Maintenance Manual

Spectrum Master™

MS2760A-0032, 9 kHz to 32 GHz
MS2760A-0044, 9 kHz to 44 GHz

MS2760A-0050, 9 kHz to 50 GHz
MS2760A-0070, 9 kHz to 70 GHz

MS2760A-0090, 9 kHz to 90 GHz
MS2760A-0110, 9 kHz to 110 GHz

MS2760A-0145, 9 kHz to 145 GHz
MS2760A-0170, 9 kHz to 170 GHz

MS2762A-0032, 6 GHz to 32 GHz
MS2762A-0044, 6 GHz to 44 GHz

MS2762A-0050, 6 GHz to 50 GHz
MS2762A-0070, 6 GHz to 70 GHz

MS2762A-0090, 6 GHz to 90 GHz
MS2762A-0110, 6 GHz to 110 GHz

MS2762A-0145, 6 GHz to 145 GHz
MS2762A-0170, 6 GHz to 170 GHz

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Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Company uses the following symbols to indicate safety-related information. For your own safety, please read the information carefully *before* operating the equipment.

Symbols Used in Manuals

Danger

This indicates a risk from a very dangerous condition or procedure that could result in serious injury or death and possible loss related to equipment malfunction. Follow all precautions and procedures to minimize this risk.

Warning

This indicates a risk from a hazardous condition or procedure that could result in light-to-severe injury or loss related to equipment malfunction. Follow all precautions and procedures to minimize this risk.

Caution

This indicates a risk from a hazardous procedure that could result in loss related to equipment malfunction. Follow all precautions and procedures to minimize this risk.

Safety Symbols Used on Equipment and in Manuals

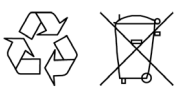
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions *before* operating the equipment. Some or all of the following five symbols may or may not be used on all Anritsu equipment. In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.

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

This indicates a compulsory safety precaution. The required operation is indicated symbolically in or near the circle.

This indicates a 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.

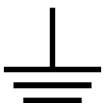
Warning

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.

Warning

or



When supplying power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If a grounded 3-pin outlet is not available, 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.

Warning

This equipment can not be repaired by the operator. Do not attempt to remove the equipment 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.

Caution

Electrostatic Discharge (ESD) can damage the highly sensitive circuits in the instrument. ESD is most likely to occur as test devices are being connected to, or disconnected from, the instrument's front and rear panel ports and connectors. You can protect the instrument and test devices by wearing a static-discharge wristband. Alternatively, you can ground yourself to discharge any static charge by touching the outer chassis of the grounded instrument before touching the instrument's front and rear panel ports and connectors. Avoid touching the test port center conductors unless you are properly grounded and have eliminated the possibility of static discharge.

Repair of damage that is found to be caused by electrostatic discharge is not covered under warranty.

Warning

This equipment is supplied with a rechargeable battery that could potentially leak hazardous compounds into the environment. These hazardous compounds present a risk of injury or loss due to exposure. Anritsu Company recommends removing the battery for long-term storage of the instrument and storing the battery in a leak-proof, plastic container. Follow the environmental storage requirements specified in the product data sheet.

Table of Contents

Chapter 1 — General Information

1-1 Introduction

This manual provides maintenance instructions for the Anritsu MS2760A and MS2762A Spectrum Masters. When referring to both models MS276xA will be used. This manual includes:

- General information, including:
  - List of necessary test equipment to perform verification testing (Table 1-1)
  - Replaceable parts list (Table 1-2)
- Performance verification procedures in Chapter 2, "Spectrum Analyzer Verification"
- Troubleshooting procedures in Chapter 3, "Troubleshooting"
- Blank test records are included in Appendix A. Copy the blank test records and use them to record measured values. These test records form a record of the performance of the MS276xA. Anritsu recommends making a copy of the blank test records to document the measurements each time a Performance Verification is performed. Continuing to document this process each time provides a detailed history of the instrument's performance, allowing trends to be observed.

Familiarity with the basic operation of the MS276xA using the GUI software is assumed, for example, how to preset the instrument and set frequency, span, and RBW settings.

Note	Before making any measurement, verify that all equipment has warmed up for at least 30 minutes.

1-2 Anritsu Customer Service Centers

For the latest service and sales information in your area, please visit the following URL:

http://www.anritsu.com/contact-us

Choose a country for regional contact information.

1-3 Recommended Test Equipment

The following test equipment listed in Table 1-1 is recommended for use in testing and maintaining the MS276xA.

Table 1-1. Test Equipment Required for Verifying Spectrum Analyzer Functions (1 of 2)

Instrument	Critical Specification	Recommended Manufacturer/Model
Synthesizer	Frequency: 9 kHz to 70 GHz	Anritsu Model MG3697C with Options 2C/3/4/15D/22
Power Meter	Frequency 9 kHz to 44 GHz	Rohde and Schwarz, NRP40T (used for the 32 and 44 GHz models)
Power Meter	Frequency 9 kHz to 67 GHz	Rohde and Schwarz, NRP67T (used for the 50 and 70 GHz models)
Power Meter	Frequency 9 kHz to 110 GHz	Rohde and Schwarz, NRP110T (used for the 90, 110, 145, and 170 GHz models)
Power Meter	Frequency 110 GHz to 170 GHz	Elva-1 Model DPM-06 (used for 145 and 170 GHz models)
170 GHz Frequency Multiplier	Input 27.5 to 42.5 GHz, +5 dBm Output 110 to 170 GHz, -3 dBm	Sage Millimeter Model STE-KF406-00-S1 (used for 145 and 170 GHz models)
110 GHz Frequency Multiplier	Output 75 to 110 GHz	Norden ND75110G0P0 (used for the 90, 110, 145, and 170 GHz models)
12 Volt DC Power Supply	12 VDC Output	Keysight E3631A (Power supply for the 110 GHz Multiplier)
WR6 Power Divider	WR6, 1.2 dB insertion loss max, VSWR better than 1.6	QuinStar Model QJH-DLFB00 (used for 145 and 170 GHz models)
Waveguide section		Mi-Wave 690D-1.5
W1 to 0.8mm adapter	W1(m) to 0.8mm(f), DC-110 GHz, 50 ohms	Anritsu Model 33W.8F50 (used for 145 and 170 GHz models)
0.8mm to WR6 adapter	WR6 to 0.8mm(f), 114 - 170 GHz, VSWR better than 1.5	Flann Model 29373-F (used for 145 and 170 GHz models)
W1 to V adapter	W1(f) to V(m), 50 ohms	Anritsu Model 34WFV50 (used for 90/110/145/170 GHz models)
V to K adapter	V(m) to K(f), 50 ohms	Anritsu Model 34VKF50A (used for 32/44 GHz models)
Isolator (Qty 2)	Isolation: 20 dB Frequency: 110-170 GHz	Millitech FBI-06 (used for 145 and 170 GHz models)
Termination	VSWR: 1.10:1 Frequency: 110-170 GHz	Sage SWL-0627-S1 (used for 145 and 170 GHz models)
50 Ohm Termination	K(f) connector, 50 ohms	Anritsu 28KF50A
50 Ohm Termination	V(f) connector, 50 ohms	Anritsu 28VF50D
50 Ohm Termination	W(f) connector, 50 ohms	Anritsu 28WF50

Table 1-1. Test Equipment Required for Verifying Spectrum Analyzer Functions (2 of 2)

Instrument	Critical Specification	Recommended Manufacturer/Model
50 Ohm Termination	0.8mm(f) connector, 50 ohms	Anritsu 28.8F50

1-4 Replaceable Parts

The MS276xA has no internal components that are field replaceable. If the unit fails the verification testing, repairs can be performed at the local Anritsu Service Center. The following table provides the cable part numbers if replacements are needed.

Table 1-2. List of Replaceable Parts

Part Number	Description
2000-1859-R	USB Cable
2000-1605-R	BNC(m) to MMCX(m) Cable

Chapter 2 — Spectrum Analyzer Verification

2-1 Introduction

This chapter contains the following verification procedures:

PASS/FAIL Determination for Instrument Key Parameter Performance Tests

Figure 2-1 shows the rule that is used to determine the pass/fail status of test results that are associated with warranted specifications.

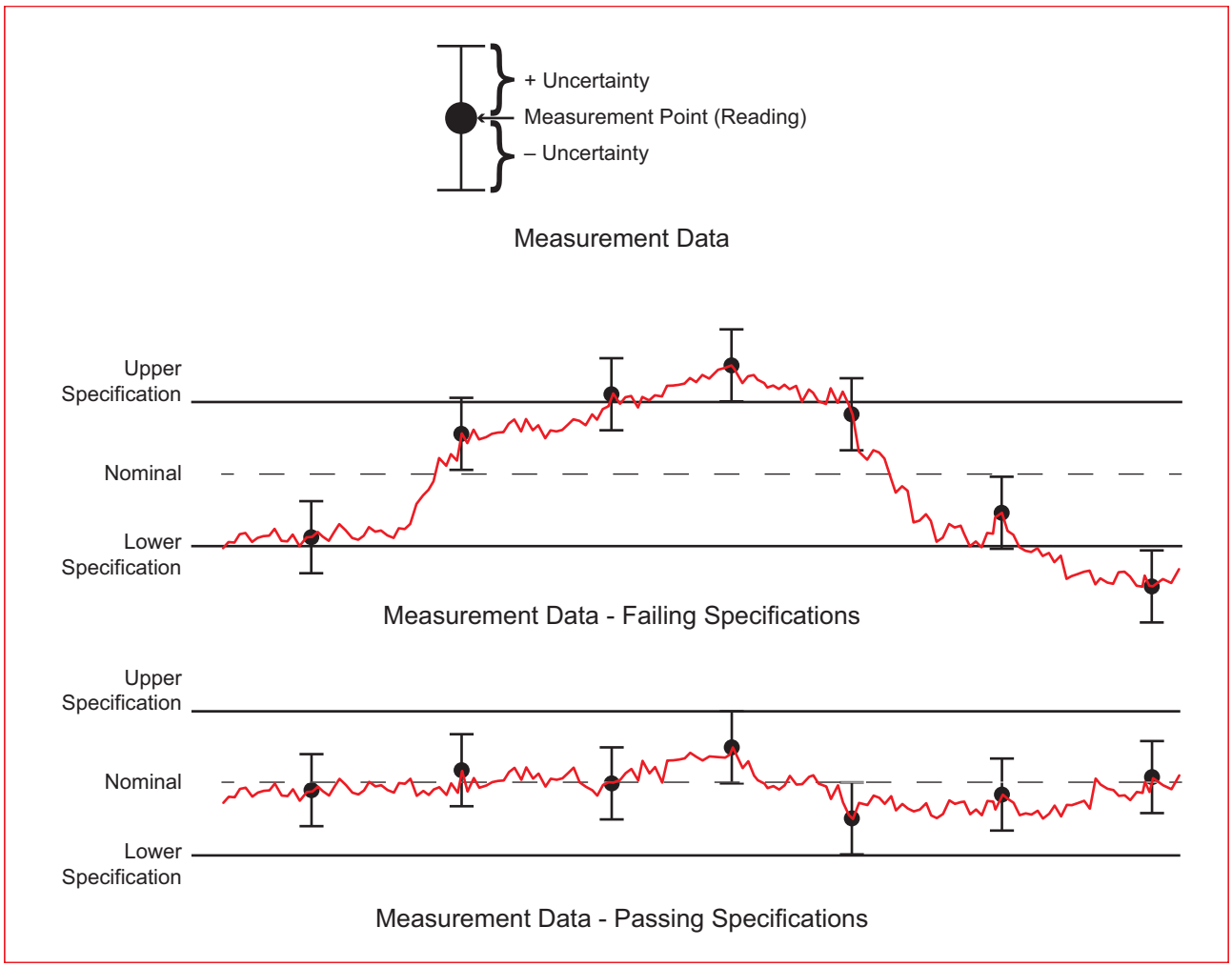


Figure 2-1. Pass/Fail Determination

The measurement uncertainty listed in each test record includes the best estimate of the errors contributed by the measurement, test equipment, standards, and other correction factors (for example, calibration factors and mismatch error) based on the suggested equipment, the equipment setup, and the prescribed test procedure. Most of the uncertainties are type-B per ISO/IEC Guide 98-3, Guide to the Expression of Uncertainty in Measurement (GUM).

2-2 Frequency Accuracy Verification

The following procedure is used to verify the frequency accuracy of the MS276xA.

Equipment Required

- Anritsu MG3697C Synthesized Signal Source
- 10 MHz Reference Standard
- 34VKF50A Adapter (For 32/44 GHz units)
- 34WFV50 Adapter (For 90/110/145/170 GHz units)
- 33W.8F50 Adapter (For 145/170 GHz units)

Frequency Accuracy Verification

1. Connect the 10 MHz Reference to the 10 MHz REF IN on the Anritsu MG3697C.
2. Connect the RF Output of the MG3697C to the RF In of the MS276xA.

Note	Do not connect the external 10 MHz Reference to the MS276xA.

3. Turn on the 10 MHz Reference Standard and the Anritsu MG3697C Synthesized Signal Source.
4. Set the MG3697C output to the frequency shown in the Frequency column of Table A-1, “Frequency Accuracy” on page A-2, for the MS276xA model being tested.
5. Set the MG3697C RF Output Level to –10 dBm.
6. Preset the MS276xA.
7. Set the MS276xA center frequency to the frequency shown in the Frequency column of Table A-1, “Frequency Accuracy” on page A-2, for the MS276xA model being tested.
8. Set the MS276xA span to 50 kHz.
9. Set the MS276xA display points to 4001.

Note	Allow equipment to warm up for 30 minutes prior to taking measurements.

10. On the MS276xA, perform a single sweep and then using the marker menu perform a peak search.
11. Record the measured frequency value in the Measured Value column of Table A-1, “Frequency Accuracy” on page A-2.
12. Calcuate the deviation which is the difference between the Measured Value and Expected Value, and record in the Deviation column of Table A-1, “Frequency Accuracy” on page A-2.
13. Ensure Deviation ± Uncertainty are within the Specification.

Note	Frequency accuracy specification (+/-0.2 ppm) is at time of calibration (adjustment). Aging value (+/-1.0 ppm) must be added to determine the specification when the instrument is verified.

2-3 Amplitude Accuracy Verification

The tests in this section verify the absolute amplitude accuracy of the MS276xA.

Equipment Required

- Anritsu MG3697C Synthesized Signal Source
- Rohde and Schwarz NRP40T Power Sensor (for 32 and 44 GHz units)
- Rohde and Schwarz NRP67T Power Sensor (for 50 and 70 GHz units)
- Rohde and Schwarz NRP110T Power Sensor (for 90, 110, 145, and 170 GHz units)
- Elva-1 DPM-06 Power Meter (for 145 and 170 GHz units)
- 110 GHz Frequency Multiplier (for 90, 110, 145, and 170 GHz units)
- 12 VDC Power Supply (for the 110 GHz Frequency Multiplier)
- 170 GHz Frequency Multiplier (for 145 and 170 GHz units)
- Quinstar QJH-DLFB00 Power Divider (for 145 and 170 GHz units)
- Mi-Wave 690D-1.5 waveguide section
- Anritsu 33W.8F50 Adapter (for 145 and 170 GHz units)
- Flann 29373-F Adapter (for 145 and 170 GHz units)
- Millitech FBI-06 Isolator, Qty 2 (for 145 and 170 GHz units)
- Sage SWL-0627-S1 Termination (for 145 and 170 GHz units)
- 10 MHz Reference Standard
- 34VKF50A Adapter (For 32/44 GHz units)
- 34WFV50 Adapter (For 90/110/145/170 GHz units)
- 33W.8F50 Adapter (For 145/170 GHz units)

Level Accuracy Below 70 GHz at 0 dBm with IF Gain Off

1. Connect the 10 MHz Reference to the 10 MHz REF IN on the Anritsu MG3697C and Ref connector on the MS276xA.

Note	Allow equipment to warm up for 30 minutes prior to taking measurements.

2. Connect the NRP power sensor to the MG3697C, ensure the RF Output is off, and zero the sensor.
3. Set the MG3697C to:
   - 100 MHz and 0 dBm, for all MS2760A models, and turn RF Output On..
   - 6020 MHz and 0 dBm for all MS2762A models, and turn RF Output On..
4. Record the measured power in column “NRP Reading” in Table A-2, “Amplitude Accuracy Below 70 GHz at 0 dBm with IF Gain Off” on page A-3.
5. Repeat Step 3 and Step 4 for the remaining frequencies in Table A-2.
6. Turn off the RF Output, remove the NRP power sensor from the MG3697C, and attach the MS276xA to the MG3697C.
7. Preset the MS276xA.
8. Set the MS276xA frequency reference to External.
9. Set the MS276xA reference level to 10 dBm.
10. Set the MS276xA RBW to 10 kHz.
11. Set the MS276xA span to 1 MHz.
12. Set the MS276xA center frequency to:

- 100 MHz for all MS2760A models.
- 6020 MHz for all MS2762A models.

13. Set the MG3697C to:
    - 100 MHz and 0 dBm, for all MS2760A models, and turn RF Output On.
    - 6020 MHz and 0 dBm for all MS2762A models, and turn RF Output On.
14. On the MS276xA, perform a single sweep and then using the marker menu perform a peak search.
15. Record the value in column "MS276xA Reading" of Table A-2, "Amplitude Accuracy Below 70 GHz at 0 dBm with IF Gain Off" on page A-3.
16. Repeat Step 12 through Step 15 for the remaining frequencies in Table A-2.
17. In Table A-2, subtract the MS276xA reading from the NRP reading and enter this value in the "Difference Between NRP and MS276xA" column for each frequency.
18. Ensure (Difference Between NRP and MS276xA) ± (Uncertainty) are within the Specification.

Level Accuracy Below 70 GHz at –20 dBm with IF Gain On

1. Connect the 10 MHz Reference to the 10 MHz REF IN on the Anritsu MG3697C and Ref connector on the MS276xA.

Note	Allow equipment to warm up for 30 minutes prior to taking measurements.

2. Connect the NRP power sensor to the MG3697C, ensure the RF Output is off, and zero the sensor.
3. Set the MG3697C to:
    - 100 MHz and -20 dBm, for all MS2760A models, and turn RF Output On..
    - 6020 MHz and -20 dBm for all MS2762A models, and turn RF Output On..
4. Record the measured power in column "NRP Reading" in Table A-3, "Amplitude Accuracy Below 70 GHz at –20 dBm with IF Gain On" on page A-3.
5. Repeat Step 3 and Step 4 for the remaining frequencies in Table A-3.
6. Turn off the RF Output, remove the NRP power sensor from the MG3697C, and attach the MS276xA to the MG3697C.
7. Preset the MS276xA.
8. Set the MS276xA frequency reference to External.
9. Set the MS276xA reference level to –10 dBm.
10. Set the MS276xA IF Gain to On.
11. Set the MS276xA RBW to 10 kHz.
12. Set the MS276xA span to 1 MHz.
13. Set the MS276xA center frequency to:
    - 100 MHz for all MS2760A models.
    - 6020 MHz for all MS2762A models.
14. Set the MG3697C to:
    - 100 MHz and -20 dBm, for all MS2760A models, and turn RF Output On.
    - 6020 MHz and -20 dBm for all MS2762A models, and turn RF Output On.
15. On the MS276xA, perform a single sweep and using the marker menu perform a peak search.
16. Record the value in column "MA276xA Reading" of Table A-3, "Amplitude Accuracy Below 70 GHz at –20 dBm with IF Gain On" on page A-3.

17. Repeat Step 13 through Step 16 for the remaining frequencies in Table A-3.
18. In Table A-3, subtract the MA276xA reading from the NRP reading and enter this value in the "Difference Between NRP and MA276xA" column for each frequency.
19. Ensure (Difference Between NRP and MS276xA) ± (Uncertainty) are within the Specification.

Level Accuracy, 70 to 110 GHz, at –10 dBm with IF Gain Off (90, 110, 145 and 170 GHz units only)

1. Connect the 10 MHz Reference to the 10 MHz REF IN on the Anritsu MG3697C and Ref connector on the MS276xA.

Note Allow equipment to warm up for 30 minutes prior to taking measurements.

2. Connect the input of the 110 GHz Frequency Multiplier to the RF output of the MG3697C.
3. Apply the 12 volt DC power to the 110 GHz Frequency Multiplier.
4. Zero the NRP110T power sensor, and then connect it to the output of the frequency multiplier.
5. Turn on the MG3697C RF output and adjust the power level so the NRP110T reads approximately –10 dBm. Note the power level setting on the MG3697C.
6. Set the MG3697C frequency to 38 GHz, which provides 76 GHz at the output of the Frequency Multiplier.
7. Record the measured power in column "NRP110T Reading" in Table A-4, "Amplitude Accuracy 70 to 110 GHz at –10 dBm with IF Gain Off" on page A-4.
8. Repeat Step 6 through Step 7 for the remaining frequencies in Table A-4.
9. Turn off the MG3697C RF output, remove the NRP110T from the Frequency Multiplier, and attach the MS276xA to the Frequency Multiplier.
10. Preset the MS276xA.
11. Set the MS276xA frequency reference to External.
12. Set the MS276xA reference level to 0 dBm.
13. Set the MS276xA RBW to 10 kHz.
14. Set the MS276xA span to 1 MHz.
15. Set the MS276xA center frequency to 76 GHz.
16. Set the MG3697C frequency to 38 GHz, the power level will be the same as noted in Step 5, and turn RF Output On.
17. On the MS276xA, perform a single sweep and using the marker menu perform a peak search.
18. Record the value in column "MA276xA Reading" of Table A-4, "Amplitude Accuracy 70 to 110 GHz at –10 dBm with IF Gain Off" on page A-4.
19. Repeat Step 15 through Step 18 for the remaining frequencies in Table A-4.
20. In Table A-4, subtract the MA276xA reading from the NRP reading and enter this value in the "Difference Between NRP and MA276xA" column for each frequency.
21. Ensure (Difference Between NRP and MS276xA) ± (Uncertainty) are within the Specification.

Level Accuracy, 110 to 170 GHz, at –10 dBm with IF Gain Off (145 and 170 GHz units only)

1. Connect the 10 MHz Reference to the 10 MHz REF IN on the Anritsu MG3697C and Ref connector on the MS276xA.

Note Allow equipment to warm up for 30 minutes prior to taking measurements.

2. Ensure the MG3697C RF Output Off.

3. Connect the input of the 170 GHz Frequency Multiplier to the RF output of the MG3697C.
4. Connect the output of the 170 GHz Frequency Multiplier to the H port of the Power Divider using the Mi-Wave 690D-1.5 waveguide section.
5. Connect the Sage SWL-0627-S1 Termination to the E port of the Power Divider.
6. Connect the two Millitech FBI-06 Isolators to each of the Power Divider's outputs.
7. Connect the Elva-1 DPM-06 to one Isolator.
8. Connect the Flann 29373-F adapter to the other Isolator, and then connect the MS276xA to the adapter.
9. Preset the MS276xA.
10. Set the MS276xA frequency reference to External.
11. Set the MS276xA reference level to 0 dBm.
12. Set the MS276xA RBW to 10 kHz.
13. Set the MS276xA span to 1 MHz.
14. Set the MS276xA center frequency to 110 GHz.
15. Set the MG3697C frequency to 27.5 GHz, which provides 110 GHz at the output of the Frequency Multiplier.
16. Set the MG3697C power level so the Elva-1 Power meter is reading approximately -10 dBm.
17. Record the measured power in column "Elva-1 Reading" in Table A-5, "Amplitude Accuracy 110 to 170 GHz at –10 dBm with IF Gain Off" on page A-4.
18. On the MS276xA, perform a single sweep and using the marker menu perform a peak search.
19. Record the value in column "MA276xA Reading" of Table A-5, "Amplitude Accuracy 110 to 170 GHz at –10 dBm with IF Gain Off" on page A-4.
20. Repeat Step 15 through Step 18 for the remaining frequencies in Table A-5.
21. In Table A-5, subtract the MA276xA reading from the Elva-1 reading and enter this value in the "Difference Between Elva-1 and MA276xA" column for each frequency.
22. Ensure (Difference Between Elva-1 and MS276xA) ± (Uncertainty) are within the Specification.

2-4 Single Side Band (SSB) Phase Noise Verification

This test is used to verify the single side band (SSB) phase noise of the MS276xA.

Equipment Required

- Anritsu MG3697C Synthesized Signal Source
- 10 MHz Reference Standard
- 34VKF50A Adapter (For 32/44 GHz units)
- 34WFV50 Adapter (For 90/110/145/170 GHz units)
- 33W.8F50 Adapter (For 145/170 GHz units)

SSB Phase Noise Verification

1. Connect the 10 MHz Reference to the 10 MHz REF IN on the Anritsu MG3697C and Ref connector on the MS276xA.
2. Connect the output of the MG3697C to the RF In connector of MS276xA.

Note	Allow the equipment to warm up for 30 minutes prior to taking measurements.

3. Set the MG3697C to:
   - 6 GHz and -10 dBm, for all MS2760A models, and turn RF Output On.
   - 7 GHz and -10 dBm for all MS2762A models, and turn RF Output On.
4. Preset the MS276xA.
5. Set the MS276xA frequency reference to External.
6. Set the MS276xA display points to 2001.
7. Set the MS276xA center frequency to:
   - 6 GHz for MS2760A models
   - 7 GHz for MS2762A models
8. Set the MS276xA span to 25 kHz.
9. Set the MS276xA RBW to 300 Hz.
10. Set the MS276xA VBW to 100 Hz.
11. On the MS276xA, turn on Marker 1 and perform a peak search.
12. On the MS276xA, turn on Marker 2 and then change the Mode to Delta Relative to Marker 1. Move Marker 2 to be 1 kHz offset from Marker 1.
13. Set the MS276xA reference level to –40 dBm.
14. Set the MS276xA IF Gain to On.
15. Record 10 amplitude measurements of Marker 2, average the 10 values and record in the Measured Value of Table A-6, “SSB Phase Noise Verification for MS276xA” on page A-5.
16. Subtract 24.7 dB from the Measured Value to get a per hertz (/Hz) value and record this value in the Calculated Value of Table A-6, “SSB Phase Noise Verification for MS276xA” on page A-5.
17. On the MS276xA, move Marker 2 to be 10 kHz offset from Marker 1 and repeat Step 15 and Step 16.
18. Set the MS276xA RBW to 1000 Hz
19. Set the MS276xA VBW to 300 Hz
20. Set the MS276xA span to 250 kHz
21. On the MS276xA, move Marker 2 to be 100 kHz offset from Marker 1.

22. Record 10 amplitude measurements of Marker 2, average the 10 values and record in the Measured Value of Table A-6, "SSB Phase Noise Verification for MS276xA" on page A-5.

23. Subtract 30 dB from the Measured Value to get a per hertz (/Hz) value and record this value in the Calculated Value of Table A-6, "SSB Phase Noise Verification for MS276xA" on page A-5.

24. Ensure (Calculated Value) **±** (Uncertainty) both are within the Specification.

25. Repeat this procedure with a source and DUT frequency of 30 GHz for all MS276xA's, and 60 GHz for MS276xA's supporting 60 GHz. Record the measurements in Table A-6, "SSB Phase Noise Verification for MS276xA" on page A-5.

2-5 Spurious Response (Second Harmonic Distortion) Verification

The following test is used to verify the spurious response of the MS276xA.

Equipment Required

- Anritsu MG3697C Synthesized Signal Source
- 10 MHz Reference Standard
- 34VKF50A Adapter (For 32/44 GHz units)
- 34WFV50 Adapter (For 90/110/145/170 GHz units)
- 33W.8F50 Adapter (For 145/170 GHz units)

Spurious Response Verification

1. Connect the 10 MHz Reference to the 10 MHz REF IN on the Anritsu MG3697C and Ref connector on the MS276xA.
2. Connect the output of the MG3697C to the RF In connector of MS276xA.

Note	Allow the equipment to warm up for 30 minutes prior to taking measurements.

3. Set the MG3697C to:
   - 1 GHz and 0 dBm, for all MS2760A models, and turn RF Output On.
   - 7 GHz and -25 dBm for all MS2762A models, and turn RF Output On.
4. Preset the MS276xA.
5. Set the MS276xA frequency reference to External.
6. Set the MS276xA display points to 1001.
7. Set the MS276xA Reference Level to:
   - 10 dBm for the MS2760A.
   - -15 dBm for the MS2762A.
8. Set the MS276xA Center Frequency to:
   - 1 GHz for the MS2760A.
   - 7 GHz for the MS2762A.
9. Set the MS276xA span to 100 kHz.
10. Set the MS276xA RBW to 300 Hz.
11. Set the MS276xA VBW to 300 Hz.
12. On the MS276xA, using the marker menu perform a peak search and record the amplitude of the fundamental signal in the Measured Value of Table A-7, “Spurious Response (Second Harmonic Distortion)” on page A-6.
13. Set the MS276xA Center Frequency to:
   - 2 GHz for the MS2760A.
   - 14 GHz for the MS2762A.
14. Set the MS276xA reference level to -40 dBm.
15. Set the MS276xA IF gain to On.
16. On the MS276xA, using the marker menu perform a peak search and record the amplitude of the harmonic signal in the Measured Value of Table A-7, “Spurious Response (Second Harmonic Distortion)” on page A-6.
17. Subtract the harmonic from the fundamental and record as the 2nd Harmonic Distortion value in Table A-7, “Spurious Response (Second Harmonic Distortion)” on page A-6.

Remaining steps are for MS2760A models only.

18. Set the MG3697C power level to –20 dBm.

19. Set the MS2760A center frequency to 1 GHz.

20. Set the MS2760A reference level to -10 dBm.

21. On the MS2760A, using the marker menu perform a peak search record the amplitude of the fundamental signal in the Measured Value of Table A-7, “Spurious Response (Second Harmonic Distortion)” on page A-6.

22. Set the MS2760A reference level to –40 dBm.

23. Set the MS2760A IF gain to On.

24. Set the MS2760A center frequency to 2 GHz.

25. On the MS2760A, using the marker menu perform a peak search and record the amplitude of the harmonic signal in the Measured Value of Table A-7, “Spurious Response (Second Harmonic Distortion)” on page A-6

26. Subtract the harmonic from the fundamental and record as the 2nd Harmonic Distortion value in Table A-7, “Spurious Response (Second Harmonic Distortion)” on page A-6.

27. Ensure (2nd Harmonic Distortion) **±** (Uncertainty) both are within the Specification.

2-6 Residual Spurious Verification

The following test is used to verify the residual spurious response of the MS276xA.

Equipment Required

- 50 Ohm Termination, 28KF50, for 32 and 44 GHz models
- 50 Ohm Termination, 28VF50D, for 50 and 70 GHz models
- 50 Ohm Termination, 28WF50, for 90 and 110 GHz models
- 50 Ohm Termination, 28.8F50, for 145 and 170 GHz models

Residual Spurious Response Test with Pre Amp On

Note	Allow equipment to warm up for 30 minutes prior to taking measurements.

1. Attach 50 Ohm Terminator to the RF input of the MS276xA and then preset the unit.
2. Set the MS276xA RBW to 1 kHz.
3. Set the MS276xA VBW to 1 kHz.
4. Set the MS276xA reference level to –40 dBm.
5. Set the MS276xA IF gain to On.
6. Set the MS276xA display points to 1001.
7. Set the MS276xA start and stop frequency, to match the model being tested in Table A-8, “Residual Spurious with Pre Amp On” on page A-6.
8. Set the MS276xA to perform a single sweep.
9. After the sweep is complete, using the marker menu perform a peak search and record the value in Table A-8, “Residual Spurious with Pre Amp On” on page A-6.
10. Ensure (Measured Value) ± (Uncertainty) both are within the Specification.
11. For 90 GHz and higher models, repeat Step 7 through Step 10 for the remaining frequency ranges in Table A-8.

2-7 Input Related Spurs Verification

The following test is used to verify input related spurs of the MS276xA.

Equipment Required

- Anritsu MG3697C Synthesized Signal Source
- 10 MHz Reference Standard
- 34VKF50A Adapter (For 32/44 GHz units)
- 34WFV50 Adapter (For 90/110/145/170 GHz units)
- 33W.8F50 Adapter (For 145/170 GHz units)

Input Related Spurs Verification

1. Connect the 10 MHz Reference to the 10 MHz REF IN on the Anritsu MG3697C and Ref connector on the MS276xA.
2. Connect the output of the MG3697C to the RF In connector of MS276xA.

Note	Allow the equipment to warm up for 30 minutes prior to taking measurements.

3. Preset the MS276xA.
4. Set the MS276xA frequency reference to External.
5. Set the MS276xA display points to 1001.
6. Set the MS276xA RBW to 10 kHz.
7. Set the MS276xA VBW to 10 kHz.
8. Set the MS276xA Center Frequency to:
   - 31.5 MHz for the MS2760A.
   - 10 GHz for the MS2762A.
9. Set the MS276xA span to 1 MHz.
10. Set the MG3697C to:
    - 31.5 MHz and -10 dBm for the MS2760A.
    - 10 GHz and -20 dBm for the MS2762A.
11. On the MS276xA, using the marker menu perform a peak search and record as the Fundamental Measured Value in Table A-9, “Input Related Spurs” on page A-8.
12. Set the MS276xA Start Frequency to:
    - 3.5 MHz for the MS2760A.
    - 9760 MHz for the MS2762A.
13. Set the MS276xA Stop Frequency to:
    - 26.4 MHz for the MS2760A.
    - 9960 MHz for the MS2762A.
14. Set the MS276xA reference level to –40 dBm.
15. Set the MS276xA IF Gain to On.
16. Set the MS276xA sweep mode from Continuous to Single.
17. On the MS276xA, using the marker menu perform a peak search.
18. Subtract the level of the fundamental signal from the peak search and record as the Measured Value in Table A-9, “Input Related Spurs” on page A-8.

19. Ensure (Measured Value) ± (Uncertainty) both are within the Specification.

20. Repeat Step 8 through Step 19 for the remaining frequencies in Table A-9.

2-8 Displayed Average Noise Level (DANL)

The following test is used to verify the Displayed Average Noise Level (DANL) of the MS276xA.

Equipment Required

- 50 Ohm Termination, 28KF50, for 32 and 44 GHz models
- 50 Ohm Termination, 28VF50D, for 50 and 70 GHz models
- 50 Ohm Termination, 28WF50, for 90 and 110 GHz models
- 50 Ohm Termination, 28.8F50, for 145 and 170 GHz models

Note	Allow equipment to warm up for 30 minutes prior to taking measurements.

1. Attach the 50 Ohm termination to the RF input of the MS276xA and then preset the MS276xA.
2. Within the Trace menu, set the MS276xA Detector Type to RMS / Avg.
3. Set the MS276xA RBW to 100 kHz.
4. Set the MS276xA VBW to 30 kHz.
5. Set the MS276xA VBW / Average Type to Logarithmic.
6. Set the MS276xA display points to 4001.
7. Set the MS276xA reference level to –40 dBm.
8. Set the MS276xA IF Gain to On.
9. On the MS276xA, change the Sweep Mode from Continuous to Single.
10. Set the MS276xA:
    - Start and Stop Frequencies shown in Table A-10, “MS2760A DANL with IF Gain On” on page A-9 for the MS2760A.
    - Start and Stop Frequencies shown in Table A-11, “MS2762A DANL with IF Gain On” on page A-9 for the MS2762A.
11. Perform a single sweep.
12. Using the marker menu, perform a peak search and subtract 50 dB from the reading to give the per Hz DANL result. Record the value in:
    - Table A-10 for the MS2760A
    - Table A-11 for the MS2762A
13. Ensure (Calculated Value) ± (Uncertainty) both are within the Specification.
14. Repeat Step 11 and Step 13 for the remaining start and stop frequencies in Table A-10 or Table A-11.

Chapter 3 — Troubleshooting

3-1 Introduction

This chapter describes the primary troubleshooting operations that can be performed by all Anritsu Service Centers. Perform the troubleshooting suggestions in the order they are listed. Operators of the MS276xA should refer to the User Guide for troubleshooting help.

3-2 Connection Problems

The MS276xA GUI Software does not recognize the MS276xA:

1. Ensure the USB cable is properly connected between the PC and the MS276xA.
2. Ensure the USB port on the PC is USB version 3.0 or greater. USB 3.0 ports can be identified by either a "SS" marking next to the connector or the actual USB connector will be the color blue.

Note	It's possible that the MS276xA will be recognized by the PC when connected to a non-USB 3.0 port, but it will not function properly.

3. Ensure the Anritsu Device Monitor (AnritsuDeviceMonitor.exe) is running on the PC connected to the MS276xA. When running, the program will be seen as the Anritsu logo within the system tray icons.
4. Ensure the green LED on the MS276xA it lit after plugging the unit into the USB 3.0 port. (This LED will not light if the Anritsu Device Monitor is not running.)

Appendix A — Test Records

This appendix provides test records that can be used to record the performance of the MS276xA. Anritsu Company recommends making a copy of the following test record pages and document the measurements each time a Performance Verification is performed. Continuing to document this process each time it is performed provides a detailed history of instrument performance, allowing trends to be observed.

MS276xA **Firmware Rev:** _____ **Operator:** _____ **Date:** _____

Serial Number: _____ **Model Number:** _____

Frequency Accuracy Verification

Table A-1. Frequency Accuracy

Model Tested	Frequency	Measured Value	Deviation	Uncertainty	Specification[a]
MS276xA-0032	31 GHz	GHz	kHz	16 Hz (0.00052 ppm)	
MS276xA-0044	39 GHz	GHz	kHz	20 Hz (0.00052 ppm)	
MS276xA-0050	49 GHz	GHz	kHz	25 Hz (0.00052 ppm)	
MS276xA-0070	67 GHz	GHz	kHz	35 Hz (0.00052 ppm)	
MS276xA-0090	67 GHz	GHz	kHz	35 Hz (0.00052 ppm)	
MS276xA-0110	67 GHz	GHz	kHz	35 Hz (0.00052 ppm)	
MS276xA-0145	67 GHz	GHz	kHz	35 Hz (0.00052 ppm)	
MS276xA-0170	67 GHz	GHz	kHz	35 Hz (0.00052 ppm)	

a. Specification is +/-0.2ppm at time of calibration (adjustment). Aging value must be added to determine the specification when the instrument is verified. Aging is +/-1.0ppm per year.

Amplitude Accuracy Verification

Table A-2. Amplitude Accuracy Below 70 GHz at 0 dBm with IF Gain Off

Freq	MG3697C Level	NRP Reading (dBm)	MS276xA Reading (dBm)	Diff. between NRP and MS276xA (dB)	Uncertainty (dB)	Spec (dB)
MS2760A-0032, -0044, -0050, -0070, -0090, -0110, -0145, -0170 Models						
100 MHz	0 dBm				0.22	± 1.3
1,000 MHz	0 dBm				0.22	± 1.8
MS276xA-0032, -0044, -0050, -0070, -0090, -0110, -0145, -0170 Models						
6,020 MHz	0 dBm				0.22	± 1.8
10 GHz	0 dBm				0.22	± 1.8
20 GHz	0 dBm				0.22	± 1.8
31.970 GHz	0 dBm				0.22	± 1.8
MS276xA-0044, -0050, -0070, -0090, -0110, -0145, -0170 Models						
39.970 GHz	0 dBm				0.22	± 1.8
MS276xA-0050, -0070, -0090, -0110, -0145, -0170 Models						
49.970 GHz	0 dBm				0.50	± 2.0
MS276xA-0070, -0090, -0110, -0145, -0170 Models						
60 GHz	0 dBm				0.50	± 2.0
67 GHz	0 dBm				0.50	± 2.0

Table A-3. Amplitude Accuracy Below 70 GHz at –20 dBm with IF Gain On

Freq	MG3697C Level	NRP Reading (dBm)	MS276xA Reading (dBm)	Diff. between NRP and MS276xA (dB)	Uncertainty (dB)	Spec (dB)
MS2760A-0032, -0044, -0050, -0070, -0090, -0110, -0145, -0170 Models						
100 MHz	-20 dBm				0.22	± 1.3
1,000 MHz	-20 dBm				0.22	± 1.8
MS276xA-0032, -0044, -0050, -0070, -0090, -0110, -0145, -0170 Models						
6,020 MHz	-20 dBm				0.22	± 1.8
10 GHz	-20 dBm				0.22	± 1.8
20 GHz	-20 dBm				0.22	± 1.8
31.970 GHz	-20 dBm				0.22	± 1.8
MS276xA-0044, -0050, -0070, -0090, -0110, -0145, -0170 Models						
39.970 GHz	-20 dBm				0.22	± 1.8
MS276xA-0050, -0070, -0090, -0110, -0145, -0170 Models						
49.970 GHz	-20 dBm				0.50	± 2.0
MS276xA-0070, -0090, -0110, -0145, -0170 Models						
60 GHz	-20 dBm				0.50	± 2.0
67 GHz	-20 dBm				0.50	± 2.0

Table A-4. Amplitude Accuracy 70 to 110 GHz at –10 dBm with IF Gain Off

MG3697C Freq	110 GHz Multiplier Output Freq	NRP110T Reading (dBm)	MS276xA Reading (dBm)	Diff. between NRP110T and MS276xA (dB)	Uncertainty (dB)	Spec (dB)
MS276xA-0090, -0110, -0145, -0170 Models						
38 GHz	76 GHz				0.55	± 2.2
40 GHz	80 GHz				0.55	± 2.2
44.985 GHz	89.970 GHz				0.55	± 2.2
MS276xA-0110, -0145, -0170 Models						
47 GHz	94 GHz				1.1	± 2.5
50 GHz	100 GHz				1.1	± 2.5
54.985 GHz	109.970 GHz				1.1	± 2.5

Table A-5. Amplitude Accuracy 110 to 170 GHz at –10 dBm with IF Gain Off

MG3697C Freq	170 GHz Multiplier Output Freq	Elva-1 Reading (dBm)	MS276xA Reading (dBm)	Diff. between Elva-1 and MS276xA (dB)	Uncertainty (dB)	Spec (dB)
MS276xA-0145 and -0170 Models						
27.5 GHz	110 GHz				2.2	± 3.5
30 GHz	120 GHz				2.2	± 3.5
32.5 GHz	130 GHz				2.2	± 3.5
35 GHz	140 GHz				2.2	± 3.5
MS276xA-0170 Models Only						
37.5 GHz	150 GHz				2.1	± 3.5
40 GHz	160 GHz				2.1	± 3.5

Single Side Band (SSB) Phase Noise Verification

Table A-6. SSB Phase Noise Verification for MS276xA

Frequency	Offset	Measured Value (dBc)	Calculated Value (dBc/Hz)	Uncertainty (dB)	Specification (dBc/Hz)
MS2760A-0032, -0044, -0050, -0070, -0090, -0110, -0145, and -0170 Models					
6 GHz	1 kHz			1.74	≤ –80
6 GHz	10 kHz			1.09	≤ –95
6 GHz	100 kHz			0.69	≤ –95
MS2762A-0032, -0044, -0050, -0070, -0090, -0110, -0145, and -0170 Models					
7 GHz	1 kHz			1.74	≤ –80
7 GHz	10 kHz			1.09	≤ –93
7 GHz	100 kHz			0.69	≤ –94
MS276xA-0032, -0044, -0050, -0070, -0090, -0110, -0145, and -0170 Models					
30 GHz	1 kHz			1.47	≤ –66
30 GHz	10 kHz			1.08	≤ –81
30 GHz	100 kHz			0.79	≤ –81
MS276xA-0070, -0090, -0110, -0145, and -0170 Models					
60 GHz	1 kHz			1.90	≤ –60
60 GHz	10 kHz			1.20	≤ –75
60 GHz	100 kHz			0.86	≤ –75

Spurious Response (Second Harmonic Distortion) Verification

Table A-7. Spurious Response (Second Harmonic Distortion)

Frequency	Level	Measured Value (dBm)	2nd Harmonic Distortion (dBc)	Uncertainty (dB)	Specification (dBc)
MS2760A Models					
1000 MHz	0 dBm				
2000 MHz	0 dBm			3.88	≤ –50
1000 MHz	-20 dBm				
2000 MHz	-20 dBm			6.58	≤ –60
MS2762A Models					
7000 MHz	-25 dBm				
14000 MHz	-25 dBm			2.93	≤ –50

Residual Spurious Verification

Table A-8. Residual Spurious with Pre Amp On

Start Freq.	Stop Freq.	Measured Values (dBm)	Uncertainty (dB)	Specification (dBm)
MS2760A-0032				
10 MHz	32 GHz		1.56	≤ –85 dBm
MS2762A-0032				
6 GHz	32 GHz		1.56	≤ –85 dBm
MS2760A-0044				
10 MHz	40 GHz		1.56	≤ –85 dBm
MS2762A-0044				
6 GHz	40 GHz		1.56	≤ –85 dBm
MS2760A-0050				
10 MHz	50 GHz		1.56	≤ –85 dBm
MS2762A-0050				
6 GHz	50 GHz		1.56	≤ –85 dBm
MS2760A-0070				
10 MHz	67 GHz		1.56	≤ –85 dBm
MS2762A-0070				
6 GHz	67 GHz		1.56	≤ –85 dBm

Table A-8. Residual Spurious with Pre Amp On

Start Freq.	Stop Freq.	Measured Values (dBm)	Uncertainty (dB)	Specification (dBm)
MS2760A-0090, -0110, -0145, and -0170 Models				
10 MHz	70 GHz		1.56	≤ –85 dBm
70 GHz	90 GHz		1.56	≤ –84 dBm
MS2762A-0090, -0110, -0145, and -0170 Models				
6 GHz	70 GHz		1.56	≤ –85 dBm
70 GHz	90 GHz		1.56	≤ –84 dBm
MS276xA-0110, -0145, and -0170 Models				
90 GHz	110 GHz		1.56	≤ –81 dBm
MS276xA-0145, and -0170 Models				
110 GHz	145 GHz		2.70	≤ –68 dBm
MS276xA-0170 Models Only				
145 GHz	170 GHz		2.70	≤ –67 dBm

Input Related Spurs Verification

Table A-9. Input Related Spurs

Fundamental Freq.	Fundamental Measured Value (dBm)	Start SPA Freq.	Stop SPA Freq.	Measured Values (dBc)	Uncertainty (dB)	Specification (dBc)
MS2760A-0032, -0044, -0050, -0070, -0090, -0110, -0145, -0170 Models						
31.5 MHz		3.5 MHz	26.4 MHz		1.91	≤ –60
70 MHz		24.5 MHz	31.5 MHz		0.91	≤ –50
133 MHz		31.5 MHz	38.5 MHz		0.63	≤ –50
217.5 MHz		189.5 MHz	210.5 MHz		1.91	≤ –60
182.5 MHz		189.5 MHz	210.5 MHz		1.91	≤ –60
3.430 GHz		759.5 MHz	780.5 MHz		0.49	≤ –35
4.970 GHz		759.5 MHz	780.5 MHz		0.49	≤ –35
7.630 GHz		759.5 MHz	780.5 MHz		0.38	≤ –35
4.970 GHz		899.5 MHz	920.5 MHz		0.44	≤ –35
6.790 GHz		899.5 MHz	920.5 MHz		0.36	≤ –35
MS2762A-0032, -0044, -0050, -0070, -0090, -0110, -0145, -0170 Models						
10 GHz		9760 MHz	9960 MHz		1.91	≤ –60
10 GHz		10022 MHz	10300 MHz		1.91	≤ –60

Displayed Average Noise Level (DANL)

Table A-10. MS2760A DANL with IF Gain On

Start Freq	Stop Freq	RBW (kHz)	VBW (kHz)	Measured Value at 100 kHz RBW (dBm)	Calculated for 1 Hz RBW (dBm)	Uncertainty (dB)	Spec. (dBm)
MS2760A-0032, -0044, -0050, -0070, -0090, -0110, -0145, and -0170 Models							
10 MHz	644 MHz	100	30			0.36	≤ –131
644 MHz	4.0 GHz	100	30			0.45	≤ –136
4.0 GHz	32 GHz	100	30			0.48	≤ –131
MS2760A-0044, -0050 and -0070, -0090, -0110, -0145, and -0170 Models							
32 GHz	40 GHz	100	30			0.48	≤ –131
MS2760A-0050 and -0070, -0090, -0110, -0145, and -0170 Models							
40 GHz	50 GHz	100	30			0.60	≤ –128
MS2760A-0070, -0090, -0110, -0145, and -0170 Models							
50 GHz	70 GHz	100	30			0.60	≤ –128
MS2760A-0090, -0110, -0145, and -0170 Models							
70 GHz	90 GHz	100	30			0.42	≤ –127
MS2760A-0110, -0145, and -0170 Models							
90 GHz	110 GHz	100	30			0.40	≤ –123
MS2760A-0110, -0145, and -0170 Models							
110 GHz	145 GHz	100	30			0.42	≤ –112
MS2760A-0170 Models							
145 GHz	170 GHz	100	30			0.67	≤ –111

Table A-11. MS2762A DANL with IF Gain On

Start Freq	Stop Freq	RBW (kHz)	VBW (kHz)	Measured Value at 100 kHz RBW (dBm)	Calculated for 1 Hz RBW (dBm)	Uncertainty (dB)	Spec. (dBm)
MS2762A-0032, -0044, -0050, -0070, -0090, -0110, -0145, and -0170 Models							
6.0 GHz	32 GHz	100	30			0.48	≤ –135
MS2762A-0044, -0050 and -0070, -0090, -0110, -0145, and -0170 Models							
32 GHz	40 GHz	100	30			0.48	≤ –135
MS2762A-0050 and -0070, -0090, -0110, -0145, and -0170 Models							

Start Freq	Stop Freq	RBW (kHz)	VBW (kHz)	Measured Value at 100 kHz RBW (dBm)	Calculated for 1 Hz RBW (dBm)	Uncertainty (dB)	Spec. (dBm)
40 GHz	50 GHz	100	30			0.43	≤ –137
MS2762A-0070, -0090, -0110, -0145, and -0170 Models							
50 GHz	70 GHz	100	30			0.43	≤ –137
MS2762A-0090, -0110, -0145, and -0170 Models							
70 GHz	90 GHz	100	30			0.42	≤ –136
MS2762A-0110, -0145, and -0170 Models							
90 GHz	110 GHz	100	30			0.40	≤ –132
MS2762A-0110, -0145, and -0170 Models							
110 GHz	145 GHz	100	30			0.42	≤ –119
MS2762A-0170 Models							
145 GHz	170 GHz	100	30			0.67	≤ –114

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