

CALIBRATED BY TRANSCAT CERTIFICATE OF CALIBRATION

Customer: Transcat Rental Expense
35 VANTAGE POINT DR
ROCHESTER, NY 14624-1151

PO Number: D435F-RR

Certificate/SO Number: 19-EZ46R-80-1 Revision 1

Manufacturer: Agilent/HP/Keysight Tech

Model Number: 11970Q

Description: Harmonic Mixer

Serial Number: 3003A02725

ID: 2965

As-Found: In Tolerance

As-Left: In Tolerance

Issue Date: Jun 11, 2021

Calibration Date: Mar 14, 2019

Due Date: Mar 14, 2022

Calibrated To: Manufacturer Specification

Calibration Procedure: 1-AC10004-2

The instruments serviced are calibrated using standards traceable to the SI units through the National Institute of Standards and Technology (NIST), or the National Research Council of Canada (NRC), or other national measurement institutes (NMI) that are signatories to the CIPM Mutual Recognition Arrangement, or accepted fundamentals and/or natural physical, or by the use of specified methods, consensus standards or ratio type measurements. Documentation supporting traceability information is available for review upon written request at a Transcat facility. The measured quantity and the measurement uncertainty are required for further dissemination of metrological traceability.

The calibration services are performed in compliance with the Lab Quality System. This calibration complies with ANSI/NCSL Z540.1-1994 (R2002) and ISO 9001:2015, as applicable. All calibrations have been performed using processes having a TAR of 4:1 or better, unless otherwise noted in the Calibration Measurement Data. Calibrations at TAR thresholds of 4:1 or better provide reasonable confidence that the instrument is within the stated tolerances.

The results of this report relate only to the item calibrated or test. Recorded calibration data is valid at the time of calibration at the environmental conditions noted. Additional information, if applicable, may be included on separate report(s). This certificate and/or data report(s) shall not be reproduced except in full, without the written approval of the laboratory. Special limitation(s) are annotated in the notes section of this report. Out of tolerance data points are marked with an asterisk (*).

Notes:

Calibrated by Keysight Technologies, certificate 11970Q3003A0272520190314 is attached.

CALIBRATED BY TRANSCAT CERTIFICATE OF CALIBRATION

Customer: Transcat Rental Expense
35 VANTAGE POINT DR
ROCHESTER, NY 14624-1151

PO Number: D435F-RR

Certificate/SO Number: 19-EZ46R-80-1 Revision 1

Environmental Data

Temperature	Relative Humidity	Temp / RH Asset
68.50°F /20.28°C	41.20%	19-269

Calibrated At:

1503 E Orangethorpe Ave
Fullerton, CA 92831

Facility Responsible:

1503 E Orangethorpe Ave
Fullerton, CA 92831
800-828-1470

Calibrated By:



Electronically Signed By:
Andy Watson

Andy Watson
Calibration Technician

May 23, 2019
20:36:17 -04:00

Reviewed By:



Electronically Signed By:
Joshua Underwood for

Kevin Kimber
Lab Manager

May 24, 2019
02:06:59 -04:00

Unit Barcode:



900B0187351

Date Received: January 28, 2019
Service Level : R2
Revised On: Revised on June 11, 2021

Certificate - Page 2 of 2

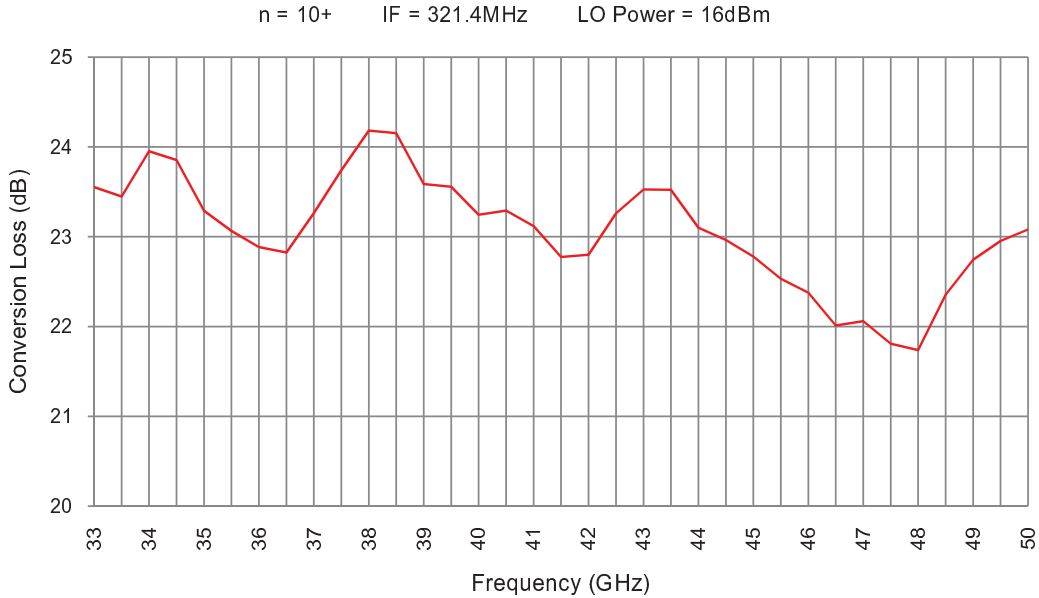
Reprinted on June 14, 2021

Customer Number: 1-628198-000

OPS-F20-013R8 04/01/2021 FP011R2 4/6/2021

MODEL: 11970Q SER: 3003A02725 DATE: 14 Mar 2019

Not for use with Keysight X-series signal analyzers. See other documents/files for X-series signal analyzers.



Freq. (GHz)	Conv. Loss (dB)	Ref. Lvl Ofs	Freq. (GHz)	Conv. Loss (dB)	Ref. Lvl Ofs
33.0	23.6	-6.4	42.0	22.8	-7.2
33.5	23.4	-6.6	42.5	23.3	-6.7
34.0	24.0	-6.0	43.0	23.5	-6.5
34.5	23.9	-6.1	43.5	23.5	-6.5
35.0	23.3	-6.7	44.0	23.1	-6.9
35.5	23.1	-6.9	44.5	23.0	-7.0
36.0	22.9	-7.1	45.0	22.8	-7.2
36.5	22.8	-7.2	45.5	22.5	-7.5
37.0	23.3	-6.7	46.0	22.4	-7.6
37.5	23.7	-6.3	46.5	22.0	-8.0
38.0	24.2	-5.8	47.0	22.1	-7.9
38.5	24.2	-5.8	47.5	21.8	-8.2
39.0	23.6	-6.4	48.0	21.7	-8.3
39.5	23.6	-6.4	48.5	22.4	-7.6
40.0	23.2	-6.8	49.0	22.7	-7.3
40.5	23.3	-6.7	49.5	23.0	-7.0
41.0	23.1	-6.9	50.0	23.1	-6.9
41.5	22.8	-7.2			

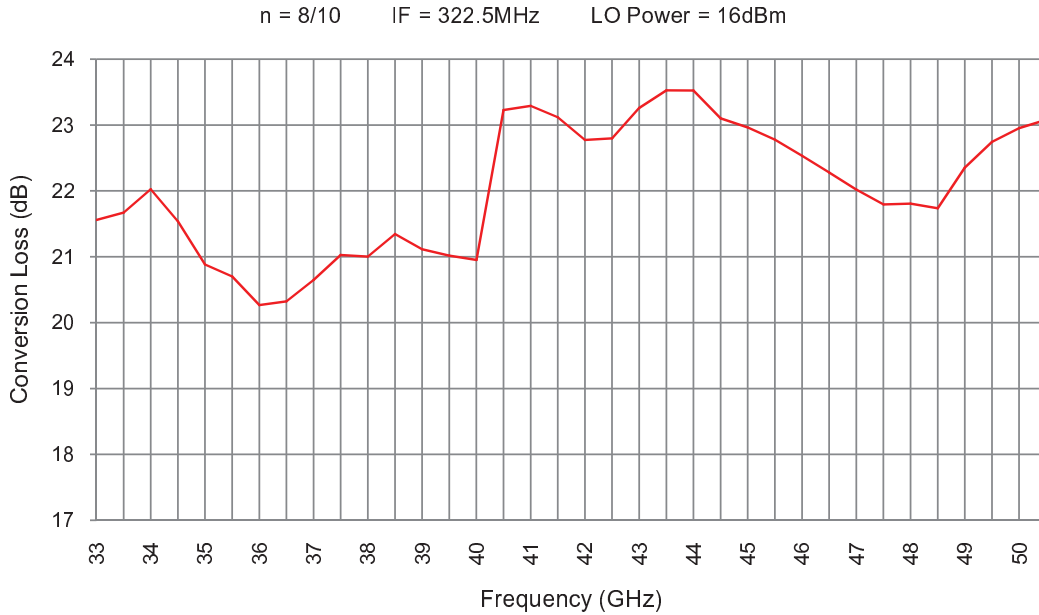
Print Date: 14-Mar-19



p/n 11970-90012

11970Q SER: 3003A02725 DATE: 14 Mar 2019

For use with Keysight X-Series signal analyzers only. See other documents/files for other spectrum analyzers.



Freq. (GHz)	Conv. Loss (dB)	Freq. (GHz)	Conv. Loss (dB)
33.0	21.6	42.0	22.8
33.5	21.7	42.5	23.3
34.0	22.0	43.0	23.5
34.5	21.5	43.5	23.5
35.0	20.9	44.0	23.1
35.5	20.7	44.5	23.0
36.0	20.3	45.0	22.8
36.5	20.3	45.5	22.5
37.0	20.6	46.0	22.3
37.5	21.0	46.5	22.0
38.0	21.0	47.0	21.8
38.5	21.3	47.5	21.8
39.0	21.1	48.0	21.7
39.5	21.0	48.5	22.4
40.0	21.0	49.0	22.7
40.0	23.2	49.5	23.0
40.5	23.3	50.0	23.1
41.0	23.1		
41.5	22.8		

Print Date: 14-Mar-19



p/n 11970-90037

Amplitude Correction
CONVERSION LOSS DATA FOR 8-MIXING
MODEL: 11970Q SER: 3003A02725 DATE: 14 Mar 2019

Frequency MHz
Antenna U: None
Frequency Linear
DATA

33000	21.55929
33170	21.49158
33340	21.44202
33510	21.67072
33680	21.76585
33850	21.79235
34020	22.02481
34190	21.9484
34360	21.86534
34530	21.53675
34700	21.22504
34870	21.09378
35040	20.88406
35210	20.79561
35380	20.65689
35550	20.70065
35720	20.58932
35890	20.37152
36060	20.26766
36230	20.33844
36400	20.33499
36570	20.32344
36740	20.34615
36910	20.50821
37080	20.64784
37250	20.79944
37420	21.02664
37590	21.09443
37760	20.97233
37930	21.00235
38100	21.33099
38270	21.45853
38440	21.34598
38610	21.04167
38780	20.99268
38950	21.11516
39120	20.96365
39290	20.85166

39460	21.0173
39630	20.98547
39800	20.96446
39970	20.96292
40140	20.89833
40310	21.13719
40480	21.06092
40650	20.99663
40820	20.82656
40990	20.60124
41160	20.363

Amplitude Correction
CONVERSION LOSS DATA FOR 10-MIXING
MODEL: 11970Q SER: 3003A02725 DATE: 14 Mar 2019

Frequency MHz
Antenna U: None
Frequency Linear
DATA

33000	23.55329
33170	23.38858
33340	23.36302
33510	23.44872
33680	23.49085
33850	23.77035
34020	23.95281
34190	24.0064
34360	24.00734
34530	23.85375
34700	23.70404
34870	23.51478
35040	23.28906
35210	23.18261
35380	23.03889
35550	23.06465
35720	23.08632
35890	22.99852
36060	22.88466
36230	22.86344
36400	22.86699
36570	22.82344
36740	22.79115
36910	22.91521
37080	23.26284
37250	23.55744
37420	23.73964
37590	23.91743
37760	24.16333
37930	24.18235
38100	24.16999
38270	24.14753
38440	24.15398
38610	23.91467
38780	23.65868
38950	23.58616
39120	23.53865
39290	23.60266

39460	23.5573
39630	23.35247
39800	23.34546
39970	23.24392
40140	23.15633
40310	23.31419
40480	23.29192
40650	23.27163
40820	23.13056
40990	23.11824
41160	23.099
41330	22.93391
41500	22.77407
41670	22.8731
41840	22.81889
42010	22.79831
42180	22.75336
42350	22.97671
42520	23.26079
42690	23.2821
42860	23.35833
43030	23.52656
43200	23.53301
43370	23.45846
43540	23.52368
43710	23.34669
43880	23.17995
44050	23.10072
44220	22.99467
44390	22.99834
44560	22.9637
44730	22.87286
44900	22.8381
45070	22.77957
45240	22.70338
45410	22.59367
45580	22.53252
45750	22.38097
45920	22.37684
46090	22.28068
46260	22.16624
46430	22.01069
46600	22.02137
46770	22.08705
46940	22.05878
47110	21.79499
47280	21.66484

47450	21.80744
47620	21.97291
47790	21.92564
47960	21.73671
48130	21.52304
48300	21.82626
48470	22.35282
48640	22.74566
48810	22.74945
48980	22.7442
49150	22.87161
49320	22.9633
49490	22.95274
49660	22.91849
49830	23.05018
50000	23.08001

Amplitude Correction
CONVERSION LOSS DATA For X-SERIES
11970Q SER: 3003A02725 DATE: 14 Mar 2019

Frequency MHz
Antenna U: None
Frequency Linear
Overlap 39900 40000
DATA

26350	0
26350	21.55929
33000	21.55929
33170	21.49158
33340	21.44202
33510	21.67072
33680	21.76585
33850	21.79235
34020	22.02481
34190	21.9484
34360	21.86534
34530	21.53675
34700	21.22504
34870	21.09378
35040	20.88406
35210	20.79561
35380	20.65689
35550	20.70065
35720	20.58932
35890	20.37152
36060	20.26766
36230	20.33844
36400	20.33499
36570	20.32344
36740	20.34615
36910	20.50821
37080	20.64784
37250	20.79944
37420	21.02664
37590	21.09443
37760	20.97233
37930	21.00235
38100	21.33099
38270	21.45853
38440	21.34598
38610	21.04167
38780	20.99268

38950	21.11516
39120	20.96365
39290	20.85166
39460	21.0173
39630	20.98547
39800	20.96446
39970	20.96292
40000	20.95152
40000	23.22846
40140	23.15633
40310	23.31419
40480	23.29192
40650	23.27163
40820	23.13056
40990	23.11824
41160	23.099
41330	22.93391
41500	22.77407
41670	22.8731
41840	22.81889
42010	22.79831
42180	22.75336
42350	22.97671
42520	23.26079
42690	23.2821
42860	23.35833
43030	23.52656
43200	23.53301
43370	23.45846
43540	23.52368
43710	23.34669
43880	23.17995
44050	23.10072
44220	22.99467
44390	22.99834
44560	22.9637
44730	22.87286
44900	22.8381
45070	22.77957
45240	22.70338
45410	22.59367
45580	22.53252
45750	22.38097
45920	22.37684
46090	22.28068
46260	22.16624
46430	22.01069

46600	22.02137
46770	22.08705
46940	22.05878
47110	21.79499
47280	21.66484
47450	21.80744
47620	21.97291
47790	21.92564
47960	21.73671
48130	21.52304
48300	21.82626
48470	22.35282
48640	22.74566
48810	22.74945
48980	22.7442
49150	22.87161
49320	22.9633
49490	22.95274
49660	22.91849
49830	23.05018
50000	23.08001



Keysight Technologies Malaysia Sdn Bhd (463532-M)
 Bayan Lepas Free Industrial Zone
 11900 Penang, Malaysia
 Keysight Approved Calibration provider #71456



5962-0476

Certificate Of Calibration

Certificate No: 11970Q3003A0272520190314

Manufacturer: Agilent Technologies
Model No: 11970Q
Options Installed With Specifications: N/A

Description: Waveguide Harmonic Mixer
Serial No: 3003A02725

Customer Asset:
Customer:
 Transcat Inc
 1503 E Orangethorpe Ave Ste B
 FULLERTON CA 92831-5214
 UNITED STATES

Location of Calibration:
 Plot 44, Bayan Lepas Industrial Park IV
 11900 Penang
 Malaysia

Date of Calibration: 14-MAR-2019
Temperature: (23 ± 3)°C
Procedure: MTA-T113

Received Date: 14-MAR-2019
Humidity: (20 to 70) % RH

This certifies that the equipment has been calibrated using applicable Keysight Technologies procedures in compliance with a quality management system registered to ISO 9001:2015.

As Received Conditions: Initial testing found the equipment to be IN SPECIFICATION at the points tested.

As Shipped Conditions: At the completion of calibration, measured values were IN SPECIFICATION at the parameters tested.

Remarks or special requirements:

Notes:

1. This calibration report may refer to equipment manufactured by HP, Agilent and Keysight as being manufactured by Keysight Technologies, Inc.
2. The test limits stated in the calibration report correspond to the published specifications of the equipment, at the points tested.
3. The documented test results relate to the equipment tested only.
4. This calibration report shall not be reproduced, except in full.

Traceability Information: Measurements are traceable to the International System of Units (SI) via national metrology institutes (www.keysight.com/find/NMI) that are signatories to the CIPM Mutual Recognition Arrangement.

Print Date: 14-MAR-2019

Ng Kok Seong
 Quality Manager
 Keysight Calibration Provider #71456

Keysight Provider #71456				
	DD	MM	YY	BY
CAL	14	03	19	NF
DUE				



KEYSIGHT
TECHNOLOGIES

Keysight Technologies Malaysia Sdn Bhd (463532-M)
Bayan Lepas Free Industrial Zone
11900 Penang, Malaysia
Keysight Approved Calibration provider #71456



5962-0476

Certificate Of Calibration

Certificate No: 11970Q3003A0272520190314

Calibration Equipment Used:

Model Number Model Description

Date used: Date equipment used in this Calibration

Trace Number

Used Date

Cal Due Date

Q8486A	Power Sensor	PC7593	14-MAR-2019	22-SEP-2019
E4448A	3Hz - 50.0 GHz PSA	PC8018	14-MAR-2019	01-MAR-2020
E8257D	Signal Source	PD7613	14-MAR-2019	26-MAR-2020
E8257D	Signal Source	PC7952	14-MAR-2019	18-OCT-2019
E4419B	EPM Series Power Meter	PC7314	14-MAR-2019	11-SEP-2019



Keysight Technologies Malaysia Sdn Bhd (463532-M)
Bayan Lepas Free Industrial Zone
11900 Penang, Malaysia
Keysight Approved Calibration provider #71456

Calibration Data

Certificate No: 11970Q3003A0272520190314

Model No: 11970Q

Serial No: 3003A02725

Max. specified Conversion Loss : 28.00dB

Max. specified Flatness : 3.80dB

Options Installed:

Date Calibrated: 14-MAR-2019

Measured Flatness : 2.66dB

Frequency GHz	Conversion Loss dB	Frequency GHz	Conversion Loss dB	Frequency GHz	Conversion Loss dB
33.00	23.55	39.46	23.56	45.92	22.38
33.17	23.39	39.63	23.35	46.09	22.28
33.34	23.36	39.80	23.35	46.26	22.17
33.51	23.45	39.97	23.24	46.43	22.01
33.68	23.49	40.14	23.16	46.60	22.02
33.85	23.77	40.31	23.31	46.77	22.09
34.02	23.95	40.48	23.29	46.94	22.06
34.19	24.01	40.65	23.27	47.11	21.79
34.36	24.01	40.82	23.13	47.28	21.66
34.53	23.85	40.99	23.12	47.45	21.81
34.70	23.70	41.16	23.10	47.62	21.97
34.87	23.51	41.33	22.93	47.79	21.93
35.04	23.29	41.50	22.77	47.96	21.74
35.21	23.18	41.67	22.87	48.13	21.52
35.38	23.04	41.84	22.82	48.30	21.83
35.55	23.06	42.01	22.80	48.47	22.35
35.72	23.09	42.18	22.75	48.64	22.75
35.89	23.00	42.35	22.98	48.81	22.75
36.06	22.88	42.52	23.26	48.98	22.74
36.23	22.86	42.69	23.28	49.15	22.87
36.40	22.87	42.86	23.36	49.32	22.96
36.57	22.82	43.03	23.53	49.49	22.95
36.74	22.79	43.20	23.53	49.66	22.92
36.91	22.92	43.37	23.46	49.83	23.05
37.08	23.26	43.54	23.52	50.00	23.08
37.25	23.56	43.71	23.35		
37.42	23.74	43.88	23.18		
37.59	23.92	44.05	23.10		
37.76	24.16	44.22	22.99		
37.93	24.18	44.39	23.00		
38.10	24.17	44.56	22.96		
38.27	24.15	44.73	22.87		
38.44	24.15	44.90	22.84		
38.61	23.91	45.07	22.78		
38.78	23.66	45.24	22.70		
38.95	23.59	45.41	22.59		
39.12	23.54	45.58	22.53		
39.29	23.60	45.75	22.38		

Note:

* Indicates Out-of-Specification (measurement exceeds specification)



Certificate of Calibration

ISO/IEC 17025:2017 and ANSI/NC SL Z540.1-1994
Certificate Number 210222-132137-eb91aa



Model Number 3116
Manufacturer EMCO
Description Horn (Small)
Serial Number 2076
Customer Asset No. i00085

Customer
 Compliance Testing LLC
 1724 S Nevada Way
 Mesa, AZ 85204
 USA

Date of Calibration 02/22/2021
Temperature 21°C
Humidity 39% RH

Location of Calibration
 Keysight Technologies Inc.
 1346 Yellowwood Road
 Kimballton, IA 51543
 United States

This certifies that the equipment has been calibrated using applicable Keysight Technologies procedures and in compliance with ISO/IEC 17025:2017 and ANSI/NC SL Z540.1-1994 (R2002). The quality management system is registered to ISO 9001:2015.

Calibration Standard(s)	Calibration Method(s)	Calibration Procedure(s)
SAE ARP 958D 2003	Combination of SAE Clause 4 and Appendix C	356847

Calibration Software
 ACF-Insertion Loss Analysis 2.9.1
 DRWG Standard Site Method 2.0.18

As Received Conditions
 The measured values of the equipment were observed in specification at the points tested.

Action Taken
 No action was taken.

As Completed Conditions
 The measured values of the equipment were observed in specification at the points tested.

Calibration Due
 Based on the customer's request, the next calibration is due on 22 Feb 2023

Remarks or Special Requirements
 This calibration report shall not be reproduced, except in full. The documented results relate to the equipment calibrated only.
 The test limits stated in the report correspond to the published specifications of the equipment, at the points tested.

Keysight Technologies, Inc.
 1346 Yellowwood Road
 Kimballton, IA 51543
 United States


 Brandt Langer Iowa Service Center Manager



Certificate of Calibration

ISO/IEC 17025:2017 and ANSI/NCSL Z540.1-1994
Certificate Number 210222-132137-eb91aa



Traceability Information

Technician Name Rodger Rasmussen

Measurements are traceable to the International System of Units (SI) via national metrology institutes (www.keysight.com/find/NMI) that are signatories to the CIPM Mutual Recognition Arrangement.

Calibration Equipment Used

Manufacturer	Model Number	Model Description	Equipment ID	Cal Due Date	Certificate Number
EMCO	3116	Horn (4.5 - 40 GHz)	10117	08/23/2021	190822-081742-4953e8
ETS	3116	Horn (Small) 4.5-40GHz	10907	08/23/2021	190822-082401-05d46a
Maury Microwave	8770CK51	2.92 Calibration Kit	612394	02/16/2022	Q-02042-1
Comtest	8M Chamber	Chamber	20021	06/04/2021	190604-101014-fb528b
Keysight Technologies, Inc.	N5225A	PNA Network Analyzer	577122	08/31/2021	1-12808024968-1

Compliance with Specification

Unless otherwise noted, the calibration results are reported without factoring in the effect of uncertainty on the assessment of compliance/specification.

In Specification/Out of Specification Explanation

The standard criteria to determine the "In Specification/Out of Specification" status is based on one or more of the following conditions, as requested by the client:

1. If the manufacturer has a specified specification for the item being calibrated, then the calibration values are compared to this specification, and the values must fall within the manufacturer's specification. The specification may be obtained from the manufacturer's web site, data sheets, equipment manuals, etc.
2. Where specifications are called out in a published standard, the calibration results are compared to this specification, and the measured values must fall within the standard's specification.
3. In cases where the manufacturer, standard, or client does not identify any relevant specifications, applicable calibration results are compared to historical data with a +/- 3 dB specification.

Uncertainty of Measurement

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008(GUM). The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95%. This probability corresponds to a coverage factor of k=2 for a normal distribution.

Parameter	Range	MU (+/-)
Horn Antennas/LPA's - 1 & 3 Meter Distance (CISPR 16-1-6), Far Field (ANSI C63.5)	700 MHz to 18 GHz	0.37 dB
	(18 to 26.5) GHz	0.42 dB
	(26.5 to 50) GHz	0.47 dB

Date of Calibration = 02/22/2021

Date Printed: Monday, February 22, 2021 3:14 PM

Customer Name: Compliance Testing LLC

Antenna Manufacturer: EMCO

Antenna Model: 3116

Antenna Serial No.: 2076

Temperature (Deg C): 21.0

Humidity (%): 39.0

Measurement Distance in Meters = 1.0

Antenna Polarization = VERT

NOTES:

CAL CERT #: 210222-132137-eb91aa

Freq (MHz)	ACF (dB)	Gain (dBi)	Num GAIN
18000.0000	44.922	10.383	10.923
18100.0000	44.864	10.489	11.193
18200.0000	44.826	10.575	11.416
18300.0000	44.861	10.588	11.450
18400.0000	44.784	10.712	11.782
18500.0000	44.806	10.737	11.850
18600.0000	44.855	10.736	11.846
18700.0000	44.798	10.839	12.131
18800.0000	44.782	10.901	12.306
18900.0000	44.732	10.997	12.581
19000.0000	44.763	11.013	12.626
19100.0000	44.721	11.099	12.881
19200.0000	44.749	11.117	12.933
19300.0000	44.765	11.147	13.021
19400.0000	44.672	11.284	13.440
19500.0000	44.649	11.351	13.650
19600.0000	44.575	11.470	14.028
19700.0000	44.500	11.590	14.420
19800.0000	44.497	11.636	14.575
19900.0000	44.444	11.734	14.906
20000.0000	44.449	11.772	15.038
20100.0000	44.418	11.845	15.295
20200.0000	44.370	11.937	15.621
20300.0000	44.528	11.822	15.212
20400.0000	44.524	11.869	15.377
20500.0000	44.520	11.916	15.544
20600.0000	44.620	11.858	15.338

20700.0000	44.590	11.930	15.594
20800.0000	44.666	11.896	15.473
20900.0000	44.615	11.987	15.803
21000.0000	44.454	12.190	16.558
21100.0000	44.537	12.148	16.400
21200.0000	44.663	12.064	16.084
21300.0000	44.584	12.183	16.532
21400.0000	44.650	12.158	16.437
21500.0000	44.687	12.162	16.451
21600.0000	44.754	12.136	16.351
21700.0000	44.860	12.070	16.105
21800.0000	44.894	12.075	16.125
21900.0000	44.844	12.165	16.462
22000.0000	44.938	12.110	16.256
22100.0000	45.052	12.035	15.979
22200.0000	45.061	12.067	16.094
22300.0000	45.101	12.066	16.090
22400.0000	45.120	12.085	16.162
22500.0000	45.226	12.017	15.912
22600.0000	45.269	12.013	15.897
22700.0000	45.336	11.984	15.792
22800.0000	45.404	11.954	15.683
22900.0000	45.422	11.974	15.756
23000.0000	45.501	11.933	15.607
23100.0000	45.560	11.913	15.533
23200.0000	45.614	11.895	15.472
23300.0000	45.644	11.903	15.499
23400.0000	45.691	11.894	15.466
23500.0000	45.688	11.933	15.607
23600.0000	45.688	11.970	15.740
23700.0000	45.670	12.024	15.939
23800.0000	45.576	12.155	16.426
23900.0000	45.497	12.271	16.869
24000.0000	45.588	12.216	16.658
24100.0000	45.679	12.162	16.450
24200.0000	45.762	12.114	16.271
24300.0000	45.881	12.032	15.965
24400.0000	45.976	11.971	15.745
24500.0000	46.051	11.933	15.605
24600.0000	46.238	11.781	15.069
24700.0000	46.337	11.716	14.847
24800.0000	46.282	11.807	15.160
24900.0000	46.343	11.780	15.068
25000.0000	46.409	11.749	14.960
25100.0000	46.327	11.867	15.370
25200.0000	46.273	11.955	15.686

25300.0000	46.172	12.091	16.183
25400.0000	46.039	12.257	16.816
25500.0000	46.069	12.262	16.834
25600.0000	46.113	12.251	16.793
25700.0000	46.121	12.278	16.896
25800.0000	46.137	12.295	16.964
25900.0000	46.274	12.191	16.563
26000.0000	46.441	12.059	16.065
26100.0000	46.476	12.056	16.056
26200.0000	46.475	12.092	16.186
26300.0000	46.497	12.102	16.226
26400.0000	46.592	12.041	15.998
26500.0000	46.593	12.071	16.112
26600.0000	46.549	12.149	16.401
26700.0000	46.397	12.333	17.112
26800.0000	46.361	12.401	17.383
26900.0000	46.382	12.414	17.432
27000.0000	46.300	12.528	17.896
27100.0000	46.270	12.589	18.152
27200.0000	46.396	12.496	17.765
27300.0000	46.480	12.443	17.551
27400.0000	46.502	12.454	17.593
27500.0000	46.586	12.401	17.381
27600.0000	46.643	12.375	17.279
27700.0000	46.682	12.367	17.248
27800.0000	46.789	12.291	16.949
27900.0000	46.741	12.371	17.263
28000.0000	46.659	12.484	17.718
28100.0000	46.665	12.510	17.822
28200.0000	46.572	12.632	18.334
28300.0000	46.475	12.760	18.881
28400.0000	46.432	12.834	19.205
28500.0000	46.476	12.821	19.147
28600.0000	46.502	12.826	19.168
28700.0000	46.488	12.869	19.361
28800.0000	46.558	12.829	19.184
28900.0000	46.600	12.817	19.131
29000.0000	46.648	12.800	19.055
29100.0000	46.774	12.704	18.638
29200.0000	46.824	12.684	18.552
29300.0000	46.829	12.708	18.656
29400.0000	46.809	12.757	18.869
29500.0000	46.833	12.764	18.896
29600.0000	46.786	12.839	19.228
29700.0000	46.796	12.860	19.318
29800.0000	46.769	12.916	19.569

29900.0000	46.673	13.041	20.141
30000.0000	46.743	12.999	19.949
30100.0000	46.802	12.970	19.814
30200.0000	46.822	12.978	19.852
30300.0000	46.843	12.986	19.888
30400.0000	46.960	12.897	19.486
30500.0000	46.953	12.932	19.645
30600.0000	47.077	12.837	19.219
30700.0000	47.169	12.774	18.940
30800.0000	47.040	12.932	19.640
30900.0000	47.097	12.902	19.508
31000.0000	47.228	12.799	19.051
31100.0000	47.214	12.842	19.238
31200.0000	47.198	12.886	19.434
31300.0000	47.251	12.860	19.319
31400.0000	47.394	12.745	18.814
31500.0000	47.423	12.744	18.809
31600.0000	47.440	12.753	18.851
31700.0000	47.449	12.773	18.935
31800.0000	47.566	12.683	18.547
31900.0000	47.787	12.488	17.735
32000.0000	47.884	12.418	17.452
32100.0000	47.916	12.414	17.434
32200.0000	48.124	12.234	16.725
32300.0000	48.406	11.979	15.771
32400.0000	48.506	11.905	15.506
32500.0000	48.461	11.977	15.765
32600.0000	48.524	11.940	15.632
32700.0000	48.732	11.759	14.993
32800.0000	48.828	11.690	14.756
32900.0000	48.782	11.762	15.004
33000.0000	48.734	11.836	15.262
33100.0000	48.927	11.669	14.687
33200.0000	49.117	11.506	14.145
33300.0000	49.060	11.588	14.416
33400.0000	48.914	11.761	15.000
33500.0000	49.044	11.656	14.643
33600.0000	49.251	11.476	14.047
33700.0000	49.299	11.453	13.974
33800.0000	49.138	11.641	14.590
33900.0000	49.153	11.651	14.625
34000.0000	49.299	11.530	14.224
34100.0000	49.409	11.447	13.953
34200.0000	49.307	11.574	14.367
34300.0000	49.040	11.866	15.367
34400.0000	49.108	11.823	15.216

34500.0000	49.079	11.877	15.407
34600.0000	49.012	11.969	15.737
34700.0000	48.800	12.207	16.622
34800.0000	48.712	12.319	17.058
34900.0000	48.787	12.269	16.863
35000.0000	48.726	12.356	17.202
35100.0000	48.543	12.563	18.043
35200.0000	48.531	12.599	18.195
35300.0000	48.610	12.545	17.969
35400.0000	48.487	12.693	18.591
35500.0000	48.397	12.808	19.089
35600.0000	48.247	12.981	19.868
35700.0000	48.118	13.135	20.583
35800.0000	47.973	13.305	21.403
35900.0000	47.766	13.535	22.571
36000.0000	47.545	13.781	23.884
36100.0000	47.248	14.103	25.719
36200.0000	47.030	14.345	27.193
36300.0000	46.867	14.532	28.389
36400.0000	46.620	14.803	30.217
36500.0000	46.334	15.111	32.445
36600.0000	46.108	15.362	34.370
36700.0000	45.988	15.506	35.528
36800.0000	45.807	15.710	37.239
36900.0000	45.712	15.828	38.267
37000.0000	45.650	15.914	39.030
37100.0000	45.601	15.986	39.685
37200.0000	45.539	16.072	40.476
37300.0000	45.546	16.088	40.626
37400.0000	45.506	16.151	41.221
37500.0000	45.528	16.153	41.236
37600.0000	45.465	16.239	42.062
37700.0000	45.457	16.269	42.359
37800.0000	45.545	16.205	41.734
37900.0000	45.542	16.230	41.980
38000.0000	45.467	16.328	42.937
38100.0000	45.371	16.447	44.129
38200.0000	45.510	16.332	42.970
38300.0000	45.652	16.212	41.802
38400.0000	45.664	16.223	41.906
38500.0000	45.744	16.165	41.353
38600.0000	45.799	16.133	41.048
38700.0000	46.000	15.954	39.392
38800.0000	46.148	15.828	38.268
38900.0000	46.272	15.726	37.381
39000.0000	46.342	15.679	36.976

39100.0000	46.473	15.570	36.060
39200.0000	46.596	15.470	35.236
39300.0000	46.735	15.352	34.296
39400.0000	46.659	15.450	35.079
39500.0000	46.798	15.333	34.147
39600.0000	46.923	15.230	33.346
39700.0000	46.967	15.209	33.181
39800.0000	47.093	15.105	32.395
39900.0000	47.246	14.973	31.428
40000.0000	47.623	14.619	28.964



Certificate of Calibration

ISO/IEC 17025:2017 and ANSI/NC SL Z540.1-1994
Certificate Number 200803-095012-b16fe9



Model Number DRG-118/A
Manufacturer ARA
Description Horn (Small)
Serial Number 1176
Customer Asset No. i00271

Customer
 Compliance Testing LLC
 1724 S Nevada Way
 Mesa, AZ 85204
 USA

Date of Calibration 08/03/2020
Temperature 23°C
Humidity 50% RH

Location of Calibration
 Keysight Technologies Inc.
 1346 Yellowwood Road
 Kimballton, IA 51543
 United States

This certifies that the equipment has been calibrated using applicable Keysight Technologies procedures and in compliance with ISO/IEC 17025:2017 and ANSI/NC SL Z540.1-1994 (R2002). The quality management system is registered to ISO 9001:2015.

Calibration Standard(s) ANSI C63.5 2017	Calibration Method(s) ANSI Clause 5.1.3	Calibration Procedure(s) 356847
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Calibration Software
 ACF-Insertion Loss Analysis 2.9.1
 DRWG Standard Site Method 2.0.14

As Received Conditions
 The measured values of the equipment were observed in specification at the points tested.

Action Taken
 No action was taken.

As Completed Conditions
 The measured values of the equipment were observed in specification at the points tested.

Calibration Due
 Based on the customer's request, the next calibration is due on 3 Aug 2022

Remarks or Special Requirements
 This calibration report shall not be reproduced, except in full. The documented results relate to the equipment calibrated only.
 The test limits stated in the report correspond to the published specifications of the equipment, at the points tested.

Keysight Technologies, Inc.
 1346 Yellowwood Road
 Kimballton, IA 51543
 United States


 Brandt Langer Iowa Service Center Manager



Certificate of Calibration

ISO/IEC 17025:2017 and ANSI/NCSL Z540.1-1994
Certificate Number 200803-095012-b16fe9



Traceability Information

Technician Name Rodger Rasmussen

Measurements are traceable to the International System of Units (SI) via national metrology institutes (www.keysight.com/find/NMI) that are signatories to the CIPM Mutual Recognition Arrangement.

Calibration Equipment Used

Manufacturer	Model Number	Model Description	Equipment ID	Cal Due Date	Certificate Number
ETS - Lindgren	3115	Horn (Small)	10988	04/11/2021	190411-140758-44cbf8
ETS-Lindgren	3115	Horn (Small)	10989	04/24/2022	200424-113107-cf5a95
Agilent Technologies, Inc.	85054B	Type N Calibration Kit	10902	03/13/2021	1-12419885451-1
Comtest	8M Chamber	Chamber	20021	06/04/2021	190604-101014-fb528b
Keysight Technologies, Inc.	N5225A	PNA Network Analyzer	577122	08/19/2020	1-11379344683-1

Compliance with Specification

Unless otherwise noted, the calibration results are reported without factoring in the effect of uncertainty on the assessment of compliance/specification.

In Specification/Out of Specification Explanation

The standard criteria to determine the "In Specification/Out of Specification" status is based on one or more of the following conditions, as requested by the client:

1. If the manufacturer has a specified specification for the item being calibrated, then the calibration values are compared to this specification, and the values must fall within the manufacturer's specification. The specification may be obtained from the manufacturer's web site, data sheets, equipment manuals, etc.
2. Where specifications are called out in a published standard, the calibration results are compared to this specification, and the measured values must fall within the standard's specification.
3. In cases where the manufacturer, standard, or client does not identify any relevant specifications, applicable calibration results are compared to historical data with a +/- 3 dB specification.

Uncertainty of Measurement

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008(GUM). The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95%. This probability corresponds to a coverage factor of k=2 for a normal distribution.

Parameter	Range	MU (+/-)
Horn Antennas/LPA's - 1 & 3 Meter Distance (CISPR 16-1-6), Far Field (ANSI C63.5)	700 MHz to 18 GHz	0.37 dB
	(18 to 26.5) GHz	0.42 dB
	(26.5 to 50) GHz	0.47 dB

Date of Calibration = August 3, 2020

Date Printed: Monday, August 3, 2020 12:06 PM

Customer Name: Compliance Testing LLC

Antenna Manufacturer: ARA

Antenna Model: DRG-118/A

Antenna Serial No.: 1176

Temperature (Deg C): 23.0

Humidity (%): 50.0

Measurement Distance in Meters = 3.0

Antenna Polarization = VERT

NOTES: Observed Pin Depth: -0.0011" from typical.

CAL CERT #: 200803-095012-b16fe9

Freq (MHz)	ACF (dB)	Gain (dBi)	Num GAIN
1000.0000	24.239	5.961	3.945
1050.0000	24.575	6.048	4.026
1100.0000	24.796	6.232	4.199
1150.0000	24.559	6.854	4.847
1200.0000	24.883	6.901	4.899
1250.0000	25.009	7.130	5.164
1300.0000	24.937	7.542	5.678
1350.0000	24.868	7.938	6.221
1400.0000	25.020	8.103	6.461
1450.0000	25.049	8.378	6.884
1500.0000	25.024	8.697	7.409
1550.0000	24.975	9.032	8.002
1600.0000	25.089	9.193	8.305
1650.0000	25.458	9.092	8.113
1700.0000	25.448	9.361	8.632
1750.0000	25.405	9.656	9.238
1800.0000	25.885	9.421	8.751
1850.0000	26.233	9.310	8.531
1900.0000	26.679	9.097	8.122
1950.0000	27.422	8.578	7.208
2000.0000	28.014	8.207	6.617
2050.0000	28.342	8.093	6.446
2100.0000	28.267	8.377	6.882
2150.0000	28.276	8.572	7.198
2200.0000	27.991	9.058	8.050
2250.0000	27.634	9.610	9.141
2300.0000	27.702	9.732	9.402

2350.0000	27.942	9.679	9.288
2400.0000	27.971	9.834	9.624
2450.0000	28.178	9.805	9.561
2500.0000	28.573	9.585	9.090
2550.0000	28.937	9.394	8.697
2600.0000	29.158	9.342	8.594
2650.0000	29.540	9.125	8.175
2700.0000	29.553	9.275	8.462
2750.0000	29.492	9.494	8.901
2800.0000	29.608	9.535	8.985
2850.0000	29.628	9.669	9.266
2900.0000	29.542	9.906	9.786
2950.0000	29.683	9.914	9.803
3000.0000	30.039	9.704	9.341
3050.0000	30.061	9.825	9.605
3100.0000	29.996	10.032	10.073
3150.0000	30.256	9.911	9.796
3200.0000	30.419	9.883	9.735
3250.0000	30.193	10.245	10.580
3300.0000	30.255	10.315	10.753
3350.0000	30.737	9.963	9.916
3400.0000	30.718	10.112	10.261
3450.0000	30.595	10.361	10.867
3500.0000	31.114	9.967	9.925
3550.0000	31.538	9.666	9.260
3600.0000	31.325	10.001	10.002
3650.0000	30.972	10.473	11.152
3700.0000	30.774	10.790	11.995
3750.0000	30.632	11.048	12.730
3800.0000	30.624	11.172	13.097
3850.0000	30.498	11.412	13.841
3900.0000	30.435	11.587	14.410
3950.0000	30.737	11.395	13.788
4000.0000	30.994	11.248	13.328
4050.0000	30.963	11.386	13.760
4100.0000	31.043	11.412	13.843
4150.0000	31.211	11.349	13.644
4200.0000	31.512	11.152	13.039
4250.0000	31.586	11.181	13.126
4300.0000	31.540	11.329	13.581
4350.0000	31.570	11.399	13.802
4400.0000	31.654	11.415	13.852
4450.0000	31.614	11.554	14.301
4500.0000	31.508	11.756	14.983
4550.0000	31.655	11.706	14.810
4600.0000	31.911	11.544	14.269

4650.0000	31.969	11.580	14.388
4700.0000	32.213	11.429	13.896
4750.0000	32.725	11.009	12.615
4800.0000	32.991	10.834	12.117
4850.0000	33.023	10.891	12.278
4900.0000	32.970	11.034	12.688
4950.0000	33.095	10.998	12.582
5000.0000	33.393	10.787	11.986
5050.0000	33.412	10.854	12.173
5100.0000	33.425	10.927	12.379
5150.0000	33.523	10.913	12.340
5200.0000	33.480	11.041	12.707
5250.0000	33.567	11.037	12.696
5300.0000	33.530	11.156	13.049
5350.0000	33.502	11.265	13.381
5400.0000	33.476	11.371	13.713
5450.0000	33.501	11.426	13.888
5500.0000	33.666	11.341	13.618
5550.0000	33.612	11.474	14.041
5600.0000	33.491	11.673	14.699
5650.0000	33.470	11.770	15.033
5700.0000	33.428	11.889	15.450
5750.0000	33.572	11.822	15.211
5800.0000	33.707	11.762	15.003
5850.0000	33.949	11.594	14.435
5900.0000	34.286	11.331	13.586
5950.0000	34.561	11.130	12.971
6000.0000	34.752	11.011	12.621
6050.0000	34.933	10.902	12.309
6100.0000	34.866	11.040	12.707
6150.0000	34.712	11.265	13.382
6200.0000	34.616	11.432	13.906
6250.0000	34.683	11.434	13.913
6300.0000	34.775	11.411	13.840
6350.0000	34.706	11.549	14.286
6400.0000	34.771	11.552	14.297
6450.0000	34.996	11.396	13.790
6500.0000	35.219	11.240	13.303
6550.0000	35.377	11.147	13.024
6600.0000	35.587	11.003	12.599
6650.0000	35.794	10.863	12.198
6700.0000	35.995	10.727	11.822
6750.0000	36.084	10.702	11.754
6800.0000	36.225	10.626	11.549
6850.0000	36.425	10.488	11.190
6900.0000	36.569	10.408	10.985

6950.0000	36.791	10.248	10.589
7000.0000	37.027	10.075	10.174
7050.0000	37.342	9.822	9.598
7100.0000	37.552	9.673	9.275
7150.0000	37.654	9.632	9.188
7200.0000	37.524	9.822	9.599
7250.0000	37.573	9.833	9.624
7300.0000	37.582	9.885	9.738
7350.0000	37.507	10.018	10.042
7400.0000	37.387	10.198	10.466
7450.0000	37.442	10.201	10.474
7500.0000	37.467	10.234	10.554
7550.0000	37.490	10.269	10.639
7600.0000	37.408	10.408	10.985
7650.0000	37.445	10.428	11.036
7700.0000	37.407	10.522	11.278
7750.0000	37.441	10.546	11.338
7800.0000	37.444	10.597	11.475
7850.0000	37.430	10.668	11.662
7900.0000	37.395	10.758	11.906
7950.0000	37.329	10.879	12.242
8000.0000	37.251	11.010	12.619
8050.0000	37.226	11.090	12.853
8100.0000	37.248	11.122	12.947
8150.0000	37.262	11.162	13.066
8200.0000	37.254	11.223	13.251
8250.0000	37.330	11.199	13.180
8300.0000	37.370	11.211	13.217
8350.0000	37.424	11.210	13.213
8400.0000	37.305	11.380	13.741
8450.0000	37.279	11.458	13.990
8500.0000	37.365	11.424	13.879
8550.0000	37.373	11.466	14.016
8600.0000	37.460	11.430	13.899
8650.0000	37.528	11.413	13.844
8700.0000	37.600	11.391	13.774
8750.0000	37.699	11.342	13.619
8800.0000	37.759	11.331	13.586
8850.0000	37.803	11.335	13.600
8900.0000	37.886	11.301	13.494
8950.0000	37.925	11.311	13.525
9000.0000	37.901	11.384	13.753
9050.0000	37.959	11.374	13.721
9100.0000	37.954	11.427	13.890
9150.0000	38.073	11.356	13.664
9200.0000	38.170	11.305	13.506

9250.0000	38.173	11.350	13.646
9300.0000	38.406	11.163	13.072
9350.0000	38.559	11.057	12.756
9400.0000	38.549	11.113	12.922
9450.0000	38.649	11.060	12.764
9500.0000	38.686	11.069	12.790
9550.0000	38.792	11.009	12.614
9600.0000	38.721	11.124	12.955
9650.0000	38.694	11.196	13.171
9700.0000	38.758	11.177	13.114
9750.0000	38.802	11.178	13.116
9800.0000	38.801	11.224	13.255
9850.0000	38.844	11.224	13.257
9900.0000	38.852	11.260	13.367
9950.0000	38.866	11.290	13.459
10000.0000	38.913	11.287	13.451
10050.0000	38.943	11.300	13.490
10100.0000	38.984	11.302	13.497
10150.0000	39.014	11.316	13.538
10200.0000	39.060	11.313	13.529
10250.0000	39.065	11.350	13.645
10300.0000	39.055	11.402	13.810
10350.0000	39.083	11.415	13.853
10400.0000	39.073	11.467	14.020
10450.0000	39.121	11.461	14.000
10500.0000	39.167	11.456	13.984
10550.0000	39.210	11.455	13.980
10600.0000	39.235	11.472	14.033
10650.0000	39.272	11.474	14.043
10700.0000	39.290	11.498	14.118
10750.0000	39.256	11.572	14.362
10800.0000	39.238	11.631	14.557
10850.0000	39.137	11.771	15.036
10900.0000	39.074	11.874	15.397
10950.0000	39.007	11.981	15.780
11000.0000	38.966	12.062	16.077
11050.0000	38.999	12.068	16.099
11100.0000	39.101	12.005	15.868
11150.0000	39.201	11.944	15.647
11200.0000	39.303	11.881	15.421
11250.0000	39.515	11.709	14.820
11300.0000	39.681	11.580	14.389
11350.0000	39.768	11.531	14.228
11400.0000	39.811	11.527	14.214
11450.0000	39.830	11.547	14.278
11500.0000	39.861	11.553	14.299

11550.0000	39.915	11.537	14.246
11600.0000	39.943	11.547	14.278
11650.0000	39.937	11.590	14.420
11700.0000	39.957	11.607	14.477
11750.0000	40.073	11.528	14.216
11800.0000	40.051	11.587	14.411
11850.0000	40.100	11.575	14.370
11900.0000	40.176	11.535	14.240
11950.0000	40.417	11.330	13.584
12000.0000	40.544	11.239	13.302
12050.0000	40.566	11.254	13.347
12100.0000	40.553	11.302	13.497
12150.0000	40.483	11.408	13.830
12200.0000	40.268	11.659	14.652
12250.0000	40.011	11.951	15.672
12300.0000	39.857	12.142	16.374
12350.0000	39.736	12.297	16.971
12400.0000	39.686	12.382	17.307
12450.0000	39.619	12.485	17.720
12500.0000	39.626	12.512	17.832
12550.0000	39.558	12.615	18.260
12600.0000	39.474	12.734	18.766
12650.0000	39.268	12.973	19.831
12700.0000	39.106	13.170	20.749
12750.0000	39.018	13.293	21.343
12800.0000	38.950	13.395	21.850
12850.0000	38.958	13.421	21.981
12900.0000	39.053	13.359	21.672
12950.0000	39.219	13.226	21.019
13000.0000	39.271	13.207	20.929
13050.0000	39.497	13.015	20.022
13100.0000	39.635	12.911	19.547
13150.0000	39.839	12.740	18.792
13200.0000	39.881	12.731	18.753
13250.0000	40.021	12.624	18.296
13300.0000	40.243	12.434	17.515
13350.0000	40.348	12.361	17.224
13400.0000	40.413	12.329	17.096
13450.0000	40.590	12.184	16.536
13500.0000	40.599	12.208	16.626
13550.0000	40.572	12.266	16.852
13600.0000	40.442	12.429	17.494
13650.0000	40.459	12.443	17.552
13700.0000	40.440	12.494	17.759
13750.0000	40.459	12.507	17.812
13800.0000	40.570	12.427	17.488

13850.0000	40.730	12.299	16.979
13900.0000	40.872	12.189	16.553
13950.0000	41.010	12.081	16.148
14000.0000	41.098	12.024	15.938
14050.0000	41.286	11.867	15.372
14100.0000	41.378	11.807	15.159
14150.0000	41.635	11.581	14.390
14200.0000	41.682	11.563	14.333
14250.0000	41.796	11.481	14.063
14300.0000	41.988	11.318	13.547
14350.0000	42.277	11.061	12.766
14400.0000	42.458	10.909	12.329
14450.0000	42.825	10.572	11.408
14500.0000	43.225	10.202	10.477
14550.0000	43.899	9.559	9.034
14600.0000	44.356	9.132	8.188
14650.0000	44.871	8.646	7.321
14700.0000	45.013	8.534	7.135
14750.0000	44.752	8.824	7.628
14800.0000	44.159	9.447	8.804
14850.0000	43.350	10.285	10.678
14900.0000	42.523	11.140	13.003
14950.0000	41.803	11.890	15.452
15000.0000	41.043	12.679	18.531
15050.0000	40.413	13.338	21.567
15100.0000	39.901	13.879	24.427
15150.0000	39.474	14.334	27.128
15200.0000	39.083	14.754	29.881
15250.0000	38.744	15.122	32.521
15300.0000	38.498	15.395	34.637
15350.0000	38.298	15.625	36.514
15400.0000	38.136	15.815	38.148
15450.0000	38.038	15.941	39.272
15500.0000	37.948	16.058	40.349
15550.0000	37.868	16.167	41.370
15600.0000	37.817	16.246	42.128
15650.0000	37.811	16.279	42.454
15700.0000	37.774	16.343	43.087
15750.0000	37.743	16.402	43.675
15800.0000	37.730	16.444	44.092
15850.0000	37.729	16.471	44.374
15900.0000	37.721	16.506	44.735
15950.0000	37.808	16.448	44.133
16000.0000	37.872	16.411	43.759
16050.0000	37.980	16.329	42.946
16100.0000	38.070	16.266	42.328

16150.0000	38.189	16.175	41.445
16200.0000	38.302	16.088	40.627
16250.0000	38.335	16.082	40.570
16300.0000	38.442	16.001	39.823
16350.0000	38.542	15.929	39.162
16400.0000	38.673	15.824	38.229
16450.0000	38.797	15.726	37.378
16500.0000	38.963	15.586	36.194
16550.0000	39.141	15.435	34.954
16600.0000	39.352	15.251	33.501
16650.0000	39.579	15.050	31.986
16700.0000	39.832	14.823	30.358
16750.0000	40.076	14.604	28.868
16800.0000	40.420	14.287	26.832
16850.0000	40.810	13.921	24.669
16900.0000	41.124	13.633	23.085
16950.0000	41.352	13.432	22.038
17000.0000	41.517	13.291	21.338
17050.0000	41.606	13.229	21.032
17100.0000	41.658	13.201	20.900
17150.0000	41.800	13.086	20.350
17200.0000	42.000	12.910	19.545
17250.0000	42.280	12.656	18.433
17300.0000	42.516	12.445	17.559
17350.0000	42.732	12.253	16.802
17400.0000	42.950	12.060	16.071
17450.0000	43.121	11.914	15.540
17500.0000	43.225	11.836	15.261
17550.0000	43.301	11.785	15.083
17600.0000	43.274	11.836	15.262
17650.0000	43.206	11.929	15.592
17700.0000	42.967	12.192	16.566
17750.0000	42.764	12.420	17.458
17800.0000	42.632	12.576	18.098
17850.0000	42.468	12.764	18.899
17900.0000	42.548	12.710	18.662
17950.0000	42.739	12.542	17.956
18000.0000	43.134	12.172	16.488

Date of Calibration = August 3, 2020

Date Printed: Monday, August 3, 2020 12:06 PM

Customer Name: Compliance Testing LLC

Antenna Manufacturer: ARA

Antenna Model: DRG-118/A

Antenna Serial No.: 1176

Temperature (Deg C): 23.0

Humidity (%): 50.0

Measurement Distance in Meters = 3.0

Antenna Polarization = VERT

NOTES: Observed Pin Depth: -0.0011" from typical.

CAL CERT #: 200803-095012-b16fe9

Freq (MHz)	ACF (dB)	Gain (dBi)	Num GAIN
1000.0000	24.239	5.961	3.945
1010.0000	24.259	6.027	4.006
1020.0000	24.274	6.099	4.072
1030.0000	24.317	6.140	4.111
1040.0000	24.397	6.143	4.115
1050.0000	24.575	6.048	4.026
1060.0000	24.722	5.984	3.966
1070.0000	24.821	5.966	3.950
1080.0000	24.837	6.031	4.010
1090.0000	24.834	6.114	4.087
1100.0000	24.796	6.232	4.199
1110.0000	24.729	6.377	4.342
1120.0000	24.670	6.514	4.481
1130.0000	24.596	6.666	4.641
1140.0000	24.547	6.792	4.777
1150.0000	24.559	6.854	4.847
1160.0000	24.620	6.869	4.863
1170.0000	24.678	6.885	4.881
1180.0000	24.759	6.879	4.874
1190.0000	24.826	6.884	4.880
1200.0000	24.883	6.901	4.899
1210.0000	24.939	6.916	4.916
1220.0000	24.947	6.980	4.989
1230.0000	24.965	7.034	5.051
1240.0000	24.989	7.080	5.105
1250.0000	25.009	7.130	5.164
1260.0000	25.061	7.146	5.183

1270.0000	25.013	7.263	5.325
1280.0000	24.959	7.385	5.477
1290.0000	24.959	7.453	5.563
1300.0000	24.937	7.542	5.678
1310.0000	24.985	7.561	5.703
1320.0000	24.965	7.647	5.817
1330.0000	24.929	7.748	5.954
1340.0000	24.935	7.807	6.035
1350.0000	24.868	7.938	6.221
1360.0000	24.870	8.000	6.310
1370.0000	24.874	8.061	6.398
1380.0000	24.871	8.127	6.496
1390.0000	24.922	8.139	6.514
1400.0000	25.020	8.103	6.461
1410.0000	25.069	8.116	6.480
1420.0000	25.068	8.178	6.573
1430.0000	25.074	8.232	6.656
1440.0000	25.078	8.290	6.745
1450.0000	25.049	8.378	6.884
1460.0000	25.026	8.461	7.016
1470.0000	25.032	8.515	7.103
1480.0000	25.055	8.551	7.162
1490.0000	25.077	8.586	7.222
1500.0000	25.024	8.697	7.409
1510.0000	25.061	8.719	7.445
1520.0000	25.082	8.754	7.507
1530.0000	25.056	8.837	7.651
1540.0000	25.010	8.941	7.836
1550.0000	24.975	9.032	8.002
1560.0000	24.983	9.080	8.090
1570.0000	25.000	9.118	8.162
1580.0000	25.025	9.148	8.219
1590.0000	25.054	9.174	8.268
1600.0000	25.089	9.193	8.305
1610.0000	25.207	9.129	8.183
1620.0000	25.335	9.056	8.046
1630.0000	25.328	9.115	8.157
1640.0000	25.366	9.130	8.185
1650.0000	25.458	9.092	8.113
1660.0000	25.453	9.150	8.222
1670.0000	25.478	9.177	8.273
1680.0000	25.502	9.204	8.325
1690.0000	25.449	9.308	8.528
1700.0000	25.448	9.361	8.632
1710.0000	25.441	9.418	8.747
1720.0000	25.367	9.543	9.002

1730.0000	25.383	9.577	9.073
1740.0000	25.408	9.603	9.126
1750.0000	25.405	9.656	9.238
1760.0000	25.462	9.649	9.223
1770.0000	25.523	9.637	9.198
1780.0000	25.613	9.596	9.111
1790.0000	25.744	9.514	8.940
1800.0000	25.885	9.421	8.751
1810.0000	26.013	9.340	8.591
1820.0000	26.119	9.283	8.478
1830.0000	26.157	9.292	8.496
1840.0000	26.178	9.319	8.548
1850.0000	26.233	9.310	8.531
1860.0000	26.292	9.299	8.509
1870.0000	26.403	9.234	8.383
1880.0000	26.504	9.180	8.279
1890.0000	26.588	9.141	8.206
1900.0000	26.679	9.097	8.122
1910.0000	26.808	9.013	7.967
1920.0000	26.968	8.898	7.759
1930.0000	27.123	8.788	7.565
1940.0000	27.262	8.695	7.404
1950.0000	27.422	8.578	7.208
1960.0000	27.594	8.452	7.001
1970.0000	27.694	8.396	6.911
1980.0000	27.793	8.340	6.824
1990.0000	27.922	8.256	6.692
2000.0000	28.014	8.207	6.617
2010.0000	28.118	8.146	6.525
2020.0000	28.193	8.114	6.477
2030.0000	28.248	8.101	6.459
2040.0000	28.296	8.097	6.452
2050.0000	28.342	8.093	6.446
2060.0000	28.323	8.154	6.538
2070.0000	28.282	8.237	6.664
2080.0000	28.278	8.284	6.735
2090.0000	28.259	8.343	6.829
2100.0000	28.267	8.377	6.882
2110.0000	28.244	8.442	6.985
2120.0000	28.232	8.494	7.070
2130.0000	28.282	8.485	7.056
2140.0000	28.316	8.492	7.067
2150.0000	28.276	8.572	7.198
2160.0000	28.278	8.611	7.263
2170.0000	28.235	8.694	7.403
2180.0000	28.196	8.773	7.539

2190.0000	28.111	8.898	7.759
2200.0000	27.991	9.058	8.050
2210.0000	27.927	9.161	8.243
2220.0000	27.839	9.288	8.488
2230.0000	27.732	9.434	8.778
2240.0000	27.701	9.503	8.920
2250.0000	27.634	9.610	9.141
2260.0000	27.596	9.687	9.304
2270.0000	27.648	9.672	9.273
2280.0000	27.667	9.692	9.315
2290.0000	27.675	9.722	9.380
2300.0000	27.702	9.732	9.402
2310.0000	27.733	9.740	9.418
2320.0000	27.786	9.724	9.384
2330.0000	27.848	9.700	9.332
2340.0000	27.906	9.678	9.286
2350.0000	27.942	9.679	9.288
2360.0000	28.043	9.616	9.153
2370.0000	28.028	9.666	9.261
2380.0000	28.059	9.673	9.274
2390.0000	28.046	9.721	9.379
2400.0000	27.971	9.834	9.624
2410.0000	28.030	9.810	9.572
2420.0000	28.008	9.869	9.702
2430.0000	28.096	9.816	9.585
2440.0000	28.170	9.778	9.501
2450.0000	28.178	9.805	9.561
2460.0000	28.281	9.738	9.414
2470.0000	28.370	9.683	9.297
2480.0000	28.495	9.594	9.108
2490.0000	28.533	9.590	9.100
2500.0000	28.573	9.585	9.090
2510.0000	28.654	9.540	8.994
2520.0000	28.804	9.425	8.759
2530.0000	28.859	9.403	8.716
2540.0000	28.862	9.435	8.780
2550.0000	28.937	9.394	8.697
2560.0000	28.978	9.386	8.682
2570.0000	29.020	9.379	8.667
2580.0000	29.038	9.395	8.699
2590.0000	29.064	9.401	8.713
2600.0000	29.158	9.342	8.594
2610.0000	29.295	9.238	8.391
2620.0000	29.411	9.155	8.232
2630.0000	29.490	9.109	8.145
2640.0000	29.504	9.128	8.181

2650.0000	29.540	9.125	8.175
2660.0000	29.561	9.136	8.197
2670.0000	29.571	9.159	8.240
2680.0000	29.566	9.196	8.311
2690.0000	29.543	9.253	8.419
2700.0000	29.553	9.275	8.462
2710.0000	29.531	9.328	8.567
2720.0000	29.528	9.364	8.637
2730.0000	29.491	9.433	8.775
2740.0000	29.433	9.523	8.959
2750.0000	29.492	9.494	8.901
2760.0000	29.511	9.507	8.927
2770.0000	29.493	9.557	9.030
2780.0000	29.511	9.569	9.056
2790.0000	29.569	9.544	9.002
2800.0000	29.608	9.535	8.985
2810.0000	29.613	9.561	9.039
2820.0000	29.611	9.593	9.106
2830.0000	29.629	9.606	9.133
2840.0000	29.628	9.638	9.201
2850.0000	29.628	9.669	9.266
2860.0000	29.604	9.723	9.382
2870.0000	29.614	9.744	9.427
2880.0000	29.589	9.799	9.548
2890.0000	29.558	9.860	9.683
2900.0000	29.542	9.906	9.786
2910.0000	29.528	9.950	9.885
2920.0000	29.560	9.947	9.879
2930.0000	29.550	9.988	9.972
2940.0000	29.570	9.997	9.993
2950.0000	29.683	9.914	9.803
2960.0000	29.748	9.878	9.723
2970.0000	29.786	9.870	9.704
2980.0000	29.869	9.816	9.584
2990.0000	29.965	9.748	9.437
3000.0000	30.039	9.704	9.341
3050.0000	30.061	9.825	9.605
3100.0000	29.996	10.032	10.073
3150.0000	30.256	9.911	9.796
3200.0000	30.419	9.883	9.735
3250.0000	30.193	10.245	10.580
3300.0000	30.255	10.315	10.753
3350.0000	30.737	9.963	9.916
3400.0000	30.718	10.112	10.261
3450.0000	30.595	10.361	10.867
3500.0000	31.114	9.967	9.925

3550.0000	31.538	9.666	9.260
3600.0000	31.325	10.001	10.002
3650.0000	30.972	10.473	11.152
3700.0000	30.774	10.790	11.995
3750.0000	30.632	11.048	12.730
3800.0000	30.624	11.172	13.097
3850.0000	30.498	11.412	13.841
3900.0000	30.435	11.587	14.410
3950.0000	30.737	11.395	13.788
4000.0000	30.994	11.248	13.328
4050.0000	30.963	11.386	13.760
4100.0000	31.043	11.412	13.843
4150.0000	31.211	11.349	13.644
4200.0000	31.512	11.152	13.039
4250.0000	31.586	11.181	13.126
4300.0000	31.540	11.329	13.581
4350.0000	31.570	11.399	13.802
4400.0000	31.654	11.415	13.852
4450.0000	31.614	11.554	14.301
4500.0000	31.508	11.756	14.983
4550.0000	31.655	11.706	14.810
4600.0000	31.911	11.544	14.269
4650.0000	31.969	11.580	14.388
4700.0000	32.213	11.429	13.896
4750.0000	32.725	11.009	12.615
4800.0000	32.991	10.834	12.117
4850.0000	33.023	10.891	12.278
4900.0000	32.970	11.034	12.688
4950.0000	33.095	10.998	12.582
5000.0000	33.393	10.787	11.986
5050.0000	33.412	10.854	12.173
5100.0000	33.425	10.927	12.379
5150.0000	33.523	10.913	12.340
5200.0000	33.480	11.041	12.707
5250.0000	33.567	11.037	12.696
5300.0000	33.530	11.156	13.049
5350.0000	33.502	11.265	13.381
5400.0000	33.476	11.371	13.713
5450.0000	33.501	11.426	13.888
5500.0000	33.666	11.341	13.618
5550.0000	33.612	11.474	14.041
5600.0000	33.491	11.673	14.699
5650.0000	33.470	11.770	15.033
5700.0000	33.428	11.889	15.450
5750.0000	33.572	11.822	15.211
5800.0000	33.707	11.762	15.003

5850.0000	33.949	11.594	14.435
5900.0000	34.286	11.331	13.586
5950.0000	34.561	11.130	12.971
6000.0000	34.752	11.011	12.621
6050.0000	34.933	10.902	12.309
6100.0000	34.866	11.040	12.707
6150.0000	34.712	11.265	13.382
6200.0000	34.616	11.432	13.906
6250.0000	34.683	11.434	13.913
6300.0000	34.775	11.411	13.840
6350.0000	34.706	11.549	14.286
6400.0000	34.771	11.552	14.297
6450.0000	34.996	11.396	13.790
6500.0000	35.219	11.240	13.303
6550.0000	35.377	11.147	13.024
6600.0000	35.587	11.003	12.599
6650.0000	35.794	10.863	12.198
6700.0000	35.995	10.727	11.822
6750.0000	36.084	10.702	11.754
6800.0000	36.225	10.626	11.549
6850.0000	36.425	10.488	11.190
6900.0000	36.569	10.408	10.985
6950.0000	36.791	10.248	10.589
7000.0000	37.027	10.075	10.174
7050.0000	37.342	9.822	9.598
7100.0000	37.552	9.673	9.275
7150.0000	37.654	9.632	9.188
7200.0000	37.524	9.822	9.599
7250.0000	37.573	9.833	9.624
7300.0000	37.582	9.885	9.738
7350.0000	37.507	10.018	10.042
7400.0000	37.387	10.198	10.466
7450.0000	37.442	10.201	10.474
7500.0000	37.467	10.234	10.554
7550.0000	37.490	10.269	10.639
7600.0000	37.408	10.408	10.985
7650.0000	37.445	10.428	11.036
7700.0000	37.407	10.522	11.278
7750.0000	37.441	10.546	11.338
7800.0000	37.444	10.597	11.475
7850.0000	37.430	10.668	11.662
7900.0000	37.395	10.758	11.906
7950.0000	37.329	10.879	12.242
8000.0000	37.251	11.010	12.619
8050.0000	37.226	11.090	12.853
8100.0000	37.248	11.122	12.947

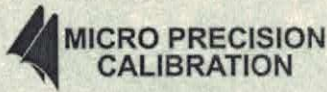
8150.0000	37.262	11.162	13.066
8200.0000	37.254	11.223	13.251
8250.0000	37.330	11.199	13.180
8300.0000	37.370	11.211	13.217
8350.0000	37.424	11.210	13.213
8400.0000	37.305	11.380	13.741
8450.0000	37.279	11.458	13.990
8500.0000	37.365	11.424	13.879
8550.0000	37.373	11.466	14.016
8600.0000	37.460	11.430	13.899
8650.0000	37.528	11.413	13.844
8700.0000	37.600	11.391	13.774
8750.0000	37.699	11.342	13.619
8800.0000	37.759	11.331	13.586
8850.0000	37.803	11.335	13.600
8900.0000	37.886	11.301	13.494
8950.0000	37.925	11.311	13.525
9000.0000	37.901	11.384	13.753
9050.0000	37.959	11.374	13.721
9100.0000	37.954	11.427	13.890
9150.0000	38.073	11.356	13.664
9200.0000	38.170	11.305	13.506
9250.0000	38.173	11.350	13.646
9300.0000	38.406	11.163	13.072
9350.0000	38.559	11.057	12.756
9400.0000	38.549	11.113	12.922
9450.0000	38.649	11.060	12.764
9500.0000	38.686	11.069	12.790
9550.0000	38.792	11.009	12.614
9600.0000	38.721	11.124	12.955
9650.0000	38.694	11.196	13.171
9700.0000	38.758	11.177	13.114
9750.0000	38.802	11.178	13.116
9800.0000	38.801	11.224	13.255
9850.0000	38.844	11.224	13.257
9900.0000	38.852	11.260	13.367
9950.0000	38.866	11.290	13.459
10000.0000	38.913	11.287	13.451
10050.0000	38.943	11.300	13.490
10100.0000	38.984	11.302	13.497
10150.0000	39.014	11.316	13.538
10200.0000	39.060	11.313	13.529
10250.0000	39.065	11.350	13.645
10300.0000	39.055	11.402	13.810
10350.0000	39.083	11.415	13.853
10400.0000	39.073	11.467	14.020

10450.0000	39.121	11.461	14.000
10500.0000	39.167	11.456	13.984
10550.0000	39.210	11.455	13.980
10600.0000	39.235	11.472	14.033
10650.0000	39.272	11.474	14.043
10700.0000	39.290	11.498	14.118
10750.0000	39.256	11.572	14.362
10800.0000	39.238	11.631	14.557
10850.0000	39.137	11.771	15.036
10900.0000	39.074	11.874	15.397
10950.0000	39.007	11.981	15.780
11000.0000	38.966	12.062	16.077
11050.0000	38.999	12.068	16.099
11100.0000	39.101	12.005	15.868
11150.0000	39.201	11.944	15.647
11200.0000	39.303	11.881	15.421
11250.0000	39.515	11.709	14.820
11300.0000	39.681	11.580	14.389
11350.0000	39.768	11.531	14.228
11400.0000	39.811	11.527	14.214
11450.0000	39.830	11.547	14.278
11500.0000	39.861	11.553	14.299
11550.0000	39.915	11.537	14.246
11600.0000	39.943	11.547	14.278
11650.0000	39.937	11.590	14.420
11700.0000	39.957	11.607	14.477
11750.0000	40.073	11.528	14.216
11800.0000	40.051	11.587	14.411
11850.0000	40.100	11.575	14.370
11900.0000	40.176	11.535	14.240
11950.0000	40.417	11.330	13.584
12000.0000	40.544	11.239	13.302
12050.0000	40.566	11.254	13.347
12100.0000	40.553	11.302	13.497
12150.0000	40.483	11.408	13.830
12200.0000	40.268	11.659	14.652
12250.0000	40.011	11.951	15.672
12300.0000	39.857	12.142	16.374
12350.0000	39.736	12.297	16.971
12400.0000	39.686	12.382	17.307
12450.0000	39.619	12.485	17.720
12500.0000	39.626	12.512	17.832
12550.0000	39.558	12.615	18.260
12600.0000	39.474	12.734	18.766
12650.0000	39.268	12.973	19.831
12700.0000	39.106	13.170	20.749

12750.0000	39.018	13.293	21.343
12800.0000	38.950	13.395	21.850
12850.0000	38.958	13.421	21.981
12900.0000	39.053	13.359	21.672
12950.0000	39.219	13.226	21.019
13000.0000	39.271	13.207	20.929
13050.0000	39.497	13.015	20.022
13100.0000	39.635	12.911	19.547
13150.0000	39.839	12.740	18.792
13200.0000	39.881	12.731	18.753
13250.0000	40.021	12.624	18.296
13300.0000	40.243	12.434	17.515
13350.0000	40.348	12.361	17.224
13400.0000	40.413	12.329	17.096
13450.0000	40.590	12.184	16.536
13500.0000	40.599	12.208	16.626
13550.0000	40.572	12.266	16.852
13600.0000	40.442	12.429	17.494
13650.0000	40.459	12.443	17.552
13700.0000	40.440	12.494	17.759
13750.0000	40.459	12.507	17.812
13800.0000	40.570	12.427	17.488
13850.0000	40.730	12.299	16.979
13900.0000	40.872	12.189	16.553
13950.0000	41.010	12.081	16.148
14000.0000	41.098	12.024	15.938
14050.0000	41.286	11.867	15.372
14100.0000	41.378	11.807	15.159
14150.0000	41.635	11.581	14.390
14200.0000	41.682	11.563	14.333
14250.0000	41.796	11.481	14.063
14300.0000	41.988	11.318	13.547
14350.0000	42.277	11.061	12.766
14400.0000	42.458	10.909	12.329
14450.0000	42.825	10.572	11.408
14500.0000	43.225	10.202	10.477
14550.0000	43.899	9.559	9.034
14600.0000	44.356	9.132	8.188
14650.0000	44.871	8.646	7.321
14700.0000	45.013	8.534	7.135
14750.0000	44.752	8.824	7.628
14800.0000	44.159	9.447	8.804
14850.0000	43.350	10.285	10.678
14900.0000	42.523	11.140	13.003
14950.0000	41.803	11.890	15.452
15000.0000	41.043	12.679	18.531

15050.0000	40.413	13.338	21.567
15100.0000	39.901	13.879	24.427
15150.0000	39.474	14.334	27.128
15200.0000	39.083	14.754	29.881
15250.0000	38.744	15.122	32.521
15300.0000	38.498	15.395	34.637
15350.0000	38.298	15.625	36.514
15400.0000	38.136	15.815	38.148
15450.0000	38.038	15.941	39.272
15500.0000	37.948	16.058	40.349
15550.0000	37.868	16.167	41.370
15600.0000	37.817	16.246	42.128
15650.0000	37.811	16.279	42.454
15700.0000	37.774	16.343	43.087
15750.0000	37.743	16.402	43.675
15800.0000	37.730	16.444	44.092
15850.0000	37.729	16.471	44.374
15900.0000	37.721	16.506	44.735
15950.0000	37.808	16.448	44.133
16000.0000	37.872	16.411	43.759
16050.0000	37.980	16.329	42.946
16100.0000	38.070	16.266	42.328
16150.0000	38.189	16.175	41.445
16200.0000	38.302	16.088	40.627
16250.0000	38.335	16.082	40.570
16300.0000	38.442	16.001	39.823
16350.0000	38.542	15.929	39.162
16400.0000	38.673	15.824	38.229
16450.0000	38.797	15.726	37.378
16500.0000	38.963	15.586	36.194
16550.0000	39.141	15.435	34.954
16600.0000	39.352	15.251	33.501
16650.0000	39.579	15.050	31.986
16700.0000	39.832	14.823	30.358
16750.0000	40.076	14.604	28.868
16800.0000	40.420	14.287	26.832
16850.0000	40.810	13.921	24.669
16900.0000	41.124	13.633	23.085
16950.0000	41.352	13.432	22.038
17000.0000	41.517	13.291	21.338
17050.0000	41.606	13.229	21.032
17100.0000	41.658	13.201	20.900
17150.0000	41.800	13.086	20.350
17200.0000	42.000	12.910	19.545
17250.0000	42.280	12.656	18.433
17300.0000	42.516	12.445	17.559

17350.0000	42.732	12.253	16.802
17400.0000	42.950	12.060	16.071
17450.0000	43.121	11.914	15.540
17500.0000	43.225	11.836	15.261
17550.0000	43.301	11.785	15.083
17600.0000	43.274	11.836	15.262
17650.0000	43.206	11.929	15.592
17700.0000	42.967	12.192	16.566
17750.0000	42.764	12.420	17.458
17800.0000	42.632	12.576	18.098
17850.0000	42.468	12.764	18.899
17900.0000	42.548	12.710	18.662
17950.0000	42.739	12.542	17.956
18000.0000	43.134	12.172	16.488



MICRO PRECISION CALIBRATION
 22835 INDUSTRIAL PLACE
 GRASS VALLEY CA 95949
 530-268-1860



Certificate of Calibration

Date: Jun 29, 2018

Cert No. 551220081442532

Customer:

COMPLIANCE TESTING LLC
 1724 S NEVADA WAY
 MESA AZ 85204

Work Order #: SAC-70095565

MPC Control #: DB8287
 Asset ID: I00463
 Gage Type: HARMONIC MIXER
 Manufacturer: AGILENT
 Model Number: 11970V
 Size: N/A
 Temp/RH: 72.0°F / 40.0%
 Location: Calibration performed at MPC facility

Serial Number: 003950
 Department: N/A
 Performed By: TIM GALVIN
 Received Condition: IN TOLERANCE
 Returned Condition: IN TOLERANCE
 Cal. Date: June 29, 2018
 Cal. Interval: 12 MONTHS
 Cal. Due Date: June 29, 2019

Calibration Notes:

See attached for data.

Standards Used to Calibrate Equipment

I.D.	Description.	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
AE4788	SPECTRUM ANALYZER	8565E	3846A01029	HEWLETT PACKARD	Oct 31, 2018	512200813079274
CE4280	WAVE SOURCE	83557A	2948A00105	AGILENT	Feb 28, 2019	512200813268159
Z3548	SWEPT CW GENERATOR	83650L	3844A00330	HEWLETT PACKARD	Dec 31, 2018	512200813171979

Procedures Used in this Event

Procedure Name	Description
KEYSIGHT 11970 SERIES	Harmonic Mixers Keysight 11970 Series Users Guide Jan-1-2015

Calibrating Technician:

TIM GALVIN

QC Approval:

Robert Means

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA's Publication and NIST Technical Note 1297, 1994 Edition. Services rendered comply with ISO/IEC 17025:2005, ANSI/NCSL Z540-1-1994, ANSI/NCSL Z540.3-2006, MPC Quality Manual, MPC CSD and with customer purchase order instructions.

Calibration cycles and resulting due dates were submitted/approved by the customer. Any number of factors may cause an instrument to drift out of tolerance before the next scheduled calibration. Recalibration cycles should be based on frequency of use, environmental conditions and customer's established systematic accuracy. The information on this report, pertains only to the instrument identified.

All standards are traceable to SI through the National Institute of Standards and Technology (NIST) and/or recognized national or international standards laboratories. Services rendered include proper manufacturer's service instruction and are warranted for no less than thirty (30) days. This report may not be reproduced in part or in a whole without the prior written approval of the issuing MPC lab.



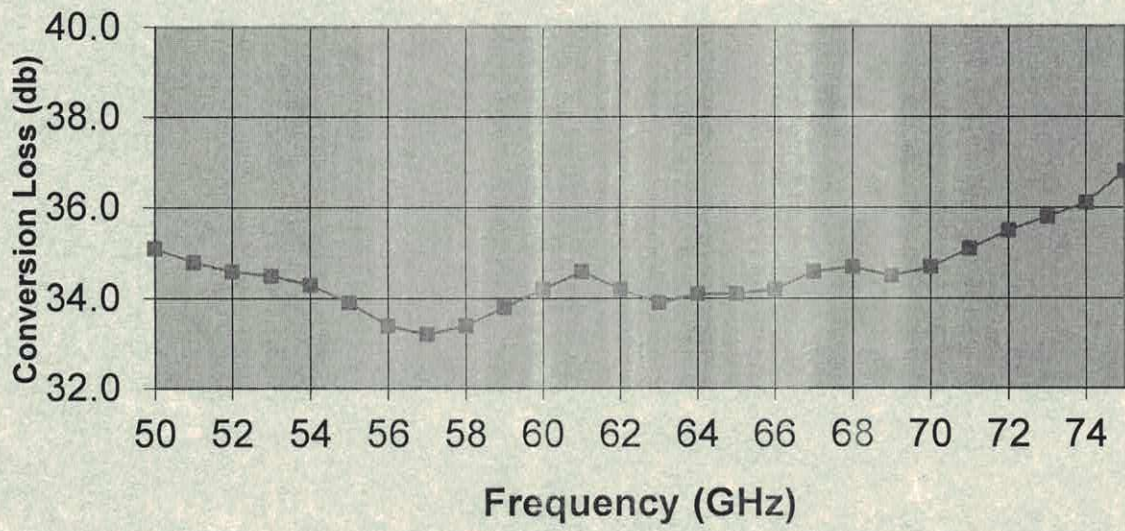
MACRO PRECISION
CALIBRATION INC.

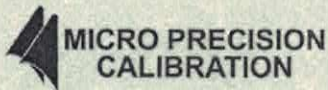
Measurement Report: Harmonic Mixer 11970V

Procedure: Manufacturer Order Number: SAC-70095565

ID Number: DB8287 Calibration Date: June 29, 2018

Frequency (GHz)	Conversion Loss	Uncertainty +/- dB
50.0	35.1	0.6
51.0	34.8	0.6
52.0	34.6	0.6
53.0	34.5	0.6
54.0	34.3	0.6
55.0	33.9	0.6
56.0	33.4	0.6
57.0	33.2	0.6
58.0	33.4	0.6
59.0	33.8	0.6
60.0	34.2	0.6
61.0	34.6	0.6
62.0	34.2	0.6
63.0	33.9	0.6
64.0	34.1	0.6
65.0	34.1	0.6
66.0	34.2	0.6
67.0	34.6	0.6
68.0	34.7	0.6
69.0	34.5	0.6
70.0	34.7	0.6
71.0	35.1	0.6
72.0	35.5	0.6
73.0	35.8	0.6
74.0	36.1	0.6
75.0	36.8	0.6





MICRO PRECISION CALIBRATION
 22835 INDUSTRIAL PLACE
 GRASS VALLEY CA 95949
 530-268-1860



Certificate of Calibration

Date: Jun 29, 2018

Cert No. 551220081442570

Customer:

COMPLIANCE TESTING LLC
 1724 S NEVADA WAY
 MESA AZ 85204

Work Order #: SAC-70095565

MPC Control #: DN0031
 Asset ID: I00464
 Gage Type: HARMONIC MIXER
 Manufacturer: HEWLETT PACKARD
 Model Number: 11970W
 Size: N/A
 Temp/RH: 72.0°F / 40.0%
 Location: Calibration performed at MPC facility

Serial Number: 190
 Department: N/A
 Performed By: TIM GALVIN
 Received Condition: IN TOLERANCE
 Returned Condition: IN TOLERANCE
 Cal. Date: June 29, 2018
 Cal. Interval: 12 MONTHS
 Cal. Due Date: June 29, 2019

Calibration Notes:

See attached for data.

Standards Used to Calibrate Equipment

I.D.	Description.	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
AE4788	SPECTRUM ANALYZER	8565E	3846A01029	HEWLETT PACKARD	Oct 31, 2018	512200813079274
DF9311	WAVE SOURCE MODULE	83554A	2612A00246	HEWLETT PACKARD	Feb 26, 2019	512200813273384
Z3548	SWEPT CW GENERATOR	83650L	3844A00330	HEWLETT PACKARD	Dec 31, 2018	512200813171979

Procedures Used in this Event

Procedure Name	Description
KEYSIGHT 11970 SERIES	Harmonic Mixers Keysight 11970 Series Users Guide Jan-1-2015

Calibrating Technician:

TIM GALVIN

QC Approval:

Robert Means

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA's Publication and NIST Technical Note 1297, 1994 Edition. Services rendered comply with ISO/IEC 17025:2005, ANSI/NCCL Z540-1-1994, ANSI/NCCL Z540.3-2006, MPC Quality Manual, MPC CSD and with customer purchase order instructions.

Calibration cycles and resulting due dates were submitted/approved by the customer. Any number of factors may cause an instrument to drift out of tolerance before the next scheduled calibration. Recalibration cycles should be based on frequency of use, environmental conditions and customer's established systematic accuracy. The information on this report, pertains only to the instrument identified.

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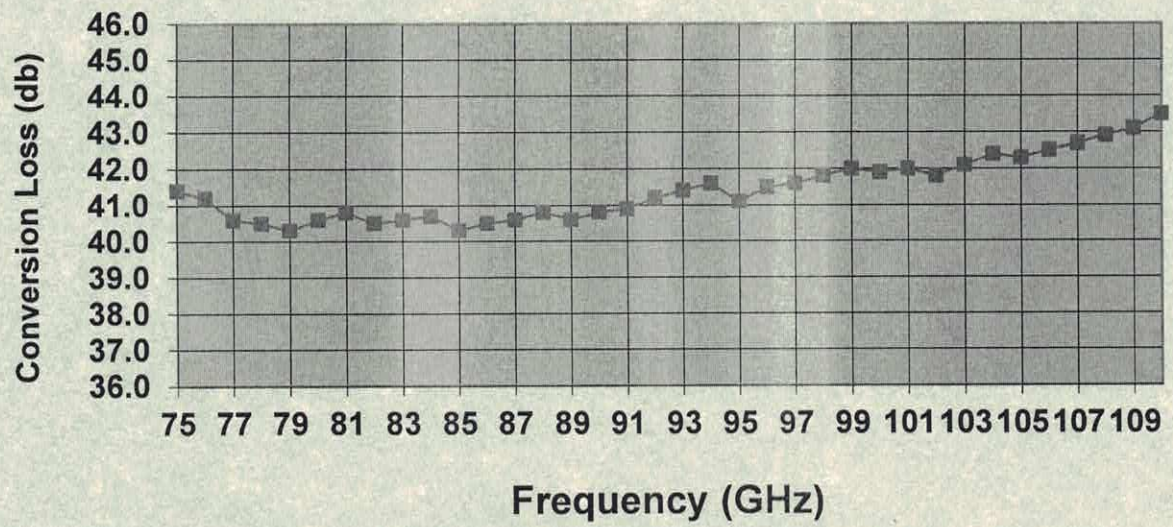


Measurement Report: Harmonic Mixer 11970W

Procedure: Manufacturer Order Number: SAC-70095565

ID Number: DN0031 Calibration Date: June 29, 2018

Frequency (GHz)	Conversion Loss	Uncertainty +/- dB
75.0	41.4	0.6
76.0	41.2	0.6
77.0	40.6	0.6
78.0	40.5	0.6
79.0	40.3	0.6
80.0	40.6	0.6
81.0	40.8	0.6
82.0	40.5	0.6
83.0	40.6	0.6
84.0	40.7	0.6
85.0	40.3	0.6
86.0	40.5	0.6
87.0	40.6	0.6
88.0	40.8	0.6
89.0	40.6	0.6
90.0	40.8	0.6
91.0	40.9	0.6
92.0	41.2	0.6
93.0	41.4	0.6
94.0	41.6	0.6
95.0	41.1	0.6
96.0	41.5	0.6
97.0	41.6	0.6
98.0	41.8	0.6
99.0	42.0	0.6
100.0	41.9	0.6
101.0	42.0	0.6
102.0	41.8	0.6
103.0	42.1	0.6
104.0	42.4	0.6
105.0	42.3	0.6
106.0	42.5	0.6
107.0	42.7	0.6
108.0	42.9	0.6
109.0	43.1	0.6
110.0	43.5	0.6



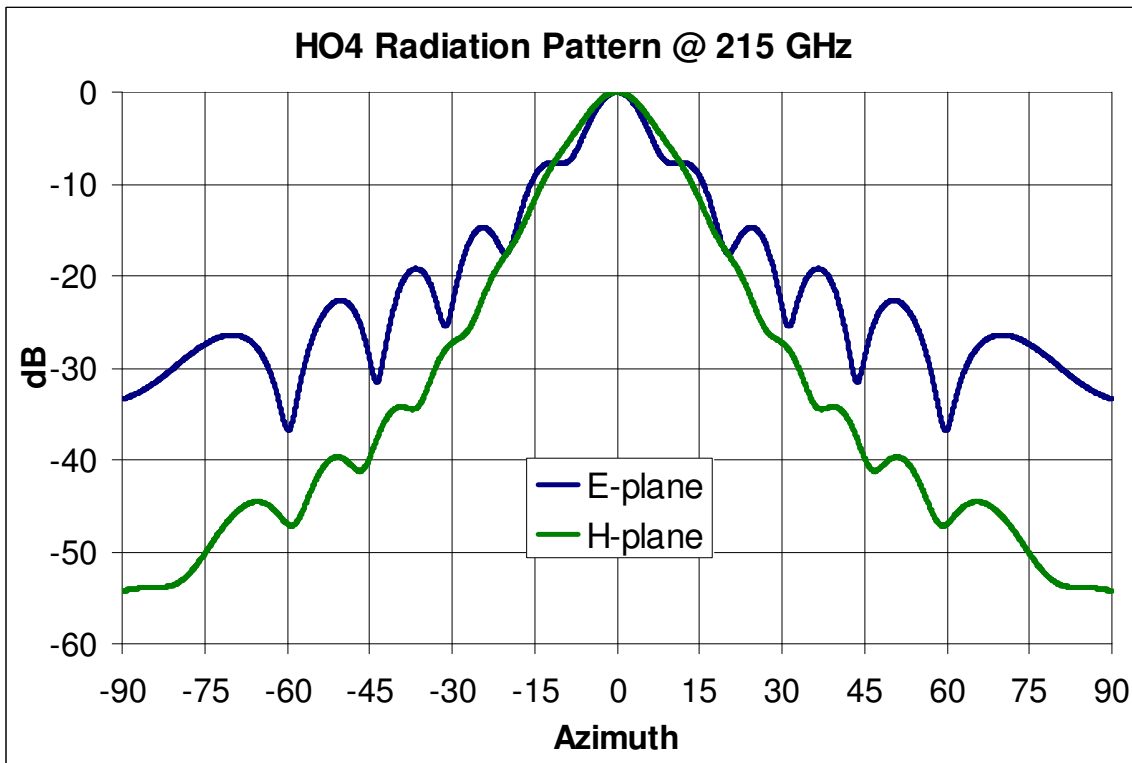
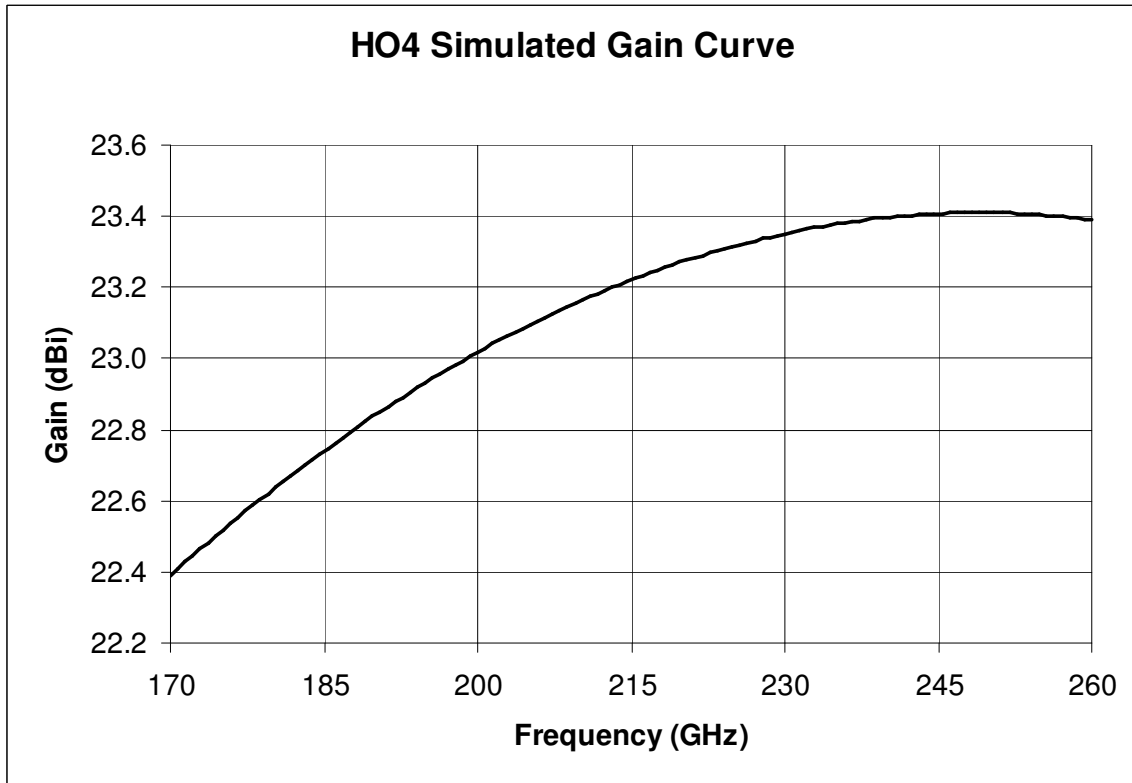
$$ACF = 19.8 - (20 * \text{LOG}(\lambda)) - (10 * \text{LOG}(G_{\text{num}}))$$

λ = wavelength in meters = speed of light / frequency (Hz) => v/f

Speed of Light = 299792458 (m/sec) $\approx 3 \times 10^8$

G_{num} = Numeric Antenna Gain = $10^{(\text{Gain}_{\text{dBi}}/10)}$

Asset # i00484 (33 - 50 GHz Horn antenna)						
Frequency	Frequency	speed of light	wavelength	Ant Gain	Antenna Gain	ACF
GHz	Hz	m/sec	m	dBi	numeric	dB
170	1.7E+11	299792458	0.001763485	22.4	173.78	52.47
180	1.8E+11	299792458	0.001665514	22.58	181.13	52.79
185	1.85E+11	299792458	0.0016205	22.75	188.36	52.86
190	1.9E+11	299792458	0.001577855	22.8	190.55	53.04
200	2E+11	299792458	0.001498962	23	199.53	53.28
207	2.07E+11	299792458	0.001448273	23.1	204.17	53.48
215	2.15E+11	299792458	0.001394384	23.22	209.89	53.69
223	2.23E+11	299792458	0.001344361	23.3	213.80	53.93
230	2.3E+11	299792458	0.001303445	23.35	216.27	54.15
237	2.37E+11	299792458	0.001264947	23.38	217.77	54.38
245	2.45E+11	299792458	0.001223643	23.4	218.78	54.65
250	2.5E+11	299792458	0.00119917	23.4	218.78	54.82
260	2.6E+11	299792458	0.001153048	23.4	218.78	55.16



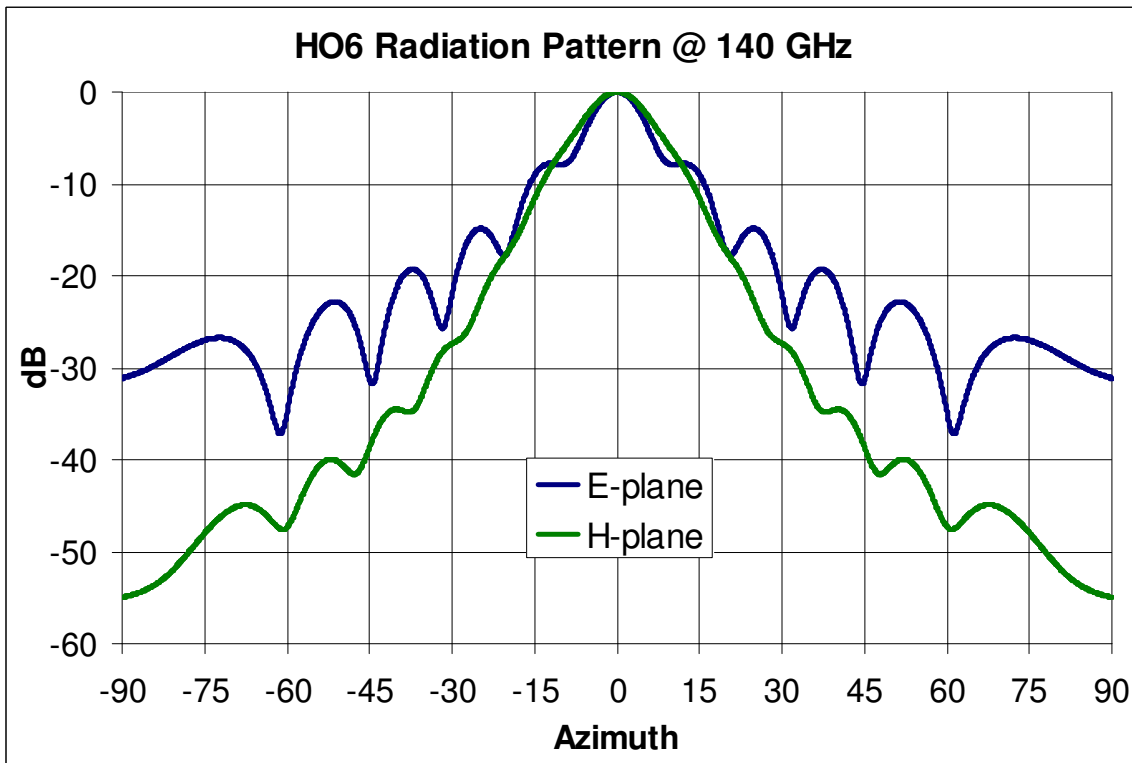
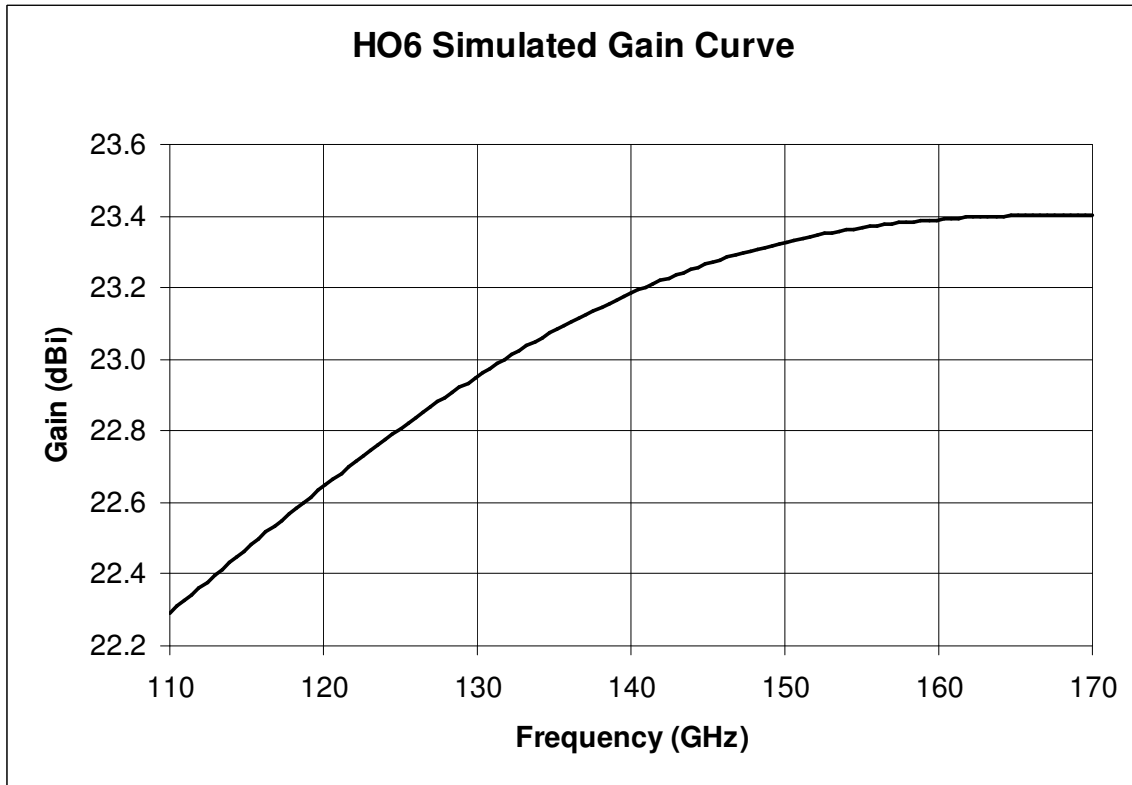
$$ACF = 19.8 - (20 * \text{LOG}(\lambda)) - (10 * \text{LOG}(G_{\text{num}}))$$

λ = wavelength in meters = speed of light / frequency (Hz) => v/f

Speed of Light = 299792458 (m/sec) $\approx 3 \times 10^8$

G_{num} = Numeric Antenna Gain = $10^{(\text{Gain}_{\text{dBi}}/10)}$

Asset # i00484 (33 - 50 GHz Horn antenna)						
Frequency	Frequency	speed of light	wavelength	Ant Gain	Antenna Gain	ACF
GHz	Hz	m/sec	m	dBi	numeric	dB
110	1.1E+11	299792458	0.002725386	22.3	169.82	48.79
115	1.15E+11	299792458	0.002606891	22.5	177.83	48.98
120	1.2E+11	299792458	0.00249827	22.62	182.81	49.23
125	1.25E+11	299792458	0.00239834	22.8	190.55	49.40
130	1.3E+11	299792458	0.002306096	22.96	197.70	49.58
135	1.35E+11	299792458	0.002220685	23.08	203.24	49.79
140	1.4E+11	299792458	0.002141375	23.19	208.45	50.00
145	1.45E+11	299792458	0.002067534	23.27	212.32	50.22
150	1.5E+11	299792458	0.001998616	23.36	216.77	50.43
155	1.55E+11	299792458	0.001934145	23.38	217.77	50.69
160	1.6E+11	299792458	0.001873703	23.9	245.47	50.45
165	1.65E+11	299792458	0.001816924	24	251.19	50.61
170	1.7E+11	299792458	0.001763485	24	251.19	50.87



Antenna Gain to Antenna correction factor conversion worksheet

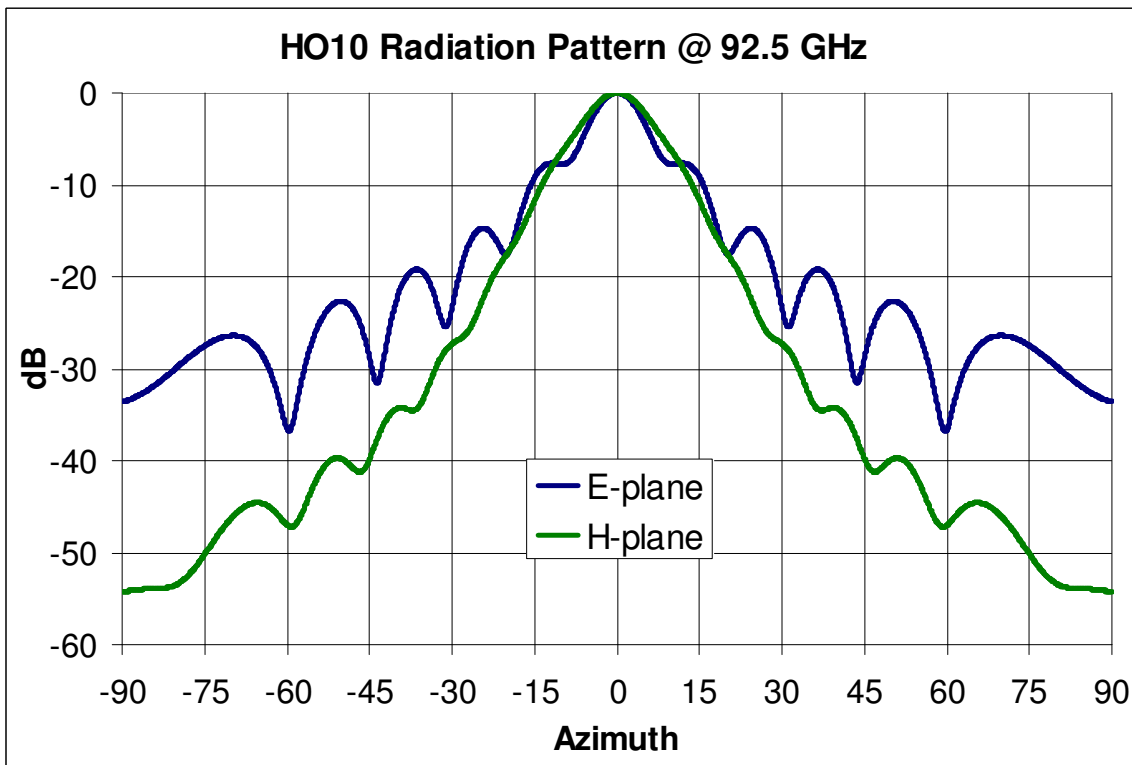
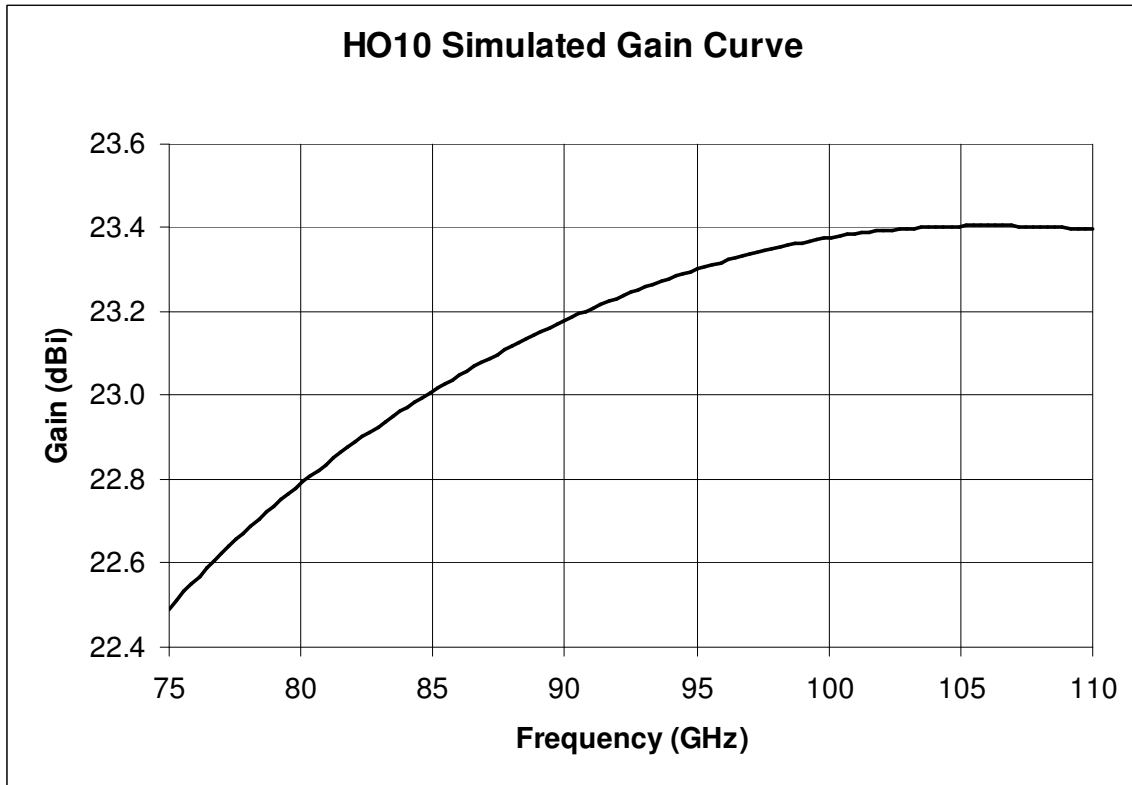
$$ACF = 19.8 - (20 * \text{LOG}(\lambda)) - (10 * \text{LOG}(G_{\text{num}}))$$

λ = wavelength in meters = speed of light / frequency (Hz) => v/f

Speed of Light = 299792458 (m/sec) $\approx 3 \times 10^8$

G_{num} = Numeric Antenna Gain = $10^{(\text{Gain}_{\text{dBi}}/10)}$

Asset # i00476 (75 - 110 GHz Horn antenna)						
Frequency	Frequency	speed of light	wavelength	Ant Gain	Antenna Gain	ACF
GHz	Hz	m/sec	m	dBi	numeric	dB
75	75000000000	299792458	0.003997233	22.5	177.83	45.26
76	76000000000	299792458	0.003944638	22.56	180.30	45.32
77	77000000000	299792458	0.003893409	22.6	181.97	45.39
78	78000000000	299792458	0.003843493	22.65	184.08	45.46
79	79000000000	299792458	0.003794841	22.7	186.21	45.52
80	80000000000	299792458	0.003747406	22.75	188.36	45.58
81	81000000000	299792458	0.003701141	22.8	190.55	45.63
82	82000000000	299792458	0.003656006	22.85	192.75	45.69
83	83000000000	299792458	0.003611957	22.9	194.98	45.75
84	84000000000	299792458	0.003568958	22.95	197.24	45.80
85	85000000000	299792458	0.00352697	23	199.53	45.85
86	86000000000	299792458	0.003485959	23.05	201.84	45.90
87	87000000000	299792458	0.00344589	23.1	204.17	45.95
88	88000000000	299792458	0.003406732	23.13	205.59	46.02
89	89000000000	299792458	0.003368455	23.15	206.54	46.10
90	90000000000	299792458	0.003331027	23.18	207.97	46.17
91	91000000000	299792458	0.003294423	23.19	208.45	46.25
92	92000000000	299792458	0.003258614	23.2	208.93	46.34
93	93000000000	299792458	0.003223575	23.24	210.86	46.39
94	94000000000	299792458	0.003189281	23.27	212.32	46.46
95	95000000000	299792458	0.00315571	23.3	213.80	46.52
96	96000000000	299792458	0.003122838	23.31	214.29	46.60
97	97000000000	299792458	0.003090644	23.33	215.28	46.67
98	98000000000	299792458	0.003059107	23.35	216.27	46.74
99	99000000000	299792458	0.003028207	23.35	216.27	46.83
100	1E+11	299792458	0.002997925	23.37	217.27	46.89
101	1.01E+11	299792458	0.002968242	23.38	217.77	46.97
102	1.02E+11	299792458	0.002939142	23.39	218.27	47.05
103	1.03E+11	299792458	0.002910606	24	251.19	46.52
104	1.04E+11	299792458	0.00288262	24	251.19	46.60
105	1.05E+11	299792458	0.002855166	24	251.19	46.69
106	1.06E+11	299792458	0.002828231	24	251.19	46.77
107	1.07E+11	299792458	0.002801799	24	251.19	46.85
108	1.08E+11	299792458	0.002775856	24	251.19	46.93
109	1.09E+11	299792458	0.00275039	24	251.19	47.01
110	1.1E+11	299792458	0.002725386	24	251.19	47.09



$$ACF = 19.8 - (20 * \text{LOG}(\lambda)) - (10 * \text{LOG}(G_{\text{num}}))$$

λ = wavelength in meters = speed of light / frequency (Hz) => v/f

Speed of Light = 299792458 (m/sec) $\approx 3 \times 10^8$

G_{num} = Numeric Antenna Gain = $10^{(\text{Gain}_{\text{dBi}}/10)}$

Asset # i00477 (50 - 75 GHz Horn antenna)						
Frequency	Frequency	speed of light	wavelength	Ant Gain	Antenna Gain	ACF
GHz	Hz	m/sec	m	dBi	numeric	dB
50	50000000000	299792458	0.005995849	22.4	173.78	41.84
51	51000000000	299792458	0.005878283	22.47	176.60	41.94
52	52000000000	299792458	0.00576524	22.5	177.83	42.08
53	53000000000	299792458	0.005656461	22.6	181.97	42.15
54	54000000000	299792458	0.005551712	22.7	186.21	42.21
55	55000000000	299792458	0.005450772	22.8	190.55	42.27
56	56000000000	299792458	0.005353437	22.85	192.75	42.38
57	57000000000	299792458	0.005259517	22.9	194.98	42.48
58	58000000000	299792458	0.005168835	22.97	198.15	42.56
59	59000000000	299792458	0.005081228	23.05	201.84	42.63
60	60000000000	299792458	0.004996541	23.1	204.17	42.73
61	61000000000	299792458	0.00491463	23.14	206.06	42.83
62	62000000000	299792458	0.004835362	23.18	207.97	42.93
63	63000000000	299792458	0.00475861	23.2	208.93	43.05
64	64000000000	299792458	0.004684257	23.25	211.35	43.14
65	65000000000	299792458	0.004612192	23.3	213.80	43.22
66	66000000000	299792458	0.00454231	23.32	214.78	43.33
67	67000000000	299792458	0.004474514	23.34	215.77	43.45
68	68000000000	299792458	0.004408713	23.36	216.77	43.55
69	69000000000	299792458	0.004344818	23.38	217.77	43.66
70	70000000000	299792458	0.004282749	23.4	218.78	43.77
71	71000000000	299792458	0.004222429	23.4	218.78	43.89
72	72000000000	299792458	0.004163784	23.4	218.78	44.01
73	73000000000	299792458	0.004106746	23.4	218.78	44.13
74	74000000000	299792458	0.004051249	23.4	218.78	44.25
75	75000000000	299792458	0.003997233	23.4	218.78	44.36

