

**CERTIFICATE #: 190227-141643-b82d3e**

190227-141643-b82d3e

**CLIENT:** Compliance Testing LLC, 1724 S Nevada Way, Mesa, AZ, 85204, USA  
**MANUFACTURER:** EMCO  
**EQUIPMENT TYPE:** Horn (Small)  
**MODEL NUMBER:** 3116  
**SERIAL NUMBER:** 2076  
**ASSET NUMBER:** i00085

**Instrumentation Environment:** **TEMP:** 21°C **RH:** 29%  
**Calibration Environment:** **TEMP:** 21°C **RH:** 29%

**DATE RECEIVED:** 02/26/2019  
**DATE OF CALIBRATION:** 02/28/2019  
**CALIBRATION DUE DATE:** 02/28/2021  
**CALIBRATION CYCLE NOTES:** 2 years from calibration date. The applied calibration cycle has been requested by the customer. The relevant documentation has been received and is on file.  
**CALIBRATION LOCATION:** 1346 Yellowwood Road, Kimballton, IA 51543  
**CALIBRATION BY:** Rodger Rasmussen

**EQUIPMENT STATUS**

|                                    |                                     |                                    |                                     |
|------------------------------------|-------------------------------------|------------------------------------|-------------------------------------|
| <b>Received in tolerance:</b>      | <input checked="" type="checkbox"/> | <b>Returned in tolerance:</b>      | <input checked="" type="checkbox"/> |
| <b>Received with limited cal.:</b> | <input type="checkbox"/>            | <b>Returned with limited cal.:</b> | <input type="checkbox"/>            |
| <b>Received out of tolerance:</b>  | <input type="checkbox"/>            | <b>Returned out of tolerance:</b>  | <input type="checkbox"/>            |

| <b>CALIBRATION STANDARD(S)</b> | <b>CALIBRATION METHOD(S)</b>               | <b>CALIBRATION PROCEDURE(S)</b> |
|--------------------------------|--------------------------------------------|---------------------------------|
| SAE ARP 958D 2003              | Combination of SAE Clause 4 and Appendix C | 356847                          |

**NOTES:**

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**Keysight-LC Service Center Manager**  
**Brandt Langer**

This report is not to be reproduced, except in full, without written approval of Keysight Technologies. All results of this calibration relate only to the item that was calibrated. The limits stated in the report correspond to the published specification of the equipment and/or standard, at the specified parameters. MEASURED VALUES ARE REPORTED ON THE ATTACHED PAGES.

**CALIBRATION EQUIPMENT USED:**

| <u>Manufacturer</u>         | <u>Equipment Type</u>  | <u>Model Number</u> | <u>Serial Number</u> | <u>Trace #</u>       | <u>Cal Due Date</u> |
|-----------------------------|------------------------|---------------------|----------------------|----------------------|---------------------|
| Comtest                     | Chamber                | 8M Chamber          | 20021                | 170321-095049-079e1b | 05/22/2019          |
| EMCO                        | Horn (4.5 - 40 GHz)    | 3116                | 9003-2135            | 170828-134217-bd6b9c | 08/28/2019          |
| ETS                         | Horn (Small) 4.5-40GHz | 3116                | 00062501             | 170828-134508-1e57d2 | 08/28/2019          |
| Keysight Technologies, Inc. | PNA Network Analyzer   | N5225A              | MY56051740           | 1-10144781110-1      | 06/25/2019          |

**CALIBRATION DATA FILE(S) THAT ARE PART OF THIS CERTIFICATE:**

2019-1MV.dat

2019-1MV.txt

\* All data/documentation is available online at: <http://certxpress.service.keysight.com/certxpress/login.aspx>

**CALIBRATION SOFTWARE:**

ACF-Insertion Loss Analysis 2.9

DRWG Standard Site Method 2.12

**IN TOLERANCE/OUT OF TOLERANCE EXPLANATION:**

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

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

**CALIBRATION TRACEABILITY:**

This laboratory is accredited to ISO/IEC 17025:2005 and NCSL/ANSI Z540-1-1994. All measurement instrumentation is traceable to a recognized National Metrology Institute, which is a signatory to the International Committee for Weights & Measures, Mutual Recognition Arrangement. Supporting documentation related to traceability is on file and is available for examination upon request.

**INTERPRETATION TO THE GUIDANCE AND USE OF CALIBRATION DATA:**

The calibration values supplied with this certificate apply to measurements made under the physical (geometric) arrangements with respect to the applicable calibration standard. This antenna has been individually calibrated in a freespace environment for stated distances from reference points on the antenna. Use of this antenna under other conditions will result in additional sources of error of which is the responsibility of the user.

**CALIBRATION UNCERTAINTY:**

☐ Actual uncertainty (Expanded) \_\_\_\_\_

☒ Uncertainties that apply to this calibration are shown below. CMC represents our typical uncertainty for the calibration documented in this certificate since, to the best of our knowledge, the conditions under which the CMC for this facility and calibration item was determined applied to this calibration as well. The repeatability contribution to CMC is based on a type A evaluation of at least 10 data sets or more.

| <u>Parameter/Equipment:</u>                                                          | <u>Range:</u>                                             | <u>CMC** (+/-):</u>           |
|--------------------------------------------------------------------------------------|-----------------------------------------------------------|-------------------------------|
| Horn Antennas/LPA's - 1 & 3 Meter Distance<br>(CISPR 16-1-6), Far Field (ANSI C63.5) | 700 MHz to 18 GHz<br>(18 to 26.5) GHz<br>(26.5 to 50) GHz | 0.37 dB<br>0.42 dB<br>0.47 dB |

**\*\* Calibration and Measurement Capability (CMC)** is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. Calibration and Measurement Capabilities represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of  $k = 2$ . The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration. In the statement of CMC, M is the uncertainty contribution of the mismatch error caused by the impedance mismatch between the calibration system of the laboratory and the device under calibration.

For further detailed explanations, a complete copy of the scope of our A2LA accreditation is available upon request.

Date of Calibration = Feb 28, 2019

Date Printed: Thursday, February 28, 2019 11:01 AM

Customer Name: Compliance Testing LLC

Antenna Manufacturer: EMCO

Antenna Model: 3116

Antenna Serial No.: 2076

Temperature (Deg C): 21.0

Humidity (%): 29.0

Measurement Distance in Meters = 1.0

Antenna Polarization = VERT

NOTES:

CAL CERT #: 190227-141643-b82d3e

| Freq<br>(MHz) | ACF<br>(dB) | Gain<br>(dBi) | Num<br>GAIN |
|---------------|-------------|---------------|-------------|
| 18000.0000    | 44.997      | 10.308        | 10.736      |
| 18100.0000    | 44.988      | 10.365        | 10.877      |
| 18200.0000    | 44.968      | 10.434        | 11.050      |
| 18300.0000    | 44.979      | 10.470        | 11.143      |
| 18400.0000    | 44.854      | 10.642        | 11.594      |
| 18500.0000    | 44.828      | 10.715        | 11.790      |
| 18600.0000    | 44.907      | 10.684        | 11.705      |
| 18700.0000    | 44.923      | 10.714        | 11.787      |
| 18800.0000    | 44.933      | 10.750        | 11.885      |
| 18900.0000    | 44.845      | 10.884        | 12.258      |
| 19000.0000    | 44.857      | 10.918        | 12.354      |
| 19100.0000    | 44.903      | 10.917        | 12.352      |
| 19200.0000    | 44.878      | 10.989        | 12.556      |
| 19300.0000    | 44.801      | 11.110        | 12.912      |
| 19400.0000    | 44.832      | 11.125        | 12.955      |
| 19500.0000    | 44.749      | 11.251        | 13.339      |
| 19600.0000    | 44.644      | 11.401        | 13.807      |
| 19700.0000    | 44.639      | 11.451        | 13.966      |
| 19800.0000    | 44.595      | 11.539        | 14.252      |
| 19900.0000    | 44.563      | 11.614        | 14.501      |
| 20000.0000    | 44.522      | 11.698        | 14.785      |
| 20100.0000    | 44.485      | 11.778        | 15.061      |
| 20200.0000    | 44.487      | 11.821        | 15.207      |
| 20300.0000    | 44.538      | 11.812        | 15.177      |
| 20400.0000    | 44.577      | 11.815        | 15.189      |
| 20500.0000    | 44.604      | 11.831        | 15.244      |
| 20600.0000    | 44.604      | 11.874        | 15.395      |
| 20700.0000    | 44.677      | 11.842        | 15.283      |
| 20800.0000    | 44.701      | 11.860        | 15.347      |
| 20900.0000    | 44.637      | 11.966        | 15.725      |
| 21000.0000    | 44.620      | 12.025        | 15.939      |
| 21100.0000    | 44.630      | 12.056        | 16.054      |

|            |        |        |        |
|------------|--------|--------|--------|
| 21200.0000 | 44.636 | 12.090 | 16.182 |
| 21300.0000 | 44.628 | 12.139 | 16.366 |
| 21400.0000 | 44.599 | 12.209 | 16.631 |
| 21500.0000 | 44.603 | 12.246 | 16.772 |
| 21600.0000 | 44.691 | 12.199 | 16.590 |
| 21700.0000 | 44.746 | 12.183 | 16.531 |
| 21800.0000 | 44.794 | 12.175 | 16.501 |
| 21900.0000 | 44.839 | 12.170 | 16.481 |
| 22000.0000 | 44.940 | 12.108 | 16.249 |
| 22100.0000 | 45.012 | 12.075 | 16.127 |
| 22200.0000 | 45.046 | 12.082 | 16.149 |
| 22300.0000 | 45.120 | 12.046 | 16.018 |
| 22400.0000 | 45.110 | 12.094 | 16.198 |
| 22500.0000 | 45.146 | 12.097 | 16.208 |
| 22600.0000 | 45.230 | 12.052 | 16.040 |
| 22700.0000 | 45.217 | 12.104 | 16.232 |
| 22800.0000 | 45.291 | 12.068 | 16.098 |
| 22900.0000 | 45.364 | 12.033 | 15.969 |
| 23000.0000 | 45.447 | 11.988 | 15.804 |
| 23100.0000 | 45.530 | 11.943 | 15.641 |
| 23200.0000 | 45.602 | 11.907 | 15.515 |
| 23300.0000 | 45.620 | 11.928 | 15.587 |
| 23400.0000 | 45.588 | 11.996 | 15.835 |
| 23500.0000 | 45.620 | 12.002 | 15.855 |
| 23600.0000 | 45.627 | 12.031 | 15.963 |
| 23700.0000 | 45.573 | 12.121 | 16.299 |
| 23800.0000 | 45.529 | 12.202 | 16.605 |
| 23900.0000 | 45.521 | 12.247 | 16.776 |
| 24000.0000 | 45.534 | 12.271 | 16.868 |
| 24100.0000 | 45.619 | 12.221 | 16.677 |
| 24200.0000 | 45.736 | 12.140 | 16.369 |
| 24300.0000 | 45.805 | 12.107 | 16.244 |
| 24400.0000 | 45.910 | 12.037 | 15.986 |
| 24500.0000 | 46.078 | 11.905 | 15.507 |
| 24600.0000 | 46.156 | 11.863 | 15.356 |
| 24700.0000 | 46.187 | 11.866 | 15.369 |
| 24800.0000 | 46.213 | 11.876 | 15.403 |
| 24900.0000 | 46.278 | 11.845 | 15.295 |
| 25000.0000 | 46.287 | 11.872 | 15.388 |
| 25100.0000 | 46.251 | 11.943 | 15.641 |
| 25200.0000 | 46.218 | 12.010 | 15.885 |
| 25300.0000 | 46.168 | 12.095 | 16.198 |
| 25400.0000 | 46.100 | 12.196 | 16.582 |
| 25500.0000 | 46.104 | 12.227 | 16.699 |
| 25600.0000 | 46.006 | 12.358 | 17.212 |
| 25700.0000 | 46.009 | 12.389 | 17.335 |
| 25800.0000 | 46.074 | 12.358 | 17.212 |
| 25900.0000 | 46.141 | 12.325 | 17.080 |
| 26000.0000 | 46.272 | 12.227 | 16.700 |
| 26100.0000 | 46.309 | 12.224 | 16.687 |

|            |        |        |        |
|------------|--------|--------|--------|
| 26200.0000 | 46.388 | 12.178 | 16.512 |
| 26300.0000 | 46.462 | 12.137 | 16.357 |
| 26400.0000 | 46.518 | 12.114 | 16.271 |
| 26500.0000 | 46.462 | 12.203 | 16.607 |
| 26600.0000 | 46.407 | 12.291 | 16.947 |
| 26700.0000 | 46.401 | 12.329 | 17.097 |
| 26800.0000 | 46.342 | 12.420 | 17.460 |
| 26900.0000 | 46.268 | 12.527 | 17.894 |
| 27000.0000 | 46.248 | 12.580 | 18.112 |
| 27100.0000 | 46.286 | 12.574 | 18.087 |
| 27200.0000 | 46.295 | 12.596 | 18.181 |
| 27300.0000 | 46.356 | 12.567 | 18.060 |
| 27400.0000 | 46.398 | 12.557 | 18.018 |
| 27500.0000 | 46.442 | 12.545 | 17.967 |
| 27600.0000 | 46.508 | 12.511 | 17.826 |
| 27700.0000 | 46.570 | 12.480 | 17.700 |
| 27800.0000 | 46.585 | 12.496 | 17.766 |
| 27900.0000 | 46.596 | 12.516 | 17.849 |
| 28000.0000 | 46.579 | 12.564 | 18.047 |
| 28100.0000 | 46.530 | 12.645 | 18.385 |
| 28200.0000 | 46.449 | 12.756 | 18.862 |
| 28300.0000 | 46.374 | 12.861 | 19.326 |
| 28400.0000 | 46.392 | 12.875 | 19.385 |
| 28500.0000 | 46.338 | 12.958 | 19.763 |
| 28600.0000 | 46.364 | 12.963 | 19.784 |
| 28700.0000 | 46.369 | 12.989 | 19.901 |
| 28800.0000 | 46.409 | 12.979 | 19.856 |
| 28900.0000 | 46.463 | 12.954 | 19.745 |
| 29000.0000 | 46.514 | 12.933 | 19.649 |
| 29100.0000 | 46.560 | 12.918 | 19.579 |
| 29200.0000 | 46.612 | 12.895 | 19.477 |
| 29300.0000 | 46.634 | 12.904 | 19.515 |
| 29400.0000 | 46.612 | 12.954 | 19.745 |
| 29500.0000 | 46.598 | 12.998 | 19.944 |
| 29600.0000 | 46.617 | 13.008 | 19.991 |
| 29700.0000 | 46.571 | 13.084 | 20.343 |
| 29800.0000 | 46.533 | 13.151 | 20.659 |
| 29900.0000 | 46.546 | 13.167 | 20.736 |
| 30000.0000 | 46.528 | 13.215 | 20.964 |
| 30100.0000 | 46.613 | 13.158 | 20.693 |
| 30200.0000 | 46.617 | 13.184 | 20.814 |
| 30300.0000 | 46.626 | 13.202 | 20.905 |
| 30400.0000 | 46.734 | 13.124 | 20.529 |
| 30500.0000 | 46.819 | 13.067 | 20.263 |
| 30600.0000 | 46.840 | 13.074 | 20.297 |
| 30700.0000 | 46.854 | 13.089 | 20.365 |
| 30800.0000 | 46.872 | 13.100 | 20.415 |
| 30900.0000 | 46.946 | 13.053 | 20.198 |
| 31000.0000 | 46.946 | 13.082 | 20.331 |
| 31100.0000 | 46.964 | 13.091 | 20.376 |

|            |        |        |        |
|------------|--------|--------|--------|
| 31200.0000 | 46.994 | 13.089 | 20.366 |
| 31300.0000 | 47.065 | 13.045 | 20.162 |
| 31400.0000 | 47.100 | 13.038 | 20.129 |
| 31500.0000 | 47.143 | 13.024 | 20.061 |
| 31600.0000 | 47.201 | 12.993 | 19.920 |
| 31700.0000 | 47.302 | 12.919 | 19.584 |
| 31800.0000 | 47.490 | 12.759 | 18.875 |
| 31900.0000 | 47.524 | 12.752 | 18.845 |
| 32000.0000 | 47.610 | 12.693 | 18.591 |
| 32100.0000 | 47.841 | 12.490 | 17.740 |
| 32200.0000 | 48.097 | 12.261 | 16.829 |
| 32300.0000 | 48.192 | 12.192 | 16.565 |
| 32400.0000 | 48.192 | 12.219 | 16.668 |
| 32500.0000 | 48.432 | 12.006 | 15.870 |
| 32600.0000 | 48.693 | 11.771 | 15.035 |
| 32700.0000 | 48.691 | 11.800 | 15.136 |
| 32800.0000 | 48.702 | 11.816 | 15.191 |
| 32900.0000 | 48.733 | 11.810 | 15.172 |
| 33000.0000 | 48.973 | 11.598 | 14.447 |
| 33100.0000 | 49.042 | 11.554 | 14.303 |
| 33200.0000 | 48.964 | 11.659 | 14.652 |
| 33300.0000 | 48.941 | 11.708 | 14.818 |
| 33400.0000 | 49.103 | 11.572 | 14.361 |
| 33500.0000 | 49.211 | 11.489 | 14.091 |
| 33600.0000 | 49.164 | 11.562 | 14.330 |
| 33700.0000 | 49.175 | 11.577 | 14.379 |
| 33800.0000 | 49.169 | 11.610 | 14.487 |
| 33900.0000 | 49.325 | 11.478 | 14.056 |
| 34000.0000 | 49.466 | 11.364 | 13.689 |
| 34100.0000 | 49.367 | 11.489 | 14.088 |
| 34200.0000 | 49.294 | 11.587 | 14.410 |
| 34300.0000 | 49.326 | 11.579 | 14.386 |
| 34400.0000 | 49.348 | 11.584 | 14.400 |
| 34500.0000 | 49.157 | 11.799 | 15.133 |
| 34600.0000 | 48.996 | 11.986 | 15.797 |
| 34700.0000 | 48.990 | 12.016 | 15.909 |
| 34800.0000 | 48.936 | 12.096 | 16.202 |
| 34900.0000 | 48.778 | 12.279 | 16.900 |
| 35000.0000 | 48.663 | 12.418 | 17.451 |
| 35100.0000 | 48.623 | 12.483 | 17.714 |
| 35200.0000 | 48.704 | 12.427 | 17.486 |
| 35300.0000 | 48.568 | 12.587 | 18.144 |
| 35400.0000 | 48.440 | 12.741 | 18.795 |
| 35500.0000 | 48.357 | 12.847 | 19.263 |
| 35600.0000 | 48.291 | 12.938 | 19.670 |
| 35700.0000 | 48.129 | 13.125 | 20.534 |
| 35800.0000 | 47.889 | 13.388 | 21.819 |
| 35900.0000 | 47.681 | 13.620 | 23.017 |
| 36000.0000 | 47.415 | 13.912 | 24.612 |
| 36100.0000 | 47.212 | 14.138 | 25.930 |

|            |        |        |        |
|------------|--------|--------|--------|
| 36200.0000 | 46.904 | 14.470 | 27.990 |
| 36300.0000 | 46.627 | 14.771 | 29.999 |
| 36400.0000 | 46.332 | 15.091 | 32.289 |
| 36500.0000 | 46.191 | 15.254 | 33.531 |
| 36600.0000 | 46.040 | 15.430 | 34.913 |
| 36700.0000 | 45.786 | 15.708 | 37.219 |
| 36800.0000 | 45.579 | 15.937 | 39.242 |
| 36900.0000 | 45.537 | 16.003 | 39.841 |
| 37000.0000 | 45.522 | 16.042 | 40.198 |
| 37100.0000 | 45.379 | 16.208 | 41.766 |
| 37200.0000 | 45.304 | 16.306 | 42.721 |
| 37300.0000 | 45.308 | 16.326 | 42.915 |
| 37400.0000 | 45.381 | 16.276 | 42.425 |
| 37500.0000 | 45.304 | 16.376 | 43.414 |
| 37600.0000 | 45.245 | 16.458 | 44.242 |
| 37700.0000 | 45.286 | 16.441 | 44.065 |
| 37800.0000 | 45.300 | 16.450 | 44.156 |
| 37900.0000 | 45.289 | 16.483 | 44.498 |
| 38000.0000 | 45.282 | 16.514 | 44.811 |
| 38100.0000 | 45.294 | 16.524 | 44.918 |
| 38200.0000 | 45.360 | 16.481 | 44.475 |
| 38300.0000 | 45.459 | 16.405 | 43.702 |
| 38400.0000 | 45.478 | 16.408 | 43.735 |
| 38500.0000 | 45.570 | 16.340 | 43.049 |
| 38600.0000 | 45.639 | 16.292 | 42.583 |
| 38700.0000 | 45.719 | 16.236 | 42.030 |
| 38800.0000 | 45.914 | 16.062 | 40.386 |
| 38900.0000 | 45.998 | 16.001 | 39.820 |
| 39000.0000 | 46.037 | 15.984 | 39.666 |
| 39100.0000 | 46.158 | 15.885 | 38.773 |
| 39200.0000 | 46.287 | 15.778 | 37.830 |
| 39300.0000 | 46.402 | 15.686 | 37.033 |
| 39400.0000 | 46.464 | 15.645 | 36.690 |
| 39500.0000 | 46.449 | 15.683 | 37.008 |
| 39600.0000 | 46.584 | 15.570 | 36.057 |
| 39700.0000 | 46.740 | 15.436 | 34.962 |
| 39800.0000 | 46.964 | 15.233 | 33.368 |
| 39900.0000 | 47.155 | 15.065 | 32.098 |
| 40000.0000 | 47.283 | 14.959 | 31.323 |

**CERTIFICATE #: 190227-135209-0602f6**

190227-135209-0602f6

**CLIENT:** Compliance Testing LLC, 1724 S Nevada Way, Mesa, AZ, 85204, USA  
**MANUFACTURER:** EMCO  
**EQUIPMENT TYPE:** Horn (Small)  
**MODEL NUMBER:** 3115  
**SERIAL NUMBER:** 9208-3925  
**ASSET NUMBER:** i00103

**Instrumentation Environment:** **TEMP:** 21°C **RH:** 29%  
**Calibration Environment:** **TEMP:** 21°C **RH:** 29%

**DATE RECEIVED:** 02/26/2019  
**DATE OF CALIBRATION:** 02/28/2019  
**CALIBRATION DUE DATE:** 02/28/2021  
**CALIBRATION CYCLE NOTES:** 2 years from calibration date. The applied calibration cycle has been requested by the customer. The relevant documentation has been received and is on file.  
**CALIBRATION LOCATION:** 1346 Yellowwood Road, Kimballton, IA 51543  
**CALIBRATION BY:** Rodger Rasmussen

**EQUIPMENT STATUS**

|                                                                   |                                                                   |
|-------------------------------------------------------------------|-------------------------------------------------------------------|
| <b>Received in tolerance:</b> <input checked="" type="checkbox"/> | <b>Returned in tolerance:</b> <input checked="" type="checkbox"/> |
| <b>Received with limited cal.:</b> <input type="checkbox"/>       | <b>Returned with limited cal.:</b> <input type="checkbox"/>       |
| <b>Received out of tolerance:</b> <input type="checkbox"/>        | <b>Returned out of tolerance:</b> <input type="checkbox"/>        |

|                                    |                                           |                                 |
|------------------------------------|-------------------------------------------|---------------------------------|
| <b>CALIBRATION STANDARD(S)</b>     | <b>CALIBRATION METHOD(S)</b>              | <b>CALIBRATION PROCEDURE(S)</b> |
| ANSI C63.5 2017, CISPR 16-1-6 2014 | ANSI Clause 5.1.3<br>CISPR Clause 9.5.1.3 | 356847                          |

**NOTES:**

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Keysight-LC Service Center Manager  
Brandt Langer

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| <u>Manufacturer</u>         | <u>Equipment Type</u> | <u>Model Number</u> | <u>Serial Number</u> | <u>Trace #</u>       | <u>Cal Due Date</u> |
|-----------------------------|-----------------------|---------------------|----------------------|----------------------|---------------------|
| Comtest                     | Chamber               | 8M Chamber          | 20021                | 170321-095049-079e1b | 05/22/2019          |
| ETS - Lindgren              | Horn (Small)          | 3115                | 00071507             | 170404-082254-feb513 | 04/04/2019          |
| ETS-Lindgren                | Horn (Small)          | 3115                | 00071508             | 180424-075800-c62ac2 | 04/24/2020          |
| Keysight Technologies, Inc. | PNA Network Analyzer  | N5225A              | MY56051740           | 1-10144781110-1      | 06/25/2019          |

|              |              |
|--------------|--------------|
| 2019-3MH.dat | 2019-3MH.txt |
| 2019-3MV.dat | 2019-3MV.txt |

ACF-Insertion Loss Analysis 2.9  
DRWG Standard Site Method 2.12

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

☐ Actual uncertainty (Expanded) \_\_\_\_\_

☒ Uncertainties that apply to this calibration are shown below. CMC represents our typical uncertainty for the calibration documented in this certificate since, to the best of our knowledge, the conditions under which the CMC for this facility and calibration item was determined applied to this calibration as well. The repeatability contribution to CMC is based on a type A evaluation of at least 10 data sets or more.

| <u>Parameter/Equipment:</u>                                                          | <u>Range:</u>                                             | <u>CMC** (+/-):</u>           |
|--------------------------------------------------------------------------------------|-----------------------------------------------------------|-------------------------------|
| Horn Antennas/LPA's - 1 & 3 Meter Distance<br>(CISPR 16-1-6), Far Field (ANSI C63.5) | 700 MHz to 18 GHz<br>(18 to 26.5) GHz<br>(26.5 to 50) GHz | 0.37 dB<br>0.42 dB<br>0.47 dB |

**\*\* Calibration and Measurement Capability (CMC)** is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. Calibration and Measurement Capabilities represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of  $k = 2$ . The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration. In the statement of CMC, M is the uncertainty contribution of the mismatch error caused by the impedance mismatch between the calibration system of the laboratory and the device under calibration.

For further detailed explanations, a complete copy of the scope of our A2LA accreditation is available upon request.

Date of Calibration = Feb 28, 2019

Date Printed: Thursday, February 28, 2019 2:27 PM

Customer Name: Compliance Testing LLC

Antenna Manufacturer: EMCO

Antenna Model: 3115

Antenna Serial No.: 9208-3925

Temperature (Deg C): 21.0

Humidity (%): 29.0

Measurement Distance in Meters = 3.0

Antenna Polarization = VERT

NOTES: Observed Pin Depth: -0.0095" from typical.

CAL CERT #: 190227-135209-0602f6

| Freq<br>(MHz) | ACF<br>(dB) | Gain<br>(dBi) | Num<br>GAIN |
|---------------|-------------|---------------|-------------|
| 1000.0000     | 24.108      | 6.091         | 4.066       |
| 1050.0000     | 24.398      | 6.226         | 4.194       |
| 1100.0000     | 24.729      | 6.299         | 4.265       |
| 1150.0000     | 24.598      | 6.816         | 4.804       |
| 1200.0000     | 25.065      | 6.718         | 4.697       |
| 1250.0000     | 25.383      | 6.756         | 4.738       |
| 1300.0000     | 25.178      | 7.301         | 5.371       |
| 1350.0000     | 25.221      | 7.586         | 5.736       |
| 1400.0000     | 25.296      | 7.826         | 6.062       |
| 1450.0000     | 25.231      | 8.197         | 6.602       |
| 1500.0000     | 25.328      | 8.393         | 6.908       |
| 1550.0000     | 25.328      | 8.678         | 7.376       |
| 1600.0000     | 25.290      | 8.993         | 7.930       |
| 1650.0000     | 25.569      | 8.981         | 7.908       |
| 1700.0000     | 26.052      | 8.756         | 7.510       |
| 1750.0000     | 26.930      | 8.130         | 6.502       |
| 1800.0000     | 26.870      | 8.435         | 6.975       |
| 1850.0000     | 27.159      | 8.385         | 6.894       |
| 1900.0000     | 27.460      | 8.315         | 6.784       |
| 1950.0000     | 27.615      | 8.385         | 6.895       |
| 2000.0000     | 27.548      | 8.673         | 7.367       |
| 2050.0000     | 27.569      | 8.866         | 7.702       |
| 2100.0000     | 27.680      | 8.964         | 7.878       |
| 2150.0000     | 27.840      | 9.008         | 7.959       |
| 2200.0000     | 27.656      | 9.392         | 8.694       |
| 2250.0000     | 27.631      | 9.612         | 9.146       |
| 2300.0000     | 27.874      | 9.560         | 9.037       |
| 2350.0000     | 28.344      | 9.278         | 8.468       |
| 2400.0000     | 28.651      | 9.153         | 8.228       |
| 2450.0000     | 28.630      | 9.354         | 8.617       |
| 2500.0000     | 28.701      | 9.458         | 8.827       |
| 2550.0000     | 28.929      | 9.402         | 8.713       |
| 2600.0000     | 29.037      | 9.463         | 8.836       |
| 2650.0000     | 29.015      | 9.649         | 9.225       |
| 2700.0000     | 28.915      | 9.912         | 9.800       |

|           |        |        |        |
|-----------|--------|--------|--------|
| 2750.0000 | 28.922 | 10.065 | 10.150 |
| 2800.0000 | 29.118 | 10.026 | 10.059 |
| 2850.0000 | 29.212 | 10.084 | 10.196 |
| 2900.0000 | 29.460 | 9.988  | 9.972  |
| 2950.0000 | 29.869 | 9.727  | 9.391  |
| 3000.0000 | 30.291 | 9.452  | 8.814  |
| 3050.0000 | 30.501 | 9.385  | 8.680  |
| 3100.0000 | 30.699 | 9.329  | 8.568  |
| 3150.0000 | 30.952 | 9.214  | 8.345  |
| 3200.0000 | 30.990 | 9.312  | 8.536  |
| 3250.0000 | 31.021 | 9.417  | 8.743  |
| 3300.0000 | 31.059 | 9.511  | 8.935  |
| 3350.0000 | 31.203 | 9.498  | 8.908  |
| 3400.0000 | 31.084 | 9.746  | 9.431  |
| 3450.0000 | 31.120 | 9.836  | 9.630  |
| 3500.0000 | 31.265 | 9.817  | 9.587  |
| 3550.0000 | 31.271 | 9.933  | 9.848  |
| 3600.0000 | 31.426 | 9.901  | 9.774  |
| 3650.0000 | 31.649 | 9.797  | 9.543  |
| 3700.0000 | 31.917 | 9.648  | 9.220  |
| 3750.0000 | 32.294 | 9.386  | 8.682  |
| 3800.0000 | 32.617 | 9.178  | 8.276  |
| 3850.0000 | 32.693 | 9.216  | 8.349  |
| 3900.0000 | 32.652 | 9.369  | 8.648  |
| 3950.0000 | 32.550 | 9.582  | 9.082  |
| 4000.0000 | 32.468 | 9.773  | 9.491  |
| 4050.0000 | 32.445 | 9.905  | 9.783  |
| 4100.0000 | 32.172 | 10.284 | 10.675 |
| 4150.0000 | 32.054 | 10.507 | 11.238 |
| 4200.0000 | 32.071 | 10.594 | 11.466 |
| 4250.0000 | 32.011 | 10.757 | 11.904 |
| 4300.0000 | 32.001 | 10.869 | 12.214 |
| 4350.0000 | 32.009 | 10.961 | 12.476 |
| 4400.0000 | 32.098 | 10.972 | 12.507 |
| 4450.0000 | 32.184 | 10.983 | 12.540 |
| 4500.0000 | 32.221 | 11.044 | 12.716 |
| 4550.0000 | 32.253 | 11.107 | 12.904 |
| 4600.0000 | 32.346 | 11.109 | 12.909 |
| 4650.0000 | 32.473 | 11.076 | 12.812 |
| 4700.0000 | 32.659 | 10.982 | 12.539 |
| 4750.0000 | 32.783 | 10.950 | 12.446 |
| 4800.0000 | 32.853 | 10.971 | 12.507 |
| 4850.0000 | 33.145 | 10.769 | 11.938 |
| 4900.0000 | 33.231 | 10.773 | 11.948 |
| 4950.0000 | 33.125 | 10.967 | 12.494 |
| 5000.0000 | 33.213 | 10.966 | 12.492 |
| 5050.0000 | 33.419 | 10.847 | 12.153 |
| 5100.0000 | 33.624 | 10.727 | 11.823 |
| 5150.0000 | 33.714 | 10.722 | 11.809 |
| 5200.0000 | 33.763 | 10.758 | 11.906 |
| 5250.0000 | 33.868 | 10.736 | 11.846 |
| 5300.0000 | 33.878 | 10.808 | 12.044 |
| 5350.0000 | 33.988 | 10.780 | 11.966 |
| 5400.0000 | 34.124 | 10.723 | 11.813 |

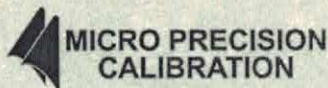
|           |        |        |        |
|-----------|--------|--------|--------|
| 5450.0000 | 34.143 | 10.785 | 11.981 |
| 5500.0000 | 34.174 | 10.834 | 12.116 |
| 5550.0000 | 34.150 | 10.936 | 12.405 |
| 5600.0000 | 34.121 | 11.042 | 12.713 |
| 5650.0000 | 34.092 | 11.149 | 13.029 |
| 5700.0000 | 34.000 | 11.317 | 13.543 |
| 5750.0000 | 34.027 | 11.366 | 13.697 |
| 5800.0000 | 34.007 | 11.462 | 14.002 |
| 5850.0000 | 34.045 | 11.499 | 14.121 |
| 5900.0000 | 34.105 | 11.512 | 14.165 |
| 5950.0000 | 34.261 | 11.429 | 13.897 |
| 6000.0000 | 34.413 | 11.351 | 13.647 |
| 6050.0000 | 34.433 | 11.403 | 13.812 |
| 6100.0000 | 34.516 | 11.391 | 13.775 |
| 6150.0000 | 34.623 | 11.354 | 13.659 |
| 6200.0000 | 34.664 | 11.383 | 13.751 |
| 6250.0000 | 34.654 | 11.464 | 14.008 |
| 6300.0000 | 34.615 | 11.571 | 14.360 |
| 6350.0000 | 34.583 | 11.672 | 14.697 |
| 6400.0000 | 34.462 | 11.861 | 15.351 |
| 6450.0000 | 34.387 | 12.004 | 15.864 |
| 6500.0000 | 34.384 | 12.074 | 16.122 |
| 6550.0000 | 34.476 | 12.048 | 16.027 |
| 6600.0000 | 34.617 | 11.974 | 15.754 |
| 6650.0000 | 34.861 | 11.795 | 15.119 |
| 6700.0000 | 35.101 | 11.620 | 14.522 |
| 6750.0000 | 35.287 | 11.500 | 14.124 |
| 6800.0000 | 35.304 | 11.546 | 14.276 |
| 6850.0000 | 35.334 | 11.580 | 14.388 |
| 6900.0000 | 35.328 | 11.648 | 14.617 |
| 6950.0000 | 35.376 | 11.663 | 14.667 |
| 7000.0000 | 35.374 | 11.727 | 14.885 |
| 7050.0000 | 35.365 | 11.798 | 15.130 |
| 7100.0000 | 35.461 | 11.764 | 15.011 |
| 7150.0000 | 35.604 | 11.683 | 14.732 |
| 7200.0000 | 35.858 | 11.489 | 14.089 |
| 7250.0000 | 36.152 | 11.255 | 13.350 |
| 7300.0000 | 36.334 | 11.133 | 12.980 |
| 7350.0000 | 36.423 | 11.102 | 12.890 |
| 7400.0000 | 36.557 | 11.028 | 12.670 |
| 7450.0000 | 36.602 | 11.041 | 12.709 |
| 7500.0000 | 36.489 | 11.213 | 13.221 |
| 7550.0000 | 36.425 | 11.334 | 13.596 |
| 7600.0000 | 36.369 | 11.447 | 13.954 |
| 7650.0000 | 36.349 | 11.525 | 14.206 |
| 7700.0000 | 36.333 | 11.596 | 14.442 |
| 7750.0000 | 36.340 | 11.646 | 14.608 |
| 7800.0000 | 36.429 | 11.612 | 14.496 |
| 7850.0000 | 36.547 | 11.551 | 14.291 |
| 7900.0000 | 36.651 | 11.501 | 14.130 |
| 7950.0000 | 36.749 | 11.458 | 13.990 |
| 8000.0000 | 36.869 | 11.392 | 13.780 |
| 8050.0000 | 36.930 | 11.386 | 13.759 |
| 8100.0000 | 36.911 | 11.458 | 13.991 |

|            |        |        |        |
|------------|--------|--------|--------|
| 8150.0000  | 36.968 | 11.455 | 13.980 |
| 8200.0000  | 36.934 | 11.542 | 14.263 |
| 8250.0000  | 37.046 | 11.483 | 14.070 |
| 8300.0000  | 37.145 | 11.436 | 13.920 |
| 8350.0000  | 37.186 | 11.447 | 13.955 |
| 8400.0000  | 37.242 | 11.443 | 13.942 |
| 8450.0000  | 37.352 | 11.385 | 13.756 |
| 8500.0000  | 37.464 | 11.325 | 13.567 |
| 8550.0000  | 37.476 | 11.363 | 13.687 |
| 8600.0000  | 37.492 | 11.397 | 13.796 |
| 8650.0000  | 37.641 | 11.300 | 13.489 |
| 8700.0000  | 37.795 | 11.196 | 13.169 |
| 8750.0000  | 37.881 | 11.160 | 13.060 |
| 8800.0000  | 37.916 | 11.174 | 13.103 |
| 8850.0000  | 37.963 | 11.175 | 13.108 |
| 8900.0000  | 37.979 | 11.208 | 13.208 |
| 8950.0000  | 37.961 | 11.275 | 13.413 |
| 9000.0000  | 37.866 | 11.418 | 13.863 |
| 9050.0000  | 37.851 | 11.481 | 14.065 |
| 9100.0000  | 37.826 | 11.554 | 14.303 |
| 9150.0000  | 37.766 | 11.663 | 14.665 |
| 9200.0000  | 37.828 | 11.648 | 14.615 |
| 9250.0000  | 37.862 | 11.661 | 14.659 |
| 9300.0000  | 37.966 | 11.603 | 14.465 |
| 9350.0000  | 37.999 | 11.618 | 14.513 |
| 9400.0000  | 38.021 | 11.642 | 14.594 |
| 9450.0000  | 38.080 | 11.629 | 14.551 |
| 9500.0000  | 38.067 | 11.688 | 14.749 |
| 9550.0000  | 38.036 | 11.765 | 15.013 |
| 9600.0000  | 37.944 | 11.902 | 15.494 |
| 9650.0000  | 37.917 | 11.973 | 15.752 |
| 9700.0000  | 37.986 | 11.950 | 15.666 |
| 9750.0000  | 38.025 | 11.955 | 15.686 |
| 9800.0000  | 38.059 | 11.965 | 15.723 |
| 9850.0000  | 38.143 | 11.926 | 15.581 |
| 9900.0000  | 38.231 | 11.882 | 15.424 |
| 9950.0000  | 38.293 | 11.864 | 15.359 |
| 10000.0000 | 38.279 | 11.921 | 15.563 |
| 10050.0000 | 38.284 | 11.959 | 15.701 |
| 10100.0000 | 38.359 | 11.928 | 15.587 |
| 10150.0000 | 38.388 | 11.941 | 15.636 |
| 10200.0000 | 38.384 | 11.988 | 15.805 |
| 10250.0000 | 38.398 | 12.016 | 15.908 |
| 10300.0000 | 38.380 | 12.077 | 16.132 |
| 10350.0000 | 38.338 | 12.161 | 16.447 |
| 10400.0000 | 38.334 | 12.206 | 16.620 |
| 10450.0000 | 38.307 | 12.276 | 16.888 |
| 10500.0000 | 38.397 | 12.226 | 16.697 |
| 10550.0000 | 38.444 | 12.222 | 16.678 |
| 10600.0000 | 38.526 | 12.180 | 16.520 |
| 10650.0000 | 38.537 | 12.210 | 16.634 |
| 10700.0000 | 38.559 | 12.228 | 16.705 |
| 10750.0000 | 38.516 | 12.313 | 17.032 |
| 10800.0000 | 38.468 | 12.401 | 17.381 |

|            |        |        |        |
|------------|--------|--------|--------|
| 10850.0000 | 38.491 | 12.417 | 17.447 |
| 10900.0000 | 38.514 | 12.435 | 17.518 |
| 10950.0000 | 38.574 | 12.414 | 17.435 |
| 11000.0000 | 38.597 | 12.431 | 17.502 |
| 11050.0000 | 38.590 | 12.478 | 17.691 |
| 11100.0000 | 38.622 | 12.484 | 17.718 |
| 11150.0000 | 38.615 | 12.531 | 17.909 |
| 11200.0000 | 38.635 | 12.549 | 17.985 |
| 11250.0000 | 38.617 | 12.606 | 18.222 |
| 11300.0000 | 38.657 | 12.604 | 18.215 |
| 11350.0000 | 38.655 | 12.645 | 18.386 |
| 11400.0000 | 38.634 | 12.704 | 18.638 |
| 11450.0000 | 38.683 | 12.693 | 18.591 |
| 11500.0000 | 38.738 | 12.675 | 18.516 |
| 11550.0000 | 38.813 | 12.639 | 18.360 |
| 11600.0000 | 38.861 | 12.628 | 18.315 |
| 11650.0000 | 38.966 | 12.561 | 18.033 |
| 11700.0000 | 39.055 | 12.508 | 17.817 |
| 11750.0000 | 39.142 | 12.458 | 17.613 |
| 11800.0000 | 39.175 | 12.462 | 17.629 |
| 11850.0000 | 39.187 | 12.488 | 17.732 |
| 11900.0000 | 39.169 | 12.542 | 17.955 |
| 11950.0000 | 39.103 | 12.644 | 18.383 |
| 12000.0000 | 38.994 | 12.790 | 19.010 |
| 12050.0000 | 38.850 | 12.969 | 19.812 |
| 12100.0000 | 38.812 | 13.043 | 20.153 |
| 12150.0000 | 38.749 | 13.143 | 20.619 |
| 12200.0000 | 38.756 | 13.171 | 20.754 |
| 12250.0000 | 38.682 | 13.280 | 21.283 |
| 12300.0000 | 38.656 | 13.343 | 21.590 |
| 12350.0000 | 38.615 | 13.419 | 21.972 |
| 12400.0000 | 38.561 | 13.508 | 22.427 |
| 12450.0000 | 38.531 | 13.572 | 22.762 |
| 12500.0000 | 38.484 | 13.654 | 23.196 |
| 12550.0000 | 38.491 | 13.681 | 23.342 |
| 12600.0000 | 38.503 | 13.705 | 23.468 |
| 12650.0000 | 38.521 | 13.721 | 23.555 |
| 12700.0000 | 38.578 | 13.699 | 23.434 |
| 12750.0000 | 38.681 | 13.630 | 23.065 |
| 12800.0000 | 38.762 | 13.583 | 22.817 |
| 12850.0000 | 38.854 | 13.525 | 22.514 |
| 12900.0000 | 38.971 | 13.441 | 22.085 |
| 12950.0000 | 39.065 | 13.381 | 21.781 |
| 13000.0000 | 39.168 | 13.310 | 21.431 |
| 13050.0000 | 39.171 | 13.342 | 21.585 |
| 13100.0000 | 39.204 | 13.342 | 21.586 |
| 13150.0000 | 39.327 | 13.252 | 21.143 |
| 13200.0000 | 39.431 | 13.181 | 20.801 |
| 13250.0000 | 39.541 | 13.103 | 20.432 |
| 13300.0000 | 39.685 | 12.993 | 19.918 |
| 13350.0000 | 39.873 | 12.836 | 19.215 |
| 13400.0000 | 39.982 | 12.760 | 18.880 |
| 13450.0000 | 40.094 | 12.681 | 18.538 |
| 13500.0000 | 40.178 | 12.629 | 18.318 |

|            |        |        |        |
|------------|--------|--------|--------|
| 13550.0000 | 40.316 | 12.522 | 17.875 |
| 13600.0000 | 40.425 | 12.446 | 17.563 |
| 13650.0000 | 40.520 | 12.382 | 17.307 |
| 13700.0000 | 40.621 | 12.313 | 17.034 |
| 13750.0000 | 40.683 | 12.283 | 16.916 |
| 13800.0000 | 40.744 | 12.254 | 16.803 |
| 13850.0000 | 40.836 | 12.193 | 16.569 |
| 13900.0000 | 40.967 | 12.093 | 16.193 |
| 13950.0000 | 41.101 | 11.991 | 15.815 |
| 14000.0000 | 41.227 | 11.896 | 15.473 |
| 14050.0000 | 41.410 | 11.743 | 14.939 |
| 14100.0000 | 41.556 | 11.629 | 14.550 |
| 14150.0000 | 41.636 | 11.580 | 14.387 |
| 14200.0000 | 41.720 | 11.526 | 14.210 |
| 14250.0000 | 41.826 | 11.450 | 13.964 |
| 14300.0000 | 41.968 | 11.339 | 13.611 |
| 14350.0000 | 42.064 | 11.273 | 13.406 |
| 14400.0000 | 42.058 | 11.309 | 13.518 |
| 14450.0000 | 42.104 | 11.293 | 13.468 |
| 14500.0000 | 42.104 | 11.324 | 13.563 |
| 14550.0000 | 42.103 | 11.355 | 13.660 |
| 14600.0000 | 42.184 | 11.303 | 13.499 |
| 14650.0000 | 42.185 | 11.331 | 13.587 |
| 14700.0000 | 42.106 | 11.440 | 13.932 |
| 14750.0000 | 41.879 | 11.697 | 14.781 |
| 14800.0000 | 41.638 | 11.968 | 15.731 |
| 14850.0000 | 41.432 | 12.203 | 16.606 |
| 14900.0000 | 41.216 | 12.448 | 17.571 |
| 14950.0000 | 41.037 | 12.655 | 18.431 |
| 15000.0000 | 40.814 | 12.908 | 19.534 |
| 15050.0000 | 40.591 | 13.160 | 20.701 |
| 15100.0000 | 40.349 | 13.431 | 22.033 |
| 15150.0000 | 40.060 | 13.748 | 23.704 |
| 15200.0000 | 39.759 | 14.077 | 25.571 |
| 15250.0000 | 39.527 | 14.338 | 27.153 |
| 15300.0000 | 39.337 | 14.556 | 28.552 |
| 15350.0000 | 39.160 | 14.763 | 29.940 |
| 15400.0000 | 38.957 | 14.993 | 31.573 |
| 15450.0000 | 38.721 | 15.258 | 33.557 |
| 15500.0000 | 38.499 | 15.508 | 35.545 |
| 15550.0000 | 38.280 | 15.754 | 37.621 |
| 15600.0000 | 38.114 | 15.948 | 39.339 |
| 15650.0000 | 38.031 | 16.060 | 40.361 |
| 15700.0000 | 37.972 | 16.145 | 41.167 |
| 15750.0000 | 37.940 | 16.206 | 41.743 |
| 15800.0000 | 37.904 | 16.269 | 42.355 |
| 15850.0000 | 37.828 | 16.373 | 43.379 |
| 15900.0000 | 37.725 | 16.502 | 44.694 |
| 15950.0000 | 37.656 | 16.600 | 45.705 |
| 16000.0000 | 37.653 | 16.629 | 46.017 |
| 16050.0000 | 37.673 | 16.637 | 46.097 |
| 16100.0000 | 37.761 | 16.576 | 45.454 |
| 16150.0000 | 37.824 | 16.539 | 45.074 |
| 16200.0000 | 37.887 | 16.503 | 44.701 |

|            |        |        |        |
|------------|--------|--------|--------|
| 16250.0000 | 37.936 | 16.482 | 44.479 |
| 16300.0000 | 37.966 | 16.478 | 44.441 |
| 16350.0000 | 38.073 | 16.398 | 43.628 |
| 16400.0000 | 38.221 | 16.275 | 42.417 |
| 16450.0000 | 38.371 | 16.152 | 41.230 |
| 16500.0000 | 38.598 | 15.951 | 39.367 |
| 16550.0000 | 38.796 | 15.779 | 37.840 |
| 16600.0000 | 38.966 | 15.637 | 36.615 |
| 16650.0000 | 39.111 | 15.518 | 35.626 |
| 16700.0000 | 39.274 | 15.381 | 34.520 |
| 16750.0000 | 39.431 | 15.249 | 33.490 |
| 16800.0000 | 39.613 | 15.094 | 32.312 |
| 16850.0000 | 39.784 | 14.948 | 31.246 |
| 16900.0000 | 39.971 | 14.787 | 30.108 |
| 16950.0000 | 40.203 | 14.581 | 28.712 |
| 17000.0000 | 40.408 | 14.401 | 27.549 |
| 17050.0000 | 40.609 | 14.226 | 26.459 |
| 17100.0000 | 40.844 | 14.016 | 25.211 |
| 17150.0000 | 41.109 | 13.776 | 23.857 |
| 17200.0000 | 41.370 | 13.541 | 22.598 |
| 17250.0000 | 41.638 | 13.297 | 21.367 |
| 17300.0000 | 41.916 | 13.044 | 20.158 |
| 17350.0000 | 42.133 | 12.852 | 19.286 |
| 17400.0000 | 42.370 | 12.640 | 18.367 |
| 17450.0000 | 42.581 | 12.454 | 17.597 |
| 17500.0000 | 42.875 | 12.185 | 16.540 |
| 17550.0000 | 43.187 | 11.899 | 15.484 |
| 17600.0000 | 43.490 | 11.621 | 14.523 |
| 17650.0000 | 43.834 | 11.301 | 13.493 |
| 17700.0000 | 44.144 | 11.016 | 12.635 |
| 17750.0000 | 44.380 | 10.803 | 12.032 |
| 17800.0000 | 44.669 | 10.540 | 11.323 |
| 17850.0000 | 44.925 | 10.308 | 10.735 |
| 17900.0000 | 45.108 | 10.150 | 10.350 |
| 17950.0000 | 45.250 | 10.032 | 10.073 |
| 18000.0000 | 45.343 | 9.963  | 9.915  |



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:

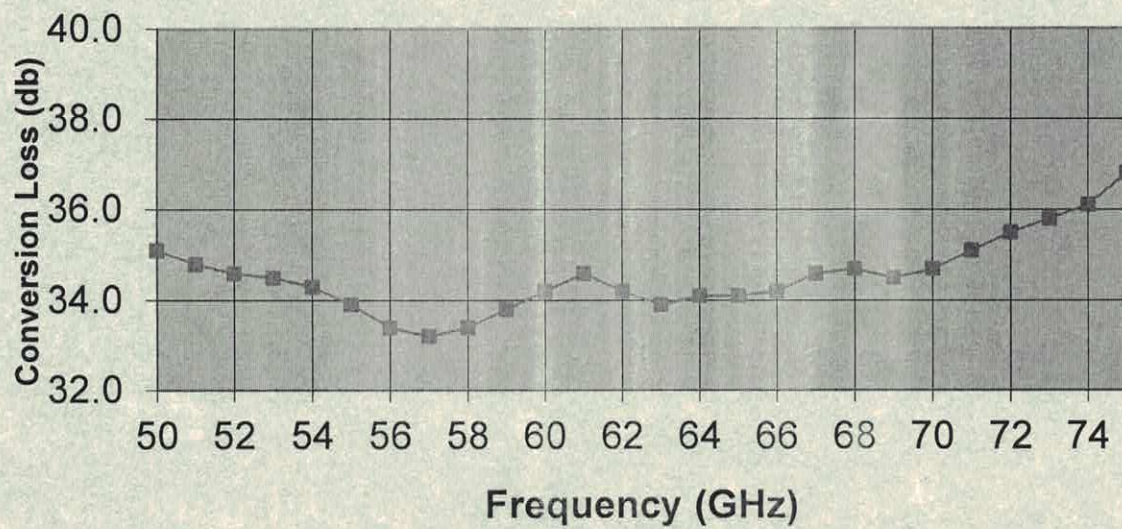
Robert Means

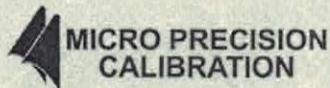
The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA's Publication and NIST Technical Note 1297, 1994 Edition. Services rendered comply with ISO/IEC 17025:2005, ANSI/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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|  <b>MICRO PRECISION<br/>CALIBRATION INC.</b> |  |                                 |                    |  |  |                       |
|-------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------|--------------------|--|--|-----------------------|
| <b>Measurement Report: Harmonic Mixer 11970V</b>                                                                              |  |                                 |                    |  |  |                       |
| Procedure: Manufacturer                                                                                                       |  | Order Number: SAC-70095565      |                    |  |  |                       |
| ID Number: DB8287                                                                                                             |  | Calibration Date: June 29, 2018 |                    |  |  |                       |
| Frequency<br>(GHz)                                                                                                            |  |                                 | Conversion<br>Loss |  |  | Uncertainty<br>+/- 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:

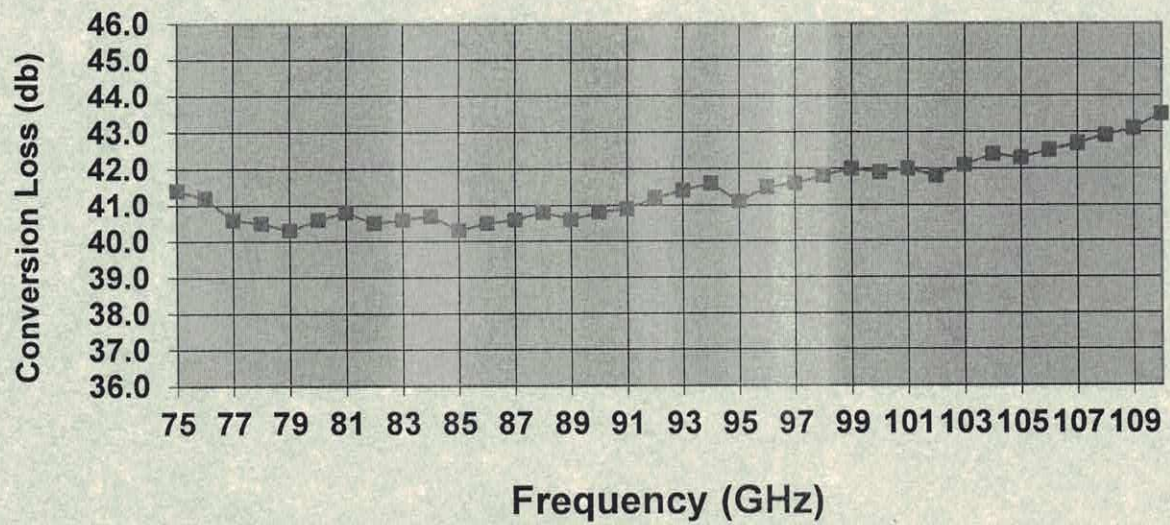
Robert Means

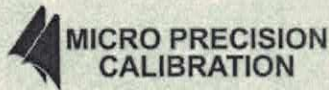
The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance 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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|                                                                                                                       |  |                                 |                    |  |  |                       |
|-----------------------------------------------------------------------------------------------------------------------|--|---------------------------------|--------------------|--|--|-----------------------|
|  MICRO PRECISION<br>CALIBRATION INC. |  |                                 |                    |  |  |                       |
| <b>Measurement Report: Harmonic Mixer 11970W</b>                                                                      |  |                                 |                    |  |  |                       |
| Procedure: Manufacturer                                                                                               |  | Order Number: SAC-70095565      |                    |  |  |                       |
| ID Number: DN0031                                                                                                     |  | Calibration Date: June 29, 2018 |                    |  |  |                       |
| Frequency<br>(GHz)                                                                                                    |  |                                 | Conversion<br>Loss |  |  | Uncertainty<br>+/- 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                   |





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



## Certificate of Calibration

Date: Jun 29, 2018

Cert No. 551220081442541

**Customer:**

COMPLIANCE TESTING LLC  
1724 S NEVADA WAY  
MESA AZ 85204

Work Order #: SAC-70095565

MPC Control #: DB8289  
Asset ID: I00465  
Gage Type: HARMONIC MIXER  
Manufacturer: HEWLETT PACKARD  
Model Number: 11970Q  
Size: 33-50 Ghz  
Temp/RH: 72.0°F / 40.0%  
Location: Calibration performed at MPC facility

Serial Number: 3003A03386  
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 |
| AM1913 | POWER SENSOR       | 8487A  | 3318A02585 | AGILENT         | Jan 31, 2019  | 512200813260111 |
| V8087  | POWER METER        | 438A   | 3513U04859 | HEWLETT PACKARD | Dec 31, 2019  | 512200813160759 |
| 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:

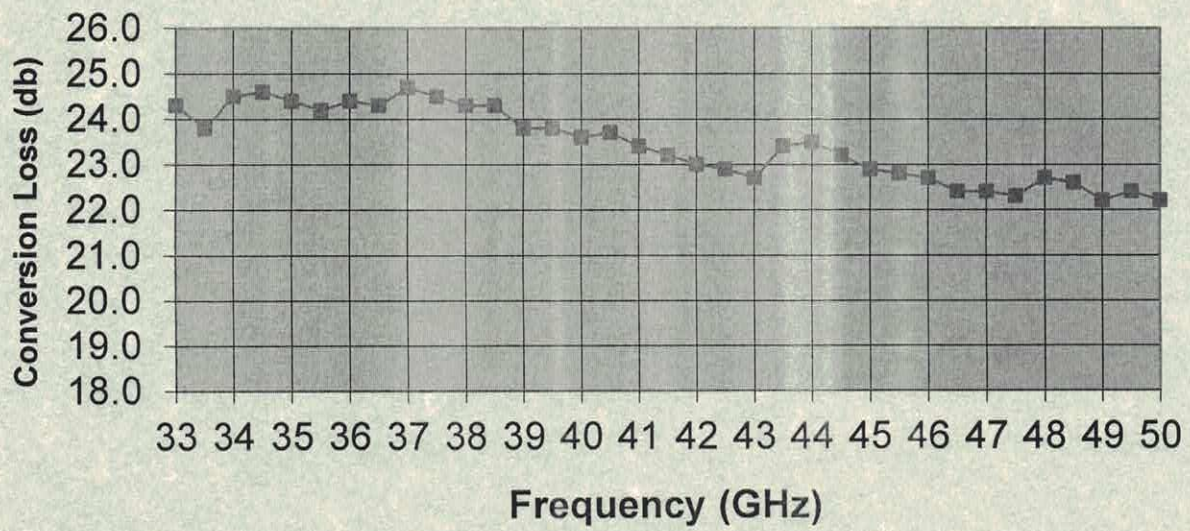
Robert Means

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.

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|                                                                                                                               |  |                                 |                    |  |  |                       |
|-------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------|--------------------|--|--|-----------------------|
|  <b>MICRO PRECISION<br/>CALIBRATION INC.</b> |  |                                 |                    |  |  |                       |
| <b>Measurement Report: Harmonic Mixer 11970Q</b>                                                                              |  |                                 |                    |  |  |                       |
| Procedure: Manufacturer                                                                                                       |  | Order Number: SAC-70095565      |                    |  |  |                       |
| ID Number: DB8289                                                                                                             |  | Calibration Date: June 29, 2018 |                    |  |  |                       |
| Frequency<br>(GHz)                                                                                                            |  |                                 | Conversion<br>Loss |  |  | Uncertainty<br>+/- dB |
| 33.0                                                                                                                          |  |                                 | 24.3               |  |  | 0.6                   |
| 33.5                                                                                                                          |  |                                 | 23.8               |  |  | 0.6                   |
| 34.0                                                                                                                          |  |                                 | 24.5               |  |  | 0.6                   |
| 34.5                                                                                                                          |  |                                 | 24.6               |  |  | 0.6                   |
| 35.0                                                                                                                          |  |                                 | 24.4               |  |  | 0.6                   |
| 35.5                                                                                                                          |  |                                 | 24.2               |  |  | 0.6                   |
| 36.0                                                                                                                          |  |                                 | 24.4               |  |  | 0.6                   |
| 36.5                                                                                                                          |  |                                 | 24.3               |  |  | 0.6                   |
| 37.0                                                                                                                          |  |                                 | 24.7               |  |  | 0.6                   |
| 37.5                                                                                                                          |  |                                 | 24.5               |  |  | 0.6                   |
| 38.0                                                                                                                          |  |                                 | 24.3               |  |  | 0.6                   |
| 38.5                                                                                                                          |  |                                 | 24.3               |  |  | 0.6                   |
| 39.0                                                                                                                          |  |                                 | 23.8               |  |  | 0.6                   |
| 39.5                                                                                                                          |  |                                 | 23.8               |  |  | 0.6                   |
| 40.0                                                                                                                          |  |                                 | 23.6               |  |  | 0.6                   |
| 40.5                                                                                                                          |  |                                 | 23.7               |  |  | 0.6                   |
| 41.0                                                                                                                          |  |                                 | 23.4               |  |  | 0.6                   |
| 41.5                                                                                                                          |  |                                 | 23.2               |  |  | 0.6                   |
| 42.0                                                                                                                          |  |                                 | 23.0               |  |  | 0.6                   |
| 42.5                                                                                                                          |  |                                 | 22.9               |  |  | 0.6                   |
| 43.0                                                                                                                          |  |                                 | 22.7               |  |  | 0.6                   |
| 43.5                                                                                                                          |  |                                 | 23.4               |  |  | 0.6                   |
| 44.0                                                                                                                          |  |                                 | 23.5               |  |  | 0.6                   |
| 44.5                                                                                                                          |  |                                 | 23.2               |  |  | 0.6                   |
| 45.0                                                                                                                          |  |                                 | 22.9               |  |  | 0.6                   |
| 45.5                                                                                                                          |  |                                 | 22.8               |  |  | 0.6                   |
| 46.0                                                                                                                          |  |                                 | 22.7               |  |  | 0.6                   |
| 46.5                                                                                                                          |  |                                 | 22.4               |  |  | 0.6                   |
| 47.0                                                                                                                          |  |                                 | 22.4               |  |  | 0.6                   |
| 47.5                                                                                                                          |  |                                 | 22.3               |  |  | 0.6                   |
| 48.0                                                                                                                          |  |                                 | 22.7               |  |  | 0.6                   |
| 48.5                                                                                                                          |  |                                 | 22.6               |  |  | 0.6                   |
| 49.0                                                                                                                          |  |                                 | 22.2               |  |  | 0.6                   |
| 49.5                                                                                                                          |  |                                 | 22.4               |  |  | 0.6                   |
| 50.0                                                                                                                          |  |                                 | 22.2               |  |  | 0.6                   |



## Antenna Gain to Antenna correction factor conversion worksheet

Enter Freq in GHz and Antenna Gain in dBi and the wavelength, numeric antenna gain, and ACF are calculated

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

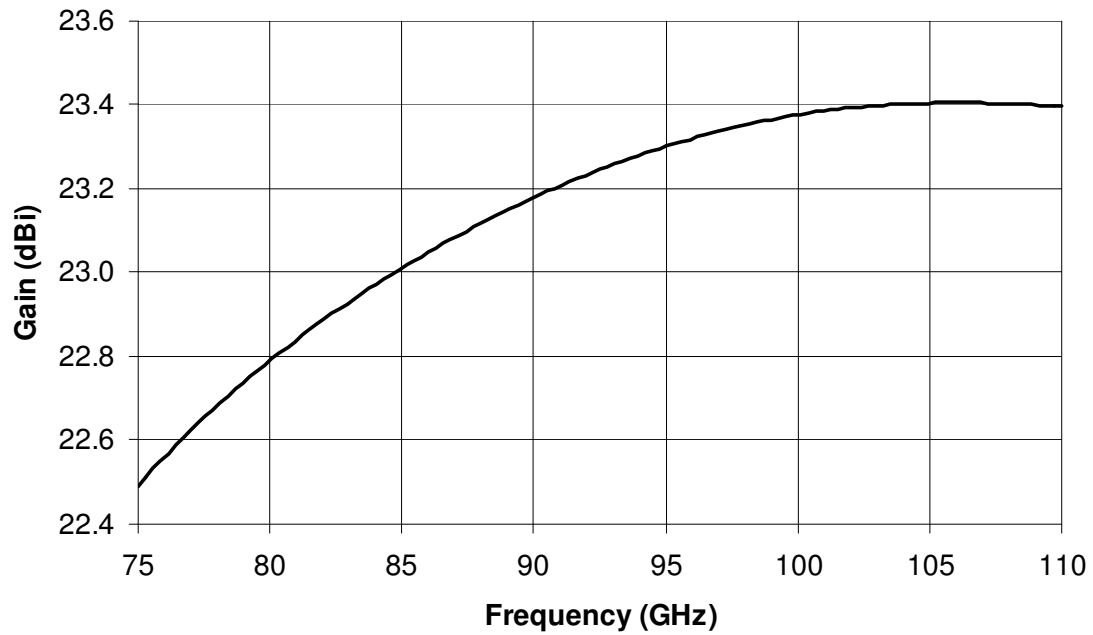
$\lambda$  = wavelength in meters = speed of light / frequency (Hz) =>  $v/f$

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

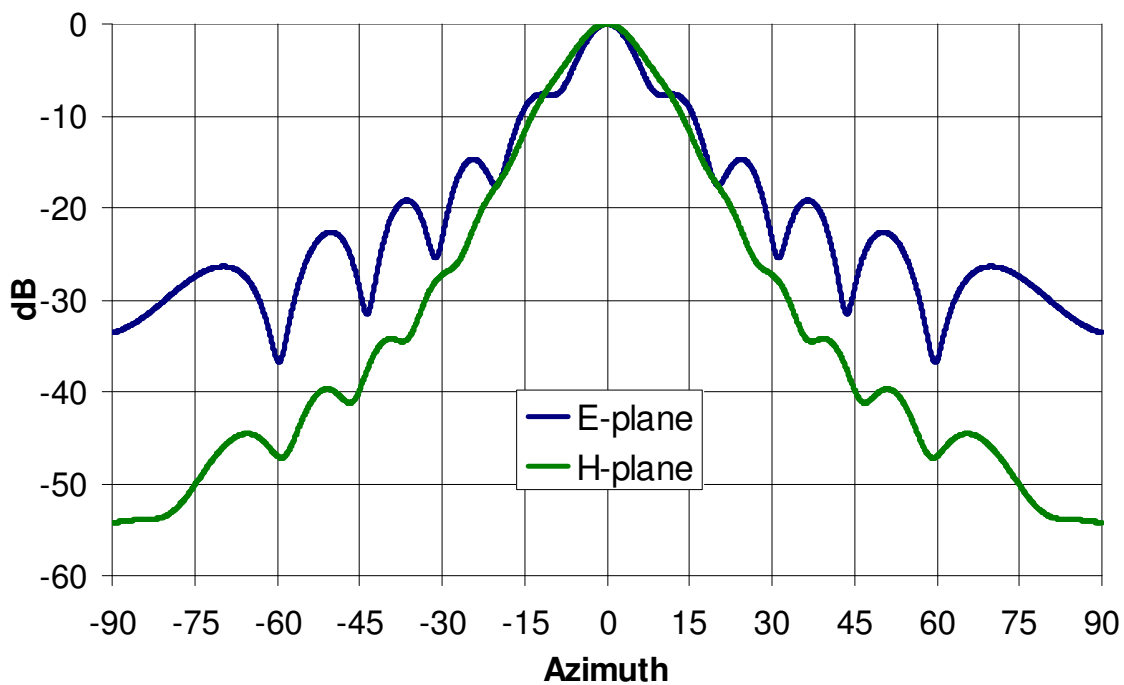
$G_{num}$  = Numeric Antenna Gain =  $10^{(Gain_{dBi}/10)}$

| 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 |

**HO10 Simulated Gain Curve**



**HO10 Radiation Pattern @ 92.5 GHz**



Enter Freq in GHz and Antenna Gain in dBi and the wavelength, numeric antenna gain, and ACF are calculated

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

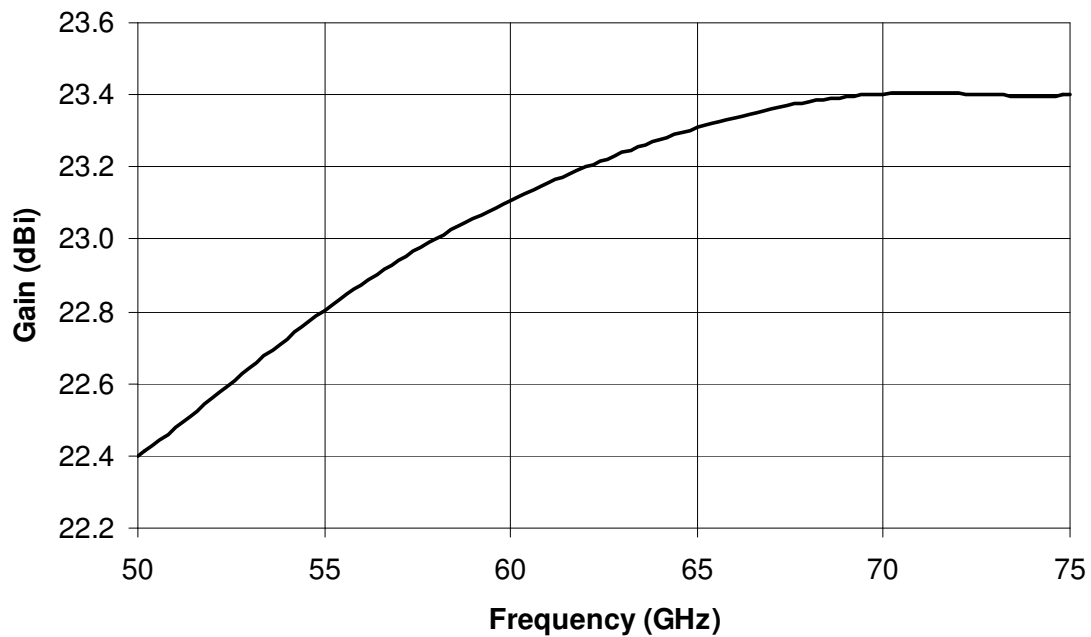
$\lambda$  = wavelength in meters = speed of light / frequency (Hz)  $\Rightarrow v/f$

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

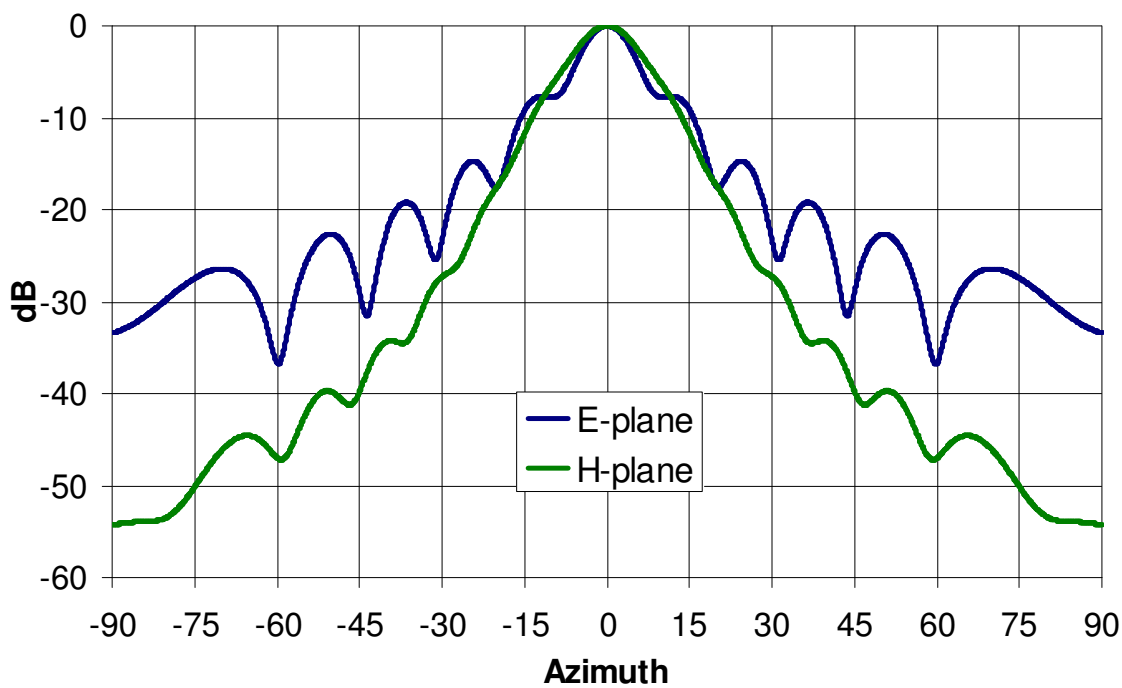
$G_{num}$  = Numeric Antenna Gain =  $10^{(Gain_{dBi}/10)}$

| 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 |

**HO15 Simulated Gain Curve**



**HO15 Radiation Pattern @ 62.5 GHz**



Enter Freq in GHz and Antenna Gain in dBi and the wavelength, numeric antenna gain, and ACF are calculated

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

$\lambda$  = wavelength in meters = speed of light / frequency (Hz)  $\Rightarrow v/f$

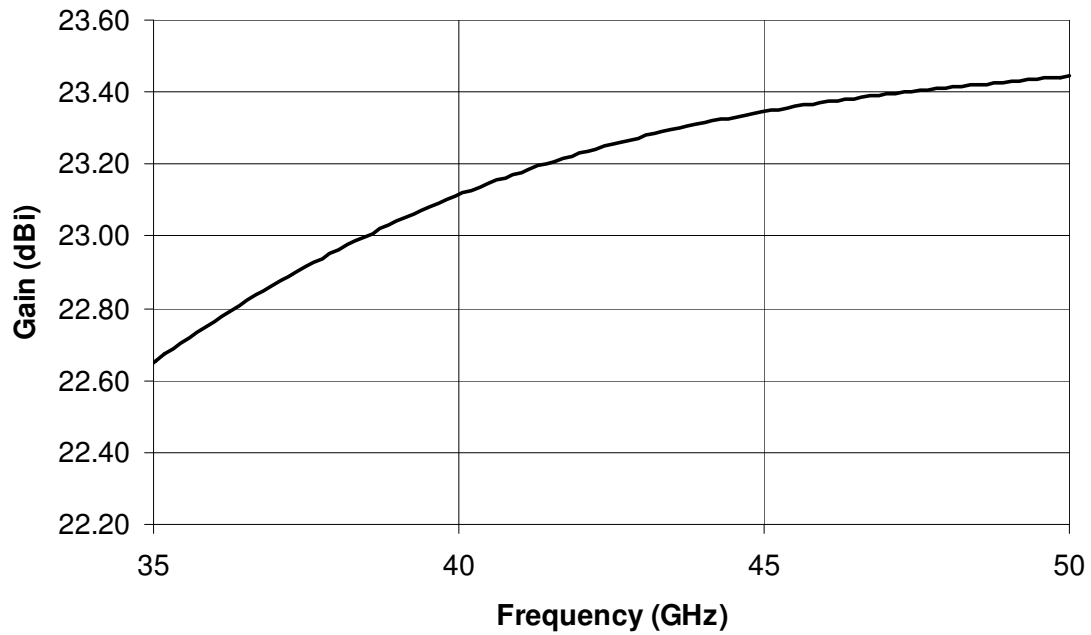
Speed of Light = 299792458 (m/sec)  $\approx 3 \times 10^8$

$G_{num}$  = Numeric Antenna Gain =  $10^{(Gain_{dBi}/10)}$

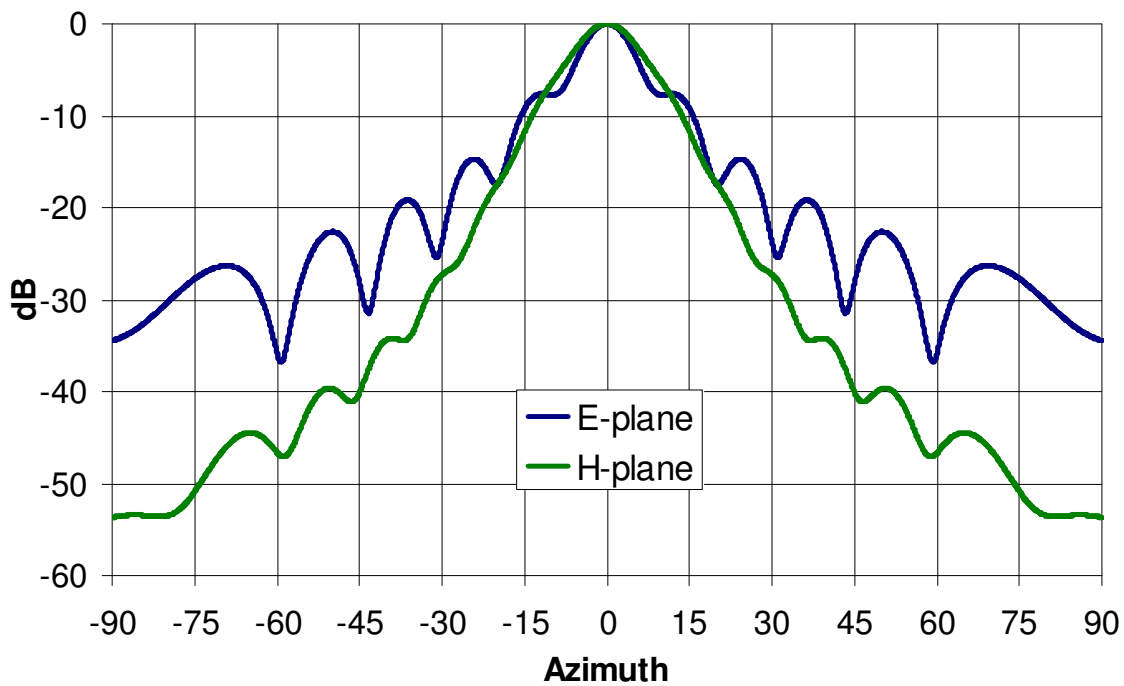
| Asset # i00484 (33 - 50 GHz Horn antenna) |             |                |             |          |              |       |
|-------------------------------------------|-------------|----------------|-------------|----------|--------------|-------|
| Frequency                                 | Frequency   | speed of light | wavelength  | Ant Gain | Antenna Gain | ACF   |
| GHz                                       | Hz          | m/sec          | m           | dBi      | numeric      | dB    |
| 33                                        | 33000000000 | 299792458      | 0.00908462  | 22.6     | 181.97       | 38.03 |
| 34                                        | 34000000000 | 299792458      | 0.008817425 | 22.6     | 181.97       | 38.29 |
| 35                                        | 35000000000 | 299792458      | 0.008565499 | 22.65    | 184.08       | 38.49 |
| 36                                        | 36000000000 | 299792458      | 0.008327568 | 22.8     | 190.55       | 38.59 |
| 37                                        | 37000000000 | 299792458      | 0.008102499 | 22.9     | 194.98       | 38.73 |
| 38                                        | 38000000000 | 299792458      | 0.007889275 | 23       | 199.53       | 38.86 |
| 39                                        | 39000000000 | 299792458      | 0.007686986 | 23.05    | 201.84       | 39.03 |
| 40                                        | 40000000000 | 299792458      | 0.007494811 | 23.1     | 204.17       | 39.20 |
| 41                                        | 41000000000 | 299792458      | 0.007312011 | 23.15    | 206.54       | 39.37 |
| 42                                        | 42000000000 | 299792458      | 0.007137916 | 23.2     | 208.93       | 39.53 |
| 43                                        | 43000000000 | 299792458      | 0.006971918 | 23.25    | 211.35       | 39.68 |
| 44                                        | 44000000000 | 299792458      | 0.006813465 | 23.3     | 213.80       | 39.83 |
| 45                                        | 45000000000 | 299792458      | 0.006662055 | 23.35    | 216.27       | 39.98 |
| 46                                        | 46000000000 | 299792458      | 0.006517227 | 23.38    | 217.77       | 40.14 |
| 47                                        | 47000000000 | 299792458      | 0.006378563 | 23.4     | 218.78       | 40.31 |
| 48                                        | 48000000000 | 299792458      | 0.006245676 | 23.41    | 219.28       | 40.48 |
| 49                                        | 49000000000 | 299792458      | 0.006118213 | 23.42    | 219.79       | 40.65 |
| 50                                        | 50000000000 | 299792458      | 0.005995849 | 23.45    | 221.31       | 40.79 |

| Example using i00085 test data (18 - 40 GHz Horn Antenna) |             |           |             |        |  |            |
|-----------------------------------------------------------|-------------|-----------|-------------|--------|--|------------|
| 18                                                        | 18000000000 | 299792458 | 0.016655137 | 10.789 |  | 45.0392241 |

**H022 Simulated Gain Curve**



**H022 Radiation Pattern @ 41.5 GHz**



# Certificate of Calibration

ISO/IEC 17025:2017 and ANSI/NCSL Z540.3-2006

Certificate Number 1-11561478968-1



**Model Number** N9038A  
**Manufacturer** Keysight Technologies Inc  
**Description** MXE EMI Receiver  
**Serial Number** MY53220134

**Date of Calibration** 9 Sep 2019  
**Procedure** TME-N7818A-E.09.03  
**Temperature** (23 ± 5) °C  
**Humidity** (50 ± 30) %RH

**Customer**  
Compliance Testing LLC  
1724 S Nevada Way  
MESA AZ 85204-6624  
United States

**Location of Calibration**  
Keysight Technologies Inc  
10090 Foothills Blvd.  
Roseville CA 95747-7102  
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/NCSL Z540.3-2006. The quality management system is registered to ISO 9001:2015.

#### As Received Conditions

One or more measured values of the equipment were observed out of specification at the points tested. Additionally, the expanded measurement uncertainty intervals about one or more measured values were entirely outside the specification.

#### Action Taken

- The equipment was adjusted.
- The equipment was repaired.

#### As Completed Conditions

The measured values of the equipment were observed in specification at the points tested. Additionally, the expanded measurement uncertainty intervals about the measured values were in specification.

#### Remarks or Special Requirements

This calibration report shall not be reproduced, except in full. The documented results relate to the equipment calibrated only.

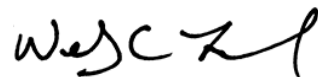
The test limits stated in the report correspond to the published specifications of the equipment, at the points tested.

This calibration report may refer to equipment manufactured by HP, Agilent and Keysight as being manufactured by Keysight Technologies.

Based on the customer's request, the next calibration is due on 9 Sep 2020.

Keysight Technologies Inc  
10090 Foothills Blvd.  
Roseville CA 95747-7102  
UNITED STATES

Issue Date 10 Sep 2019



Wes Fischbach Roseville Serv. Cntr. Mgr.

## Traceability Information

Technician ID Number 00821225

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

## Calibration Equipment Used

| Model Number              | Model Description                                                    | Equipment ID   | Cal Due Date |
|---------------------------|----------------------------------------------------------------------|----------------|--------------|
| 10 MHz External Reference | Rubidium Standard                                                    | FS72533342     | 27 Feb 2020  |
| 11667A                    | DC-18 GHz power splitter, type N, 50 ohm                             | 11667A57715    | 23 Aug 2020  |
| 11667B                    | Power splitter, DC to 26.5 GHz, 3.5 mm female connectors             | 11667B54389    | 25 Jun 2020  |
| 11667C                    | DC - 50 GHz power splitter, 50 ohm                                   | 11667C52516    | 12 Dec 2019  |
| 33250A                    | Function/Arbitrary Waveform Generator, 80 MHz                        | 33250A13731    | 6 Jun 2020   |
| 3458A                     | Digital multimeter, 8.5 digit                                        | 3458A23849     | 18 Oct 2019  |
| 500-13438D                | 10MHz-1GHz Phase Lock Frequency Source Rev.D                         | 500-1343831449 | 3 Dec 2019   |
| 53132A                    | Input<br>Universal Counter, 225 MHz, 12 digit/s, 150 ps. GPIB, RS232 | 53132A01423    | 15 Mar 2020  |
| 8482A                     | Power Sensor, 100 kHz to 4.2 GHz, -30 to +20 dBm                     | 8482A11442     | 19 Jun 2020  |
| 8485A                     | Power Sensor, 50 MHz to 26.5 GHz, -30 to +20 dBm                     | 8485A90935     | 13 Feb 2020  |
| 8487D                     | Power Sensor, 50 MHz to 50 GHz, -70 to -20 dBm                       | 8487D30001     | 13 Jun 2020  |
| 8487D                     | Power Sensor, 50 MHz to 50 GHz, -70 to -20 dBm                       | 8487D91007     | 15 Oct 2020  |
| 8490D                     | Coaxial fixed attenuator, dc-50 GHz                                  | 8490D07480     | 7 Jan 2020   |
| 8491B                     | Coaxial attenuator, dc - 18 GHz, Type N                              | 8491BA0299     | 29 May 2020  |
| 8491B                     | Coaxial attenuator, dc - 18 GHz, Type N                              | 8491B64432     | 4 Dec 2019   |
| 8491B                     | Coaxial attenuator, dc - 18 GHz, Type N                              | 8491BA0514     | 27 Sep 2020  |
| 8493C                     | Coaxial fixed attenuator, dc to 26.5 GHz                             | 8493C05761     | 14 Mar 2020  |
| 8493C                     | Coaxial fixed attenuator, dc to 26.5 GHz                             | 8493C73530     | 15 Nov 2020  |
| 8494G                     | 0-11dB programmable step ATTENUATOR., dc-4GHz                        | 8494G40782     | 8 Apr 2020   |
| 8496G                     | 0-110dB programmable step attenuator, dc-4GHz                        | 8496G40597     | 8 Apr 2020   |
| 85054B                    | Standard mechanical calibration kit, DC to 18 GHz, type-N            | 85054B00214    | 24 Apr 2020  |
| 85056A                    | Standard mechanical calibration kit, DC to 50 GHz, 2.4 mm            | 85056A00202    | 28 Jan 2020  |
| 86205A                    | 50 Ohm RF bridge 300kHz to 6GHz                                      | 86205A03005    | 11 Dec 2019  |
| E5071C                    | ENA Series Network analyzer                                          | E5071C02659    | 12 Sep 2019  |
| E8257D                    | PSG analog signal generator                                          | E8257D11509    | 4 Oct 2019   |
| E8257D                    | PSG analog signal generator                                          | E8257D01598    | 24 Jul 2021  |
| E9304A                    | Power Sensor-Average, 9 kHz to 6 GHz, -60 to +20 dBm                 | E9304A40012    | 2 Oct 2020   |
| E9304A                    | Power Sensor-Average, 9 kHz to 6 GHz, -60 to +20 dBm                 | E9304A40010    | 1 Oct 2020   |
| IGUU2916                  | EMI Calibration Pulse Generator                                      | IGUU2916916238 | 26 Sep 2019  |

# Certificate of Calibration

ISO/IEC 17025:2017 and ANSI/NCSL Z540.3-2006

Certificate Number 1-11561478968-1



| Model Number | Model Description                                    | Equipment ID | Cal Due Date |
|--------------|------------------------------------------------------|--------------|--------------|
| N1914A       | Power Meter - Average, dual channel                  | N1914A50013  | 10 Aug 2020  |
| N5230C       | PNA-L network analyzer                               | N5230C02393  | 3 May 2020   |
| N8487A       | Power Sensor - Thermocouple, average, 50MHz to 50GHz | N8487A80008  | 16 Jun 2020  |
| N8487A       | Power Sensor - Thermocouple, average, 50MHz to 50GHz | N8487A10013  | 25 Apr 2021  |

## Traceability Table

|     | Model                     | Model Description                                           | Equipment ID   | Certificate Number              | Trace Value            |
|-----|---------------------------|-------------------------------------------------------------|----------------|---------------------------------|------------------------|
| W,R | 10 MHz External Reference | Rubidium Standard                                           | FS72533342     | 1-10907609122-1-ANAB:AC-1498.01 | Frequency              |
| W,R | 11667A                    | DC-18 GHz power splitter, type N, 50 ohm                    | 11667A57715    | 1-11553657402-1-ANAB:AC-1498    | Reflection Coefficient |
| W,R | 11667B                    | Power splitter, DC to 26.5 GHz, 3.5 mm female connectors    | 11667B54389    | 1-9999173906-1-ANAB:AC-1498     | Reflection Coefficient |
| W,R | 11667C                    | DC - 50 GHz power splitter, 50 ohm                          | 11667C52516    | 1-10660921504-1-ANAB:AC-1498    | Reflection Coefficient |
| W,R | 33250A                    | Function/Arbitrary Waveform Generator, 80 MHz               | 33250A13731    | 1-11307766401-1-ANAB:AC-1498    | AC Voltage Frequency   |
| W,R | 3458A                     | Digital multimeter, 8.5 digit                               | 3458A23849     | 1-10417976162-1-ANAB:AC-1498.03 | AC Voltage             |
| W,R | 500-13438D                | 10MHz-1GHz Phase Lock Frequency Source Rev.D Input          | 500-1343831449 | 1-10640792116-1-ANAB:AC-1498    | Phase Noise            |
| W,R | 53132A                    | Universal Counter, 225 MHz, 12 digit/s, 150 ps. GPIB, RS232 | 53132A01423    | 1-9796975141-1-ANAB:AC-1498     | Frequency              |
| W,R | 8482A                     | Power Sensor, 100 kHz to 4.2 GHz, -30 to +20 dBm            | 8482A11442     | 1-10667964493-1-ANAB:AC-1498    | RF Power               |
| W,R | 8485A                     | Power Sensor, 50 MHz to 26.5 GHz, -30 to +20 dBm            | 8485A90935     | 1-10903564529-1-ANAB:AC-1498    | RF Power               |
| W,R | 8487D                     | Power Sensor, 50 MHz to 50 GHz, -70 to -20 dBm              | 8487D91007     | 1-10432218506-1-ANAB:AC-1498    | RF Power               |
| W,R | 8487D                     | Power Sensor, 50 MHz to 50 GHz, -70 to -20 dBm              | 8487D30001     | 1-10082236287-1-ANAB:AC-1498    | RF Power               |
| W,R | 8490D                     | Coaxial fixed attenuator, dc-50 GHz                         | 8490D07480     | 1-10765225307-1-ANAB:AC-1498    | Attenuation            |
| W,R | 8491B                     | Coaxial attenuator, dc - 18 GHz, Type N                     | 8491BA0299     | 1-11273972964-1-ANAB:AC-1498    | Attenuation            |
| W,R | 8491B                     | Coaxial attenuator, dc - 18 GHz, Type N                     | 8491B64432     | 1-10668206172-1-ANAB:AC-1498    | Attenuation            |
| W,R | 8491B                     | Coaxial attenuator, dc - 18 GHz, Type N                     | 8491BA0514     | 1-10449164270-1-ANAB:AC-1498    | Attenuation            |
| W,R | 8493C                     | Coaxial fixed attenuator, dc to 26.5 GHz                    | 8493C73530     | 1-10569576936-1-ANAB:AC-1498    | Attenuation            |
| W,R | 8493C                     | Coaxial fixed attenuator, dc to 26.5 GHz                    | 8493C05761     | 1-9800385023-1-ANAB:AC-1498     | Attenuation            |
| W,R | 8494G                     | 0-11dB programmable step ATTENUATOR., dc-4GHz               | 8494G40782     | 1-11112894720-2-ANAB:AC-1498    | Attenuation            |

# Certificate of Calibration

ISO/IEC 17025:2017 and ANSI/NCSL Z540.3-2006

Certificate Number 1-11561478968-1



|     | Model    | Model Description                                         | Equipment ID   | Certificate Number           | Trace Value                                             |
|-----|----------|-----------------------------------------------------------|----------------|------------------------------|---------------------------------------------------------|
| W,R | 8496G    | 0-110dB programmable step attenuator, dc-4GHz             | 8496G40597     | 1-11112894720-1-ANAB:AC-1498 | Attenuation                                             |
| W,R | 85054B   | Standard mechanical calibration kit, DC to 18 GHz, type-N | 85054B00214    | 1-11125279654-1-ANAB:AC-1498 | Reflection Coefficient                                  |
| W,R | 85056A   | Standard mechanical calibration kit, DC to 50 GHz, 2.4 mm | 85056A00202    | 1-10783639066-1-A2LA:2079.01 | Reflection Coefficient                                  |
| W   | 86205A   | 50 Ohm RF bridge 300kHz to 6GHz                           | 86205A03005    | 1-10663915176-1              |                                                         |
| R   | 85032B   | 50-Ohm Type-N calibration kit                             | 85032B08649    | 1-10295375252-1-ANAB:AC-1498 | Reflection Coefficient                                  |
| W,R | E5071C   | ENA Series Network analyzer                               | E5071C02659    | 1-10989177680-1-ANAB:AC-1498 | Attenuation<br>Frequency<br>Reflection Coefficient      |
| W,R | E8257D   | PSG analog signal generator                               | E8257D01598    | 1-11409648492-1-ANAB:AC-1498 | Frequency<br>Phase Noise<br>RF Power<br>Spectral Purity |
| W,R | E8257D   | PSG analog signal generator                               | E8257D11509    | 1-10421902838-1-ANAB:AC-1498 | Frequency<br>Phase Noise<br>RF Power<br>Spectral Purity |
| W,R | E9304A   | Power Sensor-Average, 9 kHz to 6 GHz, -60 to +20 dBm      | E9304A40010    | 1-10449377539-1-ANAB:AC-1498 | RF Power                                                |
| W,R | E9304A   | Power Sensor-Average, 9 kHz to 6 GHz, -60 to +20 dBm      | E9304A40012    | 1-10449377791-1-ANAB:AC-1498 | RF Power                                                |
| W,R | IGUU2916 | EMI Calibration Pulse Generator                           | IGUU2916916238 | 1-8948026950-1-NMI:PTB       | RF Power                                                |
| W,R | N1914A   | Power Meter - Average, dual channel                       | N1914A50013    | 1-10316190942-1-ANAB:AC-1498 | RF Power                                                |
| W,R | N5230C   | PNA-L network analyzer                                    | N5230C02393    | 1-11202078100-1-ANAB:AC-1498 | Attenuation<br>Frequency<br>Reflection Coefficient      |
| W,R | N8487A   | Power Sensor - Thermocouple, average, 50MHz to 50GHz      | N8487A10013    | 1-11481229143-1-ANAB:AC-1498 | RF Power                                                |
| W,R | N8487A   | Power Sensor - Thermocouple, average, 50MHz to 50GHz      | N8487A80008    | 1-11456096598-1-ANAB:AC-1498 | RF Power                                                |

## Legend

**W - Working Standard** The calibration equipment used for the calibration of the Model indicated on the first page of the Certificate of calibration.

**R - Reference Standard** The Reference Standard (Accredited or NMI-calibrated ETE) used to provide traceability to the SI-Units for the calibration parameters listed.

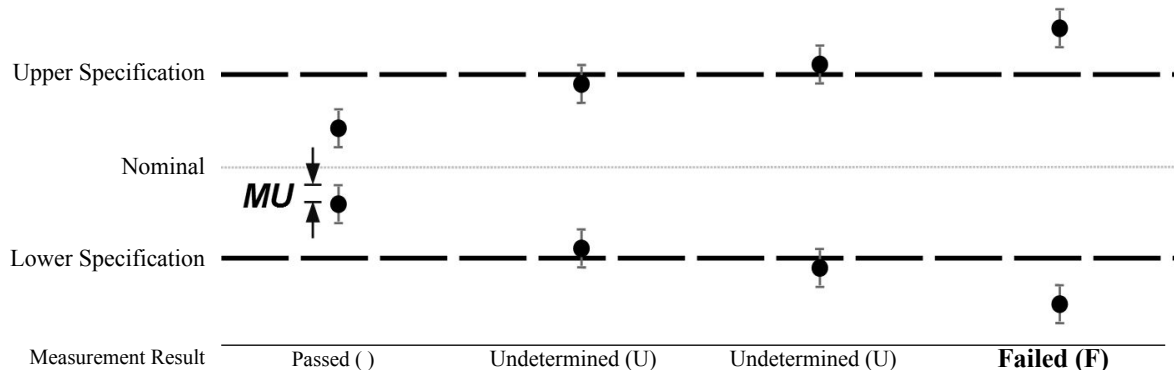
## Compliance with Specification

The uncertainty of measurement has been taken into account when determining compliance with specification, as per ILAC-G8:03/2009. If the expanded measurement uncertainty intervals centered about one or more measured values were both in as well as out of specification (upper or lower), it is not possible to state compliance or non-compliance based on a 95% coverage probability for the expanded measurement uncertainty.

An overall statement of compliance for all tests performed as received, and as completed (if any adjustments / repairs were performed) is included at the beginning of this report. Statements of compliance apply only to warranted specifications. When functional verification tests are performed, results are reported in the "Functional Test" section, and do not affect these statements of compliance. The status summaries relate to the tested item only. A final decision about whether the item's performance actually satisfies requirements of the user can only be made by the user.

### Measurement results are reported as:

- Passed ( ) - The measured values of the equipment were observed in specification at the points tested. Additionally, the expanded measurement uncertainty intervals about the measured values were in specification.
- Undetermined (U) - The expanded measurement uncertainty intervals about one or more measured values were in as well as out of specification. Consequently, neither compliance nor non-compliance with specification can be declared based on the stated coverage probability.
- Failed (F) - One or more measured values of the equipment were observed out of specification at the points tested. Additionally, the expanded measurement uncertainty intervals about one or more measured values were entirely outside the specification.



( ) This result is indicated on the measurement report as a blank space in the column labeled "Status" or "Sts".  
MU = 95% expanded measurement uncertainty.

## Acceptance Limit

The "Keysight Cal + Uncertainties + Guardbanding" service employs a guard band in the amount of the 95% expanded measurement uncertainty (MU). The resulting acceptance limit applied for Pass or Fail decisions, and for performing adjustments, is the difference of the specification and the guard band.

## 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.

## Calibration Test Results Summary

| Test Name                                         | As Completed Status |
|---------------------------------------------------|---------------------|
| Frequency Reference Accuracy                      | Passed              |
| Power Bandwidth Accuracy                          | Passed              |
| Resolution Bandwidth Switching Uncertainty        | Passed              |
| Residual Responses                                | Passed              |
| Displayed Average Noise Level                     | Passed              |
| Frequency Readout Accuracy                        | Passed              |
| Frequency Span Accuracy                           | Passed              |
| Count Accuracy                                    | Passed              |
| IF Frequency Response                             | Passed              |
| RBW Selectivity CISPR Bands                       | Passed              |
| Phase Noise                                       | Passed              |
| Absolute Amplitude Accuracy at 50 MHz             | Passed              |
| Input Attenuation Switching Uncertainty           | Passed              |
| Display Scale Fidelity                            | Passed              |
| Freq Resp Above 3.6 GHz Preamp On                 | Passed              |
| IF Input Gain Accuracy Option EXM                 | Passed              |
| LO Output Power Accuracy Option EXM               | Passed              |
| Spurious Responses                                | Passed              |
| Freq Resp Above 3.6 GHz Preamp Off                | Passed              |
| Second Harmonic Intercept                         | Passed              |
| Gain Compression                                  | Passed              |
| Third Order Intermodulation Distortion            | Passed              |
| Response To Pulses (Peak, Ave, RMS)               | Passed              |
| Variation With Pulse Repetition Freq (Ave, RMS)   | Passed              |
| Response To Intermittent Disturbances (Ave, RMS)  | Passed              |
| Radiated Band Sine Wave Accuracy                  | Passed              |
| Freq Resp 50 MHz to 3.6 GHz                       | Passed              |
| Freq Resp 9 kHz to 50 MHz                         | Passed              |
| Conducted Band Sine Wave Accuracy                 | Passed              |
| Freq Resp Below 300 kHz                           | Passed              |
| Response To Pulses (Peak, Ave, RMS) Bands A/B/C/D | Passed              |
| Q-P Detector Absolute Calibration                 | Passed              |
| Q-P Detector Variation With Pulse Repetition Freq | Passed              |
| Conducted Band VSWR                               | Passed              |
| Radiated Band VSWR                                | Passed              |

## Functional Test Results Summary

The following functional test results are not part of an accredited delivery, even if they are part of an otherwise accredited calibration report.

The following tests document the functional verification of the instruments' non-warranted performance. Neither a statement of conformance or decision rule is used for a Functional Test, measurement uncertainties are only provided by exception. For a "Functional Test" the test results are reported as "As Expected" when showing expected performance and "Not As Expected" otherwise. "As Expected" results of individual test points are indicated in the measurement report by a blank space in the column labeled "Status" to allow easier recognition of any "Not As Expected" points. If a functional test result is reported as "Not As Expected", repair and/or adjustment is

# Certificate of Calibration

ISO/IEC 17025:2017 and ANSI/NCSL Z540.3-2006

Certificate Number 1-11561478968-1



recommended. Test results reported as “Done” are possible if no limits are applied. For qualitative or quantitative “Functional Tests” the test results are not warranted, and no judgment is made. The “actual” measured results are helpful to users for some applications.

| Test Name                 | As Completed Status |
|---------------------------|---------------------|
| Internal Alignment        | As Expected         |
| MIL STD RBW Selectivity   | As Expected         |
| Effective DANL Option NFE | As Expected         |

## Tested Configuration

|                  |                                                         |
|------------------|---------------------------------------------------------|
| Firmware Version | A.19.55                                                 |
| Tested Options   | 544 B24 CR3 DP2 EDP EMC EXM LSN NFE P44 PC4 PFR SSD W7X |

| i00555_10 MHz - 40 GHz Pre-amplifier |        |  |  |
|--------------------------------------|--------|--|--|
| from 1-13-2020 test data             |        |  |  |
|                                      |        |  |  |
| Freq                                 | I/L    |  |  |
| GHz                                  | dB     |  |  |
| 1.000                                | -43.44 |  |  |
| 1.045                                | -43.45 |  |  |
| 1.090                                | -43.58 |  |  |
| 1.135                                | -43.53 |  |  |
| 1.180                                | -43.75 |  |  |
| 1.225                                | -43.79 |  |  |
| 1.270                                | -43.86 |  |  |
| 1.315                                | -43.96 |  |  |
| 1.360                                | -43.86 |  |  |
| 1.405                                | -43.90 |  |  |
| 1.450                                | -43.82 |  |  |
| 1.495                                | -43.83 |  |  |
| 1.540                                | -43.76 |  |  |
| 1.585                                | -43.67 |  |  |
| 1.630                                | -43.60 |  |  |
| 1.675                                | -43.52 |  |  |
| 1.720                                | -43.45 |  |  |
| 1.765                                | -43.36 |  |  |
| 1.810                                | -43.25 |  |  |
| 1.855                                | -43.24 |  |  |
| 1.900                                | -43.06 |  |  |
| 1.945                                | -43.00 |  |  |
| 1.990                                | -42.84 |  |  |
| 2.035                                | -42.74 |  |  |
| 2.080                                | -42.66 |  |  |
| 2.125                                | -42.54 |  |  |
| 2.170                                | -42.43 |  |  |
| 2.215                                | -42.31 |  |  |
| 2.260                                | -42.27 |  |  |
| 2.305                                | -42.13 |  |  |
| 2.350                                | -42.16 |  |  |
| 2.395                                | -42.02 |  |  |
| 2.440                                | -42.09 |  |  |
| 2.485                                | -42.13 |  |  |
| 2.530                                | -41.96 |  |  |
| 2.575                                | -42.03 |  |  |
| 2.620                                | -41.97 |  |  |
| 2.665                                | -42.04 |  |  |
| 2.710                                | -41.92 |  |  |
| 2.755                                | -41.93 |  |  |
| 2.800                                | -41.92 |  |  |
| 2.845                                | -41.92 |  |  |

1/13/2020

|       |        |  |  |
|-------|--------|--|--|
| 2.890 | -41.88 |  |  |
| 2.935 | -41.82 |  |  |
| 2.980 | -41.85 |  |  |
| 3.025 | -41.79 |  |  |
| 3.070 | -41.78 |  |  |
| 3.115 | -41.71 |  |  |
| 3.160 | -41.79 |  |  |
| 3.205 | -41.72 |  |  |
| 3.250 | -41.77 |  |  |
| 3.295 | -41.74 |  |  |
| 3.340 | -41.67 |  |  |
| 3.385 | -41.69 |  |  |
| 3.430 | -41.61 |  |  |
| 3.475 | -41.69 |  |  |
| 3.520 | -41.59 |  |  |
| 3.565 | -41.59 |  |  |
| 3.610 | -41.52 |  |  |
| 3.655 | -41.56 |  |  |
| 3.700 | -41.51 |  |  |
| 3.745 | -41.52 |  |  |
| 3.790 | -41.52 |  |  |
| 3.835 | -41.48 |  |  |
| 3.880 | -41.49 |  |  |
| 3.925 | -41.41 |  |  |
| 3.970 | -41.52 |  |  |
| 4.015 | -41.50 |  |  |
| 4.060 | -41.46 |  |  |
| 4.105 | -41.47 |  |  |
| 4.150 | -41.38 |  |  |
| 4.195 | -41.42 |  |  |
| 4.240 | -41.31 |  |  |
| 4.285 | -41.31 |  |  |
| 4.330 | -41.27 |  |  |
| 4.375 | -41.30 |  |  |
| 4.420 | -41.30 |  |  |
| 4.465 | -41.20 |  |  |
| 4.510 | -41.15 |  |  |
| 4.555 | -41.15 |  |  |
| 4.600 | -41.15 |  |  |
| 4.645 | -41.02 |  |  |
| 4.690 | -41.00 |  |  |
| 4.735 | -41.04 |  |  |
| 4.780 | -40.87 |  |  |
| 4.825 | -40.96 |  |  |
| 4.870 | -40.78 |  |  |
| 4.915 | -40.76 |  |  |
| 4.960 | -40.73 |  |  |

|       |        |  |  |
|-------|--------|--|--|
| 5.005 | -40.66 |  |  |
| 5.050 | -40.58 |  |  |
| 5.095 | -40.52 |  |  |
| 5.140 | -40.51 |  |  |
| 5.185 | -40.42 |  |  |
| 5.230 | -40.41 |  |  |
| 5.275 | -40.35 |  |  |
| 5.320 | -40.34 |  |  |
| 5.365 | -40.35 |  |  |
| 5.410 | -40.26 |  |  |
| 5.455 | -40.32 |  |  |
| 5.500 | -40.15 |  |  |
| 5.545 | -40.21 |  |  |
| 5.590 | -40.11 |  |  |
| 5.635 | -40.02 |  |  |
| 5.680 | -40.06 |  |  |
| 5.725 | -40.01 |  |  |
| 5.770 | -39.99 |  |  |
| 5.815 | -39.91 |  |  |
| 5.860 | -39.81 |  |  |
| 5.905 | -39.74 |  |  |
| 5.950 | -39.72 |  |  |
| 5.995 | -39.62 |  |  |
| 6.040 | -39.61 |  |  |
| 6.085 | -39.44 |  |  |
| 6.130 | -39.42 |  |  |
| 6.175 | -39.41 |  |  |
| 6.220 | -39.26 |  |  |
| 6.265 | -39.24 |  |  |
| 6.310 | -39.17 |  |  |
| 6.355 | -39.11 |  |  |
| 6.400 | -38.98 |  |  |
| 6.445 | -39.00 |  |  |
| 6.490 | -38.88 |  |  |
| 6.535 | -38.80 |  |  |
| 6.580 | -38.69 |  |  |
| 6.625 | -38.65 |  |  |
| 6.670 | -38.62 |  |  |
| 6.715 | -38.50 |  |  |
| 6.760 | -38.52 |  |  |
| 6.805 | -38.34 |  |  |
| 6.850 | -38.32 |  |  |
| 6.895 | -38.29 |  |  |
| 6.940 | -38.26 |  |  |
| 6.985 | -38.22 |  |  |
| 7.030 | -38.09 |  |  |
| 7.075 | -38.09 |  |  |

|       |        |  |  |
|-------|--------|--|--|
| 7.120 | -38.06 |  |  |
| 7.165 | -38.04 |  |  |
| 7.210 | -37.86 |  |  |
| 7.255 | -38.01 |  |  |
| 7.300 | -37.79 |  |  |
| 7.345 | -37.66 |  |  |
| 7.390 | -37.73 |  |  |
| 7.435 | -37.63 |  |  |
| 7.480 | -37.68 |  |  |
| 7.525 | -37.49 |  |  |
| 7.570 | -37.45 |  |  |
| 7.615 | -37.37 |  |  |
| 7.660 | -37.28 |  |  |
| 7.705 | -37.30 |  |  |
| 7.750 | -37.06 |  |  |
| 7.795 | -37.15 |  |  |
| 7.840 | -36.97 |  |  |
| 7.885 | -37.13 |  |  |
| 7.930 | -36.88 |  |  |
| 7.975 | -36.85 |  |  |
| 8.020 | -36.80 |  |  |
| 8.065 | -36.65 |  |  |
| 8.110 | -36.75 |  |  |
| 8.155 | -36.56 |  |  |
| 8.200 | -36.81 |  |  |
| 8.245 | -36.49 |  |  |
| 8.290 | -36.60 |  |  |
| 8.335 | -36.58 |  |  |
| 8.380 | -36.52 |  |  |
| 8.425 | -36.65 |  |  |
| 8.470 | -36.52 |  |  |
| 8.515 | -36.56 |  |  |
| 8.560 | -36.50 |  |  |
| 8.605 | -36.45 |  |  |
| 8.650 | -36.51 |  |  |
| 8.695 | -36.41 |  |  |
| 8.740 | -36.39 |  |  |
| 8.785 | -36.26 |  |  |
| 8.830 | -36.36 |  |  |
| 8.875 | -36.28 |  |  |
| 8.920 | -36.32 |  |  |
| 8.965 | -36.24 |  |  |
| 9.010 | -36.13 |  |  |
| 9.055 | -36.17 |  |  |
| 9.100 | -36.10 |  |  |
| 9.145 | -36.22 |  |  |
| 9.190 | -36.05 |  |  |

|        |        |  |  |
|--------|--------|--|--|
| 9.235  | -36.15 |  |  |
| 9.280  | -36.01 |  |  |
| 9.325  | -36.13 |  |  |
| 9.370  | -36.04 |  |  |
| 9.415  | -36.12 |  |  |
| 9.460  | -36.12 |  |  |
| 9.505  | -35.91 |  |  |
| 9.550  | -36.18 |  |  |
| 9.595  | -36.06 |  |  |
| 9.640  | -36.11 |  |  |
| 9.685  | -36.05 |  |  |
| 9.730  | -35.99 |  |  |
| 9.775  | -36.22 |  |  |
| 9.820  | -36.01 |  |  |
| 9.865  | -36.11 |  |  |
| 9.910  | -36.07 |  |  |
| 9.955  | -36.11 |  |  |
| 10.000 | -36.13 |  |  |
| 10.000 | -36.09 |  |  |
| 10.050 | -36.09 |  |  |
| 10.100 | -36.10 |  |  |
| 10.150 | -36.10 |  |  |
| 10.200 | -36.10 |  |  |
| 10.250 | -36.09 |  |  |
| 10.300 | -36.09 |  |  |
| 10.350 | -36.11 |  |  |
| 10.400 | -36.07 |  |  |
| 10.450 | -36.10 |  |  |
| 10.500 | -36.09 |  |  |
| 10.550 | -36.18 |  |  |
| 10.600 | -36.16 |  |  |
| 10.650 | -36.21 |  |  |
| 10.700 | -36.17 |  |  |
| 10.750 | -36.23 |  |  |
| 10.800 | -36.21 |  |  |
| 10.850 | -36.30 |  |  |
| 10.900 | -36.27 |  |  |
| 10.950 | -36.30 |  |  |
| 11.000 | -36.23 |  |  |
| 11.050 | -36.29 |  |  |
| 11.100 | -36.28 |  |  |
| 11.150 | -36.33 |  |  |
| 11.200 | -36.32 |  |  |
| 11.250 | -36.34 |  |  |
| 11.300 | -36.37 |  |  |
| 11.350 | -36.39 |  |  |
| 11.400 | -36.39 |  |  |

|        |        |  |  |
|--------|--------|--|--|
| 11.450 | -36.36 |  |  |
| 11.500 | -36.38 |  |  |
| 11.550 | -36.41 |  |  |
| 11.600 | -36.44 |  |  |
| 11.650 | -36.43 |  |  |
| 11.700 | -36.47 |  |  |
| 11.750 | -36.41 |  |  |
| 11.800 | -36.49 |  |  |
| 11.850 | -36.44 |  |  |
| 11.900 | -36.51 |  |  |
| 11.950 | -36.45 |  |  |
| 12.000 | -36.47 |  |  |
| 12.050 | -36.43 |  |  |
| 12.100 | -36.44 |  |  |
| 12.150 | -36.42 |  |  |
| 12.200 | -36.41 |  |  |
| 12.250 | -36.39 |  |  |
| 12.300 | -36.41 |  |  |
| 12.350 | -36.36 |  |  |
| 12.400 | -36.40 |  |  |
| 12.450 | -36.33 |  |  |
| 12.500 | -36.38 |  |  |
| 12.550 | -36.32 |  |  |
| 12.600 | -36.31 |  |  |
| 12.650 | -36.34 |  |  |
| 12.700 | -36.29 |  |  |
| 12.750 | -36.32 |  |  |
| 12.800 | -36.24 |  |  |
| 12.850 | -36.27 |  |  |
| 12.900 | -36.28 |  |  |
| 12.950 | -36.26 |  |  |
| 13.000 | -36.28 |  |  |
| 13.050 | -36.21 |  |  |
| 13.100 | -36.26 |  |  |
| 13.150 | -36.20 |  |  |
| 13.200 | -36.19 |  |  |
| 13.250 | -36.21 |  |  |
| 13.300 | -36.24 |  |  |
| 13.350 | -36.23 |  |  |
| 13.400 | -36.20 |  |  |
| 13.450 | -36.15 |  |  |
| 13.500 | -36.24 |  |  |
| 13.550 | -36.14 |  |  |
| 13.600 | -36.21 |  |  |
| 13.650 | -36.13 |  |  |
| 13.700 | -36.18 |  |  |
| 13.750 | -36.13 |  |  |

|        |        |  |  |
|--------|--------|--|--|
| 13.800 | -36.13 |  |  |
| 13.850 | -36.18 |  |  |
| 13.900 | -36.12 |  |  |
| 13.950 | -36.08 |  |  |
| 14.000 | -35.97 |  |  |
| 14.050 | -36.02 |  |  |
| 14.100 | -36.02 |  |  |
| 14.150 | -36.05 |  |  |
| 14.200 | -35.96 |  |  |
| 14.250 | -36.01 |  |  |
| 14.300 | -35.92 |  |  |
| 14.350 | -35.93 |  |  |
| 14.400 | -35.84 |  |  |
| 14.450 | -35.94 |  |  |
| 14.500 | -35.87 |  |  |
| 14.550 | -35.89 |  |  |
| 14.600 | -35.84 |  |  |
| 14.650 | -35.89 |  |  |
| 14.700 | -35.90 |  |  |
| 14.750 | -35.88 |  |  |
| 14.800 | -35.88 |  |  |
| 14.850 | -35.86 |  |  |
| 14.900 | -35.77 |  |  |
| 14.950 | -35.78 |  |  |
| 15.000 | -35.66 |  |  |
| 15.050 | -35.78 |  |  |
| 15.100 | -35.65 |  |  |
| 15.150 | -35.69 |  |  |
| 15.200 | -35.66 |  |  |
| 15.250 | -35.64 |  |  |
| 15.300 | -35.65 |  |  |
| 15.350 | -35.50 |  |  |
| 15.400 | -35.67 |  |  |
| 15.450 | -35.56 |  |  |
| 15.500 | -35.66 |  |  |
| 15.550 | -35.50 |  |  |
| 15.600 | -35.55 |  |  |
| 15.650 | -35.42 |  |  |
| 15.700 | -35.43 |  |  |
| 15.750 | -35.31 |  |  |
| 15.800 | -35.41 |  |  |
| 15.850 | -35.23 |  |  |
| 15.900 | -35.36 |  |  |
| 15.950 | -35.18 |  |  |
| 16.000 | -35.35 |  |  |
| 16.050 | -35.18 |  |  |
| 16.100 | -35.25 |  |  |

|        |        |  |  |
|--------|--------|--|--|
| 16.150 | -35.07 |  |  |
| 16.200 | -35.05 |  |  |
| 16.250 | -34.99 |  |  |
| 16.300 | -34.91 |  |  |
| 16.350 | -34.94 |  |  |
| 16.400 | -34.84 |  |  |
| 16.450 | -34.85 |  |  |
| 16.500 | -34.76 |  |  |
| 16.550 | -34.72 |  |  |
| 16.600 | -34.69 |  |  |
| 16.650 | -34.65 |  |  |
| 16.700 | -34.56 |  |  |
| 16.750 | -34.60 |  |  |
| 16.800 | -34.43 |  |  |
| 16.850 | -34.55 |  |  |
| 16.900 | -34.32 |  |  |
| 16.950 | -34.42 |  |  |
| 17.000 | -34.17 |  |  |
| 17.050 | -34.29 |  |  |
| 17.100 | -34.11 |  |  |
| 17.150 | -34.18 |  |  |
| 17.200 | -33.96 |  |  |
| 17.250 | -34.02 |  |  |
| 17.300 | -33.87 |  |  |
| 17.350 | -33.92 |  |  |
| 17.400 | -33.80 |  |  |
| 17.450 | -33.86 |  |  |
| 17.500 | -33.79 |  |  |
| 17.550 | -33.69 |  |  |
| 17.600 | -33.65 |  |  |
| 17.650 | -33.55 |  |  |
| 17.700 | -33.57 |  |  |
| 17.750 | -33.37 |  |  |
| 17.800 | -33.44 |  |  |
| 17.850 | -33.32 |  |  |
| 17.900 | -33.37 |  |  |
| 17.950 | -33.17 |  |  |
| 18.000 | -33.30 |  |  |
| 18.050 | -33.12 |  |  |
| 18.100 | -33.22 |  |  |
| 18.150 | -32.91 |  |  |
| 18.200 | -33.16 |  |  |
| 18.250 | -32.92 |  |  |
| 18.300 | -33.04 |  |  |
| 18.350 | -32.75 |  |  |
| 18.400 | -32.98 |  |  |
| 18.450 | -32.81 |  |  |

|        |        |  |  |
|--------|--------|--|--|
| 18.500 | -32.86 |  |  |
| 18.550 | -32.74 |  |  |
| 18.600 | -32.88 |  |  |
| 18.650 | -32.84 |  |  |
| 18.700 | -32.78 |  |  |
| 18.750 | -32.73 |  |  |
| 18.800 | -32.72 |  |  |
| 18.850 | -32.70 |  |  |
| 18.900 | -32.60 |  |  |
| 18.950 | -32.66 |  |  |
| 19.000 | -32.71 |  |  |
| 19.050 | -32.73 |  |  |
| 19.100 | -32.64 |  |  |
| 19.150 | -32.74 |  |  |
| 19.200 | -32.72 |  |  |
| 19.250 | -32.76 |  |  |
| 19.300 | -32.55 |  |  |
| 19.350 | -32.75 |  |  |
| 19.400 | -32.70 |  |  |
| 19.450 | -32.80 |  |  |
| 19.500 | -32.67 |  |  |
| 19.550 | -32.86 |  |  |
| 19.600 | -32.87 |  |  |
| 19.650 | -32.91 |  |  |
| 19.700 | -32.79 |  |  |
| 19.750 | -32.94 |  |  |
| 19.800 | -32.96 |  |  |
| 19.850 | -32.93 |  |  |
| 19.900 | -32.88 |  |  |
| 19.950 | -32.95 |  |  |
| 20.000 | -33.07 |  |  |
| 20.000 | -33.07 |  |  |
| 20.050 | -32.96 |  |  |
| 20.100 | -32.97 |  |  |
| 20.150 | -33.01 |  |  |
| 20.200 | -33.15 |  |  |
| 20.250 | -33.07 |  |  |
| 20.300 | -33.14 |  |  |
| 20.350 | -33.18 |  |  |
| 20.400 | -33.33 |  |  |
| 20.450 | -33.21 |  |  |
| 20.500 | -33.35 |  |  |
| 20.550 | -33.39 |  |  |
| 20.600 | -33.52 |  |  |
| 20.650 | -33.29 |  |  |
| 20.700 | -33.36 |  |  |
| 20.750 | -33.46 |  |  |

|        |        |  |  |
|--------|--------|--|--|
| 20.800 | -33.53 |  |  |
| 20.850 | -33.52 |  |  |
| 20.900 | -33.44 |  |  |
| 20.950 | -33.61 |  |  |
| 21.000 | -33.47 |  |  |
| 21.050 | -33.53 |  |  |
| 21.100 | -33.53 |  |  |
| 21.150 | -33.68 |  |  |
| 21.200 | -33.55 |  |  |
| 21.250 | -33.44 |  |  |
| 21.300 | -33.51 |  |  |
| 21.350 | -33.61 |  |  |
| 21.400 | -33.47 |  |  |
| 21.450 | -33.39 |  |  |
| 21.500 | -33.38 |  |  |
| 21.550 | -33.56 |  |  |
| 21.600 | -33.49 |  |  |
| 21.650 | -33.52 |  |  |
| 21.700 | -33.57 |  |  |
| 21.750 | -33.57 |  |  |
| 21.800 | -33.48 |  |  |
| 21.850 | -33.34 |  |  |
| 21.900 | -33.38 |  |  |
| 21.950 | -33.37 |  |  |
| 22.000 | -33.35 |  |  |
| 22.050 | -33.33 |  |  |
| 22.100 | -33.46 |  |  |
| 22.150 | -33.48 |  |  |
| 22.200 | -33.42 |  |  |
| 22.250 | -33.36 |  |  |
| 22.300 | -33.40 |  |  |
| 22.350 | -33.39 |  |  |
| 22.400 | -33.33 |  |  |
| 22.450 | -33.26 |  |  |
| 22.500 | -33.32 |  |  |
| 22.550 | -33.34 |  |  |
| 22.600 | -33.31 |  |  |
| 22.650 | -33.35 |  |  |
| 22.700 | -33.38 |  |  |
| 22.750 | -33.46 |  |  |
| 22.800 | -33.40 |  |  |
| 22.850 | -33.41 |  |  |
| 22.900 | -33.46 |  |  |
| 22.950 | -33.50 |  |  |
| 23.000 | -33.42 |  |  |
| 23.050 | -33.44 |  |  |
| 23.100 | -33.42 |  |  |

|        |        |  |  |
|--------|--------|--|--|
| 23.150 | -33.53 |  |  |
| 23.200 | -33.39 |  |  |
| 23.250 | -33.49 |  |  |
| 23.300 | -33.47 |  |  |
| 23.350 | -33.59 |  |  |
| 23.400 | -33.45 |  |  |
| 23.450 | -33.44 |  |  |
| 23.500 | -33.55 |  |  |
| 23.550 | -33.48 |  |  |
| 23.600 | -33.58 |  |  |
| 23.650 | -33.38 |  |  |
| 23.700 | -33.61 |  |  |
| 23.750 | -33.45 |  |  |
| 23.800 | -33.51 |  |  |
| 23.850 | -33.37 |  |  |
| 23.900 | -33.53 |  |  |
| 23.950 | -33.40 |  |  |
| 24.000 | -33.44 |  |  |
| 24.050 | -33.29 |  |  |
| 24.100 | -33.54 |  |  |
| 24.150 | -33.36 |  |  |
| 24.200 | -33.41 |  |  |
| 24.250 | -33.19 |  |  |
| 24.300 | -33.31 |  |  |
| 24.350 | -33.18 |  |  |
| 24.400 | -33.13 |  |  |
| 24.450 | -33.14 |  |  |
| 24.500 | -33.19 |  |  |
| 24.550 | -33.09 |  |  |
| 24.600 | -33.05 |  |  |
| 24.650 | -32.98 |  |  |
| 24.700 | -33.01 |  |  |
| 24.750 | -32.90 |  |  |
| 24.800 | -32.70 |  |  |
| 24.850 | -32.76 |  |  |
| 24.900 | -32.56 |  |  |
| 24.950 | -32.79 |  |  |
| 25.000 | -32.48 |  |  |
| 25.050 | -32.72 |  |  |
| 25.100 | -32.45 |  |  |
| 25.150 | -32.64 |  |  |
| 25.200 | -32.36 |  |  |
| 25.250 | -32.50 |  |  |
| 25.300 | -32.27 |  |  |
| 25.350 | -32.38 |  |  |
| 25.400 | -32.12 |  |  |
| 25.450 | -32.35 |  |  |

|        |        |  |  |
|--------|--------|--|--|
| 25.500 | -32.18 |  |  |
| 25.550 | -32.29 |  |  |
| 25.600 | -32.12 |  |  |
| 25.650 | -32.21 |  |  |
| 25.700 | -32.21 |  |  |
| 25.750 | -32.10 |  |  |
| 25.800 | -32.05 |  |  |
| 25.850 | -31.94 |  |  |
| 25.900 | -31.95 |  |  |
| 25.950 | -31.93 |  |  |
| 26.000 | -31.94 |  |  |
| 26.050 | -32.08 |  |  |
| 26.100 | -32.03 |  |  |
| 26.150 | -31.96 |  |  |
| 26.200 | -32.04 |  |  |
| 26.250 | -31.93 |  |  |
| 26.300 | -32.11 |  |  |
| 26.350 | -31.70 |  |  |
| 26.400 | -32.05 |  |  |
| 26.450 | -31.87 |  |  |
| 26.500 | -32.20 |  |  |
| 26.550 | -31.99 |  |  |
| 26.600 | -32.19 |  |  |
| 26.650 | -32.10 |  |  |
| 26.700 | -32.15 |  |  |
| 26.750 | -32.07 |  |  |
| 26.800 | -32.30 |  |  |
| 26.850 | -32.26 |  |  |
| 26.900 | -32.33 |  |  |
| 26.950 | -32.17 |  |  |
| 27.000 | -32.32 |  |  |
| 27.050 | -32.43 |  |  |
| 27.100 | -32.40 |  |  |
| 27.150 | -32.57 |  |  |
| 27.200 | -32.42 |  |  |
| 27.250 | -32.63 |  |  |
| 27.300 | -32.28 |  |  |
| 27.350 | -32.43 |  |  |
| 27.400 | -32.35 |  |  |
| 27.450 | -32.51 |  |  |
| 27.500 | -32.35 |  |  |
| 27.550 | -32.48 |  |  |
| 27.600 | -32.43 |  |  |
| 27.650 | -32.61 |  |  |
| 27.700 | -32.34 |  |  |
| 27.750 | -32.54 |  |  |
| 27.800 | -32.39 |  |  |

|        |        |  |  |
|--------|--------|--|--|
| 27.850 | -32.52 |  |  |
| 27.900 | -32.36 |  |  |
| 27.950 | -32.51 |  |  |
| 28.000 | -32.72 |  |  |
| 28.050 | -32.70 |  |  |
| 28.100 | -32.72 |  |  |
| 28.150 | -32.62 |  |  |
| 28.200 | -32.72 |  |  |
| 28.250 | -32.56 |  |  |
| 28.300 | -32.44 |  |  |
| 28.350 | -32.48 |  |  |
| 28.400 | -32.58 |  |  |
| 28.450 | -32.50 |  |  |
| 28.500 | -32.45 |  |  |
| 28.550 | -32.38 |  |  |
| 28.600 | -32.58 |  |  |
| 28.650 | -32.43 |  |  |
| 28.700 | -32.57 |  |  |
| 28.750 | -32.47 |  |  |
| 28.800 | -32.50 |  |  |
| 28.850 | -32.37 |  |  |
| 28.900 | -32.37 |  |  |
| 28.950 | -32.47 |  |  |
| 29.000 | -32.44 |  |  |
| 29.050 | -32.42 |  |  |
| 29.100 | -32.44 |  |  |
| 29.150 | -32.58 |  |  |
| 29.200 | -32.67 |  |  |
| 29.250 | -32.68 |  |  |
| 29.300 | -32.69 |  |  |
| 29.350 | -32.75 |  |  |
| 29.400 | -32.64 |  |  |
| 29.450 | -32.70 |  |  |
| 29.500 | -32.80 |  |  |
| 29.550 | -33.04 |  |  |
| 29.600 | -33.05 |  |  |
| 29.650 | -33.01 |  |  |
| 29.700 | -33.07 |  |  |
| 29.750 | -33.09 |  |  |
| 29.800 | -33.14 |  |  |
| 29.850 | -33.25 |  |  |
| 29.900 | -33.38 |  |  |
| 29.950 | -33.57 |  |  |
| 30.000 | -33.60 |  |  |
| 30.150 | -33.86 |  |  |
| 30.200 | -33.69 |  |  |
| 30.250 | -33.87 |  |  |

|        |        |  |  |
|--------|--------|--|--|
| 30.300 | -33.97 |  |  |
| 30.350 | -34.07 |  |  |
| 30.400 | -34.02 |  |  |
| 30.450 | -33.95 |  |  |
| 30.500 | -34.01 |  |  |
| 30.550 | -33.91 |  |  |
| 30.600 | -33.82 |  |  |
| 30.650 | -33.71 |  |  |
| 30.700 | -33.80 |  |  |
| 30.750 | -33.72 |  |  |
| 30.800 | -33.78 |  |  |
| 30.850 | -33.70 |  |  |
| 30.900 | -33.81 |  |  |
| 30.950 | -33.59 |  |  |
| 31.000 | -33.61 |  |  |
| 31.050 | -33.43 |  |  |
| 31.100 | -33.57 |  |  |
| 31.150 | -33.49 |  |  |
| 31.200 | -33.52 |  |  |
| 31.250 | -33.47 |  |  |
| 31.300 | -33.56 |  |  |
| 31.350 | -33.57 |  |  |
| 31.400 | -33.62 |  |  |
| 31.450 | -33.58 |  |  |
| 31.500 | -33.67 |  |  |
| 31.550 | -33.53 |  |  |
| 31.600 | -33.52 |  |  |
| 31.650 | -33.54 |  |  |
| 31.700 | -33.64 |  |  |
| 31.750 | -33.71 |  |  |
| 31.800 | -33.61 |  |  |
| 31.850 | -33.78 |  |  |
| 31.900 | -33.68 |  |  |
| 31.950 | -33.77 |  |  |
| 32.000 | -33.61 |  |  |
| 32.050 | -33.75 |  |  |
| 32.100 | -33.72 |  |  |
| 32.150 | -33.78 |  |  |
| 32.200 | -33.63 |  |  |
| 32.250 | -33.67 |  |  |
| 32.300 | -33.54 |  |  |
| 32.350 | -33.45 |  |  |
| 32.400 | -33.20 |  |  |
| 32.450 | -33.16 |  |  |
| 32.500 | -33.03 |  |  |
| 32.550 | -32.92 |  |  |
| 32.600 | -32.75 |  |  |

|        |        |  |  |
|--------|--------|--|--|
| 32.650 | -32.76 |  |  |
| 32.700 | -32.79 |  |  |
| 32.750 | -32.78 |  |  |
| 32.800 | -32.74 |  |  |
| 32.850 | -32.81 |  |  |
| 32.900 | -32.97 |  |  |
| 32.950 | -33.02 |  |  |
| 33.000 | -33.11 |  |  |
| 33.050 | -33.07 |  |  |
| 33.100 | -33.00 |  |  |
| 33.150 | -32.82 |  |  |
| 33.200 | -32.73 |  |  |
| 33.250 | -32.77 |  |  |
| 33.300 | -32.86 |  |  |
| 33.350 | -32.69 |  |  |
| 33.400 | -32.66 |  |  |
| 33.450 | -32.36 |  |  |
| 33.500 | -32.29 |  |  |
| 33.550 | -32.05 |  |  |
| 33.600 | -32.04 |  |  |
| 33.650 | -31.96 |  |  |
| 33.700 | -32.00 |  |  |
| 33.750 | -31.92 |  |  |
| 33.800 | -32.01 |  |  |
| 33.850 | -31.99 |  |  |
| 33.900 | -31.96 |  |  |
| 33.950 | -31.88 |  |  |
| 34.000 | -31.81 |  |  |
| 34.050 | -31.98 |  |  |
| 34.100 | -32.05 |  |  |
| 34.150 | -32.28 |  |  |
| 34.200 | -32.37 |  |  |
| 34.250 | -32.52 |  |  |
| 34.300 | -32.48 |  |  |
| 34.350 | -32.43 |  |  |
| 34.400 | -32.32 |  |  |
| 34.450 | -32.37 |  |  |
| 34.500 | -32.18 |  |  |
| 34.550 | -32.17 |  |  |
| 34.600 | -31.95 |  |  |
| 34.650 | -32.02 |  |  |
| 34.700 | -31.76 |  |  |
| 34.750 | -31.91 |  |  |
| 34.800 | -31.89 |  |  |
| 34.850 | -31.91 |  |  |
| 34.900 | -31.54 |  |  |
| 34.950 | -31.40 |  |  |

|        |        |  |  |
|--------|--------|--|--|
| 35.000 | -31.39 |  |  |
| 35.050 | -31.43 |  |  |
| 35.100 | -31.38 |  |  |
| 35.150 | -31.38 |  |  |
| 35.200 | -31.57 |  |  |
| 35.250 | -31.68 |  |  |
| 35.300 | -32.00 |  |  |
| 35.350 | -32.06 |  |  |
| 35.400 | -32.25 |  |  |
| 35.450 | -32.39 |  |  |
| 35.500 | -32.61 |  |  |
| 35.550 | -32.85 |  |  |
| 35.600 | -33.07 |  |  |
| 35.650 | -33.19 |  |  |
| 35.700 | -33.40 |  |  |
| 35.750 | -33.38 |  |  |
| 35.800 | -33.73 |  |  |
| 35.850 | -33.68 |  |  |
| 35.900 | -33.72 |  |  |
| 35.950 | -33.38 |  |  |
| 36.000 | -33.28 |  |  |
| 36.050 | -33.10 |  |  |
| 36.100 | -33.03 |  |  |
| 36.150 | -32.81 |  |  |
| 36.200 | -32.69 |  |  |
| 36.250 | -32.63 |  |  |
| 36.300 | -32.66 |  |  |
| 36.350 | -32.52 |  |  |
| 36.400 | -32.56 |  |  |
| 36.450 | -32.69 |  |  |
| 36.500 | -32.89 |  |  |
| 36.550 | -33.06 |  |  |
| 36.600 | -33.05 |  |  |
| 36.650 | -33.29 |  |  |
| 36.700 | -33.30 |  |  |
| 36.750 | -33.50 |  |  |
| 36.800 | -33.65 |  |  |
| 36.850 | -33.71 |  |  |
| 36.900 | -33.85 |  |  |
| 36.950 | -33.63 |  |  |
| 37.000 | -34.02 |  |  |
| 37.050 | -33.95 |  |  |
| 37.100 | -34.23 |  |  |
| 37.150 | -34.18 |  |  |
| 37.200 | -34.30 |  |  |
| 37.250 | -34.47 |  |  |
| 37.300 | -34.33 |  |  |

|        |        |  |  |
|--------|--------|--|--|
| 37.350 | -34.47 |  |  |
| 37.400 | -34.48 |  |  |
| 37.450 | -34.67 |  |  |
| 37.500 | -34.73 |  |  |
| 37.550 | -34.68 |  |  |
| 37.600 | -34.85 |  |  |
| 37.650 | -34.97 |  |  |
| 37.700 | -35.32 |  |  |
| 37.750 | -35.26 |  |  |
| 37.800 | -35.36 |  |  |
| 37.850 | -35.24 |  |  |
| 37.900 | -35.34 |  |  |
| 37.950 | -35.12 |  |  |
| 38.000 | -35.07 |  |  |
| 38.050 | -34.82 |  |  |
| 38.100 | -35.00 |  |  |
| 38.150 | -34.86 |  |  |
| 38.200 | -35.05 |  |  |
| 38.250 | -35.01 |  |  |
| 38.300 | -35.05 |  |  |
| 38.350 | -34.94 |  |  |
| 38.400 | -34.86 |  |  |
| 38.450 | -34.92 |  |  |
| 38.500 | -34.98 |  |  |
| 38.550 | -34.99 |  |  |
| 38.600 | -34.95 |  |  |
| 38.650 | -34.97 |  |  |
| 38.700 | -34.99 |  |  |
| 38.750 | -34.85 |  |  |
| 38.800 | -34.79 |  |  |
| 38.850 | -34.73 |  |  |
| 38.900 | -34.77 |  |  |
| 38.950 | -34.71 |  |  |
| 39.000 | -34.68 |  |  |
| 39.050 | -34.85 |  |  |
| 39.100 | -34.85 |  |  |
| 39.150 | -34.73 |  |  |
| 39.200 | -34.68 |  |  |
| 39.250 | -34.77 |  |  |
| 39.300 | -35.19 |  |  |
| 39.350 | -35.29 |  |  |
| 39.400 | -35.50 |  |  |
| 39.450 | -35.47 |  |  |
| 39.500 | -35.48 |  |  |
| 39.550 | -35.52 |  |  |
| 39.600 | -35.38 |  |  |
| 39.650 | -35.49 |  |  |

|        |        |  |  |
|--------|--------|--|--|
| 39.700 | -35.45 |  |  |
| 39.750 | -35.56 |  |  |
| 39.800 | -35.47 |  |  |
| 39.850 | -35.36 |  |  |
| 39.900 | -35.46 |  |  |
| 39.950 | -35.47 |  |  |
| 40.000 | -35.51 |  |  |



15385 OXNARD ST  
VAN NUYS, CA 91411

## CERTIFICATE OF CONFORMANCE

|                              |                                                                         |
|------------------------------|-------------------------------------------------------------------------|
| <b>Model Number:</b>         | KT-E8257DS10                                                            |
| <b>Serial Number:</b>        | US52140176                                                              |
| <b>Asset Number:</b>         | 1320457C                                                                |
| <b>Description:</b>          | 75GHz-110GHz Millimeter Source<br>module                                |
| <b>Test Date:</b>            | 02/27/19                                                                |
| <b>Calibration Facility:</b> | ELECTRO RENT CORPORATION (WDC)<br>15385 OXNARD ST<br>VAN NUYS, CA 91411 |

The equipment listed above meets or exceeds published specifications and has been tested or otherwise verified using industry accepted methods. This certification shall not be reproduced except in full, without the written approval of Electro Rent Corporation.'

---

Electro Rent Corporation  
Authorized Signature  
KARL HAYNES

A handwritten signature in black ink, appearing to read 'Karl Haynes', is written over a horizontal line.

# Certificate of Compliance

**Certificate No:** 9502719A-160728-3

**Manufacturer:** OML, Inc.

**Model/Part No:** S10MS-AG

**Serial/ID No:** 160728-3

**Description:** WR-10 Millimeter Wave Source Module, 75-110 GHz

**Keysight P/N:** 0955-1811

**Date of Test:** February 14, 2019

**Temperature:** (23 +/- 5) deg C

**Humidity:** 20 to 65% RH

**Procedure:**

This certifies that the above product was tested in compliance with OML specifications using applicable OML's procedures.

**As Received :** Physical Condition: Good  
Within Tolerance: No

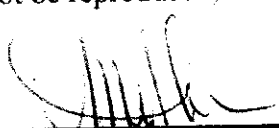
**As Shipped:** At the completion of the test, the product COMPLIED with the performance capability.

**Remarks:** Repair Service

**Traceability Information:** Traceability is to national standards administered by U.S. NIST, NRC Canada, Euromet members (NPL, PTB, BNM, etc.) or other recognized standards laboratories. Some measurements are traceable to natural physical constants, consensus standards or ratio type measurements. Supporting documentation relative to traceability is available for review by appointment.

In the absence of power standards above 110 GHz, power measurements and conversion loss measurements above 110 GHz are to confirm operation functionality and traceable only to OML.

This certificate shall not be reproduced, except in full, without the written approval of OML.

  
\_\_\_\_\_  
Mitzi Chow, Material Manager

02/15/2019

\_\_\_\_\_  
Date

OML Inc.

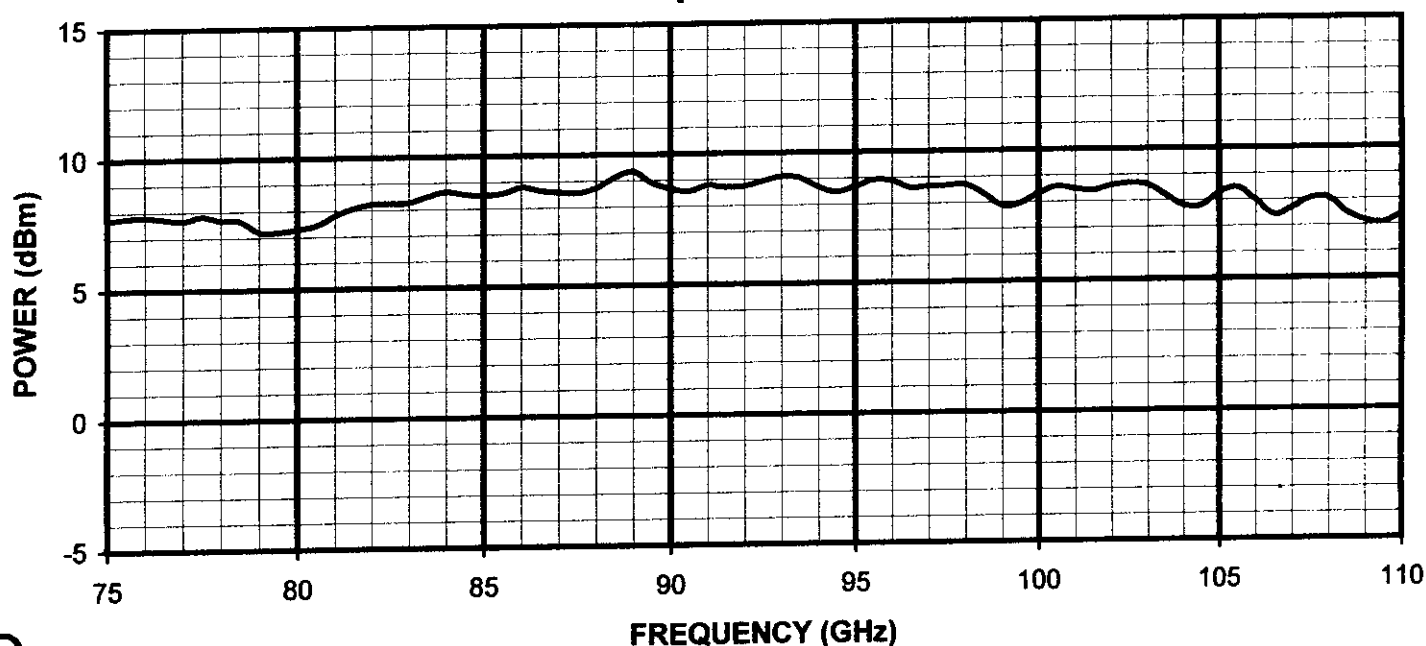
300 Digital Drive, Morgan Hill, CA 95037 USA Tel. (408) 779 2698 Fax (408) 778 0491

p19c0009\_Cal Certs  
Page 60 of 66

**S10MS-AG S/N: 160728-3**

2/14/2019

**Output Power**



**OML INC.**

300 Digital Drive, Morgan Hill, CA 95037

**Model S10MS-AG**

**S/N: 160728-3**

2/14/2019

Tested By: LV

**Output Power Test Data**

| Frequency (GHz) | Pwr Out (dBm) |
|-----------------|---------------|
| 75.00           | 7.69          |
| 75.50           | 7.78          |
| 76.00           | 7.81          |
| 76.50           | 7.73          |
| 77.00           | 7.65          |
| 77.50           | 7.82          |
| 78.00           | 7.66          |
| 78.50           | 7.63          |
| 79.00           | 7.20          |
| 79.50           | 7.19          |
| 80.00           | 7.28          |
| 80.50           | 7.43          |
| 81.00           | 7.80          |
| 81.50           | 8.07          |
| 82.00           | 8.22          |
| 82.50           | 8.23          |
| 83.00           | 8.27          |
| 83.50           | 8.48          |

| Frequency (GHz) | Pwr Out (dBm) |
|-----------------|---------------|
| 84.00           | 8.65          |
| 84.50           | 8.55          |
| 85.00           | 8.49          |
| 85.50           | 8.56          |
| 86.00           | 8.79          |
| 86.50           | 8.65          |
| 87.00           | 8.59          |
| 87.50           | 8.54          |
| 88.00           | 8.73          |
| 88.50           | 9.14          |
| 89.00           | 9.35          |
| 89.50           | 8.90          |
| 90.00           | 8.68          |
| 90.50           | 8.57          |
| 91.00           | 8.79          |
| 91.50           | 8.70          |
| 92.00           | 8.74          |
| 92.50           | 8.92          |

| Frequency (GHz) | Pwr Out (dBm) |
|-----------------|---------------|
| 93.00           | 9.09          |
| 93.50           | 9.05          |
| 94.00           | 8.68          |
| 94.50           | 8.48          |
| 95.00           | 8.68          |
| 95.50           | 8.92          |
| 96.00           | 8.88          |
| 96.50           | 8.61          |
| 97.00           | 8.66          |
| 97.50           | 8.68          |
| 98.00           | 8.71          |
| 98.50           | 8.34          |
| 99.00           | 7.87          |
| 99.50           | 7.96          |
| 100.00          | 8.32          |
| 100.50          | 8.58          |
| 101.00          | 8.48          |
| 101.50          | 8.42          |

| Frequency (GHz) | Pwr Out (dBm) |
|-----------------|---------------|
| 102.00          | 8.61          |
| 102.50          | 8.68          |
| 103.00          | 8.62          |
| 103.50          | 8.20          |
| 104.00          | 7.81          |
| 104.50          | 7.80          |
| 105.00          | 8.28          |
| 105.50          | 8.47          |
| 106.00          | 7.98          |
| 106.50          | 7.43          |
| 107.00          | 7.69          |
| 107.50          | 8.04          |
| 108.00          | 8.05          |
| 108.50          | 7.47          |
| 109.00          | 7.18          |
| 109.50          | 7.09          |
| 110.00          | 7.42          |

**OML INC.**

9502719A



15385 OXNARD ST  
VAN NUYS, CA 91411

## CERTIFICATE OF CONFORMANCE

**Model Number:** KT-E8257DS15  
**Serial Number:** US52140139  
**Asset Number:** 1608082A  
**Description:** 50GHz-75GHz Millimeter Source  
module  
**Test Date:** 12/15/17  
**Calibration Facility:** ELECTRO RENT CORPORATION (WDC)  
15385 OXNARD ST  
VAN NUYS, CA 91411

The equipment listed above meets or exceeds published specifications and has been tested or otherwise verified using industry accepted methods. This certification shall not be reproduced except in full, without the written approval of Electro Rent Corporation.'

---

Electro Rent Corporation  
Authorized Signature  
KARL HAYNES

A handwritten signature in black ink, appearing to read 'Karl Haynes', is written over a horizontal line.

# Certificate of Compliance

**Certificate No:** 6517717A-140312-1

**Manufacturer:** OML, Inc.

**Model/Part No:** S15MS-AG (Funct Verif)

**Serial/ID No:** 140312-1

**Description:** Module Source Millimeter Wave, WR-15, 50-75 GHz (Functional Verification)

**Keysight P/N:** 0955-1809 (Funct Verif)

**Date of Test:** December 4, 2017

**Temperature:** (23 +/- 5) deg C

**Humidity:** 20 to 65% RH

**Procedure:**

This certifies that the above product was tested in compliance with OML specifications using applicable OML's procedures.

**As Received :** Physical Condition: Good  
Within Tolerance: Yes

**As Shipped:** At the completion of the test, the product COMPLIED with the performance capability.

**Remarks:**

**Traceability Information:** Traceability is to national standards administered by U.S. NIST, NRC Canada, Euromet members (NPL, PTB, BNM, etc.) or other recognized standards laboratories. Some measurements are traceable to natural physical constants, consensus standards or ratio type measurements. Supporting documentation relative to traceability is available for review by appointment.

In the absence of power standards above 110 GHz, power measurements and conversion loss measurements above 110 GHz are to confirm operation functionality and traceable only to OML.

This certificate shall not be reproduced, except in full, without the written approval of OML.

  
Mitzi Chow, Material Manager

12/05/2017

Date

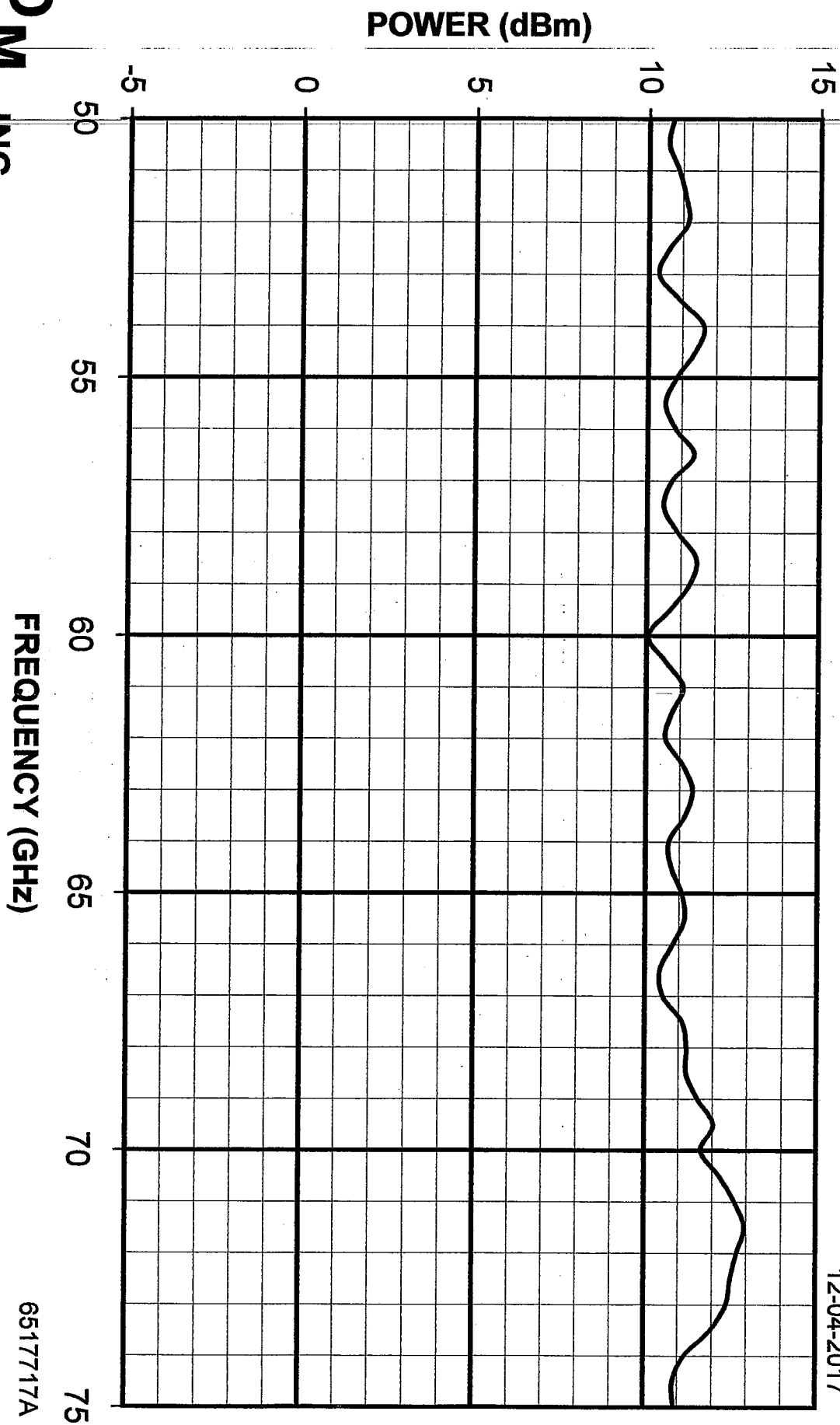
OML Inc.

300 Digital Drive, Morgan Hill, CA 95037 USA Tel. (408) 779 2698 Fax (408) 778 0491

# S15MS-AG Power Output

Ser No. 140312-1

12-04-2017



OML INC.

6517717A

Morgan Hill, CA 95037



15385 OXNARD ST  
VAN NUYS, CA 91411

## CALIBRATION CERTIFICATE

**Certificate Number:** 1778667D-07/22/19

**Calibration Date:** 07/22/19

**Procedure Method:** VENDOR CAL

**Revision Level:** REMARKS

**Calibration Facility:**

ROHDE & SCHWARZ  
zavod Vimperk, s.r.o.  
SPIDROVA 49, CZ-385 01  
VIMPERK, CZECH REPUBLIC

The equipment listed has been calibrated using the method identified above.

Measurements are traceable to the SI as defined by the documentary standards to which compliance is claimed through the calibration equipment identified on the following page, or the supplier's certificate.

Reported results of calibration are based on calibration procedure test limits, test ratios or measurement uncertainty and decision risk rules of the documentary standards to which compliance is claimed. Electro Rent Corp. does not report indeterminate results.

Calibration measurement results with units of measurement and associated measurement uncertainty information calculated using GUM methods, or as provided by the calibration procedure are identified with the asset number in order to ensure that the page(s) is (are) recognized as a part of this calibration certificate.

This certificate and associated report may not be reproduced except in full without approval of Electro Rent Corporation.

Electro Rent West Coast Distribution Center quality management system implements ISO 9001 and is registered. Our calibration system implements ISO/IEC 17025, ANSI Z540-1, and MIL-STD-45662A.

This calibration certificate and any associated report is not intended to demonstrate traceability per ILAC P10.

|                                  |                                                            |
|----------------------------------|------------------------------------------------------------|
| <b>Manufacturer:</b>             | Rohde & Schwarz                                            |
| <b>Model Number:</b>             | SMW200A-44                                                 |
| <b>Serial Number:</b>            | 107056                                                     |
| <b>Asset Number:</b>             | 1778667D                                                   |
| <b>Description:</b>              | 100kHz to 44GHz Vector Signal Generator                    |
| <b>Customer:</b>                 | COMPLIANCE TESTING<br>1724 S. NEVADA WAY<br>MESA, AZ 85204 |
| <b>Customer PO:</b>              | 6424                                                       |
| <b>Performance upon receipt:</b> | WITHIN MFR SPECS                                           |
| <b>Results of calibration:</b>   | IN TOL NO ADJ                                              |
| <b>Ambient Temp:</b>             | 70.0F                                                      |
| <b>Relative Humidity:</b>        | 50.00%                                                     |
| <b>Date of Issue:</b>            | 04/21/20                                                   |
| <b>Calib Due Date:</b>           | 07/22/22                                                   |
| <b>OS Build:</b>                 | NA                                                         |
| <b>Firmware:</b>                 | 4.60.092.24SP2                                             |

**Laboratory Manager:**  
Alejandra Salazar

**Technician:**  
Bernardo Gonzalez

# CALIBRATION CERTIFICATE

**Model Number:** SMW200A-44

**Asset Number:** 1778667D

**Certificate Number:** 1778667D-07/22/19

**Serial Number:** 107056

**Calibration Date:** 07/22/19

## Calibration Equipment

| Description | Model | Asset | Certificate Number | Cal. Due |
|-------------|-------|-------|--------------------|----------|
| N/A         | N/A   | N/A   | N/A                | N/A      |

## Remarks:

VENDOR CALIBRATION CERTIFICATE NO. 17-818537-C