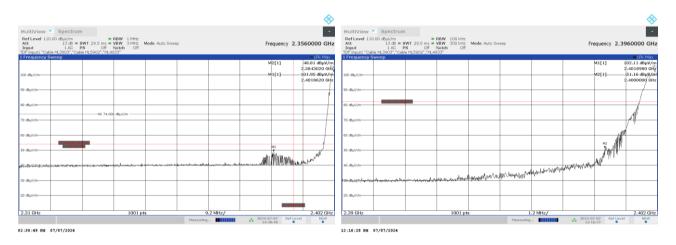


| Test specification: | Section 15.247(d), RSS-247 section 5.5, Emissions at band edges |                        |                |  |
|---------------------|---|------------------------|----------------|--|
| Test procedure:     | ANSI C63.10, section 7.8.6                                      |                        |                |  |
| Test mode:          | Compliance  | Verdict:               | PASS           |  |
| Date(s):            | 07-Jul-24   | verdict:               | PA33           |  |
| Temperature: 24 °C  | Relative Humidity: 58 %   | Air Pressure: 1012 hPa | Power: 3.6 VDC |  |
| Remarks:            |   |                        |                |  |

Plot 7.4.1 The highest band edge emission at low carrier frequency



Plot 7.4.2 The highest band edge emission at high carrier frequency







| Test specification: | Section 15.247(e) / RSS-247 | 7 section 5.2(2), Maximum | power spectral density |
|---------------------|-----------------------------|---------------------------|------------------------|
| Test procedure:     | ANSI C63.10 section 11.10.2 |                           |                        |
| Test mode:          | Compliance                  | Verdict:                  | PASS                   |
| Date(s):            | 07-Jul-24                   | verdict:                  | PASS                   |
| Temperature: 24 °C  | Relative Humidity: 58 %     | Air Pressure: 1012 hPa    | Power: 3.6 VDC         |
| Remarks:            |                             |                           |                        |

# 7.5 Peak spectral power density

#### 7.5.1 General

This test was performed to measure the peak spectral power density radiated by the transmitter RF antenna. Specification test limits are given in Table 7.5.1.

Table 7.5.1 Peak spectral power density limits

| Assigned frequency range, MHz | Measurement bandwidth, kHz | Peak spectral power density, dBm | Equivalent field strength limit @ 3m, dB(μV/m)* |
|-------------------------------|----------------------------|----------------------------------|---|
| 902.0 – 928.0                 |                            |                                  |   |
| 2400.0 - 2483.5               | 3.0                        | 8.0                              | 103.2   |
| 5725.0 - 5850.0               |                            |                                  |   |

<sup>\* -</sup> Equivalent field strength limit was calculated from the peak spectral power density as follows: E=sqrt(30×P)/r, where P is peak spectral power density and r is antenna to EUT distance in meters.

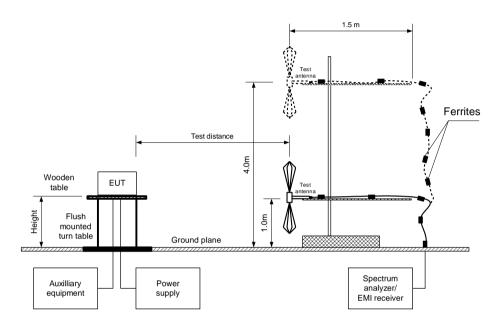
#### 7.5.2 Test procedure for field strength measurements

- 7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.
- 7.5.2.2 The EUT was adjusted to produce maximum available to end user RF output power.
- **7.5.2.3** The field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360<sup>0</sup> and the measuring antenna height was swept in both vertical and horizontal polarizations.
- **7.5.2.4** The frequency span of spectrum analyzer was set to capture the entire 6 dB band of the transmitter, in peak hold mode with resolution bandwidth set to 3.0 kHz, video bandwidth wider than resolution bandwidth, auto sweep time and sufficient number of sweeps was allowed for trace stabilization. The spectrum lines spacing was verified to be wider than 3 kHz. Otherwise the resolution bandwidth was reduced until individual spectrum lines were resolved and the power of individual spectrum lines was integrated over 3 kHz band.
- **7.5.2.5** The peak of emission was zoomed with span set just wide enough to capture the emission peak area and sweep time was set equal to span width divided by resolution bandwidth. Spectrum analyzer was set in peak hold mode, sufficient number of sweeps was allowed for trace stabilization and peak spectral power density was measured as provided in Table 7.5.2 and associated plots.



| Test specification: | Section 15.247(e) / RSS-247 section 5.2(2), Maximum power spectral density |                        |                |  |
|---------------------|--|------------------------|----------------|--|
| Test procedure:     | ANSI C63.10 section 11.10.2  |                        |                |  |
| Test mode:          | Compliance   | Verdict:               | PASS           |  |
| Date(s):            | 07-Jul-24  | verdict:               | PASS           |  |
| Temperature: 24 °C  | Relative Humidity: 58 %  | Air Pressure: 1012 hPa | Power: 3.6 VDC |  |
| Remarks:            |  |                        |                |  |

Figure 7.5.1 Setup for carrier field strength measurements





| Test specification: | Section 15.247(e) / RSS-247 section 5.2(2), Maximum power spectral density |                        |                |  |
|---------------------|--|------------------------|----------------|--|
| Test procedure:     | ANSI C63.10 section 11.10.2  |                        |                |  |
| Test mode:          | Compliance   | Verdict:               | PASS           |  |
| Date(s):            | 07-Jul-24  | verdict:               | PASS           |  |
| Temperature: 24 °C  | Relative Humidity: 58 %  | Air Pressure: 1012 hPa | Power: 3.6 VDC |  |
| Remarks:            |  |                        |                |  |

#### Table 7.5.2 Field strength measurement of peak spectral power density

ASSIGNED FREQUENCY: 2400-2483.5 MHz

TEST DISTANCE: 3 m

TEST SITE: Semi anechoic chamber

EUT HEIGHT: 0.8 m
DETECTOR USED: Peak
RESOLUTION BANDWIDTH: 3 kHz
VIDEO BANDWIDTH: 10 kHz

TEST ANTENNA TYPE: Double ridged guide (above 1000 MHz)

MODULATION: GFSK BIT RATE: 1 Mbps

| Frequency,<br>MHz | Field strength,<br>dB(μV/m) | EUT antenna<br>gain, dBi | Limit,<br>dB(μV/m) | Margin,<br>dB* | Antenna polarization | Antenna<br>height, m | Turn-table position**,<br>degrees |
|-------------------|-----------------------------|--------------------------|--------------------|----------------|----------------------|----------------------|-----------------------------------|
| 2402              | 89.18                       | 2.5                      | 103.2              | -14.02         | V                    | 1.1                  | -10                               |
| 2440              | 88.46                       | 2.5                      | 103.2              | -14.74         | V                    | 1.1                  | -13                               |
| 2480              | 89.05                       | 2.5                      | 103.2              | -14.15         | V                    | 1.0                  | -20                               |

<sup>\*-</sup> Margin = Field strength - EUT antenna gain - calculated field strength limit.

### Reference numbers of test equipment used

| • • • | north of the manual to the total equipment about |         |         |         |  |  |  |  |
|-------|--|---------|---------|---------|--|--|--|--|
|       | HL 4933  | HL 3903 | HL 5902 | HL 7585 |  |  |  |  |

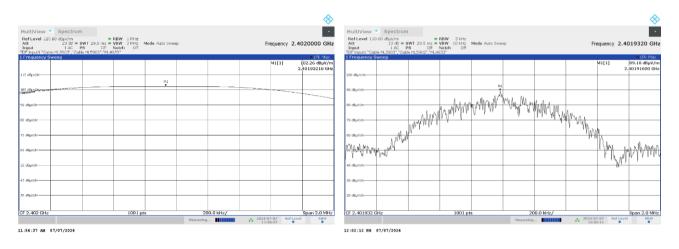
Full description is given in Appendix A.

<sup>\*\*-</sup> EUT front panel refer to 0 degrees position of turntable.

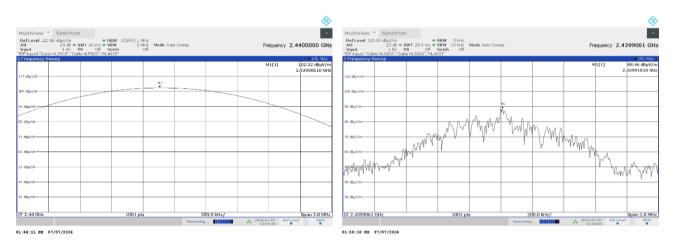


| Test specification: | Section 15.247(e) / RSS-247 | 7 section 5.2(2), Maximum | power spectral density |
|---------------------|-----------------------------|---------------------------|------------------------|
| Test procedure:     | ANSI C63.10 section 11.10.2 |                           |                        |
| Test mode:          | Compliance                  | Verdict:                  | PASS                   |
| Date(s):            | 07-Jul-24                   | verdict:                  | PASS                   |
| Temperature: 24 °C  | Relative Humidity: 58 %     | Air Pressure: 1012 hPa    | Power: 3.6 VDC         |
| Remarks:            |                             |                           |                        |

Plot 7.5.1 Peak spectral power density at low frequency



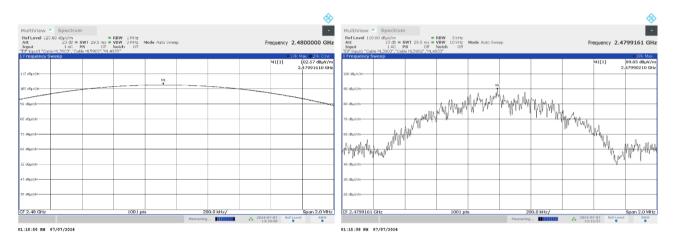
Plot 7.5.2 Peak spectral power density at mid frequency





| Test specification: | Section 15.247(e) / RSS-247 | 7 section 5.2(2), Maximum | power spectral density |
|---------------------|-----------------------------|---------------------------|------------------------|
| Test procedure:     | ANSI C63.10 section 11.10.2 |                           |                        |
| Test mode:          | Compliance                  | Verdict:                  | PASS                   |
| Date(s):            | 07-Jul-24                   | verdict:                  | PASS                   |
| Temperature: 24 °C  | Relative Humidity: 58 %     | Air Pressure: 1012 hPa    | Power: 3.6 VDC         |
| Remarks:            |                             |                           |                        |

Plot 7.5.3 Peak spectral power density at high frequency





| Test specification: | FCC Section 15.203/ RSS-Gen, Section 7.1.4, Antenna requirement |                        |                |  |
|---------------------|---|------------------------|----------------|--|
| Test procedure:     | Visual inspection / supplier declaration                        |                        |                |  |
| Test mode:          | Compliance  | Vandiet.               |                |  |
| Date(s):            | 08-Jul-24 - 11-Jul-24   | Verdict:               |                |  |
| Temperature: 25 °C  | Relative Humidity: 47 %   | Air Pressure: 1003 hPa | Power: 3.6 VDC |  |
| Remarks:            |   |                        |                |  |

# 7.6 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 7.6.1.

**Table 7.6.1 Antenna requirements** 

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





| Test specification: | Section 15.109, Radiated emission    |                        |                |  |
|---------------------|--------------------------------------|------------------------|----------------|--|
| Test procedure:     | ANSI C63.4, Sections 11.6 and 12.1.4 |                        |                |  |
| Test mode:          | Compliance                           | Vordict                | DACC           |  |
| Date(s):            | 11-Jul-24                            | - Verdict: PASS        |                |  |
| Temperature: 24 °C  | Relative Humidity: 40 %              | Air Pressure: 1008 hPa | Power: 3.6 VDC |  |
| Remarks:            |                                      |                        |                |  |

# 8 Emissions tests according to FCC 47CFR part 15 subpart B and ICES-003 requirements

#### 8.1 Radiated emission measurements

#### 8.1.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 8.1.1.

Table 8.1.1 Radiated emission test limits

| Frequency,<br>MHz | Class B limit, dB(μV/m)  10 m distance 3 m distance |                         | Class A limit,<br>dB(μV/m) |                    |  |  |  |
|-------------------|---|-------------------------|----------------------------|--------------------|--|--|--|
| IVITIZ            |   |                         | 10 m distance              | 3 m distance       |  |  |  |
|                   | FCC 47 CFR, Section 15.109                          |                         |                            |                    |  |  |  |
| 30 - 88           | 29.5*   | 40.0                    | 39.0                       | 49.5*              |  |  |  |
| 88 - 216          | 33.0*   | 43.5                    | 43.5                       | 54.0*              |  |  |  |
| 216 - 960         | 35.5*   | 46.0                    | 46.4                       | 56.9*              |  |  |  |
| Above 960         | 43.5*   | 54.0                    | 49.5                       | 60.0*              |  |  |  |
|                   |   | ICES-003, Section 3.2.2 | 2                          |                    |  |  |  |
| 30 - 88           | 30.0  | 40.0                    | 40.0                       | 50.0               |  |  |  |
| 88 - 216          | 33.1  | 43.5                    | 43.5                       | 54.0               |  |  |  |
| 216 - 230         | 35.6  | 46.0                    | 46.4                       | 56.9               |  |  |  |
| 230 - 960         | 37.0  | 47.0                    | 47.0                       | 57.0               |  |  |  |
| 960 - 1000        | 43.5  | 54.0                    | 49.5                       | 60.0               |  |  |  |
| 1000 - 40000      |   | 74 (Peak) 54 (AVR)      |                            | 80 (Peak) 60 (AVR) |  |  |  |

<sup>\*</sup> - The limit for a test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows:  $Lim_{S2} = Lim_{S1} + 20 log (S_1/S_2)$ ,

where  $S_1$  and  $S_2$  – the standard defined and the test distance respectively in meters.

#### 8.1.2 Test procedure

- **8.1.2.1** 30 1000 MHz range. The EUT was set up as shown in Figure 8.1.1 and the associated photographs, energized and the EUT performance was checked.
- **8.1.2.2** The measurements were performed in the semi anechoic chamber at 3 m test distance. The specified frequency range was investigated with the antenna connected to the EMI receiver. To find the highest emission the turntable was rotated 360° and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. The EUT cables position was varied to maximize emission.
- **8.1.2.3** 1000 40000 MHz range. The EUT was set up as shown in Figure 8.1.2 and the associated photographs, energized and the EUT performance was checked.
- **8.1.2.4** The measurements were performed in the semi anechoic chamber at 3 m test distance. The specified frequency range was investigated with the antenna connected to the EMI receiver. To find the highest emission the turntable was rotated 360° and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. In order to stay within the 3 dB beamwidth while keeping the antenna height scanned from 1 to 4 m, a few sweeps with different antenna angles over the entire height were performed.
- **8.1.2.5** The worst test results with respect to the limits were recorded in Table 7.2.2 and shown in the associated plots.



| Test specification: | Section 15.109, Radiated emission    |                        |                |  |
|---------------------|--------------------------------------|------------------------|----------------|--|
| Test procedure:     | ANSI C63.4, Sections 11.6 and 12.1.4 |                        |                |  |
| Test mode:          | Compliance                           | Verdict:               | PASS           |  |
| Date(s):            | 11-Jul-24                            | verdict:               | PASS           |  |
| Temperature: 24 °C  | Relative Humidity: 40 %              | Air Pressure: 1008 hPa | Power: 3.6 VDC |  |
| Remarks:            |                                      |                        |                |  |

Figure 8.1.1 Setup for radiated emission measurements in semi anechoic chamber in 30 – 1000 MHz range, table-top EUT

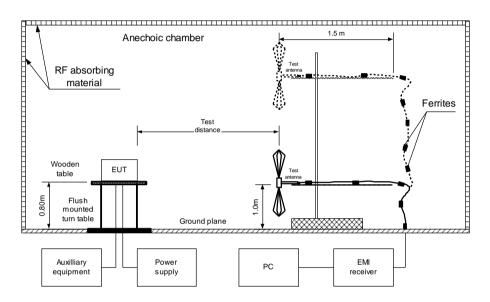
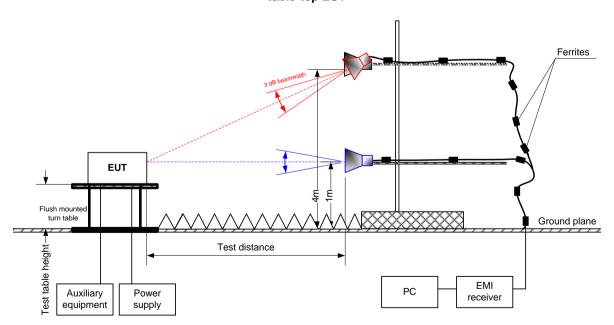


Figure 8.1.2 Setup for radiated emission measurements in semi anechoic chamber in 1000 – 40000 MHz range, table-top EUT





| Test specification: | Section 15.109, Radiated emission    |                        |                |  |
|---------------------|--------------------------------------|------------------------|----------------|--|
| Test procedure:     | ANSI C63.4, Sections 11.6 and 12.1.4 |                        |                |  |
| Test mode:          | Compliance                           | Verdict:               | PASS           |  |
| Date(s):            | 11-Jul-24                            | verdict:               | PASS           |  |
| Temperature: 24 °C  | Relative Humidity: 40 %              | Air Pressure: 1008 hPa | Power: 3.6 VDC |  |
| Remarks:            |                                      |                        |                |  |

#### Table 8.1.2 Radiated emission test results

EUT SET UP: TABLE-TOP LIMIT: Class B EUT OPERATING MODE: Stand-by

TEST SITE: SEMI ANECHOIC CHAMBER

TEST DISTANCE: 3 m

DETECTORS USED:

PEAK / QUASI-PEAK
FREQUENCY RANGE:

30 MHz – 1000 MHz

RESOLUTION BANDWIDTH: 120 kHz

|                   | Peak                  |                                   | Quasi-peak         |                |                         | Antenna      | Turn-table             |         |
|-------------------|-----------------------|-----------------------------------|--------------------|----------------|-------------------------|--------------|------------------------|---------|
| Frequency,<br>MHz | emission,<br>dB(μV/m) | Measured<br>emission,<br>dB(μV/m) | Limit,<br>dB(μV/m) | Margin,<br>dB* | Antenna<br>polarization | height,<br>m | position**,<br>degrees | Verdict |
| 935.55            | 33.50                 | 23.14                             | 46.00              | 22.86          | Horizontal              | 3.75         | 116.0                  | Pass    |

TEST SITE: SEMI ANECHOIC CHAMBER

TEST DISTANCE: 3 m

DETECTORS USED: PEAK / AVERAGE FREQUENCY RANGE: PEAK / AVERAGE 1000 MHz  $-5^{\rm th}$  harmony

RESOLUTION BANDWIDTH: 1000 kHz

| Fraguenay                |           | Peak     |         |           | Average  |         |              | Antonno | Turn table             |         |
|--------------------------|-----------|----------|---------|-----------|----------|---------|--------------|---------|------------------------|---------|
| Frequency,               | Measured  | Limit,   | Margin, | Measured  | Limit,   | Margin, | Antenna      |         | Turn-table position**, |         |
| MHz                      | emission, |          |         | emission, |          |         | polarization |         | degrees                | veruici |
| IVITIZ                   | dB(μV/m)  | dB(μV/m) | dB*     | dB(μV/m)  | dB(μV/m) | dB*     |              | m       | uegrees                |         |
| No emissions were found. |           |          |         |           |          |         | Pass         |         |                        |         |

<sup>\*-</sup> Margin = Measured emission - specification limit.

#### Reference numbers of test equipment used

|         | <u> </u> | =       |         |         |         |  |
|---------|----------|---------|---------|---------|---------|--|
| HL 3903 | HL 4933  | HL 5085 | HL 5288 | HL 5902 | HL 7585 |  |

Full description is given in Appendix A.

<sup>\*\*-</sup> EUT front panel refer to 0 degrees position of turntable.

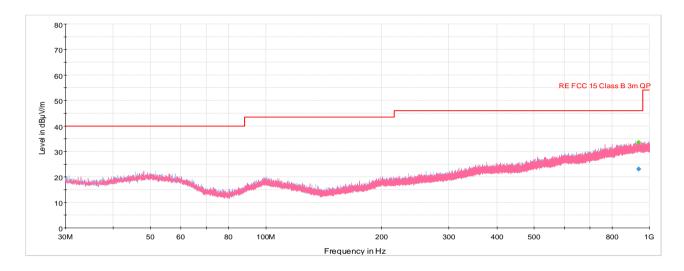


| Test specification: | Section 15.109, Radiated emission    |                        |                |  |
|---------------------|--------------------------------------|------------------------|----------------|--|
| Test procedure:     | ANSI C63.4, Sections 11.6 and 12.1.4 |                        |                |  |
| Test mode:          | Compliance                           | Verdict:               | PASS           |  |
| Date(s):            | 11-Jul-24                            | verdict:               | PASS           |  |
| Temperature: 24 °C  | Relative Humidity: 40 %              | Air Pressure: 1008 hPa | Power: 3.6 VDC |  |
| Remarks:            |                                      |                        |                |  |

Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical and horizontal antenna polarization

TEST SITE: Semi anechoic chamber

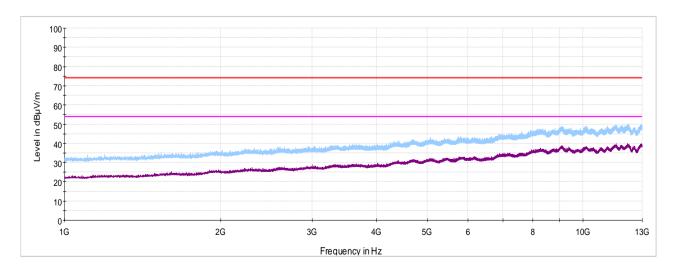
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Stand-by



Plot 8.1.2 Radiated emission measurements above 1000 MHz, vertical and horizontal antenna polarization

TEST SITE: Semi anechoic chamber

LIMIT: B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Stand-by





# 9 APPENDIX A Test equipment and ancillaries used for tests

| HL<br>No | Description  | Manufacturer                 | Model                        | Ser. No.        | Last Cal./<br>Check | Due Cal./<br>Check |
|----------|--|------------------------------|------------------------------|-----------------|---------------------|--------------------|
| 0446     | Antenna, Loop, Active, 10 (9) kHz - 30 MHz                                 | EMCO                         | 6502                         | 2857            | 29-Feb-24           | 28-Feb-25          |
| 2780     | EMC analyzer, 100 Hz to 26.5 GHz   | Agilent<br>Technologies      | E7405A                       | MY451024<br>62  | 17-Oct-23           | 17-Oct-24          |
| 3434     | Test Cable , DC-18 GHz, 1.5 m, SMA - SMA                                   | Mini-Circuits                | CBL-5FT-<br>SMSM+            | 25683           | 06-May-24           | 06-May-25          |
| 3903     | Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA                         | Huber-Suhner                 | SUCOFL<br>EX 102A            | 1226/2A         | 06-May-24           | 06-May-25          |
| 4136     | Shield Box   | TESCOM CO.,<br>LTD           | TC-5916A                     | 5916A000<br>137 | 20-May-24           | 20-May-25          |
| 4338     | Reject Band Filter, 50 Ohm, 0 to 2170 and 3000 to 18000 MHz,SMA-FM / SMA-M | Micro-Tronics                | BRM<br>50702-02              | 023             | 05-Jun-19           | 05-Jun-21          |
| 4933     | Active Horn Antenna, 1 GHz to 18 GHz                                       | COM-POWER<br>CORPORATI<br>ON | AHA-118                      | 701046          | 20-Feb-24           | 20-Feb-25          |
| 5085     | Attenuator, 4 dB, DC - 6 GHz, 1 W  | Mini-Circuits                | UNAT-4+                      | NA              | 24-Mar-22           | 24-Mar-25          |
| 5288     | Trilog Antenna, 25 MHz - 8 GHz, 100W                                       | Frankonia                    | ALX-<br>8000E                | 00809           | 24-Mar-22           | 24-Mar-25          |
| 5376     | EXA Signal Analyzer, 10 Hz - 32 GHz  | Keysight<br>Technologies     | N9010B                       | MY574704<br>04  | 08-Jan-24           | 08-Jan-25          |
| 5902     | RF cable, 18 GHz, 6.0m, N-type   | Huber-Suhner                 | SF126EA/<br>11N/11N/<br>6000 | NA              | 19-Nov-23           | 19-Nov-24          |
| 7546     | Power supply 60VDC/12.5A   | Agilent<br>Technologies      | N5747A                       | US25F676<br>2C  | 29-May-24           | 29-May-25          |
| 7585     | EMI Test Receiver, 1 Hz to 44 GHz  | Rohde &<br>Schwarz           | ESW44                        | 103130          | 21-Sep-23           | 21-Sep-24          |





#### 10 **APPENDIX B Test equipment correction factors**

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

|                | 30-                  |
|----------------|----------------------|
| 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.



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.



4500

5000

5500

6000

6500 7000 HL 4933: Active Horn Antenna COM-POWER CORPORATION, model: AHA-118, s/n 701046

| Frequency, MHz | (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                      |

| 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   |

| 7500  | -1.7 |
|---|------|
| 8000  | 1.1  |
| 8500  | -0.8 |
| 9000  | -1.5 |
| 9500  | -0.2 |
| The entering feator about he entered to receive receives in all |      |

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

-8.3

-5.9

-5.7

-3.3 -4.0

-2.2



#### 11 APPENDIX C Measurement uncertainties

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

| Test description   | Expanded uncertainty                 |
|--|--------------------------------------|
| Conducted carrier power at RF antenna connector                  | Below 12.4 GHz: ± 1.7 dB             |
|  | 12.4 GHz to 40 GHz: ± 2.3 dB         |
| Conducted emissions at RF antenna connector                      | 9 kHz to 2.9 GHz: ± 2.6 dB           |
|  | 2.9 GHz to 6.46 GHz: ± 3.5 dB        |
|  | 6.46 GHz to 13.2 GHz: ± 4.3 dB       |
|  | 13.2 GHz to 22.0 GHz: ± 5.0 dB       |
|  | 22.0 GHz to 26.8 GHz: ± 5.5 dB       |
|  | 26.8 GHz to 40.0 GHz: ± 4.8 dB       |
| Occupied bandwidth   | ± 8.0 %                              |
| Duty cycle, timing (Tx ON / OFF) and average factor measurements | ± 1.0 %                              |
| Conducted emissions with LISN                                    | 9 kHz to 150 kHz: ± 3.9 dB           |
|  | 150 kHz to 30 MHz: ± 3.8 dB          |
| Radiated emissions at 3 m measuring distance                     |                                      |
| Horizontal polarization  | Biconilog antenna: ± 5.3 dB          |
|  | Biconical antenna: ± 5.0 dB          |
|  | Log periodic antenna: ± 5.3 dB       |
| We have  | Double ridged horn antenna: ± 5.3 dB |
| Vertical polarization  | Biconilog antenna: ± 6.0 dB          |
|  | Biconical antenna: ± 5.7 dB          |
|  | Log periodic antenna: ± 6.0 dB       |
|  | Double ridged horn antenna: ± 6.0 dB |

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.





## 12 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 relevant parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; Recognized by Innovation, Science and Economic Development Canada for wireless and terminal testing (ISED), ISED #2186A, CAB identifier is IL1001; Certified by VCCI, Japan (the registration numbers are R-10808 for OATS, R-1082 for anechoic chamber, G-10869 for RE measurements above 1 GHz, C-10845 for conducted emissions site and T-11606 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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### 13 APPENDIX E

## **Specification references**

FCC 47CFR part 15: 2022

ANSI C63.10: 2013

RSS-247 Issue 3: 2023

RSS-Gen Issue 5

with\_amendment\_1\_2: 2021

ANSI C63.4-2014

ICES-003: 2020, Issue 7

Radio Frequency Devices

American National Standard of Procedures for Compliance Testing of Unlicensed

Wireless Devices

Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and

Licence- Exempt Local Area Network (LE-LAN) Devices

General Requirements and Information for the Certification of Radiocommunication

Equipment

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.

Information Technology Equipment (Including Digital Apparatus)



#### 14 **APPENDIX F** Abbreviations and acronyms

ampere

AC alternating current A/m ampere per meter AM amplitude modulation **AVRG** average (detector)

centimeter cm dΒ 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 Н height

HL Hermon laboratories

Hz hertz k kilo kHz kilohertz LO local oscillator m meter MHz megahertz min minute millimeter  $\mathsf{mm}$ millisecond ms microsecond μS NA not applicable NB narrow band

open area test site Ω Ohm

OATS

PMpulse modulation PS power supply

part per million (10<sup>-6</sup>) ppm

QΡ quasi-peak RE radiated emission RF radio frequency rms root mean square

Rx receive second s Т temperature Tx transmit V volt WB wideband

# **END OF DOCUMENT**