

# TEST REPORT

ACCORDING TO: FCC 47 CFR PART 15 subpart C, section 15.249;  
RSS-210 issue 10 Annex 2

FOR:

**Laser-Ammo Ltd.**  
**i-MTTS System Controller**  
**Model: i-MTTS-C**  
**FCC ID: 2AHUUIMTTS2**  
**IC: 21384-IMTTS2**

This report is in conformity with ISO/IEC 17025. The "A2LA Accredited" symbol endorsement applies only to the tests and calibrations that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested.  
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## 1 Applicant information

**Client name:** Laser-Ammo Ltd.  
**Address:** 7 Barshevski street, Rishon Le-Zion 7536374, Israel  
**Telephone:** +972 3958 5525  
**E-mail:** [amitay@laser-ammo.com](mailto:amitay@laser-ammo.com)  
**Contact name:** Mr. Amitay Kligman

## 2 Equipment under test attributes

**Product name:** i-MTTS System Controller  
**Product type:** Transceiver  
**Model(s):** i-MTTS-C  
**Hardware version:** REM02B  
**Software release:** IMTTS\_V3.X\_2019.01.14.production  
**Receipt date:** 29-Dec-19

## 3 Manufacturer information

**Manufacturer name:** Laser-Ammo Ltd.  
**Address:** 7 Barshevski street, Rishon Le-Zion 7536374, Israel  
**Telephone:** +972 3958 5525  
**E-Mail:** [amitay@laser-ammo.com](mailto:amitay@laser-ammo.com)  
**Contact name:** Mr. Amitay Kligman

## 4 Test details

**Project ID:** 35478  
**Location:** Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel  
**Test started:** 01-Jan-20  
**Test completed:** 01-Jan-20  
**Test specification(s):** FCC 47 CFR PART 15 subpart C, section 15.249;  
RSS-210 issue 10 Annex 2

## 5 Tests summary

| Test                                                                      | Status       |
|---------------------------------------------------------------------------|--------------|
| <b>Transmitter characteristics</b>                                        |              |
| Section 15.249(a)(d) / RSS-210, section A2.9, Field strength of emissions | Pass         |
| Section 15.249(d) / RSS-210, section A2.9, Band edge emissions            | Pass         |
| Section 15.207(a) / RSS-Gen, section 8.8, Conducted emission              | Not required |
| Section 15.203 / RSS-Gen, section 8.3, Antenna requirement                | Pass         |
| Section 15.215(c) / RSS-Gen, section 6.6, Occupied bandwidth              | Pass         |

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.

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

|                     | Name and Title                                       | Date                  | Signature                                                                                  |
|---------------------|------------------------------------------------------|-----------------------|--------------------------------------------------------------------------------------------|
| <b>Tested by:</b>   | Mr. A. Morozov test engineer<br>EMC & Radio          | 01 Jan 20             |        |
| <b>Reviewed by:</b> | Mrs. S Peysahov Sheynin test engineer EMC<br>& Radio | 20 Mar 20 – 05 Apr 20 | <br>v |
| <b>Approved by:</b> | Mr. S. Samokha, technical manager, EMC and<br>Radio  | 13 Apr 20             |       |

## 6 EUT description

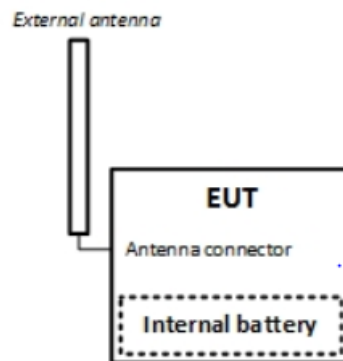
Note: The following data in this clause is provided by the customer and represents his sole responsibility

### 6.1 General information

The i-MTTS-C Controller is a battery fed device, intended to operate with Laser-Ammo product "i-MTTS". The controller is operated as an automated remote control and data collection device for i-MTTS products, using wireless communication to handle multiple drills".

Radio frequency: 2.4 GHz to 2.4835 GHz

### 6.2 Test configuration



### 6.3 Changes made in EUT

No changes were performed in the EUT.



## 6.4 Transmitter characteristics

|                                                          |                                                                                                          |                                             |                  |                                |       |  |
|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------|---------------------------------------------|------------------|--------------------------------|-------|--|
| <b>Type of equipment</b>                                 |                                                                                                          |                                             |                  |                                |       |  |
| <b>V</b>                                                 | 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)                                          |                                             |                  |                                |       |  |
| <b>Assigned frequency range</b>                          |                                                                                                          | 2400 – 2483.5 MHz                           |                  |                                |       |  |
| <b>Operating frequency range</b>                         |                                                                                                          | 2410, 2442, 2473 MHz                        |                  |                                |       |  |
| <b>RF channel spacing</b>                                |                                                                                                          | 1 MHz                                       |                  |                                |       |  |
| <b>Maximum field strength of carrier at 3 m distance</b> |                                                                                                          | 99.66 dBμV/m (peak), 61.96 dBμV/m (average) |                  |                                |       |  |
| <b>Is transmitter output power variable?</b>             |                                                                                                          | <b>V</b>                                    | No               |                                |       |  |
|                                                          |                                                                                                          |                                             | Yes              | continuous variable            |       |  |
|                                                          |                                                                                                          |                                             |                  | stepped variable with stepsize |       |  |
|                                                          |                                                                                                          |                                             |                  | dB                             |       |  |
|                                                          |                                                                                                          |                                             |                  | minimum RF power               |       |  |
|                                                          |                                                                                                          |                                             | dBm              |                                |       |  |
|                                                          |                                                                                                          |                                             | maximum RF power |                                |       |  |
|                                                          |                                                                                                          |                                             | dBm              |                                |       |  |
| <b>Antenna connection</b>                                |                                                                                                          |                                             |                  |                                |       |  |
| <b>V</b>                                                 | unique coupling                                                                                          | standard connector                          | Integral         | with temporary RF connector    |       |  |
|                                                          |                                                                                                          |                                             |                  | without temporary RF connector |       |  |
| <b>Antenna/s technical characteristics</b>               |                                                                                                          |                                             |                  |                                |       |  |
| Type                                                     | Manufacturer                                                                                             |                                             | Model number     |                                | Gain  |  |
| Rubber-duck/Whip                                         | Annxin Technologies co., LTD                                                                             |                                             | AN2400-5701SM    |                                | 2 dBi |  |
| <b>Transmitter aggregate data rate/s</b>                 |                                                                                                          | 1 Mbps                                      |                  |                                |       |  |
| <b>Type of modulation</b>                                |                                                                                                          | GFSK                                        |                  |                                |       |  |
| <b>Modulating test signal (baseband)</b>                 |                                                                                                          | PRBS                                        |                  |                                |       |  |
| <b>Transmitter power source</b>                          |                                                                                                          |                                             |                  |                                |       |  |
| <b>V</b>                                                 | Battery                                                                                                  | <b>Nominal rated voltage</b>                | Battery type     | 3 x Battery 1.5V               |       |  |
|                                                          | DC                                                                                                       | <b>Nominal rated voltage</b>                |                  |                                |       |  |
|                                                          | AC mains                                                                                                 | <b>Nominal rated voltage</b>                | Frequency        | Hz                             |       |  |



|                                                                                             |                         |                        |                |
|---------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions |                         |                        |                |
| Test procedure: ANSI C63.10 sections 6.5, 6.6                                               |                         |                        |                |
| Test mode: Compliance                                                                       |                         | Verdict: PASS          |                |
| Date(s): 01-Jan-20                                                                          |                         |                        |                |
| Temperature: 23 °C                                                                          | Relative Humidity: 47 % | Air Pressure: 1019 hPa | Power: 4.5 VDC |
| Remarks:                                                                                    |                         |                        |                |

## 7 Transmitter tests according to 47CFR part 15 subpart C and RSS-210 requirements

### 7.1 Field strength of emissions

#### 7.1.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.1.1, Table 7.1.2 and Table 7.1.3.

**Table 7.1.1 Radiated fundamental emission limits**

| Fundamental frequency, MHz | Field strength at 3 m, dB(μV/m) |         |            |
|----------------------------|---------------------------------|---------|------------|
|                            | Peak                            | Average | Quasi-Peak |
| 2400 – 2483.5              | 114.0                           | 94.0    | NA         |

**Table 7.1.2 Harmonics limits**

| Fundamental frequency, MHz | Field strength at 3 m, dB(μV/m) |         |
|----------------------------|---------------------------------|---------|
|                            | Peak                            | Average |
| 2400 – 2483.5              | 74.0                            | 54.0    |

**Table 7.1.3 Radiated spurious emissions limits (other than harmonics)**

| Frequency, MHz | Field strength at 3 m, dB(μV/m)* |                 |                 |                                          |
|----------------|----------------------------------|-----------------|-----------------|------------------------------------------|
|                | Peak                             | Quasi Peak      | Average         | Attenuation below carrier                |
| 0.009 – 0.090  | 148.5 – 128.5                    | NA              | 128.5 – 108.5** | 50 dBc (whichever is the less stringent) |
| 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            |                 |                                          |
| Above 1000     | 74.0                             | NA              | 54.0            |                                          |

\*- 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  $S_1$  and  $S_2$  – standard defined and test distance respectively in meters.

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

Note: 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 but not exceeding 40 GHz for intentional radiators operated below 10 GHz and up to the fifth harmonic of the highest fundamental frequency but not exceeding 100 GHz for intentional radiators operated above 10 GHz.



|                                                                                             |                         |                        |                |
|---------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions |                         |                        |                |
| Test procedure: ANSI C63.10 sections 6.5, 6.6                                               |                         |                        |                |
| Test mode: Compliance                                                                       |                         | Verdict: PASS          |                |
| Date(s): 01-Jan-20                                                                          |                         |                        |                |
| Temperature: 23 °C                                                                          | Relative Humidity: 47 % | Air Pressure: 1019 hPa | Power: 4.5 VDC |
| Remarks:                                                                                    |                         |                        |                |

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

7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and the performance check was conducted.

7.1.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated around its vertical axis.

7.1.2.3 The worst test results (the lowest margins), recorded in the associated tables and shown in the associated plots.

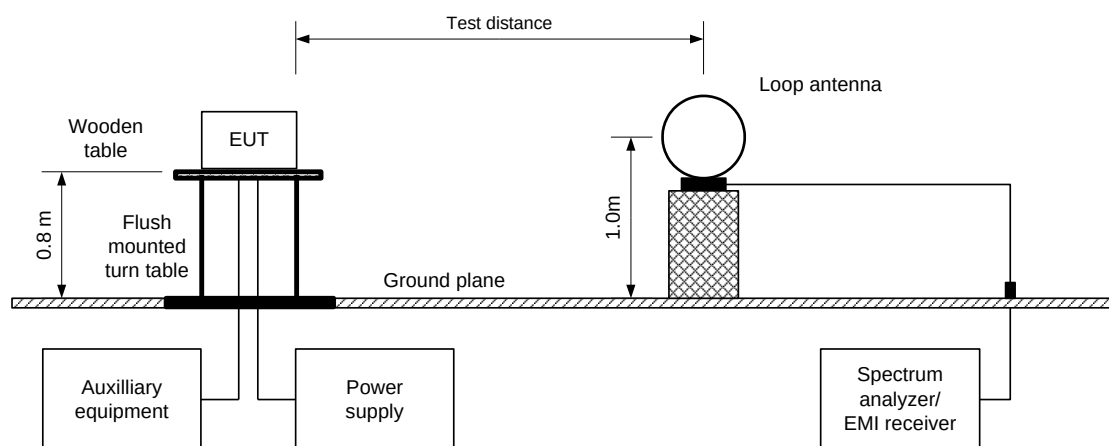
### 7.1.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.1.3.1 The EUT was set up as shown in Figure 7.1.2, Figure 7.1.3, energized and the performance check was conducted.

7.1.3.2 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.

7.1.3.3 The worst test results (the lowest margins), were recorded in the associated tables and shown in the associated plots

**Figure 7.1.1 Setup for spurious emission field strength measurements below 30 MHz**



|                                                                                             |                         |                        |                |
|---------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions |                         |                        |                |
| Test procedure: ANSI C63.10 sections 6.5, 6.6                                               |                         |                        |                |
| Test mode: Compliance                                                                       |                         | Verdict: PASS          |                |
| Date(s): 01-Jan-20                                                                          |                         |                        |                |
| Temperature: 23 °C                                                                          | Relative Humidity: 47 % | Air Pressure: 1019 hPa | Power: 4.5 VDC |
| Remarks:                                                                                    |                         |                        |                |

Figure 7.1.2 Setup for spurious emission field strength measurements in 30 -1000 MHz

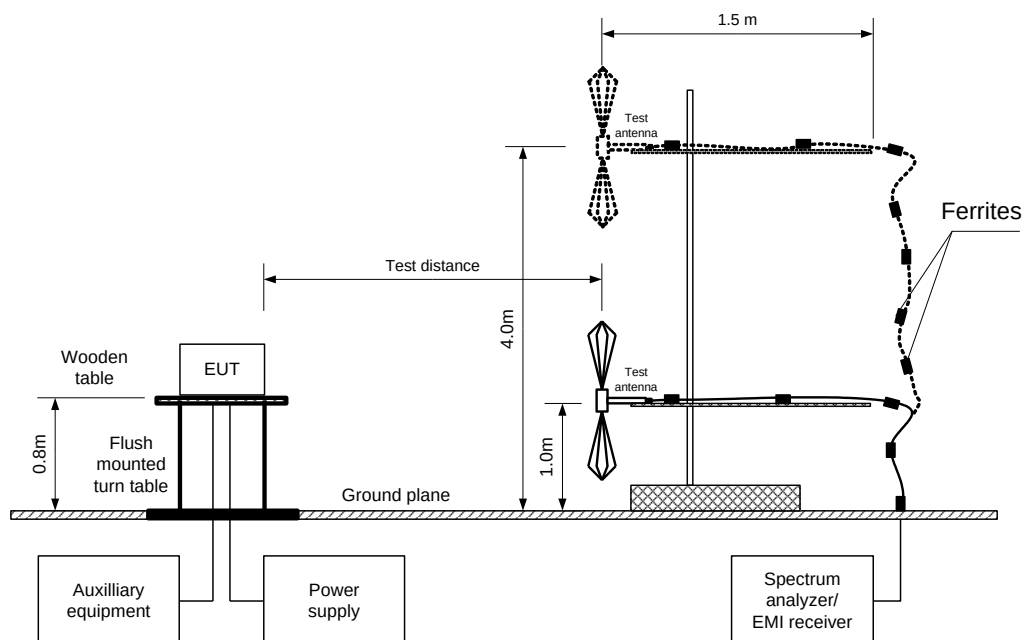
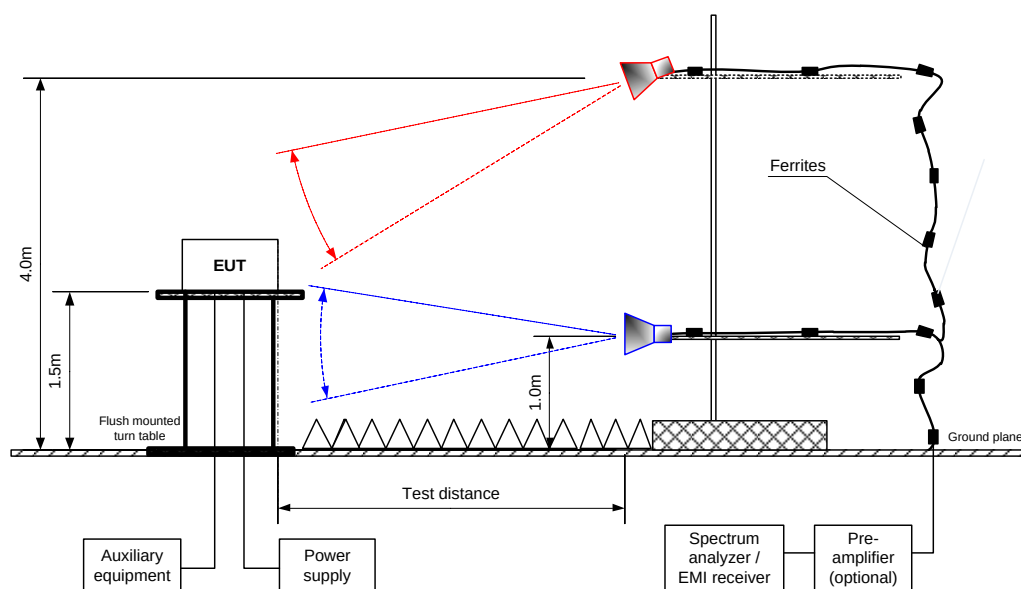


Figure 7.1.3 Setup for spurious emission field strength measurements above 1000 MHz





|                                                                                             |                         |                        |                |
|---------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions |                         |                        |                |
| Test procedure: ANSI C63.10 sections 6.5, 6.6                                               |                         |                        |                |
| Test mode: Compliance                                                                       |                         | Verdict: PASS          |                |
| Date(s): 01-Jan-20                                                                          |                         |                        |                |
| Temperature: 23 °C                                                                          | Relative Humidity: 47 % | Air Pressure: 1019 hPa | Power: 4.5 VDC |
| Remarks:                                                                                    |                         |                        |                |

Table 7.1.4 Field strength of fundamental emission and spurious emissions

|                                    |                                                                                                                    |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| TEST DISTANCE:                     | 3 m                                                                                                                |
| MODULATION:                        | GFSK                                                                                                               |
| TRANSMITTER OUTPUT POWER SETTINGS: | Maximum                                                                                                            |
| INVESTIGATED FREQUENCY RANGE:      | 0.009 – 25000 MHz                                                                                                  |
| DETECTOR USED:                     | Peak                                                                                                               |
| RESOLUTION BANDWIDTH:              | 1.0 kHz (9 kHz – 150 kHz)<br>9.0 kHz (150 kHz – 30 MHz)<br>120 kHz (30 MHz – 1000 MHz)<br>1.0 MHz (above 1000 MHz) |
| VIDEO BANDWIDTH:                   | ≥ Resolution bandwidth                                                                                             |
| TEST ANTENNA TYPE:                 | Active loop (9 kHz – 30 MHz)<br>Biconilog (30 MHz – 1000 MHz)<br>Double ridged guide (above 1000 MHz)              |

INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz

| INVESTIGATED FREQUENCY RANGE: |         |              |                      | 0.005 - 1000 MHz              |                                   |                    |                 |         |
|-------------------------------|---------|--------------|----------------------|-------------------------------|-----------------------------------|--------------------|-----------------|---------|
| Frequency,<br>MHz             | Antenna |              | Azimuth,<br>degrees* | Peak<br>emission,<br>dB(μV/m) | Quasi-peak                        |                    |                 | Verdict |
|                               | Pol.    | Height,<br>m |                      |                               | Measured<br>emission,<br>dB(μV/m) | Limit,<br>dB(μV/m) | Margin,<br>dB** |         |
| No emissions were found       |         |              |                      |                               |                                   |                    |                 | Pass    |

INVESTIGATED FREQUENCY RANGE: 1000 - 25000 MHz

| F, MHz                                       | Antenna |           | Azimuth, degrees* | Peak field strength |                 |              | Avr factor, dB | Average field strength |                 |              | Verdict |
|----------------------------------------------|---------|-----------|-------------------|---------------------|-----------------|--------------|----------------|------------------------|-----------------|--------------|---------|
|                                              | Pol.    | Height, m |                   | Measured, dB(μV/m)  | Limit, dB(μV/m) | Margin, dB** |                | Measured, dB(μV/m)     | Limit, dB(μV/m) | Margin, dB** |         |
| Fundamental emission***                      |         |           |                   |                     |                 |              |                |                        |                 |              |         |
| 2410.0                                       | Ver     | 1.38      | 85                | 99.66               | 114.0           | -14.34       | 32.1           | 67.56                  | 94.0            | -26.44       | Pass    |
| 2442.0                                       | Ver     | 1.51      | 75                | 96.77               | 114.0           | -17.23       | 32.1           | 64.67                  | 94.0            | -29.33       | Pass    |
| 2473.0                                       | Ver     | 1.35      | 80                | 97.28               | 114.0           | -16.72       | 32.1           | 65.18                  | 94.0            | -28.82       | Pass    |
| Spurious emissions at low carrier frequency  |         |           |                   |                     |                 |              |                |                        |                 |              |         |
| 1205.067                                     | Hor     | 1.54      | 360               | 37.88               | 74.0            | -36.12       | NA             | 18.75                  | 54.0            | -35.25       | Pass    |
| 4819.833                                     | Hor     | 1.53      | 26                | 53.24               | 74.0            | -20.76       | 32.1           | 21.14                  | 54.0            | -32.86       |         |
| Spurious emissions at mid carrier frequency  |         |           |                   |                     |                 |              |                |                        |                 |              |         |
| 1221.000                                     | Ver     | 2.59      | 112               | 40.99               | 74.0            | -33.01       | NA             | 19.55                  | 54.0            | -34.45       | Pass    |
| 7326.067                                     | Vert    | 1.28      | 87                | 60.56               | 74.0            | -13.44       | 32.1           | 28.46                  | 54.0            | -25.54       |         |
| Spurious emissions at high carrier frequency |         |           |                   |                     |                 |              |                |                        |                 |              |         |
| 7418.700                                     | Ver     | 1.00      | 90                | 59.40               | 74.0            | -14.60       | 32.1           | 27.30                  | 54.0            | -26.70       | Pass    |

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

\*\*- Margin, dB = Measured (calculated) value, dB(μV/m) - Limit, dB(μV/m).

Table 7.1.5 Average factor calculation

| Transmission pulse |                                            | Transmission burst |            | Transmission train duration, ms | Average factor, dB |
|--------------------|--------------------------------------------|--------------------|------------|---------------------------------|--------------------|
| Duration, ms       | Number of transmission pulse within 100 ms | Duration, ms       | Period, ms |                                 |                    |
| 0.118              | 21                                         | NA                 | NA         | 100                             | -32.1              |

\*- Average factor was calculated as follows:  $20\log((\text{Transmission pulse duration} \times \text{Number of transmission pulse within 100 ms}) / 100 \text{ ms})$ 

Reference numbers of test equipment used

|         |         |         |         |        |         |         |         |
|---------|---------|---------|---------|--------|---------|---------|---------|
| HL 0446 | HL 3903 | HL 4355 | HL 4933 | HL4956 | HL 5288 | HL 5372 | HL 5665 |
|---------|---------|---------|---------|--------|---------|---------|---------|

Full description is given in Appendix A.



HERMON LABORATORIES

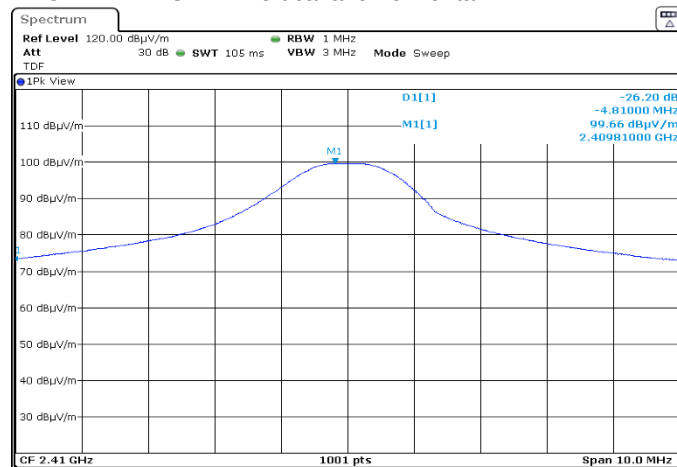
Report ID: LASRAD\_FCC.35478

Date of Issue: 13-Apr-20

|                                                                                             |                         |                        |                |
|---------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions |                         |                        |                |
| Test procedure: ANSI C63.10 sections 6.5, 6.6                                               |                         |                        |                |
| Test mode: Compliance                                                                       |                         | Verdict: PASS          |                |
| Date(s): 01-Jan-20                                                                          |                         |                        |                |
| Temperature: 23 °C                                                                          | Relative Humidity: 47 % | Air Pressure: 1019 hPa | Power: 4.5 VDC |
| Remarks:                                                                                    |                         |                        |                |

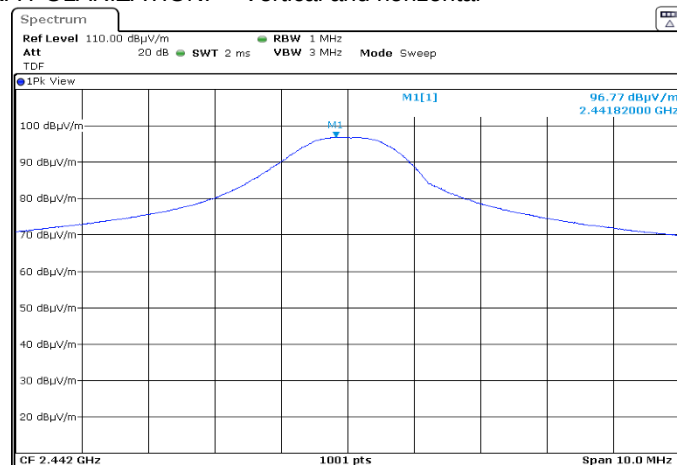
**Plot 7.1.1 Radiated emission measurements at the low fundamental frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and horizontal



**Plot 7.1.2 Radiated emission measurements at the mid fundamental frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and horizontal





HERMON LABORATORIES

Report ID: LASRAD\_FCC.35478

Date of Issue: 13-Apr-20

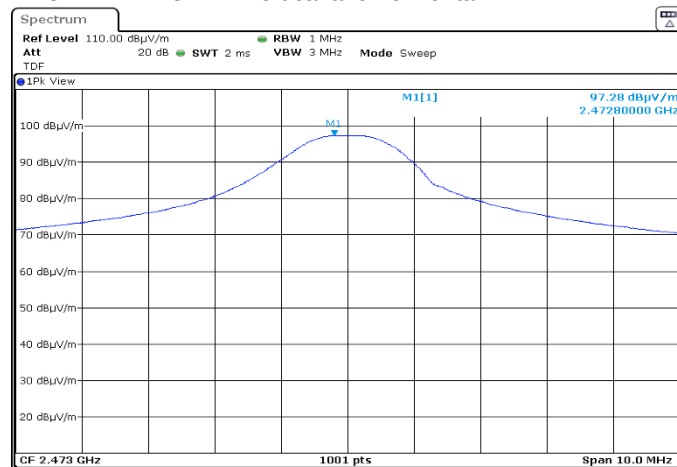
|                                                                                             |                         |                        |                |
|---------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions |                         |                        |                |
| Test procedure: ANSI C63.10 sections 6.5, 6.6                                               |                         |                        |                |
| Test mode: Compliance                                                                       |                         | Verdict: PASS          |                |
| Date(s): 01-Jan-20                                                                          |                         |                        |                |
| Temperature: 23 °C                                                                          | Relative Humidity: 47 % | Air Pressure: 1019 hPa | Power: 4.5 VDC |
| Remarks:                                                                                    |                         |                        |                |

**Plot 7.1.3 Radiated emission measurements at the high fundamental frequency**

TEST SITE: Semi anechoic chamber

TEST DISTANCE: 3 m

ANTENNA POLARIZATION: Vertical and horizontal

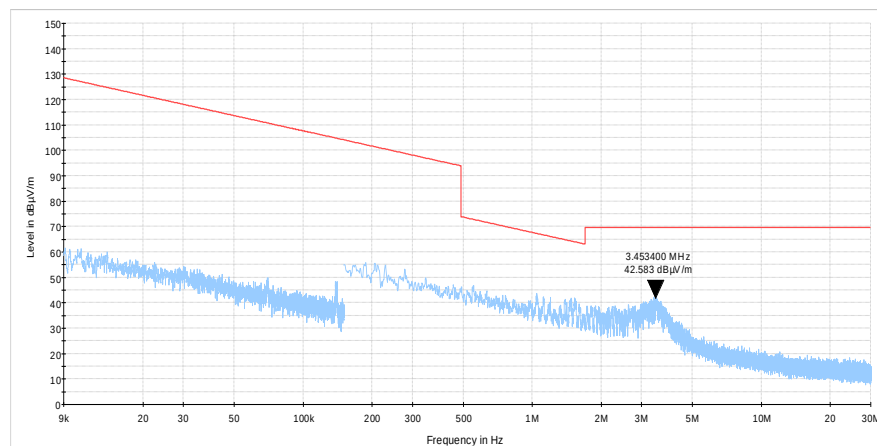




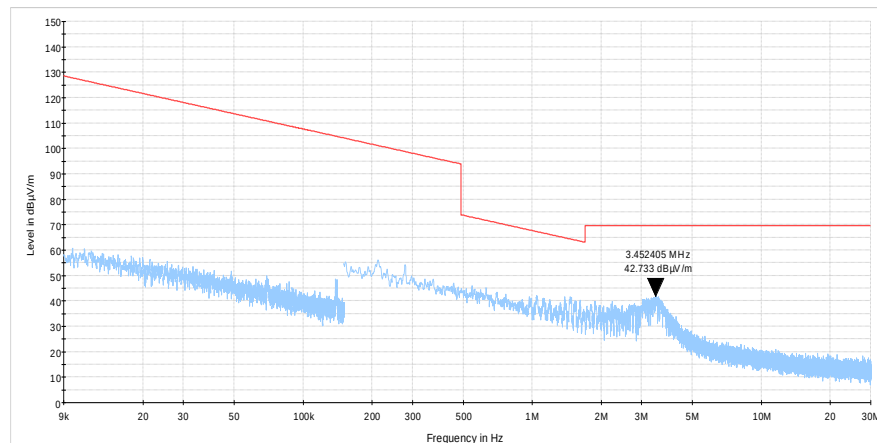
|                                                                                                    |                                |                               |                       |
|----------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10 sections 6.5, 6.6                                               |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                       |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 01-Jan-20                                                                          |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                          | <b>Relative Humidity:</b> 47 % | <b>Air Pressure:</b> 1019 hPa | <b>Power:</b> 4.5 VDC |
| <b>Remarks:</b>                                                                                    |                                |                               |                       |

**Plot 7.1.4 Radiated emission measurements from 9 kHz to 30 MHz at low frequency**

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

**Plot 7.1.5 Radiated emission measurements from 9 kHz to 30 MHz at mid frequency**

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





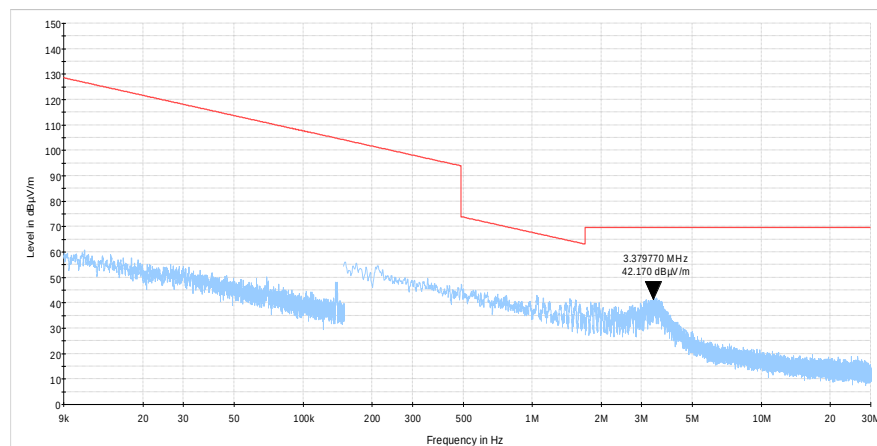
|                                                                                                    |                                |                               |                       |
|----------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10 sections 6.5, 6.6                                               |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                       |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 01-Jan-20                                                                          |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                          | <b>Relative Humidity:</b> 47 % | <b>Air Pressure:</b> 1019 hPa | <b>Power:</b> 4.5 VDC |
| <b>Remarks:</b>                                                                                    |                                |                               |                       |

**Plot 7.1.6 Radiated emission measurements from 9 kHz to 30 MHz at high frequency**

TEST SITE: Semi anechoic chamber

TEST DISTANCE: 3 m

ANTENNA POLARIZATION: Vertical

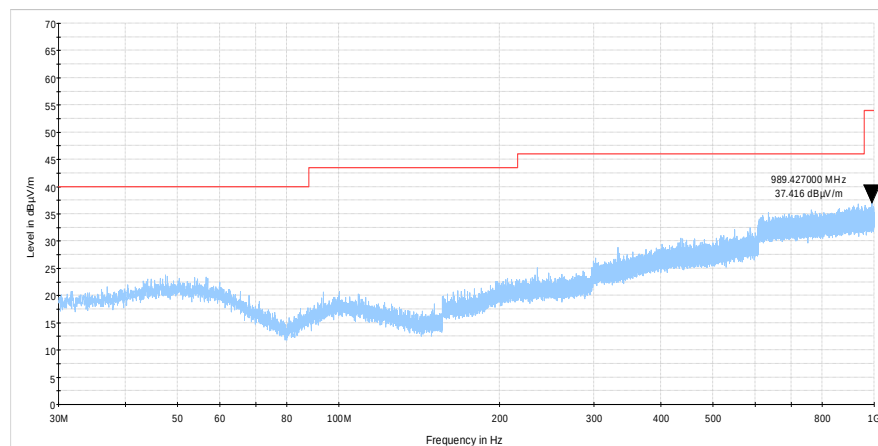




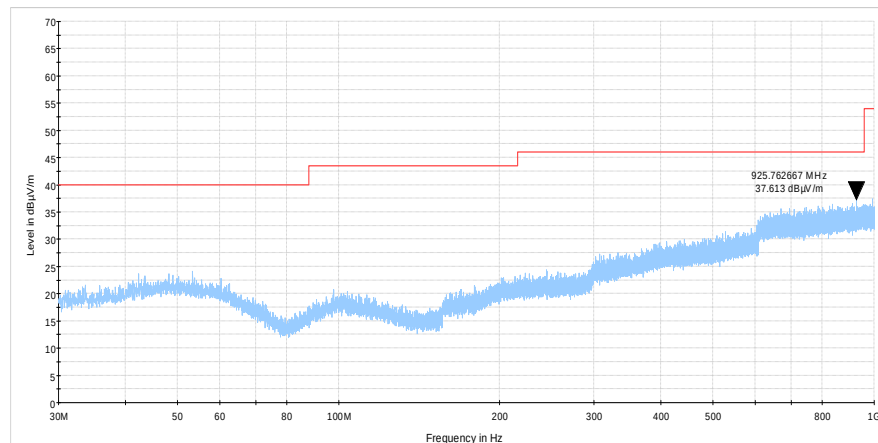
|                                                                                                    |                                |                               |                       |
|----------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10 sections 6.5, 6.6                                               |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                       |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 01-Jan-20                                                                          |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                          | <b>Relative Humidity:</b> 47 % | <b>Air Pressure:</b> 1019 hPa | <b>Power:</b> 4.5 VDC |
| <b>Remarks:</b>                                                                                    |                                |                               |                       |

**Plot 7.1.7 Radiated emission measurements from 30 to 1000 MHz at low frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal

**Plot 7.1.8 Radiated emission measurements from 30 to 1000 MHz at mid frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal





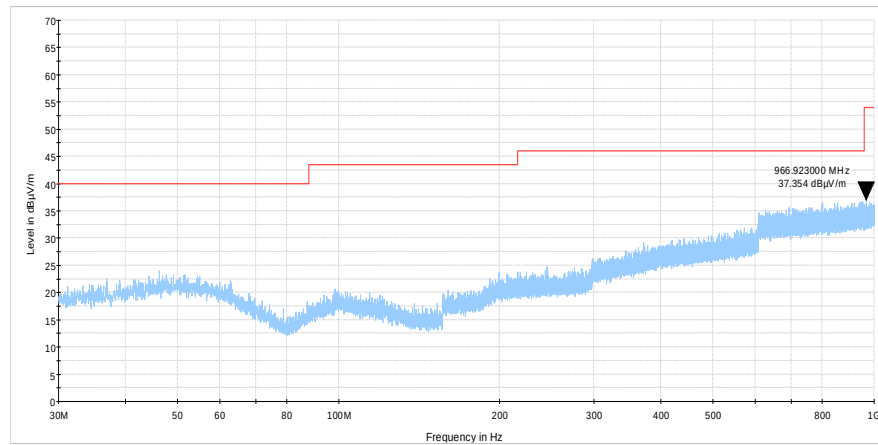
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|                     |                         |                                                                         |                |
|---------------------|-------------------------|-------------------------------------------------------------------------|----------------|
| Test specification: |                         | Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions |                |
| Test procedure:     |                         | ANSI C63.10 sections 6.5, 6.6                                           |                |
| Test mode:          |                         | Verdict: PASS                                                           |                |
| Date(s):            |                         |                                                                         |                |
| 01-Jan-20           |                         |                                                                         |                |
| Temperature: 23 °C  | Relative Humidity: 47 % | Air Pressure: 1019 hPa                                                  | Power: 4.5 VDC |
| Remarks:            |                         |                                                                         |                |

**Plot 7.1.9 Radiated emission measurements from 30 to 1000 MHz at high frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal

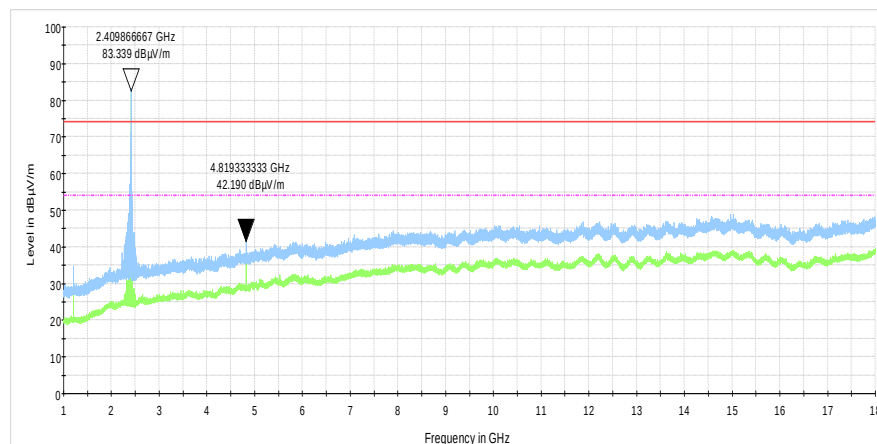




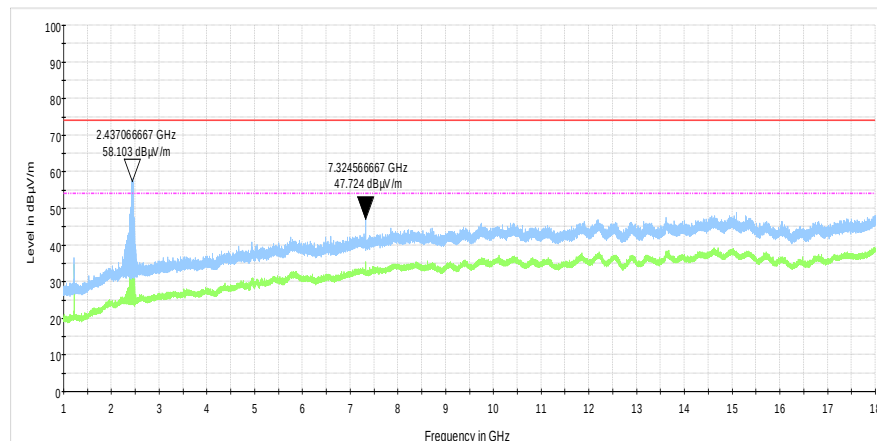
|                                                                                                    |                                |                               |                       |
|----------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10 sections 6.5, 6.6                                               |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                       |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 01-Jan-20                                                                          |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                          | <b>Relative Humidity:</b> 47 % | <b>Air Pressure:</b> 1019 hPa | <b>Power:</b> 4.5 VDC |
| <b>Remarks:</b>                                                                                    |                                |                               |                       |

**Plot 7.1.10 Radiated emission measurements from 1.0 to 18.0 GHz at low frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal

**Plot 7.1.11 Radiated emission measurements from 1.0 to 18.0 GHz at mid frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal

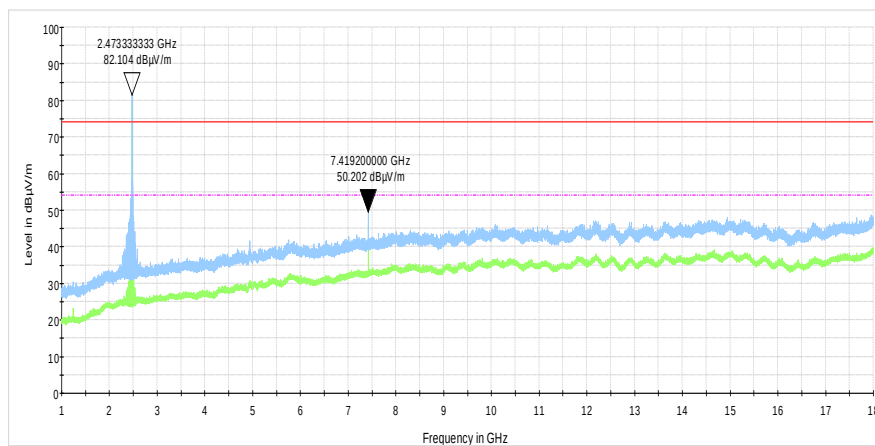




|                                                                                                    |                                |                               |                       |
|----------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10 sections 6.5, 6.6                                               |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                       |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 01-Jan-20                                                                          |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                          | <b>Relative Humidity:</b> 47 % | <b>Air Pressure:</b> 1019 hPa | <b>Power:</b> 4.5 VDC |
| <b>Remarks:</b>                                                                                    |                                |                               |                       |

**Plot 7.1.12 Radiated emission measurements from 1.0 to 18.0 GHz at high frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal

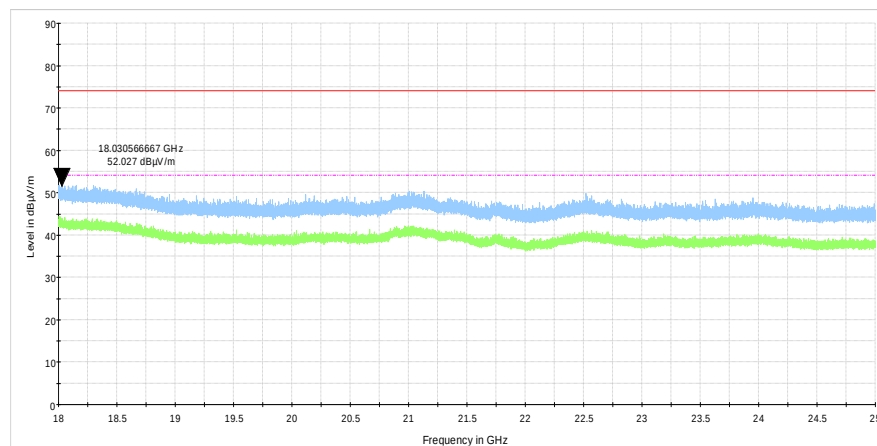




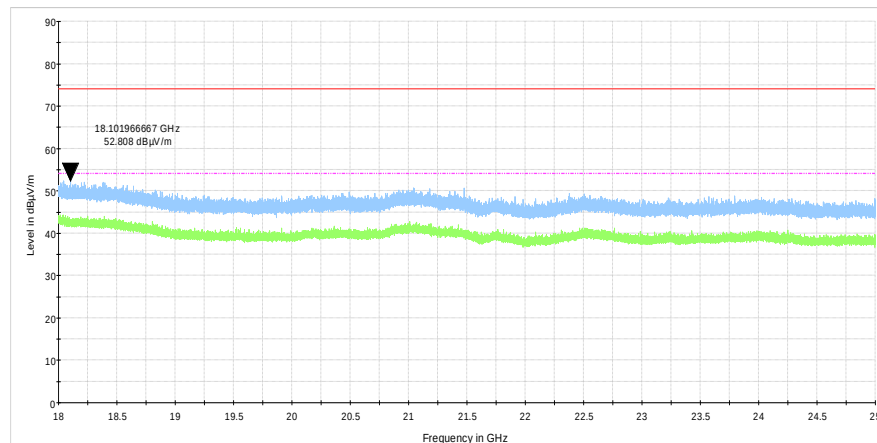
|                                                                                                    |                                |                               |                       |
|----------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10 sections 6.5, 6.6                                               |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                       |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 01-Jan-20                                                                          |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                          | <b>Relative Humidity:</b> 47 % | <b>Air Pressure:</b> 1019 hPa | <b>Power:</b> 4.5 VDC |
| <b>Remarks:</b>                                                                                    |                                |                               |                       |

**Plot 7.1.13 Radiated emission measurements from 18.0 – 25.0 GHz at low frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal

**Plot 7.1.14 Radiated emission measurements from 18.0 – 25.0 GHz at mid frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal

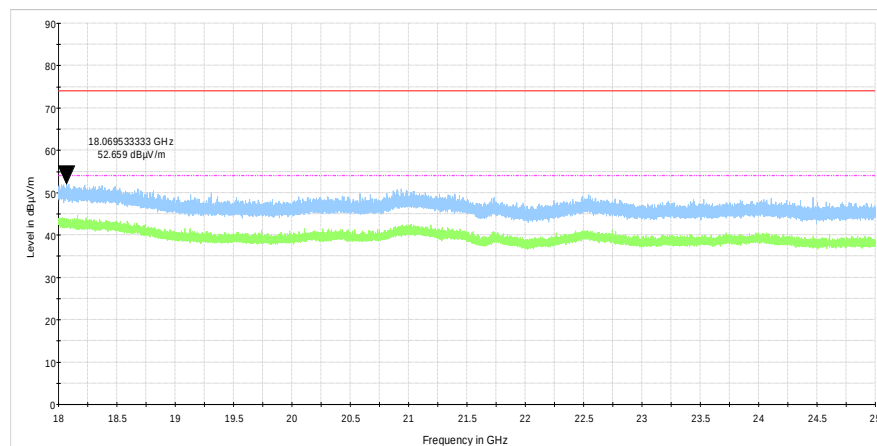




|                                                                                                    |                                |                               |                       |
|----------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10 sections 6.5, 6.6                                               |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                       |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 01-Jan-20                                                                          |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                          | <b>Relative Humidity:</b> 47 % | <b>Air Pressure:</b> 1019 hPa | <b>Power:</b> 4.5 VDC |
| <b>Remarks:</b>                                                                                    |                                |                               |                       |

**Plot 7.1.15 Radiated emission measurements from 18.0 – 25.0 GHz at high frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal





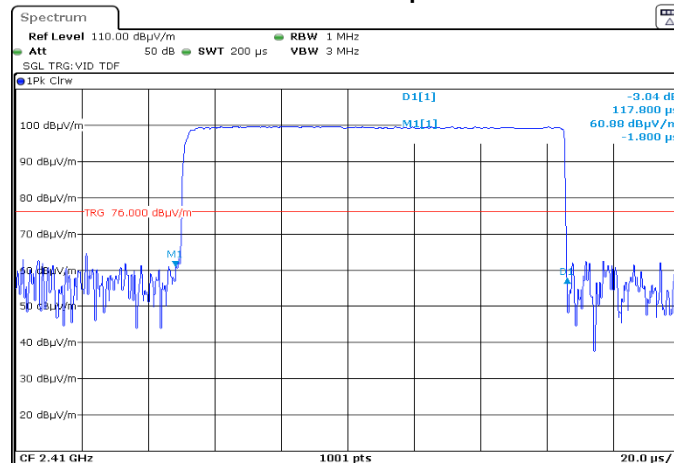
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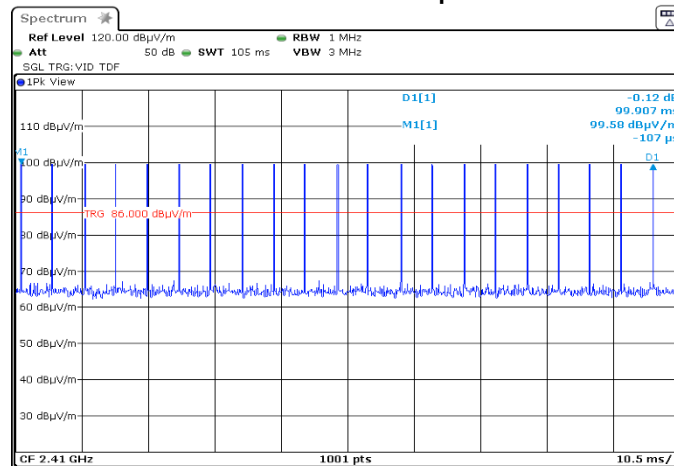
Date of Issue: 13-Apr-20

|                                                                                             |                         |                        |                |
|---------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions |                         |                        |                |
| Test procedure: ANSI C63.10 sections 6.5, 6.6                                               |                         |                        |                |
| Test mode: Compliance                                                                       |                         | Verdict: PASS          |                |
| Date(s): 01-Jan-20                                                                          |                         |                        |                |
| Temperature: 23 °C                                                                          | Relative Humidity: 47 % | Air Pressure: 1019 hPa | Power: 4.5 VDC |
| Remarks:                                                                                    |                         |                        |                |

Plot 7.1.16 Transmission pulse duration



Plot 7.1.17 Number of transmission pulse within 100 ms





|                                                                                        |                                |                               |                       |
|----------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.215(c)/ RSS-Gen, section 6.6, Occupied bandwidth |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10 section 6.9.2                                       |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                           |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 01-Jan-20                                                              |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                              | <b>Relative Humidity:</b> 47 % | <b>Air Pressure:</b> 1019 hPa | <b>Power:</b> 4.5 VDC |
| <b>Remarks:</b>                                                                        |                                |                               |                       |

## 7.2 Occupied bandwidth test

### 7.2.1 General

This test was performed to verify that the 20 dB bandwidth of the emissions was contained within the standard specified frequency band according to FCC §15.215 requirements. Specification test limits are given in Table 7.2.1.

**Table 7.2.1 Occupied bandwidth limits**

| Assigned frequency, MHz | Modulation envelope reference points*, dBc |
|-------------------------|--------------------------------------------|
| 902 - 928               | 20.0                                       |
| <b>2400 – 2483.5</b>    |                                            |
| 5725 – 5875             |                                            |
| 24000 – 24250           |                                            |

\*- Modulation envelope reference points provided in terms of attenuation below modulated carrier.

**Table 7.2.2 Occupied bandwidth limits RSS-210**

| Assigned frequency, MHz | Modulation envelope reference points*, % |
|-------------------------|------------------------------------------|
| 902 - 928               | 99                                       |
| <b>2400 – 2483.5</b>    |                                          |
| 5725 – 5875             |                                          |
| 24000 – 24250           |                                          |

\*- Modulation envelope reference points provided in terms of attenuation below modulated carrier.

### 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 spectrum analyzer sweep time and bandwidth were set to capture all major modulation sidebands of emission and sweep time was set sufficiently slow to ensure peak measurements. Spectrum analyzer was set in peak hold mode and time sufficient for trace stabilization was allowed.

**7.2.2.3** The peak of emission was measured. The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.2.3 and associated plot.

**Figure 7.2.1 Occupied bandwidth test setup**





|                                                                                 |                         |                        |                |
|---------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.215(c)/ RSS-Gen, section 6.6, Occupied bandwidth |                         |                        |                |
| Test procedure: ANSI C63.10 section 6.9.2                                       |                         |                        |                |
| Test mode: Compliance                                                           |                         | Verdict: PASS          |                |
| Date(s): 01-Jan-20                                                              |                         |                        |                |
| Temperature: 23 °C                                                              | Relative Humidity: 47 % | Air Pressure: 1019 hPa | Power: 4.5 VDC |
| Remarks:                                                                        |                         |                        |                |

Table 7.2.3 Occupied bandwidth test results

ASSIGNED FREQUENCY BAND 2400.0 – 2483.5 MHz  
 DETECTOR USED: Peak hold  
 RESOLUTION BANDWIDTH: 30 kHz  
 VIDEO BANDWIDTH: 100 kHz  
 MODULATION: GFSK

| Carrier frequency, MHz | 99% Occupied bandwidth, kHz | 20 dBc OBW, kHz | Verdict |
|------------------------|-----------------------------|-----------------|---------|
| 2410.0                 | 875.1                       | 795.2           | Pass    |
| 2442.0                 | 891.1                       | 807.2           | Pass    |
| 2473.0                 | 899.1                       | 807.2           | Pass    |

## Reference numbers of test equipment used

|         |         |         |         |  |  |  |  |  |
|---------|---------|---------|---------|--|--|--|--|--|
| HL 3903 | HL 4355 | HL 4933 | HL 5665 |  |  |  |  |  |
|---------|---------|---------|---------|--|--|--|--|--|

Full description is given in Appendix A.



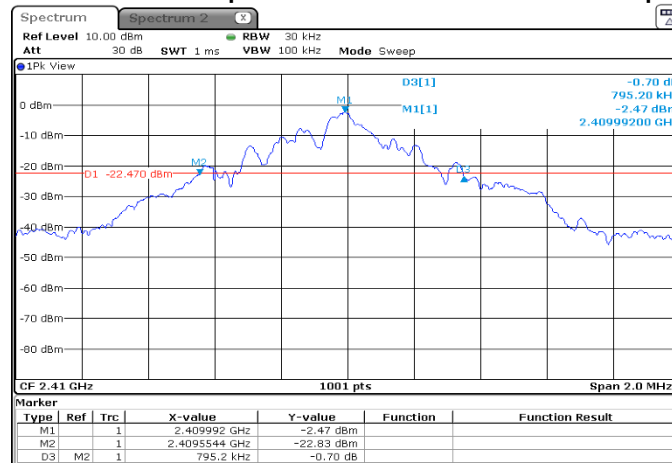
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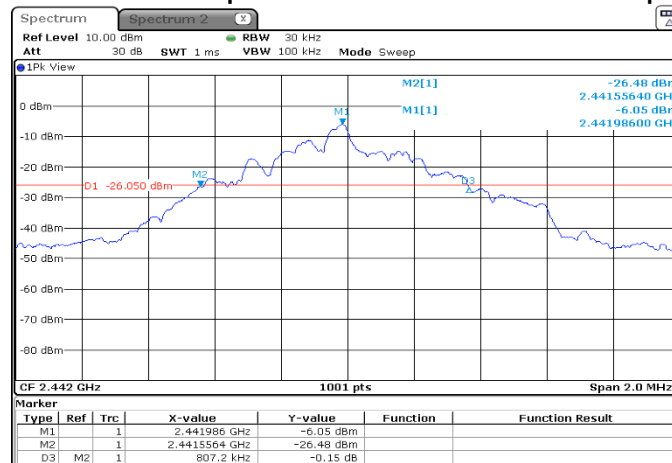
Date of Issue: 13-Apr-20

|                                                                                 |                         |                        |                |
|---------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.215(c)/ RSS-Gen, section 6.6, Occupied bandwidth |                         |                        |                |
| Test procedure: ANSI C63.10 section 6.9.2                                       |                         |                        |                |
| Test mode: Compliance                                                           |                         | Verdict: PASS          |                |
| Date(s): 01-Jan-20                                                              |                         |                        |                |
| Temperature: 23 °C                                                              | Relative Humidity: 47 % | Air Pressure: 1019 hPa | Power: 4.5 VDC |
| Remarks:                                                                        |                         |                        |                |

Plot 7.2.1 20 dBc occupied bandwidth test result at low frequency



Plot 7.2.2 20 dBc occupied bandwidth test result at mid frequency





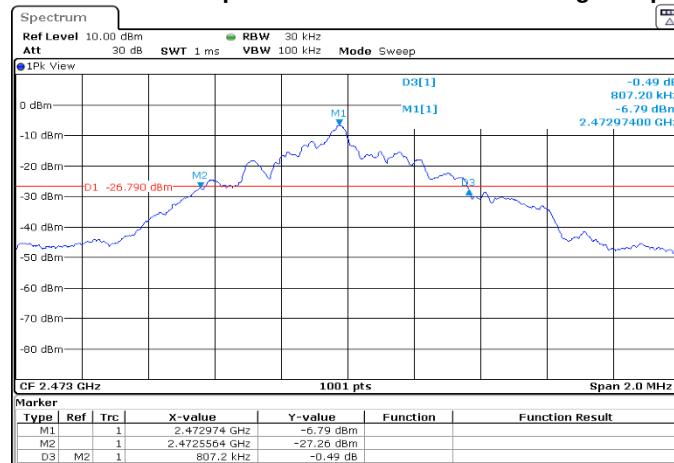
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Report ID: LASRAD\_FCC.35478

Date of Issue: 13-Apr-20

|                                                                                 |                         |                        |                |
|---------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.215(c)/ RSS-Gen, section 6.6, Occupied bandwidth |                         |                        |                |
| Test procedure: ANSI C63.10 section 6.9.2                                       |                         |                        |                |
| Test mode: Compliance                                                           |                         | Verdict: PASS          |                |
| Date(s): 01-Jan-20                                                              |                         |                        |                |
| Temperature: 23 °C                                                              | Relative Humidity: 47 % | Air Pressure: 1019 hPa | Power: 4.5 VDC |
| Remarks:                                                                        |                         |                        |                |

Plot 7.2.3 20 dBc occupied bandwidth test result at high frequency





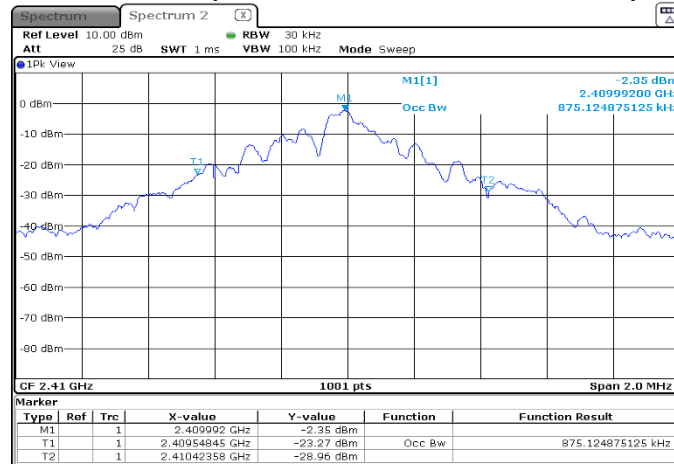
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Report ID: LASRAD\_FCC.35478

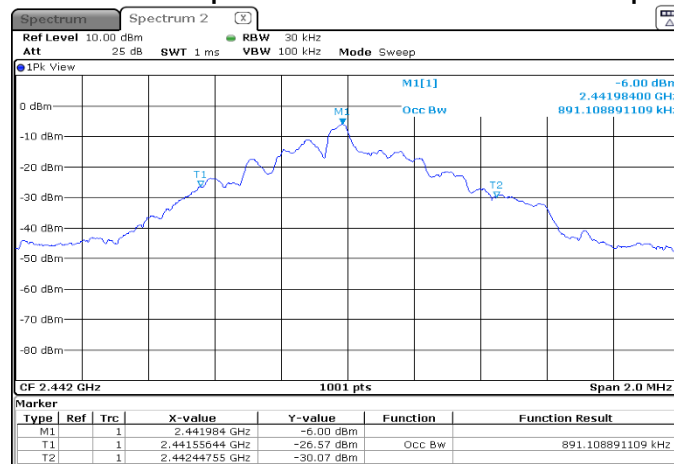
Date of Issue: 13-Apr-20

|                                                                                 |                         |                        |                |
|---------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.215(c)/ RSS-Gen, section 6.6, Occupied bandwidth |                         |                        |                |
| Test procedure: ANSI C63.10 section 6.9.2                                       |                         |                        |                |
| Test mode: Compliance                                                           |                         | Verdict: PASS          |                |
| Date(s): 01-Jan-20                                                              |                         |                        |                |
| Temperature: 23 °C                                                              | Relative Humidity: 47 % | Air Pressure: 1019 hPa | Power: 4.5 VDC |
| Remarks:                                                                        |                         |                        |                |

Plot 7.2.4 99% occupied bandwidth test result at low frequency



Plot 7.2.5 99% occupied bandwidth test result at mid frequency



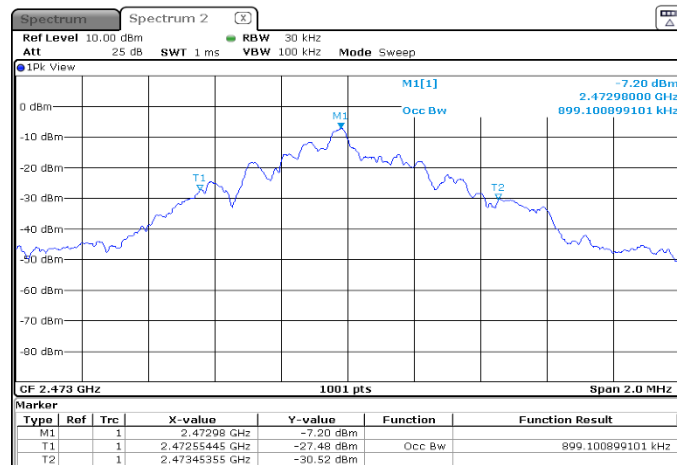


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Report ID: LASRAD\_FCC.35478  
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|                                                                                 |                         |                        |                |
|---------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.215(c)/ RSS-Gen, section 6.6, Occupied bandwidth |                         |                        |                |
| Test procedure: ANSI C63.10 section 6.9.2                                       |                         |                        |                |
| Test mode: Compliance                                                           |                         | Verdict: PASS          |                |
| Date(s): 01-Jan-20                                                              |                         |                        |                |
| Temperature: 23 °C                                                              | Relative Humidity: 47 % | Air Pressure: 1019 hPa | Power: 4.5 VDC |
| Remarks:                                                                        |                         |                        |                |

Plot 7.2.6 99% occupied bandwidth test result at high frequency





|                                                                                         |                                |                               |                       |
|-----------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.249(d)/RSS-210, section A2.9, Band edge emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10 section 6.10                                         |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                            |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 01-Jan-20                                                               |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                               | <b>Relative Humidity:</b> 47 % | <b>Air Pressure:</b> 1019 hPa | <b>Power:</b> 4.5 VDC |
| <b>Remarks:</b>                                                                         |                                |                               |                       |

## 7.3 Band edge emission

### 7.3.1 General

This test was performed to verify the EUT band edge emission including all associated side bands was attenuated at least 50 dB below the unmodulated carrier level or below the general spurious emission limit. Specification test limits are given in Table 7.3.1.

**Table 7.3.1 Band edge emission limits**

| Frequency band,<br>MHz | Field strength limit at 3 m, dBμV/m |         | Attenuation below carrier,<br>dBc |
|------------------------|-------------------------------------|---------|-----------------------------------|
|                        | Peak                                | Average |                                   |
| 2400.0 – 2483.5        | 74.0                                | 54.0    | 50                                |

### 7.3.2 Test procedure

**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 spectrum analyzer frequency span was set to capture all major modulation sidebands of emission and sweep time was set sufficiently slow to ensure peak measurements. Spectrum analyzer was set in peak hold mode and time sufficient for trace stabilization was allowed.

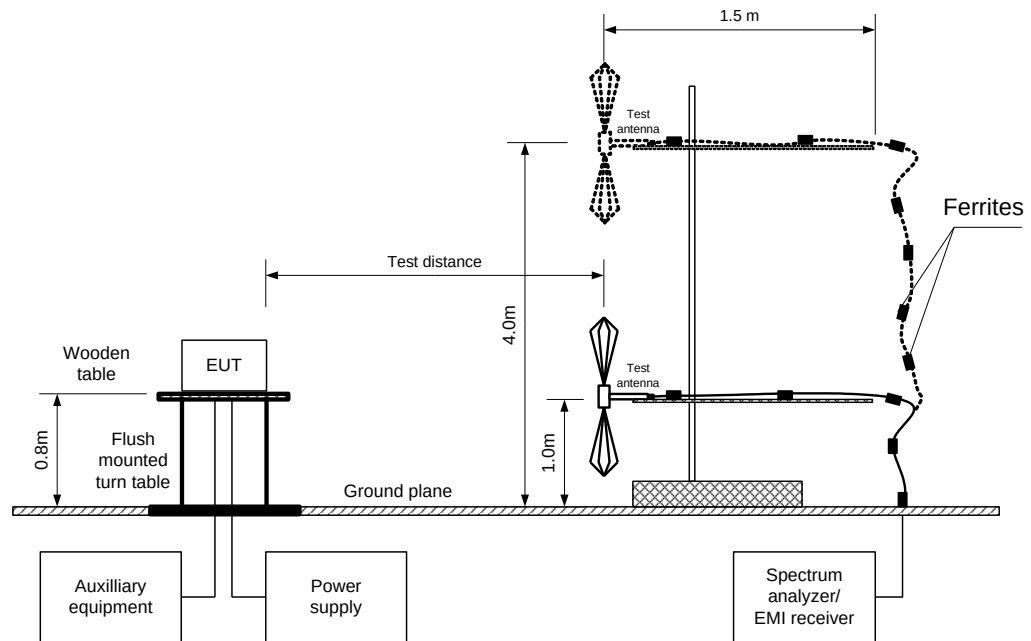
**7.3.2.3** The frequency of modulation envelope points beyond which power level drops below the band edge emission limit was measured.

**7.3.2.4** The test results were recorded in Table 7.3.2 and shown in the associated plots.



|                                                                                  |                         |                        |                |
|----------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.249(d)/RSS-210, section A2.9, Band edge emissions |                         |                        |                |
| Test procedure: ANSI C63.10 section 6.10                                         |                         |                        |                |
| Test mode: Compliance                                                            |                         | Verdict: PASS          |                |
| Date(s): 01-Jan-20                                                               |                         |                        |                |
| Temperature: 23 °C                                                               | Relative Humidity: 47 % | Air Pressure: 1019 hPa | Power: 4.5 VDC |
| Remarks:                                                                         |                         |                        |                |

Figure 7.3.1 Band edge emission measurement set up





|                                                                                  |                         |                        |                |
|----------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.249(d)/RSS-210, section A2.9, Band edge emissions |                         |                        |                |
| Test procedure: ANSI C63.10 section 6.10                                         |                         |                        |                |
| Test mode: Compliance                                                            |                         | Verdict: PASS          |                |
| Date(s): 01-Jan-20                                                               |                         |                        |                |
| Temperature: 23 °C                                                               | Relative Humidity: 47 % | Air Pressure: 1019 hPa | Power: 4.5 VDC |
| Remarks:                                                                         |                         |                        |                |

Table 7.3.2 Band edge emission test results

OPERATING FREQUENCY RANGE: 2400.0 – 2483.5 MHz  
 DETECTOR USED: Peak hold  
 RESOLUTION BANDWIDTH: 1 MHz  
 VIDEO BANDWIDTH: 3 MHz  
 MODULATION: FSK  
 MODULATING SIGNAL: PRBS  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

| Modulation envelope |                | Peak field strength |                 |             | Average field strength |                        |                 |             | Verdict |
|---------------------|----------------|---------------------|-----------------|-------------|------------------------|------------------------|-----------------|-------------|---------|
| Edge                | Frequency, MHz | Measured, dB(μV/m)  | Limit, dB(μV/m) | Margin, dB* | Measured, dB(μV/m)     | Calculated, dB(μV/m)** | Limit, dB(μV/m) | Margin, dB* |         |
| Low                 | 2400.0         | 67.31               | 74.0            | -6.69       | 67.31                  | 35.21                  | 54.0            | -18.79      | Pass    |
| High                | 2483.5         | 63.64               | 74.0            | -10.36      | 63.64                  | 31.54                  | 54.0            | -22.46      |         |

\* - Margin = measured value – limit

\*\* - Calculated average field strength = Measured average field strength – Average factor (32.1 dB)

#### Reference numbers of test equipment used

|         |         |         |         |  |  |  |  |
|---------|---------|---------|---------|--|--|--|--|
| HL 3903 | HL 4933 | HL 5372 | HL 5665 |  |  |  |  |
|---------|---------|---------|---------|--|--|--|--|

Full description is given in Appendix A.



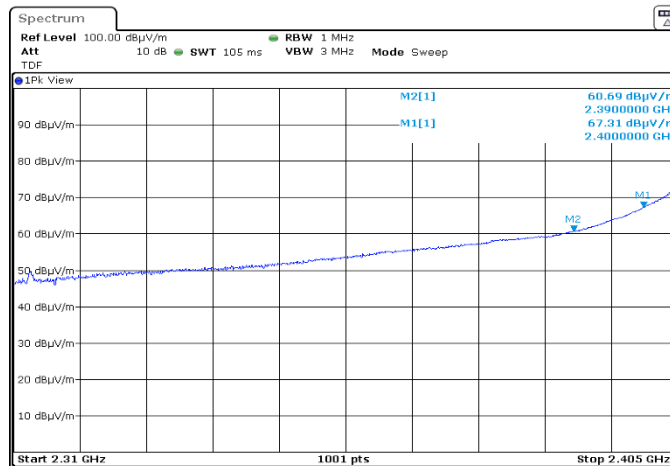
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|                                                                                  |                         |                        |                |
|----------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.249(d)/RSS-210, section A2.9, Band edge emissions |                         |                        |                |
| Test procedure: ANSI C63.10 section 6.10                                         |                         |                        |                |
| Test mode: Compliance                                                            |                         | Verdict: PASS          |                |
| Date(s): 01-Jan-20                                                               |                         |                        |                |
| Temperature: 23 °C                                                               | Relative Humidity: 47 % | Air Pressure: 1019 hPa | Power: 4.5 VDC |
| Remarks:                                                                         |                         |                        |                |

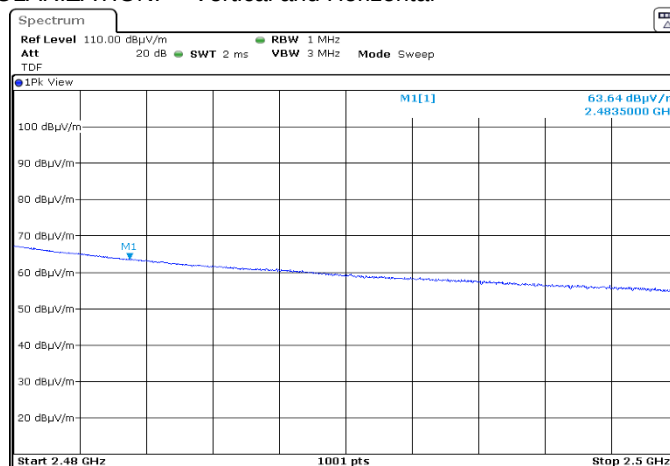
Plot 7.3.1 Low band edge emission test result

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal



Plot 7.3.2 High band edge emission test result

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal





|                                                                                       |                                |                               |                       |
|---------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.203 / RSS-Gen, Section 8.3, Antenna requirement |                                |                               |                       |
| <b>Test procedure:</b> Visual inspection / supplier declaration                       |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                          |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 01-Jan-20                                                             |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                             | <b>Relative Humidity:</b> 47 % | <b>Air Pressure:</b> 1019 hPa | <b>Power:</b> 4.5 VDC |
| <b>Remarks:</b>                                                                       |                                |                               |                       |

## 7.4 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.

The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.4.1.

**Table 7.4.1 Antenna requirements**

| Requirement                                        | Rationale         | Verdict |
|----------------------------------------------------|-------------------|---------|
| The transmitter antenna is permanently attached    | NA                | Comply  |
| The transmitter employs a unique antenna connector | Visual inspection |         |
| The transmitter requires professional installation | NA                |         |

## 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 (9) kHz - 30 MHz         | EMCO                  | 6502                     | 2857       | 24-Feb-19        | 24-Feb-20       |
| 3903  | Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA | Huber-Suhner          | SUCOFL EX 102A           | 1226/2A    | 07-Apr-19        | 07-Apr-20       |
| 4355  | Signal and Spectrum Analyzer, 9 kHz to 7 GHz       | Rohde & Schwarz       | FSV 7                    | 101630     | 04-Aug-19        | 04-Aug-20       |
| 4933  | Active Horn Antenna, 1 GHz to 18 GHz               | COM-POWER CORPORATION | AHA-118                  | 701046     | 06-Jan-20        | 06-Jan-21       |
| 5112  | RF cable, 40 GHz, 5.5 m, K-type                    | Huber-Suhner          | SF102EA/11SK/11SK/5500MM | 502494/2EA | 18-Apr-19        | 18-Apr-20       |
| 5288  | Trilog Antenna, 25 MHz - 8 GHz, 100W               | Frankonia             | ALX-8000E                | 00809      | 08-Feb-19        | 08-Feb-22       |
| 5372  | MXE EMI receiver, 3 Hz to 44 GHz                   | Keysight Technologies | N9038A                   | MY57290155 | 18-Jun-19        | 18-Jun-20       |
| 5665  | Cable SF118/11N(x2)/6M, 18 GHz, 11N/11N            | Huber-Suhner          | SF118                    | 501644/118 | 23-Oct-19        | 23-Oct-20       |

## 9 APPENDIX B Test equipment correction factors

**HL 0446: Active Loop Antenna**  
EMCO, model: 6502, s/n 2857

| Frequency, | Measured antenna factor, dBS/m | Measurement uncertainty, dB |
|------------|--------------------------------|-----------------------------|
| 10         | -33.4                          | ±1.0                        |
| 20         | -37.8                          | ±1.0                        |
| 50         | -40.5                          | ±1.0                        |
| 75         | -41.0                          | ±1.0                        |
| 100        | -41.2                          | ±1.0                        |
| 150        | -41.2                          | ±1.0                        |
| 250        | -41.1                          | ±1.0                        |
| 500        | -41.2                          | ±1.0                        |
| 750        | -41.3                          | ±1.0                        |
| 1000       | -41.3                          | ±1.0                        |

| Frequency, | Measured antenna factor, dBS/m | Measurement uncertainty, dB |
|------------|--------------------------------|-----------------------------|
| 2000       | -41.4                          | ±1.0                        |
| 3000       | -41.4                          | ±1.0                        |
| 4000       | -41.5                          | ±1.0                        |
| 5000       | -41.5                          | ±1.0                        |
| 10000      | -41.7                          | ±1.0                        |
| 15000      | -42.1                          | ±1.0                        |
| 20000      | -42.7                          | ±1.0                        |
| 25000      | -44.2                          | ±1.0                        |
| 30000      | -45.8                          | ±1.0                        |

The antenna factor shall be added to receiver reading in dB $\mu$ V to obtain field strength in dB $\mu$ A/m.

**HL 4933: Active Horn Antenna**  
COM-POWER CORPORATION, model: AHA-118, s/n 701046

| Frequency, MHz | Measured antenna factor (with preamplifier), dB/m |
|----------------|---------------------------------------------------|
| 1000           | -16.1                                             |
| 1500           | -15.1                                             |
| 2000           | -10.9                                             |
| 2500           | -11.9                                             |
| 3000           | -11.1                                             |
| 3500           | -10.6                                             |
| 4000           | -8.6                                              |
| 4500           | -8.3                                              |
| 5000           | -5.9                                              |
| 5500           | -5.7                                              |
| 6000           | -3.3                                              |
| 6500           | -4.0                                              |
| 7000           | -2.2                                              |
| 7500           | -1.7                                              |
| 8000           | 1.1                                               |
| 8500           | -0.8                                              |
| 9000           | -1.5                                              |
| 9500           | -0.2                                              |

| Frequency, MHz | Measured antenna factor (with preamplifier), dB/m |
|----------------|---------------------------------------------------|
| 10000          | 1.8                                               |
| 10500          | 1.0                                               |
| 11000          | 0.3                                               |
| 11500          | -0.5                                              |
| 12000          | 3.1                                               |
| 12500          | 1.4                                               |
| 13000          | -0.3                                              |
| 13500          | -0.4                                              |
| 14000          | 2.5                                               |
| 14500          | 2.2                                               |
| 15000          | 1.9                                               |
| 15500          | 0.5                                               |
| 16000          | 2.1                                               |
| 16500          | 1.2                                               |
| 17000          | 0.6                                               |
| 17500          | 3.1                                               |
| 18000          | 4.2                                               |

The antenna factor shall be added to receiver reading in dB $\mu$ V to obtain field strength in dB $\mu$ V/m.

HL 5112, RF cable, 40 GHz, 5.5 m, K-type,  
Huber-Suhner, SF102EA/11SK/11SK/5500MM, s/n 502494/2EA, HL 5112

| Set / Applied,<br>MHz | Measured,<br>dB | Uncertainty,<br>dB |
|-----------------------|-----------------|--------------------|
| 100                   | 0.70            | ±0.07              |
| 200                   | 0.99            | ±0.08              |
| 300                   | 1.21            | ±0.08              |
| 500                   | 1.55            | ±0.08              |
| 1000                  | 2.18            | ±0.08              |
| 1500                  | 2.67            | ±0.08              |
| 2000                  | 3.09            | ±0.08              |
| 2500                  | 3.46            | ±0.10              |
| 3000                  | 3.80            | ±0.10              |
| 3500                  | 4.12            | ±0.10              |
| 4000                  | 4.41            | ±0.10              |
| 4500                  | 4.69            | ±0.10              |
| 5000                  | 4.95            | ±0.10              |
| 5500                  | 5.20            | ±0.10              |
| 6000                  | 5.45            | ±0.10              |
| 6500                  | 5.68            | ±0.10              |
| 7000                  | 5.91            | ±0.10              |
| 7500                  | 6.13            | ±0.10              |
| 8000                  | 6.34            | ±0.10              |
| 8500                  | 6.56            | ±0.10              |
| 9000                  | 6.76            | ±0.10              |
| 9500                  | 6.95            | ±0.10              |
| 10000                 | 7.16            | ±0.10              |
| 10500                 | 7.33            | ±0.10              |
| 11000                 | 7.51            | ±0.10              |
| 11500                 | 7.68            | ±0.10              |
| 12000                 | 7.85            | ±0.10              |
| 12500                 | 8.02            | ±0.13              |
| 13000                 | 8.17            | ±0.13              |
| 13500                 | 8.31            | ±0.13              |
| 14000                 | 8.46            | ±0.13              |
| 14500                 | 8.61            | ±0.18              |
| 15000                 | 8.76            | ±0.18              |
| 15500                 | 8.91            | ±0.18              |
| 16000                 | 9.07            | ±0.18              |
| 16500                 | 9.22            | ±0.18              |
| 17000                 | 9.36            | ±0.18              |
| 17500                 | 9.51            | ±0.18              |
| 18000                 | 9.66            | ±0.18              |
| 18500                 | 9.81            | ±0.23              |
| 19000                 | 9.95            | ±0.23              |
| 19500                 | 10.10           | ±0.23              |

| Set / Applied,<br>MHz | Measured,<br>dB | Uncertainty,<br>dB |
|-----------------------|-----------------|--------------------|
| 20000                 | 10.25           | ±0.23              |
| 20500                 | 10.38           | ±0.23              |
| 21000                 | 10.52           | ±0.23              |
| 21500                 | 10.67           | ±0.23              |
| 22000                 | 10.84           | ±0.23              |
| 22500                 | 11.00           | ±0.29              |
| 23000                 | 11.10           | ±0.29              |
| 23500                 | 11.20           | ±0.29              |
| 24000                 | 11.32           | ±0.29              |
| 24500                 | 11.42           | ±0.29              |
| 25000                 | 11.59           | ±0.23              |
| 25500                 | 11.70           | ±0.23              |
| 26000                 | 11.85           | ±0.23              |
| 26500                 | 11.97           | ±0.23              |
| 27000                 | 12.07           | ±0.33              |
| 27500                 | 12.17           | ±0.33              |
| 28000                 | 12.26           | ±0.40              |
| 28500                 | 12.38           | ±0.40              |
| 29000                 | 12.50           | ±0.40              |
| 29500                 | 12.63           | ±0.40              |
| 30000                 | 12.75           | ±0.40              |
| 30500                 | 12.82           | ±0.33              |
| 31000                 | 12.93           | ±0.33              |
| 31500                 | 13.09           | ±0.33              |
| 32000                 | 13.22           | ±0.33              |
| 32500                 | 13.35           | ±0.33              |
| 33000                 | 13.48           | ±0.33              |
| 33500                 | 13.60           | ±0.33              |
| 34000                 | 13.72           | ±0.33              |
| 34500                 | 13.80           | ±0.40              |
| 35000                 | 13.92           | ±0.40              |
| 35500                 | 14.01           | ±0.40              |
| 36000                 | 14.12           | ±0.40              |
| 36500                 | 14.23           | ±0.40              |
| 37000                 | 14.34           | ±0.33              |
| 37500                 | 14.44           | ±0.33              |
| 38000                 | 14.57           | ±0.33              |
| 38500                 | 14.72           | ±0.33              |
| 39000                 | 14.82           | ±0.33              |
| 39500                 | 14.94           | ±0.33              |
| 40000                 | 15.08           | ±0.47              |

**HL 5288: Trilog Antenna**  
**Frankonia, model: ALX-8000E, s/n: 00809**  
**30-1000 MHz**

| Frequency, MHz | Antenna factor, dB/m |
|----------------|----------------------|
| 30             | 14.96                |
| 35             | 15.33                |
| 40             | 16.37                |
| 45             | 17.56                |
| 50             | 17.95                |
| 60             | 16.87                |
| 70             | 13.22                |
| 80             | 10.56                |
| 90             | 13.61                |
| 100            | 15.46                |
| 120            | 14.03                |
| 140            | 12.23                |

| Frequency, MHz | Antenna factor, dB/m |
|----------------|----------------------|
| 160            | 12.67                |
| 180            | 13.34                |
| 200            | 15.40                |
| 250            | 16.42                |
| 300            | 17.28                |
| 400            | 19.98                |
| 500            | 21.11                |
| 600            | 22.90                |
| 700            | 24.13                |
| 800            | 25.25                |
| 900            | 26.35                |
| 1000           | 27.18                |

The antenna factor shall be added to receiver reading in dB $\mu$ V to obtain field strength in dB $\mu$ V/m.

**above 1000 MHz**

| Frequency, MHz | Antenna factor, dB/m |
|----------------|----------------------|
| 1000           | 26.9                 |
| 1100           | 28.1                 |
| 1200           | 28.4                 |
| 1300           | 29.6                 |
| 1400           | 29.1                 |
| 1500           | 30.4                 |
| 1600           | 30.7                 |
| 1700           | 31.5                 |
| 1800           | 32.3                 |
| 1900           | 32.6                 |
| 2000           | 32.5                 |
| 2100           | 32.9                 |
| 2200           | 33.5                 |
| 2300           | 33.2                 |
| 2400           | 33.7                 |
| 2500           | 34.6                 |
| 2600           | 34.7                 |
| 2700           | 34.6                 |
| 2800           | 35.0                 |
| 2900           | 35.5                 |
| 3000           | 36.2                 |
| 3100           | 36.8                 |
| 3200           | 36.8                 |
| 3300           | 37.0                 |
| 3400           | 37.5                 |
| 3500           | 38.2                 |

| Frequency, MHz | Antenna factor, dB/m |
|----------------|----------------------|
| 3600           | 38.9                 |
| 3700           | 39.4                 |
| 3800           | 39.4                 |
| 3900           | 39.6                 |
| 4000           | 39.7                 |
| 4100           | 39.8                 |
| 4200           | 40.5                 |
| 4300           | 40.9                 |
| 4400           | 41.1                 |
| 4500           | 41.4                 |
| 4600           | 41.3                 |
| 4700           | 41.6                 |
| 4800           | 41.9                 |
| 4900           | 42.3                 |
| 5000           | 42.7                 |
| 5100           | 43.0                 |
| 5200           | 42.9                 |
| 5300           | 43.5                 |
| 5400           | 43.6                 |
| 5500           | 44.3                 |
| 5600           | 44.7                 |
| 5700           | 45.0                 |
| 5800           | 45.0                 |
| 5900           | 45.3                 |
| 6000           | 45.9                 |

The antenna factor shall be added to receiver reading in dB $\mu$ V to obtain field strength in dB $\mu$ V/m.

## 10 APPENDIX C Measurement uncertainties

### Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

| Test description                                                                                      | Expanded uncertainty                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Conducted emissions with LISN                                                                         | 9 kHz to 150 kHz: $\pm 3.9$ dB<br>150 kHz to 30 MHz: $\pm 3.8$ dB                                                                                                                                                                                                                                            |
| Radiated emissions at 10 m measuring distance<br>Horizontal polarization<br><br>Vertical polarization | Biconilog antenna: $\pm 5.0$ dB<br>Biconical antenna: $\pm 5.0$ dB<br>Log periodic antenna: $\pm 5.1$ dB<br>Double ridged horn antenna: $\pm 5.3$ dB<br>Biconilog antenna: $\pm 5.5$ dB<br>Biconical antenna: $\pm 5.5$ dB<br>Log periodic antenna: $\pm 5.6$ dB<br>Double ridged horn antenna: $\pm 5.8$ dB |
| Radiated emissions at 3 m measuring distance<br>Horizontal polarization<br><br>Vertical polarization  | Biconilog antenna: $\pm 5.3$ dB<br>Biconical antenna: $\pm 5.0$ dB<br>Log periodic antenna: $\pm 5.3$ dB<br>Double ridged horn antenna: $\pm 5.3$ dB<br>Biconilog antenna: $\pm 6.0$ dB<br>Biconical antenna: $\pm 5.7$ dB<br>Log periodic antenna: $\pm 6.0$ dB<br>Double ridged horn antenna: $\pm 6.0$ dB |
| Conducted emissions at RF antenna connector                                                           | 9 kHz to 2.9 GHz: $\pm 2.6$ dB<br>2.9 GHz to 6.46 GHz: $\pm 3.5$ dB<br>6.46 GHz to 13.2 GHz: $\pm 4.3$ dB<br>13.2 GHz to 22.0 GHz: $\pm 5.0$ dB<br>22.0 GHz to 26.8 GHz: $\pm 5.5$ dB<br>26.8 GHz to 40.0 GHz: $\pm 4.8$ dB                                                                                  |
| Duty cycle, timing (Tx ON / OFF) and average factor measurements                                      | $\pm 1.0$ %                                                                                                                                                                                                                                                                                                  |
| Occupied bandwidth                                                                                    | $\pm 8.0$ %                                                                                                                                                                                                                                                                                                  |

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.

## 11 APPENDIX D Test laboratory 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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## 12 APPENDIX E

### Specification references

FCC 47CFR part 15: 2019

ANSI C63.10: 2013

ANSI C63.4: 2014

RSS-210 Issue 10: 2019

RSS-Gen Issue 5: 2018

Radio Frequency Devices

American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

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

Licence- Exempt Radio Apparatus: Category 1 Equipment

General Requirements for Compliance of Radio Apparatus

## 13 APPENDIX F Abbreviations and acronyms

|                |                                             |
|----------------|---------------------------------------------|
| A              | ampere                                      |
| AC             | alternating current                         |
| A/m            | ampere per meter                            |
| AM             | amplitude modulation                        |
| AVRG           | average (detector)                          |
| cm             | centimeter                                  |
| dB             | decibel                                     |
| dBm            | decibel referred to one milliwatt           |
| dB( $\mu$ V)   | decibel referred to one microvolt           |
| dB( $\mu$ V/m) | decibel referred to one microvolt per meter |
| dB( $\mu$ A)   | decibel referred to one microampere         |
| 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                                       |
| k              | kilo                                        |
| kHz            | kilohertz                                   |
| LO             | local oscillator                            |
| m              | meter                                       |
| MHz            | megahertz                                   |
| min            | minute                                      |
| mm             | millimeter                                  |
| ms             | millisecond                                 |
| $\mu$ s        | microsecond                                 |
| NA             | not applicable                              |
| NB             | narrow band                                 |
| OATS           | open area test site                         |
| $\Omega$       | Ohm                                         |
| PM             | pulse modulation                            |
| PS             | power supply                                |
| ppm            | part per million ( $10^{-6}$ )              |
| QP             | quasi-peak                                  |
| RE             | radiated emission                           |
| RF             | radio frequency                             |
| rms            | root mean square                            |
| Rx             | receive                                     |
| s              | second                                      |
| T              | temperature                                 |
| Tx             | transmit                                    |
| V              | volt                                        |
| WB             | wideband                                    |

END OF DOCUMENT