

TEST REPORT

ACCORDING TO: FCC CFR 47 Part 15 subpart C, section 15.231
RSS-210 issue 9 Annex A

FOR:

Triple Plus Ltd.
CLM Water Flood Detector V2 US
Model: CLM-FDAMAP-2-00
FCC ID: 2AFOIFLD
IC: 20798-FLD

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

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Telephone: +972-72-22-11-370
Fax: +972-4-959-3991
E-mail: yuval.abraham@tripleplus.io
Contact name: Mr. Yuval Abraham

2 Equipment under test attributes

Product name: CLM Water Flood Detector V2 US
Product type: Wireless flood detector
Model(s): CLM-FDAMAP-2-00
Serial number: Prototype
Hardware version: 1.1
Software release: 3.0.2.0
Receipt date 15-Sep-19

3 Manufacturer information

Manufacturer name: Triple Plus Ltd.
Address: 5 Hamada street, Yokneam 2069200, Israel
Telephone: +972-72-22-11-370
Fax: +972-4-959-3991
E-Mail: yuval.abraham@tripleplus.io
Contact name: Mr. Yuval Abraham

4 Test details

Project ID: 34184
Location: Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel
Test started: 06-Oct-19
Test completed: 15-Oct-19
Test specification(s): FCC 47CFR part 15, subpart C, §15.231;
RSS-210 issue 9 Annex A





5 Tests summary

| Test | Status |
|--------------------------------------------------------------------------------------|--------------|
| Transmitter characteristics | |
| FCC Part 15, Section 231(a) / RSS-210, Section A1.1, Periodic operation requirements | Pass |
| FCC Part 15, Section 231(a) / RSS-210, Section A1.2, Field strength of emissions | Pass |
| FCC Part 15, Section 231(c) / RSS-210, Section A1.3, Occupied bandwidth | Pass |
| FCC Part 15, Section 207 / RSS-Gen, Section 8.8, Conducted emission | Not required |
| FCC Part 15, Section 203 / RSS-Gen, Section 8.3, Antenna requirements | Pass |

This test report supersedes the previously issued test report identified by Doc ID: TRIRAD_FCC.34184.Flood_Detector

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 |
|---------------------|---------------------------------------------------|-----------------------|---------------------------------------------------------------------------------------|
| Tested by: | Mr. A. Morozov test engineer EMC & Radio | 06 Oct 19 – 15 Oct 19 |  |
| | Mr. E. Pitt test engineer EMC & Radio | |  |
| Reviewed by: | Mrs. S Peysahov Sheynin test engineer EMC & Radio | 20 Dec 19 – 07 Jan 20 |  |
| Approved by: | Mr. S. Samokha, technical manager, EMC and Radio | 09 Jan 20 |  |

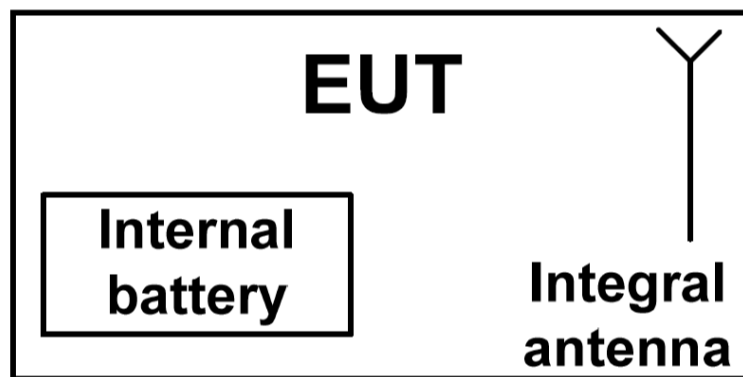
6 EUT description

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

6.1 General information

The CLM Flood Detector wireless and battery-operated Water Flood Sensor, part of the Tripleplus Cloud Leak management system. The device is installed in places where high chance of water flooding may occur. The device periodically checks for water leaks and notifies the Hub of the status. The unit is powered from 2xAAA non-rechargeable batteries and utilizes an ISM transceiver with integral antenna.

6.2 Test configuration



6.3 Changes made in EUT

No changes were implemented in the EUT during testing.

6.4 Transmitter characteristics

| | | | | | |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------|------------------------------------------------|------------------|-------------------------------------------------------------|--------------------------------|
| Type of equipment | | | | | |
| X | 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) | | | | |
| Operating frequencies | | 915 MHz | | | |
| Maximum rated output power | | At transmitter 50 Ω RF output connector | | dBm | |
| | | Field strength at 3 m distance | | 101.92 dB(μ V/m) -peak 78.32 dB(μ V/m)-average | |
| Is transmitter output power variable? | | X | No | | |
| | | | Yes | continuous variable | |
| | | | | stepped variable with stepsize | |
| | | | | dB | |
| | | | | minimum RF power | |
| | | | maximum RF power | | dBm |
| Antenna connection | | | | | |
| unique coupling | | standard connector | | X | integral |
| | | | | X | with temporary RF connector |
| | | | | X | without temporary RF connector |
| Antenna/s technical characteristics | | | | | |
| Type | | Manufacturer | | Model number | |
| Internal | | Triple Plus Ltd. | | MM000006 | |
| Type of modulation | | 2GFSK | | | |
| Transmitter aggregate data rate/s | | 38.4 kbps | | | |
| Transmitter power source | | | | | |
| X | Battery | Nominal rated voltage | | 3.0VDC | |
| | DC | Nominal rated voltage | | VDC | |
| | AC mains | Nominal rated voltage | | VAC | Frequency |
| Common power source for transmitter and receiver | | | | | |
| | | | | X | yes |
| | | | | | no |



| | | | |
|----------------------------|--------------------------------|---------------------------------------------------------------------------------------------|-----------------------|
| Test specification: | | FCC Part 15, Section 231(a) / RSS-210, Section A1.1, Periodic operation requirements | |
| Test procedure: | | Supplier declaration | |
| Test mode: | | Compliance | Verdict: PASS |
| Date(s): | | 10-Oct-19 | |
| Temperature: 23 °C | Relative Humidity: 48 % | Air Pressure: 1010 hPa | Power: Battery |
| Remarks: | | | |

7 Transmitter tests according to 47CFR part 15 subpart C requirements

7.1 Periodic operation requirements

7.1.1 General

The EUT was verified for compliance with periodic operation requirements listed below:

- Continuous transmissions such as voice, video and the radio control of toys are not permitted;
- A manually operated transmitter shall employ switch that will automatically deactivate the transmitter within not more than 5 seconds of being released;
- A transmitter activated automatically shall cease transmission within 5 seconds after activation;
- Periodic transmissions, excluding polling or supervision transmissions, at regular predetermined intervals are not permitted;
- Total duration of polling or supervision transmissions, including data, to determine system integrity in security or safety applications shall not exceed 2 seconds per hour;
- Transmission of set-up information for security systems may exceed the transmission duration limits of 5 seconds, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

The rationale for compliance with the above requirements was either test results or supplier declaration. The summary of results is provided in Table 7.1.1.

7.1.2 Test procedure for transmitter shut down test

7.1.2.1 The EUT was set up as shown in Figure 7.1.1.

7.1.2.2 The spectrum analyzer center frequency was adjusted to the EUT carrier, span set to zero and video triggered for transmission.

7.1.2.3 The transmitter was activated either manually or automatically. Once manually operated transmitter was activated, the switch was immediately released.

7.1.2.4 The transmission time was captured and shown in Plot 7.1.1.

7.1.3 Test procedure for measurements of polling / supervision transmission duration

7.1.3.1 The EUT was set up as shown in Figure 7.1.1.

7.1.3.2 The spectrum analyzer center frequency was adjusted to the EUT carrier, span set to zero and video triggered for transmission.

7.1.3.3 The transmission time was captured and shown in Plot 7.1.2, Plot 7.1.3.

Figure 7.1.1 Setup for transmitter shut down test



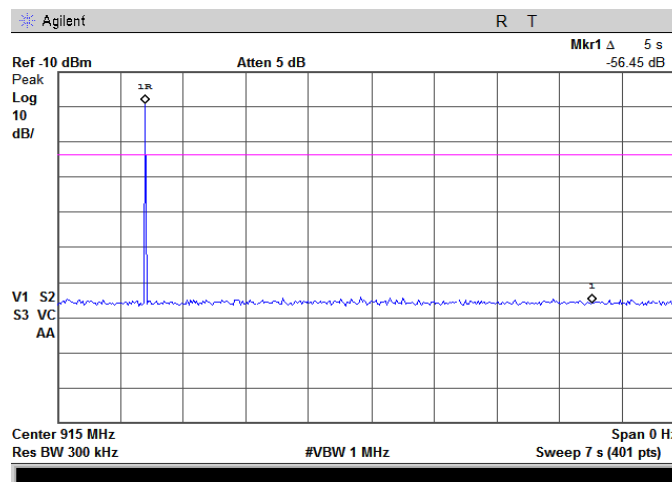


| | | | |
|---------------------|-------------------------|--------------------------------------------------------------------------------------|----------------|
| Test specification: | | FCC Part 15, Section 231(a) / RSS-210, Section A1.1, Periodic operation requirements | |
| Test procedure: | | Supplier declaration | |
| Test mode: | | Verdict: PASS | |
| Date(s): | | | |
| 10-Oct-19 | | | |
| Temperature: 23 °C | Relative Humidity: 48 % | Air Pressure: 1010 hPa | Power: Battery |
| Remarks: | | | |

Table 7.1.1 Periodic operation requirements

| Requirement | Rationale | Verdict |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------|
| Continuous transmissions are not permitted | Supplier declaration | Comply |
| A manually operated transmitter shall be deactivated within not more than 5 seconds of switch being released | NA | NA |
| Transmitter activated automatically shall cease transmission within 5 seconds | Plot 7.1.1 | Comply |
| Periodic transmissions at regular predetermined intervals are not permitted | Supplier declaration | Comply |
| Total duration of polling or supervision transmissions shall not exceed 2 seconds per hour | Plot 7.1.2, Plot 7.1.3 | Comply |
| Transmission of set-up information for security systems may exceed the transmission duration limits of 5 seconds, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data. | Supplier declaration | Comply |

Plot 7.1.1 Transmitter shut down test result





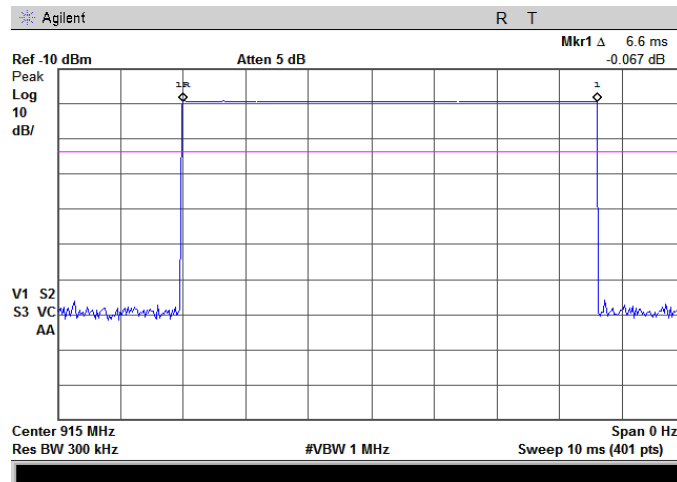
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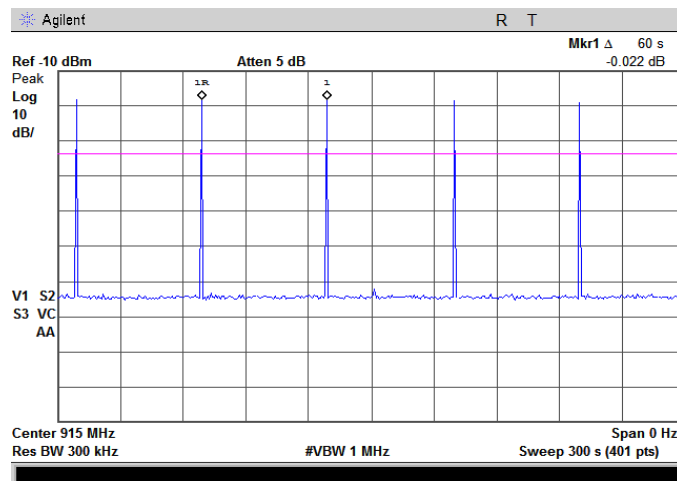
Date of Issue: 28-Jan-20

| | | | |
|----------------------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: FCC Part 15, Section 231(a) / RSS-210, Section A1.1, Periodic operation requirements | | | |
| Test procedure: Supplier declaration | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 10-Oct-19 | | | |
| Temperature: 23 °C | Relative Humidity: 48 % | Air Pressure: 1010 hPa | Power: Battery |
| Remarks: | | | |

Plot 7.1.2 Polling / supervision transmission duration



Plot 7.1.3 Total duration of polling / supervision transmissions





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Date of Issue: 28-Jan-20

| | | | |
|-----------------------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(a) / RSS-210, Section A1.1, Periodic operation requirements | | | |
| Test procedure: Supplier declaration | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 10-Oct-19 | | | |
| Temperature: 23 °C | Relative Humidity: 48 % | Air Pressure: 1010 hPa | Power: Battery |
| Remarks: | | | |

Table 7.1.2 Total duration of polling / supervision transmissions

| Duration, ms | Repetition period, sec | Maximum number of transmissions within 1 hour | Total duration within 1 hour, ms |
|-----------------|---------------------------|--------------------------------------------------|-------------------------------------|
| 6.6 | 60 | 60 | 396 |

Reference numbers of test equipment used

| | | | | | | | |
|---------|--|--|--|--|--|--|--|
| HL 2780 | | | | | | | |
|---------|--|--|--|--|--|--|--|

Full description is given in Appendix A.



| | | | |
|---------------------|-------------------------|----------------------------------------------------------------------------------|----------------|
| Test specification: | | FCC Part 15, Section 231(b) / RSS-210, Section A1.2, Field strength of emissions | |
| Test procedure: | | ANSI C63.10, Section 6.3 | |
| Test mode: | | Verdict: PASS | |
| Date(s): | | | |
| 06-Oct-19 | | | |
| Temperature: 24 °C | Relative Humidity: 41 % | Air Pressure: 1011 hPa | Power: Battery |
| Remarks: | | | |

7.2 Field strength of emissions

7.2.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.2.1 and Table 7.2.2.

Table 7.2.1 Radiated fundamental emission limits

| Fundamental frequency, MHz | Field strength at 3 m, dB(μV/m) | |
|----------------------------|---------------------------------|---------|
| | Peak | Average |
| 915.0 | 102.0 | 82.0 |

Table 7.2.2 Radiated spurious emissions limits

| Frequency, MHz | Field strength at 3 m, dB(μV/m) | | | | |
|----------------|---------------------------------|-----------------|-----------------|--------------------------|---------|
| | Within restricted bands | | | Outside restricted bands | |
| | Peak | Quasi Peak | Average | Peak | Average |
| 0.009 – 0.090 | 148.5 – 128.5 | NA | 128.5 – 108.5** | 82.0 | 62.0 |
| 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:

$$\text{Lims}_2 = \text{Lims}_1 + 40 \log (S_1/S_2),$$

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

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

Note 1: The fundamental emission limit in dB(μV/m) was calculated as follows:

$$\text{Lim}_{AVR} = 20 \times \log (56.81818 \times F - 6136.3636) \text{ - within } 130 - 174 \text{ MHz band;}$$

$$\text{Lim}_{AVR} = 20 \times \log (41.6667 \times F - 7083.3333) \text{ - within } 260 - 470 \text{ MHz band,}$$

where F is the carrier frequency in MHz.

The limit for spurious emissions was 20 dB lower than fundamental emission limit.

The above limits provided in terms of average values, peak limit was 20 dB above the average limit.

Note 2: 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.



| | | | |
|---------------------|-------------------------|----------------------------------------------------------------------------------|----------------|
| Test specification: | | FCC Part 15, Section 231(b) / RSS-210, Section A1.2, Field strength of emissions | |
| Test procedure: | | ANSI C63.10, Section 6.3 | |
| Test mode: | | Verdict: PASS | |
| Date(s): | | | |
| 06-Oct-19 | | | |
| Temperature: 24 °C | Relative Humidity: 41 % | Air Pressure: 1011 hPa | Power: Battery |
| Remarks: | | | |

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

7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and the performance check was conducted.

7.2.2.2 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.

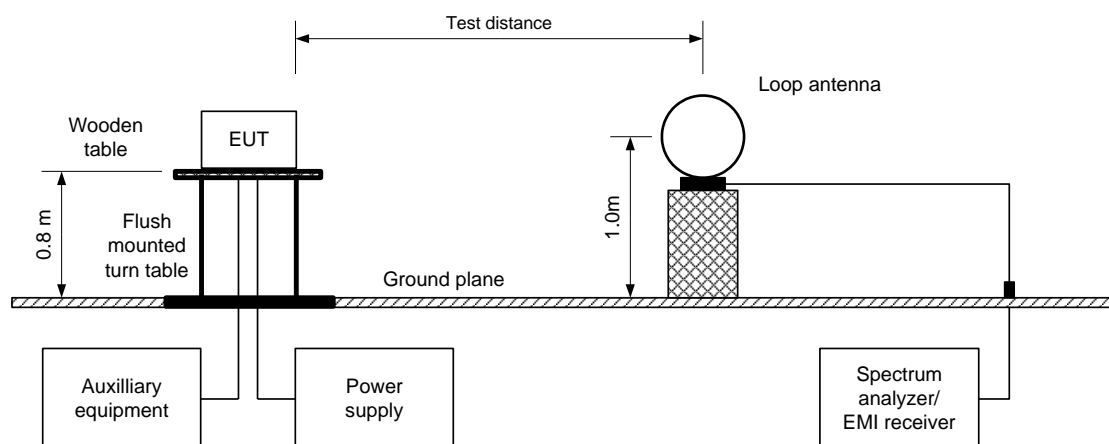
7.2.2.3 The worst test results (the lowest margins) recorded in Table 7.2.3, Table 7.2.5 and shown in the associated plots.

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

7.2.3.1 The EUT was set up as shown in Figure 7.2.2, Figure 7.2.3, energized and the performance check was conducted.

7.2.3.2 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.

7.2.3.3 The worst test results (the lowest margins) recorded in Table 7.2.3, Table 7.2.5 and shown in the associated plots.

Figure 7.2.1 Setup for spurious emission field strength measurements below 30 MHz



| | | | |
|------------------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: FCC Part 15, Section 231(b) / RSS-210, Section A1.2, Field strength of emissions | | | |
| Test procedure: ANSI C63.10, Section 6.3 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 06-Oct-19 | | | |
| Temperature: 24 °C | Relative Humidity: 41 % | Air Pressure: 1011 hPa | Power: Battery |
| Remarks: | | | |

Figure 7.2.2 Setup for spurious emission field strength measurements in 30 -1000 MHz

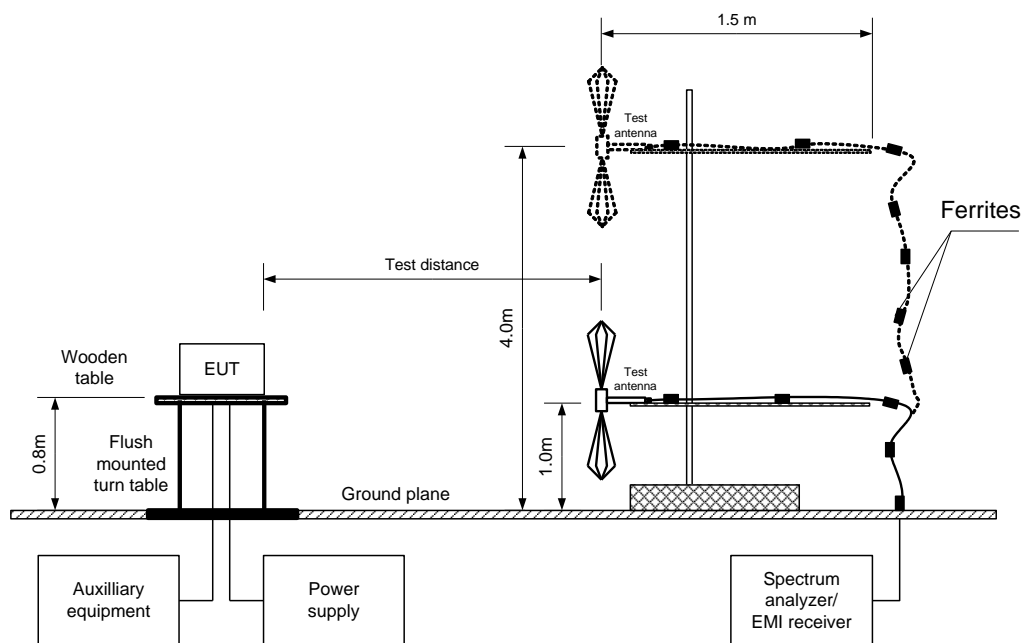
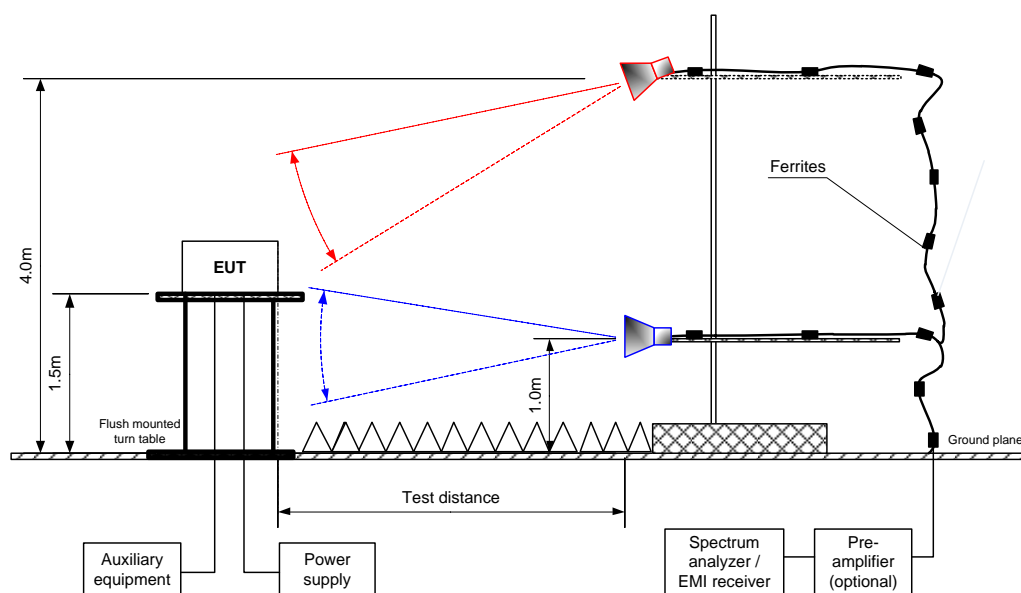


Figure 7.2.3 Setup for spurious emission field strength measurements above 1000 MHz





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| | | | |
|----------------------------|--------------------------------|-----------------------------------------------------------------------------------------|-----------------------|
| Test specification: | | FCC Part 15, Section 231(b) / RSS-210, Section A1.2, Field strength of emissions | |
| Test procedure: | | ANSI C63.10, Section 6.3 | |
| Test mode: | | Compliance | Verdict: PASS |
| Date(s): | | 06-Oct-19 | |
| Temperature: 24 °C | Relative Humidity: 41 % | Air Pressure: 1011 hPa | Power: Battery |
| Remarks: | | | |



| | | | |
|-------------------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(b) / RSS-210, Section A1.2, Field strength of emissions | | | |
| Test procedure: ANSI C63.10, Section 6.3 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 06-Oct-19 | | | |
| Temperature: 24 °C | Relative Humidity: 41 % | Air Pressure: 1011 hPa | Power: Battery |
| Remarks: | | | |

Table 7.2.3 Field strength of fundamental emission, spurious emissions outside restricted bands and within restricted bands at frequencies above 1 GHz

TEST DISTANCE: 3 m
EUT POSITION: Typical (Vertical)
MODULATION: 2GFSK
BIT RATE: 38.4 kbps
INVESTIGATED FREQUENCY RANGE: 0.009 - 9500 MHz
DETECTOR USED: Peak
RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz)
9.0 kHz (150 kHz – 30 MHz)
120 kHz (30 MHz – 1000 MHz)
1.0 MHz (above 1000 MHz)
VIDEO BANDWIDTH: ≥ Resolution bandwidth
TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
Biconilog (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)

| F, MHz | Antenna | | Azimuth, degrees* | Peak field strength | | | Average field strength | | | | Verdict |
|-------------------------|---------|-----------|-------------------|---------------------|-----------------|--------------|------------------------|----------------------|-----------------|--------------|---------|
| | Pol. | Height, m | | Measured, dB(μV/m) | Limit, dB(μV/m) | Margin, dB** | Measured, dB(μV/m) | Calculated, dB(μV/m) | Limit, dB(μV/m) | Margin, dB** | |
| Fundamental emission*** | | | | | | | | | | | |
| 915.000 | V | 1.0 | 199 | 101.92 | 102.0 | -0.08 | 101.92 | 78.32 | 82.0 | -3.68 | Pass |
| Spurious emissions | | | | | | | | | | | |
| 1830.136 | V | 1.26 | 190 | 43.08 | 82.0 | -30.92 | 43.08 | 19.48 | 62.0 | -42.52 | Pass |
| 2744.924 | H | 2.04 | 64 | 40.74 | 74.0 | -33.26 | 40.74 | 17.14 | 54.0 | -36.86 | |
| 3659.935 | V | 1.26 | 10 | 44.09 | 74.0 | -29.91 | 44.09 | 20.49 | 54.0 | -33.51 | |
| 4575.223 | H | 1.00 | 360 | 45.64 | 74.0 | -28.36 | 45.64 | 22.04 | 54.0 | -31.96 | |

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

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

Table 7.2.4 Average factor calculation

| Transmission pulse | | Transmission burst | | Transmission train duration, ms | Average factor, dB |
|--------------------|-------------|--------------------|------------|---------------------------------|--------------------|
| Duration, ms | Period, sec | Duration, ms | Period, ms | | |
| 6.6 | 60 | NA | NA | NA | -23.6 |

*- Average factor was calculated as follows
for pulse train shorter than 100 ms:

$$\text{Average factor} = 20 \times \log_{10} \left(\frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{Burst duration}}{\text{Train duration}} \times \text{Number of bursts within pulse train} \right)$$

for pulse train longer than 100 ms:

$$\text{Average factor} = 20 \times \log_{10} \left(\frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{Burst duration}}{100 \text{ ms}} \times \text{Number of bursts within 100 ms} \right)$$



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| | | | |
|---------------------|-------------------------|----------------------------------------------------------------------------------|----------------|
| Test specification: | | FCC Part 15, Section 231(b) / RSS-210, Section A1.2, Field strength of emissions | |
| Test procedure: | | ANSI C63.10, Section 6.3 | |
| Test mode: | | Verdict: PASS | |
| Date(s): | | | |
| 06-Oct-19 | | | |
| Temperature: 24 °C | Relative Humidity: 41 % | Air Pressure: 1011 hPa | Power: Battery |
| Remarks: | | | |

Table 7.2.5 Field strength of emissions below 1 GHz within restricted bands

TEST DISTANCE: 3 m
 EUT POSITION: Typical (Vertical)
 MODULATION: 2GFSK
 BIT RATE: 38.4 kbps
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz)
 9.0 kHz (150 kHz – 30 MHz)
 120 kHz (30 MHz – 1000 MHz)
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)

| DecimHz (50 MHz – 1000 MHz) | | | | | | | | |
|-----------------------------|-------------------------|-----------------------------|-----------------|-------------|----------------------|-------------------|--------------------------------|---------|
| Frequency, MHz | Peak emission, dB(μV/m) | Quasi-peak | | | Antenna polarization | Antenna height, m | Turn-table position**, degrees | Verdict |
| | | Measured emission, dB(μV/m) | Limit, dB(μV/m) | Margin, dB* | | | | |
| No emissions were found | | | | | | | | Pass |

*- Margin = Measured emission - specification limit.

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

Reference numbers of test equipment used

| | | | | | | | |
|---------|---------|---------|---------|---------|---------|--|--|
| HL 0446 | HL 3903 | HL 4360 | HL 4933 | HL 5288 | HL 5404 | | |
|---------|---------|---------|---------|---------|---------|--|--|

Full description is given in Appendix A.



| | | | |
|---------------------|-------------------------|----------------------------------------------------------------------------------|----------------|
| Test specification: | | FCC Part 15, Section 231(b) / RSS-210, Section A1.2, Field strength of emissions | |
| Test procedure: | | ANSI C63.10, Section 6.3 | |
| Test mode: | | Verdict: PASS | |
| Date(s): | | | |
| Temperature: 24 °C | Relative Humidity: 41 % | Air Pressure: 1011 hPa | Power: Battery |
| Remarks: | | | |

Table 7.2.6 Restricted bands according to FCC 15, Section 205

| MHz | MHz | MHz | MHz | MHz | GHz |
|-------------------|---------------------|-----------------------|-----------------|---------------|---------------|
| 0.09 - 0.11 | 8.37625 - 8.38675 | 73 - 74.6 | 399.9 - 410 | 2690 - 2900 | 10.6 - 12.7 |
| 0.495 - 0.505 | 8.41425 - 8.41475 | 74.8 - 75.2 | 608 - 614 | 3260 - 3267 | 13.25 - 13.4 |
| 2.1735 - 2.1905 | 12.290 - 12.293 | 108 - 121.94 | 960 - 1240 | 3332 - 3339 | 14.47 - 14.5 |
| 4.125 - 4.128 | 12.51975 - 12.52025 | 123 - 138 | 1300 - 1427 | 3345.8 - 3358 | 15.35 - 16.2 |
| 4.17725 - 4.17775 | 12.57675 - 12.57725 | 149.9 - 150.05 | 1435 - 1626.5 | 3600 - 4400 | 17.7 - 21.4 |
| 4.20725 - 4.20775 | 13.36 - 13.41 | 156.52475 - 156.52525 | 1645.5 - 1646.5 | 4500 - 5150 | 22.01 - 23.12 |
| 6.215 - 6.218 | 16.420 - 16.423 | 156.7 - 156.9 | 1660 - 1710 | 5350 - 5460 | 23.6 - 24 |
| 6.26775 - 6.26825 | 16.69475 - 16.69525 | 162.0125 - 167.17 | 1718.8 - 1722.2 | 7250 - 7750 | 31.2 - 31.8 |
| 6.31175 - 6.31225 | 16.80425 - 16.80475 | 167.72 - 173.2 | 2200 - 2300 | 8025 - 8500 | 36.43 - 36.5 |
| 8.291 - 8.294 | 25.5 - 25.67 | 240 - 285 | 2310 - 2390 | 9000 - 9200 | Above 38.6 |
| 8.362 - 8.366 | 37.5 - 38.25 | 322 - 335.4 | 2483.5 - 2500 | 9300 - 9500 | |

Table 7.2.7 Restricted bands according to RSS-Gen, Table 3

| MHz | MHz | MHz | MHz | MHz | GHz |
|-------------------|---------------------|-----------------------|-----------------|---------------|---------------|
| 0.09 - 0.11 | 8.291 - 8.294 | 16.80425 - 16.80475 | 399.9 - 410 | 3260 - 3267 | 10.6 - 12.7 |
| 2.1735 - 2.190 | 8.362 - 8.366 | 25.5 - 25.67 | 608 - 614 | 3332 - 3339 | 13.25 - 13.4 |
| 3.020 - 3.026 | 8.37625 - 8.38675 | 37.5 - 38.25 | 960 - 1427 | 3345.8 - 3358 | 14.47 - 14.5 |
| 4.125 - 4.128 | 8.41425 - 8.41475 | 73 - 74.6 | 1435 - 1626.5 | 3500 - 4400 | 15.35 - 16.2 |
| 4.17725 - 4.17775 | 12.290 - 12.293 | 74.8 - 75.2 | 1645.5 - 1646.5 | 4500 - 5150 | 17.7 - 21.4 |
| 4.20725 - 4.20775 | 12.51975 - 12.52025 | 108 - 138 | 1660 - 1710 | 5350 - 5460 | 22.01 - 23.12 |
| 5.677 - 5.683 | 12.57675 - 12.57725 | 156.52475 - 156.52525 | 1718.8 - 1722.2 | 7250 - 7750 | 23.6 - 24.0 |
| 6.215 - 6.218 | 13.36 - 13.41 | 156.7 - 156.9 | 2200 - 2300 | 8025 - 8500 | 31.2 - 31.8 |
| 6.26775 - 6.26825 | 16.42 - 16.423 | 240 - 285 | 2310 - 2390 | 9000 - 9200 | 36.43 - 36.5 |
| 6.31175 - 6.31225 | 16.69475 - 16.69525 | 322 - 335.4 | 2655 - 2900 | 9300 - 9500 | Above 38.6 |

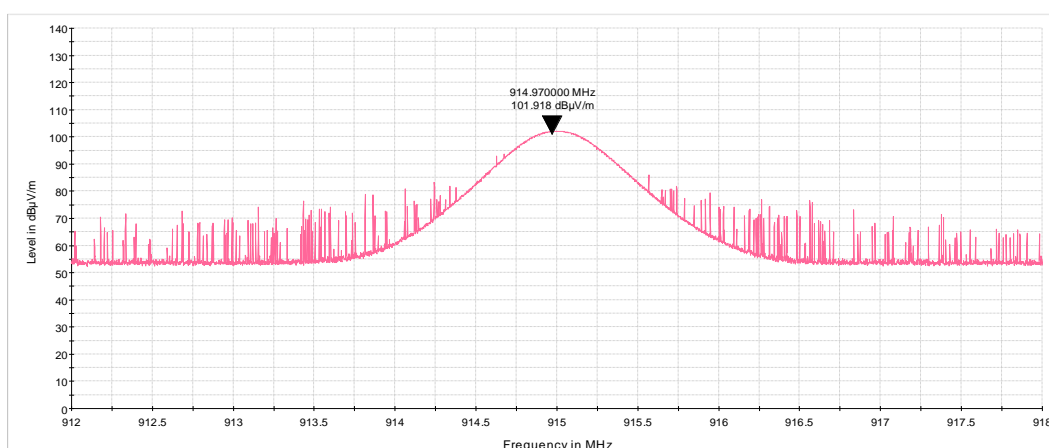


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| | | | |
|------------------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: FCC Part 15, Section 231(b) / RSS-210, Section A1.2, Field strength of emissions | | | |
| Test procedure: ANSI C63.10, Section 6.3 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 06-Oct-19 | | | |
| Temperature: 24 °C | Relative Humidity: 41 % | Air Pressure: 1011 hPa | Power: Battery |
| Remarks: | | | |

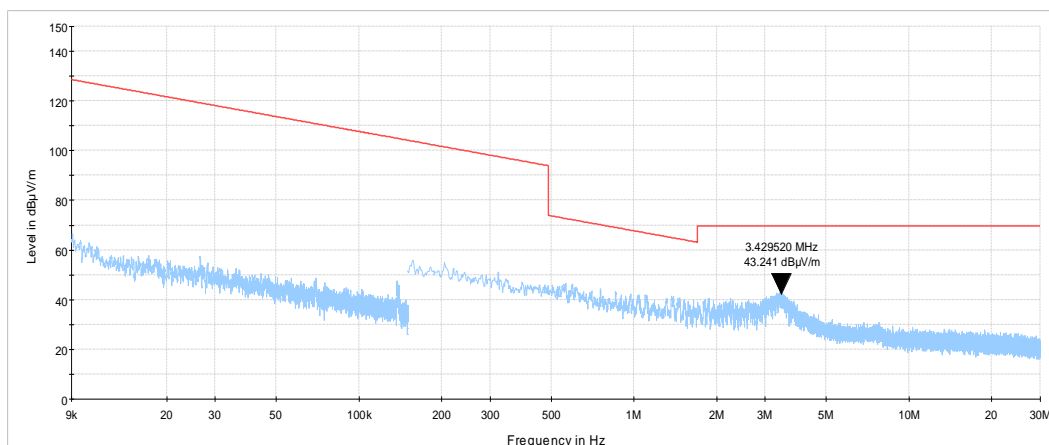
Plot 7.2.1 Radiated emission measurements at the fundamental frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and horizontal
EUT POSITION: Typical (Vertical)
INPUT VOLTAGE: Unom



Plot 7.2.2 Radiated emission measurements from 9 kHz to 30 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



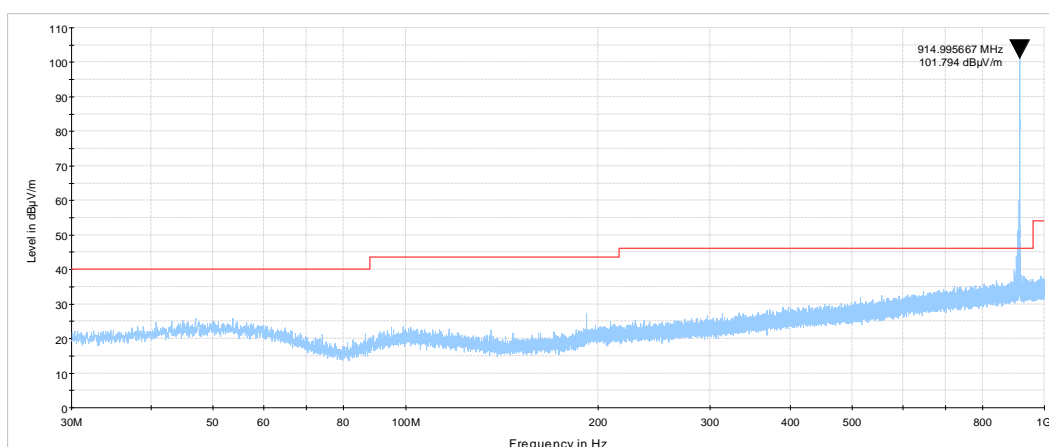


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| | | | |
|---------------------|-------------------------|----------------------------------------------------------------------------------|----------------|
| Test specification: | | FCC Part 15, Section 231(b) / RSS-210, Section A1.2, Field strength of emissions | |
| Test procedure: | | ANSI C63.10, Section 6.3 | |
| Test mode: | | Verdict: PASS | |
| Date(s): | | | |
| 06-Oct-19 | | | |
| Temperature: 24 °C | Relative Humidity: 41 % | Air Pressure: 1011 hPa | Power: Battery |
| Remarks: | | | |

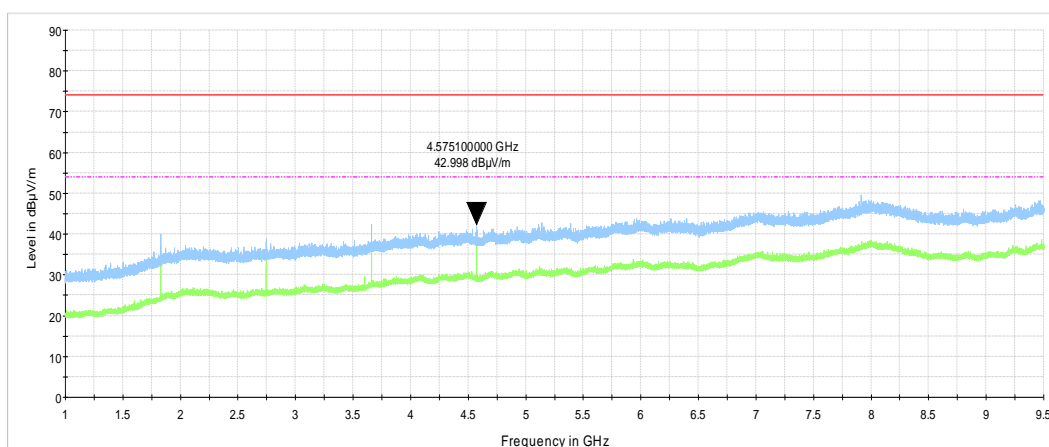
Plot 7.2.3 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical (Vertical)



Plot 7.2.4 Radiated emission measurements from 1000 to 9500 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical (Vertical)

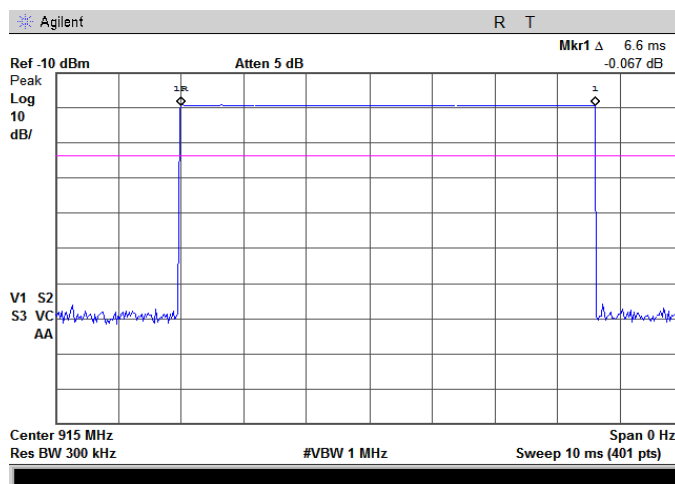




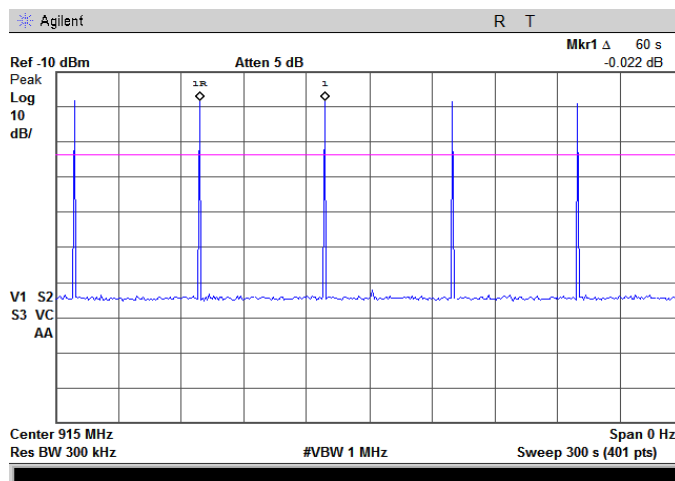
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| | | | |
|---------------------|-------------------------|----------------------------------------------------------------------------------|----------------|
| Test specification: | | FCC Part 15, Section 231(b) / RSS-210, Section A1.2, Field strength of emissions | |
| Test procedure: | | ANSI C63.10, Section 6.3 | |
| Test mode: | | Compliance | Verdict: PASS |
| Date(s): | | 06-Oct-19 | |
| Temperature: 24 °C | Relative Humidity: 41 % | Air Pressure: 1011 hPa | Power: Battery |
| Remarks: | | | |

Plot 7.2.5 Transmission pulse duration



Plot 7.2.6 Transmission pulse period





| | | | |
|---------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: FCC Part 15, Section 231(c) / RSS-210, Section A1.3, Occupied bandwidth | | | |
| Test procedure: ANSI C63.10, Section 6.9.2 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 11-Oct-19 | | | |
| Temperature: 23 °C | Relative Humidity: 48 % | Air Pressure: 1010 hPa | Power: Battery |
| Remarks: | | | |

7.3 Occupied bandwidth test

7.3.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Occupied bandwidth limits

| Assigned frequency, MHz | Modulation envelope reference points*, dBc | Maximum allowed bandwidth, % of the carrier frequency |
|-------------------------|--------------------------------------------|-------------------------------------------------------|
| 70 - 900 | 20.0 | 0.25 |
| Above 900 | | 0.50 |

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

7.3.2 Test procedure

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.

7.3.2.2 The EUT was set to transmit modulated carrier.

7.3.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.3.2 and associated plot.

Figure 7.3.1 Occupied bandwidth test setup





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| | | | |
|---------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: FCC Part 15, Section 231(c) / RSS-210, Section A1.3, Occupied bandwidth | | | |
| Test procedure: ANSI C63.10, Section 6.9.2 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 11-Oct-19 | | | |
| Temperature: 23 °C | Relative Humidity: 48 % | Air Pressure: 1010 hPa | Power: Battery |
| Remarks: | | | |

Table 7.3.2 Occupied bandwidth test results

DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 3 kHz
VIDEO BANDWIDTH: 30 kHz
MODULATION ENVELOPE REFERENCE POINTS: 20 dBc
MODULATION: 2GFSK
BIT RATE: 38.4 kbps

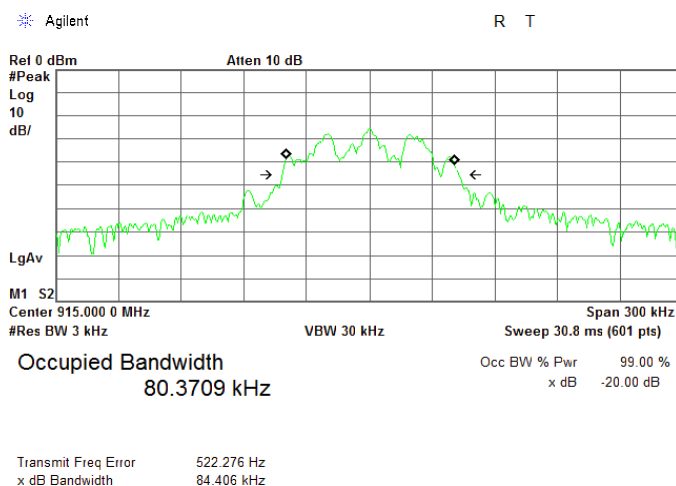
| Carrier frequency, MHz | Occupied bandwidth, kHz | Limit | | Margin, kHz | Verdict |
|------------------------|-------------------------|----------------------------|------|-------------|---------|
| | | % of the carrier frequency | kHz | | |
| 915 | 84.406 | 0.5 | 4575 | 4490.594 | Pass |

Reference numbers of test equipment used

| | | | | | | | | |
|---------|----|----|--|--|--|--|--|--|
| HL 3818 | HL | HL | | | | | | |
|---------|----|----|--|--|--|--|--|--|

Full description is given in Appendix A.

Plot 7.3.1 Occupied bandwidth test result



| | | | |
|----------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|---------------------|
| Test specification: FCC Part 15, Section 203 / RSS-Gen, Section 7.1.4, Antenna requirements | | | |
| Test procedure: Visual inspection / supplier declaration | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 15-Oct-19 | | | |
| Temperature: 23 °C | Relative Humidity: 43 % | Air Pressure: 1013 hPa | Power: 3 VDC |
| Remarks: | | | |

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 | Visual inspection | Comply |
| The transmitter employs a unique antenna connector | NA | |
| The transmitter requires professional installation | NA | |

Photograph 7.4.1 Antenna assembly



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 |
| 787 | Transient Limiter 9 kHz-200 MHz | Hewlett Packard | 11947A | 3107A01877 | 08-Oct-19 | 08-Oct-20 |
| 2780 | EMC analyzer, 100 Hz to 26.5 GHz | Agilent Technologies | E7405A | MY45102462 | 28-Feb-19 | 28-Feb-20 |
| 3016 | LISN, Two-line V-network, 9 kHz to 30 MHz, (50 uH+5 Ohm), CISPR16-1, MIL-461E | Rohde & Schwarz | ESH 3-Z5 | 892239/002 | 27-Jan-19 | 27-Jan-20 |
| 3818 | PSA Series Spectrum Analyzer, 3 Hz- 44 GHz | Agilent Technologies | E4446A | MY48250288 | 24-Apr-19 | 24-Apr-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 |
| 4360 | EMI Test Receiver, 20 Hz to 40 GHz. | Rohde & Schwarz | ESU40 | 100322 | 31-Dec-18 | 31-Dec-19 |
| 4778 | EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL4777 | Hewlett Packard | 8542E | 30807A00262, 3427A00123 | 28-Oct-18 | 28-Oct-19 |
| 4933 | Active Horn Antenna, 1 GHz to 18 GHz | COM-POWER CORPORATION | AHA-118 | 701046 | 06-Jan-19 | 06-Jan-20 |
| 5288 | Trilog Antenna, 25 MHz - 8 GHz, 100W | Frankonia | ALX-8000E | 00809 | 08-Feb-19 | 08-Feb-22 |
| 5404 | RF cable, 18 GHz, N-N, 6 m | Huber-Suhner | SF118/11 N(x2) | 500024/18 | 11-Aug-19 | 11-Aug-20 |
| 5476 | Cable, BNC/BNC, 10.5 m | Western wire | MIL-C-17G | NA | 30-Jan-19 | 30-Jan-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 μ V to obtain field strength in dB μ A/m.

HL 3016: LISN, Two-line V-network, 9 to 30 MHz, (50 uH+5 Ohm)
Rohde & Schwarz, model: ESH 3-Z5, s/n 892239/002, HL 3016

Voltage division factor (insertion loss)

| Frequency, | L1, dB | N, dB | Uncertainty, dB |
|------------|--------|-------|-----------------|
| 10 | 0.70 | 0.72 | ±0.12 |
| 15 | 0.43 | 0.42 | ±0.12 |
| 20 | 0.30 | 0.28 | ±0.12 |
| 25 | 0.23 | 0.21 | ±0.12 |
| 30 | 0.18 | 0.17 | ±0.08 |
| 40 | 0.15 | 0.12 | ±0.08 |
| 50 | 0.13 | 0.11 | ±0.08 |
| 60 | 0.12 | 0.10 | ±0.09 |
| 70 | 0.11 | 0.09 | ±0.09 |
| 80 | 0.10 | 0.08 | ±0.09 |
| 90 | 0.10 | 0.08 | ±0.09 |
| 100 | 0.10 | 0.08 | ±0.09 |
| 150 | 0.10 | 0.08 | ±0.09 |
| 170 | 0.10 | 0.08 | ±0.09 |
| 200 | 0.09 | 0.08 | ±0.09 |
| 250 | 0.09 | 0.08 | ±0.09 |
| 300 | 0.10 | 0.08 | ±0.09 |
| 350 | 0.10 | 0.09 | ±0.09 |
| 400 | 0.10 | 0.08 | ±0.09 |
| 500 | 0.11 | 0.08 | ±0.09 |
| 600 | 0.11 | 0.09 | ±0.09 |
| 700 | 0.11 | 0.09 | ±0.09 |
| 800 | 0.11 | 0.09 | ±0.09 |
| 900 | 0.12 | 0.10 | ±0.09 |
| 1000 | 0.12 | 0.10 | ±0.09 |
| 1200 | 0.13 | 0.10 | ±0.16 |
| 1500 | 0.13 | 0.12 | ±0.16 |
| 2000 | 0.15 | 0.13 | ±0.16 |
| 2500 | 0.17 | 0.14 | ±0.16 |
| 3000 | 0.18 | 0.15 | ±0.16 |
| 4000 | 0.21 | 0.19 | ±0.16 |
| 5000 | 0.25 | 0.21 | ±0.16 |
| 7000 | 0.38 | 0.32 | ±0.16 |
| 10000 | 0.49 | 0.40 | ±0.16 |
| 15000 | 0.82 | 0.72 | ±0.16 |
| 20000 | 1.03 | 0.87 | ±0.16 |
| 30000 | 1.34 | 0.98 | ±0.32 |

HL 4933 Active Horn Antenna, 1 GHz to 18 GHz
COM-POWER CORPORATION AHA-118 , s/n 701046 HL 4933

| Frequency, MHz | Measured antenna factor, dB/m | Frequency, MHz | Measured antenna factor, dB/m |
|----------------|-------------------------------|----------------|-------------------------------|
| 1000 | -16.1 | 3200 | -11.2 |
| 1050 | -16.0 | 3250 | -10.8 |
| 1100 | -15.1 | 3300 | -10.8 |
| 1150 | -16.4 | 3350 | -10.7 |
| 1200 | -16.0 | 3400 | -10.3 |
| 1250 | -15.6 | 3450 | -10.2 |
| 1300 | -15.1 | 3500 | -10.1 |
| 1350 | -14.8 | 3550 | -10.4 |
| 1400 | -15.1 | 3600 | -10.5 |
| 1450 | -15.1 | 3650 | -10.4 |
| 1500 | -15.5 | 3700 | -10.4 |
| 1550 | -15.2 | 3750 | -10.3 |
| 1600 | -14.7 | 3800 | -10.1 |
| 1650 | -14.4 | 3850 | -10.0 |
| 1700 | -14.4 | 3900 | -9.9 |
| 1750 | -14.0 | 3950 | -9.8 |
| 1800 | -13.6 | 4000 | -9.7 |
| 1850 | -12.7 | 4050 | -9.3 |
| 1900 | -11.9 | 4100 | -8.6 |
| 1950 | -11.9 | 4150 | -8.2 |
| 2000 | -11.8 | 4200 | -8.3 |
| 2050 | -11.3 | 4250 | -8.5 |
| 2100 | -11.3 | 4300 | -8.5 |
| 2150 | -11.7 | 4350 | -8.3 |
| 2200 | -12.3 | 4400 | -8.0 |
| 2250 | -12.3 | 4450 | -7.7 |
| 2300 | -12.4 | 4500 | -7.6 |
| 2350 | -12.2 | 4550 | -7.4 |
| 2400 | -11.7 | 4600 | -7.5 |
| 2450 | -11.5 | 4650 | -7.8 |
| 2500 | -11.5 | 4700 | -7.6 |
| 2550 | -11.5 | 4750 | -6.8 |
| 2600 | -11.5 | 4800 | -6.1 |
| 2650 | -11.3 | 4850 | -5.7 |
| 2700 | -11.3 | 4900 | -5.8 |
| 2750 | -11.1 | 4950 | -5.8 |
| 2800 | -11.1 | 5000 | -6.0 |
| 2850 | -11.3 | 5050 | -5.7 |
| 2900 | -11.1 | 5100 | -5.4 |
| 2950 | -11.0 | 5150 | -5.1 |
| 3000 | -11.1 | 5200 | -4.6 |
| 3050 | -10.9 | 5250 | -4.6 |
| 3100 | -10.7 | 5300 | -4.8 |
| 3150 | -10.6 | 5350 | -5.1 |



| Frequency, MHz | Measured antenna factor, dB/m | Frequency, MHz | Measured antenna factor, dB/m |
|----------------|-------------------------------|----------------|-------------------------------|
| 5400 | -5.1 | 8300 | 0.8 |
| 5450 | -4.6 | 8350 | 0.5 |
| 5500 | -4.0 | 8400 | 0.3 |
| 5550 | -3.5 | 8450 | 0.5 |
| 5600 | -3.1 | 8500 | 0.8 |
| 5650 | -3.3 | 8550 | 0.9 |
| 5700 | -3.8 | 8600 | 0.9 |
| 5750 | -4.3 | 8650 | 0.6 |
| 5800 | -4.3 | 8700 | 0.0 |
| 5850 | -4.0 | 8750 | -0.3 |
| 5900 | -3.5 | 8800 | 0.0 |
| 5950 | -3.2 | 8850 | 0.5 |
| 6000 | -3.2 | 8900 | 0.6 |
| 6050 | -3.2 | 8950 | 0.4 |
| 6100 | -3.3 | 9000 | -0.3 |
| 6150 | -3.3 | 9050 | -1.0 |
| 6200 | -3.1 | 9100 | -1.2 |
| 6250 | -2.9 | 9150 | -0.6 |
| 6300 | -2.8 | 9200 | -0.1 |
| 6350 | -3.0 | 9250 | 0.0 |
| 6400 | -3.2 | 9300 | -0.1 |
| 6450 | -3.4 | 9350 | -0.5 |
| 6500 | -3.7 | 9400 | -0.7 |
| 6550 | -3.6 | 9450 | -0.4 |
| 6600 | -3.4 | 9500 | 0.2 |
| 6650 | -2.9 | 9550 | 0.5 |
| 6700 | -2.6 | 9600 | 0.5 |
| 6750 | -2.5 | 9650 | 0.3 |
| 6800 | -2.6 | 9700 | 0.0 |
| 6850 | -2.8 | 9750 | 0.0 |
| 6900 | -2.7 | 9800 | 0.6 |
| 6950 | -2.3 | 9850 | 1.4 |
| 7000 | -2.0 | 9900 | 1.8 |
| 7050 | -1.9 | 9950 | 1.7 |
| 7100 | -1.8 | 10000 | 1.4 |
| 7150 | -1.8 | 10100 | 0.8 |
| 7200 | -1.7 | 10200 | 1.2 |
| 7250 | -1.7 | 10300 | 1.5 |
| 7300 | -1.6 | 10400 | 1.1 |
| 7350 | -1.5 | 10500 | 1.6 |
| 7400 | -1.5 | 10600 | 3.0 |
| 7450 | -1.3 | 10700 | 2.9 |
| 7500 | -1.4 | 10800 | 1.3 |
| 7550 | -1.3 | 10900 | 1.0 |
| 7600 | -1.0 | 11000 | 1.1 |
| 7650 | -0.7 | 11100 | 0.7 |
| 7700 | -0.3 | 11200 | 1.1 |
| 7750 | 0.1 | 11300 | 1.5 |
| 7800 | 0.3 | 11400 | 1.4 |
| 7850 | 0.4 | 11500 | 0.6 |
| 7900 | 0.2 | 11600 | 1.0 |
| 7950 | 0.1 | 11700 | 1.4 |
| 8000 | 0.2 | 11800 | 0.7 |
| 8050 | 0.3 | 11900 | 0.9 |
| 8100 | 0.8 | 12000 | 2.1 |
| 8150 | 1.1 | 12100 | 2.1 |
| 8200 | 1.1 | 12200 | 0.9 |
| 8250 | 1.0 | 12300 | 1.6 |
| 12400 | 2.1 | | |
| 12500 | 1.2 | | |
| 12600 | 1.3 | | |
| 12700 | 2.4 | | |



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| | |
|-------|-----|
| 12800 | 1.8 |
| 12900 | 0.6 |
| 13000 | 0.9 |
| 13100 | 1.1 |
| 13200 | 0.7 |
| 13300 | 0.9 |
| 13400 | 1.8 |
| 13500 | 2.1 |
| 13600 | 1.2 |
| 13700 | 0.8 |
| 13800 | 1.2 |
| 13900 | 1.5 |
| 14000 | 1.7 |
| 14100 | 2.2 |
| 14200 | 2.8 |
| 14300 | 3.0 |
| 14400 | 3.0 |
| 14500 | 3.3 |
| 14600 | 4.0 |
| 14700 | 5.4 |
| 14800 | 5.4 |
| 14900 | 4.7 |
| 15000 | 3.1 |
| 15100 | 2.0 |
| 15200 | 1.5 |
| 15300 | 1.4 |
| 15400 | 1.7 |
| 15500 | 1.9 |
| 15600 | 1.2 |
| 15700 | 0.2 |
| 15800 | 0.6 |
| 15900 | 1.2 |
| 16000 | 0.6 |
| 16100 | 0.6 |
| 16200 | 1.9 |
| 16300 | 2.2 |
| 16400 | 0.9 |
| 16500 | 0.7 |
| 16600 | 1.7 |
| 16700 | 1.3 |
| 16800 | 1.0 |
| 16900 | 2.0 |
| 17000 | 2.4 |
| 17100 | 1.8 |
| 17200 | 1.8 |
| 17300 | 2.5 |
| 17400 | 2.7 |
| 17500 | 3.1 |
| 17600 | 3.7 |
| 17700 | 4.3 |
| 17800 | 4.8 |
| 17900 | 5.7 |
| 18000 | 5.1 |

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 μ V to obtain field strength in dB μ 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 μ V to obtain field strength in dB μ V/m.

10 APPENDIX C 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-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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11 APPENDIX D 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: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB |
| Radiated emissions at 10 m measuring distance Horizontal polarization Vertical polarization | Biconilog antenna: ± 5.0 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.1 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 5.5 dB Biconical antenna: ± 5.5 dB Log periodic antenna: ± 5.6 dB Double ridged horn antenna: ± 5.8 dB |
| Radiated emissions at 3 m measuring distance Horizontal polarization Vertical polarization | Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB |
| Conducted emissions at RF antenna connector | 9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB |
| Duty cycle, timing (Tx ON / OFF) and average factor measurements | ± 1.0 % |
| Occupied bandwidth | ± 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.

12 APPENDIX E

Specification references

47CFR part 15: 2019

Radio Frequency Devices

ANSI C63.10: 2013

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

ANSI C63.4: 2014

American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

RSS-210 Issue 9: 2018

Licence- Exempt Radio Apparatus:Category I Equipment

13 APPENDIX F

Abbreviations and acronyms

| | |
|----------------|---------------------------------------------|
| A | ampere |
| AC | alternating current |
| AM | amplitude modulation |
| AVRG | average (detector) |
| cm | centimeter |
| dB | decibel |
| dBm | decibel referred to one milliwatt |
| dB(μ V) | decibel referred to one microvolt |
| dB(μ V/m) | decibel referred to one microvolt per meter |
| dB(μ 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 |
| μ s | microsecond |
| NA | not applicable |
| NB | narrow band |
| OATS | open area test site |
| Ω | 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