calibration

±0.4 dB (RBW ≤ 1 kHz, 0 to –20 dB)

±1.0 dB (RBW ≤ 1 kHz, 0 to –90 dB)

ATT ATT setting (dB)	Correction (dB)	Measured result (dB)	Calculated result (dB)	Spec.(dB)	Cumulative error (dB)
0				±0.4	±0.06
10				±0.4	±0.06
20				±1.0	±0.09
30				±1.0	±0.09
40				±1.0	±0.09
50				±1.0	±0.09
60				±1.0	±0.21
70				±1.0	±0.21
80				±1.0	±0.21
90				±1.0	±0.21

(6/10)

Model Name MS2681A date _____

Serial NO. _____

Tested by _____

Frequency response

Referred to 50 MHz, RF ATT10 dB, Temperature18 to 28˚C

±0.6 dB (9 kHz to 3.0 GHz)

MS2681A Frequency	Correction (dB)	Result (dB)	Calculated result (dB)	Spec. (dB)	Cumulative error (dB)
50 MHz			0.00 (referrence)	—	—
200 MHz				±0.6	±0.16
500 MHz				±0.6	±0.16
1 GHz				±0.6	±0.16
1.5 GHz				±0.6	±0.16
2 GHz				±0.6	±0.16
3 GHz				±0.6	±0.16

Reference level accuracy

After calibration, frequency: 50 MHz, Span:1 MHz (RBW, VBW, RF ATT, SWT: Auto)

±0.5 dB (0 to –49.9 dBm)

±0.75 dB (–69.9 to –50 dBm, +0.1 to +30 dBm)

±1.5 dB (–70 to –80 dBm)

MS2681A Reference level	Attenuator Correction (dB)	Result (dB) Marker level	Calculated result (dB)	Spec.(dB)	Cumulative error (dB)
0 dBm				±0.5	±0.10
-10 dBm				±0.5	±0.10
-20 dBm				±0.5	±0.10
-30 dBm				±0.5	±0.12
-40 dBm				±0.5	±0.12
-50 dBm				±0.75	±0.12
-60 dBm				±0.75	±0.22
-70 dBm				±1.5	±0.22
-80 dBm				±1.5	±0.22

(7/10)

Model Name MS2681A date _____

Serial NO. _____

Tested by _____

Average noise level

Resolution bandwidth: 300 Hz, VBW: 1 Hz, Input attenuator: 0 dB

≤–124 dBm + f [GHz] dB (1 MHz to 2.5 GHz, Band 0)

≤–120 dBm + f [GHz] dB (2.5 to 3.0 GHz, Band 0)

MS2681A setting Center frequency	Result (dB)	Spec.(dBm)	Cumulative error (dB)
1 MHz		-124.0	±1.23
99 MHz		-124.0	±1.23
499 MHz		-123.6	±1.23
999 MHz		-123.1	±1.23
1499 MHz		-122.6	±1.23
1999 MHz		-122.1	±1.23
2499 MHz		-121.6	±1.23
2999 MHz		-117.1	±1.23

(8/10)

Model Name MS2681A date _____

Serial NO. _____

Tested by _____

Second harmonic distortion

Mixer input level: –30 dBm

≤–60 dBc (Frequency: 10 to 200 MHz)

≤–75 dBc (Frequency: 0.2 to 0.85 GHz)

≤–70 dBc (Frequency: 0.85 to 1.5 GHz)

Signal generator	MS2681A setting	Result (dB)	Spec.(dBc)	Cumulative error (dB)
Output frequency	Band			
48 MHz	0		-60	±1.09
780 MHz	0		-75	±1.09

Resolution bandwidth (RBW) switching error

Referred to RBW 3kHz

±0.3 dB (300 Hz to 5 MHz)

±0.5 dB (10 MHz, 20 MHz)

MS2681A setting		Result (dB)	Spec. (dB)	Cumulative error (dB)
RBW	Span frequency			
300 Hz	2 kHz		±0.3	±0.02
1 kHz	5 kHz		±0.3	±0.02
3 kHz	15 kHz		0.00 (referrence)	—
10 kHz	50 kHz		±0.3	±0.02
30 kHz	150 kHz		±0.3	±0.02
100 kHz	500 kHz		±0.3	±0.02
300 kHz	1.5 MHz		±0.3	±0.02
1 MHz	5 MHz		±0.3	±0.02
3 MHz	15 MHz		±0.3	±0.02
5 MHz	25 MHz		±0.3	±0.02
10 MHz	50 MHz		±0.5	±0.02
20 MHz	100 MHz		±0.5	±0.02

(9/10)

Model Name MS2681A date _____

Serial NO. _____

Tested by _____

Input attenuator (RF ATT) switching error

Referred to 50 MHz, RF ATT 10 dB
±0.3 dB (10 to 50 dB)
±0.5 dB (52 to 62 dB)

MS2681A setting		Attenuator		Result (dB) marker level	Calculated result (dB)	Spec.(dB)	Cumulative error (dB)
Reference level	RF ATT	Setting	Correction				
-10 dBm	60 dB	0 dB				±0.5	±0.11
-20 dBm	50 dB	10 dB				±0.3	±0.11
-30 dBm	40 dB	20 dB				±0.3	±0.11
-40 dBm	30 dB	30 dB				±0.3	±0.13
-50 dBm	20 dB	40 dB				±0.3	±0.13
-60 dBm	10 dB	50 dB			0.00 (reference)	—	—

Frequency domain sweep time accuracy

±3% (10 ms to 1000 s)

MS2681A setting	Min.	Result	Max.	Spec.	Cumulative error
Sweep time					
100 ms	97 ms		103 ms	±3%	±11 ns
500 ms	485 ms		515 ms	±3%	±11 ns
10 s	9.7 s		10.3 s	±3%	±11 ns
100 s	97 s		103 s	±3%	±11 ns

MS2681A setting	Result	Min.	Calculated result	Max.	Spec.	Cumulative error
Sweep time	Frequency difference					
50 ms		48.5 ms		51.5 ms	±3%	±141 µs
20 ms		19.4 ms		20.6 ms	±3%	±56.5 µs
10 ms		9.7 ms		1.03 ms	±3%	±28.2 µs

(10/10)

Model Name MS2681A date _____

Serial NO. _____

Tested by _____

Time domain sweep time accuracy

±1% (10 µs to 1000 s)

MS2681A setting Sweep time	Min.	Result	Max.	Spec.	Cumulative error
100 ms	99 ms		101 ms	±1%	±11 ns
500 ms	495 ms		505 ms	±1%	±11 ns
10 s	9.9 s		1.01 s	±1%	±11 ns
100 s	99 s		101 s	±1%	±11 ns

MS2681A setting Sweep time	Min.	Calculated result	Max.	Spec.	Cumulative error
50 ms	49.5 ms		50.5 ms	±1%	±141 µs
20 ms	19.8 ms		20.2 ms	±1%	±56.5 µs
10 ms	9.9 ms		1.01 ms	±1%	±28.2 µs
5 ms	4.95 ms		5.05 ms	±1%	±14.1 µs
1 ms	0.99 ms		1.01 ms	±1%	±2.82 µs
100 µs	99 µs		101 µs	±1%	±0.282 µs
10 µs	9.9 µs		10. 1µs	±1%	±28.2 ns

MS2683A
Performance Test Record

(1/10)

NO. _____

DATE _____

Model MS2683A

Serial NO. _____

Options _____

Date _____

Tested by _____

Ambient temparature _____ ˚C

Relative humidity _____ %

Perwer mains line voltage (nominal) _____ Vac

Powermains line frquency (nominal) _____ Hz

Test Equipment used

Descriptions	MODEL NO.	Cal Date
Synthesized signal generator		
Synthesized Sweeper		
Attenuator		
Power meter		
Power senser		
50 Ω Termination		
Low pass filter		
Frequency counter		
Frequency standard		

Model Name MS2683A date _____

Serial NO. _____

Tested by _____

Reference oscillator frequency stability

• Frequency stability

Referred to the frequency after 24 hour warm-up

$\pm 2 \times 10^{-8}$

	Min.	Result	Max.	Cumulative error
Frequency stability/day	-2×10^{-8}		$+2\times10^{-8}$	$+2\times10^{-10}$

• Temperature stability

Referred to the frequency at 25°C

$\pm 5 \times 10^{-8}$

Ambient temperature	Min.	Result	Max.	Cumulative error
0°C	-5×10^{-8}		$+5\times10^{-8}$	$+2\times10^{-10}$
50°C	-5×10^{-8}		$+5\times10^{-8}$	$+2\times10^{-10}$

Frequency readout accuracy

± ((Displayed frequency) × (reference frequency accuracy) + (span) × (span accuracy) + (resolution bandwidth) × 0.15 + 10 Hz)

Center frequency	Span frequebcy	Resolution bandwidth	Min. (Hz)	Result (Hz)	Max. (Hz)	Cumulative error (Hz)
500 MHz	10 kHz	300 Hz	-110		+110	21
	200 kHz	3 kHz	-2 010		+2 010	401
	100 MHz	300 kHz	-1 000 010		+1 000 010	20 000
5 GHz	10 kHz	300 Hz	-110		+110	21
	200 kHz	3 kHz	-2 010		+2 010	401
	100 MHz	300 kHz	-1 000 010		+1 000 010	20 000
7 GHz	10 kHz	300 Hz	-110		+110	21
	200 kHz	3 kHz	-2 010		+2 010	401
	100 MHz	300 kHz	-1 000 010		+1 000 010	20 000

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Model Name MS2683A date _____

Serial NO. _____

Tested by _____

Frequency span readout accuracy

Single band sweep

±1.0%

MS2683A		Min. (Hz)	Result (Hz)	Max. (Hz)	Cumulative error (Hz)
Center frequency	Span frequency				
1.5 GHz	20 kHz	-200		+200	40
	200 kHz	-2 000		+2 000	400
	2 MHz	-20 000		+20 000	4 000
	20 MHz	-200 000		+200 000	40 000
	200 MHz	-2 000 000		+2 000 000	400 000
	2 GHz	-20 000 000		+20 000 000	4 000 000
5 GHz	20 MHz	-200 000		+200 000	40 000
	200 MHz	-2 000 000		+2 000 000	400 000
	2 GHz	-20 000 000		+20 000 000	4 000 000

Model Name MS2683A date _____

Serial NO. _____

Tested by _____

Resolution bandwidth accuracy and selectivity

• Resolution bandwidth accuracy

±20% (300 Hz to 10 MHz)

±40% (20 MHz)

MS2683A		Min. Cumulative error (Hz)	Min. (Hz)	Result (Hz)	Max. (Hz)	Max. Cumulative error (Hz)
Resolution bandwidth	Span frequency					
300 Hz	10 kHz	+8	240		360	-8
1 kHz	30 kHz	+22	800		1 200	-24
3 kHz	100 kHz	+80	2 400		3 600	-80
10 kHz	300 kHz	+220	8 000		12 000	-240
30 kHz	1 MHz	+800	24 000		36 000	-800
100 kHz	3 MHz	+2 200	80 000		120 000	-2 400
300 kHz	10 MHz	+8 000	240 000		360 000	-8 000
1 MHz	30 MHz	+22 000	800 000		1 200 000	-24 000
3 MHz	100 MHz	+80 000	2 400 000		3 600 000	-80 000
5 MHz	150 MHz	+110 000	4 000 000		6 000 000	-120 000
10 MHz	200 MHz	+220 000	8 000 000		1 200 000	-240 000
20 MHz	200 MHz	+480 000	12 000 000		28 000 000	-520 000

• Resolution bandwidth selectivity

≤15 : 1

MS2683A		Result		Calculated result	Spec.	Max. Cumulative error (Hz)
Resolution bandwidth	Span frequency	60 dB bandwidth (Hz)	3 dB bandwidth (Hz)	Selectivity		
300 Hz	10 kHz				≤15:1	+0.14
1 kHz	30 kHz				≤15:1	+0.12
3 kHz	100 kHz				≤15:1	+0.14
10 kHz	300 kHz				≤15:1	+0.12
30 kHz	1 MHz				≤15:1	+0.14
100 kHz	3 MHz				≤15:1	+0.12
300 kHz	10 MHz				≤15:1	+0.14
1 MHz	30 MHz				≤15:1	+0.12
3 MHz	100 MHz				≤15:1	+0.14
5 MHz	150 MHz				≤15:1	+0.12
10 MHz	200 MHz				≤15:1	+0.08
20 MHz	200 MHz				≤15:1	+0.08

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Model Name MS2683A date _____

Serial NO. _____

Tested by _____

Sideband phase noise

≤–108 dBc/Hz (Frequency: 1 GHz, frequency offset: 10 kHz)

≤–120 dBc/Hz (Frequency: 1 GHz, frequency offset: 100 kHz)

Frequency offset	MS2683A Span frequency	Result	Spec	Cumulative error
10 kHz	25 kHz		-108 dBc/Hz	-1.1 dB
100 kHz	250 kHz		-120 dBc/Hz	-1.1 dB

Frequency measurement accuracy

≤± (displayed frequency × reference oscillator accuracy ± 1 count ± 2 Hz)

Signal generator Output frequency	MS2683A Count resolution	Min.	Result	Max.
500 MHz	1 Hz	499.999 997 MHz		500.000 003 MHz
500 MHz	10 Hz	499.999 99 MHz		500.000 01 MHz
500 MHz	100 Hz	499.999 9 MHz		500.000 1 MHz
500 MHz	1 kHz	499.999 MHz		500.001 MHz

Amplitude display accuracy

After executing calibration

±0.4 dB (RBW ≤ 1 kHz, 0 to –20 dB)

±1.0 dB (RBW ≤ 1 kHz, 0 to –90 dB)

ATT ATT setting (dB)	Correction (dB)	Measured result (dB)	Calculated result (dB)	Spec.(dB)	Cumulative error (dB)
0				±0.4	±0.06
10				±0.4	±0.06
20				±1.0	±0.09
30				±1.0	±0.09
40				±1.0	±0.09
50				±1.0	±0.09
60				±1.0	±0.21
70				±1.0	±0.21
80				±1.0	±0.21
90				±1.0	±0.21

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Model Name MS2683A date _____

Serial NO. _____

Tested by _____

Frequency response

Referred to 50 MHz, RF ATT10 dB, Temperature18 to 28˚C
±0.6 dB (9 kHz to 3.2 GHz, Band 0)
±1.0 dB (3.15 to 7.8 GHz, Band 1)
*Band 1: After executing preselector tuning

MS2683A		Correction (dB)	Result (dB)	Calculated result (dB)	Spec. (dB)	Cumulative error (dB)
Band	Frequency					
0	50 MHz			0.00 (referrence)	—	—
0	200 MHz				±0.6	±0.16
0	500 MHz				±0.6	±0.16
0	1 GHz				±0.6	±0.16
0	1.5 GHz				±0.6	±0.16
0	2 GHz				±0.6	±0.16
0	3 GHz				±0.6	±0.16
1-	3.2 GHz				±1.0	±0.14
1-	4 GHz				±1.0	±0.14
1-	5 GHz				±1.0	±0.14
1-	6.2 GHz				±1.0	±0.14
1+	6.3 GHz				±1.0	±0.14
1+	7 GHz				±1.0	±0.14
1+	7.5 GHz				±1.0	±0.14
1+	7.8 GHz				±1.0	±0.14

Reference level accuracy

After calibration, frequency: 50 MHz, Span:1 MHz (RBW, VBW, RF ATT, SWT: Auto)
±0.5 dB (0 to –49.9 dBm)
±0.75 dB (–69.9 to –50 dBm, +0.1 to +30 dBm)
±1.5 dB (–70 to –80 dBm)

MS2683A	Attenuator	Result (dB)	Calculated	Spec.(dB)	Cumulative
Reference level	Correction (dB)	Marker level	result (dB)		error (dB)
0 dBm				±0.5	±0.10
-10 dBm				±0.5	±0.10
-20 dBm				±0.5	±0.10
-30 dBm				±0.5	±0.12
-40 dBm				±0.5	±0.12
-50 dBm				±0.75	±0.12
-60 dBm				±0.75	±0.22
-70 dBm				±1.5	±0.22
-80 dBm				±1.5	±0.22

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Model Name MS2683A date _____

Serial NO. _____

Tested by _____

Average noise level

Resolution bandwidth: 300 Hz, VBW: 1 Hz, Input attenuator: 0 dB

≤–124 dBm + f [GHz] dB (1 MHz to 2.5 GHz, Band 0)

≤–120 dBm + f [GHz] dB (2.5 to 3.2 GHz, Band 0)

≤–122 dBm + 0.5 × f [GHz] dB (3.15 to 7.8 GHz, Band 1)

MS2683A setting		Result (dB)	Spec.(dBm)	Cumulative error (dB)
Band	Center frequency			
0	1 MHz		-124.0	±1.23
0	99 MHz		-124.0	±1.23
0	499 MHz		-123.6	±1.23
0	999 MHz		-123.1	±1.23
0	1499 MHz		-122.6	±1.23
0	1999 MHz		-122.1	±1.23
0	2499 MHz		-121.6	±1.23
0	2999 MHz		-117.1	±1.23
0	3199 MHz		-116.9	±1.23
1-	3201 MHz		-120.4	±1.23
1-	3499 MHz		-120.3	±1.23
1-	3999 MHz		-120.1	±1.23
1-	4499 MHz		-119.8	±1.23
1-	4999 MHz		-119.6	±1.23
1+	6299 MHz		-118.9	±1.23
1+	6201 MHz		-118.9	±1.23
1+	6499 MHz		-118.8	±1.23
1+	6999 MHz		-118.6	±1.23
1+	7799 MHz		-118.2	±1.23

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Model Name MS2683A date _____

Serial NO. _____

Tested by _____

Second harmonic distortion

Mixer input level: –30 dBm

≤–60 dBc (Frequency: 10 to 200 MHz)

≤–75 dBc (Frequency: 0.2 to 0.85 GHz, Band 0)

≤–70 dBc (Frequency: 0.85 to 1.6 GHz, Band 0)

Mixer input level: –10 dBm

≤–90 dBc (Frequency: 1.6 to 3.9 GHz, Band 1)

Signal generator	MS2683A setting	Result (dB)	Spec.(dBc)	Cumulative error (dB)
Output frequency	Band			
48 MHz	0		-60	±1.09
780 MHz	0		-75	±1.09

Resolution bandwidth (RBW) switching error

Referred to RBW 3kHz

±0.3 dB (300 Hz to 5 MHz)

±0.5 dB (10 MHz, 20 MHz)

MS2683A setting		Result (dB)	Spec. (dB)	Cumulative error (dB)
RBW	Span frequency			
300 Hz	2 kHz		±0.3	±0.02
1 kHz	5 kHz		±0.3	±0.02
3 kHz	15 kHz		0.00 (referrence)	—
10 kHz	50 kHz		±0.3	±0.02
30 kHz	150 kHz		±0.3	±0.02
100 kHz	500 kHz		±0.3	±0.02
300 kHz	1.5 MHz		±0.3	±0.02
1 MHz	5 MHz		±0.3	±0.02
3 MHz	15 MHz		±0.3	±0.02
5 MHz	25 MHz		±0.3	±0.02
10 MHz	50 MHz		±0.5	±0.02
20 MHz	100 MHz		±0.5	±0.02

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Model Name MS2683A date _____

Serial NO. _____

Tested by _____

Input attenuator (RF ATT) switching error

Referred to 50 MHz, RF ATT 10 dB
±0.3 dB (10 to 50 dB)
±0.5 dB (52 to 62 dB)

MS2683A setting		Attenuator		Result (dB) marker level	Calculated result (dB)	Spec.(dB)	Cumulative error (dB)
Reference level	RF ATT	Setting	Correction				
-10 dBm	60 dB	0 dB				±0.5	±0.11
-20 dBm	50 dB	10 dB				±0.3	±0.11
-30 dBm	40 dB	20 dB				±0.3	±0.11
-40 dBm	30 dB	30 dB				±0.3	±0.13
-50 dBm	20 dB	40 dB				±0.3	±0.13
-60 dBm	10 dB	50 dB			0.00 (reference)	—	—

Frequency domain sweep time accuracy

±3% (10 ms to 1000 s)

MS2683A setting Sweep time	Min.	Result	Max.	Spec.	Cumulative error
100 ms	97 ms		103 ms	±3%	±11 ns
500 ms	485 ms		515 ms	±3%	±11 ns
10 s	9.7 s		10.3 s	±3%	±11 ns
100 s	97 s		103 s	±3%	±11 ns

MS2683A setting	Result	Min.	Calculated result	Max.	Spec.	Cumulative error
Sweep time	Frequency difference					
50 ms		48.5 ms		51.5 ms	±3%	±141 µs
20 ms		19.4 ms		20.6 ms	±3%	±56.5 µs
10 ms		9.7 ms		1.03 ms	±3%	±28.2 µs

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Model Name MS2683A date _____

Serial NO. _____

Tested by _____

Time domain sweep time accuracy

±1% (10 µs to 1000 s)

MS2683A setting Sweep time	Min.	Result	Max.	Spec.	Cumulative error
100 ms	99 ms		101 ms	±1%	±11 ns
500 ms	495 ms		505 ms	±1%	±11 ns
10 s	9.9 s		1.01 s	±1%	±11 ns
100 s	99 s		101 s	±1%	±11 ns

MS2683A setting Sweep time	Min.	Calculated result	Max.	Spec.	Cumulative error
50 ms	49.5 ms		50.5 ms	±1%	±141 µs
20 ms	19.8 ms		20.2 ms	±1%	±56.5 µs
10 ms	9.9 ms		1.01 ms	±1%	±28.2 µs
5 ms	4.95 ms		5.05 ms	±1%	±14.1 µs
1 ms	0.99 ms		1.01 ms	±1%	±2.82 µs
100 µs	99 µs		101 µs	±1%	±0.282 µs
10 µs	9.9 µs		10. 1µs	±1%	±28.2 ns

MS2687A
Performance Test Record

NO. _____

DATE _____

Model MS2687A

Serial NO. _____

Options _____

Date _____

Tested by _____

Ambient temparature _____ ˚C

Relative humidity _____ %

Perwer mains line voltage (nominal) _____ Vac

Powermains line frquency (nominal) _____ Hz

Test Equipment used

Descriptions	MODEL NO.	Cal Date
Synthesized signal generator		
Synthesized Sweeper		
Attenuator		
Power meter		
Power senser		
50 Ω Termination		
Low pass filter		
Frequency counter		
Frequency standard		

Model Name MS2687A date _____

Serial NO. _____

Tested by _____

Reference oscillator frequency stability

• Frequency stability

Referred to the frequency after 24 hour warm-up

$\pm 2 \times 10^{-8}$

	Min.	Result	Max.	Cumulative error
Frequency stability/day	-2×10^{-8}		$+2\times10^{-8}$	$+2\times10^{-10}$

• Temperature stability

Referred to the frequency at 25°C

$\pm 5 \times 10^{-8}$

Ambient temperature	Min.	Result	Max.	Cumulative error
0°C	-5×10^{-8}		$+5\times10^{-8}$	$+2\times10^{-10}$
50°C	-5×10^{-8}		$+5\times10^{-8}$	$+2\times10^{-10}$

Frequency readout accuracy

± ((Displayed frequency) × (reference frequency accuracy) + (span) × (span accuracy) + (resolution bandwidth) × 0.15 + 10 Hz × N)

Center frequency	Span frequebcy	Resolution bandwidth	Min. (Hz)	Result (Hz)	Max. (Hz)	Cumulative error (Hz)
500 MHz	10 kHz	300 Hz	-110		+110	21
	200 kHz	3 kHz	-2 010		+2 010	401
	100 MHz	300 kHz	-1 000 010		+1 000 010	20 000
5 GHz	10 kHz	300 Hz	-110		+110	21
	200 kHz	3 kHz	-2 010		+2 010	401
	100 MHz	300 kHz	-1 000 010		+1 000 010	20 000
7 GHz	10 kHz	300 Hz	-110		+110	21
	200 kHz	3 kHz	-2 010		+2 010	401
	100 MHz	300 kHz	-1 000 010		+1 000 010	20 000
12 GHz	10 kHz	300 Hz	-315		+315	21
	200 kHz	3 kHz	-5470		+5470	401
	100 MHz	300 kHz	-2545000		+2545000	20000
20 GHz	10 kHz	300 Hz	-325		+325	21
	200 kHz	3 kHz	-5480		+5480	401
	100 MHz	300 kHz	-2545000		+2545000	20000
29 GHz	10 kHz	300 Hz	-335		+335	21
	200 kHz	3 kHz	-5490		+5490	401
	100 MHz	300 kHz	-2545000		+2545000	20000

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Model Name MS2687A date _____

Serial NO. _____

Tested by _____

Frequency span readout accuracy

Single band sweep

±1.0%

MS2687A		Min. (Hz)	Result (Hz)	Max. (Hz)	Cumulative error (Hz)
Center frequency	Span frequency				
1.5 GHz	20 kHz	-200		+200	40
	200 kHz	-2 000		+2 000	400
	2 MHz	-20 000		+20 000	4 000
	20 MHz	-200 000		+200 000	40 000
	200 MHz	-2 000 000		+2 000 000	400 000
	2 GHz	-20 000 000		+20 000 000	4 000 000
5 GHz	20 MHz	-200 000		+200 000	40 000
	200 MHz	-2 000 000		+2 000 000	400 000
	2 GHz	-20 000 000		+20 000 000	4 000 000
12 GHz	20 MHz	-500 000		+500 000	20 000
	200 MHz	-5 000 000		+5 000 000	200 000
	2 GHz	-50 000 000		+50 000 000	2 000 000
20 GHz	30 MHz	-750 000		+750 000	30 000
	300 MHz	-7 500 000		+7 500 000	300 000
	3 GHz	-75 000 000		+75 000 000	3 000 000
26 GHz	40 MHz	-1 000 000		+1 000 000	40 000
	400 MHz	-10 000 000		+10 000 000	400 000
	4 GHz	-100 000 000		+100 000 000	4 000 000

Model Name MS2687A date _____

Serial NO. _____

Tested by _____

Resolution bandwidth accuracy and selectivity

• Resolution bandwidth accuracy

±20% (300 Hz to 10 MHz)

±40% (20 MHz)

MS2687A		Min. Cumulative error (Hz)	Min. (Hz)	Result (Hz)	Max. (Hz)	Max. Cumulative error (Hz)
Resolution bandwidth	Span frequency					
300 Hz	10 kHz	+8	240		360	-8
1 kHz	30 kHz	+22	800		1 200	-24
3 kHz	100 kHz	+80	2 400		3 600	-80
10 kHz	300 kHz	+220	8 000		12 000	-240
30 kHz	1 MHz	+800	24 000		36 000	-800
100 kHz	3 MHz	+2 200	80 000		120 000	-2 400
300 kHz	10 MHz	+8 000	240 000		360 000	-8 000
1 MHz	30 MHz	+22 000	800 000		1 200 000	-24 000
3 MHz	100 MHz	+80 000	2 400 000		3 600 000	-80 000
5 MHz	150 MHz	+110 000	4 000 000		6 000 000	-120 000
10 MHz	200 MHz	+220 000	8 000 000		1 200 000	-240 000
20 MHz	200 MHz	+480 000	12 000 000		28 000 000	-520 000

• Resolution bandwidth selectivity

≤15 : 1

MS2687A		Result		Calculated result	Spec.	Max. Cumulative error (Hz)
Resolution bandwidth	Span frequency	60 dB bandwidth (Hz)	3 dB bandwidth (Hz)	Selectivity		
300 Hz	10 kHz				≤15:1	+0.14
1 kHz	30 kHz				≤15:1	+0.12
3 kHz	100 kHz				≤15:1	+0.14
10 kHz	300 kHz				≤15:1	+0.12
30 kHz	1 MHz				≤15:1	+0.14
100 kHz	3 MHz				≤15:1	+0.12
300 kHz	10 MHz				≤15:1	+0.14
1 MHz	30 MHz				≤15:1	+0.12
3 MHz	100 MHz				≤15:1	+0.14
5 MHz	150 MHz				≤15:1	+0.12
10 MHz	200 MHz				≤15:1	+0.08
20 MHz	200 MHz				≤15:1	+0.08

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Model Name MS2687A date _____

Serial NO. _____

Tested by _____

Sideband phase noise

≤–108 dBc/Hz (Frequency: 1 GHz, frequency offset: 10 kHz)

≤–120 dBc/Hz (Frequency: 1 GHz, frequency offset: 100 kHz)

Frequency offset	MS2687A Span frequency	Result	Spec	Cumulative error
10 kHz	25 kHz		-108 dBc/Hz	-1.1 dB
100 kHz	250 kHz		-120 dBc/Hz	-1.1 dB

Frequency measurement accuracy

≤± (displayed frequency × reference oscillator accuracy ± 1 count ± 2 Hz)

Signal generator Output frequency	MS2687A Count resolution	Min.	Result	Max.
500 MHz	1 Hz	499.999 997 MHz		500.000 003 MHz
500 MHz	10 Hz	499.999 99 MHz		500.000 01 MHz
500 MHz	100 Hz	499.999 9 MHz		500.000 1 MHz
500 MHz	1 kHz	499.999 MHz		500.001 MHz

Amplitude display accuracy

After executing calibration

±0.4 dB (RBW ≤ 1 kHz, 0 to –20 dB)

±1.0 dB (RBW ≤ 1 kHz, 0 to –90 dB)

ATT ATT setting (dB)	Correction (dB)	Measured result (dB)	Calculated result (dB)	Spec.(dB)	Cumulative error (dB)
0				±0.4	±0.06
10				±0.4	±0.06
20				±1.0	±0.09
30				±1.0	±0.09
40				±1.0	±0.09
50				±1.0	±0.09
60				±1.0	±0.21
70				±1.0	±0.21
80				±1.0	±0.21
90				±1.0	±0.21

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Model Name MS2687A date _____

Serial NO. _____

Tested by _____

Frequency response

1) Relative flatness
   At input attenuator = 10 dB
   ±1.0 dB (9 kHz to 3.2 GHz, band 0), ±1.5 dB (3.15 to 7.9 GHz, band 1)
   ±3.0 dB (7.8 to 15.2 GHz, band 2), ±4.0 dB (15.1 to 22.5 GHz, band 3)
   ±4.0 dB (22.4 to 30.0 GHz, band 4)
2) At Band 1, 2, 3, 4, after pre-selector tuning
3) Absolute flatness
   Refered to 50 MHz, input attenuator = 10 dB
   ±5.0 dB (9 kHz to 30.0 GHz)
   * At Band 1, 2, 3, 4, after pre-selector tuning

MS2687A		Calibration value (dB)	Measurement value (dB)	Calculated result	Standard (dB)	Max accumulated error (dB)
Band	Frequency					
0	50 MHz			0.00 (referrence)	—	—
0	500 MHz				±5.0 dB	±0.16
0	1 GHz				±5.0 dB	±0.16
0	1.5 GHz				±5.0 dB	±0.16
0	2 GHz				±5.0 dB	±0.16
0	3 GHz				±5.0 dB	±0.16
1-	3.5 GHz				±5.0 dB	±0.14
1-	4 GHz				±5.0 dB	±0.14
1-	5 GHz				±5.0 dB	±0.14
1-	6 GHz				±5.0 dB	±0.14
1+	7 GHz				±5.0 dB	±0.14
1+	7.9 GHz				±5.0 dB	±0.14
2+	8 GHz				±5.0 dB	±0.14
2+	10 GHz				±5.0 dB	±0.14
2+	12 GHz				±5.0 dB	±0.14
2+	14 GHz				±5.0 dB	±0.14
2+	15 GHz				±5.0 dB	±0.14
3+	16 GHz				±5.0 dB	±0.14
3+	18 GHz				±5.0 dB	±0.14
3+	20 GHz				±5.0 dB	±0.14
3+	22 GHz				±5.0 dB	±0.14
4+	23 GHz				±5.0 dB	±0.14
4+	24 GHz				±5.0 dB	±0.14
4+	26 GHz				±5.0 dB	±0.14
4+	28 GHz				±5.0 dB	±0.14
4+	30 GHz				±5.0 dB	±0.14

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Model Name MS2687A date _____

Serial NO. _____

Tested by _____

Reference level accuracy

After calibration, frequency: 50 MHz, Span:1 MHz (RBW, VBW, RF ATT, SWT: Auto)
±0.5 dB (0 to –49.9 dBm)
±0.75 dB (–69.9 to –50 dBm, +0.1 to +30 dBm)
±1.5 dB (–70 to –80 dBm)

MS2687A Reference level	Attenuator Correction (dB)	Result (dB) Marker level	Calculated result (dB)	Spec.(dB)	Cumulative error (dB)
0 dBm				±0.5	±0.10
-10 dBm				±0.5	±0.10
-20 dBm				±0.5	±0.10
-30 dBm				±0.5	±0.12
-40 dBm				±0.5	±0.12
-50 dBm				±0.75	±0.12
-60 dBm				±0.75	±0.22
-70 dBm				±1.5	±0.22
-80 dBm				±1.5	±0.22

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Model Name MS2687A date _____

Serial NO. _____

Tested by _____

Average noise level

At input attenuator = 0 dB, VBW = 1 Hz, Detection mode: Sample
≤–124 dBm + f [GHz] dB (1 MHz to 2.5 GHz, band 0),
≤–120 dBm + f [GHz] dB (2.5 to 3.0 GHz, band 0)
≤–115 dBm (3.15 to 7.9 GHz, band 1), ≤–107 dBm (7.8 to 15.2 GHz, band 2)
≤–103 dBm (15.1 to 22.5 GHz, band 3), ≤–96 dBm (22.4 to 30.0 GHz, band 4)

MS2687A setting		Measurement value (dBm)	Standard	Max accumulated error (dB)
Band	Center frequency			
0	1 MHz		-124	±1.23
0	99 MHz		-124	±1.23
0	499 MHz		-123.6	±1.23
0	999 MHz		-123.1	±1.23
0	1499 MHz		-122.6	±1.23
0	2999 MHz		-117.1	±1.23
1-	3199 MHz		-115	±1.23
1-	3999 MHz		-115	±1.23
1-	5999 MHz		-115	±1.23
1+	6299 MHz		-115	±1.23
1+	6999 MHz		-115	±1.23
1+	7899 MHz		-115	±1.23
2+	7999 MHz		-107	±1.23
2+	9999 MHz		-107	±1.23
2+	11.999 GHz		-107	±1.23
2+	13.999 GHz		-107	±1.23
2+	14.999 GHz		-107	±1.23
3+	15.999 GHz		-103	±1.23
3+	17.999 GHz		-103	±1.23
3+	19.999 GHz		-103	±1.23
3+	21.999 GHz		-103	±1.23
4+	22.999 GHz		-96	±1.23
4+	24.999 GHz		-96	±1.23
4+	26.999 GHz		-96	±1.23
4+	28.999 GHz		-96	±1.23
4+	29.999 GHz		-96	±1.23

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Model Name MS2687A date _____

Serial NO. _____

Tested by _____

Second harmonic distortion

Mixer input level: –30 dBm

≤–60 dBc (Frequency:10 to 200 MHz)

≤–70 dBc (Frequency: 0.2 to 1.6 GHz, Band 0)

Mixer input level: –10 dBm

≤–90 dBc (Frequency: 1.6 to 15 GHz, Band 1, 2, 3, 4)

Signal generator	MS2687A setting	Result (dB)	Spec.(dBc)	Cumulative error (dB)
Output frequency	Band			
48 MHz	0		-60	±1.09
780 MHz	0		-75	±1.09

Resolution bandwidth (RBW) switching error

Referred to RBW 3 kHz

±0.3 dB (300 Hz to 5 MHz)

±0.5 dB (10 MHz, 20 MHz)

MS2687A setting		Result (dB)	Spec. (dB)	Cumulative error (dB)
RBW	Span frequency			
300 Hz	2 kHz		±0.3	±0.02
1 kHz	5 kHz		±0.3	±0.02
3 kHz	15 kHz		0.00 (referrence)	—
10 kHz	50 kHz		±0.3	±0.02
30 kHz	150 kHz		±0.3	±0.02
100 kHz	500 kHz		±0.3	±0.02
300 kHz	1.5 MHz		±0.3	±0.02
1 MHz	5 MHz		±0.3	±0.02
3 MHz	15 MHz		±0.3	±0.02
5 MHz	25 MHz		±0.3	±0.02
10 MHz	50 MHz		±0.5	±0.02
20 MHz	100 MHz		±0.5	±0.02

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Model Name MS2687A date _____

Serial NO. _____

Tested by _____

Input attenuator (RF ATT) switching error

Referred to 50 MHz, RF ATT 10 dB
±0.3 dB (10 to 50 dB)
±0.5 dB (60 to 70 dB)

MS2687A setting		Attenuator		Result (dB) marker level	Calculated result (dB)	Spec.(dB)	Cumulative error (dB)
Reference level	RF ATT	Setting	Correction				
-10 dBm	60 dB	0 dB				±0.5	±0.11
-20 dBm	50 dB	10 dB				±0.3	±0.11
-30 dBm	40 dB	20 dB				±0.3	±0.11
-40 dBm	30 dB	30 dB				±0.3	±0.13
-50 dBm	20 dB	40 dB				±0.3	±0.13
-60 dBm	10 dB	50 dB			0.00 (reference)	—	—

Frequency domain sweep time accuracy

±3% (10 ms to 1000 s)

MS2687A setting	Min.	Result	Max.	Spec.	Cumulative error
Sweep time					
100 ms	97 ms		103 ms	±3%	±11 ns
500 ms	485 ms		515 ms	±3%	±11 ns
10 s	9.7 s		10.3 s	±3%	±11 ns
100 s	97 s		103 s	±3%	±11 ns

MS2687A setting	Result	Min.	Calculated result	Max.	Spec.	Cumulative error
Sweep time	Frequency difference					
50 ms		48.5 ms		51.5 ms	±3%	±141 µs
20 ms		19.4 ms		20.6 ms	±3%	±56.5 µs
10 ms		9.7 ms		1.03 ms	±3%	±28.2 µs

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Model Name MS2687A date _____

Serial NO. _____

Tested by _____

Time domain sweep time accuracy

±1% (10 µs to 1000 s)

MS2687A setting Sweep time	Min.	Result	Max.	Spec.	Cumulative error
100 ms	99 ms		101 ms	±1%	±11 ns
500 ms	495 ms		505 ms	±1%	±11 ns
10 s	9.9 s		1.01 s	±1%	±11 ns
100 s	99 s		101 s	±1%	±11 ns

MS2687A setting Sweep time	Min.	Calculated result	Max.	Spec.	Cumulative error
50 ms	49.5 ms		50.5 ms	±1%	±141 µs
20 ms	19.8 ms		20.2 ms	±1%	±56.5 µs
10 ms	9.9 ms		1.01 ms	±1%	±28.2 µs
5 ms	4.95 ms		5.05 ms	±1%	±14.1 µs
1 ms	0.99 ms		1.01 ms	±1%	±2.82 µs
100 µs	99 µs		101 µs	±1%	±0.282 µs
10 µs	9.9 µs		10. 1µs	±1%	±28.2 ns

MS2687B
Performance Test Record

NO. _____

DATE _____

Model MS2687B

Serial NO. _____

Options _____

Date _____

Tested by _____

Ambient temparature _____ ˚C

Relative humidity _____ %

Perwer mains line voltage (nominal) _____ Vac

Powermains line frquency (nominal) _____ Hz

Test Equipment used

Descriptions	MODEL NO.	Cal Date
Synthesized signal generator		
Synthesized Sweeper		
Attenuator		
Power meter		
Power senser		
50 Ω Termination		
Low pass filter		
Frequency counter		
Frequency standard		

Model Name MS2687B date _____

Serial NO. _____

Tested by _____

Reference oscillator frequency stability

• Frequency stability

Referred to the frequency after 24 hour warm-up

$\pm 2 \times 10^{-8}$

	Min.	Result	Max.	Cumulative error
Frequency stability/day	-2×10^{-8}		$+2\times10^{-8}$	$+2\times10^{-10}$

• Temperature stability

Referred to the frequency at 25°C

$\pm 5 \times 10^{-8}$

Ambient temperature	Min.	Result	Max.	Cumulative error
0°C	-5×10^{-8}		$+5\times10^{-8}$	$+2\times10^{-10}$
50°C	-5×10^{-8}		$+5\times10^{-8}$	$+2\times10^{-10}$

Frequency readout accuracy

± ((Displayed frequency) × (reference frequency accuracy) + (span) × (span accuracy) + (resolution bandwidth) × 0.15 + 10 Hz × N)

Center frequency	Span frequebcy	Resolution bandwidth	Min. (Hz)	Result (Hz)	Max. (Hz)	Cumulative error (Hz)
500 MHz	10 kHz	300 Hz	-110		+110	21
	200 kHz	3 kHz	-2 010		+2 010	401
	100 MHz	300 kHz	-1 000 010		+1 000 010	20 000
5 GHz	10 kHz	300 Hz	-110		+110	21
	200 kHz	3 kHz	-2 010		+2 010	401
	100 MHz	300 kHz	-1 000 010		+1 000 010	20 000
7 GHz	10 kHz	300 Hz	-110		+110	21
	200 kHz	3 kHz	-2 010		+2 010	401
	100 MHz	300 kHz	-1 000 010		+1 000 010	20 000
12 GHz	10 kHz	300 Hz	-315		+315	21
	200 kHz	3 kHz	-5470		+5470	401
	100 MHz	300 kHz	-2545000		+2545000	20000
20 GHz	10 kHz	300 Hz	-325		+325	21
	200 kHz	3 kHz	-5480		+5480	401
	100 MHz	300 kHz	-2545000		+2545000	20000
29 GHz	10 kHz	300 Hz	-335		+335	21
	200 kHz	3 kHz	-5490		+5490	401
	100 MHz	300 kHz	-2545000		+2545000	20000

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Model Name MS2687B date _____

Serial NO. _____

Tested by _____

Frequency span readout accuracy

Single band sweep

±1.0%

MS2687B		Min. (Hz)	Result (Hz)	Max. (Hz)	Cumulative error (Hz)
Center frequency	Span frequency				
1.5 GHz	20 kHz	-200		+200	40
	200 kHz	-2 000		+2 000	400
	2 MHz	-20 000		+20 000	4 000
	20 MHz	-200 000		+200 000	40 000
	200 MHz	-2 000 000		+2 000 000	400 000
	2 GHz	-20 000 000		+20 000 000	4 000 000
5 GHz	20 MHz	-200 000		+200 000	40 000
	200 MHz	-2 000 000		+2 000 000	400 000
	2 GHz	-20 000 000		+20 000 000	4 000 000
12 GHz	20 MHz	-500 000		+500 000	20 000
	200 MHz	-5 000 000		+5 000 000	200 000
	2 GHz	-50 000 000		+50 000 000	2 000 000
20 GHz	30 MHz	-750 000		+750 000	30 000
	300 MHz	-7 500 000		+7 500 000	300 000
	3 GHz	-75 000 000		+75 000 000	3 000 000
26 GHz	40 MHz	-1 000 000		+1 000 000	40 000
	400 MHz	-10 000 000		+10 000 000	400 000
	4 GHz	-100 000 000		+100 000 000	4 000 000

Model Name MS2687B date _____

Serial NO. _____

Tested by _____

Resolution bandwidth accuracy and selectivity

• Resolution bandwidth accuracy

±20% (300 Hz to 10 MHz)

±40% (20 MHz)

MS2687B		Min. Cumulative error (Hz)	Min. (Hz)	Result (Hz)	Max. (Hz)	Max. Cumulative error (Hz)
Resolution bandwidth	Span frequency					
300 Hz	10 kHz	+8	240		360	-8
1 kHz	30 kHz	+22	800		1 200	-24
3 kHz	100 kHz	+80	2 400		3 600	-80
10 kHz	300 kHz	+220	8 000		12 000	-240
30 kHz	1 MHz	+800	24 000		36 000	-800
100 kHz	3 MHz	+2 200	80 000		120 000	-2 400
300 kHz	10 MHz	+8 000	240 000		360 000	-8 000
1 MHz	30 MHz	+22 000	800 000		1 200 000	-24 000
3 MHz	100 MHz	+80 000	2 400 000		3 600 000	-80 000
5 MHz	150 MHz	+110 000	4 000 000		6 000 000	-120 000
10 MHz	200 MHz	+220 000	8 000 000		1 200 000	-240 000
20 MHz	200 MHz	+480 000	12 000 000		28 000 000	-520 000

• Resolution bandwidth selectivity

≤15 : 1

MS2687B		Result		Calculated result	Spec.	Max. Cumulative error (Hz)
Resolution bandwidth	Span frequency	60 dB bandwidth (Hz)	3 dB bandwidth (Hz)	Selectivity		
300 Hz	10 kHz				≤15:1	+0.14
1 kHz	30 kHz				≤15:1	+0.12
3 kHz	100 kHz				≤15:1	+0.14
10 kHz	300 kHz				≤15:1	+0.12
30 kHz	1 MHz				≤15:1	+0.14
100 kHz	3 MHz				≤15:1	+0.12
300 kHz	10 MHz				≤15:1	+0.14
1 MHz	30 MHz				≤15:1	+0.12
3 MHz	100 MHz				≤15:1	+0.14
5 MHz	150 MHz				≤15:1	+0.12
10 MHz	200 MHz				≤15:1	+0.08
20 MHz	200 MHz				≤15:1	+0.08

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Model Name MS2687B date _____

Serial NO. _____

Tested by _____

Sideband phase noise

≤–108 dBc/Hz (Frequency: 1 GHz, frequency offset: 10 kHz)

≤–120 dBc/Hz (Frequency: 1 GHz, frequency offset: 100 kHz)

Frequency offset	MS2687B Span frequency	Result	Spec	Cumulative error
10 kHz	25 kHz		-108 dBc/Hz	-1.1 dB
100 kHz	250 kHz		-120 dBc/Hz	-1.1 dB

Frequency measurement accuracy

≤± (displayed frequency × reference oscillator accuracy ± 1 count ± 2 Hz)

Signal generator Output frequency	MS2687B Count resolution	Min.	Result	Max.
500 MHz	1 Hz	499.999 997 MHz		500.000 003 MHz
500 MHz	10 Hz	499.999 99 MHz		500.000 01 MHz
500 MHz	100 Hz	499.999 9 MHz		500.000 1 MHz
500 MHz	1 kHz	499.999 MHz		500.001 MHz

Amplitude display accuracy

After executing calibration

±0.4 dB (RBW ≤ 1 kHz, 0 to –20 dB)

±1.0 dB (RBW ≤ 1 kHz, 0 to –90 dB)

ATT ATT setting (dB)	Correction (dB)	Measured result (dB)	Calculated result (dB)	Spec.(dB)	Cumulative error (dB)
0				±0.4	±0.06
10				±0.4	±0.06
20				±1.0	±0.09
30				±1.0	±0.09
40				±1.0	±0.09
50				±1.0	±0.09
60				±1.0	±0.21
70				±1.0	±0.21
80				±1.0	±0.21
90				±1.0	±0.21

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Model Name MS2687B date _____

Serial NO. _____

Tested by _____

Frequency response

1) Relative flatness
   At input attenuator = 10 dB
   ±1.0 dB (9 kHz to 3.2 GHz, band 0), ±1.5 dB (3.15 to 7.9 GHz, band 1)
   ±3.0 dB (7.8 to 15.3 GHz, band 2)
   ±4.0 dB (15.2 to 30.0 GHz, band 4)
2) At Band 1, 2, 4, after pre-selector tuning
3) Absolute flatness
   Refered to 50 MHz, input attenuator = 10 dB
   ±5.0 dB (9 kHz to 30.0 GHz)
   * At Band 1, 2, 4, after pre-selector tuning

MS2687B		Calibration value (dB)	Measurement value (dB)	Calculated result	Standard (dB)	Max accumulated error (dB)
Band	Frequency					
0	50 MHz			0.00 (referrence)	—	—
0	500 MHz				±5.0 dB	±0.16
0	1 GHz				±5.0 dB	±0.16
0	1.5 GHz				±5.0 dB	±0.16
0	2 GHz				±5.0 dB	±0.16
0	3 GHz				±5.0 dB	±0.16
1-	3.5 GHz				±5.0 dB	±0.14
1-	4 GHz				±5.0 dB	±0.14
1-	5 GHz				±5.0 dB	±0.14
1-	6 GHz				±5.0 dB	±0.14
1+	7 GHz				±5.0 dB	±0.14
1+	7.9 GHz				±5.0 dB	±0.14
2+	8 GHz				±5.0 dB	±0.14
2+	10 GHz				±5.0 dB	±0.14
2+	12 GHz				±5.0 dB	±0.14
2+	14 GHz				±5.0 dB	±0.14
2+	15 GHz				±5.0 dB	±0.14
3+	16 GHz				±5.0 dB	±0.14
3+	18 GHz				±5.0 dB	±0.14
3+	20 GHz				±5.0 dB	±0.14
3+	22 GHz				±5.0 dB	±0.14
4+	23 GHz				±5.0 dB	±0.14
4+	24 GHz				±5.0 dB	±0.14
4+	26 GHz				±5.0 dB	±0.14
4+	28 GHz				±5.0 dB	±0.14
4+	30 GHz				±5.0 dB	±0.14

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Model Name MS2687B date _____

Serial NO. _____

Tested by _____

Reference level accuracy

After calibration, frequency: 50 MHz, Span:1 MHz (RBW, VBW, RF ATT, SWT: Auto)
±0.5 dB (0 to –49.9 dBm)
±0.75 dB (–69.9 to –50 dBm, +0.1 to +30 dBm)
±1.5 dB (–70 to –80 dBm)

MS2687B Reference level	Attenuator Correction (dB)	Result (dB) Marker level	Calculated result (dB)	Spec.(dB)	Cumulative error (dB)
0 dBm				±0.5	±0.10
-10 dBm				±0.5	±0.10
-20 dBm				±0.5	±0.10
-30 dBm				±0.5	±0.12
-40 dBm				±0.5	±0.12
-50 dBm				±0.75	±0.12
-60 dBm				±0.75	±0.22
-70 dBm				±1.5	±0.22
-80 dBm				±1.5	±0.22

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Model Name MS2687B date _____

Serial NO. _____

Tested by _____

Average noise level

At input attenuator = 0 dB, VBW = 1 Hz, Detection mode: Sample
≤–124 dBm + f [GHz] dB (1 MHz to 2.5 GHz, band 0),
≤–120 dBm + f [GHz] dB (2.5 to 3.0 GHz, band 0)
≤–115 dBm (3.15 to 7.9 GHz, band 1), ≤–113 dBm (7.8 to 15.3 GHz, band 2)
≤–103 dBm (15.2 to 30.0 GHz, band 4)

MS2687B setting		Measurement value (dBm)	Standard	Max accumulated error (dB)
Band	Center frequency			
0	1 MHz		-124	±1.23
0	99 MHz		-124	±1.23
0	499 MHz		-123.6	±1.23
0	999 MHz		-123.1	±1.23
0	1499 MHz		-122.6	±1.23
0	2999 MHz		-117.1	±1.23
1-	3199 MHz		-115	±1.23
1-	3999 MHz		-115	±1.23
1-	5999 MHz		-115	±1.23
1+	6299 MHz		-115	±1.23
1+	6999 MHz		-115	±1.23
1+	7899 MHz		-115	±1.23
2+	7999 MHz		-113	±1.23
2+	9999 MHz		-113	±1.23
2+	11.999 GHz		-113	±1.23
2+	13.999 GHz		-113	±1.23
2+	14.999 GHz		-113	±1.23
3+	15.999 GHz		-103	±1.23
3+	17.999 GHz		-103	±1.23
3+	19.999 GHz		-103	±1.23
3+	21.999 GHz		-103	±1.23
4+	22.999 GHz		-103	±1.23
4+	24.999 GHz		-103	±1.23
4+	26.999 GHz		-103	±1.23
4+	28.999 GHz		-103	±1.23
4+	29.999 GHz		-103	±1.23

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Model Name MS2687B date _____

Serial NO. _____

Tested by _____

Second harmonic distortion

Mixer input level: –30 dBm

≤–60 dBc (Frequency:10 to 200 MHz)

≤–70 dBc (Frequency: 0.2 to 1.6 GHz, Band 0)

Mixer input level: –10 dBm

≤–90 dBc (Frequency: 1.6 to 15 GHz, Band 1, 2, 4)

Signal generator	MS2687B setting	Result (dB)	Spec.(dBc)	Cumulative error (dB)
Output frequency	Band			
48 MHz	0		-60	±1.09
780 MHz	0		-70	±1.09

Resolution bandwidth (RBW) switching error

Referred to RBW 3 kHz

±0.3 dB (300 Hz to 5 MHz)

±0.5 dB (10 MHz, 20 MHz)

MS2687B setting		Result (dB)	Spec. (dB)	Cumulative error (dB)
RBW	Span frequency			
300 Hz	2 kHz		±0.3	±0.02
1 kHz	5 kHz		±0.3	±0.02
3 kHz	15 kHz		0.00 (referrence)	—
10 kHz	50 kHz		±0.3	±0.02
30 kHz	150 kHz		±0.3	±0.02
100 kHz	500 kHz		±0.3	±0.02
300 kHz	1.5 MHz		±0.3	±0.02
1 MHz	5 MHz		±0.3	±0.02
3 MHz	15 MHz		±0.3	±0.02
5 MHz	25 MHz		±0.3	±0.02
10 MHz	50 MHz		±0.5	±0.02
20 MHz	100 MHz		±0.5	±0.02

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Model Name MS2687B date _____

Serial NO. _____

Tested by _____

Input attenuator (RF ATT) switching error

Referred to 50 MHz, RF ATT 10 dB
±0.3 dB (10 to 50 dB)
±0.5 dB (60 to 70 dB)

MS2687B setting		Attenuator		Result (dB) marker level	Calculated result (dB)	Spec.(dB)	Cumulative error (dB)
Reference level	RF ATT	Setting	Correction				
-10 dBm	60 dB	0 dB				±0.5	±0.11
-20 dBm	50 dB	10 dB				±0.3	±0.11
-30 dBm	40 dB	20 dB				±0.3	±0.11
-40 dBm	30 dB	30 dB				±0.3	±0.13
-50 dBm	20 dB	40 dB				±0.3	±0.13
-60 dBm	10 dB	50 dB			0.00 (reference)	—	—

Frequency domain sweep time accuracy

±3% (10 ms to 1000 s)

MS2687B setting	Min.	Result	Max.	Spec.	Cumulative error
Sweep time					
100 ms	97 ms		103 ms	±3%	±11 ns
500 ms	485 ms		515 ms	±3%	±11 ns
10 s	9.7 s		10.3 s	±3%	±11 ns
100 s	97 s		103 s	±3%	±11 ns

MS2687B setting	Result	Min.	Calculated result	Max.	Spec.	Cumulative error
Sweep time	Frequency difference					
50 ms		48.5 ms		51.5 ms	±3%	±141 µs
20 ms		19.4 ms		20.6 ms	±3%	±56.5 µs
10 ms		9.7 ms		1.03 ms	±3%	±28.2 µs

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Model Name MS2687B date _____

Serial NO. _____

Tested by _____

Time domain sweep time accuracy

±1% (10 µs to 1000 s)

MS2687B setting Sweep time	Min.	Result	Max.	Spec.	Cumulative error
100 ms	99 ms		101 ms	±1%	±11 ns
500 ms	495 ms		505 ms	±1%	±11 ns
10 s	9.9 s		1.01 s	±1%	±11 ns
100 s	99 s		101 s	±1%	±11 ns

MS2687B setting Sweep time	Min.	Calculated result	Max.	Spec.	Cumulative error
50 ms	49.5 ms		50.5 ms	±1%	±141 µs
20 ms	19.8 ms		20.2 ms	±1%	±56.5 µs
10 ms	9.9 ms		1.01 ms	±1%	±28.2 µs
5 ms	4.95 ms		5.05 ms	±1%	±14.1 µs
1 ms	0.99 ms		1.01 ms	±1%	±2.82 µs
100 µs	99 µs		101 µs	±1%	±0.282 µs
10 µs	9.9 µs		10. 1µs	±1%	±28.2 ns