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Technical Data Sheet & Configuration Guide

VectorStar™

High Performance, Broadband Network Analysis Solutions

MS4640A Series

Vector Network Analyzers, Microwave

Introduction

This document provides the specifications for the MS4640A series microwave Vector Network Analyzers (VNAs) listed below, including all related options, and accessories.

Instrument Models:

MS4642A	10 MHz to 20 GHz*
MS4644A	10 MHz to 40 GHz*
MS4645A	10 MHz to 50 GHz*
MS4647A	10 MHz to 70 GHz*

Main Options:

MS4640A-070	70 kHz Low-End Frequency Extension
MS4640A-002	Time Domain
MS4640A-007	Receiver Offset
MS464xA-051	Direct Access Loops
MS464xA-06x	Active Measurements Suite

Separate documents found on the Anritsu website (www.us.anritsu.com\VectorStar) provides specifications for 110 GHz Broadband Coaxial, Banded Waveguide and Multiport solutions, based on the MS4640A VNA.

A color detailed brochure provides in-depth descriptions of the VectorStar family's features and benefits.

* See page 25 for extended operational frequency ranges.

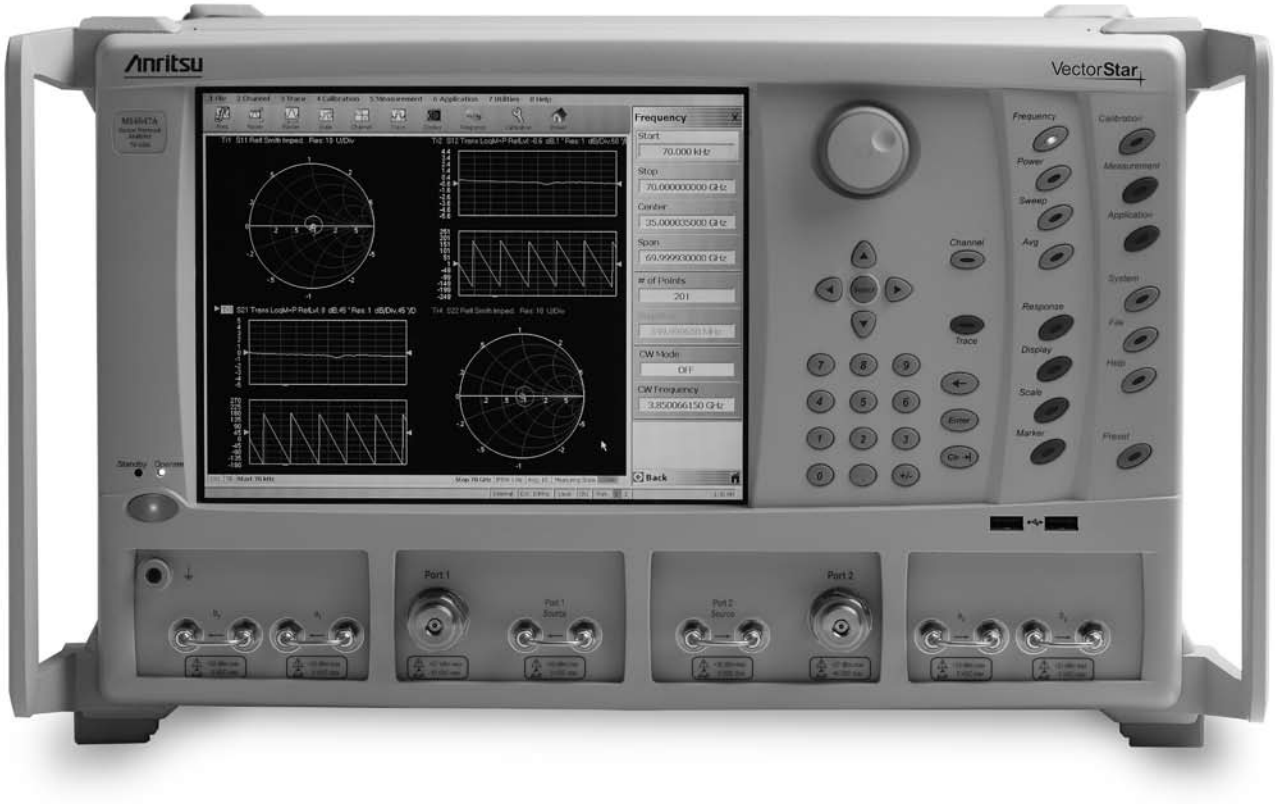


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1. Definitions

All specifications and characteristics apply under the following conditions, unless otherwise stated:

- After 90 minutes of warm-up time, where the instruments is left in the ON state.
- Over the 25 ºC ± 5 ºC temperature range.
- For error-corrected specifications, over 23 ºC ± 3 ºC, with < 1 ºC variation from calibration temperature.
- For error-corrected specifications are warranted and include guard-bands, unless otherwise stated.
- Specifications do not include effects of any user cables attached to the instrument.
- Specifications may exclude discrete spurious responses.
- All specifications apply with internal 10 MHz Crystal Oscillator Reference Signal.
- All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu website: www.us.anritsu.com
- Typical performance indicates the measured performance of an average unit. It does not include guard-bands and is not covered by the product warranty. Typical specifications are shown in parenthesis, such as (-102 dB), or noted as Typical.
- Characteristic performance indicates a performance designed-in and verified during the design phase. It does include guard-bands and is not covered by the product warranty.
- All uncertainties below 300 kHz are typical.
- Recommended Calibration Cycle: 12 months
- All specifications are with Interpolation Mode Off

2. System Dynamic Range

Calculated as the difference between the maximum rated source power and the specified noise floor at the specified location.

MS4642A, 20 GHz Model, System Dynamic Range (dB)

Frequency Range (GHz)	at Ports 1 or 2			at b_1 or b_2	
	Standard	Option 051	Option 061* or 062	Option 051	Option 061* or 062
0.07 to 0.3 MHz	85	83	81	114	112
0.3 to 2 MHz	102	100	98	126	124
2 to 10 MHz	115	113	111	134	132
0.01 to 2.5	122	119	114	140	135
2.5 to 20	123	119	115	134	130

MS4644A, 40 GHz Model, System Dynamic Range (dB)

Frequency Range (GHz)	at Ports 1 or 2			at b_1 or b_2	
	Standard	Option 051	Option 061* or 062	Option 051	Option 061* or 062
0.07 to 0.3 MHz	85	83	81	114	112
0.3 to 2 MHz	102	100	98	126	124
2 to 10 MHz	115	113	111	134	132
0.01 to 2.5	122	119	114	140	135
2.5 to 40	119	115	110	130	125

MS4645A & MS4647A, 50 & 70 GHz Models, System Dynamic Range (dB)

Frequency Range (GHz)	at Ports 1 or 2			at b_1 or b_2	
	Standard	Option 051	Option 061*or 062	Option 051	Option 061* or 062
0.07 to 0.3 MHz	85	83	81	114	112
0.3 to 2 MHz	102	100	98	126	124
2 to 10 MHz	115	113	111	134	132
0.01 to 2.5	122	119	114	140	135
2.5 to 5	116	112	106	127	121
5 to 20	115	111	105	126	120
20 to 38	116	111	105	126	120
38 to 50	115	109	104	124	119
50 to 65	107	101	97	116	112
65 to 67	103	97	91	112	106
67 to 70	100	91	84	106	99

* The Option 061 Dynamic Range reported in this column applies for S_{21} measurements. For S_{12} Dynamic Range, use the figures from the “Option 051” column.

3. Receiver Dynamic Range

Calculated as the difference between the maximum receiver input level for 0.1 dB compression and the specified noise floor at the specified location. Characteristic Performance.

All Models, Receiver Dynamic Range (dB)

Frequency Range (GHz)	at Ports 1 or 2			at b_1 or b_2	
	Standard	Option 051	Option 061* or 062	Option 051	Option 061* or 062
0.07 to 0.3 MHz	80	79	78	90	89
0.3 to 2 MHz	102	102	102	107	107
2 to 10 MHz	115	115	115	115	115
0.01 to 2.5	120	119	116	119	116
2.5 to 5	120	118	115	117	114
5 to 20	120	118	115	118	115
20 to 40**	120	118	115	118	116
38 to 50	120	118	117	117	117
50 to 65	117	115	115	113	114
65 to 67	115	113	111	110	109
67 to 70	113	110	109	107	108

* The Option 061 Dynamic Range reported in this column applies for S21 measurements. For S12 Dynamic Range, use the figures from the "Option 051" column.
** 20 to 38 GHz for MS4647A

4. Receiver Compression

Port power level beyond which the response may be compressed more than 0.1 dB† relative to the normalization level.
10 Hz IF bandwidth used to remove any trace noise effects. Match not included. Performance is characteristic.

All Models, 0.1 dB Compression Levels (dBm)

Frequency Range (GHz)	at Ports 1 or 2			at a_x Loops	at b_x Loops	
	Standard	Option 051	Option 061* or 062	Option 051 or 06x	Option 051	Option 061* or 062
< 0.3 MHz	+5	+5	+5	-15	-15	-15
0.3 to 10 MHz	+10	+11	+12	-10	-10	-9
0.01 to 2.5	+10	+11	+12	-10	-10	-9
2.5 to 5	+10	+11	+12	-5	-5	-4
5 to 20	+10	+11	+12	-4	-4	-3
20 to 40**	+10	+11	+12	-4	-4	-2
38 to 50	+10	+12	+14	-4	-4	-1
50 to 65	+10	+12	+14	-5	-5	-2
65 to 67	+10	+13	+15	-5	-5	-2
67 to 70	+10	+13	+15	-5	-5	-1

* The Option 061 compression level reported in this column applies to Port 2 or b_2. For port 1 or b_1 compression level, use the figures from the appropriate Port x or b_x "Option 051" column.
** 20 to 38 GHz for MS4647A
† 0.17 dB for < 0.3 MHz

5. High Level Noise

Measured at 1 kHz IF bandwidth, at default power, with either full reflects or through transmission. RMS.
Characteristic performance on MS4647A with either Option -051, -061, or -062.
Trace noise magnitude may be degraded to 20 mdB rms (typical) at particular frequencies, due to spurious receiver residuals.

Frequency (GHz)	Magnitude (dB)	Phase (degree)
< 500 kHz	< 0.04	< 0.4
500 kHz to 2.5	< 0.0045	< 0.05
2.5 to 5	< 0.0045	< 0.05
5 to 20	< 0.0045	< 0.05
20 to 40	< 0.006	< 0.06
40 to 67	< 0.006	< 0.08
67 to 70	< 0.008 (< 0.006)	< 0.08

6. Noise Floor

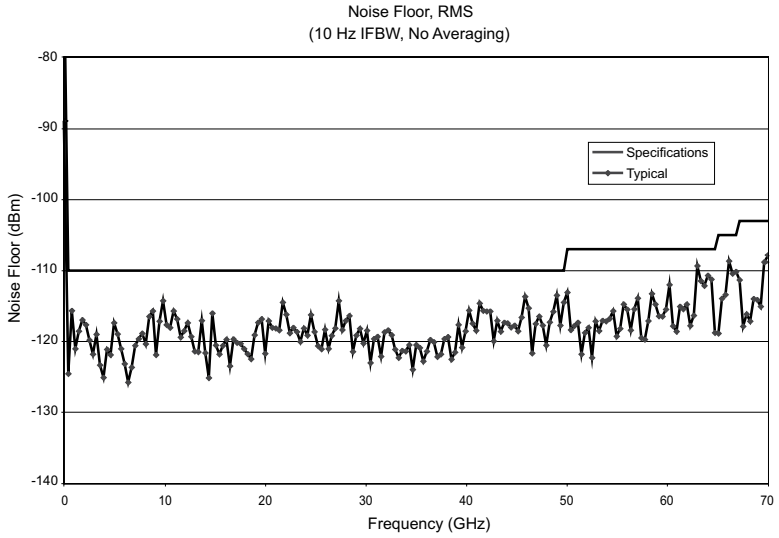
Measured at 10 Hz IF Bandwidth with no averaging, and at –10 dBm port power. RMS, no leakage correction applied. Measurement made with a through line connection, with its effects compensated for. Performance at a_x and b_x loops is characteristic.

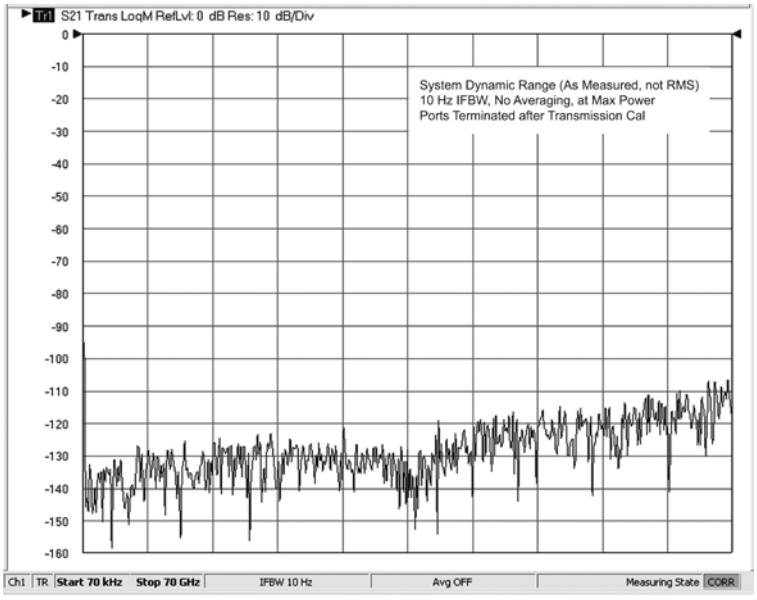
All Models, Noise Floor (dBm)

Frequency Range (GHz)	at Ports 1 or 2			at a_x Loops	at b_x Loops	
	Standard	Option 051	Option 061* or 062	Option 051 or 06x	Option 051	Option 061* or 062
0.07 to 0.3 MHz	-75	-74	-73	-105	-105	-104
0.3 to 2 MHz	-92	-91	-90	-117	-117	-116
2 to 10 MHz	-105	-104	-103	-125	-125	-124
0.01 to 2.5	-110	-108	-104	-129	-129	-125
2.5 to 40**	-110	-107	-103	-121	-122	-118
38 to 50	-110	-106	-103	-121	-121	-118
50 to 65	-107	-103	-101	-118	-118	-116
65 to 67	-105	-100	-96	-115	-115	-111
67 to 70	-103	-97	-94	-112	-112	-109

* The Option 061 noise floor reported in this column applies to Port 2 or b_2. For Port 1 or b_1 noise floor, use the figures from the appropriate Port x or b_x "Option 051" column.

** 2.5 to 38 GHz for MS4647A





7. Power Range

Maximum Rated Power to minimum level. The difference reflects the ALC range for standard models or with Option 051, and the ALC + Attenuator Range for models with Options 06x.

MS4642A, 20 GHz Model, Power Range (dBm to dBm)

Frequency (GHz)	Standard (No Options)	Option 051	Option 061* or 062
< 0.01	+10 to -25	+9 to -25	+8 to -95
0.01 to 2.5	+12 to -25	+11 to -25	+10 to -95
2.5* to 20	+13 to -20	+12 to -20	+11 to -90

* Typical between 2.5 and 2.7 GHz

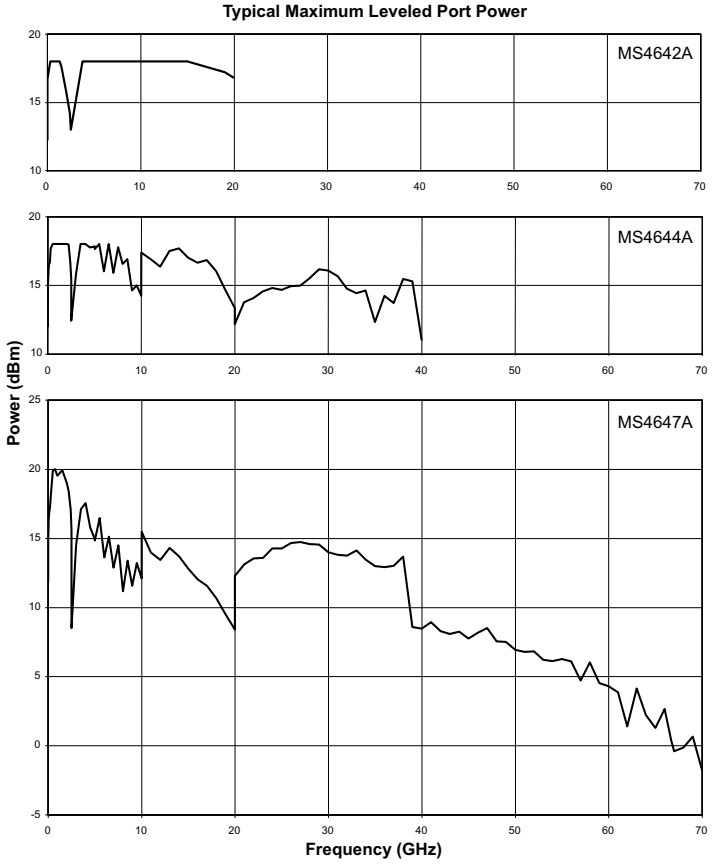
MS4644A, 40 GHz Model, Power Range (dBm to dBm)

Frequency (GHz)	Standard (No Options)	Option 051	Option 061* or 062
< 0.01	+10 to -25	+9 to -25	+8 to -95
0.01 to 2.5	+12 to -25	+11 to -25	+10 to -95
2.5 to 20	+9 to -20	+8 to -20	+7 to -90
20 to 40	+9 to -25	+8 to -25	+7 to -95

MS4645A & MS4647A, 50 & 70 GHz Models, Power Range (dBm to dBm)

Frequency (GHz)	Standard (No Options)	Option 051	Option 061* or 062
< 0.01	+10 to -25	+9 to -25	+8 to -85
0.01 to 2.5	+12 to -25	+11 to -25	+10 to -85
2.5 to 5	+6 to -20	+5 to -20	+3 to -80
5 to 20	+5 to -20	+4 to -20	+2 to -80
20 to 38	+6 to -25	+4 to -25	+2 to -85
38 to 50	+5 to -25	+3 to -25	+1 to -85
50 to 65	0 to -25	-2 to -25	-4 to -85
65 to 67	-2 to -25	-3 to -25	-5 to -85
67 to 70	-3 to -25	-6 to -25	-10 to -85

* The Option 061 power range reported in this column applies to Port 1. For Port 2 Power Range, use the figures from the " Option 051" column.



8. Output "Default" Power

Instrument default power. For maximum rated power, go to Power Range.

Model	Standard (No Options)	Option 051, 061 or 062
MS4642A, 20 GHz	+5 dBm	+5 dBm
MS4644A, 40 GHz	+5 dBm	+5 dBm
MS4645A, 50 GHz	-3 dBm	-10 dBm
MS4647A, 70 GHz	-3 dBm	-10 dBm

9. Power Accuracy, Linearity, and Resolution

Frequency (GHz)	Accuracy* (dB)	Linearity** (dB)	Resolution (dB)
< 0.01	±1.5	±1.5	0.01
0.01 to 40	±1.5	±1.0	0.01
40 to 67	±3.0	±1.0	0.01
67 to 70	±4.0 (±3.0)	± 2.0 (± 1.0)	0.01

* Measured at default power.
** Measured between default and 5 dB below default port power.

10. Measurement Stability

Ratio measurement, with ports shorted. Characteristic.

Frequency (GHz)	Magnitude (dB/ºC)	Phase (degree/ºC)
< 0.01	< 0.04	< 0.4
0.01 to 20	< 0.02	< 0.2
20 to 40	< 0.03	< 0.5
40 to 67	< 0.03	< 0.7
67 to 70	< 0.04	< 0.8

11. Frequency Resolution, Accuracy, and Stability

Resolution	Accuracy	Stability
1 Hz	±5 x 10^{-7} Hz/Hz (at time of calibration)	<5 x 10^{-9}/°C over 0 °C to 50 °C temperature <1 x 10^{-9}/day aging, instrument on

12. Phase Noise, Harmonics and Non-Harmonics (Spurious)

Measured at default power. Non-Harmonics are characteristic performance.

Frequency (GHz)	SSB Phase Noise (dBc/Hz) at 10 kHz offset	Harmonics (dBc) (second and third)	Non-Harmonic Spurious (dBc) at > 1 kHz offsets
< 0.01	-78	-20	-20
0.01 to 2.5	-84	-20	-30
2.5 to 5	-84	-20*	-30
5 to 10	-78	-20	-30
10 to 20	-72	-20	-30
20 to 40	-66	-20	-30
40 to 67	-61	-20	-30
67 to 70	-61	-20	-30

* May degrade by 3 dB (typical) between 2.5 and 2.7 GHz

13. Uncorrected (Raw) Port Characteristics

Characteristic performance with either Option -051, -061, or -062.

Frequency Range (GHz)	Directivity (dB)	Port Match** (dB)
<0.01	> 10*	> 8
0.01 to 2.5	> 9*	> 10
2.5 to 5	> 20	> 10
5 to 20	> 17	> 9
20 to 40	> 14	> 7
40 to 65	> 11	> 7
65 to 67	> 11	> 7
67 to 70	> 5 (> 10)	> 7

* Raw Directivity degraded to 4 dB (typical) below 300 kHz and in a 300 MHz window below 2.5 GHz.
** Port Match is defined as the worst of source and load match.

14. Corrected System Performance and Uncertainties

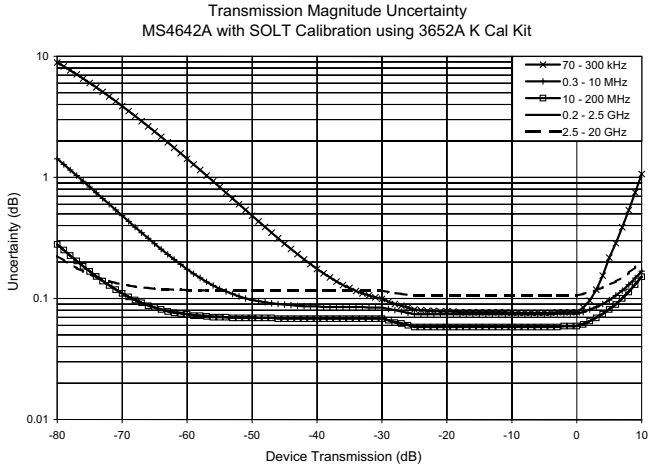
MS4642A 20 GHz Model, with 12-term SOLT with Sliding Load Calibration, using the 3652A-1 K Cal Kit

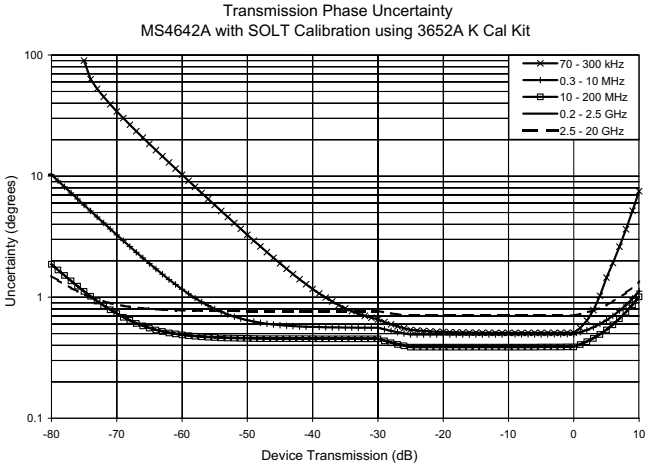
Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match* (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
< 0.01	> 38	> 36	> 38	±0.02	±0.05
0.01 to 2.5	> 42	> 41	> 42	±0.005	±0.03
2.5 to 20	> 43	> 39	> 43	±0.006	±0.07

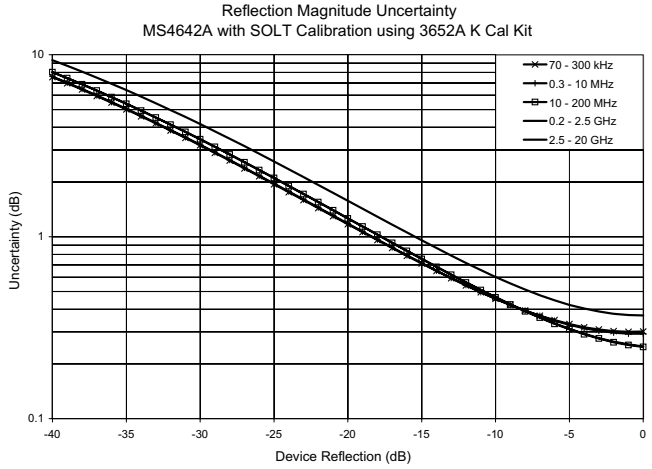
* Since Residual Load Match is limited by Residual Directivity and the user test port cable, it can only be specified as Residual Directivity. For practical considerations, derate it by ~ 8 dB for a 3670 series test port cable, to compensate for effects such as match, repeatability, bend radius, etc.

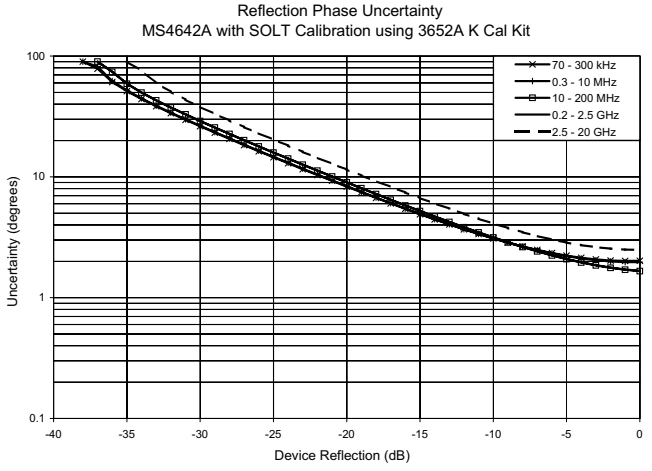
Measurement Uncertainties

The graphs give measurement uncertainties after the above calibration. The errors are worse case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that $s_{11} = s_{22} = 0$. For reflection uncertainties, it is assumed that $s_{21} = s_{12} = 0$. All calibrations and measurements were performed at 0 dBm or default port power, whichever is less. For other conditions, please use our free Exact Uncertainty Calculator software, down-loadable from the Anritsu website at, www.us.anritsu.com.









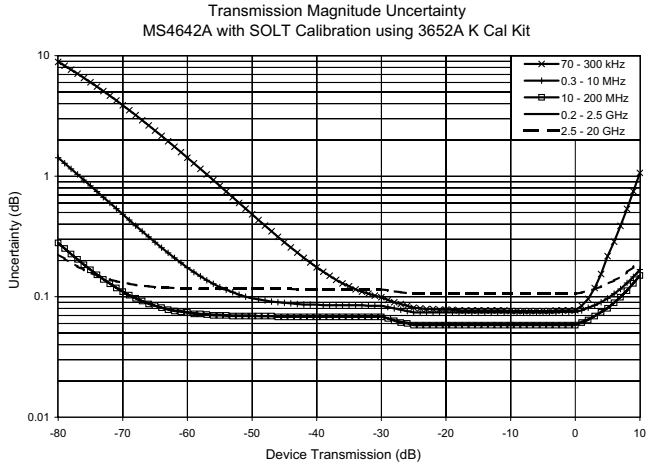
MS4642A 20 GHz Model, with 12-term SOLT Calibration, using the 3652A or 3652A-1 K Cal Kit

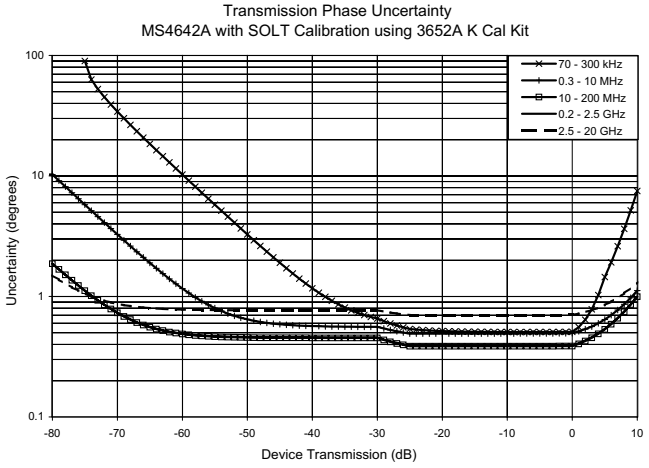
Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match* (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
< 0.01	> 38	> 36	> 38	±0.02	±0.05
0.01 to2.5	> 37	> 41	> 37	±0.005	±0.03
2.5 to 20	> 34	> 39	> 35	±0.006	±0.07

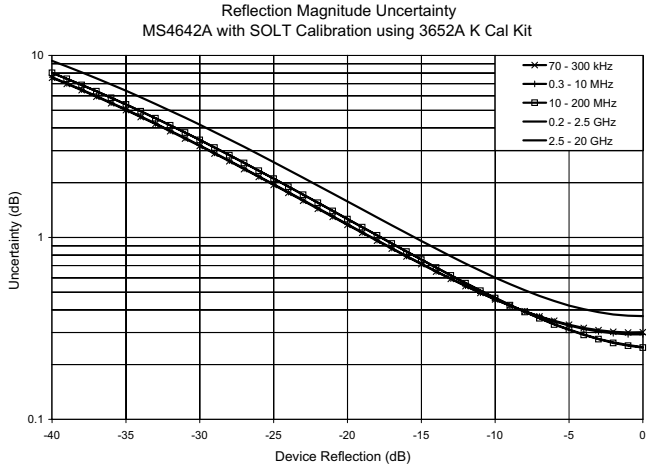
* Since Residual Load Match is limited by Residual Directivity and the user test port cable, it can only be specified at Residual Directivity. For practical considerations, derate it by ~ 8 dB for a 3670 series test port cable, to compensate for effects such as match, repeatability, bend radius, etc.

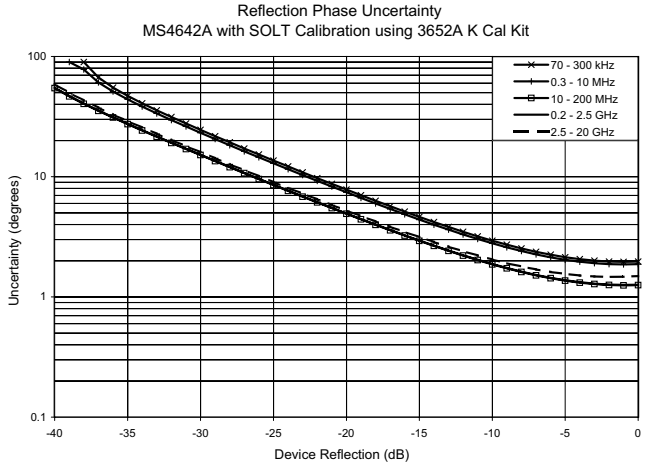
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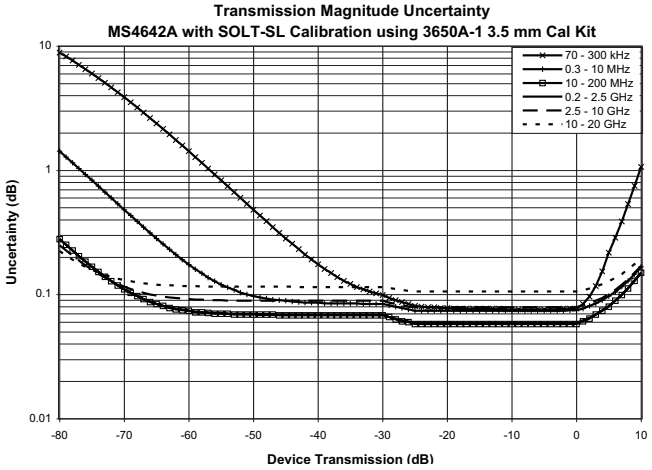
MS4642A 20 GHz Model, with 12-term SOLT with Sliding Load Calibration, using the 3650A-1 3.5 mm Cal Kit

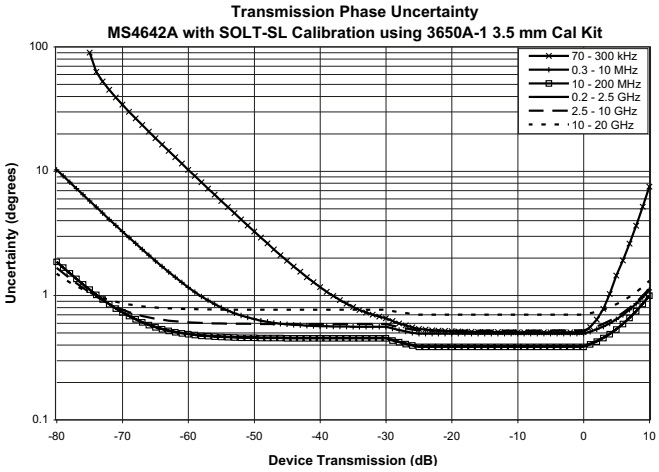
Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match* (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
< 0.01	> 40	> 37	> 40	±0.02	±0.05
0.01 to 2.5	> 42	> 41	> 42	±0.005	±0.03
2.5 to 10	> 43	> 39	> 43	±0.005	±0.03
10 to 20	> 43	> 39	> 43	±0.006	±0.07

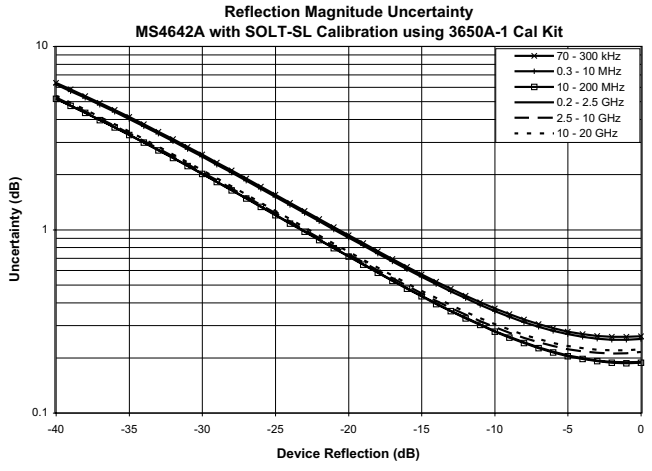
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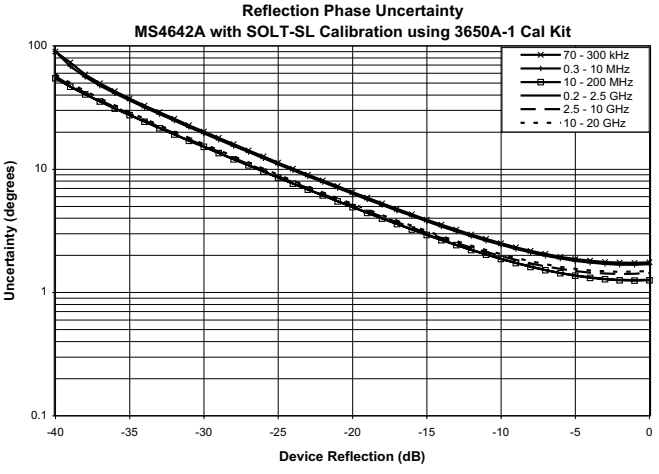
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The graphs give measurement uncertainties after the above calibration. The errors are worse case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that $s_{11} = s_{22} = 0$. For reflection uncertainties, it is assumed that $s_{21} = s_{12} = 0$. All calibrations and measurements were performed at 0 dBm or default port power, whichever is less. For other conditions, please use our free Exact Uncertainty Calculator software, down-loadable from the Anritsu website at, www.us.anritsu.com.









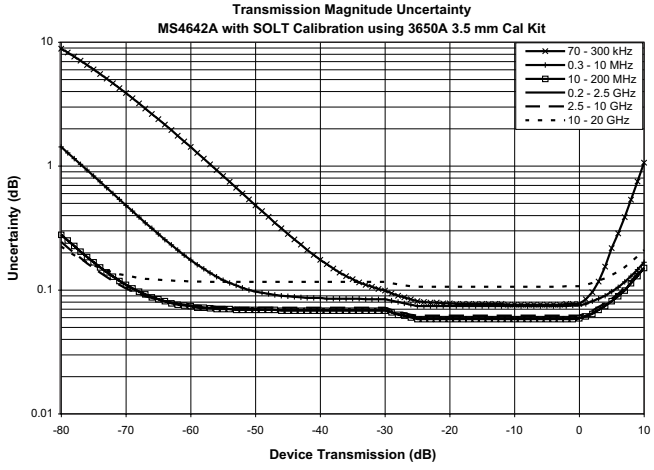
MS4642A 20 GHz Model, with 12-term SOLT Calibration, using the 3650A or 3650A-1 3.5 mm Cal Kit

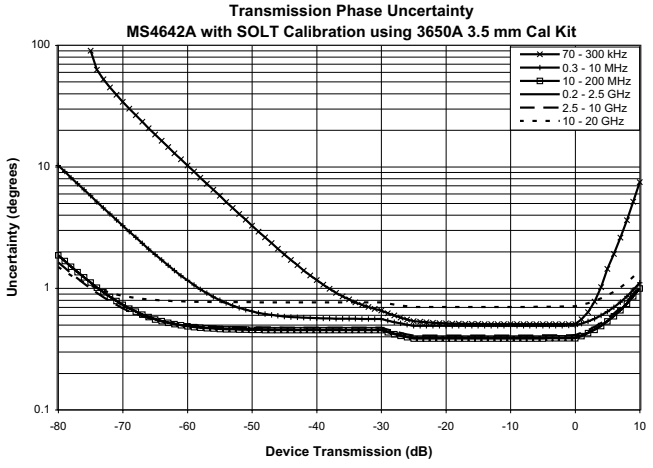
Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match* (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
< 0.01	> 40	> 37	> 40	±0.02	±0.05
0.01 to 2.5	> 42	> 40	> 42	±0.005	±0.03
2.5 to 10	> 40	> 34	> 40	±0.005	±0.03
10 to 20	> 30	> 34	> 30	±0.006	±0.07

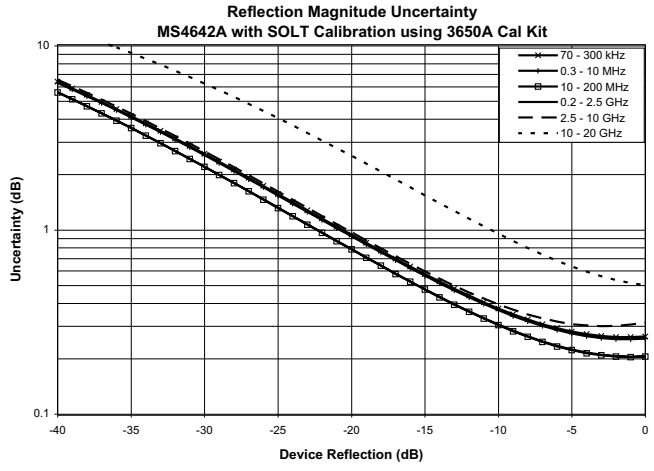
* Since Residual Load Match is limited by Residual Directivity and the user test port cable, it can only be specified at Residual Directivity.
For practical considerations, derate it by ~ 8 dB for a 3670 series test port cable, to compensate for effects such as match, repeatability, bend radius, etc.

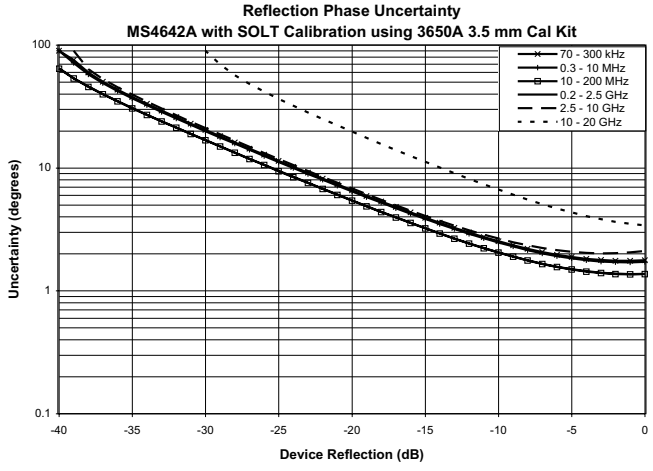
Measurement Uncertainties

The graphs give measurement uncertainties after the above calibration. The errors are worse case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that $s_{11} = s_{22} = 0$. For reflection uncertainties, it is assumed that $s_{21} = s_{12} = 0$. All calibrations and measurements were performed at 0 dBm or default port power, whichever is less. For other conditions, please use our free Exact Uncertainty Calculator software, down-loadable from the Anritsu website at, www.us.anritsu.com.









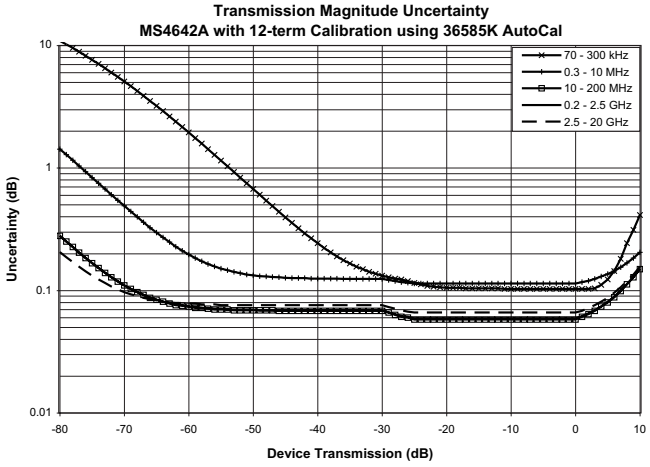
MS4642A 20 GHz Model, with 12-term Calibration, using the 36585K K AutoCal™

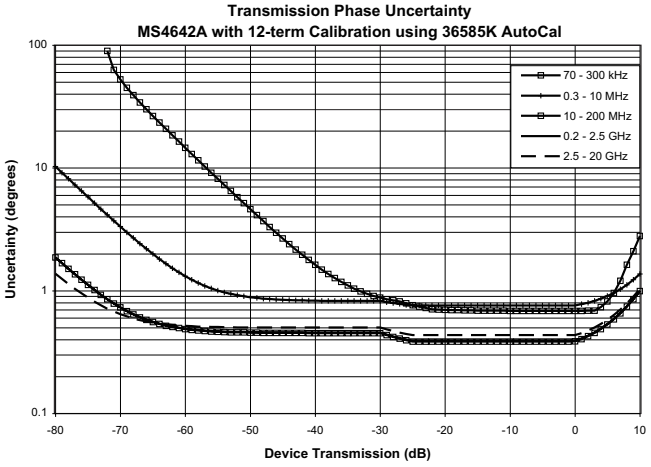
Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match* (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
< 0.01**	> 40	> 40	> 43	±0.10	±0.10
0.01 to 2.5	> 43	> 47	> 43	±0.05	±0.03
2.5 to 20	> 50	> 47	> 50	±0.09	±0.03

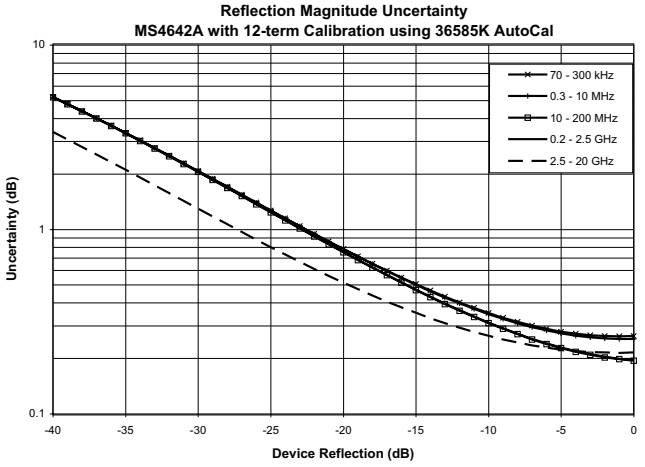
* Since Residual Load Match is limited by Residual Directivity and the user test port cable, it can only be specified as Residual Directivity.
For practical considerations, derate it by ~ 8 dB for a 3670 series test port cable, to compensate for effects such as match, repeatability, bend radius, etc.
** Typical performance below 2 MHz

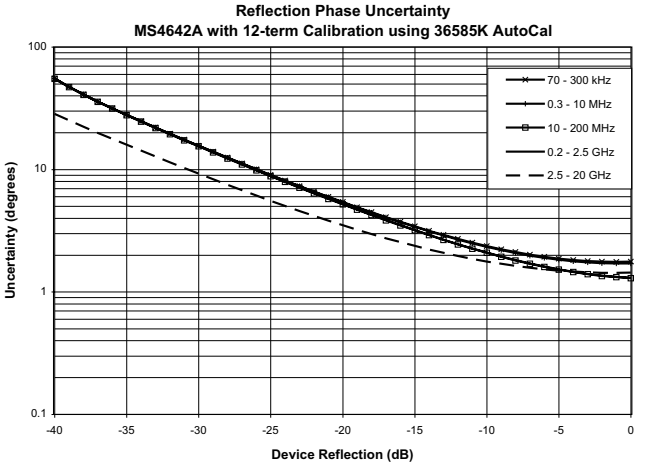
Measurement Uncertainties

The graphs give measurement uncertainties after the above calibration. The errors are worse case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that $s_{11} = s_{22} = 0$. For reflection uncertainties, it is assumed that $s_{21} = s_{12} = 0$. All calibrations and measurements were performed at 0 dBm or default port power, whichever is less. For other conditions, please use our free Exact Uncertainty Calculator software, down-loadable from the Anritsu website at, www.us.anritsu.com.









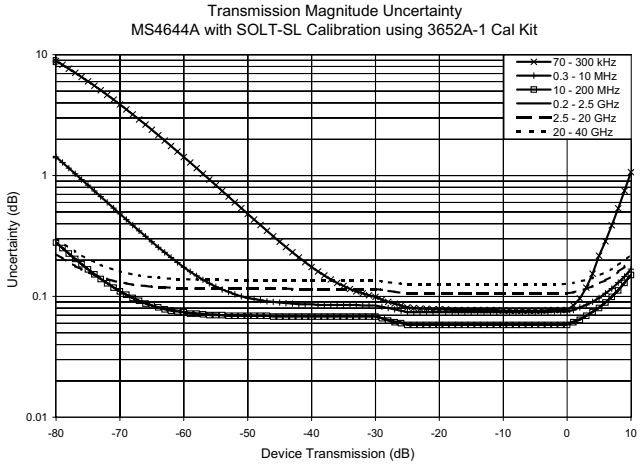
MS4644A 40 GHz Model, with 12-term SOLT with Sliding Load Calibration, using the 3652A-1 K Cal Kit

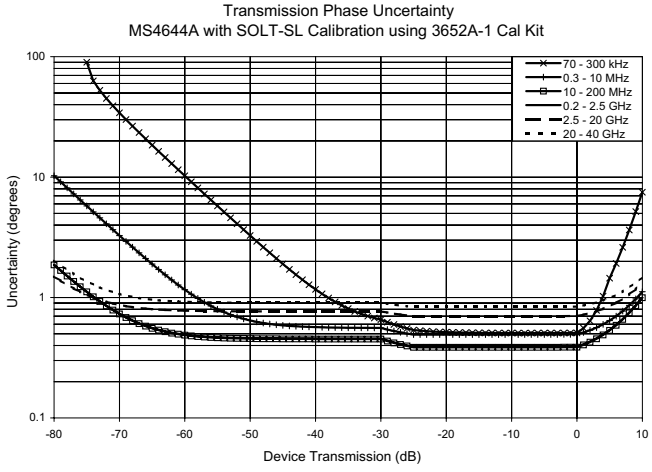
Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match* (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
< 0.01	> 38	> 36	> 38	±0.02	±0.05
0.01 to 2.5	> 42	> 41	> 42	±0.005	±0.03
2.5 to 20	> 43	> 39	> 43	±0.006	±0.07
20 to 40	> 40	> 34	> 40	±0.006	±0.08

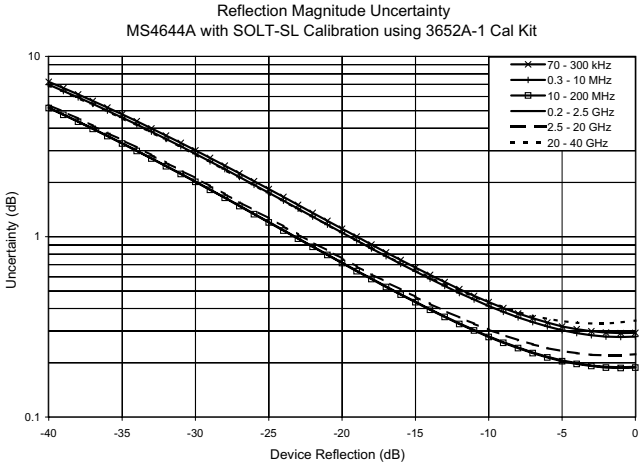
* Since Residual Load Match is limited by Residual Directivity and the user test port cable, it can only be specified at Residual Directivity.
For practical considerations, derate it by ~ 8 dB for a 3670 series test port cable, to compensate for effects such as match, repeatability, bend radius, etc.

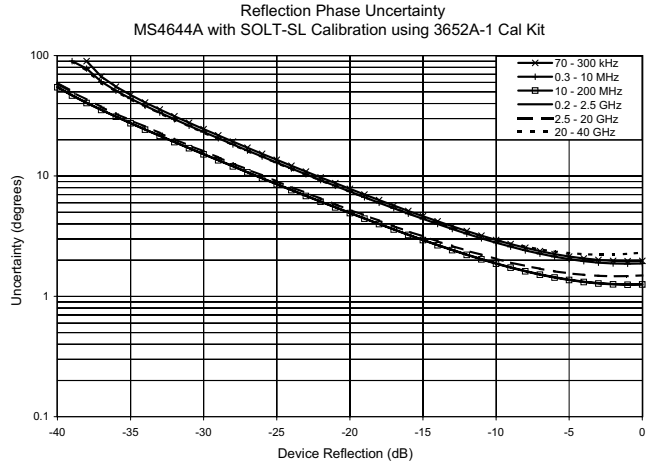
Measurement Uncertainties

The graphs give measurement uncertainties after the above calibration. The errors are worse case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that $s_{11} = s_{22} = 0$. For reflection uncertainties, it is assumed that $s_{21} = s_{12} = 0$. All calibrations and measurements were performed at 0 dBm or default port power, whichever is less. For other conditions, please use our free Exact Uncertainty Calculator software, down-loadable from the Anritsu website at, www.us.anritsu.com.









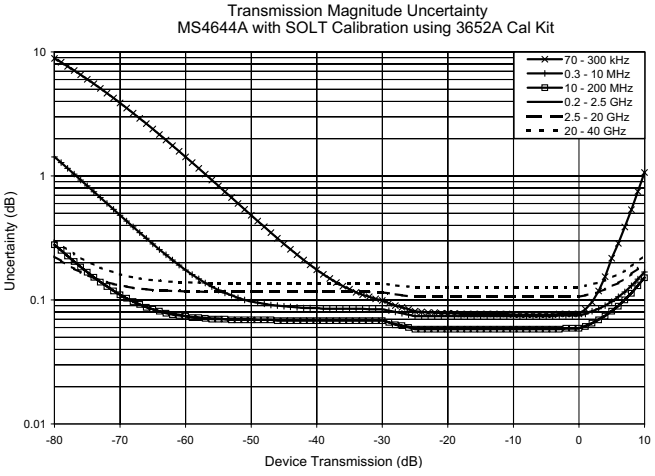
MS4644A 40 GHz Model, with 12-term SOLT Calibration, using the 3652A or 3652A-1 K Cal Kit

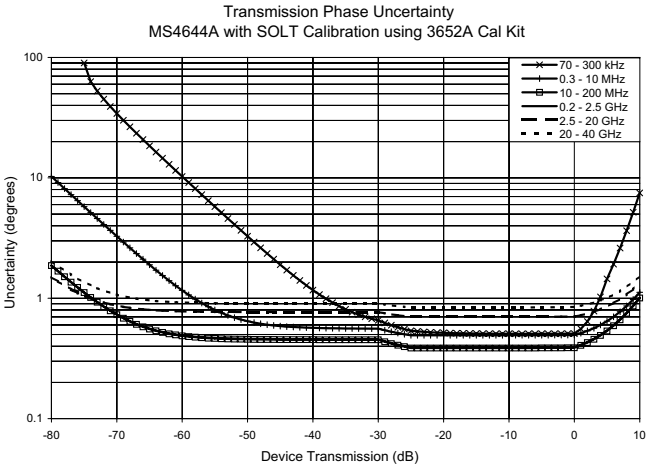
Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match* (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
< 0.01	> 38	> 36	> 38	±0.02	±0.05
0.01 to 2.5	> 37	> 41	> 37	±0.005	±0.03
2.5 to 20	> 34	> 39	> 35	±0.006	±0.07
20 to 40	> 32	> 34	> 32	±0.006	±0.08

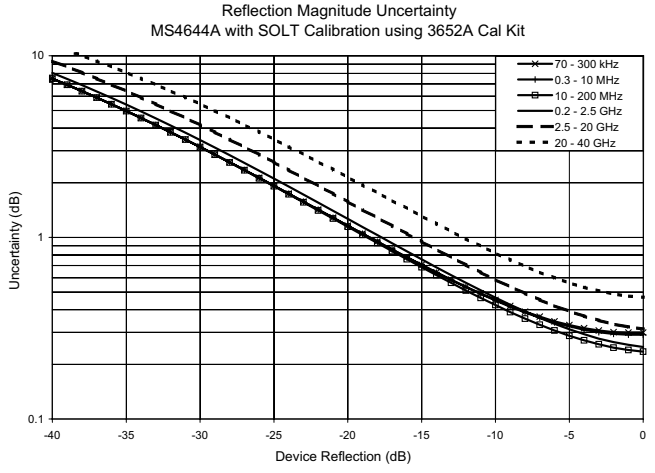
* Since Residual Load Match is limited by Residual Directivity and the user test port cable, it can only be specified as Residual Directivity. For practical considerations, derate it by ~ 8 dB for a 3670 series test port cable, to compensate for effects such as match, repeatability, bend radius, etc.

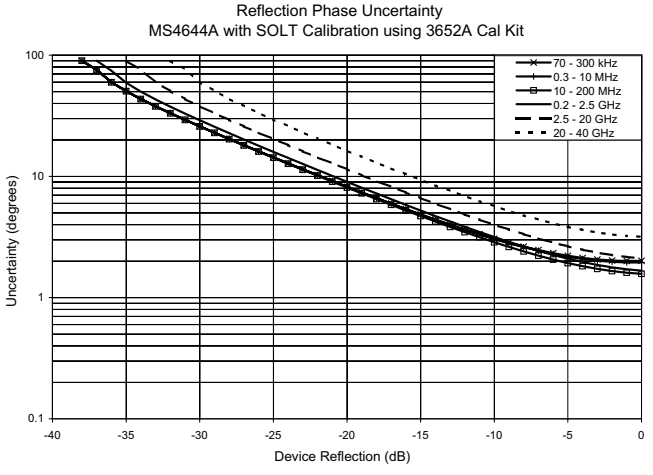
Measurement Uncertainties

The graphs give measurement uncertainties after the above calibration. The errors are worse case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that $s_{11} = s_{22} = 0$. For reflection uncertainties, it is assumed that $s_{21} = s_{12} = 0$. All calibrations and measurements were performed at 0 dBm or default port power, whichever is less. For other conditions, please use our free Exact Uncertainty Calculator software, down-loadable from the Anritsu website at, www.us.anritsu.com.









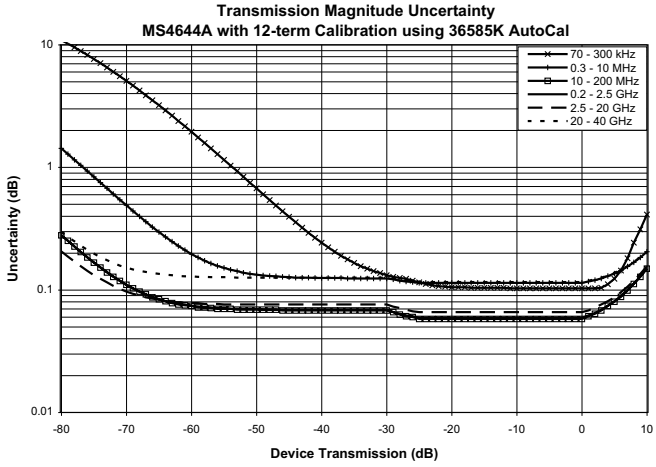
MS4644A 40 GHz Model, with 12-term Calibration, using the 36585K K AutoCal

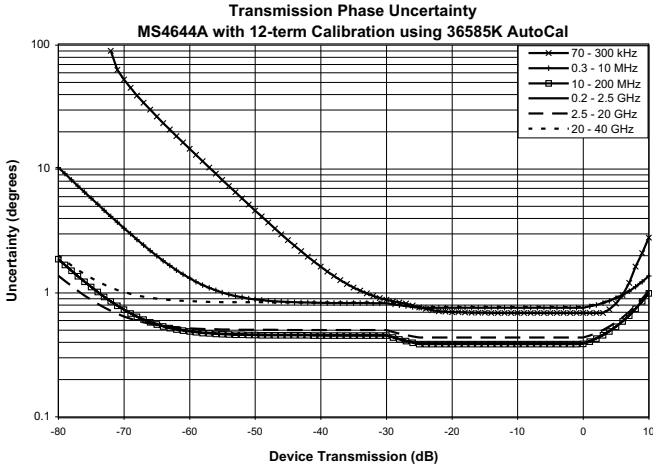
Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match* (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
< 0.01**	> 40	> 40	> 43	±0.10	±0.10
0.01 to 2.5	> 43	> 47	> 43	±0.05	±0.03
2.5 to 20	> 50	> 47	> 50	±0.09	±0.03
20 to 40	> 48	> 47	> 48	±0.14	±0.07

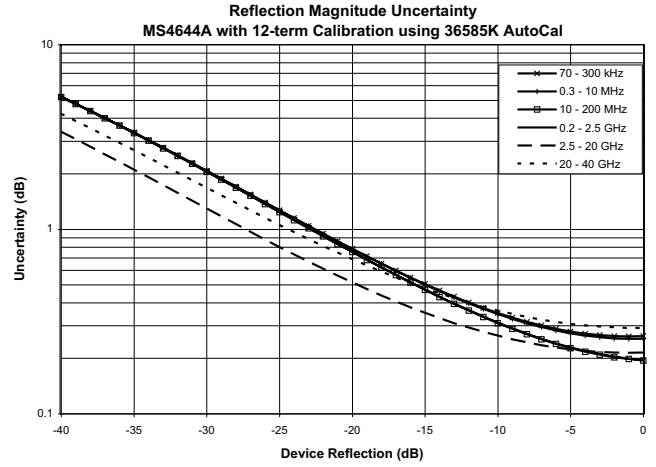
* Since Residual Load Match is limited by Residual Directivity and the user test port cable, it can only be specified at Residual Directivity.
For practical considerations, derate it by ~ 8 dB for a 3670 series test port cable, to compensate for effects such as match, repeatability, bend radius, etc.
** Typical performance below 2 MHz

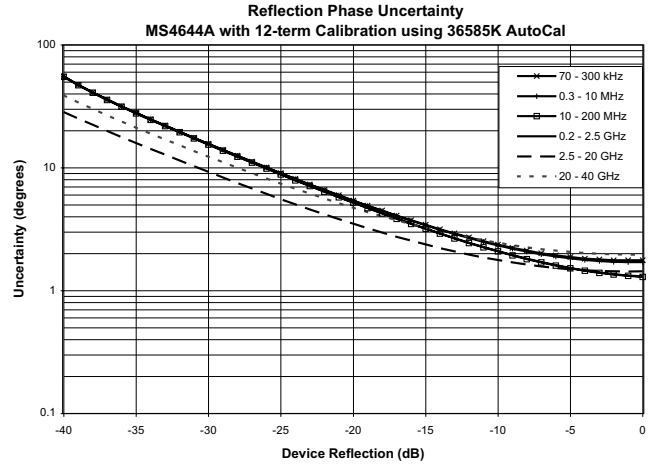
Measurement Uncertainties

The graphs give measurement uncertainties after the above calibration. The errors are worse case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that $s_{11} = s_{22} = 0$. For reflection uncertainties, it is assumed that $s_{21} = s_{12} = 0$. All calibrations and measurements were performed at 0 dBm or default port power, whichever is less. For other conditions, please use our free Exact Uncertainty Calculator software, down-loadable from the Anritsu website at, www.us.anritsu.com.









MS4645A & MS4647A 50 & 70 GHz Models, with 12-term SOLT with Sliding Load Calibration, using the 3654D-1 V Cal Kit

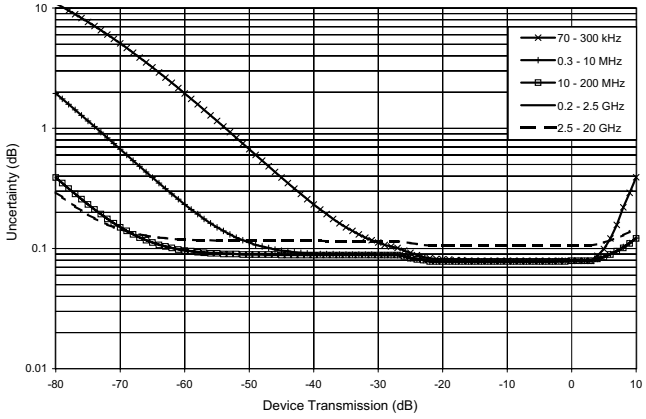
Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match* (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
< 0.01	> 38	> 36	> 38	±0.02	±0.05
0.01 to 2.5	> 41	> 39	> 41	±0.02	±0.05
2.5 to 20	> 41	> 37	> 41	±0.02	±0.07
20 to 40	> 37	> 32	> 37	±0.02	±0.08
40 to 65	> 35	> 28	> 35	±0.08	±0.12
65 to 67	> 35	> 28	> 35	±0.15	±0.15
67 to 70	> 30	> 26	> 30	±0.30	±0.15

* Since Residual Load Match is limited by Residual Directivity and the user test port cable, it can only be specified as Residual Directivity.
For practical considerations, derate it by ~ 8 dB for a 3670 series test port cable, to compensate for effects such as match, repeatability, bend radius, etc.

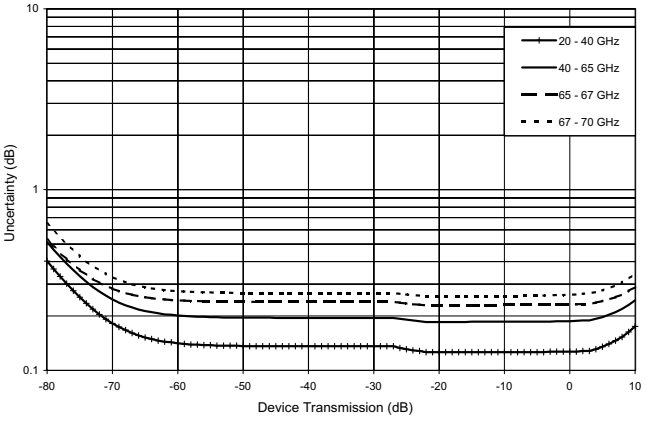
Measurement Uncertainties (Transmission)

The graphs give measurement uncertainties after the above calibration. The errors are worse case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that $s_{11} = s_{22} = 0$. For reflection uncertainties, it is assumed that $s_{21} = s_{12} = 0$. All calibrations and measurements were performed at 0 dBm or default port power, whichever is less. For other conditions, please use our free Exact Uncertainty Calculator software, down-loadable from the Anritsu website at, www.us.anritsu.com.

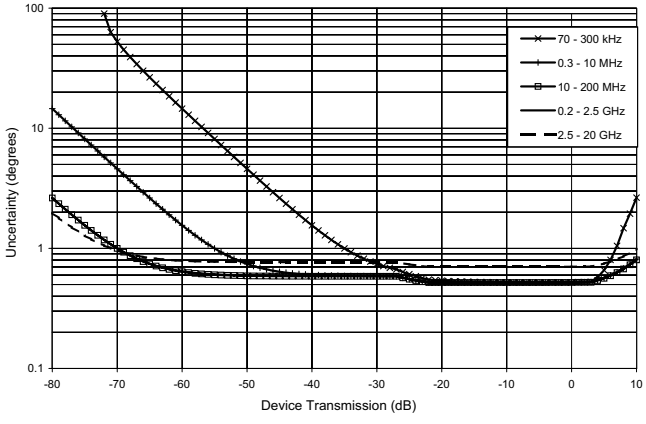
Transmission Magnitude Uncertainty (1 of 2)
MS4647A with SOLT-SL Calibration using 3654D-1 Cal Kit



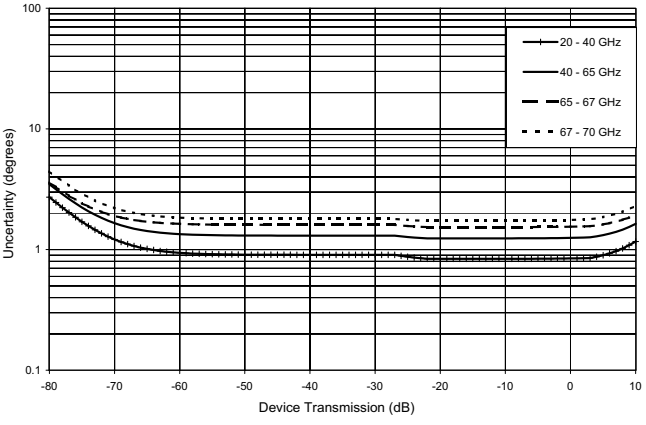
Transmission Magnitude Uncertainty (2 of 2)
MS4647A with SOLT-SL Calibration using 3654D-1 Cal Kit



Transmission Phase Uncertainty (1 of 2)
MS4647A with SOLT-SL Calibration using 3654D-1 Cal Kit

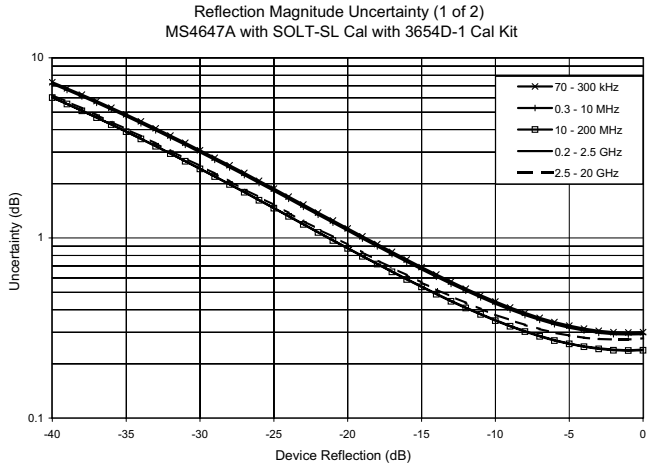


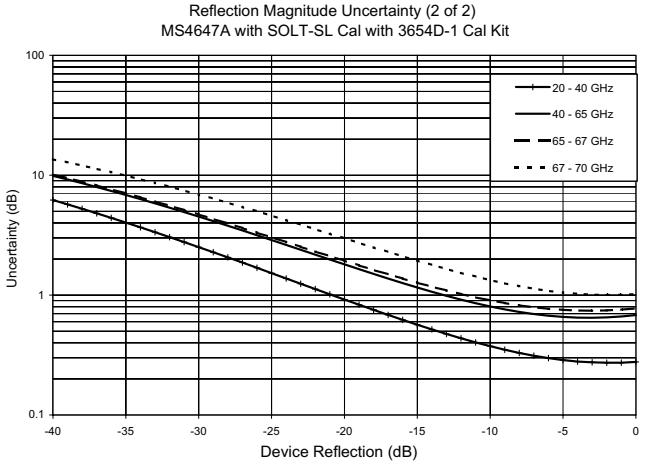
Transmission Phase Uncertainty (2 of 2)
MS4647A with SOLT-SL Calibration using 3654D-1 Cal Kit

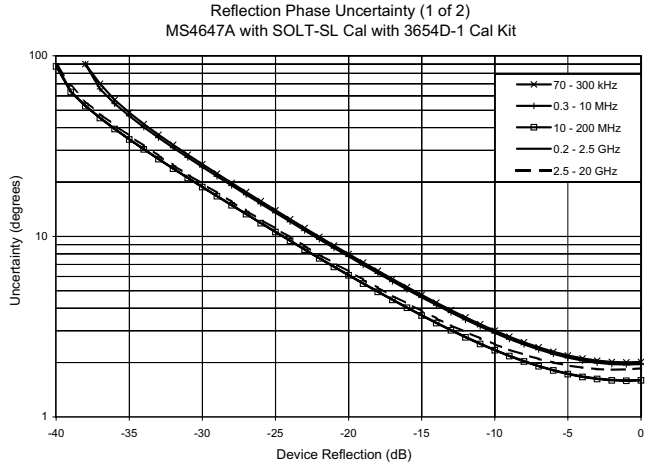


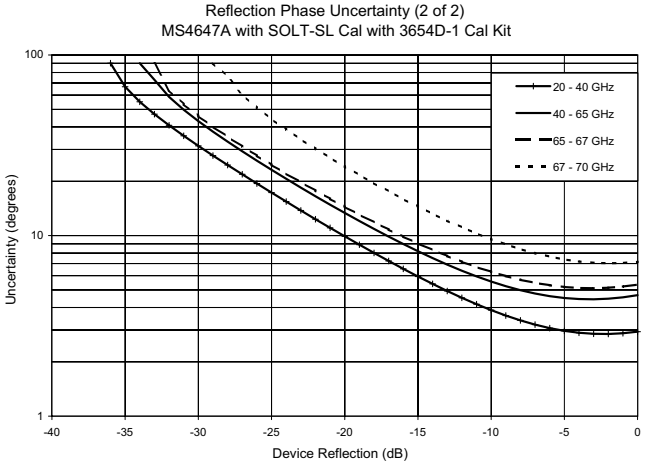
Measurement Uncertainties (Reflection)

The graphs give measurement uncertainties after the above calibration. The errors are worse case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that $s_{11} = s_{22} = 0$. For reflection uncertainties, it is assumed that $s_{21} = s_{12} = 0$. All calibrations and measurements were performed at 0 dBm or default port power, whichever is less. For other conditions, please use our free Exact Uncertainty Calculator software, down-loadable from the Anritsu website at, www.us.anritsu.com.









MS4645A & MS4647A 50 & 70 GHz Models, with 12-term SOLT Calibration, using the 3654D or 3654D-1 V Cal Kit

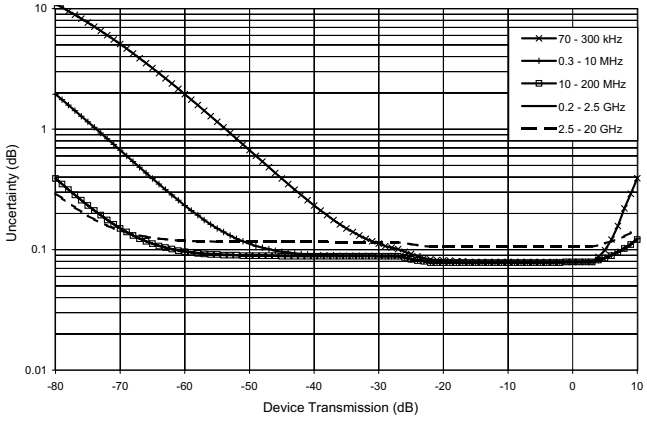
Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match* (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
< 0.01	> 38	> 36	> 38	±0.02	±0.05
0.01 to 2.5	> 40	> 39	> 40	±0.02	±0.05
2.5 to 20	> 40	> 37	> 40	±0.02	±0.07
20 to 40	> 35	> 32	> 35	±0.02	±0.08
40 to 65	> 32	> 28	> 32	±0.08	±0.12
65 to 67	> 32	> 28	> 32	±0.15	±0.15
67 to 70	> 28	> 26	> 28	±0.30	±0.15

* Since Residual Load Match is limited by Residual Directivity and the user test port cable, it can only be specified as Residual Directivity.
For practical considerations, derate it by ~ 8 dB for a 3670 series test port cable, to compensate for effects such as match, repeatability, bend radius, etc.

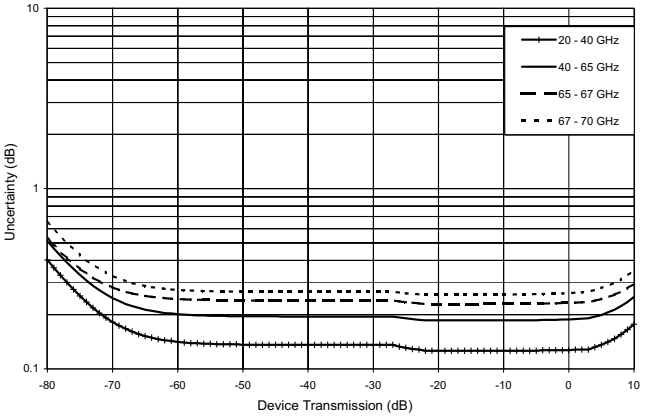
Measurement Uncertainties (Transmission)

The graphs give measurement uncertainties after the above calibration. The errors are worse case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that $s_{11} = s_{22} = 0$. For reflection uncertainties, it is assumed that $s_{21} = s_{12} = 0$. All calibrations and measurements were performed at 0 dBm or default port power, whichever is less. For other conditions, please use our free Exact Uncertainty Calculator software, down-loadable from the Anritsu website at, www.us.anritsu.com.

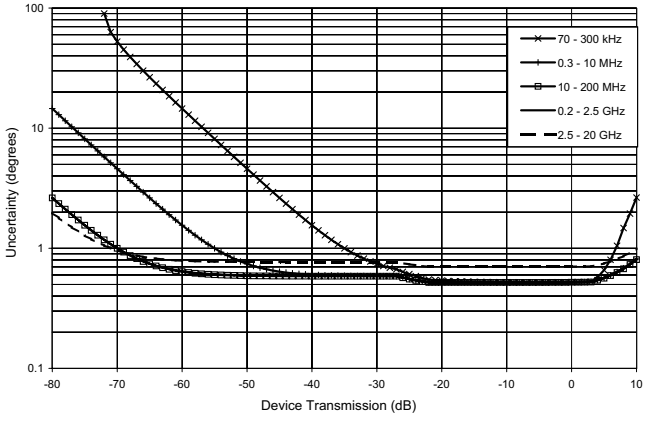
Transmission Magnitude Uncertainty (1 of 2)
MS4647A with SOLT Calibration using 3654D Cal Kit



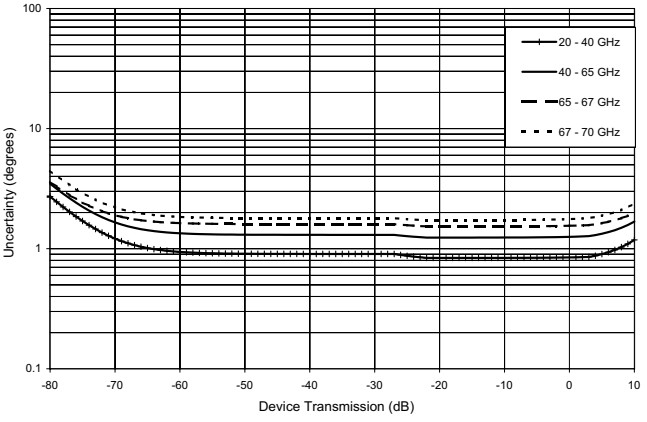
Transmission Magnitude Uncertainty (2 of 2)
MS4647A with SOLT Calibration using 3654D Cal Kit



Transmission Phase Uncertainty (1 of 2)
MS4647A with SOLT Calibration using 3654D Cal Kit



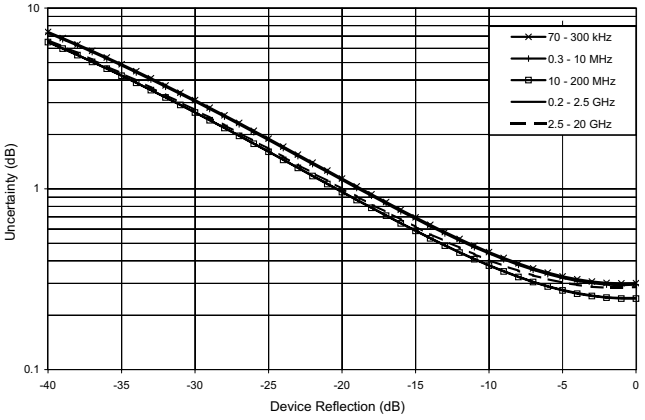
Transmission Phase Uncertainty (2 of 2)
MS4647A with SOLT Calibration using 3654D Cal Kit



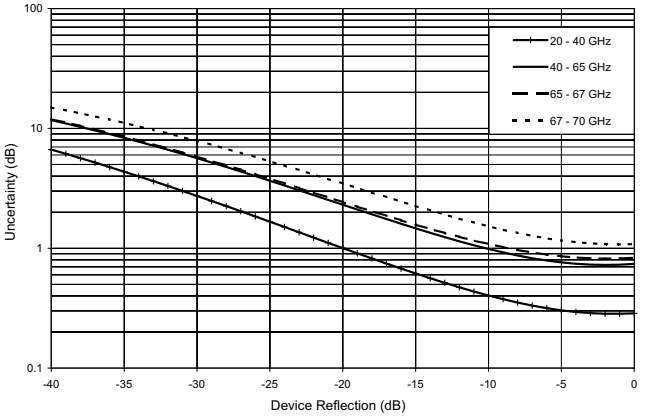
Measurement Uncertainties (Reflection)

The graphs give measurement uncertainties after the above calibration. The errors are worse case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that $s_{11} = s_{22} = 0$. For reflection uncertainties, it is assumed that $s_{21} = s_{12} = 0$. All calibrations and measurements were performed at 0 dBm or default port power, whichever is less. For other conditions, please use our free Exact Uncertainty Calculator software, down-loadable from the Anritsu website at, www.us.anritsu.com.

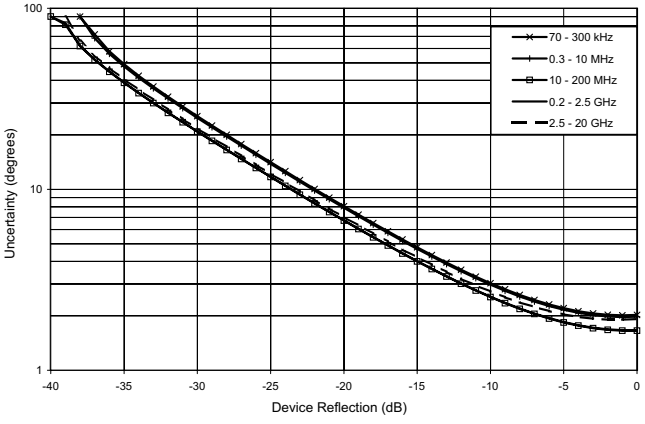
Reflection Magnitude Uncertainty (1 of 2)
MS4647A with SOLT Calibration using 3654D Cal Kit



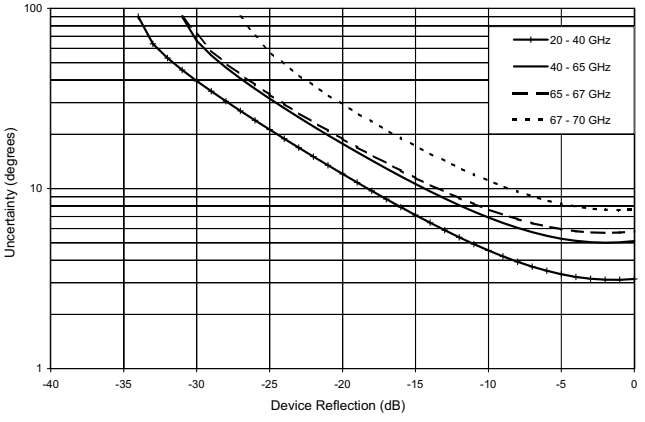
Reflection Magnitude Uncertainty (2 of 2)
MS4647A with SOLT Calibration using 3654D Cal Kit



Reflection Phase Uncertainty (1 of 2)
MS4647A with SOLT Calibration using 3654D Cal Kit



Reflection Phase Uncertainty (2 of 2)
MS4647A with SOLT Calibration using 3654D Cal Kit



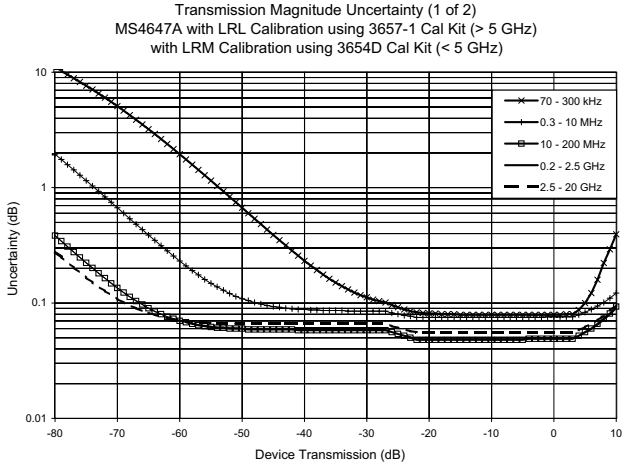
MS4645A & MS4647A 50 & 70 GHz Models, with an LRL Calibration, using the 3657-1 V Multi-line Cal Kit, symmetric reflects

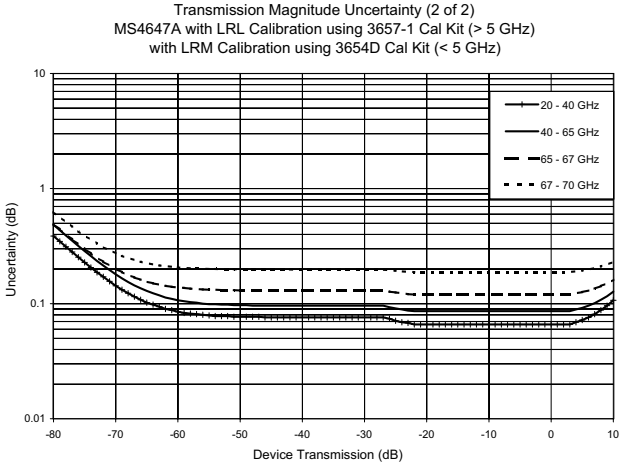
Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match* (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
0.24** to 2.5	> 50	> 50	> 50	±0.005	±0.02
2.5 to 20	> 50	> 50	> 50	±0.005	±0.02
20 to 40	> 50	> 50	> 50	±0.005	±0.02
40 to 65	> 45	> 50	> 45	±0.015	±0.02
65 to 67	> 45	> 50	> 45	±0.03	±0.04
67 to 70	> 45	> 45	> 45	±0.10	±0.08

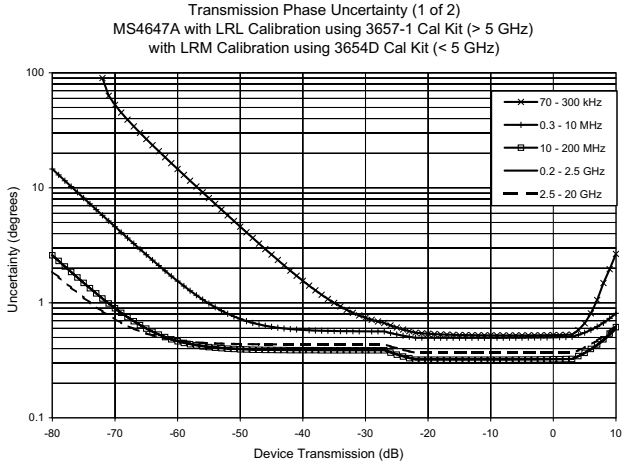
* Since Residual Load Match is limited by Residual Directivity and the user test port cable, it can only be specified as Residual Directivity.
For practical considerations, derate it by ~ 8 dB for a 3670 series test port cable, to compensate for effects such as match, repeatability, bend radius, etc.
**Limited to about 240 MHz, due to the longest line delta of 34.84 mm in the 3657 series Multi-line cal kit.

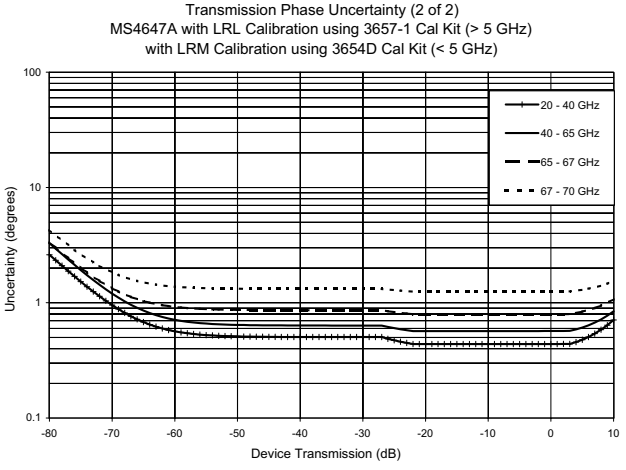
Measurement Uncertainties (Transmission)

The graphs give measurement uncertainties after the above calibration. The errors are worse case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that $s_{11} = s_{22} = 0$. For reflection uncertainties, it is assumed that $s_{21} = s_{12} = 0$. All calibrations and measurements were performed at 0 dBm or default port power, whichever is less. For other conditions, please use our free Exact Uncertainty Calculator software, down-loadable from the Anritsu website at, www.us.anritsu.com.



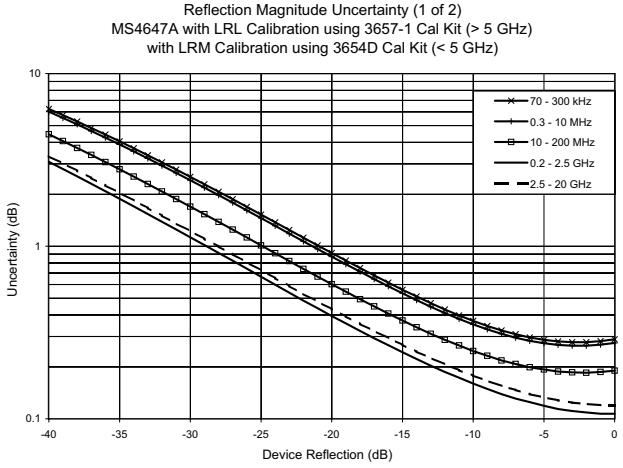


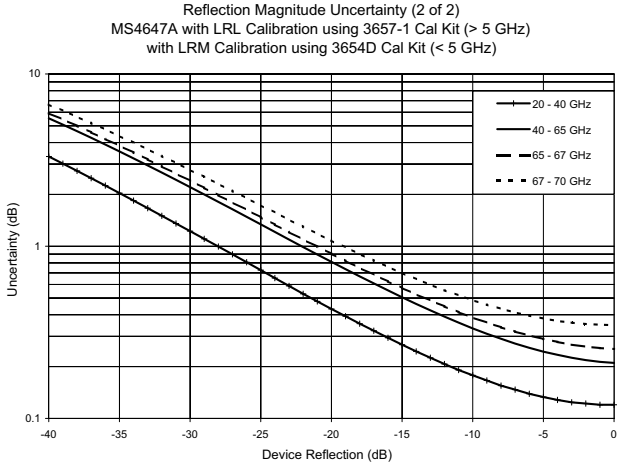


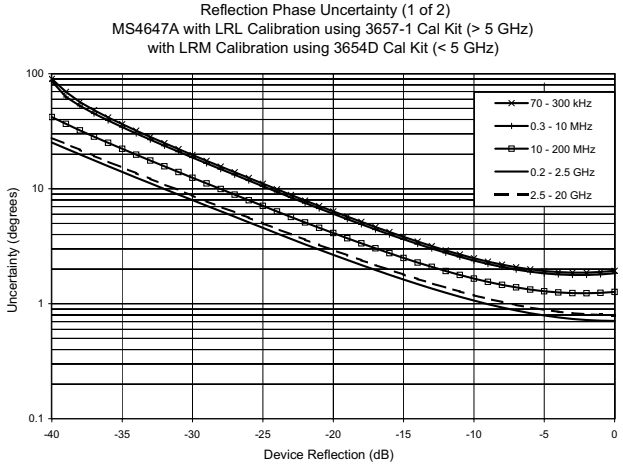


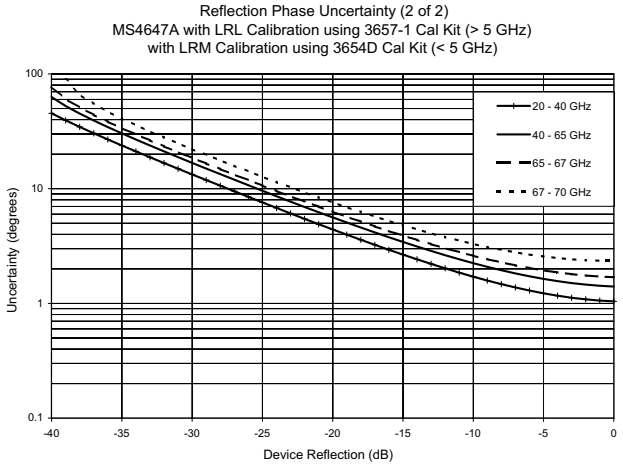
Measurement Uncertainties (Reflection)

The graphs give measurement uncertainties after the above calibration. The errors are worse case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that $s_{11} = s_{22} = 0$. For reflection uncertainties, it is assumed that $s_{21} = s_{12} = 0$. All calibrations and measurements were performed at 0 dBm or default port power, whichever is less. For other conditions, please use our free Exact Uncertainty Calculator software, down-loadable from the Anritsu website at, www.us.anritsu.com.









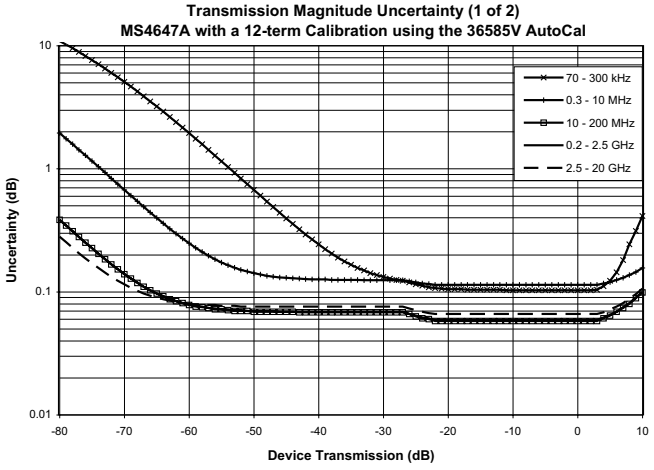
MS4645A & MS4647A 50 & 70 GHz Models, with 12-term Calibration, using the 36585V V AutoCal

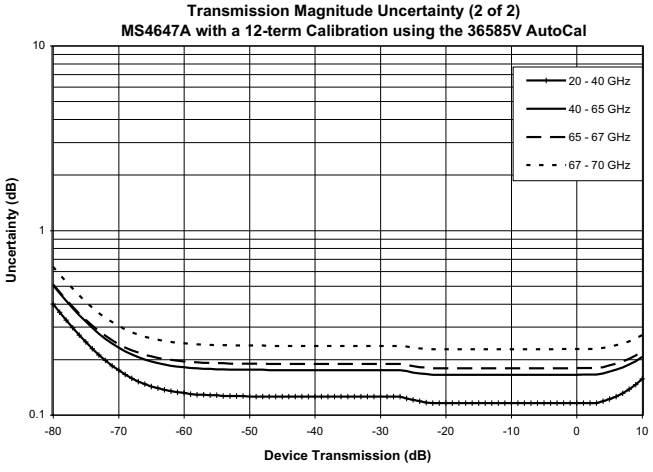
Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match* (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
< 0.01**	> 40	> 40	> 40	±0.10	±0.10
0.01 to 2.5	> 43	> 47	> 43	±0.05	±0.03
2.5 to 20	> 50	> 47	> 50	±0.09	±0.03
20 to 40	> 48	> 47	> 48	±0.14	±0.07
40 to 65	> 43	> 45	> 43	±0.17***	±0.10
65 to 67	> 43	> 45	> 43	±0.17	±0.10
67 to 70	> 42	> 40	> 42	±0.30	±0.12

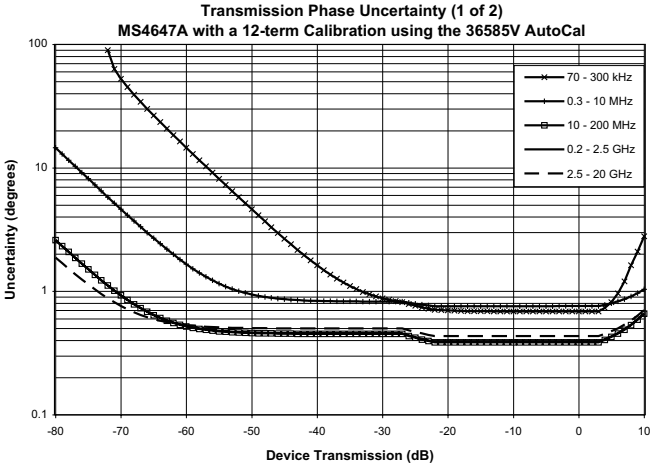
* Since Residual Load Match is limited by Residual Directivity and the user test port cable, it can only be specified as Residual Directivity.
For practical considerations, derate it by ~ 8 dB for a 3670 series test port cable, to compensate for effects such as match, repeatability, bend radius, etc.
** Typical performance below 2 MHz
*** ±0.25 dB from 51 to 55 GHz

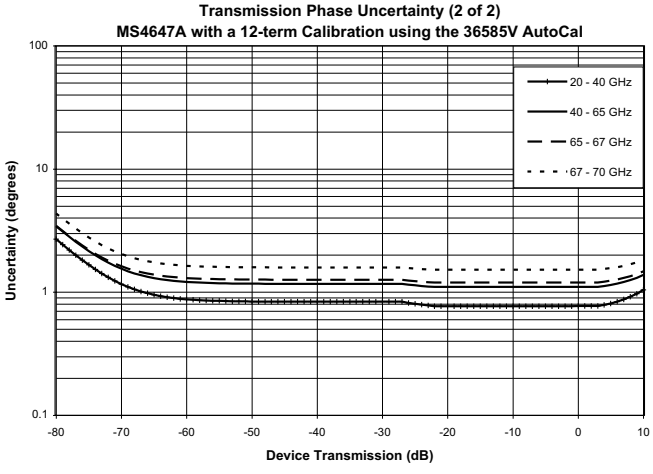
Measurement Uncertainties (Transmission)

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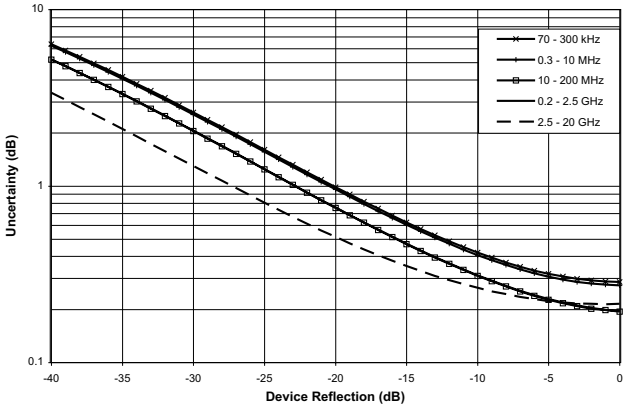




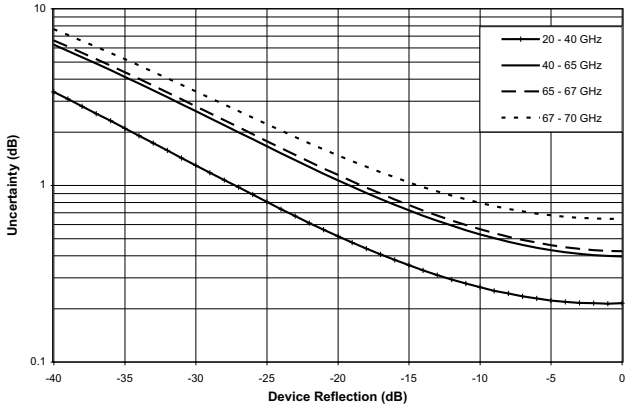
Measurement Uncertainties (Reflection)

The graphs give measurement uncertainties after the above calibration. The errors are worse case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that $s_{11} = s_{22} = 0$. For reflection uncertainties, it is assumed that $s_{21} = s_{12} = 0$. All calibrations and measurements were performed at 0 dBm or default port power, whichever is less. For other conditions, please use our free Exact Uncertainty Calculator software, down-loadable from the Anritsu website at, www.us.anritsu.com

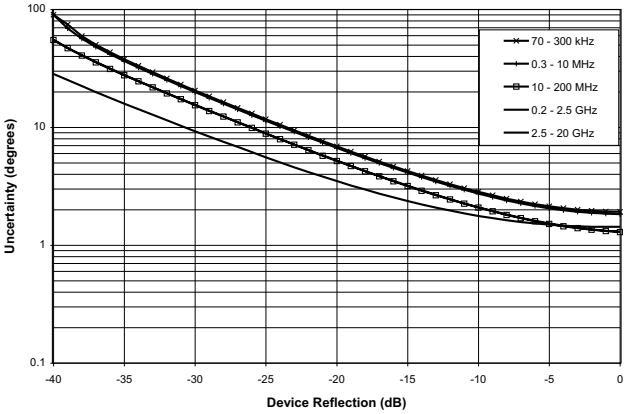
Reflection Magnitude Uncertainty (1 of 2)
MS4647A with a 12-term Calibration using the 36585V AutoCal



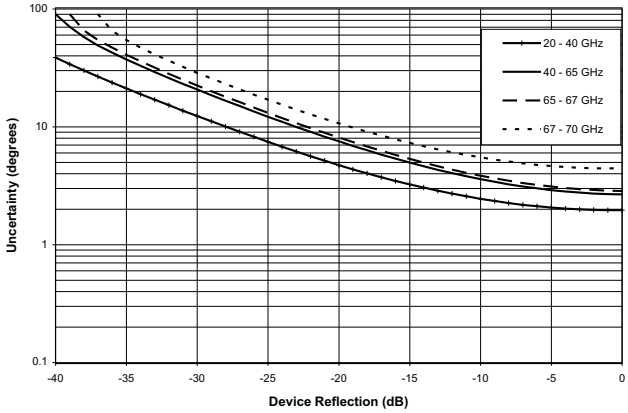
Reflection Magnitude Uncertainty (2 of 2)
MS4647A with a 12-term Calibration using the 36585V AutoCal



Reflection Phase Uncertainty (1 of 2)
MS4647A with a 12-term Calibration using the 36585V AutoCal



Reflection Phase Uncertainty (2 of 2)
MS4647A with a 12-term Calibration using the 36585V AutoCal



15. Measurement Time*

Measurement times include sweep time, and band-switching time, in single channel mode. Typical.

20 µs/pt is achieved in true swept mode, with 25K points, with ALC turned on for level accuracy, with display turned-on for tuning purposes, with locking turned-on for frequency accuracy and repeatability, with correction turned on to meet published residual specifications, and over the full span of the product with all band-switch points to fully characterize a device.

Measurement Time (ms), SYNTHESIZED sweep, Display ON and ALC ON

Calibration	Sweep Width	IF BW	401 points	1,601 points	25,001 points	100,000 points
Uncorrected or 1-port calibration	Narrow (≤1 GHz span without bandswitch points)	1 MHz	14	40	510	2,200
		30 kHz	22	90	1,230	4,900
		1 kHz	380	1600	25,000	100,000
	Wide (70 GHz span)	1 MHz	50	70	570	2,300
		30 kHz	67	120	1,300	5,000
		1 kHz	420	1,670	25,000	100,000
2-port calibration (per sweep)	Narrow (≤1 GHz span without bandswitch points)	1 MHz	14	40	510	2,200
		30 kHz	22	90	1,230	4,900
		1 kHz	400	1,610	25,000	100,000
	Wide (70 GHz span)	1 MHz	50	70	570	2,300
		30 kHz	67	120	1,300	5,000
		1 kHz	420	1,670	25,000	100,000

Measurement Time (ms) vs. Noise Floor (dBm), SYNTHESIZED sweep, Display ON and ALC ON

Calibration	Full Band Sweep	1,601 points Measurement Time	Achieved Noise Floor (dBm) (at max. frequency)	IF BW (kHz)
2-port calibration (per sweep)	MS4642A	90	-85	100
		190	-95	10
	MS4644A	95	-80	100
		190	-90	10
	MS4647A	100	-75	100
		190	-85	10

16. Remote Operability

Via GPIB	Using IEEE 488.2	1 MB/s Data Transfer Speed	Use SCPI or previous generation Lightning VNA commands. Also compatible with a basic but fundamental set of HP/Agilent 8510x VNA commands.
Via LAN	Using VXI-11 Protocol	2.5 MB/s Data Transfer Speed	
Via USB	Using USBTMC Protocol	5.5 MB/s Data Transfer Speed	
Drivers (for GPIB, LAN, or USB)	National Instruments LabVIEW and LabWindows/CVI drivers. Available for downloads from both Anritsu's and NI's websites. .NET/COM driver for Windows Applications such as: Visual Studio 6 thru VS 2005, VB6, C#, C++, C, Visual C, HP Vee, and more. Available for download from the Anritsu Website. These drivers require VISA runtime, not provided by Anritsu. NI's VISA (≥ version 3.2) is recommended for .NET and USB support.		
Triggering	Internal, External, GPIB Single point, Single Sweep, Single Channel, All Channels Hand-shaking for optimum tandem sweeps (check rear panel connections)		

Throughput Time (ms), SYNTHESIZED sweep, Display ON and ALC ON, single 20 GHz sweep, 30 kHz IFBW, including trigger and data transfer time

Communication Type	Data Format	401 points	1,601 points	100,000 points
GPIB (IEEE-488.2)	32- or 64-bit Floating	380	410	6,400
	ASCII	290	370	7,400
LAN (VXI-11)	32- or 64-bit Floating	280	320	6,300
	ASCII	290	350	7,400
USB (USBTMC class)	32- or 64-bit Floating	280	310	6,000
	ASCII	290	350	6,800

* Subject to the conditions and including the events specified. Chosen conditions reflect true measurement conditions, based on customers' input on speed environment expectations. Full transparency and disclosure given for best comparisons and decisions.

17. Standard Capabilities

Operating Frequency*	MS4642A	10 MHz to 20.2 GHz
	MS4644A	10 MHz to 40.5 GHz
	MS4645A	10 MHz to 50.5 GHz
	MS4647A	10 MHz to 70 GHz
	MS4647A-070	40 kHz to 10 MHz Coverage Extension
Measurement Parameters	S_{11}, S_{21}, S_{22}, S_{12}, and any user-defined combination of a_1, a_2, b_1, b_2, and 1 For 4-port measurements, refer to the separate multiport technical datasheet on www.us.anritsu.com\vectorstar.	
Domains	Frequency Domain, Power Domain, CW Draw, and Time (Distance) Domain	
Frequency Sweep Types	Linear, CW, or Segmented	
Power Sweep Types	Linear, log, or constant power sweeps, or constant power slope (dB/GHz) over frequency sweep	
Graph Types	Log Magnitude, Phase, Log Magnitude and Phase, Smith Chart (Impedance), Smith Chart (Admittance), Linear Polar, Log Polar, Group delay, Linear Magnitude, Linear Magnitude and Phase, Real, Imaginary, Real and Imaginary, SWR, Power Out, Impedance, Power In	
Data Points	2 to 25,001 points, or 100,000 points in single channel	
Limit Lines	Single or segmented. 2 limit lines per trace. 50 segments per limit line.	
Single Limit Readouts	Uses interpolation to determine the intersection frequency	
Test Limits	Both single and segmented limits can be used for PASS/FAIL testing.	
Data Averaging	Point-by-point (default), max Averaging = IF Bandwidth/1 Hz	
	Sweep-by-sweep (no limit)	
IF Bandwidth	1, 3, 10, 30, 100, 300, 1k, 3k, 10k, 30k, 100k, 300k, 1M (Hz)	
Reference Plane	The reference planes of a calibration or other normalization can be changed by entering a line length or time delay. Dielectric constants may be entered for different media so the length entry can be physically meaningful. Dispersion modeling is used in the cases of microstrip and waveguide to take into account frequency dependent phase velocities. Attenuations (with frequency slope) and constant phase offsets can also be entered to better describe any reference plane distortions. For more complete reference plane manipulation, the full de-embedding system can also be used.	
Measurement Frequency Range	Frequency range of the measurement can be narrowed within the calibration range without recalibration. CW mode permits single frequency measurements also without recalibration. If interpolation is not activated, the subset frequency range is forced to use calibration frequency points. If interpolation is activated, any frequency range that is a subset of the calibration frequency range can be used, but there may be some added interpolation error.	
Group Delay Aperture	Defined as the frequency span over which the phase change is computed at a given frequency point. The aperture can be changed without recalibration. The minimum aperture is the frequency range divided by the number of points in calibration and can be increased to 20% of the frequency range.	
Group Delay Range	< 180° of phase change within the aperture	
Channels and Traces	16 channels, each with up to 16 traces	
Display	Color touch screen LCD, 10.4” diagonal	
Display Colors	Unlimited colors for data traces, memory, text, markers, graticules and limit lines.	
Trace Memory and Math	A separate memory for each trace can be used to store measurement data for later display or subtraction, addition, multiplication or division with current measurement data. The trace data can be saved and recalled.	
Intra-trace Math	Any two traces within a channel can also be combined (via addition, subtraction, multiplication or division) and displayed on another trace.	
Scale Resolution (minimum per division)	Log Magnitude	0.001 dB
	Linear Magnitude	1 pU
	Phase	0.01°
	Group Delay	0.001 ps
	Time	0.001 ps
	Distance	0.1 µm
	SWR	1 pU
	Power	0.01 dB
Markers	12 per trace (x 16 traces x 16 channels, for a total of 3,072) Coupled or decoupled within a channel Data displayed in graph area or in table form	
Reference Marker	Additional marker per trace for reference	
Marker Statistics	Mean, max, min, standard deviation , per trace or over a marker region	
Marker Search and Tracking	Search and/or track for min, max, peak, or target value	
Filter Parameters	Display x dB bandwidth and frequencies, center frequency, loss, Q and shape factors	
Blank Frequency Information	Blanking function removes all references to frequencies on the display. Frequency references can only be restored through a system preset or GPIB command.	

* Extended frequency range over which these models and options will operate, but without any implied or warranted performance specifications.

18. Calibration and Correction Capabilities

Calibration Methods	Short-Open-Load-Through (SOLT) with Fixed or Sliding Load Offset-Short (SSLT) with Fixed or Sliding Load Triple-Offset-Short (SSST) with Fixed or Sliding Load Short-Open-Load-Reciprocal (SOLR) Reciprocal or Unknown Through Method (SSLR, SSSR) Line-Reflect-Line (LRL) / Line-Reflect-Match (LRM) Advanced-LRM (A-LRM™) for improved on-wafer calibrations AutoCal with Thru Update available
Correction Models	2-Port (Forward, Reverse, or both directions) 1-Port (s_{11}, s_{22}, or both) Transmission Frequency Response (Forward, Reverse, or both directions) Reflection Frequency Response (s_{11}, s_{22}, or both)
Merged Calibration	Merge multiple calibrations over bands of frequency points and with different algorithms
Calibration Standards' Coefficients	Load coefficients from your Anritsu cal kit's USB Memory stick Enter manual coefficients into User-Defined locations Use NIST models for Loads
Reference Impedance	Modify the reference impedance from 50 Ω to any impedance but not 0 Ω
Interpolation	Allows interpolation between calibration frequency points
Adapter Removal Calibration	Characterizes and "removes" an adapter that is used during calibration that will not be used for subsequent device measurements; for accurate measurement of non-insertable devices
Dispersion Compensation	Selectable as Coaxial, other non-dispersive (e.g., for coplanar waveguide), Waveguide, or Microstrip.
Flat Power Calibrations and Linear Power Calibrations (Power Meter Correction)	Different power meter calibrations are available to enhance power accuracy at the desired reference plane (to usually ~0.1 dB for short periods of time). A flat power calibration (when in frequency sweep mode) is available at a user-selectable power level, if it is within the power adjustment range of the internal source. Other power levels are then arrived at by offset transfers. A linear power calibration is performed over a range of power levels for use in power sweep mode and is performed at a specified frequency or frequency range. Both calibrations are performed using an external power meter (Anritsu MA2438A, MA2488A, MA249xA, Agilent 437 or equivalent) over the Dedicated GPIB port or other suitable control ports.
Embedding/De-embedding	The MS4640A is equipped with an Embedding/De-embedding system. De-embedding is generally used for removal of test fixture contributions, modeled networks and other networks described by S-parameters (s2p files) from measurements. Similarly, the Embedding function can be used to simulate matching circuits for optimizing amplifier designs or simply adding effects of a known structure to a measurement. Multiple networks can be embedded/de-embedded and changing the port and network orientations is handled easily. An extraction utility is part of this package that allows the easier computation of de-embedding files based on some additional calibration steps and measurements.
Impedance Conversion	Allows entry of different reference impedances (complex values) for different ports

19. Optional Capabilities

Time Domain Measurements Option 002	Displays all S-parameters and overlays with Frequency Domain Low-pass Mode with added harmonics frequency list flexibility Band-pass Mode Phasor Impulse Mode Windowing Gating (pass-band or reject-band) Frequency with Time Gate	
Receiver Offset Option 007	Allows for independent source and receive functions for Mixer, Harmonics, IMD and other measurements, where the source and receive frequencies are offset.	
	Multiple Source Control Mode	To independently control the frequencies of up to four external sources, in addition to the internal source, and the receiver, in a synchronized manner.
	NxN Frequency-translated Devices' Calibration and Measurements Capability	For accurate and absolute magnitude and phase measurements of match, gain/loss, and group delay of devices such as mixers and converters
Direct Access Loops Option 051	Adds three Access loops per port for Source, Test, and Receive Paths ≥ 2.5 GHz Frequency Coverage loops, located at front panel < 2.5 GHz Frequency Coverage loops, located at rear panel (These loops are included when ordering option 06x shown below. Therefore, options 05x and 06x are mutually exclusive.)	
Active Measurements Suite Option 06x	Adds Step Attenuators, Bias Tees, and Direct Access Loops, and Gain Compression and Efficiency Measurement Capabilities.	
	Attenuators	70 dB, 10 dB/step, for MS4642A and MS4644A 60 dB, 10 dB/step, for MS4647A
	Option 061	2 attenuators: One in Source 1 path, and one in Receive 2 path
	Option 062	4 attenuators: One in each Source and in each Receive paths
	Bias Tees	0.4 A max., 40 VDC max. 3 kHz BW (nominal), looking into a High Impedance 10 MΩ to Ground for DUT Static Discharge Protection Located at rear panel
	Access Loops	Includes option 05x loops, listed above (Therefore, options 05x and 06x are mutually exclusive.)
	Gain Compression	Swept Power Gain Compression at a cw frequency P_{xdB} over Swept Frequency, up to 401 points
70 kHz Frequency Extension Option 070	Extends the standard 10 MHz low-end start frequency to 70 kHz, for 70 kHz to 20, 40, or 70 GHz coverage models.	

20. CPU and related

CPU	Pentium 4 or greater
Display	26 cm Color XGA Touch-Screen Display
Storage Memory	Serial-ATA Hard Drive, for OS, Programs, and Data. (> 30 GB)
Security	Rear Panel Hard Drive, removable Additional Hard Drives with OS available (Option 004)
Operating System	Windows XP Professional Environment
Virus Protection	The following Anti-Virus software products have been tested with the MS4640A, and are therefore recommended as a choice to be purchased and installed by the user: 1. Trend Micro

21. Front Panel Connections

Test Ports 1 and 2	Universal Test Port Connectors, easily exchangeable in case of damage K (male) for MS4642A and MS4644A V (male) for MS4645A and MS4647A Damage Input Levels: +27 dBm max., 40 VDC max.
Direct Access Loops (optional)	For Source, Test and Receive paths, 3 per port, for ≥ 2.5 GHz frequency coverage K (females) for MS4642A and MS4644A V (females) for MS4645A and MS4647A Damage Input Levels: +20 dBm max., 0 VDC max.
USB Ports	Two Type A USB 2.0 Ports for peripherals such as keyboard, mouse, memory stick, hardware key, etc. (two more USB ports located at the rear panel)
Chassis Grounding Port	Banana (female)

22. Rear Panel Connections

AC Power Input	AC Input connector, with On/Off switch, and fuses 350 VA max., 90-264 VAC, 47-63 Hz (power factor controlled)	
System HDD	System Hard Drive Interface	
USB Control Port	Type B USB 2.0 port for controlling the instrument externally, for remote operation	
USB Ports	Two type A USB 2.0 Ports for peripherals such as keyboard, mouse, memory stick, hardware key, etc. (more USB ports at the front panel)	
Keyboard and Mouse Ports	Dedicated PS/2 ports. Could be used with USB keyboard and mouse via adapters, sparing USB 2.0 ports.	
LAN Port	10/100BaseT Ethernet	
GPIB Port (talker/listener)	Type D-24, female, IEEE 488.2 compatible, for controlling the instrument externally, for remote operation	
GPIB Port (dedicated controller)	Type D-24, female, for the control of external instruments such as power meters, external test sets, etc.	
External I/O Port	25-pin D-Sub, female, User-defined I/O for custom external test set interface, to synchronize with different sweep states, such as Start, Stop, Driven Port, etc.	
	Pin 1	Limit Pass/Fail
	Pin 2, 3, 15, 16	TTL In
	Pin 4, 13 14, 21	GND
	Pin 5-12, 17-20, 22	TTL Out
	Pin 23-25	Reserved
Serial Port	9-pin D-Sub, male, compatible with RS-232, provides control for AutoCal modules, etc.	
VGA Port	15-pin mini D-Sub, for simultaneously projecting the instrument's screen display onto an external VGA monitor, with 1024 x 768 min. resolution	
Bias Inputs (optional)	BNC (female), one per port (check option 06x)	
Bias Fuses (optional)	One per port. (0.5A, 250V)	
Direct Access Loops (optional)	For Source, Test and Receive paths, 3 per port, for < 2.5 GHz frequency coverage SMA (females) Damage Input Levels: +20 dBm max., 0 VDC max.	
IF Inputs/Outputs	a1, a2, b1, b2, IF Inputs/Outputs, SMA (females) Inputs used with external converters such as mmW modules, or for antenna testing. Outputs used with external IF digitizers and processors. Nominal Inputs: 5 to 20 MHz (mode dependent), 0 dBm for full scale Nominal Outputs: 0.2 to 100 MHz (mode dependent), +10 dBm max.	
10 MHz In	BNC (female), auto-sensing, better than 1000 ppm accuracy recommended. Signal: -10 dBm to +3 dBm, 50 Ω Nominal	
10 MHz Out	BNC (female), derived from the internal reference, unless an external 10 MHz reference input is applied. Signal: 0 ± 5 dBm sinusoidal, 50 Ω Nominal	
Analog In 1 & 2	BNC (females), two independent inputs for measurements simultaneous with the RF measurements, for current sensing, efficiency computation, power detection, etc. Range: -10 V to +10 V with automatic offset and gain calibrations Accuracy: 2 mV + 2% for |V| < 5 V; 2% for |V| > 5 V Nominal input impedance: 60 kΩ	
Ext Analog Out	BNC (female), for external attenuator control, external switch control, analog triggering assistance, measurement system integration and other purposes. Normal operating modes: Sawtooth sync sweep, TTL indication of driving port, open loop level controller. Range: -10 V to +10 V; low impedance drive Accuracy: 20 mV + 2% Load: > 5 kΩ	
Ext Trigger	BNC (female) 0-3.3 V input (5 V tolerant) High impedance (> 100 kΩ)	100 ns minimum input pulse width Programmable edge trigger
Lock Status	BNC (female) 0-3.3 V input (5 V tolerant) High impedance (> 100 kΩ)	100 ns minimum input pulse width Positive-edge trigger
Ready for Trigger	BNC (female) 0-3.3 V latched output Low impedance (~ 50 Ω)	Voh = 2 V min @ -12 mA Vol = 0.8 V max @ +12 mA
Trigger Out	BNC (female) 0-3.3 V pulse output 1 usec positive pulse	Low impedance (~ 50 Ω) Voh = 2 V min @ -12 mA Vol = 0.8 V max @ +12 mA



MS4640A Rear Panel

23. Mechanical and Environmental

Dimensions (without rack mount option)	Height	267 mm body (6u) 286 mm between feet outer edges
	Width	426 mm body 457 mm between feet outer edges 487 mm between front panel handles outer edges
	Depth	502 mm body 591 mm between handle and foot outer edges
Weight	< 28 kg (Fully-loaded MS4647A weight shown)	
Environmental (Operating)	Conforms to MIL-PRF-28800F (class 3)	
	Temperature Range	0 ºC to +50 ºC without error codes*
	Relative Humidity	5% to 95% at +40 ºC
	Altitude	4,600 m
Environmental (Non-operating)	Temperature Range	-40 ºC to +75 ºC
	Relative Humidity	0% to 90% at +65 ºC (non-condensing)
	Altitude	15,200 m
EMI	Meets the emissions and immunity requirements of: EN55011/1991 Class A/CISPR-11 Class A EN50082-1/1993 IEC 801-2/1984 (4 kV CD, 8 kV AD) IEC 1000-4-3/1995 (3 V/m, 80-1000 MHz) IEC 801-4/1988 (500 V SL, 1000 V PL) IEC 1000-4-5/1995 (2 kV L-E, 1 kV L-L)	

* Except for ‘unleveled’ error messages that may occur at temperature outside the specified performance temperature range of 25 ºC ± 5 ºC.

24. Automatic Calibrators (AutoCal)

Two AutoCal modules are available, the standard AutoCal (36581-series) and the precision AutoCal (36585-series). While the 36581 AutoCal provides the automation and performance needed for most manufacturing requirements, the 36585-series Precision AutoCal adds un-paralleled performance, better than any SOLT manual calibration, even if using Sliding Loads. The 36581-series Standard AutoCal is available in one model, covering 40 MHz to 20 GHz. The 36585-series Precision AutoCal is available in two broadband models covering the entire range of 70 kHz to 40 or 70 GHz. This makes the 36585-series Precision AutoCal the recommended calibrator for practically all applications.

36581-series Standard AutoCal
(Also check the 36585-series Precision Autocal)

Provides fast and repeatable calibrations, 40 MHz to 20 GHz, with a single connection to the test ports, eliminating susceptibility to user errors, and connector wear. The VectorStar will control the AutoCal directly for 1- or 2-port cals and Thru Updates. Each AutoCal is shipped with a characterization file, which is valid for 6 months. After that, the user can re-characterize the AutoCal with the built-in capability. Re-characterization is also helpful when adding adapters to the AutoCal, for measuring devices with different type of connectors, such as N, 3.5 mm, even Waveguide.



36581 series Standard AutoCal

For measuring non-insertable K devices or SMA or 3.5 mm devices without using Adapter Removal or Re-characterizing the AutoCal, the 36583 series of matched adapters are available. These adapters could be inter-changed between connector types and sexes, without invali-dating the original calibration. Adapter Removal can also be used for non-insertable devices. This calibration routine is provided in VectorStar's AutoCal menus.



Matched Adapters Set

Description	Additional Information	Part Number
AutoCal, Standard, K (male) to K (female)	40 MHz to 20 GHz, 2-port	36581KKF
Matched Adapters Set, K	K (female)* to K (male), 2 ea K (female)* to K (female), 2 ea	36583K
Matched Adapters Set, 3.5 mm	K (female)* to 3.5 mm (male), 2 ea K (female)* to 3.5 mm (female), 2 ea	36583L
Matched Adapters Set, SMA	K (female)* to SMA (male), 2 ea K (female)* to SMA (female), 2 ea	36583S

* Assumes the use of K male test port cables.

Residual Errors after a calibration using the 36581KKF Standard AutoCal (typical)

36581KKF Calibration Residuals	Directivity	Source and Load Match	Reflection Tracking	Transmission Tracking (Internal Thru Mode*)	Transmission Tracking (True Thru Mode*)
Without 36583x	36 dB	34 dB	± 0.20 dB	± 0.20 dB	± 0.10 dB
With 36583x	34 dB	32 dB	± 0.25 dB	± 0.25 dB	± 0.15 dB

* In True Thru Mode, the user is given the opportunity to connect the test ports together directly, removing the AutoCal, for an improved Thru over the AutoCal's internal characterized thru, for a slight improvement in Transmission Tracking.

36585-series Precision AutoCal

In addition to what is provided with the Standard 36581-series AutoCal, this Precision series provides better corrected characteristics using over-determined algorithms, and transferring characteristics from a highly accurate LRL type calibration. The resulting accuracies will beat that of a Sliding Load SOLT calibration. In order to remove the effects of matched adapters, the Precision 36585-series AutoCal comes in a variety of connector sex types. Adapter Removal Calibration routine is still available in the VectorStar software. With coverage from 70 kHz to 70 GHz, the 36585-series Precision AutoCal offers not only the fastest and most reliable calibration, but also the most accurate broadband coaxial VNA calibration method, with the longest re-characterization period of 12 months.



36585V series Precision AutoCal



36585 series Precision AutoCal

Description	Additional Information	Part Number
Precision AutoCal, K 70 kHz to 40 GHz, 2-port	K (male) to K (male)	36585K-2M
	K (female) to K (female)	36585K-2F
	K (male) to K (female)	36585K-2MF
Precision AutoCal, V 70 kHz to 70 GHz, 2-port	V (male) to V (male)	36585V-2M
	V (female) to V (female)	36585V-2F
	V (male) to V (female)	36585V-2MF

AutoCal General and Environmental

36581-series Dimensions	65 mm H x 155 mm W x 90 mm D body (excluding connectors)
36585-series Dimensions	42 mm H x 64 mm W x 140 mm D body (excluding connectors)
Control	Serial RS-232 control by the VNA via supplied 9-pin D-Sub cable (allowing forward-compatibility to legacy AutoCals)
Power	DC powered via supplied universal 110/220V AC/DC adapter (with enough power to maintain optimum stability)
Operating Temperature	18 to 28 °C
Storage Temperature	-20 to 70 °C
Relative Humidity	5% to 95% at 40 °C
EMC	Conforms to the EMC Directive, 89/336/EEC per EN61326 EN55011:1991 EN61000-3-2:1995 EN61000-3-3:1995
Immunity	EN61000-4-2:1995 EN61000-4-3:1995 EN61000-4-4:1995 EN61000-4-5:1995 EN61000-4-6:1995 EN61000-4-11:1995

25. Mechanical Calibration Kits

SMA/3.5 mm Calibration Kit, 3650A series

3650A cal kit provides 50 Ω calibrations, for 3.5 mm or SMA devices, using 3.5 mm standards.
3650A-1 cal kit includes Sliding Loads

3650A Cal Kit contains:	**Additional Information (typical)**	**Quantity**	**Part Number**
Termination 3.5 mm (male)	Return Loss: > 37 dB (F ≤ 18.5 GHz)	2	28S50B-2
Termination 3.5 mm (female)	> 30 dB (F > 18.5 GHz)	2	28SF50B-2
Open 3.5 mm (male)	Offset: 5 mm	1	24S50
Open 3.5 mm (female)	Offset: 5 mm	1	24SF50
Short 3.5 mm (male)	Offset: 5 mm	1	23S50
Short 3.5 mm (female)	Offset: 5 mm	1	23SF50
Adapter, 3.5 mm (male) to 3.5 mm (male)		1	33SS50
Adapter, 3.5 mm (female) to 3.5 mm (female)		2	33SFSF50
Adapter, 3.5 mm (male) to 3.5 mm (female)		2	33SSF50
Torque Wrench	8 mm (5/16"), 0.9 N-m (8 in-lb)	1	01-201
Wrench, Universal	For SMA, 3.5 mm, 2.4 mm, K and V	1	01-204
Pin Depth Gauge		1	01-222
Adapter (female) for Pin Gauge		1	01-223
Reference Flat		1	01-210
Connector Thumb Wheel		4	A18311
Coefficients for standards	On a memory stick and 3.5" floppy	1	–
3650A-1 Cal Kit adds:	**Additional Information (typical)**	**Quantity**	**Part Number**
Sliding Termination 3.5 mm (male)		1	17S50
Sliding Termination 3.5 mm (female)		1	17SF50
Flush Short (male)		1	01-211
Flush Short (female)		1	01-212

K (2.92 mm) Calibration Kit, 3652A series

3652A cal kit provides 50 Ω calibrations, for K devices
3652A-1 cal kit includes Sliding Loads

3652A Cal Kit contains:	**Additional Information (typical)**	**Quantity**	**Part Number**
Termination K (male)	Return Loss: > 34 dB (F ≤ 18.5 GHz)	2	28K50A
Termination K (female)	> 32 dB (F ≤ 40 GHz)	2	28KF50A
Open K (male)	Offset: 5 mm	1	24K50
Open K (female)	Offset: 5 mm	1	24KF50
Short K (male)	Offset: 5 mm	1	23K50
Short K (female)	Offset: 5 mm	1	23KF50
Adapter, K (male) to K (male)		1	33KK50
Adapter, K (female) to K (female)		2	33KFKF50
Adapter, K (male) to K (female)		2	33KKF50
Torque Wrench	8 mm (5/16"), 0.9 N-m (8 in-lb)	1	01-201
Wrench, Universal	For SMA, 3.5 mm, 2.4 mm, K and V	1	01-204
Pin Depth Gauge		1	01-222
Adapter (female) for Pin Gauge		1	01-223
Reference Flat		1	01-210
Connector Thumb Wheel		4	A18311
Coefficients for standards	On a memory stick and 3.5" floppy	1	–
3652A-1 Cal Kit adds:	**Additional Information (typical)**	**Quantity**	**Part Number**
Sliding Termination K (male)		1	17K50
Sliding Termination K (female)		1	17KF50
Flush Short (male)		1	01-211
Flush Short (female)		1	01-212

V (1.85 mm) Calibration Kit, 3654D series

3654D cal kit provides 50 Ω calibrations, for V devices
3654D-1 cal kit includes Sliding Loads

3654D Cal Kit contains:	**Additional Information (typical)**	**Quantity**	**Part Number**
Termination V (male)	Return Loss: > 40 dB (F ≤ 20 GHz) > 35 dB (F ≤ 40 GHz) > 32 dB (F ≤ 67 GHz) > 28 dB (F ≤ 70 GHz)	2	28V50D
Termination V (female)		2	28VF50D
Open V (male)	Offset: 4.75 mm	1	24V50C
Open V (female)	Offset: 4.75 mm	1	24VF50C
Short V (male)	Offset: 5.1 mm	1	23V50C
Short V (female)	Offset: 5.1 mm	1	23VF50C
Adapter, V (male) to V (male)		1	33VV50C
Adapter, V (female) to V (female)		2	33VFVF50C
Adapter, V (male) to V (female)		2	33VVF50C
Torque Wrench	8 mm (5/16"), 0.9 N-m (8 in-lb)	1	01-201
Wrench, Universal	For SMA, 3.5 mm, 2.4 mm, K and V	1	01-204
Pin Depth Gauge		1	01-322
Adapter (female) for Pin Gauge		1	01-323
Reference Flat		1	01-210
Connector Thumb Wheel		4	A18311
Coefficients for standards	On a memory stick and 3.5" floppy	1	–
3654D-1 Cal Kit adds:	**Additional Information (typical)**	**Quantity**	**Part Number**
Sliding Termination V (male)		1	17V50C
Sliding Termination V (female)		1	17VF50C
Flush Short (male)		1	01-312
Flush Short (female)		1	01-311



3654D series, V (1.85 mm) Calibration Kit



3657 series, V (1.85 mm) Multi-Line Calibration Kit

V (1.85 mm) Multi-Line Calibration Kit, 3657 series

3657 cal kit provides 50 Ω bead-less V (male to male) lines for metrology applications.
3657-1 cal kit includes Shorts for LRL-type coaxial calibrations

3657 Cal Kit contains:		**Additional Information**	**Quantity**	**Part Number**
Line 1	Center Conductor	Electrical Length = 15 mm; 50 Ω	1	65899-1
	Outer Conductor		1	65898-1
Line 2	Center Conductor	Electrical Length = 16.7 mm; 50 Ω	1	65899-2
	Outer Conductor		1	65898-2
Line 3	Center Conductor	Electrical Length = 18.4 mm; 50 Ω	1	65899-3
	Outer Conductor		1	65898-3
Line 4	Center Conductor	Electrical Length = 20.1 mm; 50 Ω	1	65899-4
	Outer Conductor		1	65898-4
Line 5	Center Conductor	Electrical Length = 21.8 mm; 50 Ω	1	65899-5
	Outer Conductor		1	65898-5
Line 6	Center Conductor	Electrical Length = 49.84 mm; 50 Ω	1	65899-6
	Outer Conductor		1	65898-6
Tool, Center Conductor Removal Plug			1	65922
Fixture, Center Conductor Installation, Short		For Lines 1-5	1	65901-1
Fixture, Center Conductor Installation, Long		For Line 6	1	65901-6
Open-Ended Wrench		7 mm	1	783-1243
Torque Wrench		8 mm (5/16"), 0.9 N-m (8 in-lb)	1	01-201
3657-1 Cal Kit adds:		**Additional Information**	**Quantity**	**Part Number**
Short V (male)		Offset: 5.1 mm	2	23V50B
Short V (female)		Offset: 5.1 mm	2	23VF50B

26. Verification Kits

Verification kits include characterized traceable standards (two attenuators, an airline, and a stepped impedance airline Beatty Standard) that can be used with the provided software and data to verify the calibration and resulting performance of your VNA. The applicable calibrations are Short-Open-Load-Through (SOLT) with Sliding Load using a 365x-1 Cal Kit, and 36585 series AutoCal, male-female version. Cal Kits are purchased separately. Verification is also provided as a service, eliminating the investment in kits. These verification kits are dedicated for the MS4640A, and are not for older VNAs.

Description	Part Number
3.5 mm Verification Kit	3666-1
K Verification Kit	3668-1
V Verification Kit	3669B-1



Verification Kit



Precision Adapters, Attenuators and more

27. Precision Adapters, Attenuators, and more

Anritsu carries a complete line of precision adapters and attenuators. For more information, please visit our website at www.us.anritsu.com.

28. Test Port Cables

3670-series Test Port Cables, Ruggedized Semi-rigid, up to 70 GHz

Description	Frequency Range	Impedance	Length (cm)	Insertion Loss* (dB)	Return Loss (dB)	Part Number
K (female) to K (male)	DC to 40 GHz	50 Ω	30.5 (12")	2.3 dB/m @ 20 GHz 4.7 dB/m @ 40 GHz	≥ 16	3670K50-1
			61.0 (24")			3670K50-2
V (female) to V (male)	DC to 70 GHz		30.5 (12")	3.6 dB/m @ 20 GHz 5.2 dB/m @ 40 GHz 7.2 dB/m @ 70 GHz	≥ 16	3670V50A-1
			61.0 (24")			3670V50A-2

*Typical



70 GHz Ruggedized Semi-rigid Test Cable, 3670-series



67 GHz Phase Stable Flexible Test Port Cable, 3671-series

3671-series Test Port Cables, Flexible, Phase Stable, up to 67 GHz

Description	Frequency Range	Impedance	Length (cm)	Insertion Loss (dB, f in GHz)	Return Loss (dB)	Phase Stability (± degrees, f in GHz)	Part Number
K* (female) to 3.5 mm (male)	DC to 20 GHz	50 Ω	63.5 (25")	0.11+ 0.01f + 0.30 √f	≥ 18	≤ (0.5+ 0.13f) (1 coil)	3671S50-1
K* (female) to K (male or female)	DC to 40 GHz	50 Ω	63.5 (25")	0.26+ 0.006f + 0.46 √f	≥ 16	≤ (0.5+ 0.08f) (1/2 coil)	3671K50-x
K* (female) to K (male)	DC to 40 GHz	50 Ω	96.5 (38")	0.39+ 0.013f + 0.64 √f	≥ 16	≤ (0.5+ 0.17f) (1 coil)	3671K50-2
V* (female) to V (male)	DC to 67 GHz	50 Ω	63.5 (25")	8.5	≥ 14	≤ 8.5 (1/2 coil)	3671V50B-1
V* (female) to V (male)	DC to 67 GHz	50 Ω	96.5 (38")	8.5	≥ 14	≤ 10.5 (1 coil)	3671V50B-2

* Ruggedized style for VNA test ports. Does not fit standard male connectors.

29. Universal Test Fixture (UTF)

The 3680-series UTF provide an accurate, repeatable solution for measuring microstrip and coplanar substrate devices. Input and output connections are made to the substrate device by two spring-loaded jaws that include coax-to-microstrip/coplanar launchers. One jaw is movable in two dimensions to accommodate substrates of different lengths and offsets. Right angle launchers are available for right angle devices. Microstrip calibration/verification kits are available for substrate thicknesses of 10 mil (60 GHz), 15 mil (30 GHz), and 25 mil (20 GHz). A 25 mil, 20 GHz, coplanar waveguide calibration/verification kit is also available.



3680 series Universal Test Fixture (UTF)

Electrical Specifications

	Part Number	Frequency Coverage	Frequency Range (GHz)	Return Loss (dB)	Repeatability (dB)
UTF	3680-20	DC to 20 GHz	DC to 20	> 17	< ± 0.10
	3680K	DC to 40 GHz	20 to 40	> 14	< ± 0.20
	3680V	DC to 60 GHz	40 to 60	> 8	< ± 0.30
Right Angle Launcher	36801K	DC to 40 GHz	DC to 20	> 16	< ± 0.15
	36801V	DC to 60 GHz	20 to 40	> 12	< ± 0.25
			40 to 60	> 7	< ± 0.40

General

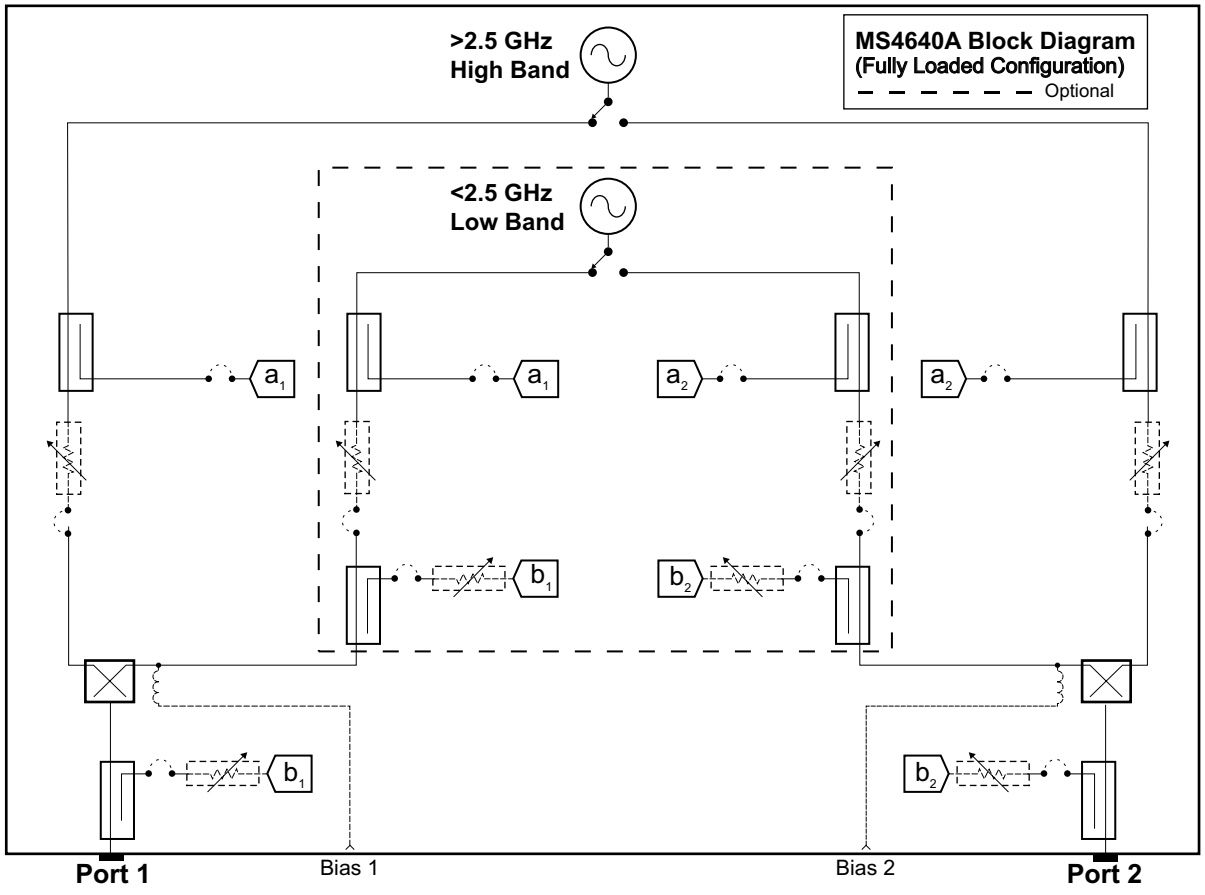
	Parameter	UTF	Specification
UTF	Substrate Length	3680-20	0.5 cm (min) to 10 cm (max)
		3680K	0.5 cm (min) to 5 cm (max)
		3680V	0.5 cm (min) to 5 cm (max)
	Maximum Substrate Width	All	No Limit
	Substrate Thickness	All	0.12 mm (min), 1.9 mm (max)
	Maximum Line Offset	3680-20	± 2.5 cm
		3680K	± 1.2 cm
		3680V	± 1.2 cm
	Input and Output Connectors	3680-20	3.5 mm (females)
		3680K	K (females)
		3680V	V (females)
	Overall Size	All	10 cm x 12.7 cm x 6.4 cm
Right Angle Launcher	Distance from in-line connector, axial	All	1 cm (min), 4 cm (max)
	Distance from in-line connector, offset	All	0 cm (min), 2 cm (max)

30. Warranty

Standard warranty included free-of-charge. Additional warranty available.

Instrument and built-in options	3 years from the date of shipment
Calibration kits and AutoCals	1 year from the date of shipment
Test Port Cables	1 year from the date of shipment
All other accessories	1 year from the date of shipment

31. Block Diagram



32. Ordering Information

Instrument Models

Part Number	Description	More Information
MS4642A	Vector Network Analyzer 10 MHz to 20 GHz*	Includes: - CD with Operation and Programming Manuals, Measurement Guide, and other technical publications in .pdf format, and miscellaneous utilities - DVD with Norton Ghost Backup Software - Microsoft Windows XP-Pro DVD (not for use with the VNA) - Mouse, USB, Optical - Power Cord
MS4644A	Vector Network Analyzer 10 MHz to 40 GHz*	
MS4645A	Vector Network Analyzer 10 MHz to 50 GHz*	
MS4647A	Vector Network Analyzer 10 MHz to 70 GHz*	

* Refer to page 25 for extended operational frequency ranges.

Options

Part Number	Description	More Information	
MS4640A-001	Rack Mount	Adds handles and removes feet for shelf-mounting, into a 19" universal rack.	
MS4640A-002	Time Domain		
MS4640A-004	Hard Drive, Serial-ATA, with OS	Additional HD, Pluggable at rear panel	
MS4640A-007	Receiver Offset		
MS4642A-051	Direct Access Loops	For MS4642A, not available with options 061, 062	
MS4644A-051		For MS4644A, not available with options 061, 062	
MS4645A-051		For MS4645A, not available with options 061, 062	
MS4647A-051		For MS4647A, not available with options 061, 062	
MS4642A-061	Active Measurements Suite	For MS4642A	With 2 Step Attenuators
MS4642A-062			With 4 Step Attenuators
MS4644A-061		For MS4644A	With 2 Step Attenuators
MS4644A-062			With 4 Step Attenuators
MS4645A-061		For MS4645A	With 2 Step Attenuators
MS4645A-062			With 4 Step Attenuators
MS4647A-061		For MS4647A	With 2 Step Attenuators
MS4647A-062			With 4 Step Attenuators
MS4640A-070	70 kHz Low-End Frequency Extension		
MS4640A-098	Z540/Guide 25 Calibration, No Data		
MS4640A-099	Premium Calibration, With Data		

Automatic Calibrators, Precision AutoCal

Part Number	Description	More Information
36585K-2M	K Precision AutoCal 70 kHz to 40 GHz	K (male) to K (male)
36585K-2F		K (female) to K (female)
36585K-2MF		K (male) to K (female)
36585V-2M	V Precision AutoCal 70 kHz to 70 GHz	V (male) to V (male)
36585V-2F		V (female) to V (female)
36585V-2MF		V (male) to V (female)

Automatic Calibrators, Standard AutoCal

Part Number	Description	More Information
36581KKF	K Standard AutoCal, 40 MHz to 20 GHz	K (male) to K (female)
36583S	Matched Adapters Set	SMA
36583L		3.5 mm
36583K		K

Calibration Kits, Mechanical

Part Number	Description	More Information
3650A	SMA/3.5 mm Calibration Kit	Without Sliding Loads
3650A-1		With Sliding Loads
3652A	K Calibration Kit	Without Sliding Loads
3652A-1		With Sliding Loads
3654D	V Calibration Kit	Without Sliding Loads
3654D-1		With Sliding Loads
3657	V Multi-Line Calibration Kit	Without Shorts
3657-1		With Shorts

Verification Kits

Part Number	Description	More Information
3666-1	SMA/3.5 mm Verification Kit	
3668-1	K Verification Kit	
3669B-1	V Verification Kit	

Test Port Cables, Ruggedized Semi-rigid

Part Number	Description	More Information
3670K50-1	K (female) to K (male), 1 each	30.5 cm (12”)
3670K50-2		61.0 cm (24”)
3670V50A-1	V (female) to V (male), 1 each	30.5 cm (12”), rated to 70 GHz
3670V50A-2		61.0 cm (24”), rated to 70 GHz

Test Port Cables, Flexible, Phase Stable

Part Number	Description	More Information
3671S50-1	K* (female) to 3.5 mm (male), 2 each	63.5 cm (25”)
3671K50-1	K* (female) to K (male), 2 each	63.5 cm (25”)
3671K50-2	K* (female) to K (male), 1 each	96.5 cm (38”)
3671K50-3	K* (female) to K (male), 1 each, and K* (female) to K (female), 1 each	63.5 cm (25”) 63.5 cm (25”)
3671V50B-1	V* (female) to V (male), 2 each	63.5 cm (25”), rated to 67 GHz
3671V50B-2	V* (female) to V (male), 1 each	96.5 cm (38”), rated to 67 GHz

* Ruggedized style for VNA test ports. Does not fit standard male connectors.

Test Port Converters, to change or replace VNA test ports

Part Number	Description	More Information
34YK50C	Universal Test Port Connector to K (male)	Using 01-202 wrench (not included)
34YV50C	Universal Test Port Connector to V (male)	Using 01-202 wrench (not included)

Universal Test Fixture

Part Number	Description	More Information
3680-20	UTF	DC to 20 GHz
3680K		DC to 40 GHz
3680V		DC to 60 GHz
36801K	Right Angle Launcher	DC to 30 GHz
36801V		DC to 50 GHz
36803	Bias Probe	
36804B-10M	Microstrip Calibration/Verification Kit	10 mil, DC to 50 GHz
36804B-15M		15 mil, DC to 30 GHz
36804B-25M		25 mil, DC to 15 GHz

Precision Fixed Attenuators, Adapters (in and out of series, waveguide to coaxial), and more

Part Number	More Information
11410-00235	Refer to our extensive Precision RF & Microwave Components Catalog

Tools and Accessories

Part Number	Description	More Information
2100-5	GPIB Cable	0.5 m
2100-1		1 m
2100-2		2 m
2100-4		4 m
760-246-R	Transit Case, MS4640A	Hard plastic with wheels, 85 cm x 70 cm x 45 cm
01-201	Torque Wrench (for tightening male devices)	8 mm (5/16”), 0.9 N-m (8 in-lb) for SMA, 3.5 mm, 2.4 mm, K, and V
01-204	Wrench, Universal (circular, open-ended)	for SMA, 3.5 mm, 2.4 mm, K and V
01-203	Torque Wrench (for tightening the VNA test ports to female devices)	20.6 mm (13/16”), 0.9 N-m (8 in-lb)
01-202	Wrench (for servicing the universal test port)	For the removal or installation of a test port

Manuals (binder)

Part Number	Description	More Information
10410-00266	MS4640A Series Operation Manual	Soft-copies included with VNA (except for Maintenance Manual) All manuals available as free down-loads at www.us.anritsu.com.
10410-00267	MS4640A Series Programming Manual	
10410-00268	MS4640A Series Maintenance Manual	
10410-00269	MS4640A Series Measurements Guide	

Extended Service Options

Part Number	Location of Service	Duration of Contract	Type of Service
MS4642A-ES311	On-Site	3 year	Repair only
MS4644A-ES311			
MS4645A-ES311			
MS4647A-ES311			
MS4642A-ES314			Standard Calibration
MS4644A-ES314			
MS4645A-ES314			
MS4647A-ES314			
MS4642A-ES318			Premium Calibration
MS4644A-ES318			
MS4645A-ES318			
MS4647A-ES318			
MS4642A-ES312	Return to Service Center	3 year	Standard Calibration
MS4644A-ES312			
MS4645A-ES312			
MS4647A-ES312			
MS4642A-ES315			Premium Calibration
MS4644A-ES315			
MS4645A-ES315			
MS4647A-ES315			
MS4642A-ES510		5 year	Repair only
MS4644A-ES510			
MS4645A-ES510			
MS4647A-ES510			
MS4642A-ES512			Standard Calibration
MS4644A-ES512			
MS4645A-ES512			
MS4647A-ES512			
MS4642A-ES515			Premium Calibration
MS4644A-ES515			
MS4645A-ES515			
MS4647A-ES515			
MS4642A-ES513			Repair + Standard Calibration
MS4644A-ES513			
MS4645A-ES513			
MS4647A-ES513			
MS4642A-ES516			Repair + Premium Calibration
MS4644A-ES516			
MS4645A-ES516			
MS4647A-ES516			

Upgrade Options (post-delivery)

Contact your local Anritsu service center for adding internal options, or increasing the frequency coverage of your existing MS4640A-series VNA.

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Technical Data Sheet No. 11410-00432, Rev. C Printed in United States 2009-06

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