

TEST REPORT

ACCORDING TO: FCC 47 CFR part 15 section 15.255:2017

FOR:

Siklu Communication Ltd.
Point-to-point wireless Ethernet link
operating in 57-71 GHz
Models: EH-600T-ODU-PoE
EH-600TX-ODU-PoE
EH-600TL-ODU-PoE
FCC ID:2ACYESK-60GTDD-B1

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1 Applicant information

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Telephone: +972 3921 4015
Fax: +972 3921 4162
E-mail: baruch@siklu.com
Contact name: Mr. Baruch Schwarz

2 Equipment under test attributes

Product name: Point-to-point wireless Ethernet link operating at 57-71 GHz
Product type: Transceiver
Model(s): EH-600T-ODU-PoE
Serial number: S810000100
Hardware version: D0
Software release: 7.5
Receipt date 05-Dec-17

3 Manufacturer information

Manufacturer name: Siklu Communication Ltd.
Address: 43 Hasivim street, Petach-Tikva 49517, Israel
Telephone: +972 3921 4015
Fax: +972 3921 4162
E-Mail: baruch@siklu.com
Contact name: Mr. Baruch Schwarz

4 Test details

Project ID: 30351
Location: Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel
Test started: 05-Dec-17
Test completed: 22-Jan-18
Test specification(s): FCC 47 CFR part 15 section 15.255:2017

5 Tests summary

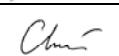
| Test | Status |
|--|---|
| Transmitter characteristics | |
| FCC Section 15.255(c)(ii), Transmitter power and power spectral density | Pass |
| FCC Section 15.215(c), Occupied bandwidth | Pass |
| FCC Section 15.255(d)(2), Radiated spurious emissions below 40 GHz | Pass |
| FCC Section 15. 255(d)(3), Radiated emissions outside assigned band and above 40 GHz up to 200 GHz | Pass |
| FCC Section 15.255(f), Frequency tolerance | Tested without limit |
| FCC Section 15.255(g), RF exposure | Pass, exhibit included in Application for certification |

The product was approved under FCC ID:2ACYESK-60GTDD-B1 for operation in 57 – 64 GHz band. The relevant tests were done to support operation in 57 – 71 GHz band in accordance with FCC 47CFR part 15:2017 and submit Application for Class II permissive changes certification.

The change is software controlled, no hardware change was made.

This test report supersedes the previously issued test report identified by Doc ID:SIKRAD_FCC.30351.

The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

| | Name and Title | Date | Signature |
|---------------------|---|-------------------|---|
| Tested by: | Mr. S. Samokha, test engineer Mr. K. Zushchyk, test engineer | January 22, 2018 |  |
| Reviewed by: | Mrs. M. Cherniavsky, certification engineer | February 8 , 2018 |  |
| Approved by: | Mr. M. Nikishin, EMC and Radio group manager | March 26, 2018 |  |



6 EUT description

6.1 General information

The EUT is an outdoor unit of point-to-point high BW system, the first TDD member of Siklu's EtherHaul family of wireless products, featuring carrier grade, high capacity Ethernet with flexible support of the 57-71 GHz regulated V-Band. The EUT radio supports up to 1 Gbps.

Siklu's EtherHaul EH-600T Rev D0 wireless backhaul radio link operates in the new E-band spectrum, which has clear technological and economical advantages over the existing lower frequency bands.

The EtherHaul EH-600T Rev D0 system comprises:

- the EtherHaul EH-600T-ODU-POE outdoor unit (radio link unit and antenna);
- the EtherHaul system host software and command line interface for complete and flexible system configuration, administration and management.

During the testing the EUT system was powered by 48 VDC.

6.2 Ports and lines

| Port type | Port description | Connected from | Connected to | Qty. | Cable type | Cable length, m |
|-----------|------------------|----------------|--------------|------|------------|-----------------|
| Telecom | Ethernet-POE | EUT ETH1 | POE/POH | 1 | Shielded | 2 |
| Telecom | Ethernet-PSE | EUT ETH2 | Open circuit | 1 | Shielded | 2 |
| Telecom | Ethernet-PSE | EUT ETH3 | Open circuit | 1 | Shielded | 2 |

6.3 Support and test equipment

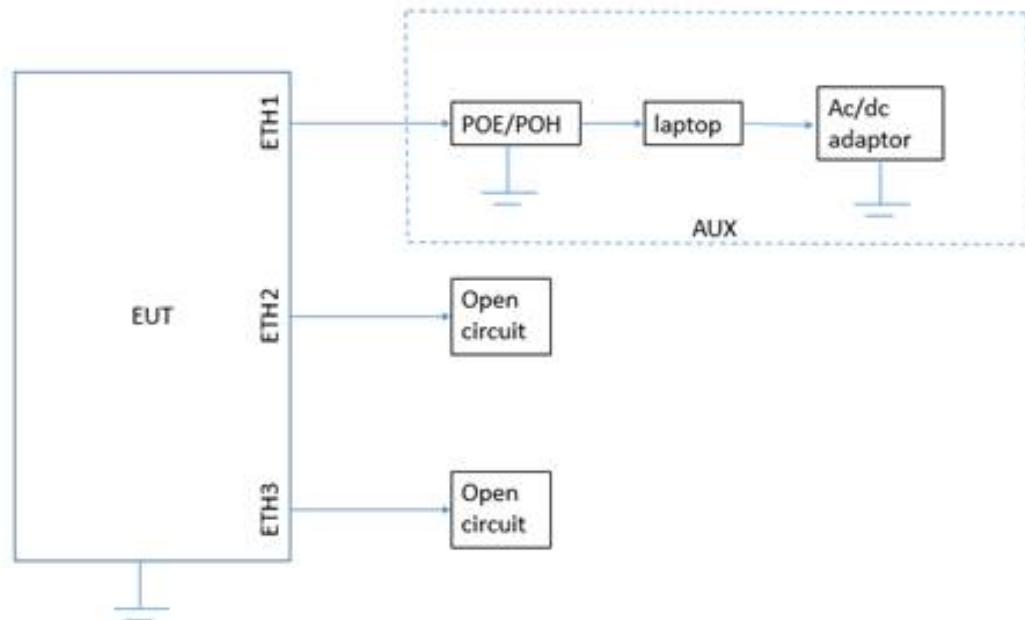
| Description | Manufacturer | Model number | Serial number |
|----------------------------|-----------------------|-------------------|-------------------|
| Test generator MetroExpert | VeEX.Inc. | VE PAL MX300 | TM4B02KA810633 |
| Laptop | IBM | ThinkPad 1874 | L3-ADLL8 |
| POE | Power Dsine Microsemi | 9001G-40/SP rev.B | 11226519000962A01 |
| AC/DC Adapter | Mean Well | PLC 60-48 | 7203369 |

6.4 Changes made in the EUT

No changes were performed in the EUT during testing.



6.5 Test configuration





6.6 Transmitter characteristics

| Type of equipment | | | | | |
|--|--|--------------------------------|--------------------|--|--|
| V | Stand-alone (Equipment with or without its own control provisions) | | | | |
| | Combined equipment (Equipment where the radio part is fully integrated within another type of equipment) | | | | |
| | Plug-in card (Equipment intended for a variety of host systems) | | | | |
| Intended use | Condition of use | | | | |
| V fixed | Always at a distance more than 2 m from all people | | | | |
| mobile | Always at a distance more than 20 cm from all people | | | | |
| portable | May operate at a distance closer than 20 cm to human body | | | | |
| Assigned frequency range | 57.0 GHz – 71.0 GHz | | | | |
| Operating frequencies (tested) | 69875 MHz | | | | |
| Maximum rated output power | At transmitter 50 Ω RF output connector | | | | |
| Is transmitter output power variable? | V | No | | | |
| | Yes | continuous variable | | | |
| | | stepped variable with stepsize | | | |
| | | minimum RF power | dB | | |
| maximum RF power | | | | | |
| Antenna connection | | | | | |
| unique coupling | V | standard connector | Integral | | |
| | | | | | |
| | | with temporary RF connector | | | |
| | | without temporary RF connector | | | |
| Antenna/s technical characteristics | | | | | |
| Type | Manufacturer | Model number | Gain | | |
| Integrated (cassegrain reflector) | Siklu Ltd. | GENT006 | 37 dBi | | |
| Transmitter 99% power bandwidth, MHz | Transmitter aggregate data rate/s, Mbps | | Type of modulation | | |
| 250 | 80 | | QPSK | | |
| 500 | 160 | | QPSK | | |
| 500 | 852 | | 16QAM | | |
| 500 | 1280 | | 64QAM | | |
| Type of multiplexing | TDD | | | | |
| Transmitter power source | | | | | |
| V | Nominal rated voltage | Battery type | | | |
| | DC | 48 V | | | |
| | Voltage range | POE 42-57 V | | | |
| AC mains | Nominal rated voltage | Frequency | | | |
| Common power source for transmitter and receiver | | V | yes | | |
| | | | no | | |



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| | | |
|---|--------------------------------|-------------------------------|
| Test specification: Section 15.255(c)(ii), Transmitter power and power spectral density | | |
| Test procedure: 47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Section 9.11 | | |
| Test mode: Compliance | | Verdict: PASS |
| Date(s): 11-Jan-18 | | |
| Temperature: 25 °C | Relative Humidity: 44 % | Air Pressure: 1012 hPa |
| Remarks: | | |

7 Transmitter tests

7.1 Transmitter power test

7.1.1 General

This test was performed to measure the peak output power at RF antenna connector. Specification test limits are given in Table 7.1.1.

Table 7.1.1 Conducted output power limits

| Assigned frequency range, MHz | Maximum output power | | | |
|-------------------------------|----------------------|------|------------|---------|
| | Peak output power | | EIRP, dBm* | |
| | mW | dBm | Peak | Average |
| 57000 – 71000 | 500 | 27.0 | 57 | 54 |

*EIRP limit was calculated as follows:

Average power: 82 dBm – 2 dB x (51-37) = 54 dBm

Peak power: 85 dBm – 2 dB x (51-37) = 57 dBm.

7.1.2 Test procedure

- 7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.
- 7.1.2.2 The EUT was adjusted to produce maximum available for end user RF output power.
- 7.1.2.3 The average and peak voltage was measured at the high frequency with oscilloscope and provided in the associated plots.
- 7.1.2.4 The step 7.1.2.3 was repeated for all modulations and emissions bandwidth.
- 7.1.2.5 The unmodulated signal was applied to Zero-Biased Detector via variable attenuator as shown in Figure 7.1.2.
- 7.1.2.6 The variable attenuator was adjusted such that the oscilloscope indicated a voltage equal to the peak voltage recorded in the step 7.1.2.3.
- 7.1.2.7 The variable attenuator was disconnected from the Zero-Biased Detector.
- 7.1.2.8 Without changing any settings, the variable attenuator was connected to a power meter as shown in Figure 7.1.3.
- 7.1.2.9 The power was measured and result was recorded in Table 7.1.2 and Table 7.1.3.
- 7.1.2.10 The steps 7.1.2.5 through 7.1.2.10 were repeated for the average voltage recorded in the step 7.1.2.3 and 7.1.2.4.



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| | | |
|--|--------------------------------|-------------------------------|
| Test specification: Section 15.255(c)(ii), Transmitter power and power spectral density | | |
| Test procedure: 47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Section 9.11 | | |
| Test mode: Compliance | | Verdict: PASS |
| Date(s): 11-Jan-18 | | |
| Temperature: 25 °C | Relative Humidity: 44 % | Air Pressure: 1012 hPa |
| Remarks: | | |

Figure 7.1.1 Peak output power test setup

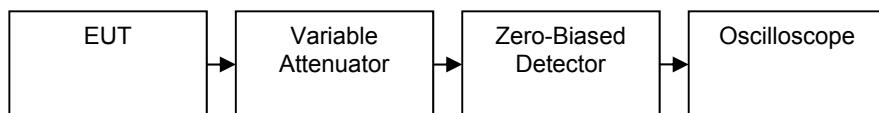


Figure 7.1.2 Peak output power test setup

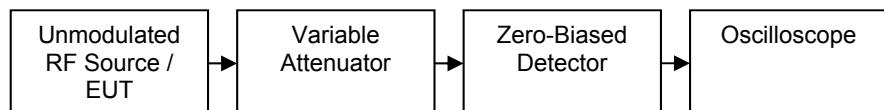
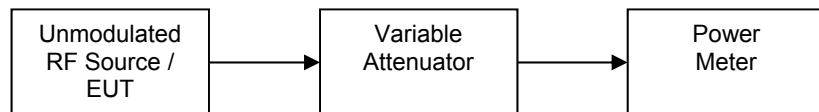


Figure 7.1.3 Peak output power test setup





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| | | | | | | | | | | |
|--|--------------------------------|--|-------------------------------|--|----------------------|--|-------------|--|--|--|
| Test specification: Section 15.255(c)(ii), Transmitter power and power spectral density | | | | | | | | | | |
| Test procedure: | | 47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Section 9.11 | | | | | | | | |
| Test mode: | Compliance | | | | Verdict: | | PASS | | | |
| Date(s): | 11-Jan-18 | | | | | | | | | |
| Temperature: 25 °C | Relative Humidity: 44 % | | Air Pressure: 1012 hPa | | Power: 48 VDC | | | | | |
| Remarks: | | | | | | | | | | |

Table 7.1.2 Peak output power test results

OPERATING FREQUENCY RANGE: 57.0 – 71.0 GHz

DETECTOR USED: Peak

VIDEO BANDWIDTH: >10 MHz

TRANSMITTER OUTPUT POWER SETTINGS: Maximum

| Frequency, MHz | Modulation | Bit rate, Mbps | Duty Cycle, % | Peak output power, dBm | EIRP, dBm* | Limit, dBm | Margin, dB** | Verdict |
|----------------|------------|----------------|---------------|------------------------|------------|------------|--------------|---------|
| 69875 | QPSK/250 | 80 | 100 | 7.05 | 44.05 | 57.00 | -12.95 | Pass |
| 69875 | QPSK/500 | 160 | 100 | 6.45 | 43.45 | 57.00 | -13.55 | Pass |
| 69875 | 16QAM | 852 | 100 | 6.38 | 43.38 | 57.00 | -13.62 | Pass |
| 69875 | 64QAM | 1280 | 100 | 6.30 | 43.30 | 57.00 | -13.70 | Pass |

* - EIRP, dBm = Power output power, dBm + Antenna Gain(dBi), where Antenna Gain = 37.0 dBi

** - Margin, dB = EIRP, dBm – Limit, dBm

Table 7.1.3 Average output power test results

OPERATING FREQUENCY RANGE: 57.0 – 71.0 GHz

DETECTOR USED: Average

VIDEO BANDWIDTH: >10 MHz

TRANSMITTER OUTPUT POWER SETTINGS: Maximum

| Frequency, MHz | Modulation | Bit rate, Mbps | Duty Cycle, % | Average output power, dBm | EIRP, dBm * | Limit, dBm | Margin, dB** | Verdict |
|----------------|------------|----------------|---------------|---------------------------|-------------|------------|--------------|---------|
| 69875 | QPSK/250 | 80 | 100 | 3.50 | 40.50 | 54.00 | -13.50 | Pass |
| 69875 | QPSK/500 | 160 | 100 | 4.00 | 41.00 | 54.00 | -13.00 | Pass |
| 69875 | 16QAM | 852 | 100 | 4.00 | 41.00 | 54.00 | -13.00 | Pass |
| 69875 | 64QAM | 1280 | 100 | 3.80 | 40.80 | 54.00 | -13.20 | Pass |

* - EIRP, dBm = Average output power, dBm + Antenna Gain(dBi), where Antenna Gain = 37.0 dBi

** - Margin, dB = EIRP, dBm – Limit, dBm

Reference numbers of test equipment used

| | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|
| HL 1299 | HL 1300 | HL 1301 | HL 3290 | HL 3291 | HL 3295 | HL 3333 | HL 4273 |
|---------|---------|---------|---------|---------|---------|---------|---------|

Full description is given in Appendix A.

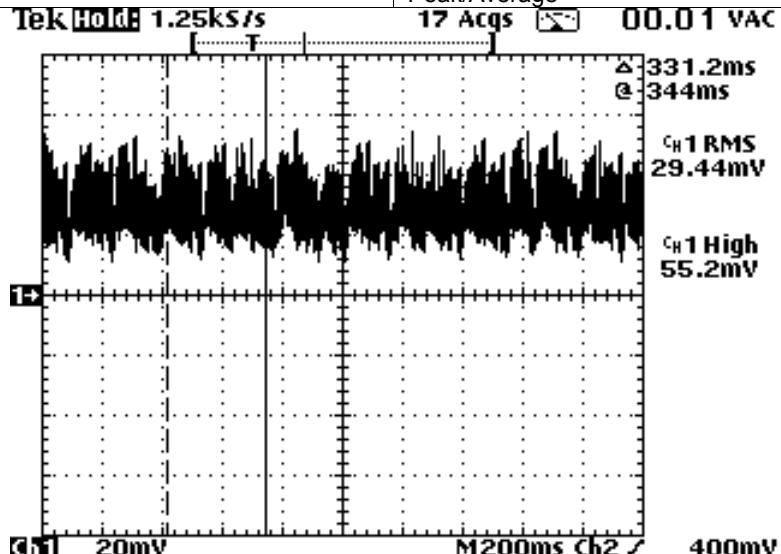


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| | | |
|--|-------------------------|------------------------|
| Test specification: Section 15.255(c)(ii), Transmitter power and power spectral density | | |
| Test procedure: 47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Section 9.11 | | |
| Test mode: | Compliance | Verdict: PASS |
| Date(s): | 11-Jan-18 | |
| Temperature: 25 °C | Relative Humidity: 44 % | Air Pressure: 1012 hPa |
| Power: 48 VDC | | |
| Remarks: | | |

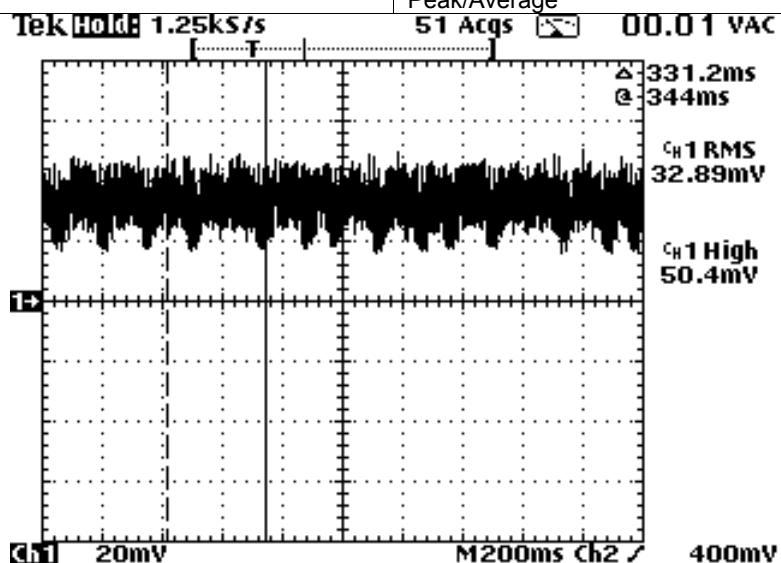
Plot 7.1.1 Output power test result

| | |
|---------------------|--------------|
| MODULATION: | QPSK |
| EMISSION BANDWIDTH: | 250 MHz |
| DETECTOR: | Peak/Average |



Plot 7.1.2 Output power test result

| | |
|---------------------|--------------|
| MODULATION: | QPSK |
| EMISSION BANDWIDTH: | 500 MHz |
| DETECTOR: | Peak/Average |

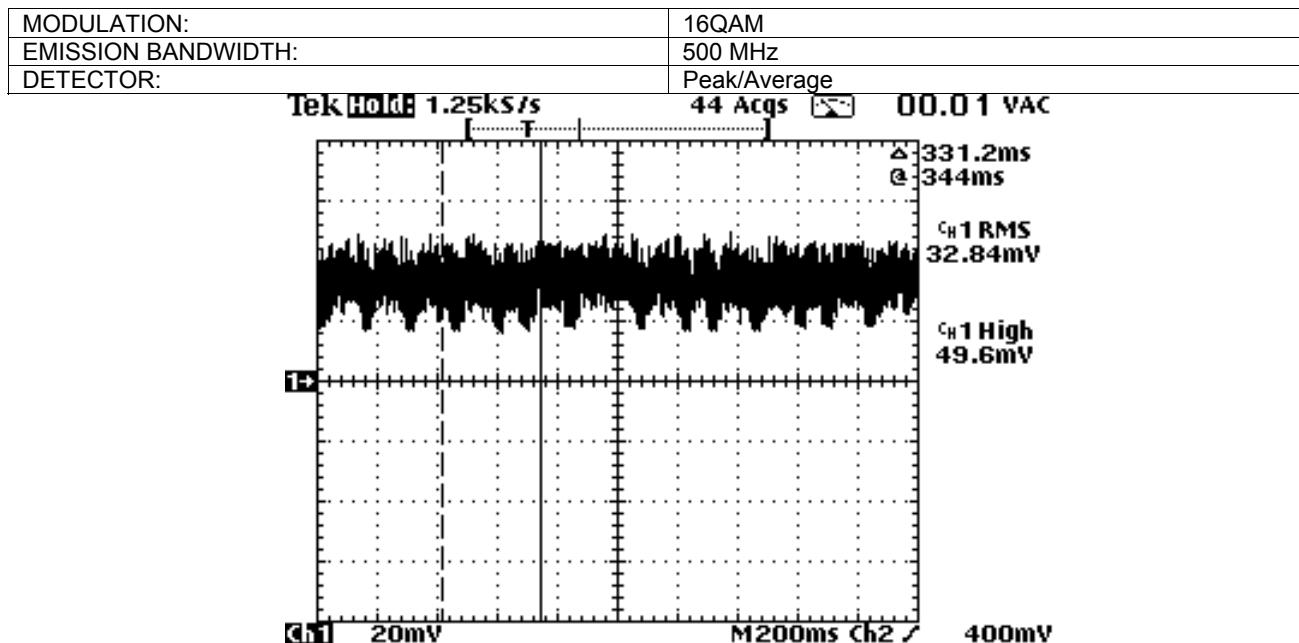




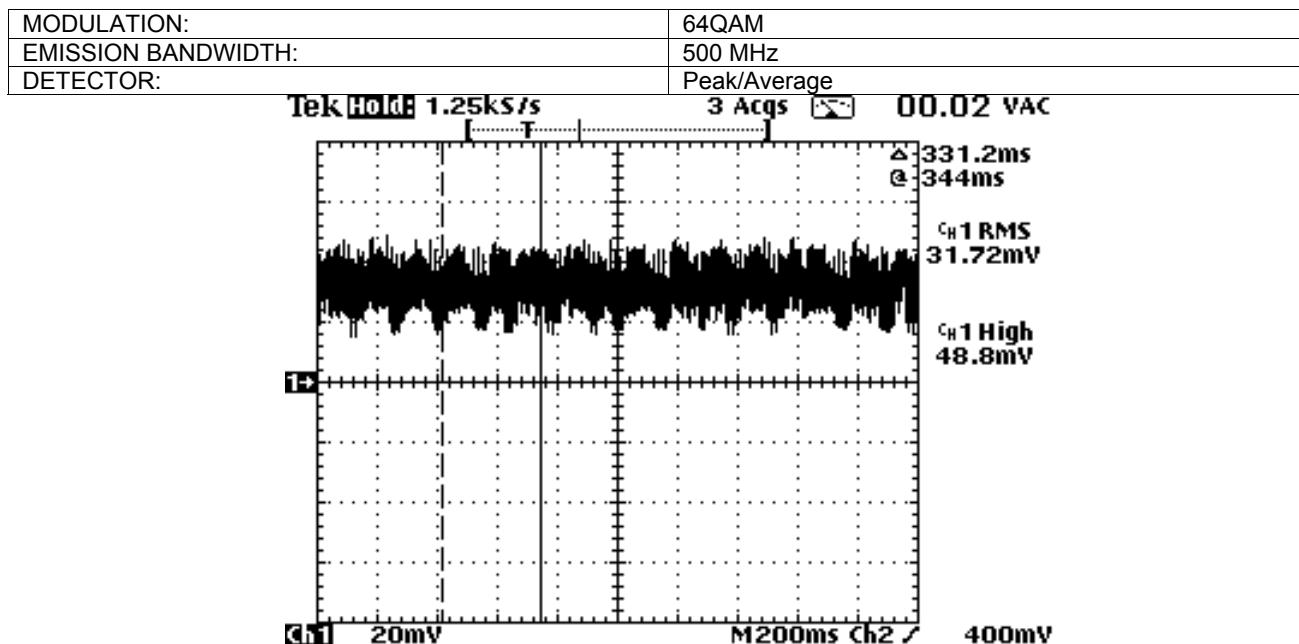
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| | | |
|--|-------------------------|------------------------|
| Test specification: Section 15.255(c)(ii), Transmitter power and power spectral density | | |
| Test procedure: 47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Section 9.11 | | |
| Test mode: | Compliance | Verdict: PASS |
| Date(s): | 11-Jan-18 | |
| Temperature: 25 °C | Relative Humidity: 44 % | Air Pressure: 1012 hPa |
| Power: 48 VDC | | |
| Remarks: | | |

Plot 7.1.3 Output power test result



Plot 7.1.4 Output power test result





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| | | |
|---|--------------------------------|-------------------------------|
| Test specification: Section 15.215(c), Occupied bandwidth | | |
| Test procedure: 47 CFR, Section 2.1049, ANSI C63.10, Section 9.3 | | |
| Test mode: Compliance | | Verdict: PASS |
| Date(s): 11-Jan-18 | | |
| Temperature: 25 °C | Relative Humidity: 44 % | Air Pressure: 1015 hPa |
| Remarks: | | |

7.2 Occupied bandwidth test

7.2.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.2.1.

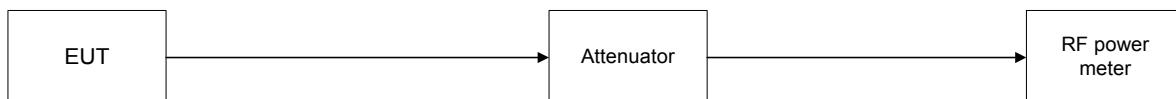
Table 7.2.1 Occupied bandwidth limits

| Assigned frequency range, MHz | Modulation envelope reference points | Max bandwidth, MHz |
|-------------------------------|--------------------------------------|--------------------|
| 57000 - 71000 | 20 dBc | 250 / 500 |
| 57000 - 71000 | 99% | 250 / 500 |

7.2.2 Test procedure

- 7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.
- 7.2.2.2 The EUT was set to transmit modulated carrier as provided in Table 7.2.2.
- 7.2.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope. The test results are provided in Table 7.2.2 and the associated plots

Figure 7.2.1 Occupied bandwidth test setup





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| Test specification: Section 15.215(c), Occupied bandwidth | | | | |
|--|--|--|-------------------------------|----------------------|
| Test procedure: | | 47 CFR, Section 2.1049, ANSI C63.10, Section 9.3 | | |
| Test mode: Compliance | | | | Verdict: PASS |
| Date(s): 11-Jan-18 | | | | |
| Temperature: 25 °C | | Relative Humidity: 44 % | Air Pressure: 1015 hPa | Power: 48 VDC |
| Remarks: | | | | |

Table 7.2.2 Occupied bandwidth test results

OPERATING FREQUENCY RANGE: 57000 –71000 MHz

DETECTOR USED: Peak

RESOLUTION BANDWIDTH: 1% OBW

| Frequency, MHz | Modulation | Occupied bandwidth 99%, MHz | Occupied bandwidth 20 dBc MHz | Verdict |
|----------------------|------------|-----------------------------|-------------------------------|---------|
| EBW = 250 MHz | | | | |
| 69875 | QPSK | 240.67 | 261.50 | Pass |
| EBW = 500 MHz | | | | |
| 69875 | QPSK | 471.36 | 485.30 | Pass |
| 69875 | 16QAM | 471.34 | 485.90 | Pass |
| 69875 | 64QAM | 472.46 | 491.30 | Pass |

Reference numbers of test equipment used

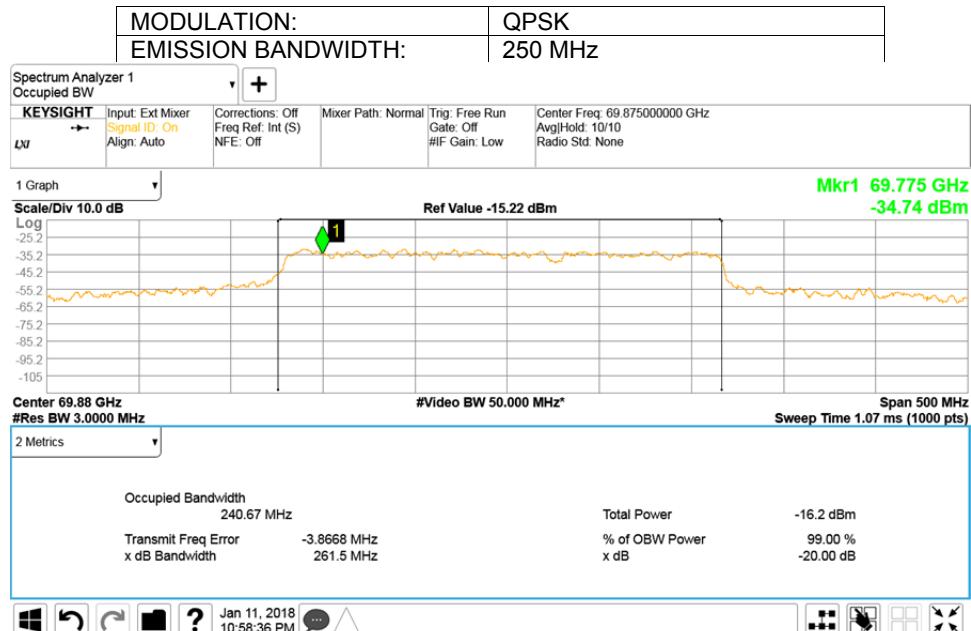
| | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|
| HL 1303 | HL 2358 | HL 2909 | HL 3291 | HL 3295 | HL 3305 | HL 3433 | HL 3434 |
|---------|---------|---------|---------|---------|---------|---------|---------|

Full description is given in Appendix A.

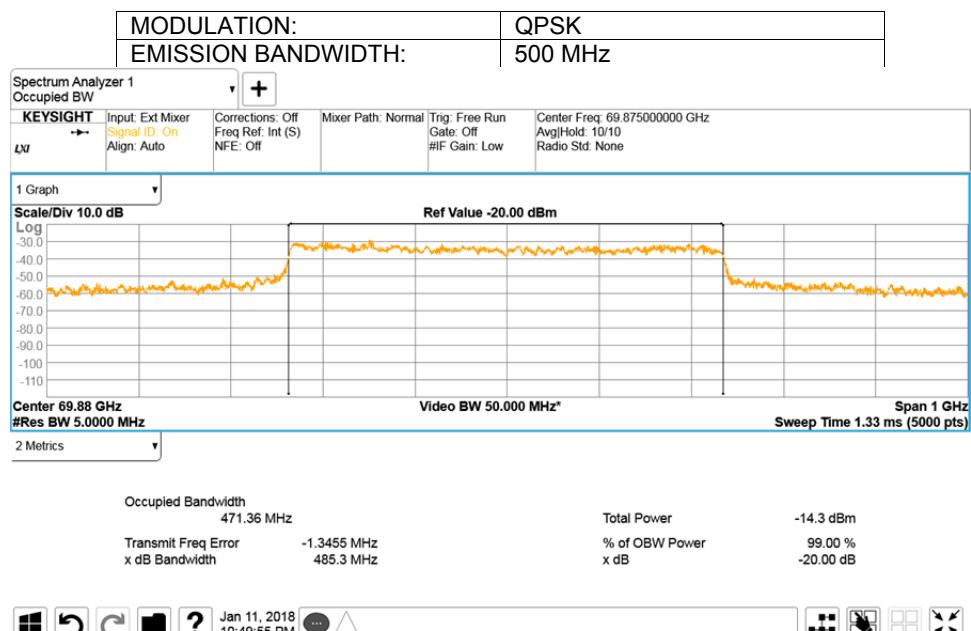


| | | | |
|----------------------------|--|-------------------------------|----------------------|
| Test specification: | Section 15.215(c), Occupied bandwidth | | |
| Test procedure: | 47 CFR, Section 2.1049, ANSI C63.10, Section 9.3 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 11-Jan-18 | | |
| Temperature: 25 °C | Relative Humidity: 44 % | Air Pressure: 1015 hPa | Power: 48 VDC |
| Remarks: | | | |

Plot 7.2.1 Occupied bandwidth



Plot 7.2.2 Occupied bandwidth

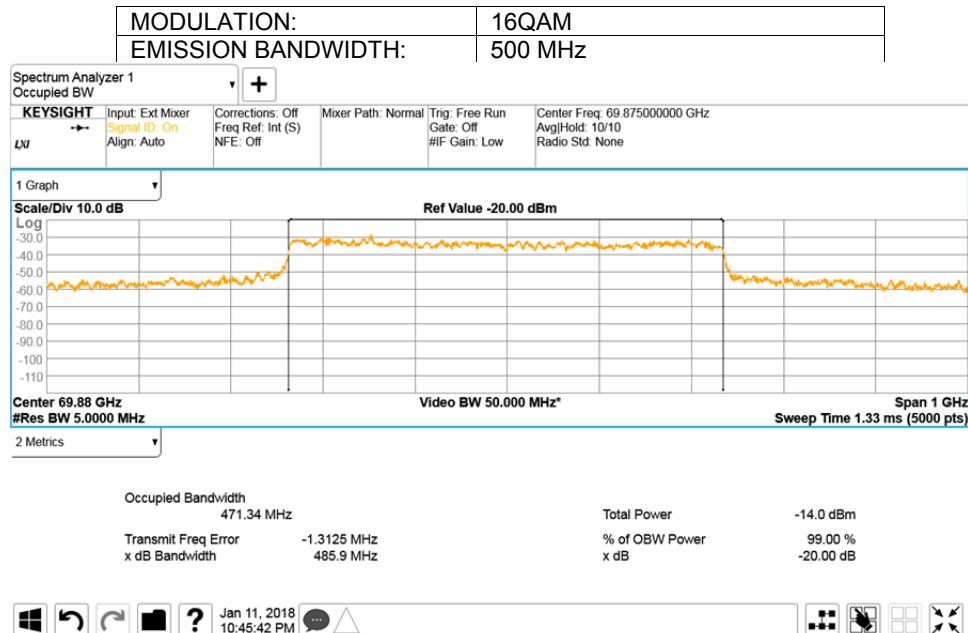




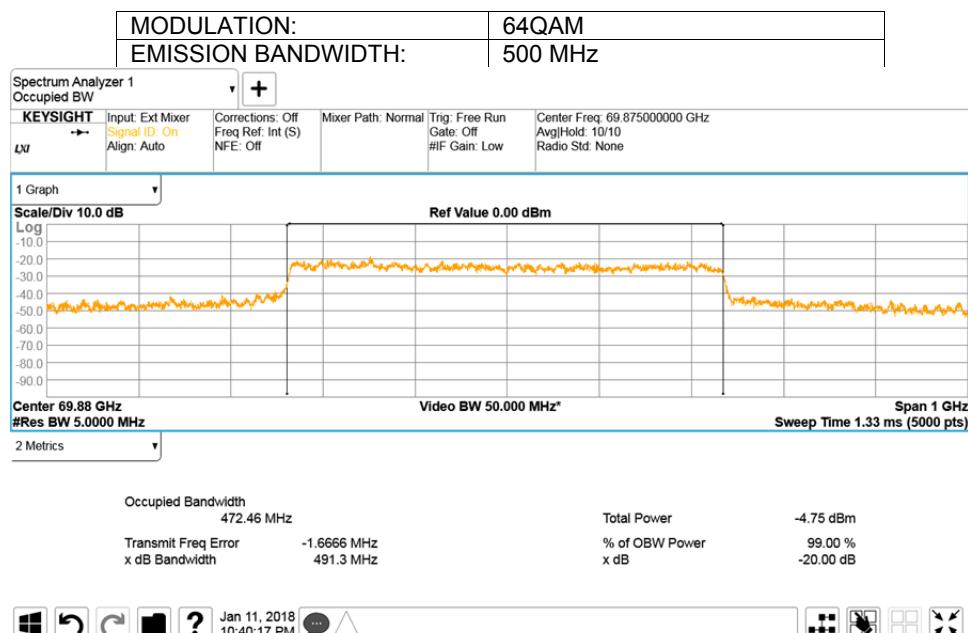
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| Test specification: Section 15.215(c), Occupied bandwidth | | |
|---|--------------------------------|-------------------------------|
| Test procedure: 47 CFR, Section 2.1049, ANSI C63.10, Section 9.3 | | |
| Test mode: Compliance | | Verdict: PASS |
| Date(s): 11-Jan-18 | | |
| Temperature: 25 °C | Relative Humidity: 44 % | Air Pressure: 1015 hPa |
| Remarks: | | |

Plot 7.2.3 Occupied bandwidth



Plot 7.2.4 Occupied bandwidth





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| | | |
|--|--------------------------------|-------------------------------|
| Test specification: Section 15.255(d)(2), Out of band radiated emissions below 40 GHz | | |
| Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13 | | |
| Test mode: Compliance | | Verdict: PASS |
| Date(s): 05-Dec-17 - 10-Dec-17 | | |
| Temperature: 24.3 °C | Relative Humidity: 48 % | Air Pressure: 1020 hPa |
| Remarks: | | |

7.3 Out of band radiated emissions below 40 GHz

7.3.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Radiated emission limits

| Frequency, MHz | Field strength at 3 m within restricted bands, dB(µV/m)*** | | |
|----------------|--|-----------------|-----------------|
| | Peak | Quasi Peak | Average |
| 0.009 – 0.090 | 148.5 – 128.5 | NA | 128.5 – 108.5** |
| 0.090 – 0.110 | NA | 108.5 – 106.8** | NA |
| 0.110 – 0.490 | 126.8 – 113.8 | NA | 106.8 – 93.8** |
| 0.490 – 1.705 | NA | 73.8 – 63.0** | NA |
| 1.705 – 30.0* | | 69.5** | |
| 30 – 88 | | 40.0 | |
| 88 – 216 | | 43.5 | |
| 216 – 960 | | 46.0 | |
| 960 – 1000 | | 54.0 | |

*- The above field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency.

**- The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:

$$\text{Lim}_{S2} = \text{Lim}_{S1} + 40 \log (S_1/S_2),$$

where S₁ and S₂ – standard defined and test distance respectively in meters.

*** - The limit decreases linearly with the logarithm of frequency.

7.3.2 Test procedure for spurious emission field strength measurements in 9 kHz to 30 MHz band

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and the performance check was conducted.

7.3.2.2 The specified frequency range was investigated with loop antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna was rotated around its vertical axis and the measuring antenna polarization was switched from vertical to horizontal.

7.3.2.3 The worst test results (the lowest margins) were recorded in Table 7.3.2 and shown in the associated plots.

7.3.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.3.3.1 The EUT was set up as shown in Figure 7.3.2, Figure 7.3.3, energized and the performance check was conducted.

7.3.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

7.3.3.3 The worst test results (the lowest margins) were recorded in Table 7.3.2 and shown in the associated plots.



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| | | |
|--|--------------------------------|-------------------------------|
| Test specification: Section 15.255(d)(2), Out of band radiated emissions below 40 GHz | | |
| Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13 | | |
| Test mode: Compliance | Verdict: PASS | |
| Date(s): 05-Dec-17 - 10-Dec-17 | | |
| Temperature: 24.3 °C | Relative Humidity: 48 % | Air Pressure: 1020 hPa |
| Power: 48 VDC | | |
| Remarks: | | |

Figure 7.3.1 Radiated emissions below 30 MHz test set up

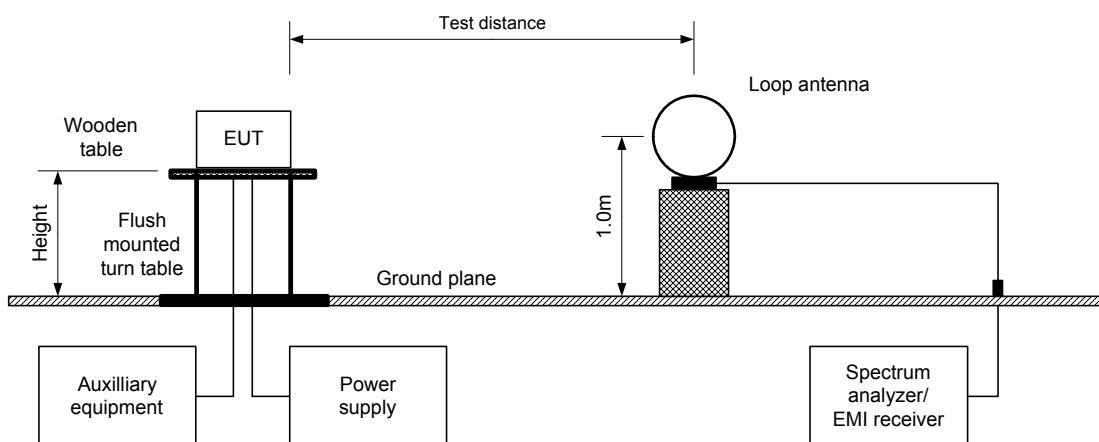
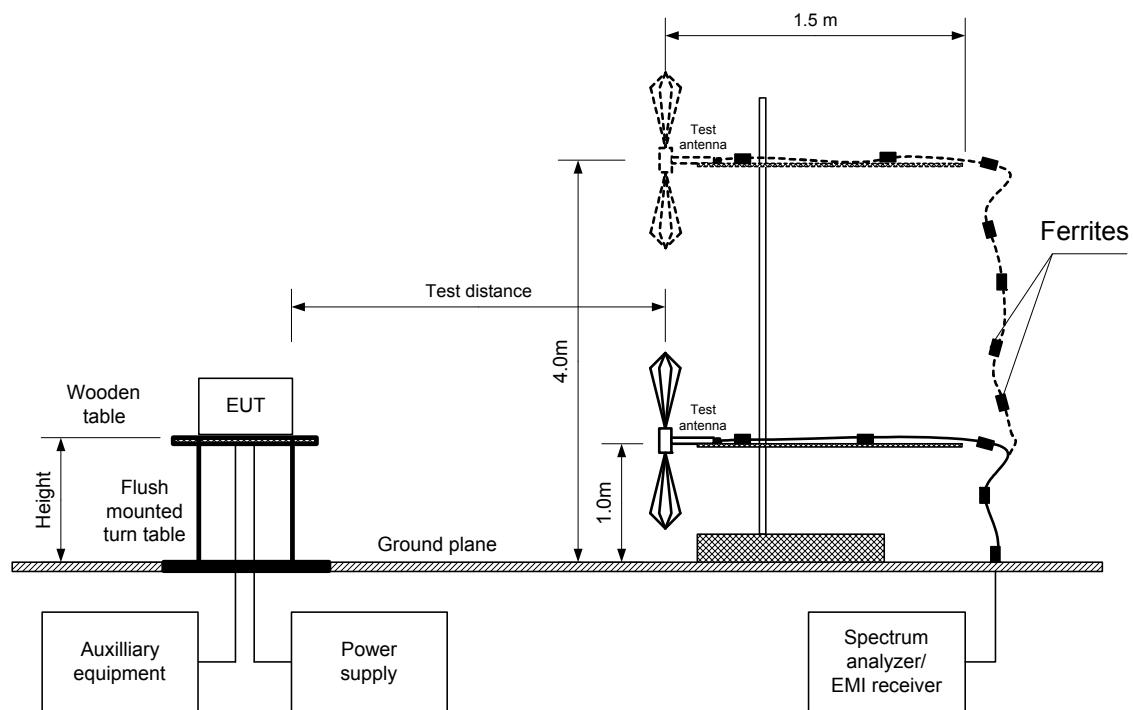


Figure 7.3.2 Radiated emissions above 30 MHz test set up

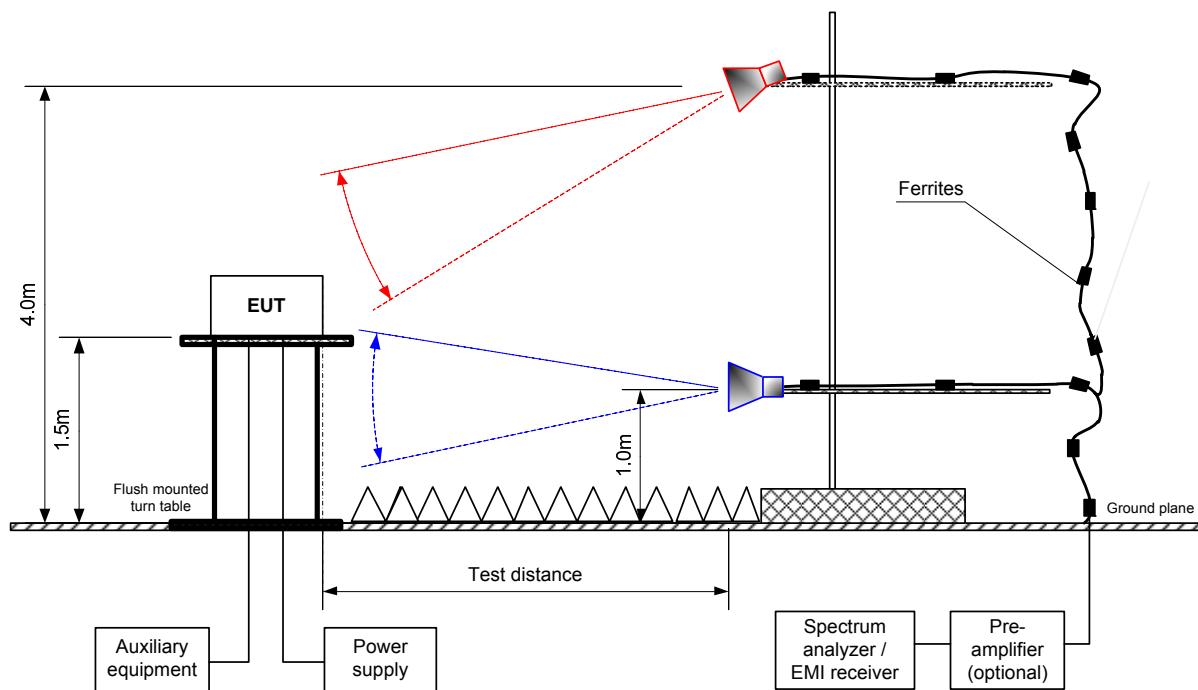




HERMON LABORATORIES

| | | |
|--|--------------------------------|-------------------------------|
| Test specification: Section 15.255(d)(2), Out of band radiated emissions below 40 GHz | | |
| Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13 | | |
| Test mode: Compliance | Verdict: PASS | |
| Date(s): 05-Dec-17 - 10-Dec-17 | | |
| Temperature: 24.3 °C | Relative Humidity: 48 % | Air Pressure: 1020 hPa |
| Power: 48 VDC | | |
| Remarks: | | |

Figure 7.3.3 Setup for spurious emission field strength measurements above 1000 MHz





HERMON LABORATORIES

| | |
|--|--------------------------------|
| Test specification: Section 15.255(d)(2), Out of band radiated emissions below 40 GHz | |
| Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13 | |
| Test mode: Compliance | Verdict: PASS |
| Date(s): 05-Dec-17 - 10-Dec-17 | |
| Temperature: 24.3 °C | Relative Humidity: 48 % |
| Air Pressure: 1020 hPa | |
| Power: 48 VDC | |
| Remarks: | |

Table 7.3.2 Out of band radiated emissions test results

TEST DISTANCE: 3 m
 EUT POSITION: Typical (Vertical)
 MODULATION: QPSK
 MODULATING SIGNAL: PRBS
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 INVESTIGATED FREQUENCY RANGE: 0.009 – 40000 MHz
 RESOLUTION BANDWIDTH: 1.0 kHz (9 kHz – 150 kHz)
 9.0 kHz (150 kHz – 30 MHz)
 120 kHz (30 MHz – 1000 MHz)
 ≥ Resolution bandwidth
 VIDEO BANDWIDTH: 1.0 kHz (9 kHz – 150 kHz)
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)
 Double-Ridged Waveguide Horn (above 1 GHz)

| Frequency, MHz | Peak emission, dB(µV/m) | Quasi-peak | | | Antenna polarization | Antenna height, m | Turn-table position**, degrees | Verdict |
|----------------|-------------------------|-----------------------------|-----------------|-------------|----------------------|-------------------|--------------------------------|---------|
| | | Measured emission, dB(µV/m) | Limit, dB(µV/m) | Margin, dB* | | | | |
| 39.091000 | 36.31 | 30.50 | 40.00 | -9.50 | Vert | 102 | 12 | Pass |
| 40.962833 | 37.21 | 30.79 | 40.00 | -9.21 | Vert | 133 | 180 | |
| 44.500000 | 31.67 | 25.83 | 40.00 | -14.17 | Vert | 177 | -155 | |
| 61.887333 | 37.29 | 32.55 | 40.00 | -7.45 | Vert | 102 | 59 | |
| 66.281833 | 33.11 | 27.86 | 40.00 | -12.14 | Vert | 132 | 13 | |
| 78.390333 | 30.24 | 24.18 | 40.00 | 15.82 | Vert | 100 | 1 | |
| 499.977333 | 35.62 | 33.12 | 46.00 | 12.88 | Hor | 177 | -122 | |

*- Margin = Measured emission - specification limit.

**- EUT front panel refer to 0 degrees position of turntable.

Reference numbers of test equipment used

| | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|
| HL 0446 | HL 0604 | HL 3001 | HL 3818 | HL 3901 | HL 4353 | HL 4360 | HL 4933 |
| HL 4956 | HL 5245 | | | | | | |

Full description is given in Appendix A.

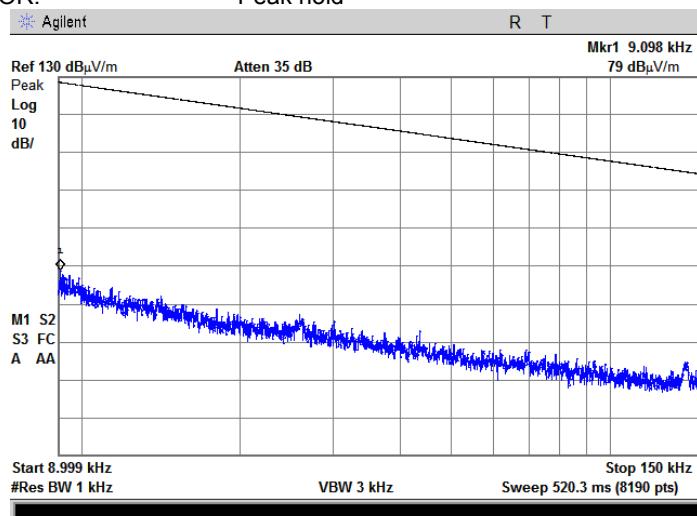


HERMON LABORATORIES

| | | |
|--|--------------------------------|-------------------------------|
| Test specification: Section 15.255(d)(2), Out of band radiated emissions below 40 GHz | | |
| Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13 | | |
| Test mode: Compliance | Verdict: PASS | |
| Date(s): 05-Dec-17 - 10-Dec-17 | | |
| Temperature: 24.3 °C | Relative Humidity: 48 % | Air Pressure: 1020 hPa |
| Remarks: | | |

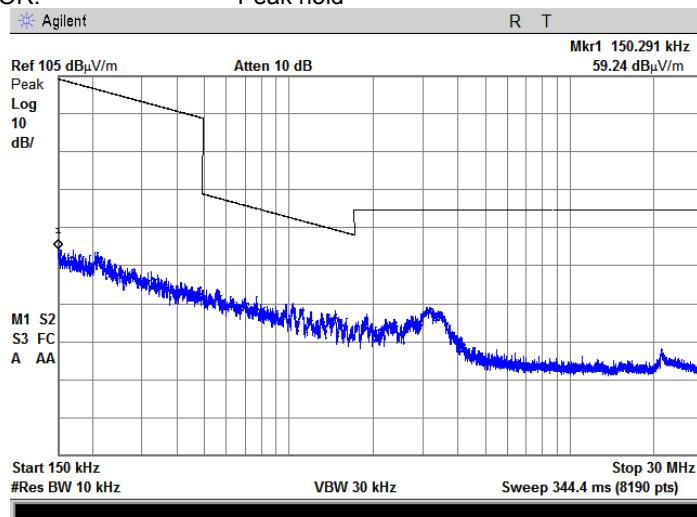
Plot 7.3.1 Radiated emission measurements from 9 to 150 kHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
DETECTOR: Peak hold



Plot 7.3.2 Radiated emission measurements from 0.15 to 30 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
DETECTOR: Peak hold



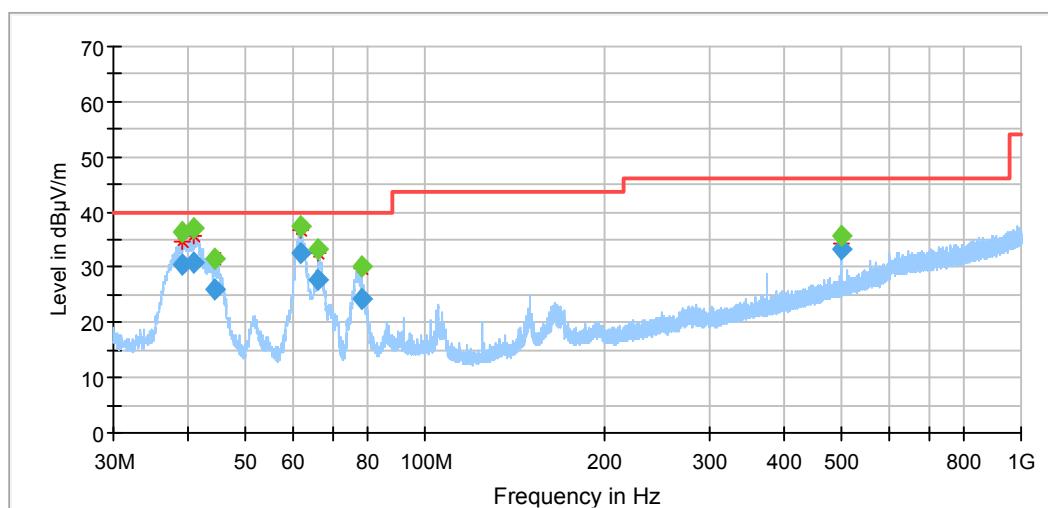


HERMON LABORATORIES

| | | |
|--|--------------------------------|-------------------------------|
| Test specification: Section 15.255(d)(2), Out of band radiated emissions below 40 GHz | | |
| Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13 | | |
| Test mode: Compliance | Verdict: PASS | |
| Date(s): 05-Dec-17 - 10-Dec-17 | | |
| Temperature: 24.3 °C | Relative Humidity: 48 % | Air Pressure: 1020 hPa |
| Power: 48 VDC | | |
| Remarks: | | |

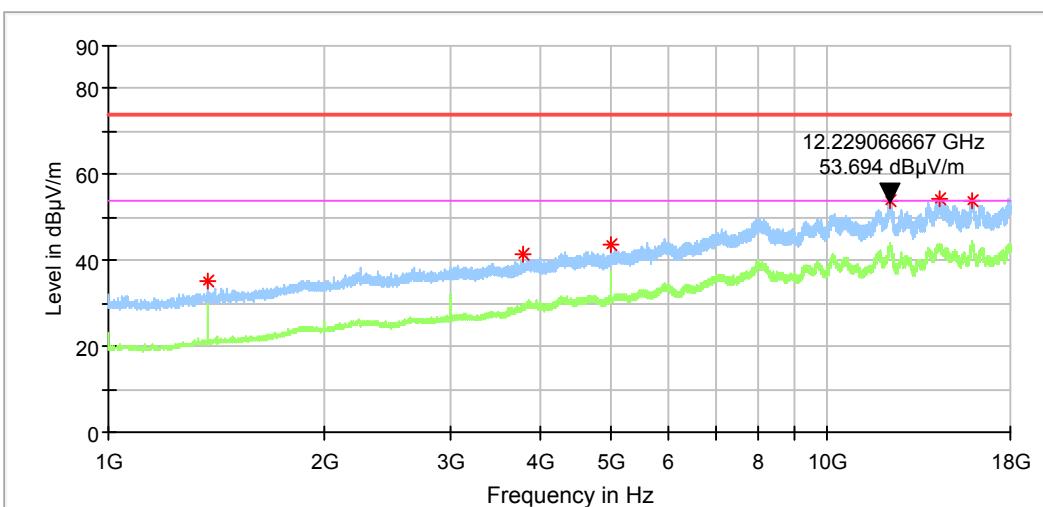
Plot 7.3.3 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
DETECTOR: Peak hold



Plot 7.3.4 Radiated emission measurements from 1 to 18 GHz

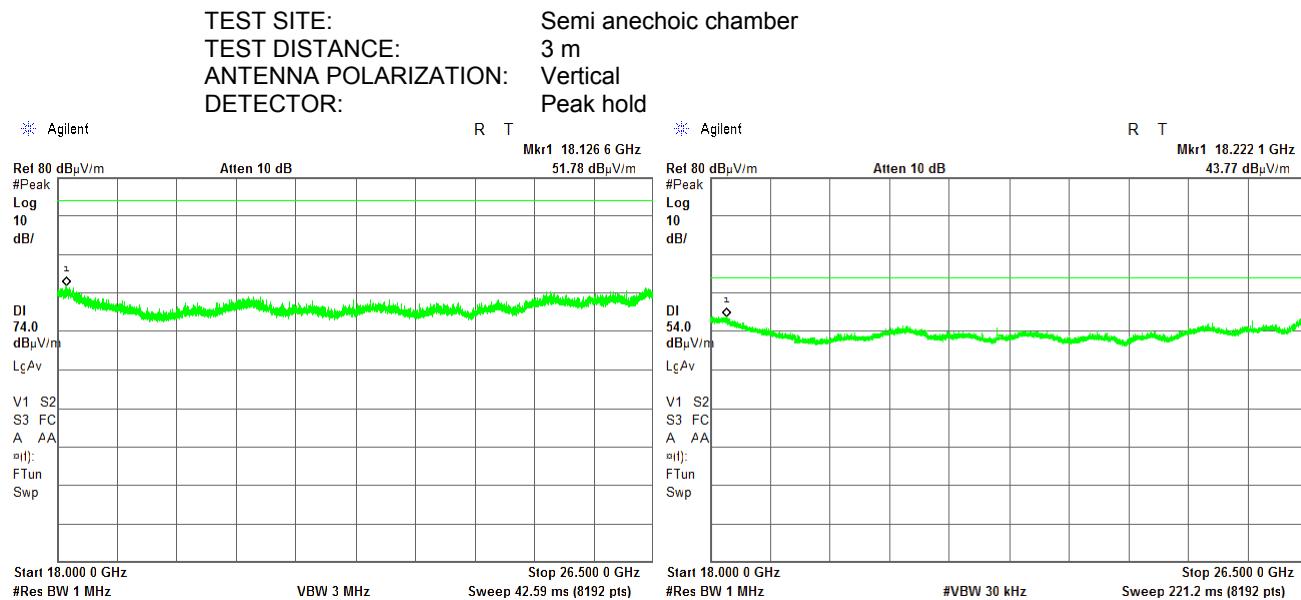
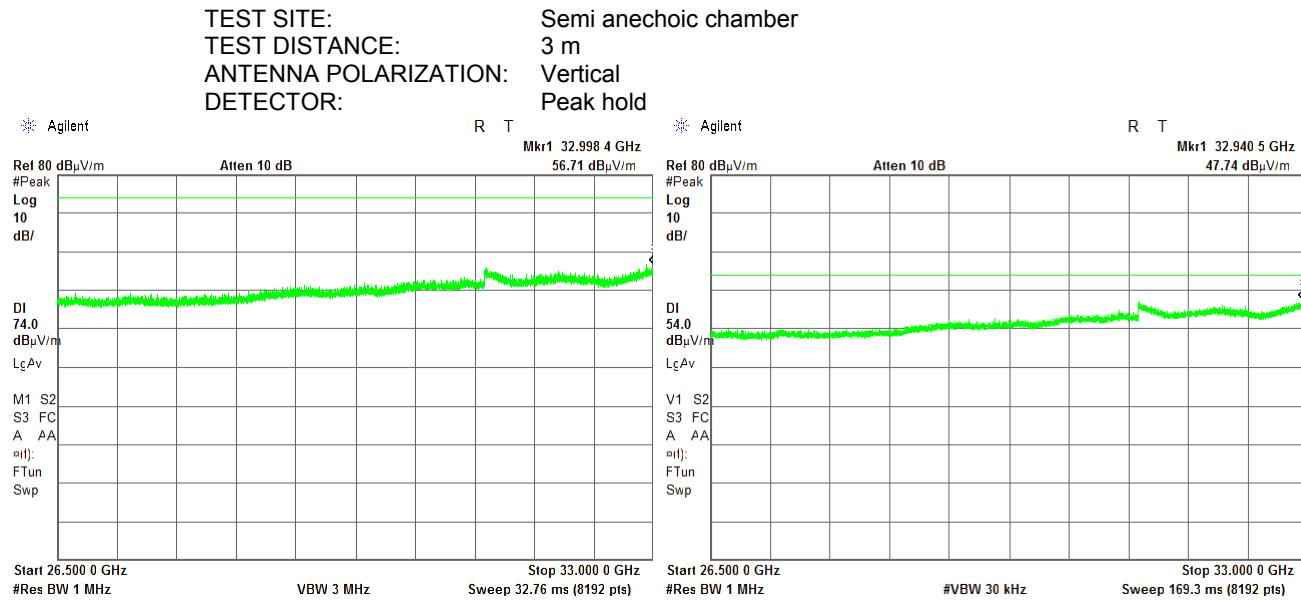
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
DETECTOR: Peak hold





HERMON LABORATORIES

| | | |
|--|--------------------------------|-------------------------------|
| Test specification: Section 15.255(d)(2), Out of band radiated emissions below 40 GHz | | |
| Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13 | | |
| Test mode: Compliance | Verdict: PASS | |
| Date(s): 05-Dec-17 - 10-Dec-17 | | |
| Temperature: 24.3 °C | Relative Humidity: 48 % | Air Pressure: 1020 hPa |
| Remarks: | | |

Plot 7.3.5 Radiated emission measurements from 18 to 26.5 GHz**Plot 7.3.6 Radiated emission measurements from 26.5 to 33 GHz**

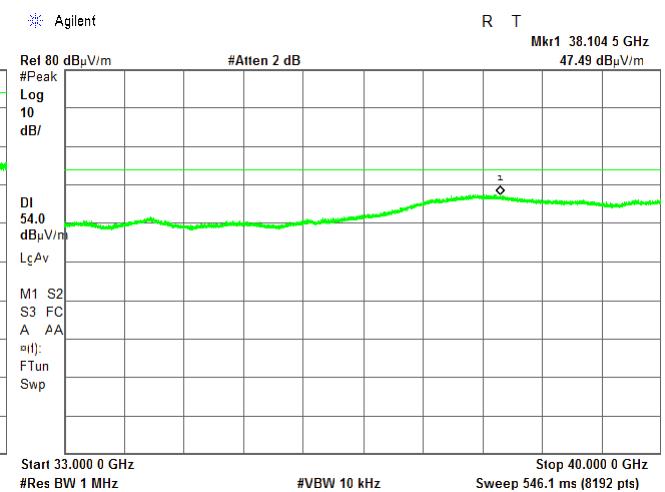
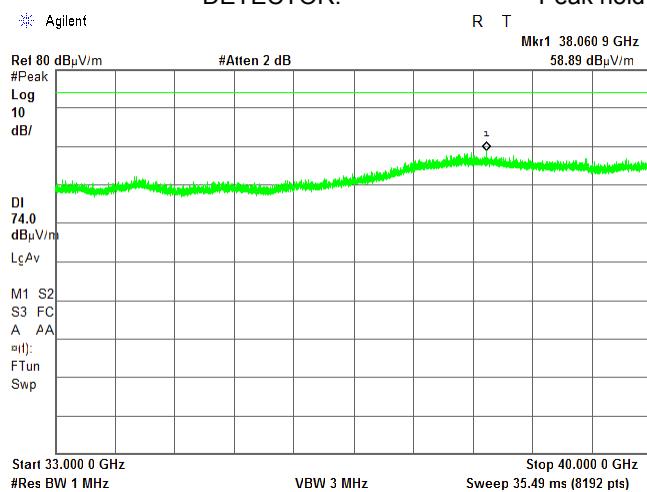


HERMON LABORATORIES

| Test specification: Section 15.255(d)(2), Out of band radiated emissions below 40 GHz | | |
|--|--------------------------------|-------------------------------|
| Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13 | | |
| Test mode: Compliance | | Verdict: PASS |
| Date(s): 05-Dec-17 - 10-Dec-17 | | |
| Temperature: 24.3 °C | Relative Humidity: 48 % | Air Pressure: 1020 hPa |
| Power: 48 VDC | | |
| Remarks: | | |

Plot 7.3.7 Radiated emission measurements from 33 to 40 GHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
DETECTOR: Peak hold





HERMON LABORATORIES

| | | |
|--|--------------------------------|-------------------------------|
| Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz | | |
| Test procedure: ANSI C63.10, Sections 9.9, 9.12 | | |
| Test mode: Compliance | | Verdict: PASS |
| Date(s): 07-Jan-18 | | |
| Temperature: 24.4 °C | Relative Humidity: 46 % | Air Pressure: 1020 hPa |
| Remarks: | | |

7.4 Out of band radiated emissions above 40 GHz up to 200 GHz

7.4.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.4.1, Table 7.4.2.

Table 7.4.1 Radiated spurious emission test limits

| Frequency, GHz | Equivalent field strength limit @ 3m, dB(µV/m)*** |
|-------------------|---|
| 40– 200 | 85.3 |

* - Excluding the in band emission within ± 250 % of the authorized bandwidth from the carrier

** - P is transmitter output power in Watts

*** - Equivalent field strength limit was calculated from maximum allowed ERP of spurious as follows:
 $E = \sqrt{30 \times P \times 1.64} / r$, where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

Table 7.4.2 Radiated spurious emission test limits

| Frequency, GHz | Power density at 3 m distance pW/cm ² | Distance, m | Field strength dB(µV/m)*, peak | Field strength dB(µV/m)*, average |
|-------------------|---|----------------|--------------------------------------|---|
| 40 – 220 | 90.0 | 3.0 | 105.3 | 85.3 |
| 40 - 90 | 90.0 | 3.0 | 105.3 | 85.3 |
| 90 - 110 | 90.0 | 0.5 | 120.9* | 100.9* |
| 110 - 130 | 90.0 | 0.07 | 137.9* | 117.9* |
| 130 - 140 | 90.0 | 0.05 | 140.9* | 120.9* |
| 140 - 200 | 90.0 | 0.001 | 165.3* | 145.3* |

*- The limit for other test distance was calculated using the inverse distance extrapolation factor as follows:

$$Lim_{S2} = Lim_{S1} + 20 \log (S_1 / S_2),$$

7.4.2 Test procedure for spurious emission field strength measurements

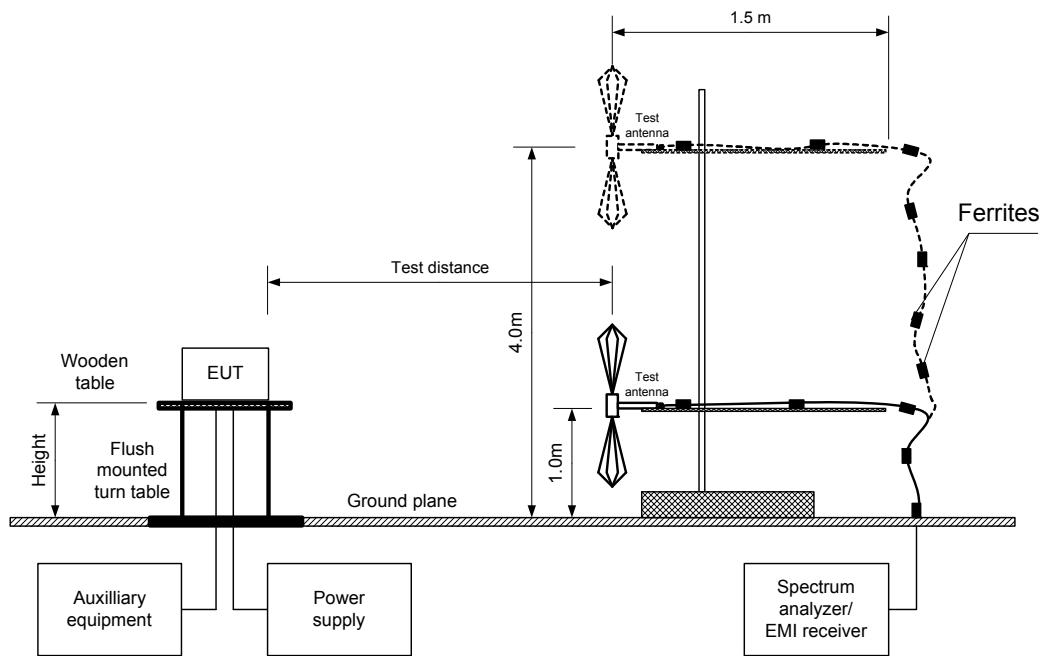
- 7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and the performance check was conducted.
- 7.4.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.
- 7.4.2.3 The test results are given in Table 7.4.3 and shown in the associated plots.



HERMON LABORATORIES

| | | |
|--|--------------------------------|-------------------------------|
| Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz | | |
| Test procedure: ANSI C63.10, Sections 9.9, 9.12 | | |
| Test mode: Compliance | | Verdict: PASS |
| Date(s): 07-Jan-18 | | |
| Temperature: 24.4 °C | Relative Humidity: 46 % | Air Pressure: 1020 hPa |
| Power: 48 VDC | | |
| Remarks: | | |

Figure 7.4.1 Radiated emissions above 40 GHz test set up





HERMON LABORATORIES

| | |
|--|---------------------------------|
| Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz | |
| Test procedure: | ANSI C63.10, Sections 9.9, 9.12 |
| Test mode: | Compliance |
| Date(s): | 07-Jan-18 |
| Temperature: 24.4 °C | Relative Humidity: 46 % |
| Air Pressure: 1020 hPa | |
| Power: 48 VDC | |
| Remarks: | |

Table 7.4.3 Out of band radiated emissions test results

| | |
|-------------------------------|---|
| TEST DISTANCE: | 0.001 - 3 m |
| EUT POSITION: | Typical (Vertical) |
| MODULATION: | QPSK |
| CHANNEL BANDWIDTH: | 250 MHz |
| TRANSMITTER OUTPUT POWER: | Maximum |
| INVESTIGATED FREQUENCY RANGE: | 40 – 200 GHz |
| RESOLUTION BANDWIDTH: | 1000 kHz |
| VIDEO BANDWIDTH: | ≥ Resolution bandwidth |
| TEST ANTENNA TYPE: | Standard Gain Horn 24dB (40-60 GHz) Standard Gain Horn 24dB (50-75 GHz) Standard Gain Horn 24dB (75-110 GHz) Standard Gain Horn 24dB (90-140 GHz) Standard Gain Horn 25dB (140-200 GHz) |

| Frequency, MHz | Antenna | | Azimuth, degrees* | Peak field strength(VBW=3 MHz) | | | Average field strength(VBW=1 kHz) | | | Verdict | | |
|-----------------------------|----------|-----------|-------------------|--------------------------------|-----------------|--------------|-----------------------------------|-----------------|--------------|---------|--|--|
| | Polariz. | Height, m | | Measured, dB(µV/m) | Limit, dB(µV/m) | Margin, dB** | Measured, dB(µV/m) | Limit, dB(µV/m) | Margin, dB** | | | |
| Carrier frequency 69875 MHz | | | | | | | | | | | | |
| No emissions were found | | | | | | | | | | | | |

*- EUT front panel refer to 0 degrees position of turntable.

**- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

| | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|
| HL 0747 | HL 0770 | HL 0771 | HL 0772 | HL 1304 | HL 1305 | HL 1312 | HL 2909 |
| HL 3235 | HL 3296 | HL 3297 | HL 3306 | HL 3329 | HL 3433 | HL 3434 | HL 3536 |
| HL 3901 | HL 4023 | | | | | | |

Full description is given in Appendix A.

Reference numbers of test equipment used

| HL No. | Description | Manufacturer | Model | Ser. No. | Last Cal./Check | Due Cal./Check |
|--------|--------------------------|--------------|----------------|------------|-----------------|----------------|
| NA | Signal Analyzer | Keysight | MXA N9020B | MY56080135 | 22-Jun-17 | 22-Jun-18 |
| NA | Waveguide Harmonic Mixer | Keysight | M1971E Opt 003 | MY56130185 | 11-Apr-17 | 10-May-18 |

Full description is given in Appendix A.



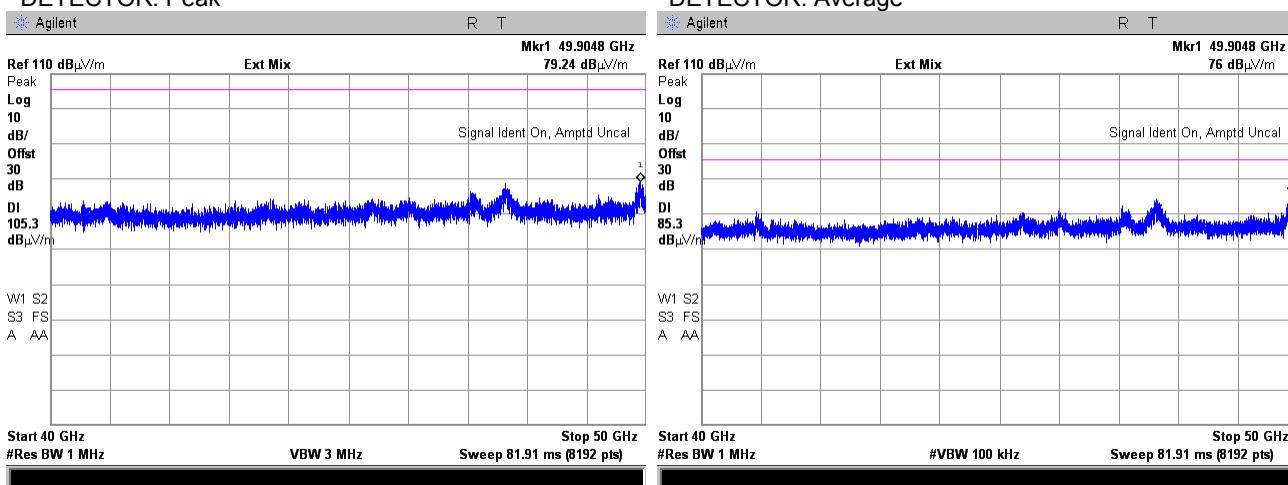
HERMON LABORATORIES

| | | |
|--|--------------------------------|-------------------------------|
| Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz | | |
| Test procedure: ANSI C63.10, Sections 9.9, 9.12 | | |
| Test mode: Compliance | | Verdict: PASS |
| Date(s): | 07-Jan-18 | |
| Temperature: 24.4 °C | Relative Humidity: 46 % | Air Pressure: 1020 hPa |
| Power: 48 VDC | | |
| Remarks: | | |

Plot 7.4.1 Radiated emission measurements from 40 to 50 GHz

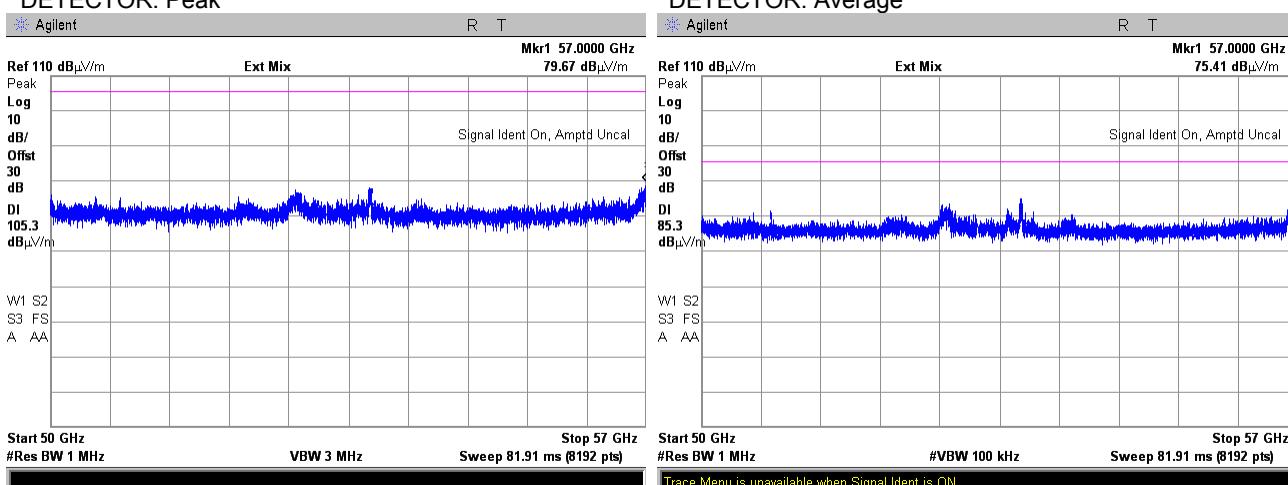
TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak

OATS
3 m
Vertical & Horizontal
DETECTOR: Average

**Plot 7.4.2 Radiated emission measurements from 50 to 57 GHz**

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak

OATS
3 m
Vertical & Horizontal
DETECTOR: Average





HERMON LABORATORIES

| | | |
|--|--------------------------------|-------------------------------|
| Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz | | |
| Test procedure: ANSI C63.10, Sections 9.9, 9.12 | | |
| Test mode: Compliance | | Verdict: PASS |
| Date(s): | 07-Jan-18 | |
| Temperature: 24.4 °C | Relative Humidity: 46 % | Air Pressure: 1020 hPa |
| Remarks: | | |

Plot 7.4.3 Radiated emission measurements from 64 to 69.25 GHz

TEST SITE:

OATS

TEST DISTANCE:

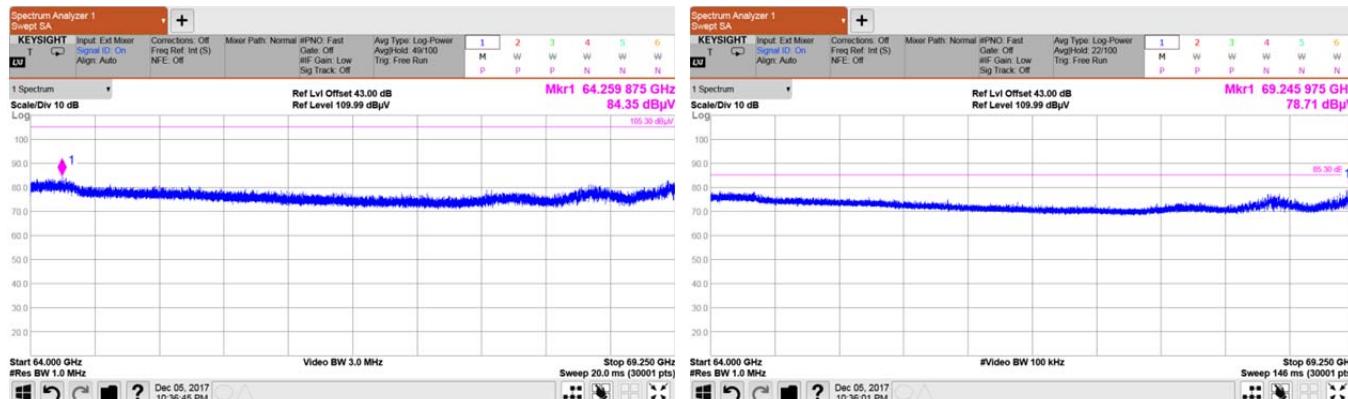
3 m

DETECTOR: Peak

DETECTOR: Average

ANTENNA POLARIZATION:

Vertical and Horizontal



Screen 17-20 Horizontal



HERMON LABORATORIES

| Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz | | |
|--|---------------------------------|-------------------------------|
| Test procedure: | ANSI C63.10, Sections 9.9, 9.12 | |
| Test mode: | Compliance | |
| Date(s): | 07-Jan-18 | |
| Temperature: 24.4 °C | Relative Humidity: 46 % | Air Pressure: 1020 hPa |
| Remarks: | | |

Plot 7.4.4 Radiated emission measurements from 70.5 to 80 GHz

TEST SITE:

OATS

TEST DISTANCE:

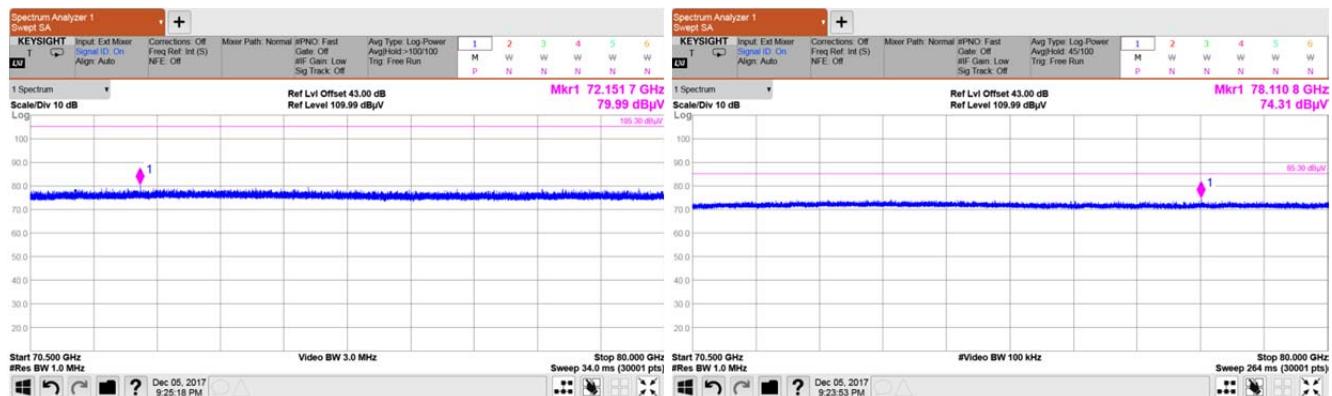
3 m

DETECTOR: Peak

DETECTOR: Average

ANTENNA POLARIZATION:

Vertical and Horizontal





HERMON LABORATORIES

Report ID: SIKRAD_FCC.30351_rev1.docx

Date of Issue: 26-Mar-18

| Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz | | |
|---|---------------------------------|------------------------|
| Test procedure: | ANSI C63.10, Sections 9.9, 9.12 | |
| Test mode: | Compliance | |
| Date(s): | 07-Jan-18 | |
| Temperature: 24.4 °C | Relative Humidity: 46 % | Air Pressure: 1020 hPa |
| Power: 48 VDC | | |
| Remarks: | | |

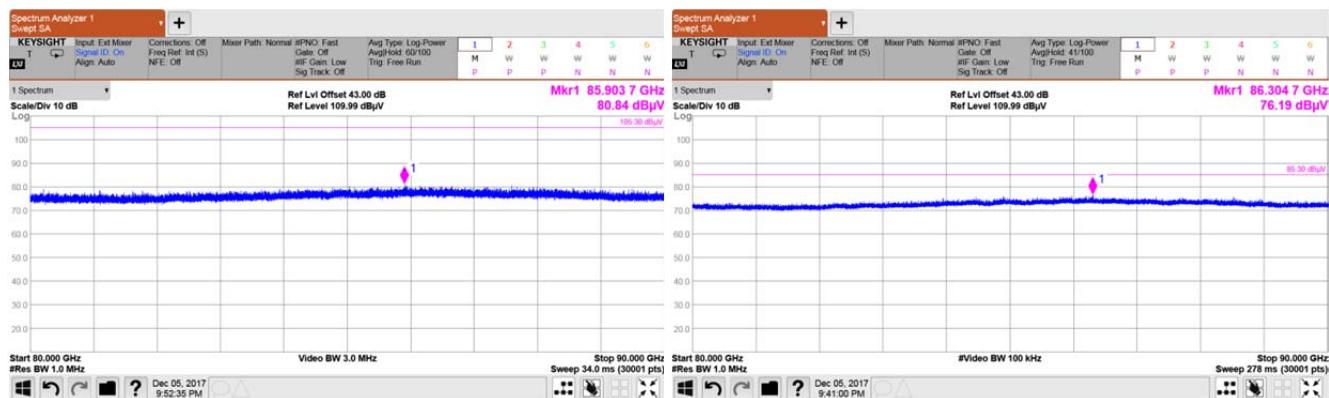
Plot 7.4.5 Radiated emission measurements from 80 to 90 GHz

TEST SITE:
TEST DISTANCE:
DETECTOR: Peak

OATS
3 m
DETECTOR: Average

ANTENNA POLARIZATION:

Vertical and Horizontal





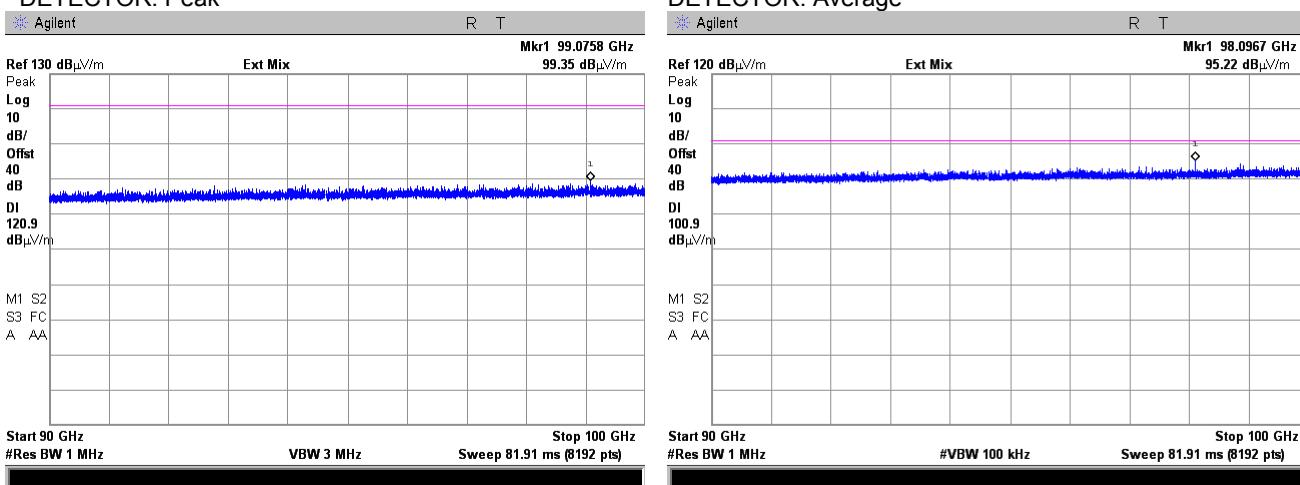
HERMON LABORATORIES

| | | |
|--|--------------------------------|-------------------------------|
| Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz | | |
| Test procedure: ANSI C63.10, Sections 9.9, 9.12 | | |
| Test mode: Compliance | | Verdict: PASS |
| Date(s): | 07-Jan-18 | |
| Temperature: 24.4 °C | Relative Humidity: 46 % | Air Pressure: 1020 hPa |
| Remarks: | | |

Plot 7.4.6 Radiated emission measurements from 90 to 100 GHz

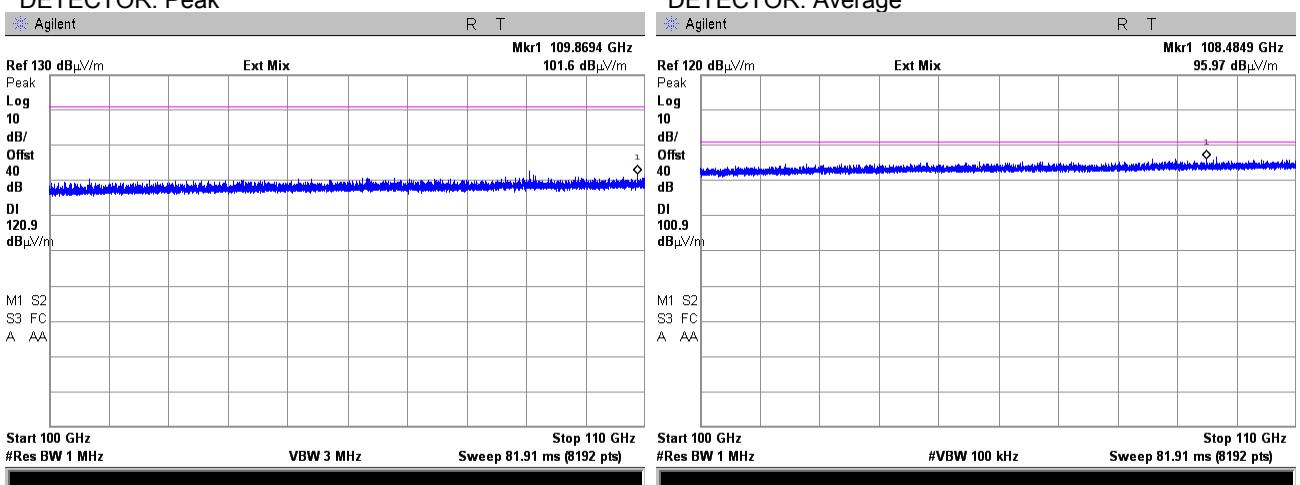
TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak

OATS
0.5 m
Vertical and Horizontal
DETECTOR: Average

**Plot 7.4.7 Radiated emission measurements from 100 to 110 GHz**

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak

OATS
0.5 m
Vertical and Horizontal
DETECTOR: Average



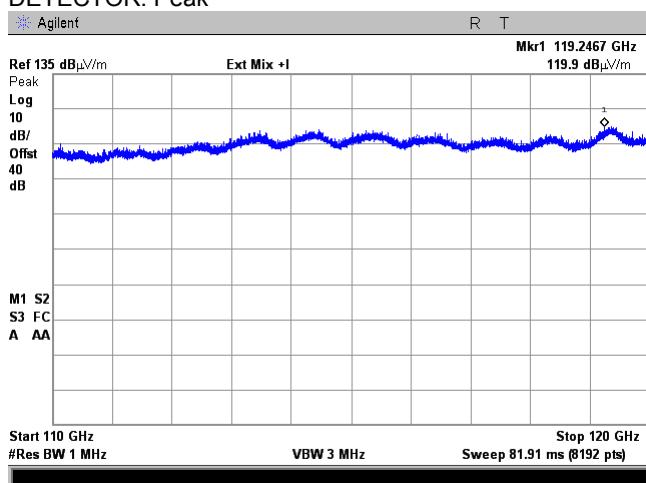


HERMON LABORATORIES

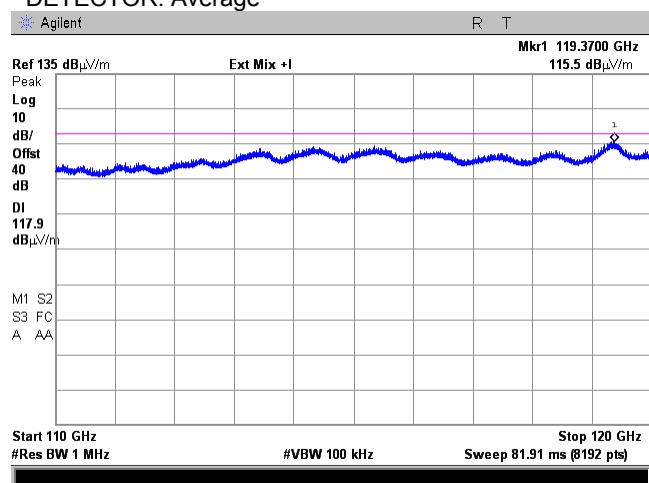
| | | |
|--|--------------------------------|-------------------------------|
| Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz | | |
| Test procedure: ANSI C63.10, Sections 9.9, 9.12 | | |
| Test mode: Compliance | | Verdict: PASS |
| Date(s): | 07-Jan-18 | |
| Temperature: 24.4 °C | Relative Humidity: 46 % | Air Pressure: 1020 hPa |
| Remarks: | | |

Plot 7.4.8 Radiated emission measurements from 110 to 120 GHz

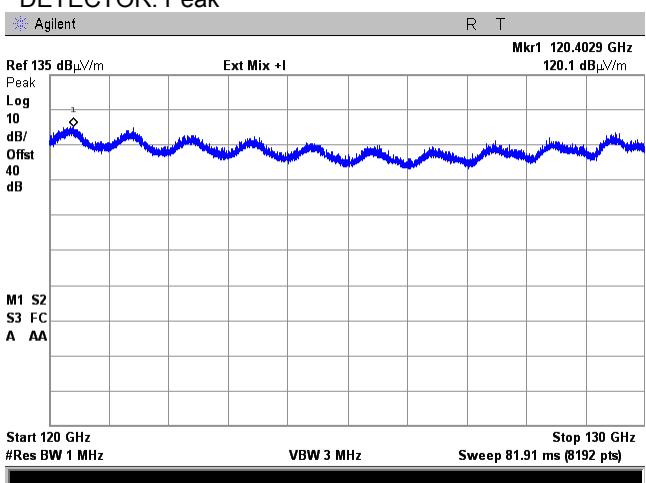
TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak



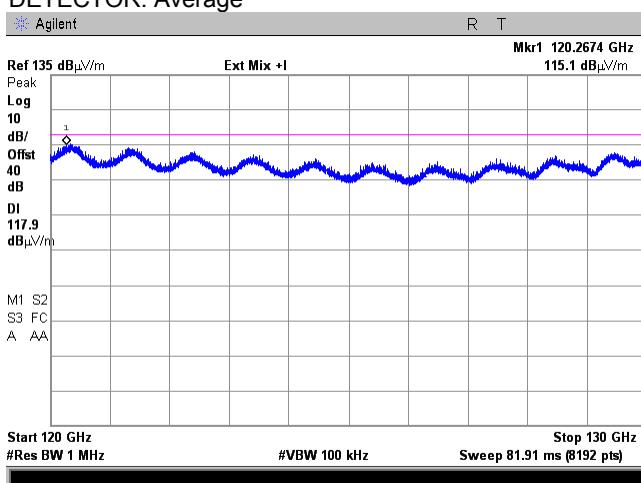
OATS
0.07 m
Vertical and Horizontal
DETECTOR: Average

Peak 137.9 dB μ V/m limit applied.**Plot 7.4.9 Radiated emission measurements from 120 to 130 GHz**

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak



OATS
0.07 m
Vertical and Horizontal
DETECTOR: Average

Peak 137.9 dB μ V/m, average 117.9 dB μ V/m limits applied.



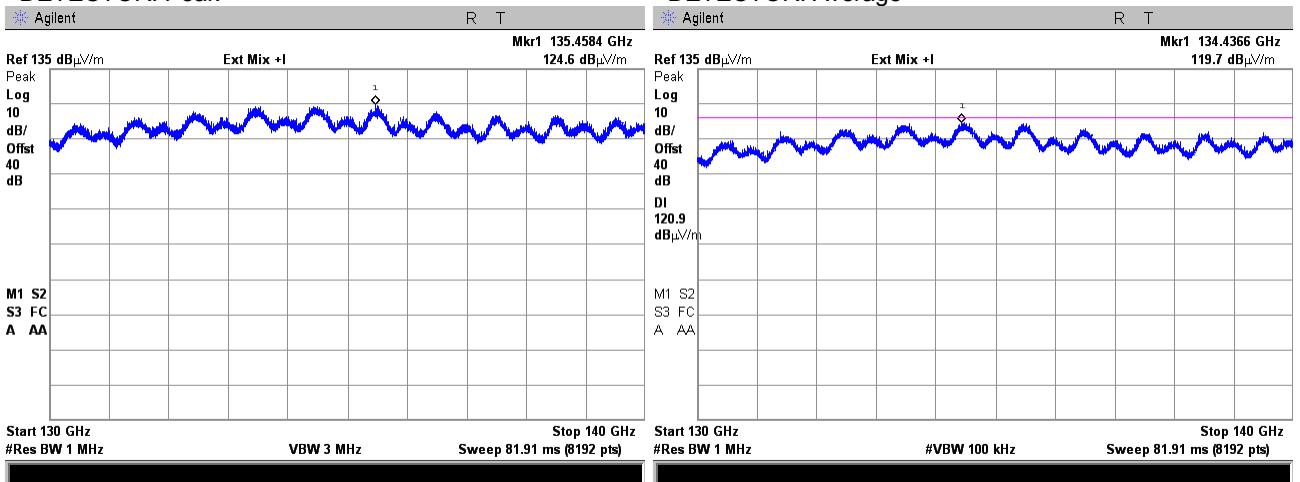
HERMON LABORATORIES

| Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz | | |
|---|-------------------------|------------------------|
| Test procedure: ANSI C63.10, Sections 9.9, 9.12 | | |
| Test mode: Compliance | | Verdict: PASS |
| Date(s): 07-Jan-18 | | |
| Temperature: 24.4 °C | Relative Humidity: 46 % | Air Pressure: 1020 hPa |
| Remarks: | | Power: 48 VDC |

Plot 7.4.10 Radiated emission measurements from 130 to 140 GHz

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak

OATS
0.05 m
Vertical and Horizontal
DETECTOR: Average

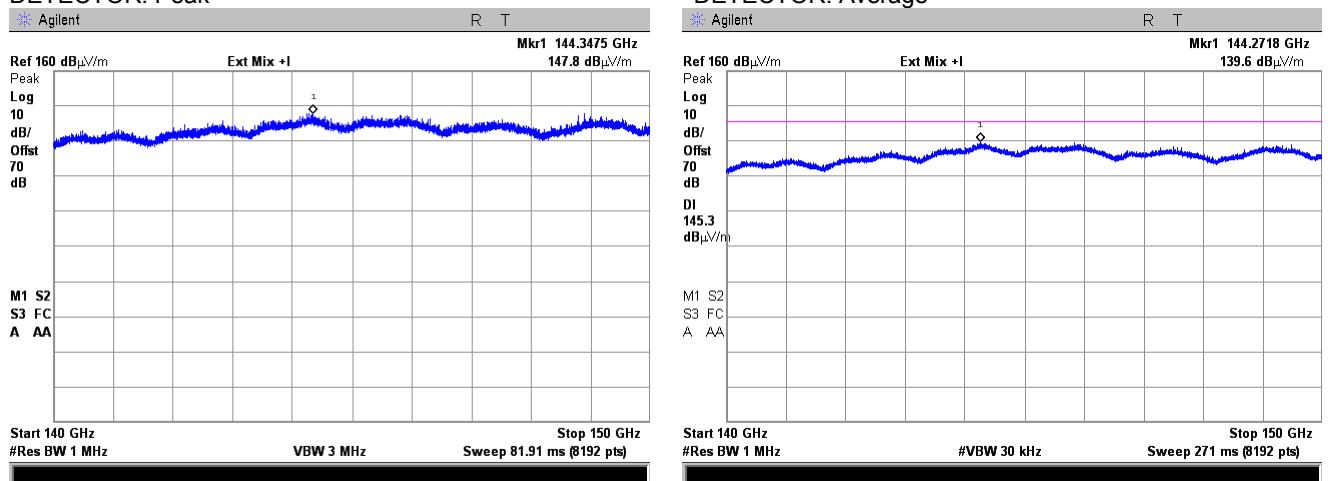


Peak 140.9 dBµV/m, average 120.9 dBµV/m limits applied.

Plot 7.4.11 Radiated emission measurements from 140 to 150 GHz

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak

OATS
0.001 m
Vertical and Horizontal
DETECTOR: Average



Peak 165.3 dBµV/m, average 145.38 dBµV/m limits applied.

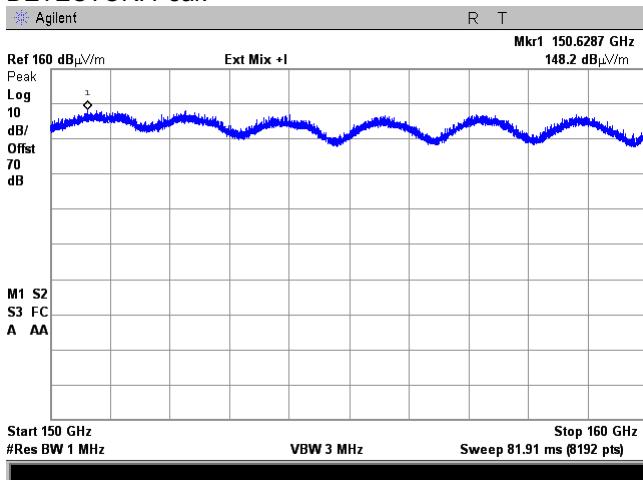


HERMON LABORATORIES

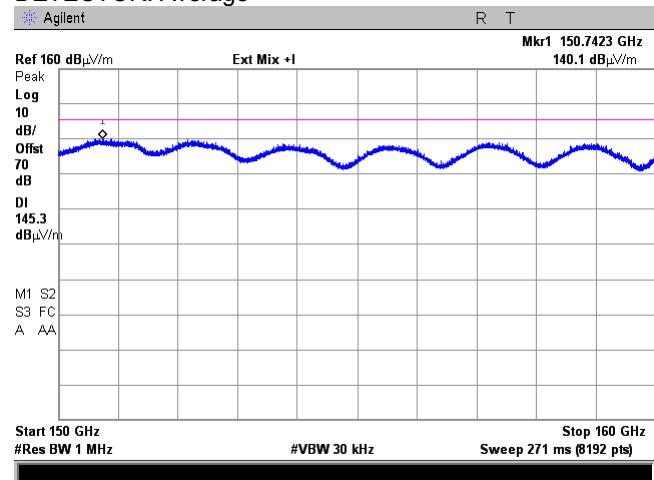
| | | |
|--|--------------------------------|-------------------------------|
| Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz | | |
| Test procedure: ANSI C63.10, Sections 9.9, 9.12 | | |
| Test mode: Compliance | | Verdict: PASS |
| Date(s): | 07-Jan-18 | |
| Temperature: 24.4 °C | Relative Humidity: 46 % | Air Pressure: 1020 hPa |
| Remarks: | | |

Plot 7.4.12 Radiated emission measurements from 150 to 160 GHz

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak



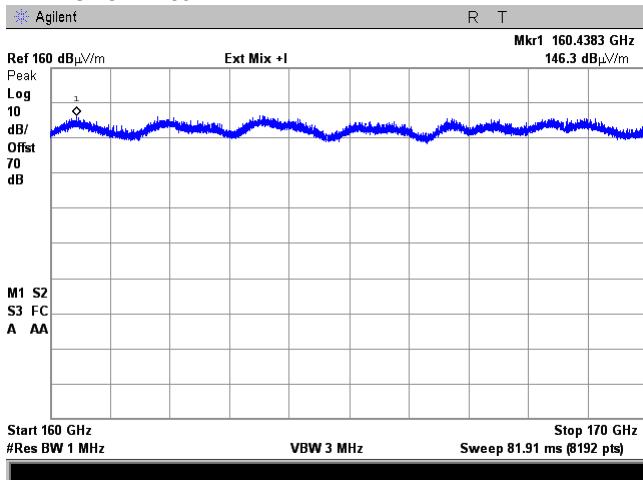
OATS
0.001 m
Vertical and Horizontal
DETECTOR: Average



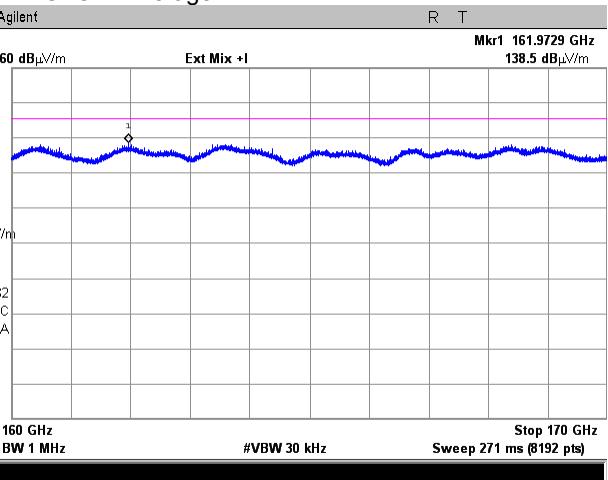
Peak 165.3 dBuV/m, average 145.38 dBuV/m limits applied.

Plot 7.4.13 Radiated emission measurements from 160 to 170 GHz

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak



OATS
0.001 m
Vertical and Horizontal
DETECTOR: Average



Peak 165.3 dBuV/m, average 145.38 dBuV/m limits applied.



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| | | |
|--|--------------------------------|-------------------------------|
| Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz | | |
| Test procedure: ANSI C63.10, Sections 9.9, 9.12 | | |
| Test mode: Compliance | | Verdict: PASS |
| Date(s): 07-Jan-18 | | |
| Temperature: 24.4 °C | Relative Humidity: 46 % | Air Pressure: 1020 hPa |
| Remarks: | | |

Plot 7.4.14 Radiated emission measurements from 170 to 180 GHz

TEST SITE:

OATS

TEST DISTANCE:

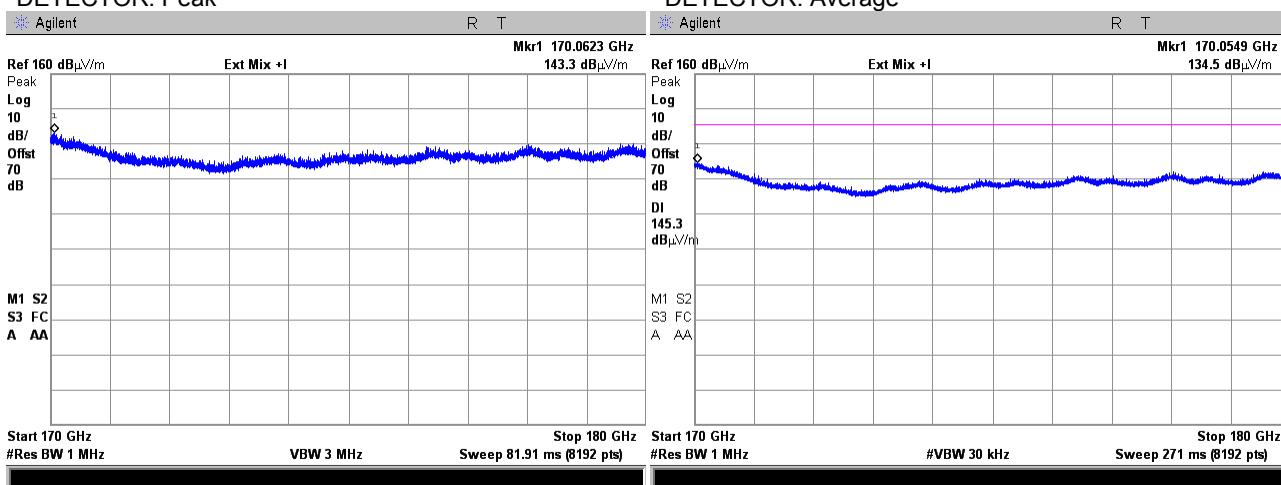
0.001 m

ANTENNA POLARIZATION:

Vertical and Horizontal

DETECTOR: Peak

DETECTOR: Average

Peak 165.3 dB μ V/m, average 145.38 dB μ V/m limits applied.**Plot 7.4.15 Radiated emission measurements from 180 to 190 GHz**

TEST SITE:

OATS

TEST DISTANCE:

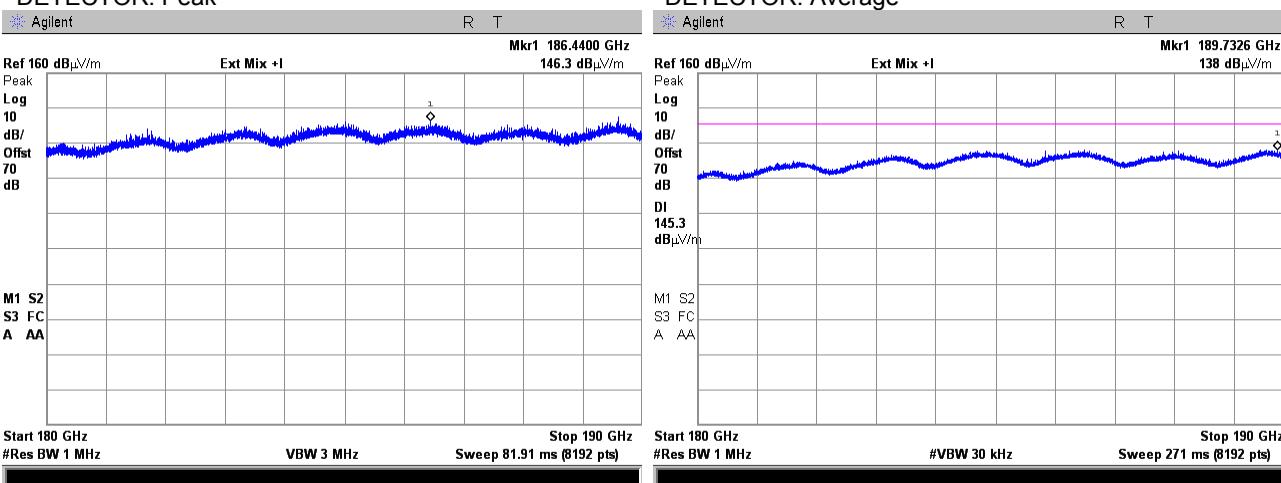
0.001 m

ANTENNA POLARIZATION:

Vertical and Horizontal

DETECTOR: Peak

DETECTOR: Average

Peak 165.3 dB μ V/m, average 145.38 dB μ V/m limits applied.



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| Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz | | |
|--|--------------------------------|-------------------------------|
| Test procedure: ANSI C63.10, Sections 9.9, 9.12 | | |
| Test mode: Compliance | | Verdict: PASS |
| Date(s): 07-Jan-18 | | |
| Temperature: 24.4 °C | Relative Humidity: 46 % | Air Pressure: 1020 hPa |
| Power: 48 VDC | | |
| Remarks: | | |

Plot 7.4.16 Radiated emission measurements from 190 to 200 GHz

TEST SITE:

OATS

TEST DISTANCE:

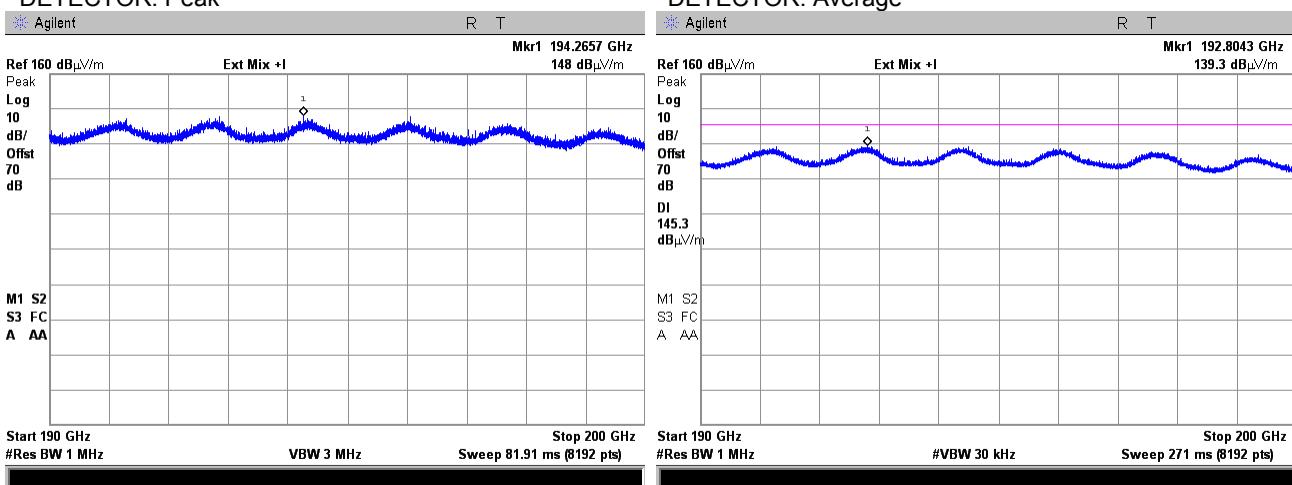
0.001 m

ANTENNA POLARIZATION:

Vertical and Horizontal

DETECTOR: Peak

DETECTOR: Average



Peak 165.3 dBuV/m, average 145.38 dBuV/m limits applied.



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| | | |
|--|--------------------------------|-------------------------------|
| Test specification: Section 15.255(f), Frequency tolerance | | |
| Test procedure: 47 CFR, Section 2.1055; ANSI C63.10, Section 9.14 | | |
| Test mode: Compliance | | Verdict: PASS |
| Date(s): 21-Jan-18 | | |
| Temperature: 25 °C | Relative Humidity: 53 % | Air Pressure: 1019 hPa |
| Remarks: | | |

7.5 Frequency stability test

7.5.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.5.1.

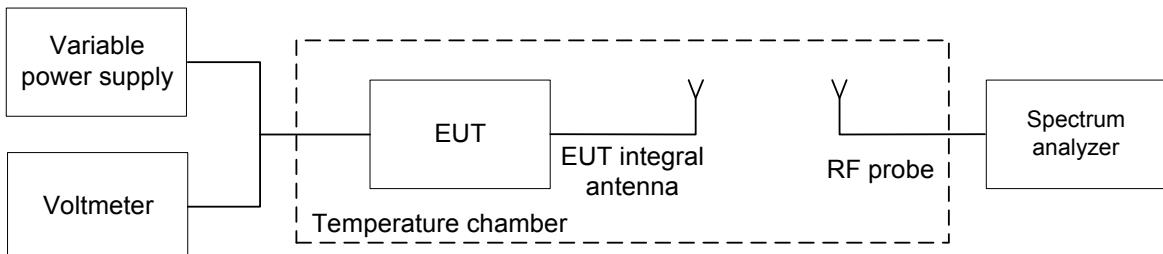
Table 7.5.1 Frequency stability limits

| Assigned frequency, MHz | Maximum allowed frequency displacement |
|-------------------------|--|
| 69875 | NA |

7.5.2 Test procedure

- 7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.
- 7.5.2.2 The EUT power was turned off. Temperature within test chamber was set to +30°C and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.
- 7.5.2.3 The EUT was powered on and carrier frequency was measured at start up moment +30°C and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.
- 7.5.2.4 The above procedure was repeated at the rest of the test temperatures and voltages as provided in Table 7.5.2. The EUT was powered off.
- 7.5.2.5 Frequency displacement was calculated and compared with the limit as provided in Table 7.5.2.

Figure 7.5.1 Frequency stability test setup





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| | | |
|--|--------------------------------|-------------------------------|
| Test specification: Section 15.255(f), Frequency tolerance | | |
| Test procedure: 47 CFR, Section 2.1055; ANSI C63.10, Section 9.14 | | |
| Test mode: Compliance | Verdict: PASS | |
| Date(s): 21-Jan-18 | | |
| Temperature: 25 °C | Relative Humidity: 53 % | Air Pressure: 1019 hPa |
| Remarks: | | |

Table 7.5.2 Frequency stability test results

OPERATING FREQUENCY: 57000 – 71000 MHz
 NOMINAL POWER VOLTAGE: 48 V
 TEMPERATURE STABILIZATION PERIOD: 20 min
 POWER DURING TEMPERATURE TRANSITION: Off
 SPECTRUM ANALYZER MODE: Counter
 RESOLUTION BANDWIDTH: 3 kHz
 VIDEO BANDWIDTH: 10 kHz
 MODULATION: Unmodulated

| T, °C | Voltage, V | Frequency, MHz | | | | | | | Max frequency drift, kHz | |
|---------------------------------|------------|----------------|---------------------|---------------------|---------------------|---------------------|---------------------|----------------------|--------------------------|----------|
| | | Start up | 1 st min | 2 nd min | 3 rd min | 4 th min | 5 th min | 10 th min | Positive | Negative |
| High frequency 69875 MHz | | | | | | | | | | |
| -20 | nominal | 69875.0806 | 69875.0871 | 69.875.0882 | 69875.0884 | 69875.0886 | 69875.0887 | 69875.0880 | 1137.2 | 0 |
| -10 | nominal | 69875.0430 | NA | NA | NA | NA | NA | 69874.9863 | 1091.5 | 0 |
| 0 | nominal | 69874.8249 | 69874.7945 | 69874.7872 | 69874.7775 | 69874.7692 | 69874.7628 | 69874.7306 | 873.4 | 0 |
| 10 | nominal | 69874.5727 | NA | NA | NA | NA | NA | 69874.4700 | 621.2 | 0 |
| 20 | +15% | 69873.8976 | NA | NA | NA | NA | NA | 69873.8969 | 0 | 54.6 |
| 20 | nominal | 69873.9000 | NA | NA | NA | NA | NA | 69873.9515 | 0 | 51.5 |
| 20 | -15%) | 69873.8960 | NA | NA | NA | NA | NA | 69873.8957 | 0 | 55.8 |
| 30 | nominal | 69874.0338 | 69874.0375 | 69874.0378 | 69874.0077 | 69874.0005 | 69.873.9955 | 69873.9764 | 86.3 | 0 |
| 40 | nominal | 69873.8772 | NA | NA | NA | NA | NA | 69873.8163 | 0 | 135.2 |
| 50 | nominal | 69873.7733 | NA | NA | NA | NA | NA | 69873.7833 | 0 | 178.2 |

* - Reference frequency

Reference numbers of test equipment used

| | | | | | | | |
|---------|---------|---------|---------|--|--|--|--|
| HL 2358 | HL 2909 | HL 3210 | HL 3305 | | | | |
|---------|---------|---------|---------|--|--|--|--|

Full description is given in Appendix A.



HERMON LABORATORIES

8 APPENDIX A Test equipment and ancillaries used for tests

| HL No | Description | Manufacturer | Model | Ser. No. | Last Cal./Check* | Due Cal./Check* |
|-------|---|----------------------------------|-------------|-------------|------------------|-----------------|
| 0446 | Antenna, Loop, Active, 10 kHz - 30 MHz | EMCO | 6502 | 2857 | 19-Jan-17 | 19-Feb-18 |
| 0604 | Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz | EMCO | 3141 | 9611-1011 | 12-May-17 | 12-May-18 |
| 0747 | Mixer, Millimeter Wave Harmonic 90 - 140 GHZ | Oleson Microwave Labs | M08HW | F80429-1 | 03-Mar-17 | 03-Mar-20 |
| 0770 | Antenna Standard Gain Horn, 40-60 GHz WR-19, U-band, 24 dB mid-band gain | Quinstar Technology | QWH-1900-AA | 118 | 18-Jul-17 | 18-Jul-18 |
| 0771 | Antenna Standard Gain Horn, 60-90 GHz, WR-12, 24 dB mid-band gain | Quinstar Technology | QWH-1200-AA | 111 | 13-Jul-17 | 13-Jul-18 |
| 0772 | Antenna Standard Gain Horn, 75-110 GHz, WR-10, 24 dB mid-band gain | Quinstar Technology | QWH-0800-AA | 110 | 13-Jul-17 | 13-Jul-18 |
| 1299 | Transition waveguide ET28S -19R | Custom Microwave | ET28S - 19R | 1299 | 30-Jul-15 | 30-Jul-18 |
| 1300 | Transition waveguide ET28S -19R | Custom Microwave | ET28S - 19R | 1300 | 30-Jul-15 | 30-Jul-18 |
| 1301 | Transition waveguide ET28S -12R | Custom Microwave | ET28S - 12R | 1301 | 30-Jul-15 | 30-Jul-18 |
| 1303 | Transition waveguide ET28S -12R | Custom Microwave | ET28S - 12R | S0951 | 30-Jul-15 | 30-Jul-18 |
| 1304 | Transition waveguide ET28S - 8R | Custom Microwave | ET28S - 8R | 1304 | 30-Jul-15 | 30-Jul-18 |
| 1305 | Transition waveguide ET28S - 8R | Custom Microwave | ET28S - 8R | 1305 | 30-Jul-15 | 30-Jul-18 |
| 1312 | Mixer Millimeter Wave Harmonic 140-220 GHz | Oleson Microwave Labs | M05HWD | G91112-1 | 03-Mar-17 | 03-Mar-20 |
| 2358 | Power Supply, 2 X 0-36VDC / 5A, 5VDC / 5A | Horizon Electronics | DHR3655 D | 767469 | 05-Jun-17 | 05-Jun-18 |
| 2909 | Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz | Agilent Technologies | E4407B | MY414447 62 | 09-Mar-17 | 09-Mar-18 |
| 3001 | EMC Analyzer, 9 kHz to 3 GHz | Agilent Technologies | E7402A | US394401 80 | 09-Oct-17 | 09-Oct-18 |
| 3210 | Temperature Chamber, (-50...+100) °C | Associated Environmental Systems | NA | NA | 03-Sep-17 | 03-Sep-18 |
| 3235 | Harmonic mixer 40 to 60 GHz | Agilent Technologies | 11970U | MY300301 82 | 16-Aug-16 | 16-Aug-19 |
| 3290 | Attenuator, direct reading, 40 to 60 GHz, 0.4 W | Quinstar Technology | QAD-U00000 | 10381008 | 10-Dec-17 | 10-Dec-18 |
| 3291 | Attenuator, direct reading, 60 to 90 GHz, 0.2 W | Quinstar Technology | QAD-E00000 | 10381009 | 10-Dec-17 | 10-Dec-18 |
| 3295 | Tapered transition, WR-28, UG-599 to WR-15, UG-385 (26.5-40 GHz to 50-75 GHz) | Quinstar Technology | QWP-AV0000 | 10381005 | 30-Jul-15 | 30-Jul-18 |



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| HL No. | Description | Manufacturer | Model | Ser. No. | Last Cal./Check* | Due Cal./Check* |
|--------|--|-----------------------|--------------------|--------------|------------------|-----------------|
| 3296 | Tapered transition, WR-28, UG-599 to WR-10, UG-387 (26.5-40 GHz to 75-100 GHz) | Quinstar Technology | QWP-AW0000 | 10381006 | 30-Jul-15 | 30-Jul-18 |
| 3297 | Tapered , WR-28, UG-599 to WR-10, UG-387 (26.5-40 GHz to 75-100 GHz) | Quinstar Technology | QWP-AW0000 | 10381007 | 30-Jul-15 | 30-Jul-18 |
| 3305 | Harmonic mixer 50 to 75 GHz | Agilent Technologies | 11970V | MY300301 49 | 16-Aug-16 | 16-Aug-19 |
| 3306 | Harmonic mixer 75 to 110 GHz | Agilent Technologies | 11970W | MY252102 73 | 16-Aug-16 | 16-Aug-19 |
| 3329 | Antenna Standard Gain Horn, 140-220 GHz, WR-5, 24 dB mid-band gain | Quinstar Technology | NA | NA | 19-Jul-17 | 19-Jul-18 |
| 3333 | Oscilloscope, 1 GHz, 4 channels | LeCroy Corporation | LC584AL | 10239 | 18-Jan-17 | 18-Jan-18 |
| 3433 | Test Cable , DC-18 GHz, 1.5 m, SMA - SMA | Mini-Circuits | CBL-5FT-SMSM+ | 25679 | 27-Mar-17 | 27-Mar-18 |
| 3434 | Test Cable , DC-18 GHz, 1.5 m, SMA - SMA | Mini-Circuits | CBL-5FT-SMSM+ | 25683 | 27-Mar-17 | 27-Mar-18 |
| 3536 | Antenna Standard Gain Horn, 90-140 GHz, WR-8, 24 dB mid-band gain | Quinstar Technology | QWH-FPRR00 | 111590040 01 | 15-Jun-17 | 15-Jun-18 |
| 3818 | PSA Series Spectrum Analyzer, 3 Hz- 44 GHz | Agilent Technologies | E4446A | MY482502 88 | 07-May-17 | 07-May-18 |
| 3901 | Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA | Huber-Suhner | SUCOFLE X 102A | 1225/2A | 20-Feb-17 | 20-Feb-18 |
| 4023 | Diplexer for use OML mixers with Agilent spectrum analyzer | Oleson Microwave Labs | DPL.26 | NA | 10-Dec-17 | 10-Dec-18 |
| 4273 | Test Cable , DC-18 GHz, 1.8 m, SMA/M - N/M | Mini-Circuits | CBL-6FT-SMNM+ | 70045 | 04-Jun-17 | 04-Jun-18 |
| 4353 | Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M | MegaPhase | NC29-N1N1-244 | 12025101 003 | 15-Mar-17 | 15-Mar-18 |
| 4360 | EMI Test Receiver, 20 Hz to 40 GHz. | Rohde & Schwarz | ESU40 | 100322 | 26-Dec-17 | 26-Dec-18 |
| 4933 | Active Horn Antenna, 1 GHz to 18 GHz | Com-Power Corporation | AHA-118 | 701046 | 04-Jan-18 | 04-Jan-19 |
| 4956 | Active horn antenna, 18 to 40 GHz | Com-Power Corporation | AHA-840 | 105004 | 11-Jan-18 | 11-Jan-19 |
| 5245 | RF cable, 18 GHz, 3 m, N-type | Huber-Suhner | ST18A/N m/Nm/300 0 | 602211/18 A | 27-Jul-17 | 27-Jul-18 |

*The calibration was valid during the testing time

8.1 Test equipment and ancillaries used for tests

| HL No. | Description | Manufacturer | Model | Ser. No. | Last Cal./Check | Due Cal./Check |
|--------|--------------------------|--------------|----------------|------------|-----------------|----------------|
| NA | Signal Analyzer | Keysight | MXA N9020B | MY56080135 | 22-Jun-17 | 22-Jun-18 |
| NA | Waveguide Harmonic Mixer | Keysight | M1971E Opt 003 | MY56130185 | 11-Apr-17 | 10-May-18 |



HERMON LABORATORIES

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

| Test description | Expanded uncertainty |
|--|---|
| Radiated emissions at 10 m measuring distance Horizontal polarization | Biconilog antenna: ± 5.0 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.1 dB Double ridged horn antenna: ± 5.3 dB |
| Vertical polarization | Biconilog antenna: ± 5.5 dB Biconical antenna: ± 5.5 dB Log periodic antenna: ± 5.6 dB Double ridged horn antenna: ± 5.8 dB |
| Radiated emissions at 3 m measuring distance Horizontal polarization | Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB |
| Vertical polarization | Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB |
| Conducted emissions at RF antenna connector | 9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB |

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.

Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.

In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.



HERMON LABORATORIES

10 APPENDIX C Test facility description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, Radio, Safety, Environmental and Telecommunication testing facility.

Hermon Laboratories is recognized and accredited by the Federal Communications Commission (USA) for 1, 2, 15, 18 parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; registered by Industry Canada for electromagnetic emissions, file number IC 2186A-1 for OATS, certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, G-869 for RE measurements above 1 GHz, C-845 for conducted emissions site and T-1606 for conducted emissions at telecommunication ports).

The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing, environmental simulation and calibration (for exact scope please refer to Certificate No. 839.01, 839.03 and 839.04).

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Person for contact: Mr. Michael Nikishin, EMC&Radio group manager

11 APPENDIX D Specification references

| | |
|---------------------|--|
| 47CFR part 27: 2017 | Private land mobile radio services |
| 47CFR part 1: 2017 | Practice and procedure |
| 47CFR part 2: 2017 | Frequency allocations and radio treaty matters; general rules and regulations |
| ANSI C63.10: 2013 | American National Standard of Procedures for Compliance Testing of Unlicenced Wireless Devices |
| ANSI C63.2: 1996 | American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications. |
| ANSI C63.4: 2014 | American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz. |



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12 APPENDIX E Test equipment correction factors

Antenna factor
Active loop antenna
Model 6502, S/N 2857, HL 0446

| Frequency, MHz | Magnetic antenna factor, dB | Electric antenna factor, dB |
|-------------------|--------------------------------|--------------------------------|
| 0.009 | -32.8 | 18.7 |
| 0.010 | -33.8 | 17.7 |
| 0.020 | -38.3 | 13.2 |
| 0.050 | -41.1 | 10.4 |
| 0.075 | -41.3 | 10.2 |
| 0.100 | -41.6 | 9.9 |
| 0.150 | -41.7 | 9.8 |
| 0.250 | -41.6 | 9.9 |
| 0.500 | -41.8 | 9.8 |
| 0.750 | -41.9 | 9.7 |
| 1.000 | -41.4 | 10.1 |
| 2.000 | -41.5 | 10.0 |
| 3.000 | -41.4 | 10.2 |
| 4.000 | -41.4 | 10.1 |
| 5.000 | -41.5 | 10.1 |
| 10.000 | -41.9 | 9.6 |
| 15.000 | -41.9 | 9.6 |
| 20.000 | -42.2 | 9.3 |
| 25.000 | -42.8 | 8.7 |
| 30.000 | -44.0 | 7.5 |

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field strength in dB(μ V/m).

Antenna factor
Standard gain horn antenna
Quinstar Technology
Model QWH
Ser.No.112, HL 0768, 0769, 0770, 0771, 0772

| Frequency min, GHz | Frequency max, GHz | Antenna factor, dB(1/m) |
|-----------------------|-----------------------|----------------------------|
| 18.000 | 26.500 | 32.01 |
| 26.500 | 40.000 | 35.48 |
| 40.000 | 60.000 | 39.03 |
| 60.000 | 90.000 | 42.55 |
| 90.000 | 140.000 | 46.23 |
| 140.000 | 220.000 | 50.11 |

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field intensity in dB(μ V/m).



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Antenna factor
Biconilog antenna EMCO Model 3141
Ser.No.1011, HL 0604

| Frequency, MHz | Antenna factor, dB(1/m) | Frequency, MHz | Antenna factor, dB(1/m) | Frequency, MHz | Antenna factor, dB(1/m) |
|----------------|-------------------------|----------------|-------------------------|----------------|-------------------------|
| 26 | 7.8 | 580 | 20.6 | 1320 | 27.8 |
| 28 | 7.8 | 600 | 21.3 | 1340 | 28.3 |
| 30 | 7.8 | 620 | 21.5 | 1360 | 28.2 |
| 40 | 7.2 | 640 | 21.2 | 1380 | 27.9 |
| 60 | 7.1 | 660 | 21.4 | 1400 | 27.9 |
| 70 | 8.5 | 680 | 21.9 | 1420 | 27.9 |
| 80 | 9.4 | 700 | 22.2 | 1440 | 27.8 |
| 90 | 9.8 | 720 | 22.2 | 1460 | 27.8 |
| 100 | 9.7 | 740 | 22.1 | 1480 | 28.0 |
| 110 | 9.3 | 760 | 22.3 | 1500 | 28.5 |
| 120 | 8.8 | 780 | 22.6 | 1520 | 28.9 |
| 130 | 8.7 | 800 | 22.7 | 1540 | 29.6 |
| 140 | 9.2 | 820 | 22.9 | 1560 | 29.8 |
| 150 | 9.8 | 840 | 23.1 | 1580 | 29.6 |
| 160 | 10.2 | 860 | 23.4 | 1600 | 29.5 |
| 170 | 10.4 | 880 | 23.8 | 1620 | 29.3 |
| 180 | 10.4 | 900 | 24.1 | 1640 | 29.2 |
| 190 | 10.3 | 920 | 24.1 | 1660 | 29.4 |
| 200 | 10.6 | 940 | 24.0 | 1680 | 29.6 |
| 220 | 11.6 | 960 | 24.1 | 1700 | 29.8 |
| 240 | 12.4 | 980 | 24.5 | 1720 | 30.3 |
| 260 | 12.8 | 1000 | 24.9 | 1740 | 30.8 |
| 280 | 13.7 | 1020 | 25.0 | 1760 | 31.1 |
| 300 | 14.7 | 1040 | 25.2 | 1780 | 31.0 |
| 320 | 15.2 | 1060 | 25.4 | 1800 | 30.9 |
| 340 | 15.4 | 1080 | 25.6 | 1820 | 30.7 |
| 360 | 16.1 | 1100 | 25.7 | 1840 | 30.6 |
| 380 | 16.4 | 1120 | 26.0 | 1860 | 30.6 |
| 400 | 16.6 | 1140 | 26.4 | 1880 | 30.6 |
| 420 | 16.7 | 1160 | 27.0 | 1900 | 30.6 |
| 440 | 17.0 | 1180 | 27.0 | 1920 | 30.7 |
| 460 | 17.7 | 1200 | 26.7 | 1940 | 30.9 |
| 480 | 18.1 | 1220 | 26.5 | 1960 | 31.2 |
| 500 | 18.5 | 1240 | 26.5 | 1980 | 31.6 |
| 520 | 19.1 | 1260 | 26.5 | 2000 | 32.0 |
| 540 | 19.5 | 1280 | 26.6 | | |
| 560 | 19.8 | 1300 | 27.0 | | |

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field strength in dB(μ V/m).



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Antenna factor, HL 4933

**Active Horn Antenna Factor Calibration**

1 GHz to 18 GHz

| Equipment: | ACTIVE HORN ANTENNA | | | | |
|---|------------------------------|--|--------------------|------------------------------|--|
| Model: | AHA-118 | | | | |
| Serial Number: | 701046 | | | | |
| Calibration Distance: | 3 Meter | | | | |
| Polarization: | Horizontal | | | | |
| Calibration Date: | 11/12/2014 | | | | |
| Frequency (GHz) | Preamplifier Gain (dB) | Antenna Factor with pre-amp (dB/m) | Frequency (GHz) | Preamplifier Gain (dB) | Antenna Factor with pre-amp (dB/m) |
| 1 | 40.96 | -16.47 | 10 | 40.94 | -1.97 |
| 1.5 | 41.21 | -14.53 | 10.5 | 40.63 | -1.06 |
| 2 | 41.44 | -13.30 | 11 | 40.74 | -1.50 |
| 2.5 | 41.71 | -12.87 | 11.5 | 40.65 | -0.52 |
| 3 | 41.96 | -12.26 | 12 | 40.76 | -0.15 |
| 3.5 | 42.14 | -11.77 | 12.5 | 41.03 | -0.85 |
| 4 | 42.13 | -10.91 | 13 | 41.37 | -0.81 |
| 4.5 | 41.79 | -9.41 | 13.5 | 41.18 | 0.05 |
| 5 | 41.44 | -7.54 | 14 | 40.98 | 0.36 |
| 5.5 | 40.91 | -6.47 | 14.5 | 40.81 | 1.26 |
| 6 | 40.69 | -5.48 | 15 | 40.65 | 0.25 |
| 6.5 | 40.64 | -5.53 | 15.5 | 40.93 | -1.05 |
| 7 | 40.76 | -4.12 | 16 | 41.31 | -1.44 |
| 7.5 | 40.94 | -3.12 | 16.5 | 40.96 | -0.80 |
| 8 | 40.68 | -1.69 | 17 | 40.64 | -0.02 |
| 8.5 | 40.08 | -1.71 | 17.5 | 40.57 | 1.81 |
| 9 | 40.41 | -1.86 | 18 | 40.08 | 3.63 |
| 9.5 | 41.21 | -2.73 | | | |
| Calibration according to ARP 958 | | | | | |
| Antenna Factor to be added to receiver reading: | | | | | |
| Meter Reading (dBuV) + Antenna Factor (dB/m) = Corrected Reading (dBuV/m) | | | | | |



HERMON LABORATORIES

Antenna factor, HL 4956



Active Horn Antenna Factor Calibration

18 GHz to 40 GHz

| Equipment: | ACTIVE HORN ANTENNA | | | | |
|---|------------------------------|--|--------------------|------------------------------|--|
| Model: | AHA-840 | | | | |
| Serial Number: | 105004 | | | | |
| Calibration Distance: | 3 meter | | | | |
| Polarization: | Horizontal | | | | |
| Calibration Date: | 1/26/2015 | | | | |
| Frequency (GHz) | Preamplifier Gain (dB) | Antenna Factor with pre-amp (dB/m) | Frequency (GHz) | Preamplifier Gain (dB) | Antenna Factor with pre-amp (dB/m) |
| 18 | 38.83 | -1.06 | 29.5 | 42.47 | -5.33 |
| 18.5 | 39.34 | -2.65 | 30 | 41.91 | -4.86 |
| 19 | 39.71 | -3.88 | 30.5 | 41.60 | -4.64 |
| 19.5 | 39.87 | -4.35 | 31 | 41.52 | -4.60 |
| 20 | 39.98 | -3.97 | 31.5 | 41.56 | -4.79 |
| 20.5 | 40.42 | -3.68 | 32 | 41.80 | -5.21 |
| 21 | 41.12 | -4.06 | 32.5 | 42.29 | -5.54 |
| 21.5 | 41.74 | -5.46 | 33 | 42.79 | -5.63 |
| 22 | 42.14 | -6.22 | 33.5 | 42.88 | -5.38 |
| 22.5 | 42.35 | -6.42 | 34 | 42.62 | -4.76 |
| 23 | 42.50 | -6.59 | 34.5 | 42.63 | -4.84 |
| 23.5 | 42.65 | -6.82 | 35 | 43.15 | -5.13 |
| 24 | 42.81 | -7.01 | 35.5 | 43.91 | -5.83 |
| 24.5 | 42.86 | -7.37 | 36 | 44.59 | -6.39 |
| 25 | 42.73 | -7.53 | 36.5 | 45.04 | -6.64 |
| 25.5 | 42.77 | -7.45 | 37 | 45.08 | -6.40 |
| 26 | 42.85 | -7.21 | 37.5 | 44.82 | -5.75 |
| 26.5 | 42.98 | -7.17 | 38 | 44.16 | -4.58 |
| 27 | 43.14 | -7.22 | 38.5 | 42.90 | -2.66 |
| 27.5 | 43.18 | -7.32 | 39 | 42.39 | -1.71 |
| 28 | 43.04 | -7.10 | 39.5 | 43.76 | -2.49 |
| 28.5 | 43.01 | -6.73 | 40 | 45.98 | -5.21 |
| Calibration per ANSI C63.5: 2006 Standard Site Method, Equations 1-6 (3-antenna) | | | | | |
| Corrected Reading (dB μ V/m) = Meter Reading (dB μ V) + AFE(dB/m) | | | | | |



HERMON LABORATORIES

Cable loss
Test Cable, Mini-Circuits, CBL-5FT-SMSM+, SMA-SMA, 18 GHz, 1.5 m, S/N 25679
Mini-Circuits, HL 3433

| Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB |
|-------------------|-------------------|-------------------|-------------------|
| 10.0 | 0.06 | 9000 | 2.01 |
| 100 | 0.17 | 9500 | 2.06 |
| 500 | 0.41 | 10000 | 2.05 |
| 1000 | 0.58 | 10500 | 2.18 |
| 1500 | 0.72 | 11000 | 2.26 |
| 2000 | 0.86 | 11500 | 2.28 |
| 2500 | 0.96 | 12000 | 2.43 |
| 3000 | 1.04 | 12500 | 2.53 |
| 3500 | 1.13 | 13000 | 2.52 |
| 4000 | 1.23 | 13500 | 2.56 |
| 4500 | 1.31 | 14000 | 2.60 |
| 5000 | 1.41 | 14500 | 2.59 |
| 5500 | 1.49 | 15000 | 2.67 |
| 6000 | 1.55 | 15500 | 2.76 |
| 6500 | 1.63 | 16000 | 2.86 |
| 7000 | 1.71 | 16500 | 2.91 |
| 7500 | 1.78 | 17000 | 2.95 |
| 8000 | 1.86 | 17500 | 3.02 |
| 8500 | 1.92 | 18000 | 3.07 |



HERMON LABORATORIES

Cable loss
Test Cable, Mini-Circuits, CBL-5FT-SMSM+, SMA-SMA, 18 GHz, 1.5 m, S/N 25683
Mini-Circuits, HL 3434

| Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB |
|-------------------|-------------------|-------------------|-------------------|
| 10.0 | 0.06 | 9000 | 1.96 |
| 100 | 0.16 | 9500 | 2.01 |
| 500 | 0.40 | 10000 | 2.01 |
| 1000 | 0.57 | 10500 | 2.14 |
| 1500 | 0.72 | 11000 | 2.21 |
| 2000 | 0.85 | 11500 | 2.24 |
| 2500 | 0.95 | 12000 | 2.36 |
| 3000 | 1.03 | 12500 | 2.47 |
| 3500 | 1.11 | 13000 | 2.46 |
| 4000 | 1.21 | 13500 | 2.50 |
| 4500 | 1.29 | 14000 | 2.53 |
| 5000 | 1.39 | 14500 | 2.53 |
| 5500 | 1.46 | 15000 | 2.62 |
| 6000 | 1.52 | 15500 | 2.70 |
| 6500 | 1.60 | 16000 | 2.80 |
| 7000 | 1.68 | 16500 | 2.86 |
| 7500 | 1.75 | 17000 | 2.88 |
| 8000 | 1.83 | 17500 | 2.94 |
| 8500 | 1.88 | 18000 | 3.00 |



HERMON LABORATORIES

Cable loss
Microwave Cable Assembly, Huber-Suhner, 40 GHz, 3.5 m, SMA-SMA, S/N 1225/2A
HL 3901

| Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB |
|----------------|----------------|----------------|----------------|----------------|----------------|
| 10 | 0.09 | 9500 | 4.29 | 21000 | 6.67 |
| 100 | 0.41 | 10000 | 4.40 | 22000 | 6.92 |
| 500 | 0.93 | 10500 | 4.52 | 23000 | 7.00 |
| 1000 | 1.33 | 11000 | 4.64 | 24000 | 7.18 |
| 1500 | 1.63 | 11500 | 4.76 | 25000 | 7.29 |
| 2000 | 1.90 | 12000 | 4.87 | 26000 | 7.55 |
| 2500 | 2.12 | 12500 | 4.99 | 27000 | 7.70 |
| 3000 | 2.33 | 13000 | 5.11 | 28000 | 7.88 |
| 3500 | 2.50 | 13500 | 5.20 | 29000 | 8.02 |
| 4000 | 2.67 | 14000 | 5.31 | 30000 | 8.15 |
| 4500 | 2.82 | 14500 | 5.42 | 31000 | 8.35 |
| 5000 | 2.99 | 15000 | 5.51 | 32000 | 8.40 |
| 5500 | 3.16 | 15500 | 5.58 | 33000 | 8.62 |
| 6000 | 3.32 | 16000 | 5.68 | 34000 | 8.73 |
| 6500 | 3.51 | 16500 | 5.78 | 35000 | 8.78 |
| 7000 | 3.65 | 17000 | 5.91 | 36000 | 8.94 |
| 7500 | 3.79 | 17500 | 5.99 | 37000 | 9.21 |
| 8000 | 3.92 | 18000 | 6.07 | 38000 | 9.37 |
| 8500 | 4.04 | 19000 | 6.36 | 39000 | 9.45 |
| 9000 | 4.18 | 20000 | 6.49 | 40000 | 9.52 |



HERMON LABORATORIES

Cable loss
Test cable, Mini-Circuits, S/N 70045, 18 GHz, 1.8 m, SMA/M - N/M
CBL-6FT-SMNM+, HL 4273

| Frequency, MHz | Cable loss, dB |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 10 | 0.09 | 4800 | 1.76 | 9800 | 2.70 | 14800 | 3.59 |
| 30 | 0.11 | 4900 | 1.78 | 9900 | 2.71 | 14900 | 3.59 |
| 50 | 0.14 | 5000 | 1.81 | 10000 | 2.73 | 15000 | 3.60 |
| 100 | 0.20 | 5100 | 1.82 | 10100 | 2.75 | 15100 | 3.63 |
| 200 | 0.30 | 5200 | 1.86 | 10200 | 2.76 | 15200 | 3.67 |
| 300 | 0.38 | 5300 | 1.89 | 10300 | 2.79 | 15300 | 3.70 |
| 400 | 0.45 | 5400 | 1.92 | 10400 | 2.81 | 15400 | 3.68 |
| 500 | 0.50 | 5500 | 1.96 | 10500 | 2.82 | 15500 | 3.70 |
| 600 | 0.55 | 5600 | 2.00 | 10600 | 2.83 | 15600 | 3.71 |
| 700 | 0.60 | 5700 | 2.03 | 10700 | 2.87 | 15700 | 3.77 |
| 800 | 0.65 | 5800 | 2.04 | 10800 | 2.87 | 15800 | 3.75 |
| 900 | 0.69 | 5900 | 2.07 | 10900 | 2.88 | 15900 | 3.77 |
| 1000 | 0.73 | 6000 | 2.10 | 11000 | 2.89 | 16000 | 3.79 |
| 1100 | 0.77 | 6100 | 2.10 | 11100 | 2.91 | 16100 | 3.85 |
| 1200 | 0.80 | 6200 | 2.11 | 11200 | 2.92 | 16200 | 3.82 |
| 1300 | 0.84 | 6300 | 2.11 | 11300 | 2.94 | 16300 | 3.83 |
| 1400 | 0.88 | 6400 | 2.14 | 11400 | 2.95 | 16400 | 3.88 |
| 1500 | 0.92 | 6500 | 2.15 | 11500 | 2.98 | 16500 | 3.89 |
| 1600 | 0.95 | 6600 | 2.15 | 11600 | 3.00 | 16600 | 3.92 |
| 1700 | 0.98 | 6700 | 2.16 | 11700 | 3.02 | 16700 | 3.88 |
| 1800 | 1.01 | 6800 | 2.19 | 11800 | 3.04 | 16800 | 3.95 |
| 1900 | 1.04 | 6900 | 2.22 | 11900 | 3.08 | 16900 | 3.91 |
| 2000 | 1.07 | 7000 | 2.24 | 12000 | 3.09 | 17000 | 3.97 |
| 2100 | 1.09 | 7100 | 2.26 | 12100 | 3.12 | 17100 | 3.92 |
| 2200 | 1.13 | 7200 | 2.29 | 12200 | 3.13 | 17200 | 3.94 |
| 2300 | 1.15 | 7300 | 2.32 | 12300 | 3.16 | 17300 | 3.94 |
| 2400 | 1.18 | 7400 | 2.36 | 12400 | 3.17 | 17400 | 3.98 |
| 2500 | 1.21 | 7500 | 2.39 | 12500 | 3.19 | 17500 | 3.93 |
| 2600 | 1.24 | 7600 | 2.41 | 12600 | 3.20 | 17600 | 3.95 |
| 2700 | 1.27 | 7700 | 2.43 | 12700 | 3.21 | 17700 | 3.96 |
| 2800 | 1.30 | 7800 | 2.46 | 12800 | 3.21 | 17800 | 3.97 |
| 2900 | 1.34 | 7900 | 2.49 | 12900 | 3.22 | 17900 | 3.96 |
| 3000 | 1.36 | 8000 | 2.52 | 13000 | 3.22 | 18000 | 3.97 |
| 3100 | 1.38 | 8100 | 2.52 | 13100 | 3.24 | | |
| 3200 | 1.41 | 8200 | 2.54 | 13200 | 3.24 | | |
| 3300 | 1.45 | 8300 | 2.59 | 13300 | 3.27 | | |
| 3400 | 1.46 | 8400 | 2.61 | 13400 | 3.28 | | |
| 3500 | 1.49 | 8500 | 2.60 | 13500 | 3.31 | | |
| 3600 | 1.51 | 8600 | 2.63 | 13600 | 3.31 | | |
| 3700 | 1.55 | 8700 | 2.65 | 13700 | 3.35 | | |
| 3800 | 1.34 | 8800 | 2.65 | 13800 | 3.37 | | |
| 3900 | 1.36 | 8900 | 2.65 | 13900 | 3.40 | | |
| 4000 | 1.38 | 9000 | 2.66 | 14000 | 3.43 | | |
| 4100 | 1.41 | 9100 | 2.66 | 14100 | 3.45 | | |
| 4200 | 1.45 | 9200 | 2.67 | 14200 | 3.46 | | |
| 4300 | 1.46 | 9300 | 2.67 | 14300 | 3.46 | | |
| 4400 | 1.49 | 9400 | 2.67 | 14400 | 3.49 | | |
| 4500 | 1.51 | 9500 | 2.68 | 14500 | 3.50 | | |
| 4600 | 1.55 | 9600 | 2.69 | 14600 | 3.50 | | |
| 4700 | 1.34 | 9700 | 2.69 | 14700 | 3.52 | | |



HERMON LABORATORIES

Cable loss
Low Loss Armored Test Cable, MegaPhase, 18 GHz, 6.2 m, N type-M/N type-M,
NC29-N1N1-244S/N 12025101 003,
HL 4353

| Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB |
|-------------------|-------------------|-------------------|-------------------|
| 50 | 0.20 | 9000 | 2.71 |
| 100 | 0.27 | 9500 | 2.81 |
| 300 | 0.47 | 10000 | 2.90 |
| 500 | 0.61 | 10500 | 2.97 |
| 1000 | 0.87 | 11000 | 3.06 |
| 1500 | 1.07 | 11500 | 3.13 |
| 2000 | 1.24 | 12000 | 3.20 |
| 2500 | 1.39 | 12500 | 3.26 |
| 3000 | 1.53 | 13000 | 3.34 |
| 3500 | 1.65 | 13500 | 3.39 |
| 4000 | 1.77 | 14000 | 3.47 |
| 4500 | 1.89 | 14500 | 3.54 |
| 5000 | 1.99 | 15000 | 3.62 |
| 5500 | 2.07 | 15500 | 3.69 |
| 6000 | 2.20 | 16000 | 3.76 |
| 6500 | 2.30 | 16500 | 3.83 |
| 7000 | 2.39 | 17000 | 3.86 |
| 7500 | 2.51 | 17500 | 3.94 |
| 8000 | 2.58 | 18000 | 4.02 |
| 8500 | 2.65 | | |



HERMON LABORATORIES

Cable loss
RF Cable, Huber-Suhner, 18 GHz, 3 m, N- type,
ST18A/Nm/Nm/3000, S/N 602211/18A
HL 5245

| Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB |
|-------------------|-------------------|-------------------|-------------------|
| 0.1 | 0.01 | 5500 | 1.76 |
| 50 | 0.16 | 6000 | 1.85 |
| 100 | 0.23 | 6500 | 1.93 |
| 200 | 0.32 | 7000 | 2.02 |
| 300 | 0.39 | 7500 | 2.11 |
| 400 | 0.45 | 8000 | 2.19 |
| 500 | 0.51 | 8500 | 2.26 |
| 600 | 0.56 | 9000 | 2.30 |
| 700 | 0.60 | 9500 | 2.33 |
| 800 | 0.65 | 10000 | 2.37 |
| 900 | 0.68 | 10500 | 10500 |
| 1000 | 0.72 | 11000 | 11000 |
| 1100 | 0.76 | 11500 | 11500 |
| 1200 | 0.80 | 12000 | 12000 |
| 1300 | 0.83 | 12500 | 12500 |
| 1400 | 0.86 | 13000 | 13000 |
| 1500 | 0.89 | 13500 | 13500 |
| 1600 | 0.92 | 14000 | 14000 |
| 1700 | 0.95 | 14500 | 14500 |
| 1800 | 0.98 | 15000 | 15000 |
| 1900 | 1.01 | 15500 | 15500 |
| 2000 | 1.03 | 16000 | 16000 |
| 2500 | 1.16 | 16500 | 16500 |
| 3000 | 1.27 | 17000 | 17000 |
| 3500 | 1.38 | 17500 | 17500 |
| 4000 | 1.48 | 18000 | 18000 |
| 4500 | 1.58 | | |
| 5000 | 1.67 | | |



HERMON LABORATORIES

13 APPENDIX F Abbreviations and acronyms

| | |
|----------|---|
| A | ampere |
| AC | alternating current |
| A/m | ampere per meter |
| AM | amplitude modulation |
| AVRG | average (detector) |
| BB | broad band |
| cm | centimeter |
| dB | decibel |
| dBm | decibel referred to one milliwatt |
| dB(µV) | decibel referred to one microvolt |
| dB(µV/m) | decibel referred to one microvolt per meter |
| dB(µA) | decibel referred to one microampere |
| dBΩ | decibel referred to one Ohm |
| DC | direct current |
| EIRP | equivalent isotropically radiated power |
| ERP | effective radiated power |
| EUT | equipment under test |
| F | frequency |
| GHz | gigahertz |
| GND | ground |
| H | height |
| HL | Hermon laboratories |
| Hz | hertz |
| ITE | information technology equipment |
| k | kilo |
| KHz | kilohertz |
| LISN | line impedance stabilization network |
| LO | local oscillator |
| m | meter |
| MHz | megahertz |
| min | minute |
| mm | millimeter |
| ms | millisecond |
| µs | microsecond |
| NA | not applicable |
| NB | narrow band |
| NT | not tested |
| OATS | open area test site |
| Ω | Ohm |
| QP | quasi-peak |
| PM | pulse modulation |
| PS | power supply |
| RE | radiated emission |
| RF | radio frequency |
| rms | root mean square |
| Rx | receive |
| s | second |
| T | temperature |
| Tx | transmit |
| V | volt |
| VA | volt-ampere |

END OF DOCUMENT