

TEST REPORT

ACCORDING TO: FCC 47CFR part 15 subpart C §15.247 (FHSS) and subpart B,
RSS-247 Issue 2:2017, RSS-Gen Issue 5:2018, ICES-003 Issue 6:2016

FOR:

Visonic Ltd.

Outdoor PIR Detector

Model: MP-902 PG2

FCC ID: WP3MP902PG2

IC: 1467C-MP902PG2

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1 Applicant information

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Contact name: Mr. Zuri Rubin

2 Equipment under test attributes

Product name: Outdoor PIR Detector
Product type: Transceiver
Model: MP-902 PG2
Serial number: N/A
Hardware version: 90-208775
Software release: JS-703461
Receipt date: 24-May-18

3 Manufacturer information

Manufacturer name: Visonic Ltd.
Address: 24 Habarzel street, Tel Aviv 69710, Israel
Telephone: +972 3645 6832
Fax: +972 3645 6788
E-Mail: zuri.rubin@jci.com
Contact name: Mr. Zuri Rubin

4 Test details

Project ID: 31036
Location: Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel
Test started: 05-Jun-18
Test completed: 13-Jun-18
Test specifications: FCC 47CFR part 15 subpart C §15.247 (FHSS) and subpart B, RSS-247 Issue 2:2017, RSS-Gen Issue 5:2018, ICES-003 Issue 6:2016




5 Tests summary

| Test | Status |
|--|---|
| Transmitter characteristics | |
| Section 15.247(a)1 / RSS-247 section 5.1(c), 20 dB bandwidth | Pass |
| Section 15.247(a)1 / RSS-247 section 5.1(b), Frequency separation | Pass |
| Section 15.247(a)1 / RSS-247 section 5.1(c), Number of hopping frequencies | Pass |
| Section 15.247(a)1 / RSS-247 section 5.1(c), Average time of occupancy | Pass |
| Section 15.247(b) / RSS-247 section 5.4(a), Peak output power | Pass |
| Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions | Pass |
| Section 15.247(d) / RSS-247 section 5.5, Emissions at band edges | Pass |
| Section 15.247(i)5 / RSS-102 section 2.5, RF exposure | Pass, the exhibit to the application of certification is provided |
| Section 15.203 / RSS-Gen section 8.3, Antenna requirements | Pass |
| Section 15.207(a) / RSS-Gen section 8.8, Conducted emission | Not required |
| Unintentional emissions | |
| Section 15.107/ICES-003, Section 6.1, Class B, Conducted emission at AC power port | Not required |
| Section 15.109/ RSS-Gen section 7.1.2 /ICES-003, Section 6.2, Class B, Radiated emission | Pass |

This test report supersedes the previously issued test report identified by Doc ID:VISRAD_FCC.31036.

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: | Mrs. E. Pitt, test engineer | 05-Jun-18 – 13-Jun-18 |  |
| Reviewed by: | Mrs. Y. Rapin, technical writer | 18-Oct-18 |  |
| Approved by: | Mr. K. Zushchuk, project and customer manager, EMC and radio group | 18-Oct-18 |  |

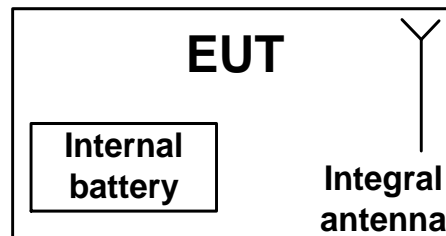


6 EUT description

6.1 General information

The EUT is a an outdoor PIR detector operating at 912.750 – 919.106 MHz. The EUT is equipped with an integral antenna and is powered from 3 VDC internal battery.

6.2 Test configuration



6.3 Changes made in EUT

No changes were implemented in the EUT during the 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) | | | | | |
| Intended use | | Condition of use | | | | |
| | fixed | Always at a distance more than 2 m from all people | | | | |
| X | mobile | Always at a distance more than 20 cm from all people | | | | |
| | portable | May operate at a distance closer than 20 cm to human body | | | | |
| Assigned frequency ranges | | 902 – 928 MHz | | | | |
| Operating frequencies | | 912.750 – 919.106 MHz | | | | |
| Maximum rated output power | | At transmitter 50 Ω RF output connector | | | dBm | |
| | | Peak output power | | | 19.717 dBm | |
| Is transmitter output power variable? | | X | No | | | |
| | | | Yes | | continuous variable | |
| | | | | | stepped variable with stepsize | dB |
| | | | | | minimum RF power | dBm |
| | | | 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 | | |
| Helical | | Ocean | | Visonic P.N - H-302031 | | |
| Gain | | -1 dBi | | | | |
| Transmitter aggregate data rate/s | | 50 kbps | | | | |
| Type of modulation | | GFSK | | | | |
| Modulating test signal (baseband) | | PRBS | | | | |
| Transmitter power source | | | | | | |
| X | Battery | Nominal rated voltage | 6.0 VDC | Battery type | CR123A (2 batteries in series) | |
| | DC | Nominal rated voltage | | | | |
| | AC mains | Nominal rated voltage | | Frequency | | |
| Common power source for transmitter and receiver | | | | X | yes | |
| | | | | | no | |
| Spread spectrum technique used | | X | Frequency hopping (FHSS) | | | |
| | | | Digital transmission system (DTS) | | | |
| | | | Hybrid | | | |
| Spread spectrum parameters for transmitters tested per FCC 15.247 only | | | | | | |
| FHSS | Total number of hops | | 50 | | | |
| | Bandwidth per hop | | 106.688 kHz | | | |
| | Max. separation of hops | | 130.833 kHz | | | |



| | | | |
|----------------------------|--|-------------------------------|---------------------|
| Test specification: | Section 15.247(a)1, RSS-247 section 5.1(c), 20 dB bandwidth | | |
| Test procedure: | ANSI C63.10, section 7.8.7 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 05-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

7 Transmitter tests according to 47CFR part 15 subpart C and RSS-247 requirements

7.1 20 dB bandwidth

7.1.1 General

This test was performed to measure the 20 dB bandwidth of the transmitter hopping channel. Specification test limits are given in Table 7.1.1.

Table 7.1.1 The 20 dB bandwidth limits

| Assigned frequency, MHz | Maximum bandwidth, kHz | Modulation envelope reference points*, dBc |
|-------------------------|------------------------|--|
| 902.0 – 928.0 | 250 | 20 |
| 2400.0 – 2483.5 | NA | |
| 5725.0 – 5850.0 | 1000 | |

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

7.1.2 Test procedure

7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.

7.1.2.2 The EUT was set to transmit modulated carrier at maximum data rate.

7.1.2.3 The transmitter bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.1.2 and associated plot.

7.1.2.4 The test was repeated for each data rate and each modulation format.

Figure 7.1.1 The 20 dB bandwidth test setup





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| | | | |
|----------------------------|--|-------------------------------|---------------------|
| Test specification: | Section 15.247(a)1, RSS-247 section 5.1(c), 20 dB bandwidth | | |
| Test procedure: | ANSI C63.10, section 7.8.7 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 05-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

Table 7.1.2 The 20 dB bandwidth test results

ASSIGNED FREQUENCY BAND: 902.0 – 928.0 MHz
 DETECTOR USED: Peak
 SWEEP TIME: Auto
 VIDEO BANDWIDTH: ≥ RBW
 MODULATION ENVELOPE REFERENCE POINTS: 20.0 dBc
 FREQUENCY HOPPING: Disabled

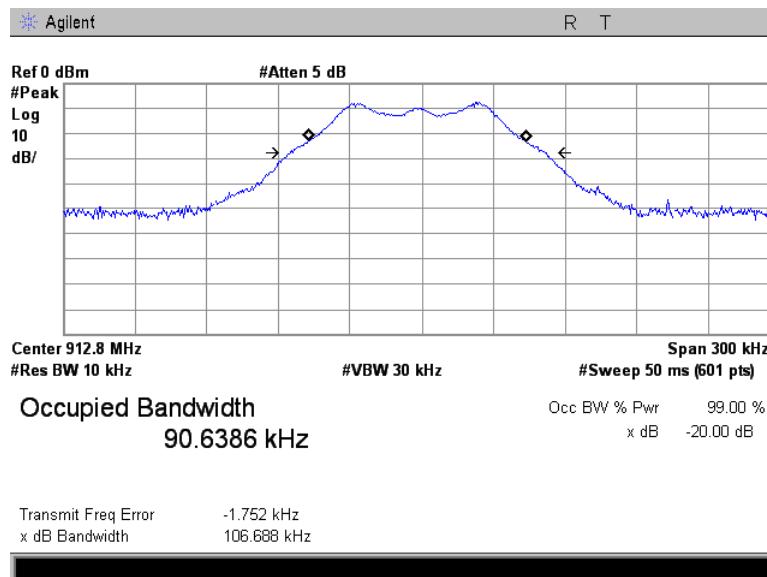
| Carrier frequency, MHz | Type of modulation | Data rate, kbps | 99% BW | 20 dB bandwidth, kHz | Limit, kHz | Margin, kHz | Verdict |
|------------------------|--------------------|-----------------|---------|----------------------|------------|-------------|---------|
| 912.750 | GFSK | 50 | 90.6386 | 106.688 | 250 | -143.312 | Pass |
| 915.863 | | | 90.3821 | 105.859 | 250 | -144.141 | Pass |
| 919.106 | | | 90.6075 | 106.383 | 250 | -143.617 | Pass |

Reference numbers of test equipment used

| | | | | | | | | |
|---------|---------|--|--|--|--|--|--|--|
| HL 2909 | HL 4135 | | | | | | | |
|---------|---------|--|--|--|--|--|--|--|

Full description is given in Appendix A.

Plot 7.1.1 The 20 dB bandwidth test result at low frequency





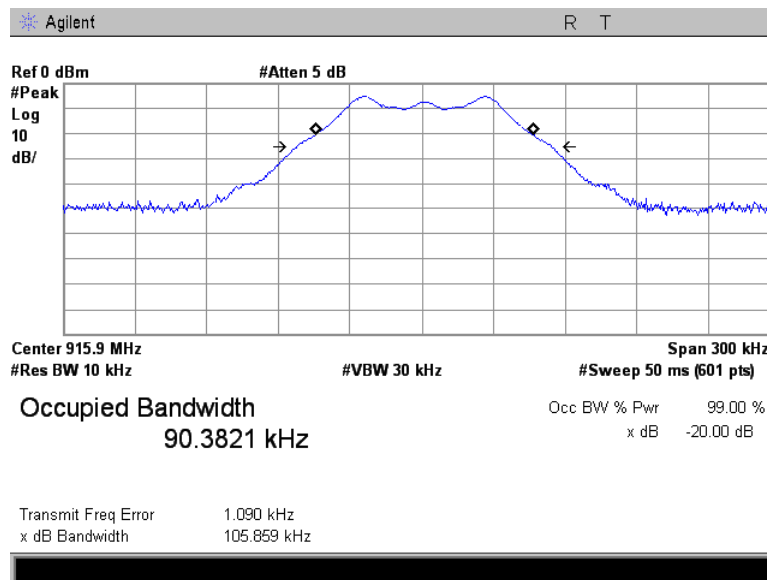
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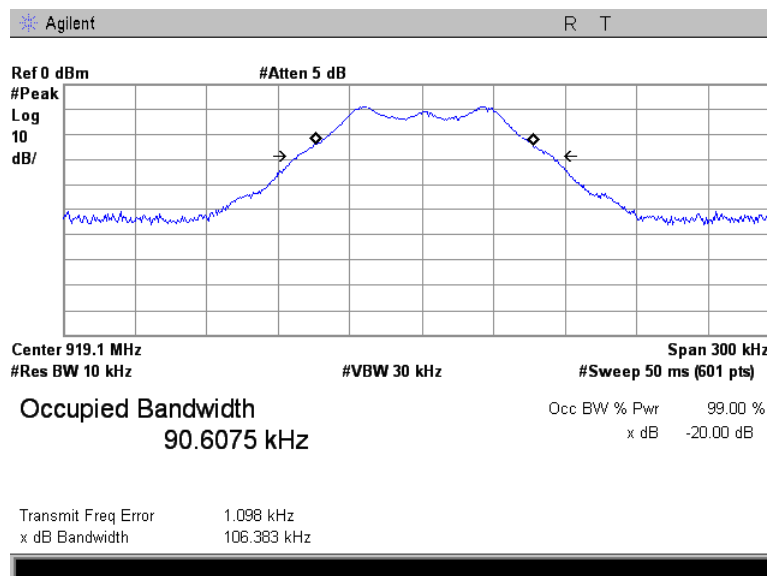
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| | | | |
|---------------------|---|------------------------|--------------|
| Test specification: | Section 15.247(a)1, RSS-247 section 5.1(c), 20 dB bandwidth | | |
| Test procedure: | ANSI C63.10, section 7.8.7 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 05-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

Plot 7.1.2 The 20 dB bandwidth test result at mid frequency



Plot 7.1.3 The 20 dB bandwidth test result at high frequency





| | | | |
|----------------------------|---|-------------------------------|---------------------|
| Test specification: | Section 15.247(a)1, RSS-247 section 5.1(b), Frequency separation | | |
| Test procedure: | ANSI C63.10, section 7.8.2 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 05-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

7.2 Carrier frequency separation

7.2.1 General

This test was performed to measure frequency separation between the peaks of adjacent channels. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Carrier frequency separation limits

| Assigned frequency range, MHz | Carrier frequency separation | |
|----------------------------------|--|--|
| | Output power 30 dBm | Output power 21 dBm |
| 902.0 – 928.0 | 25 kHz or 20 dB bandwidth of the hopping channel, whichever is greater | 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater |
| 2400.0 – 2483.5 | | |
| 5725.0 – 5850.0 | | |

7.2.2 Test procedure

- 7.2.2.1** The EUT was set up as shown in Figure 7.2.1, energized with frequency hopping function enabled and its proper operation was checked.
- 7.2.2.2** The spectrum analyzer span was set to capture the carrier frequency and both of adjacent channels, the lower and the higher. The resolution bandwidth was set wider than 1 % of the frequency span.
- 7.2.2.3** The spectrum analyzer was set in max hold mode and allowed trace to stabilize.
- 7.2.2.4** The frequency separation between the peaks of adjacent channels was measured as provided in Table 7.2.2 and associated plots.

Figure 7.2.1 Carrier frequency separation test setup





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| | | | |
|----------------------------|---|-------------------------------|---------------------|
| Test specification: | Section 15.247(a)1, RSS-247 section 5.1(b), Frequency separation | | |
| Test procedure: | ANSI C63.10, section 7.8.2 | | |
| Test mode: | Compliance | Verdict: PASS | |
| Date(s): | 05-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

Table 7.2.2 Carrier frequency separation test results

ASSIGNED FREQUENCY: 902-928 MHz
 MODULATION: GFSK
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: $\geq 1\%$ of the span
 VIDEO BANDWIDTH: \geq RBW
 FREQUENCY HOPPING: Enabled
 20 dB BANDWIDTH: 106.688 kHz

| Carrier frequency separation, kHz | Limit, kHz | Margin* | Verdict |
|-----------------------------------|------------|---------|---------|
| 130.833 | 106.688 | 24.145 | Pass |

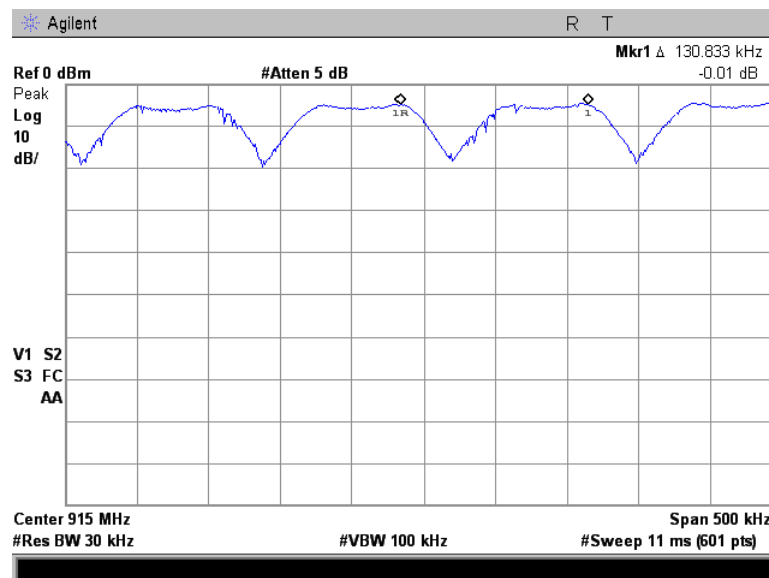
* - Margin = Carrier frequency separation – specification limit.

Reference numbers of test equipment used

| | | | | | | | |
|---------|---------|--|--|--|--|--|--|
| HL 2909 | HL 4135 | | | | | | |
|---------|---------|--|--|--|--|--|--|

Full description is given in Appendix A.

Plot 7.2.1 Carrier frequency separation





| | | | |
|----------------------------|--|-------------------------------|---------------------|
| Test specification: | Section 15.247(a)1, RSS-247 section 5.1(c), Number of hopping frequencies | | |
| Test procedure: | ANSI C63.10, section 7.8.3 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 05-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1010 hPa | Power: 3 VDC |
| Remarks: | | | |

7.3 Number of hopping frequencies

7.3.1 General

This test was performed to calculate the number of hopping frequencies used by the EUT. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Minimum number of hopping frequencies

| Assigned frequency range, MHz | Number of hopping frequencies |
|-------------------------------|---|
| 902.0 – 928.0 | 50 (if the 20 dB bandwidth is less than 250 kHz) 25 (if the 20 dB bandwidth is 250 kHz or greater) |
| 2400.0 – 2483.5 | 15 |
| 5725.0 – 5850.0 | 75 |

7.3.2 Test procedure

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized with frequency hopping function enabled and its proper operation was checked.

7.3.2.2 Initially the spectrum analyzer span was set equal to frequency band of operation and the resolution bandwidth was set wider than 1 % of the frequency span. If the separate hopping channels were not clearly resolved the frequency band of operation was broken to sections and the resolution bandwidth was set wider than 1 % of the frequency span of each section.

7.3.2.3 The spectrum analyzer was set in max hold mode and allowed trace to stabilize.

7.3.2.4 The number of frequency hopping channels was calculated as provided in Table 7.3.2 and associated plots.

Figure 7.3.1 Hopping frequencies test setup





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| | | | |
|---------------------|---|------------------------|--------------|
| Test specification: | Section 15.247(a)1, RSS-247 section 5.1(c), Number of hopping frequencies | | |
| Test procedure: | ANSI C63.10, section 7.8.3 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 05-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1010 hPa | Power: 3 VDC |
| Remarks: | | | |

Table 7.3.2 Hopping frequencies test results

ASSIGNED FREQUENCY: 902.0 – 928.0 MHz
MODULATION: GFSK
DETECTOR USED: Peak
RESOLUTION BANDWIDTH: $\geq 1\%$ of the span
VIDEO BANDWIDTH: \geq RBW
FREQUENCY HOPPING: Enabled

| Number of hopping frequencies | Minimum number of hopping frequencies | Margin* | Verdict |
|-------------------------------|---------------------------------------|---------|---------|
| 50 | 50 | 0 | Pass |

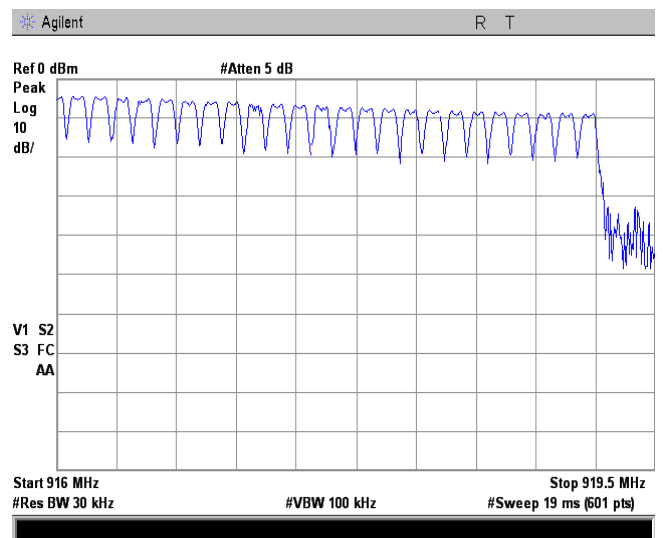
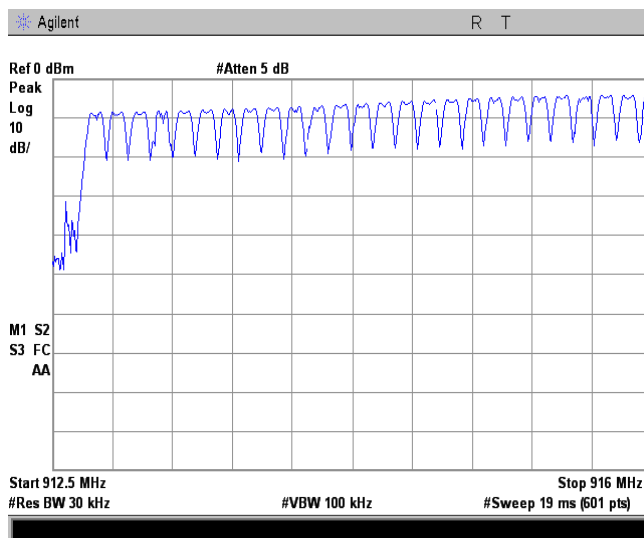
* - Margin = Number of hopping frequencies – Minimum number of hopping frequencies.

Reference numbers of test equipment used

| | | | | | | | |
|---------|---------|--|--|--|--|--|--|
| HL 3818 | HL 4136 | | | | | | |
|---------|---------|--|--|--|--|--|--|

Full description is given in Appendix A.

Plot 7.3.1 Number of hopping frequencies





| | | | |
|----------------------------|--|-------------------------------|---------------------|
| Test specification: | Section 15.247(a)1, RSS-247 section 5.1(c), Average time of occupancy | | |
| Test procedure: | ANSI C63.10, section 7.8.4 | | |
| Test mode: | Compliance | Verdict: PASS | |
| Date(s): | 13-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

7.4 Average time of occupancy

7.4.1 General

This test was performed to calculate the average time of occupancy (dwell time) on any frequency channel of the EUT. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Average time of occupancy limits

| Assigned frequency range, MHz | Maximum average time of occupancy, s | Investigated period, s | Number of hopping frequencies |
|-------------------------------|--------------------------------------|------------------------|-------------------------------|
| 902.0 – 928.0 | 0.4 | 20.0 | ≥ 50 |
| 902.0 – 928.0 | 0.4 | 10.0 | < 50 |
| 2400.0 – 2483.5 | 0.4 | 0.4 × N | N (≥ 15) |
| 5725.0 – 5850.0 | 0.4 | 30.0 | ≥ 75 |

7.4.2 Test procedure

7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized with frequency hopping function enabled and its proper operation was checked.

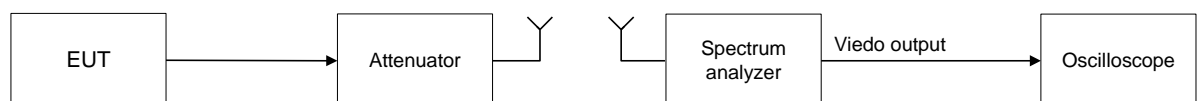
7.4.2.2 The spectrum analyzer span was set to zero centered on a hopping channel.

7.4.2.3 The single transmission duration and period were measured with oscilloscope.

7.4.2.4 The average time of occupancy was calculated as the single transmission time multiplied by the investigated period and divided by the single transmission period.

7.4.2.5 The test was repeated at each data rate and modulation type as provided in Table 7.4.2 and associated plots.

Figure 7.4.1 Average time of occupancy test setup





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| | | | |
|----------------------------|--|-------------------------------|---------------------|
| Test specification: | Section 15.247(a)1, RSS-247 section 5.1(c), Average time of occupancy | | |
| Test procedure: | ANSI C63.10, section 7.8.4 | | |
| Test mode: | Compliance | Verdict: PASS | |
| Date(s): | 13-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

Table 7.4.2 Average time of occupancy test results

ASSIGNED FREQUENCY: 902-928 MHz
 MODULATION: GFSK
 DETECTOR USED: Peak
 NUMBER OF HOPPING FREQUENCIES: 50
 INVESTIGATED PERIOD: 20s
 FREQUENCY HOPPING: Enabled

| Carrier frequency, MHz | Single transmission duration, ms | Number transmission during 20 s | Average time of occupancy*, s | Bit rate, kbps | Symbol rate, Msymbol/s | Limit, s | Margin, s** | Verdict |
|------------------------|----------------------------------|---------------------------------|-------------------------------|----------------|------------------------|----------|-------------|---------|
| 915.863 | 4.0 | 1 | 0.004 | 50 | NA | 0.4 | -0.396 | Pass |

* - Average time of occupancy = (Single transmission duration × Investigated period) / (Single transmission period × number of hopping channels).

** - Margin = Average time of occupancy – specification limit.

Reference numbers of test equipment used

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

Full description is given in Appendix A.



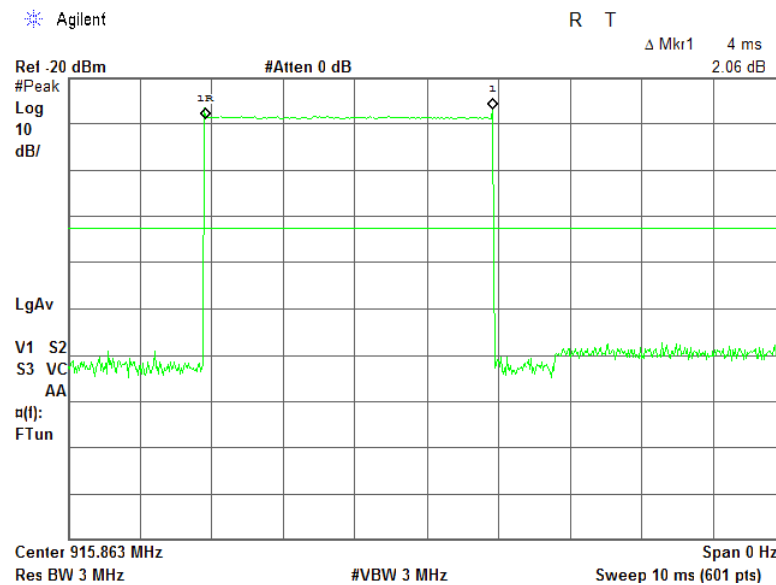
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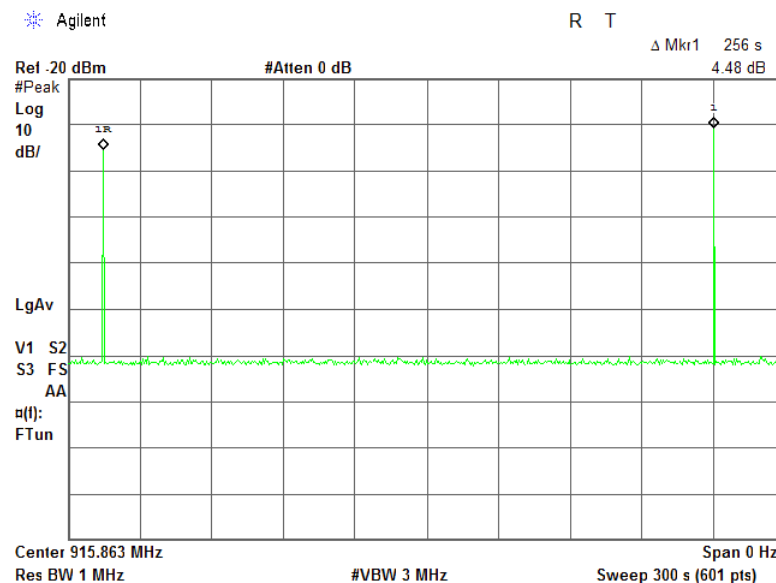
Date of Issue: 24-Oct-18

| | | | |
|---------------------|---|------------------------|--------------|
| Test specification: | Section 15.247(a)1, RSS-247 section 5.1(c), Average time of occupancy | | |
| Test procedure: | ANSI C63.10, section 7.8.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 13-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

Plot 7.4.1 Single transmission duration



Plot 7.4.2 Number transmission





| | | | |
|----------------------------|---|-------------------------------|---------------------|
| Test specification: | Section 15.247(b), RSS-247 section 5.4(a), Peak output power | | |
| Test procedure: | ANSI C63.10, section 7.8.5 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 06-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

7.5 Peak output power

7.5.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.5.1.

Table 7.5.1 Peak output power limits

| Assigned frequency range, MHz | Peak output power* | | Equivalent field strength limit @ 3m, dB(μV/m)* | Maximum antenna gain, dBi |
|-------------------------------|------------------------------|-----------------------------|---|---------------------------|
| | W | dBm | | |
| 902.0 – 928.0 | 0.25 (<50 hopping channels) | 24.0(<50 hopping channels) | 125.2 (<50 hopping channels) | 6.0* |
| | 1.0 (≥50 hopping channels) | 30.0 (≥50 hopping channels) | 131.2 (≥50 hopping channels) | |
| 2400.0 – 2483.5 | 0.125 (<75 hopping channels) | 21.0(<75 hopping channels) | 122.2 (<75 hopping channels) | |
| | 1.0 (≥75 hopping channels) | 30.0 (≥75 hopping channels) | 131.2 (≥75 hopping channels) | |
| 5725.0 – 5850.0 | 1.0 | 30.0 | 131.2 | |

*- Equivalent field strength limit was calculated from the peak output power as follows: $E = \sqrt{30 \times P \times G} / r$, where P is peak output power in Watts, r is antenna to EUT distance in meters and G is transmitter antenna gain in dBi.

** - The limit is provided in terms of conducted RF power at the antenna connector. If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power limit shall be reduced below the stated value as follows:

- by 1 dB for every 3 dB that the directional gain of antenna exceeds 6 dBi for fixed point-to-point transmitters operate in 2400-2483.5 MHz band;
- without any corresponding reduction for fixed point-to-point transmitters operate in 5725-5850 MHz band;
- by the amount in dB that the directional gain of antenna exceeds 6 dBi for the rest of transmitters.

7.5.2 Test procedure

7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.

7.5.2.2 The EUT was adjusted to produce maximum available to end user RF output power.

7.5.2.3 The frequency span of spectrum analyzer was set approximately 5 times wider than 20 dB bandwidth of the EUT and the resolution bandwidth was set wider than 20 dB bandwidth of the EUT. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.

7.5.2.4 The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.5.2 and associated plots.

7.5.2.5 The maximum peak output power was calculated from the field strength of carrier as follows:

$$P = (E \times d)^2 / (30 \times G),$$

where P is the peak output power in W, E is the field strength in V/m, d is the test distance and G is the transmitter numeric antenna gain over an isotropic radiator.

The above equation was converted in logarithmic units for 3 m test distance:

$$\text{Peak output power in dBm} = \text{Field strength in dB}(\mu\text{V/m}) - \text{Transmitter antenna gain in dBi} - 95.2 \text{ dB}$$

7.5.2.6 The worst test results (the lowest margins) were recorded in Table 7.5.2.

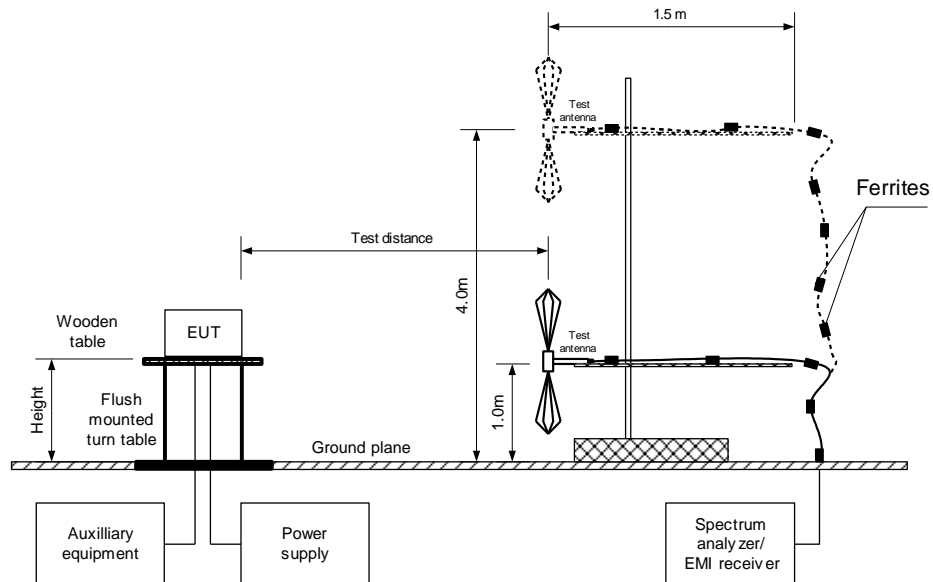


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| | | | |
|---------------------|--|------------------------|--------------|
| Test specification: | Section 15.247(b), RSS-247 section 5.4(a), Peak output power | | |
| Test procedure: | ANSI C63.10, section 7.8.5 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 06-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

Figure 7.5.1 Setup for carrier field strength measurements





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| | | | |
|----------------------------|---|-------------------------------|---------------------|
| Test specification: | Section 15.247(b), RSS-247 section 5.4(a), Peak output power | | |
| Test procedure: | ANSI C63.10, section 7.8.5 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 06-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

Table 7.5.2 Peak output power test results

ASSIGNED FREQUENCY: 902-928 MHz
 TEST DISTANCE: 3 m
 EUT HEIGHT: 0.8 m
 TEST SITE: Semi anechoic chamber
 DETECTOR USED: Peak
 TEST ANTENNA TYPE: Biconilog (30 MHz – 1000 MHz)
 Double ridged guide (above 1000 MHz)
 MODULATION: GFSK
 BIT RATE: 50 kbps
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 DETECTOR USED: Peak
 EUT 20 dB BANDWIDTH: 106.688 MHz
 RESOLUTION BANDWIDTH: 1 MHz
 VIDEO BANDWIDTH: 3 MHz
 FREQUENCY HOPPING: Disabled
 NUMBER OF FREQUENCY HOPPING CHANNELS: 50

| Frequency, MHz | Field strength, dB(μV/m) | Antenna polarization | Antenna height, m | Azimuth, degrees* | EUT antenna gain, dBi | Peak output power, dBm** | Limit, dBm | Margin, dB*** | Verdict |
|----------------|--------------------------|----------------------|-------------------|-------------------|-----------------------|--------------------------|------------|---------------|---------|
| 912.741 | 112.514 | Vertical | 1.5 | 0 | -1 | 18.314 | 30 | -11.686 | Pass |
| 915.848 | 113.917 | Vertical | 1.5 | 0 | -1 | 19.717 | 30 | -10.283 | Pass |
| 919.101 | 109.430 | Vertical | 1.5 | 0 | -1 | 15.230 | 30 | -14.770 | Pass |

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

**- Peak output power was calculated from the field strength of carrier as follows: $P = (E \times d)^2 / (30 \times G)$, where P is the peak output power in W, E is the field strength in V/m, d is the test distance in meters and G is the transmitter numeric antenna gain over an isotropic radiator. The above equation was converted in logarithmic units for 3 m test distance:
Peak output power in dBm = Field strength in dB(μV/m) - Transmitter antenna gain in dBi – 95.2 dB

***- Margin = Peak output power – specification limit.

Note: Maximum peak output power was obtained at Unom input power voltage.

Reference numbers of test equipment used

| | | | | | | | |
|---------|---------|---------|---------|--|--|--|--|
| HL 5111 | HL 4360 | HL 4933 | HL 4277 | | | | |
|---------|---------|---------|---------|--|--|--|--|

Full description is given in Appendix A.

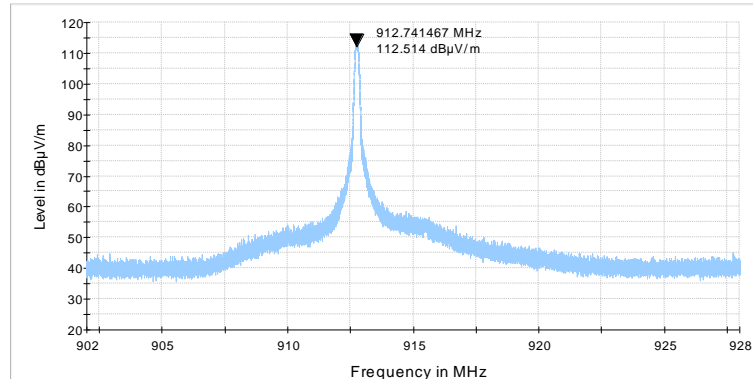


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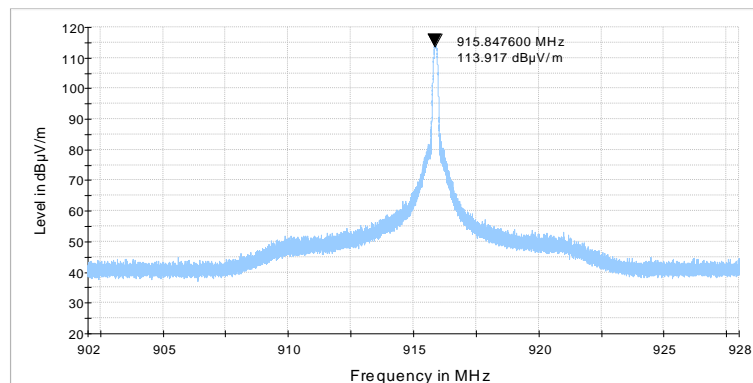
Report ID: VISRAD_FCC.31036_rev_1
Date of Issue: 24-Oct-18

| | | | |
|---------------------|--|------------------------|--------------|
| Test specification: | Section 15.247(b), RSS-247 section 5.4(a), Peak output power | | |
| Test procedure: | ANSI C63.10, section 7.8.5 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 06-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

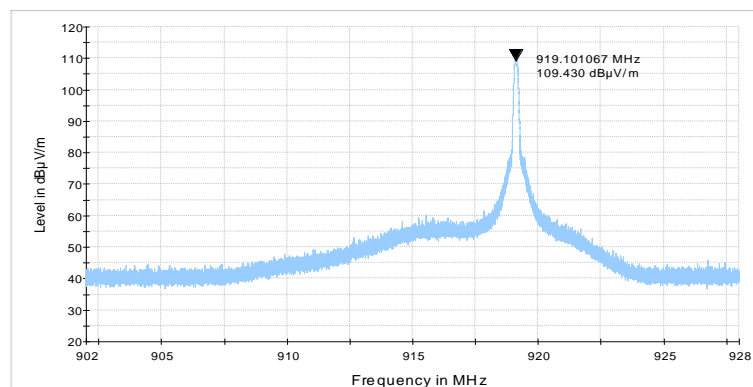
Plot 7.5.1 Field strength of carrier at low frequency



Plot 7.5.2 Field strength of carrier at mid frequency



Plot 7.5.3 Field strength of carrier at high frequency





| | | | |
|----------------------------|--|-------------------------------|---------------------|
| Test specification: | Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
| Test procedure: | ANSI C63.10, sections 6.5, 6.6 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 13-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

7.6 Field strength of spurious emissions

7.6.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.6.1.

Table 7.6.1 Radiated spurious emissions limits

| Frequency, MHz | Field strength at 3 m within restricted bands, dB(μV/m)*** | | | Attenuation of field strength of spurious versus carrier outside restricted bands, dBc*** |
|----------------------------------|--|-----------------|-----------------|---|
| | Peak | Quasi Peak | Average | |
| 0.009 – 0.090 | 148.5 – 128.5 | NA | 128.5 – 108.5** | 20.0 |
| 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 | | |
| 1000 – 10 th harmonic | 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.

*** - The 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.

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

7.6.1.1 The EUT was set up as shown in Figure 7.6.1, energized and the performance check was conducted.

7.6.1.2 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.

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

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

7.6.2.1 The EUT was set up as shown in Figure 7.6.2 / Figure 7.6.3, energized and the performance check was conducted.

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

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



| | | | |
|---------------------|---|------------------------|--------------|
| Test specification: | Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
| Test procedure: | ANSI C63.10, sections 6.5, 6.6 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 13-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

Figure 7.6.1 Setup for spurious emission field strength measurements below 30 MHz

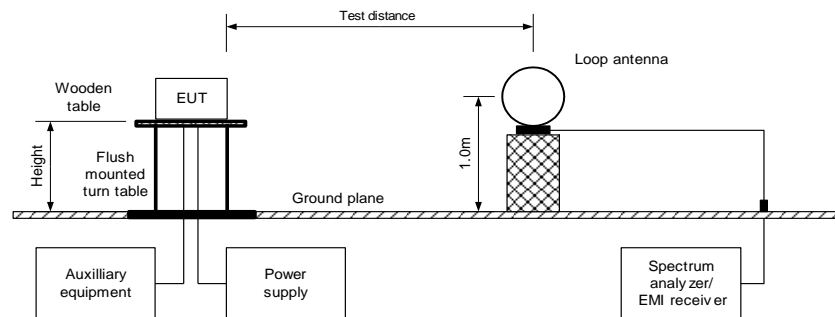


Figure 7.6.2 Setup for spurious emission field strength measurements from 30 to 1000 MHz

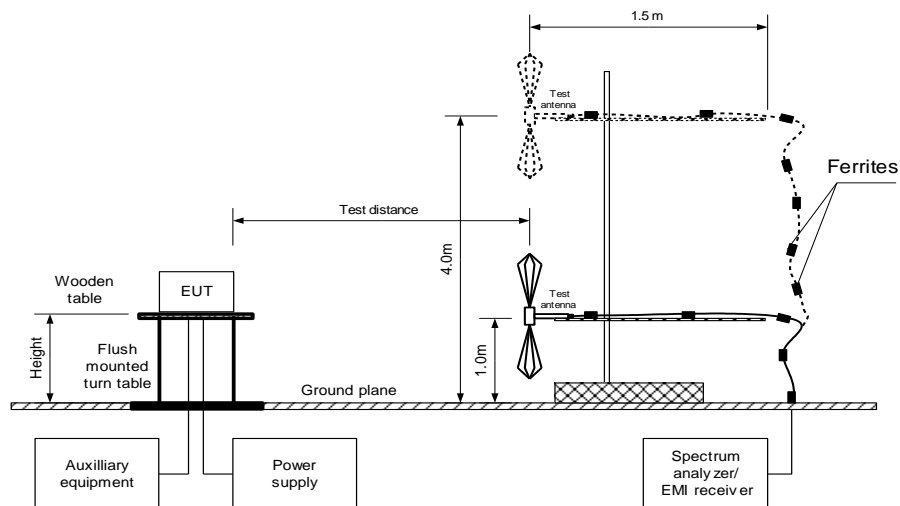
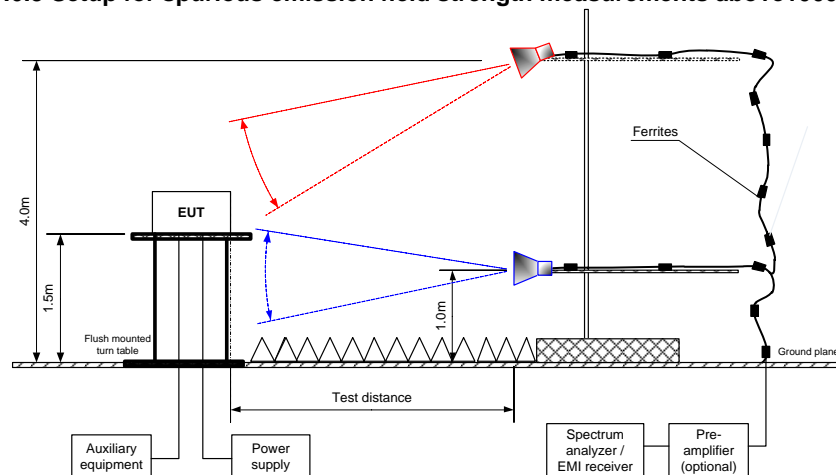


Figure 7.6.3 Setup for spurious emission field strength measurements above 1000 MHz





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| | | | | |
|---------------------|---|------------------------|--------------|--|
| Test specification: | Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | | |
| Test procedure: | ANSI C63.10, sections 6.5, 6.6 | | | |
| Test mode: | Compliance | Verdict: PASS | | |
| Date(s): | 13-Jun-18 | | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC | |
| Remarks: | | | | |

Table 7.6.2 Field strength of emissions outside restricted bands

ASSIGNED FREQUENCY: 902-928 MHz
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz
 TEST DISTANCE: 3 m
 MODULATION: GFSK
 BIT RATE: 50 kbps
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 100 kHz
 VIDEO BANDWIDTH: 300 kHz
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)
 Double ridged guide (above 1000 MHz)
 FREQUENCY HOPPING: Disabled

| Frequency, MHz | Field strength of spurious, dB(μV/m) | Antenna polarization | Antenna height, m | Azimuth, degrees* | Field strength of carrier, dB(μV/m) | Attenuation below carrier, dBc | Limit, dBc | Margin, dB** | Verdict |
|------------------------|--------------------------------------|----------------------|-------------------|-------------------|-------------------------------------|--------------------------------|------------|--------------|---------|
| Low carrier frequency | | | | | | | | | |
| 1825.72 | 45.80 | V | 2.1 | 10 | 112.514 | 66.714 | 20.0 | 46.714 | Pass |
| 5476.75 | 62.10 | H | 1.8 | 36 | | 50.414 | | 50.414 | |
| 6389.05 | 55.22 | H | 1.6 | 13 | | 57.294 | | 37.294 | |
| Mid carrier frequency | | | | | | | | | |
| 1831.79 | 48.82 | H | 1.81 | -166 | 113.917 | 65.097 | 20.0 | 45.097 | Pass |
| 5495.48 | 58.09 | H | 1.55 | -180 | | 55.827 | | 35.827 | |
| 6411.10 | 52.74 | H | 1.28 | 177 | | 61.177 | | 41.177 | |
| High carrier frequency | | | | | | | | | |
| 1838.37 | 51.65 | V | 1.27 | -5 | 109.430 | 57.78 | 20.0 | 37.78 | Pass |
| 5514.49 | 62.42 | H | 2.05 | -1 | | 47.01 | | 27.01 | |
| 6433.92 | 54.49 | V | 2.57 | -7 | | 54.94 | | 34.94 | |

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

** - Margin = Attenuation below carrier – specification limit.



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| | | | | |
|---------------------|---|------------------------|--------------|--|
| Test specification: | Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | | |
| Test procedure: | ANSI C63.10, sections 6.5, 6.6 | | | |
| Test mode: | Compliance | Verdict: PASS | | |
| Date(s): | 13-Jun-18 | | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC | |
| Remarks: | | | | |

Table 7.6.3 Field strength of spurious emissions above 1 GHz within restricted bands

ASSIGNED FREQUENCY: 902 - 928 MHz
 INVESTIGATED FREQUENCY RANGE: 1000 – 9500 MHz
 TEST DISTANCE: 3 m
 MODULATION: GFSK
 BIT RATE: 50 Kbps
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 1000 kHz
 TEST ANTENNA TYPE: Double ridged guide
 FREQUENCY HOPPING: Disabled

| Frequency, MHz | Antenna | | Azimuth, degrees* | Peak field strength | | | Average field strength | | | | Verdict |
|------------------------|--------------|--------------|----------------------|-----------------------|--------------------|-----------------|------------------------|-------------------------|--------------------|------------------|---------|
| | Polarization | 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*** | |
| Low carrier frequency | | | | | | | | | | | |
| 2738.29 | V | 1.5 | -12 | 51.61 | 74 | -22.39 | 51.61 | 23.61 | 54 | -30.39 | Pass |
| 3650.87 | V | 1.3 | 10 | 48.49 | 74 | -25.51 | 48.49 | 20.49 | 54 | -33.51 | |
| 4563.90 | H | 1.9 | 12 | 61.31 | 74 | -12.69 | 61.31 | 33.31 | 54 | -20.69 | |
| 7301.85 | H | 1.3 | -31 | 50.87 | 74 | -23.13 | 50.87 | 22.87 | 54 | -31.13 | |
| 8141.15 | H | 1.3 | -90 | 49.55 | 74 | -24.45 | 49.55 | 21.55 | 54 | -32.45 | |
| Mid carrier frequency | | | | | | | | | | | |
| 2747.41 | V | 1.8 | 180 | 58.71 | 74 | -15.29 | 58.71 | 30.71 | 54 | -23.29 | Pass |
| 3663.25 | V | 1.3 | 7 | 51.79 | 74 | -22.21 | 51.79 | 23.79 | 54 | -30.21 | |
| 4579.37 | H | 1.8 | 176 | 58.02 | 74 | -15.98 | 58.02 | 30.02 | 54 | -23.98 | |
| 7326.94 | H | 1.0 | 178 | 53.31 | 74 | -20.69 | 53.31 | 25.31 | 54 | -28.69 | |
| 8243.00 | H | 1.6 | 171 | 54.29 | 74 | -19.71 | 54.29 | 26.29 | 54 | -27.71 | |
| 9158.62 | H | 1.6 | 171 | 51.50 | 74 | -15.29 | 51.50 | 30.71 | 54 | -23.29 | |
| High carrier frequency | | | | | | | | | | | |
| 2757.53 | V | 2.0 | -36 | 57.66 | 74 | -16.34 | 57.66 | 29.66 | 54 | -24.34 | Pass |
| 3676.23 | V | 1.0 | 145 | 51.41 | 74 | -22.59 | 51.41 | 23.41 | 54 | -30.59 | |
| 4595.61 | H | 2.4 | -10 | 60.76 | 74 | -13.24 | 60.76 | 32.76 | 54 | -21.24 | |
| 7353.08 | H | 2.6 | -20 | 52.01 | 74 | -21.99 | 52.01 | 24.01 | 54 | -29.99 | |
| 8271.96 | H | 2.6 | 0 | 52.44 | 74 | -21.56 | 52.44 | 24.44 | 54 | -29.56 | |

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

**- Margin = Measured field strength - specification limit.

 ***- Margin = Calculated field strength - specification limit,
 where Calculated field strength = Measured field strength + average factor.
Table 7.6.4 Average factor calculation

| Transmission pulse | | Transmission burst | | Transmission train duration, ms | Average factor, dB |
|--------------------|--------------------------------|--------------------|------------|---------------------------------|--------------------|
| Duration, ms | Number of pulses within 100 ms | Duration, ms | Period, ms | | |
| 4 | 1 | N/A | N/A | N/A | -28 |

Average factor or pulse train shorter than 100 ms was calculated as follows:

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

Average factor or pulse train longer than 100 ms was calculated as follows:

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



| | | | |
|----------------------------|--|-------------------------------|---------------------|
| Test specification: | Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
| Test procedure: | ANSI C63.10, sections 6.5, 6.6 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 13-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

Table 7.6.5 Field strength of spurious emissions below 1 GHz within restricted bands

ASSIGNED FREQUENCY: 902-928 MHz
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz
 TEST DISTANCE: 3 m
 MODULATION: GFSK
 MODULATING SIGNAL: PRBS
 BIT RATE: 50 Kbps
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 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)
 FREQUENCY HOPPING: Disabled

| Frequency, MHz | | Quasi-peak | | | Antenna polarization | Antenna height, m | Turn-table position**, degrees | Verdict |
|---------------------------------------|-----------------------------|-----------------|-------------|--|----------------------|-------------------|--------------------------------|---------|
| Peak emission, dB(μV/m) | Measured emission, dB(μV/m) | Limit, dB(μV/m) | Margin, dB* | | | | | |
| No spurious emissions have been found | | | | | | | | Pass |

*- Margin = Measured emission - specification limit.

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



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|---------------------|---|------------------------|--------------|--|
| Test specification: | Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | | |
| Test procedure: | ANSI C63.10, sections 6.5, 6.6 | | | |
| Test mode: | Compliance | Verdict: PASS | | |
| Date(s): | 13-Jun-18 | | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC | |
| Remarks: | | | | |

Table 7.6.6 Restricted bands according to FCC section 15.205

| 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 | 12.29 - 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 | 16.42 - 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 7.6.7 Restricted bands according to RSS-Gen

| 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 - 2.1905 | 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 | 12.29 - 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 |
| 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 |

Reference numbers of test equipment used

| | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|
| HL 3615 | HL 3818 | HL 4276 | HL 4339 | HL 4360 | HL 4933 | HL 5111 | HL 5288 |
|---------|---------|---------|---------|---------|---------|---------|---------|

Full description is given in Appendix A.



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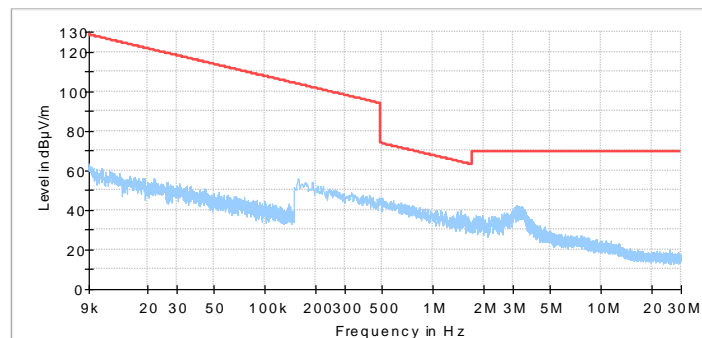
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| | | | |
|---------------------|---|------------------------|--------------|
| Test specification: | Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
| Test procedure: | ANSI C63.10, sections 6.5, 6.6 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 13-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

Plot 7.6.1 Radiated emission measurements from 9 kHz to 30 MHz at the low, mid, high carrier frequency

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





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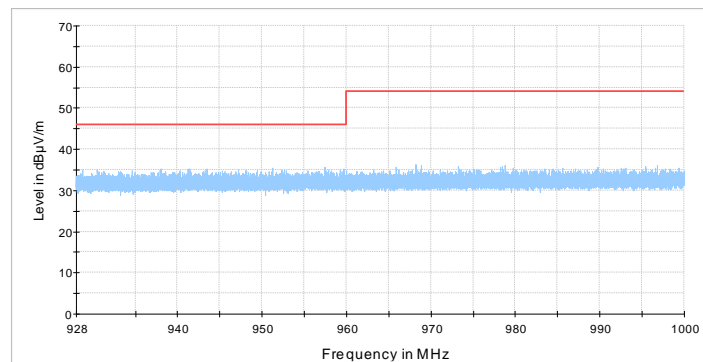
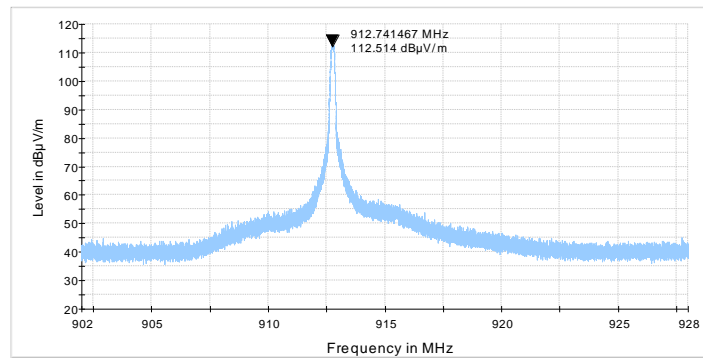
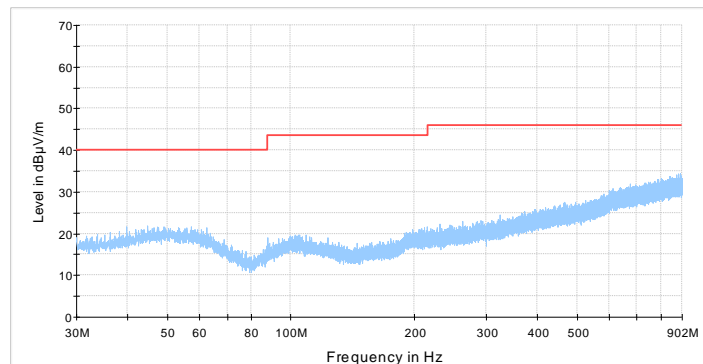
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| | | | |
|---------------------|---|------------------------|--------------|
| Test specification: | Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
| Test procedure: | ANSI C63.10, sections 6.5, 6.6 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 13-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

Plot 7.6.2 Radiated emission measurements from 30 to 1000 MHz at the low carrier frequency

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





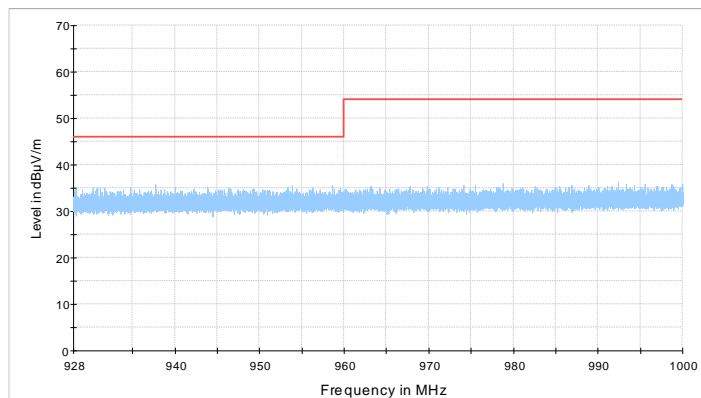
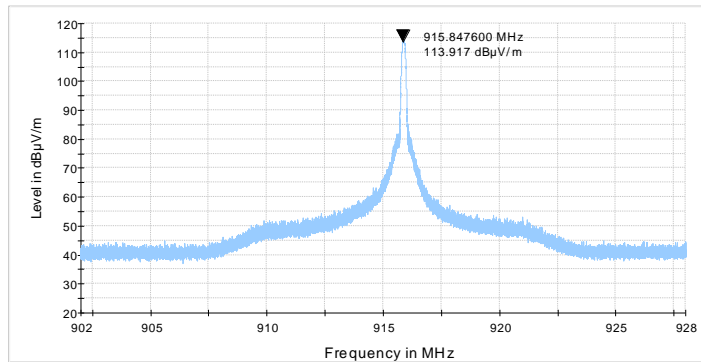
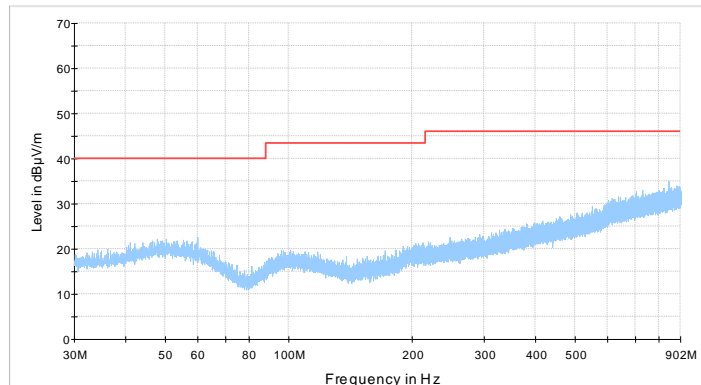
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Report ID: VISRAD_FCC.31036_rev_1
Date of Issue: 24-Oct-18

| | | | |
|---------------------|---|------------------------|--------------|
| Test specification: | Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
| Test procedure: | ANSI C63.10, sections 6.5, 6.6 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 13-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

Plot 7.6.3 Radiated emission measurements from 30 to 1000 MHz at the mid carrier frequency

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





HERMON LABORATORIES

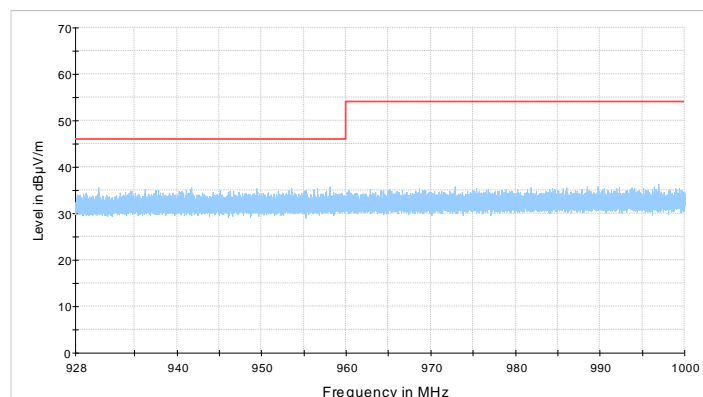
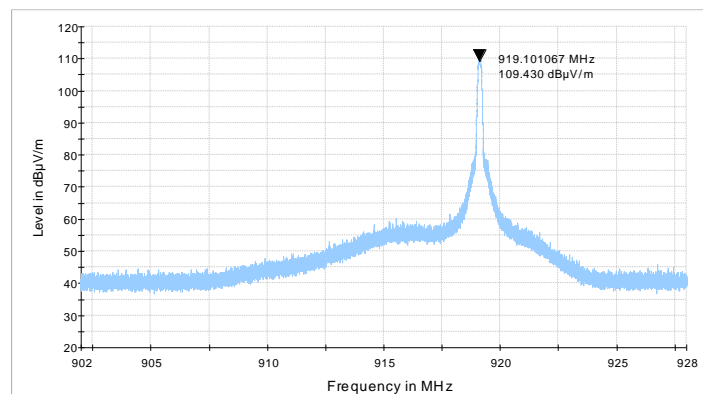
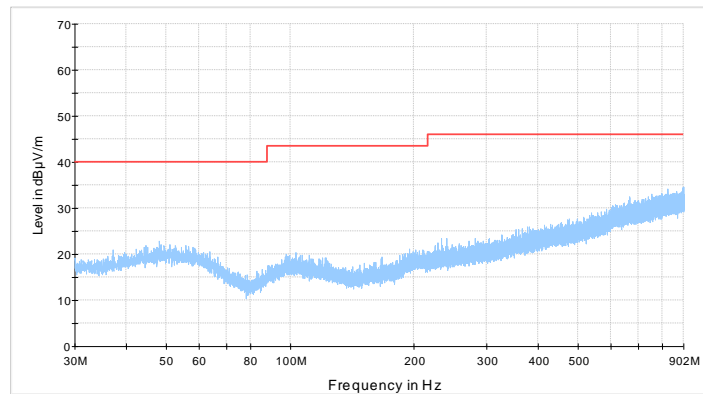
Report ID: VISRAD_FCC.31036_rev_1

Date of Issue: 24-Oct-18

| | | | |
|---------------------|---|------------------------|--------------|
| Test specification: | Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
| Test procedure: | ANSI C63.10, sections 6.5, 6.6 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 13-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

Plot 7.6.4 Radiated emission measurements from 30 to 1000 MHz at the high carrier frequency

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





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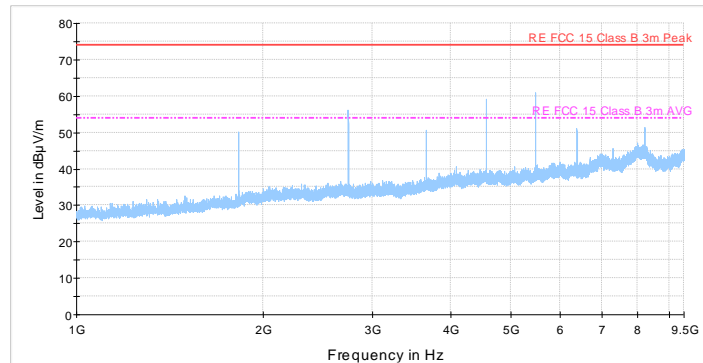
Report ID: VISRAD_FCC.31036_rev_1

Date of Issue: 24-Oct-18

| | | | |
|---------------------|---|------------------------|--------------|
| Test specification: | Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
| Test procedure: | ANSI C63.10, sections 6.5, 6.6 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 13-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

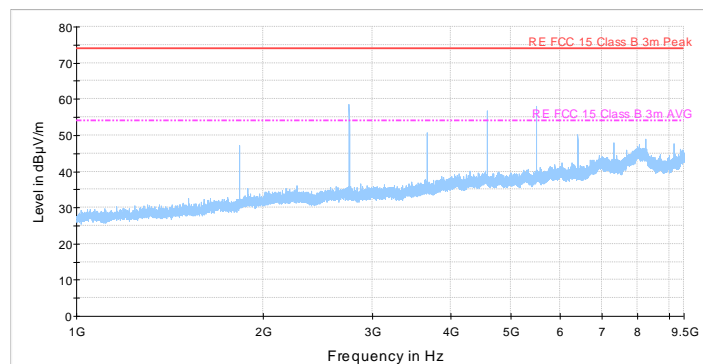
Plot 7.6.5 Radiated emission measurements from 1000 to 9500 MHz at the low carrier frequency

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



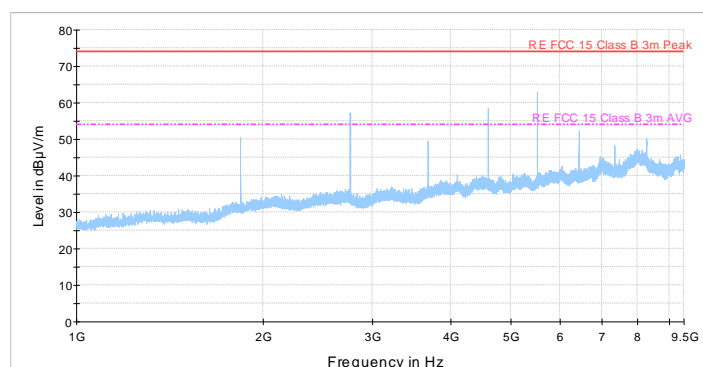
Plot 7.6.6 Radiated emission measurements from 1000 to 9500 MHz at the mid carrier frequency

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



Plot 7.6.7 Radiated emission measurements from 1000 to 9500 MHz at the high carrier frequency

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





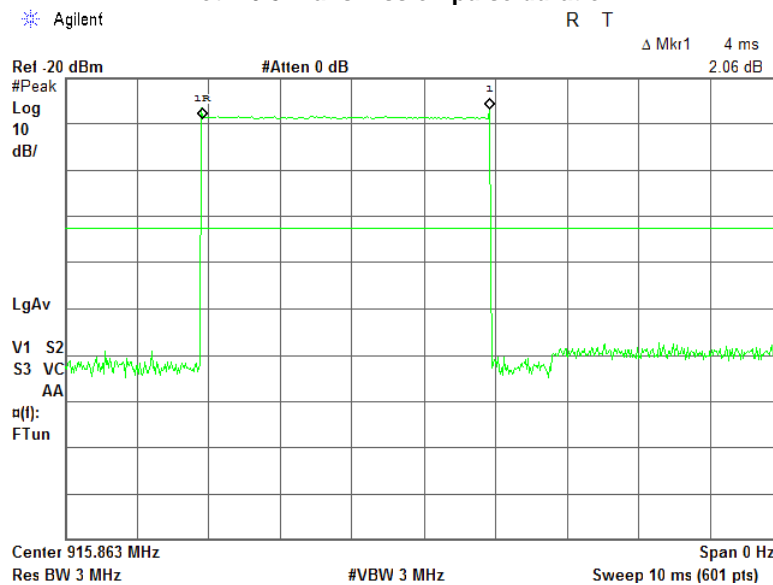
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Report ID: VISRAD_FCC.31036_rev_1

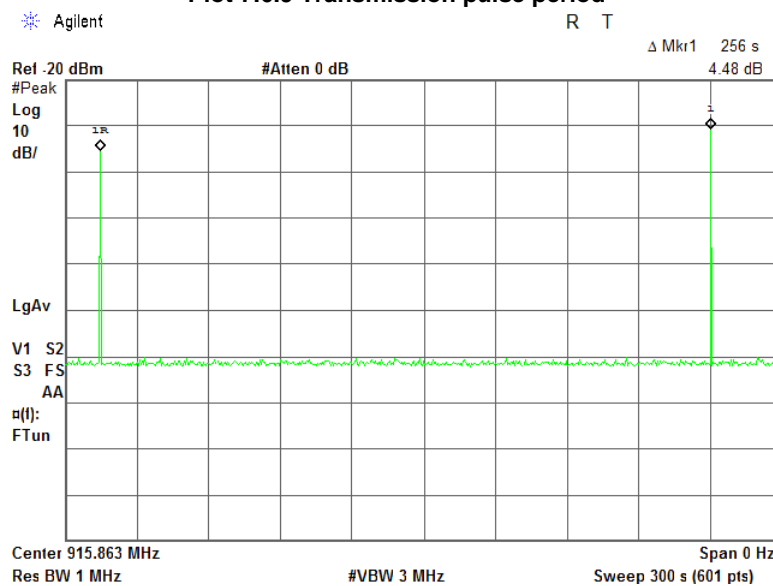
Date of Issue: 24-Oct-18

| | | | |
|---------------------|---|------------------------|--------------|
| Test specification: | Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
| Test procedure: | ANSI C63.10, sections 6.5, 6.6 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 13-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

Plot 7.6.8 Transmission pulse duration



Plot 7.6.9 Transmission pulse period





| | | | |
|----------------------------|--|-------------------------------|---------------------|
| 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): | 05-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

7.7 Band edge radiated emissions

7.7.1 General

This test was performed to measure emissions, radiated from the EUT at the assigned frequency band edges. Specification test limits are given in Table 7.7.1.

Table 7.7.1 Band edge emission limits

| Assigned frequency, MHz | Attenuation below carrier*, dBc | Field strength at 3 m within restricted bands, dB(μ V/m) | |
|-------------------------|---------------------------------|---|---------|
| | | Peak | Average |
| 902.0 – 928.0 | 20.0 | 74.0 | 54.0 |
| 2400.0 – 2483.5 | | | |
| 5725.0 – 5850.0 | | | |

* - Band edge emission limit is provided in terms of attenuation below the peak of modulated carrier measured with the same resolution bandwidth.

7.7.2 Test procedure

- 7.7.2.1 The EUT was set up as shown in Figure 7.7.1, energized normally modulated at the maximum data rate with its hopping function disabled and its proper operation was checked.
- 7.7.2.2 The EUT was adjusted to produce maximum available to end user RF output power at the lowest carrier frequency.
- 7.7.2.3 The spectrum analyzer span was set to capture the carrier frequency and associated modulation products. The resolution bandwidth was set wider than 1 % of the frequency span.
- 7.7.2.4 The spectrum analyzer was set in max hold mode and allowed trace to stabilize. The highest emission level within the authorized band was measured.
- 7.7.2.5 The maximum band edge emission and modulation product outside of the band were measured as provided in Table 7.7.2 and associated plots and referenced to the highest emission level measured within the authorized band.
- 7.7.2.6 The above procedure was repeated with the EUT adjusted to produce maximum RF output power at the highest carrier frequency.
- 7.7.2.7 The above procedure was repeated with the frequency hopping function enabled.

Figure 7.7.1 Band edge emission test setup





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| | | | |
|----------------------------|--|-------------------------------|---------------------|
| 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): | 05-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

Table 7.7.2 Band edge emission test results

ASSIGNED FREQUENCY RANGE: 902-928 MHz
 DETECTOR USED: Peak
 MODULATION: GFSK
 BIT RATE: 50 kbps
 RESOLUTION BANDWIDTH: $\geq 1\%$ of the span
 VIDEO BANDWIDTH: \geq RBW

| Frequency, MHz | Band edge emission, dBm | Emission at carrier, dBm | Attenuation below carrier, dBc | Limit, dBc | Margin, dB* | Verdict |
|----------------------------|-------------------------|--------------------------|--------------------------------|------------|-------------|---------|
| Frequency hopping disabled | | | | | | |
| 902 | -65.90 | -5.930 | 59.970 | 20.0 | 39.970 | Pass |
| 928 | -65.71 | -8.481 | 57.229 | | 37.229 | |
| Frequency hopping enabled | | | | | | |
| 902 | -64.04 | -8.183 | 55.857 | 20.0 | 35.857 | Pass |
| 928 | -66.48 | -8.882 | 57.598 | | 37.598 | |

*- Margin = Attenuation below carrier – specification limit.

Reference numbers of test equipment used

| | | | | | | |
|---------|---------|--|--|--|--|--|
| HL 2909 | HL 4135 | | | | | |
|---------|---------|--|--|--|--|--|

Full description is given in Appendix A.



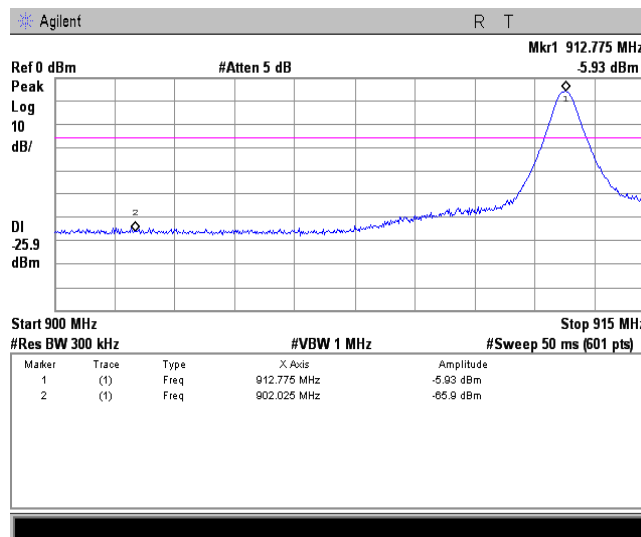
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Report ID: VISRAD_FCC.31036_rev_1

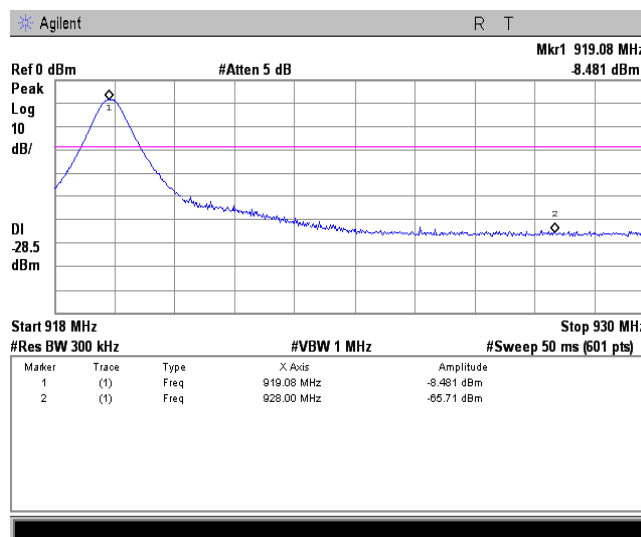
Date of Issue: 24-Oct-18

| | | | |
|---------------------|---|------------------------|--------------|
| 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): | 05-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

Plot 7.7.1 The highest band edge emission at low carrier frequency with hopping function disabled



Plot 7.7.2 The highest band edge emission at high carrier frequency with hopping function disabled





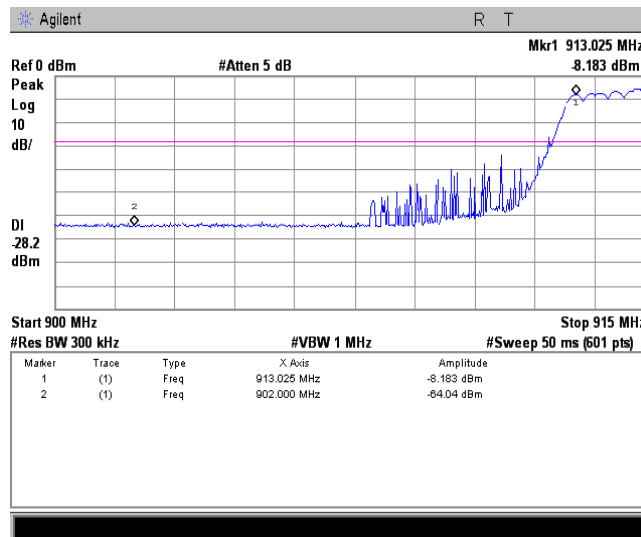
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Report ID: VISRAD_FCC.31036_rev_1

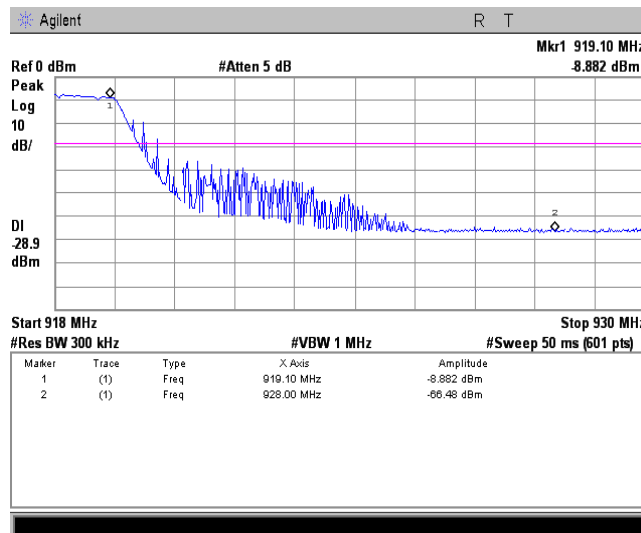
Date of Issue: 24-Oct-18

| | | | |
|---------------------|---|------------------------|--------------|
| 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): | 05-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1008 hPa | Power: 3 VDC |
| Remarks: | | | |

Plot 7.7.3 The highest band edge emission at low carrier frequency with hopping function enabled



Plot 7.7.4 The highest band edge emission at high carrier frequency with hopping function enabled





| | | | |
|----------------------------|---|-------------------------------|---------------------|
| Test specification: | Section 15.203, RSS-Gen, Section 7.1.4, Antenna requirements | | |
| Test procedure: | Visual inspection | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 06-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1009 hPa | Power: 3 VDC |
| Remarks: | | | |

7.8 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 7.8.1.

Table 7.8.1 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 | |



| | | | |
|----------------------------|--|-------------------------------|---------------------|
| Test specification: | Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Radiated emission | | |
| Test procedure: | ANSI C63.4, Section 12.2.5 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 05-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1009 hPa | Power: 3 VDC |
| Remarks: | | | |

8 Unintentional emissions according to 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, MHz | Class B limit, dB(μV/m) | | Class A limit, dB(μV/m) | |
|-------------------|-------------------------|--------------|-------------------------|--------------|
| | 10 m distance | 3 m distance | 10 m distance | 3 m distance |
| 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* |

* The limit for test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows: $Lims_2 = Lims_1 + 20 \log(S_1/S_2)$, where S_1 and S_2 – standard defined and test distance respectively in meters.

8.1.2 Test procedure for measurements

8.1.2.1 The EUT was set up as shown in Figure 8.1.1 and associated photographs, energized and the performance check was conducted.

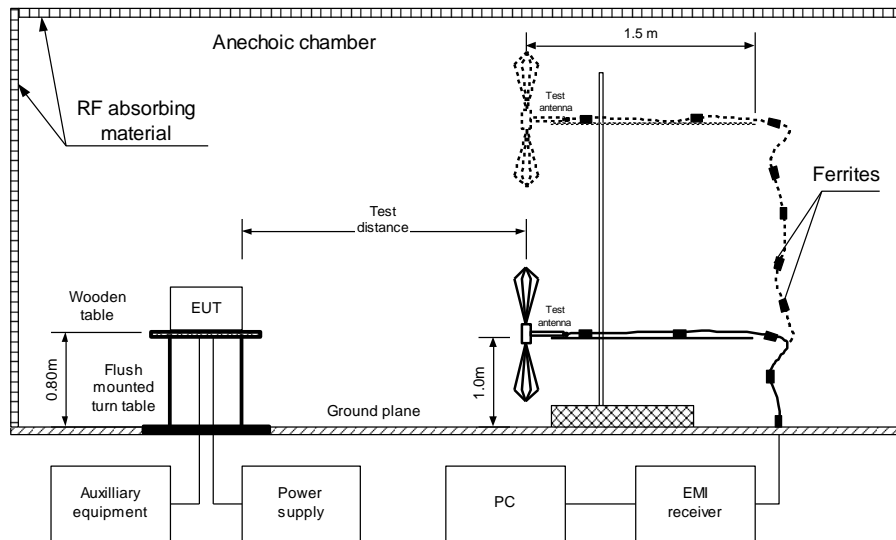
8.1.2.2 The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position was varied.

8.1.2.3 The worst test results (the lowest margins) were recorded in Table 8.1.2 and shown in the associated plots.

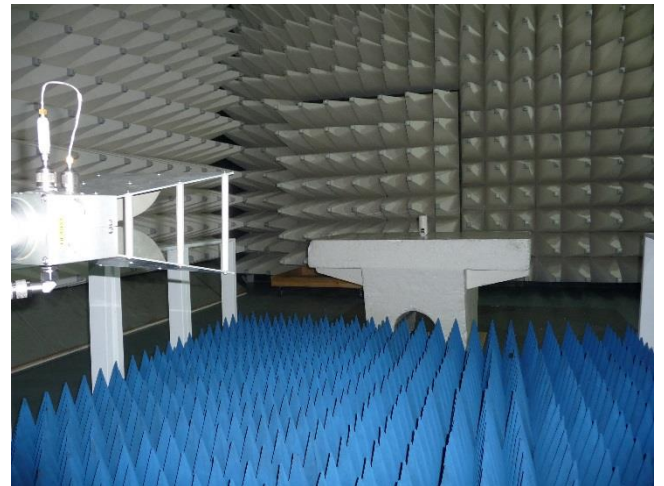


| | | | |
|---------------------|---|------------------------|--------------|
| Test specification: | Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Radiated emission | | |
| Test procedure: | ANSI C63.4, Section 12.2.5 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 05-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1009 hPa | Power: 3 VDC |
| Remarks: | | | |

Figure 8.1.1 Setup for radiated emission measurements in anechoic chamber



Photograph 8.1.1 Setup for final radiated emission measurements, general view





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| | | | |
|----------------------------|--|-------------------------------|---------------------|
| Test specification: | Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Radiated emission | | |
| Test procedure: | ANSI C63.4, Section 12.2.5 | | |
| Test mode: | Compliance | Verdict: PASS | |
| Date(s): | 05-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1009 hPa | Power: 3 VDC |
| Remarks: | | | |

Table 8.1.2 Radiated emission test results

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Receive
TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / QUASI-PEAK
FREQUENCY RANGE: 30 MHz – 1000 MHz
RESOLUTION BANDWIDTH: 120 kHz

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

TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 5000 MHz
RESOLUTION BANDWIDTH: 1000 kHz

| Frequency, MHz | Peak | | | Average | | | Antenna polarization | Antenna height, m | Turn-table position**, degrees | Verdict |
|-------------------------|-----------------------------------|--------------------|----------------|-----------------------------------|--------------------|----------------|-------------------------|-------------------------|--------------------------------------|---------|
| | Measured emission, dB(μV/m) | Limit, dB(μV/m) | Margin, dB* | Measured emission, dB(μV/m) | Limit, dB(μV/m) | Margin, dB* | | | | |
| No emission peaks found | | | | | | | | | | Pass |

*- Margin = Measured emission - specification limit.

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

Reference numbers of test equipment used

| | | | | | | | |
|---------|---------|---------|---------|--|--|--|--|
| HL 3615 | HL 4360 | HL 5111 | HL 5288 | | | | |
|---------|---------|---------|---------|--|--|--|--|

Full description is given in Appendix A.



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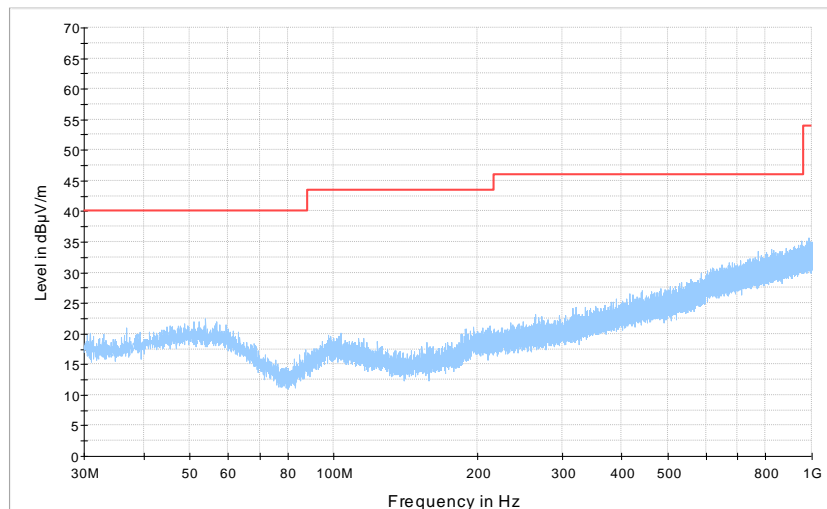
Report ID: VISRAD_FCC.31036_rev_1

Date of Issue: 24-Oct-18

| | | | |
|---------------------|---|------------------------|--------------|
| Test specification: | Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Radiated emission | | |
| Test procedure: | ANSI C63.4, Section 12.2.5 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 05-Jun-18 | | |
| Temperature: 23 °C | Relative Humidity: 55 % | Air Pressure: 1009 hPa | Power: 3 VDC |
| Remarks: | | | |

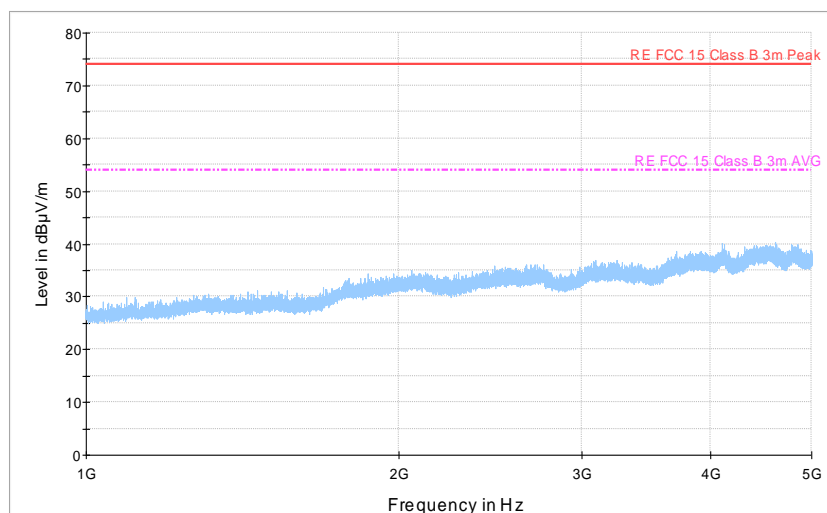
Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical & horizontal antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive



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

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive



9 APPENDIX A Test equipment and ancillaries used for tests

| HL No | Description | Manufacturer | Model | Ser. No. | Last Cal./ Check | Due Cal./ Check |
|-------|---|-----------------------|---------------------------|-------------|------------------|-----------------|
| 2909 | Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz | Agilent Technologies | E4407B | MY41444762 | 27-Mar-18 | 27-Mar-19 |
| 3615 | Cable RF, 6.5 m, N type-N type, DC-6 GHz | Suhner Switzerland | RG 214/U | NA | 10-Jun-18 | 10-Jun-19 |
| 3818 | PSA Series Spectrum Analyzer, 3 Hz-44 GHz | Agilent Technologies | E4446A | MY48250288 | 28-May-18 | 28-May-19 |
| 4135 | Shield Box | TESCOM CO., LTD | TC-5916A | 5916A000136 | 04-Apr-18 | 04-Apr-19 |
| 4276 | Test Cable , DC-18 GHz, 3.05 m, N/M - N/M | Mini-Circuits | APC-10FT-NMNM+ | 0747A | 24-Aug-17 | 24-Aug-18 |
| 4277 | Test Cable , DC-18 GHz, 3.05 m, N/M - N/M | Mini-Circuits | APC-10FT-NMNM+ | 0748A | 10-Sep-17 | 10-Sep-18 |
| 4339 | High pass Filter, 50 Ohm, 1000 to 18000 MHz, SMA-FM / SMA-M | Micro-Tronics | HPM50115-02 | 1 | 14-May-17 | 14-May-18 |
| 4360 | EMI Test Receiver, 20 Hz to 40 GHz. | Rohde & Schwarz | ESU40 | 100322 | 26-Dec-17 | 26-Dec-18 |
| 4933 | Active Horn Antenna, 1 GHz to 18 GHz | COM-POWER CORPORATION | AHA-118 | 701046 | 04-Jan-18 | 04-Jan-19 |
| 5111 | RF cable, 40 GHz, 5.5 m, K-type | Huber-Suhner | SF102EA/11SK /11SK/5500MM | 502493/2EA | 09-Apr-18 | 09-Apr-19 |
| 5288 | Trilog Antenna, 25 MHz - 8 GHz, 100W | Frankonia | ALX-8000E | 809 | 21-Jan-18 | 21-Jan-19 |

10 APPENDIX B Test equipment correction factors

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

HL 5288: Antenna factor Trilog Antenna, 25 MHz - 8 GHz, 100W
Frankonia, model: ALX-8000E, s/n: 00809

| 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.

HL 3615: RF Cable
Suhner Switzerland, model: RG 214/U, s/n: NA

| Set / Applied, MHz | Measured, dB | Uncertainty, dB |
|-----------------------|-----------------|--------------------|
| 50 | 0.31 | +0.08 / -0.08 dB |
| 100 | 0.45 | +0.08 / -0.08 dB |
| 200 | 0.66 | +0.08 / -0.08 dB |
| 300 | 0.83 | +0.09 / -0.09 dB |
| 400 | 0.98 | +0.09 / -0.09 dB |
| 500 | 1.12 | +0.09 / -0.09 dB |
| 600 | 1.26 | +0.09 / -0.09 dB |
| 700 | 1.38 | +0.09 / -0.09 dB |
| 800 | 1.50 | +0.09 / -0.09 dB |
| 900 | 1.63 | +0.09 / -0.09 dB |
| 1000 | 1.74 | +0.09 / -0.09 dB |
| 1100 | 1.85 | +0.09 / -0.09 dB |
| 1200 | 1.97 | +0.09 / -0.09 dB |
| 1300 | 2.08 | +0.09 / -0.09 dB |
| 1400 | 2.19 | +0.09 / -0.09 dB |
| 1500 | 2.30 | +0.09 / -0.09 dB |
| 1600 | 2.41 | +0.09 / -0.09 dB |
| 1700 | 2.53 | +0.09 / -0.09 dB |
| 1800 | 2.63 | +0.09 / -0.09 dB |
| 1900 | 2.74 | +0.09 / -0.09 dB |
| 2000 | 2.83 | +0.09 / -0.09 dB |
| 2100 | 2.93 | +0.11 / -0.11 dB |
| 2200 | 3.00 | +0.11 / -0.11 dB |
| 2300 | 3.07 | +0.11 / -0.11 dB |
| 2400 | 3.13 | +0.11 / -0.11 dB |
| 2500 | 3.19 | +0.15 / -0.15 dB |
| 2600 | 3.25 | +0.15 / -0.15 dB |
| 2700 | 3.33 | +0.15 / -0.15 dB |
| 2800 | 3.40 | +0.15 / -0.15 dB |
| 2900 | 3.48 | +0.15 / -0.15 dB |
| 3000 | 3.57 | +0.15 / -0.15 dB |
| 3100 | 3.63 | +0.17 / -0.17 dB |
| 3200 | 3.71 | +0.17 / -0.17 dB |

| Set / Applied, MHz | Measured, dB | Uncertainty, dB |
|-----------------------|-----------------|--------------------|
| 3300 | 3.78 | +0.17 / -0.17 dB |
| 3400 | 3.88 | +0.17 / -0.17 dB |
| 3500 | 3.96 | +0.17 / -0.17 dB |
| 3600 | 4.06 | +0.17 / -0.17 dB |
| 3700 | 4.15 | +0.17 / -0.17 dB |
| 3800 | 4.26 | +0.17 / -0.17 dB |
| 3900 | 4.36 | +0.17 / -0.17 dB |
| 4000 | 4.48 | +0.17 / -0.17 dB |
| 4100 | 4.58 | +0.22 / -0.23 dB |
| 4200 | 4.72 | +0.22 / -0.23 dB |
| 4300 | 4.80 | +0.22 / -0.23 dB |
| 4400 | 4.93 | +0.22 / -0.23 dB |
| 4500 | 5.00 | +0.22 / -0.23 dB |
| 4600 | 5.10 | +0.22 / -0.23 dB |
| 4700 | 5.20 | +0.22 / -0.23 dB |
| 4800 | 5.30 | +0.22 / -0.23 dB |
| 4900 | 5.43 | +0.22 / -0.23 dB |
| 5000 | 5.54 | +0.22 / -0.23 dB |
| 5100 | 5.65 | +0.22 / -0.23 dB |
| 5200 | 5.73 | +0.22 / -0.23 dB |
| 5300 | 5.86 | +0.22 / -0.23 dB |
| 5400 | 5.95 | +0.22 / -0.23 dB |
| 5500 | 6.05 | +0.22 / -0.23 dB |
| 5600 | 6.16 | +0.22 / -0.23 dB |
| 5700 | 6.28 | +0.22 / -0.23 dB |
| 5800 | 6.38 | +0.22 / -0.23 dB |
| 5900 | 6.53 | +0.22 / -0.23 dB |
| 6000 | 6.63 | +0.22 / -0.23 dB |
| 6100 | 6.75 | +0.22 / -0.23 dB |
| 6200 | 6.82 | +0.22 / -0.23 dB |
| 6300 | 6.93 | +0.22 / -0.23 dB |
| 6400 | 7.00 | +0.22 / -0.23 dB |
| 6500 | 7.05 | +0.22 / -0.23 dB |

HL 4277: Test Cable
Mini-Circuits, model: APC-10FT-NMNM+, s/n 0748A

| Set / Applied, MHz | Measured, dB | Uncertainty, dB |
|-----------------------|-----------------|--------------------|
| 0.1 | 0.26 | +0.07 / -0.07 dB |
| 50 | 0.27 | +0.07 / -0.07 dB |
| 100 | 0.38 | +0.07 / -0.07 dB |
| 200 | 0.55 | +0.07 / -0.07 dB |
| 300 | 0.69 | +0.08 / -0.09 dB |
| 400 | 0.80 | +0.08 / -0.09 dB |
| 500 | 0.91 | +0.08 / -0.09 dB |
| 600 | 1.00 | +0.08 / -0.09 dB |
| 700 | 1.08 | +0.08 / -0.09 dB |
| 800 | 1.17 | +0.08 / -0.09 dB |
| 900 | 1.24 | +0.08 / -0.09 dB |
| 1000 | 1.32 | +0.08 / -0.09 dB |
| 1100 | 1.39 | +0.12 / -0.13 dB |
| 1200 | 1.45 | +0.12 / -0.13 dB |
| 1300 | 1.52 | +0.12 / -0.13 dB |
| 1400 | 1.58 | +0.12 / -0.13 dB |
| 1500 | 1.65 | +0.12 / -0.13 dB |
| 1600 | 1.71 | +0.12 / -0.13 dB |
| 1700 | 1.77 | +0.12 / -0.13 dB |
| 1800 | 1.82 | +0.12 / -0.13 dB |
| 1900 | 1.88 | +0.12 / -0.13 dB |
| 2000 | 1.93 | +0.12 / -0.13 dB |
| 2100 | 1.99 | +0.12 / -0.13 dB |
| 2200 | 2.05 | +0.12 / -0.13 dB |
| 2300 | 2.10 | +0.12 / -0.13 dB |
| 2400 | 2.15 | +0.12 / -0.13 dB |
| 2500 | 2.20 | +0.17 / -0.18 dB |
| 2600 | 2.25 | +0.17 / -0.18 dB |
| 2700 | 2.30 | +0.17 / -0.18 dB |
| 2800 | 2.35 | +0.17 / -0.18 dB |
| 2900 | 2.40 | +0.17 / -0.18 dB |
| 3000 | 2.44 | +0.17 / -0.18 dB |
| 3100 | 2.49 | +0.19 / -0.2 dB |
| 3200 | 2.54 | +0.19 / -0.2 dB |
| 3300 | 2.58 | +0.19 / -0.2 dB |
| 3400 | 2.62 | +0.19 / -0.2 dB |
| 3500 | 2.66 | +0.19 / -0.2 dB |
| 3600 | 2.71 | +0.19 / -0.2 dB |
| 3700 | 2.75 | +0.19 / -0.2 dB |
| 3800 | 2.79 | +0.19 / -0.2 dB |
| 3900 | 2.84 | +0.19 / -0.2 dB |
| 4000 | 2.88 | +0.19 / -0.2 dB |

| Set / Applied, MHz | Measured, dB | Uncertainty, dB |
|-----------------------|-----------------|--------------------|
| 4100 | 2.84 | +0.19 / -0.2 dB |
| 4200 | 2.88 | +0.19 / -0.2 dB |
| 4300 | 2.92 | +0.3 / -0.33 dB |
| 4400 | 2.96 | +0.3 / -0.33 dB |
| 4500 | 3.01 | +0.3 / -0.33 dB |
| 4600 | 3.05 | +0.3 / -0.33 dB |
| 4700 | 3.09 | +0.3 / -0.33 dB |
| 4800 | 3.13 | +0.3 / -0.33 dB |
| 4900 | 3.18 | +0.3 / -0.33 dB |
| 5000 | 3.21 | +0.3 / -0.33 dB |
| 5100 | 3.25 | +0.3 / -0.33 dB |
| 5200 | 3.30 | +0.3 / -0.33 dB |
| 5300 | 3.34 | +0.3 / -0.33 dB |
| 5400 | 3.39 | +0.3 / -0.33 dB |
| 5500 | 3.44 | +0.3 / -0.33 dB |
| 5600 | 3.48 | +0.3 / -0.33 dB |
| 5700 | 3.53 | +0.3 / -0.33 dB |
| 5800 | 3.57 | +0.3 / -0.33 dB |
| 5900 | 3.60 | +0.3 / -0.33 dB |
| 6000 | 3.65 | +0.3 / -0.33 dB |
| 6100 | 3.68 | +0.3 / -0.33 dB |
| 6200 | 3.72 | +0.3 / -0.33 dB |
| 6300 | 3.77 | +0.3 / -0.33 dB |
| 6400 | 3.83 | +0.3 / -0.33 dB |
| 6500 | 3.86 | +0.3 / -0.33 dB |
| 6600 | 3.92 | +0.3 / -0.33 dB |
| 6700 | 3.96 | +0.3 / -0.33 dB |
| 6800 | 4.00 | +0.3 / -0.33 dB |
| 6900 | 4.04 | +0.3 / -0.33 dB |
| 7000 | 4.08 | +0.3 / -0.33 dB |
| 7100 | 4.11 | +0.3 / -0.33 dB |
| 7200 | 4.16 | +0.3 / -0.33 dB |
| 7300 | 4.20 | +0.3 / -0.33 dB |
| 7400 | 4.24 | +0.3 / -0.33 dB |
| 7500 | 4.29 | +0.3 / -0.33 dB |
| 7600 | 4.33 | +0.3 / -0.33 dB |
| 7700 | 4.38 | +0.3 / -0.33 dB |
| 7800 | 4.42 | +0.3 / -0.33 dB |
| 7900 | 4.51 | +0.3 / -0.33 dB |
| 8000 | 4.52 | +0.3 / -0.33 dB |
| 8100 | 4.55 | +0.34 / -0.36 dB |
| 8200 | 4.55 | +0.34 / -0.36 dB |

HL 4277: Test cable

| Set / Applied, MHz | Measured, dB | Uncertainty, dB |
|--------------------|--------------|------------------|
| 8300 | 4.57 | +0.34 / -0.36 dB |
| 8400 | 4.60 | +0.34 / -0.36 dB |
| 8500 | 4.60 | +0.34 / -0.36 dB |
| 8600 | 4.63 | +0.34 / -0.36 dB |
| 8700 | 4.63 | +0.34 / -0.36 dB |
| 8800 | 4.64 | +0.34 / -0.36 dB |
| 8900 | 4.65 | +0.34 / -0.36 dB |
| 9000 | 4.67 | +0.34 / -0.36 dB |
| 9100 | 4.69 | +0.34 / -0.36 dB |
| 9200 | 4.71 | +0.34 / -0.36 dB |
| 9300 | 4.73 | +0.34 / -0.36 dB |
| 9400 | 4.76 | +0.34 / -0.36 dB |
| 9500 | 4.78 | +0.34 / -0.36 dB |
| 9600 | 4.81 | +0.34 / -0.36 dB |
| 9700 | 4.85 | +0.34 / -0.36 dB |
| 9800 | 4.87 | +0.34 / -0.36 dB |
| 9900 | 4.89 | +0.34 / -0.36 dB |
| 10000 | 4.93 | +0.34 / -0.36 dB |
| 10100 | 4.96 | +0.4 / -0.44 dB |
| 10200 | 4.99 | +0.4 / -0.44 dB |
| 10300 | 5.02 | +0.4 / -0.44 dB |
| 10400 | 5.05 | +0.4 / -0.44 dB |
| 10500 | 5.08 | +0.4 / -0.44 dB |
| 10600 | 5.11 | +0.4 / -0.44 dB |
| 10700 | 5.14 | +0.4 / -0.44 dB |
| 10800 | 5.17 | +0.4 / -0.44 dB |
| 10900 | 5.19 | +0.4 / -0.44 dB |
| 11000 | 5.22 | +0.4 / -0.44 dB |
| 11100 | 5.25 | +0.4 / -0.44 dB |
| 11200 | 5.28 | +0.4 / -0.44 dB |
| 11300 | 5.31 | +0.4 / -0.44 dB |
| 11400 | 5.34 | +0.4 / -0.44 dB |
| 11500 | 5.38 | +0.4 / -0.44 dB |
| 11600 | 5.41 | +0.4 / -0.44 dB |
| 11700 | 5.45 | +0.4 / -0.44 dB |
| 11800 | 5.49 | +0.4 / -0.44 dB |
| 11900 | 5.53 | +0.4 / -0.44 dB |
| 12000 | 5.56 | +0.4 / -0.44 dB |
| 12100 | 5.60 | +0.4 / -0.44 dB |
| 12200 | 5.63 | +0.4 / -0.44 dB |
| 12300 | 5.68 | +0.4 / -0.44 dB |
| 12400 | 5.72 | +0.4 / -0.44 dB |
| 12500 | 5.75 | +0.47 / -0.52 dB |
| 12600 | 5.80 | +0.47 / -0.52 dB |
| 12700 | 5.84 | +0.47 / -0.52 dB |
| 12800 | 5.93 | +0.47 / -0.52 dB |
| 12900 | 5.94 | +0.47 / -0.52 dB |
| 13000 | 5.98 | +0.47 / -0.52 dB |
| 13100 | 6.03 | +0.47 / -0.52 dB |

| Set / Applied, MHz | Measured, dB | Uncertainty, dB |
|--------------------|--------------|------------------|
| 13200 | 6.09 | +0.47 / -0.52 dB |
| 13300 | 6.17 | +0.47 / -0.52 dB |
| 13400 | 6.27 | +0.47 / -0.52 dB |
| 13500 | 6.37 | +0.47 / -0.52 dB |
| 13600 | 6.49 | +0.47 / -0.52 dB |
| 13700 | 6.57 | +0.47 / -0.52 dB |
| 13800 | 6.60 | +0.47 / -0.52 dB |
| 13900 | 6.61 | +0.47 / -0.52 dB |
| 14000 | 6.59 | +0.47 / -0.52 dB |
| 14100 | 6.57 | +0.47 / -0.52 dB |
| 14200 | 6.54 | +0.47 / -0.52 dB |
| 14300 | 6.53 | +0.47 / -0.52 dB |
| 14400 | 6.49 | +0.47 / -0.52 dB |
| 14500 | 6.48 | +0.47 / -0.52 dB |
| 14600 | 6.46 | +0.47 / -0.52 dB |
| 14700 | 6.46 | +0.47 / -0.52 dB |
| 14800 | 6.49 | +0.47 / -0.52 dB |
| 14900 | 6.51 | +0.47 / -0.52 dB |
| 15000 | 6.54 | +0.47 / -0.52 dB |
| 15100 | 6.57 | +0.47 / -0.52 dB |
| 15200 | 6.62 | +0.47 / -0.52 dB |
| 15300 | 6.64 | +0.47 / -0.52 dB |
| 15400 | 6.68 | +0.47 / -0.52 dB |
| 15500 | 6.71 | +0.47 / -0.52 dB |
| 15600 | 6.78 | +0.47 / -0.52 dB |
| 15700 | 6.79 | +0.47 / -0.52 dB |
| 15800 | 6.82 | +0.47 / -0.52 dB |
| 15900 | 6.88 | +0.47 / -0.52 dB |
| 16000 | 6.89 | +0.47 / -0.52 dB |
| 16100 | 6.96 | +0.47 / -0.52 dB |
| 16200 | 6.97 | +0.47 / -0.52 dB |
| 16300 | 7.02 | +0.47 / -0.52 dB |
| 16400 | 7.07 | +0.47 / -0.52 dB |
| 16500 | 7.12 | +0.47 / -0.52 dB |
| 16600 | 7.17 | +0.47 / -0.52 dB |
| 16700 | 7.20 | +0.47 / -0.52 dB |
| 16800 | 7.22 | +0.47 / -0.52 dB |
| 16900 | 7.23 | +0.47 / -0.52 dB |
| 17000 | 7.24 | +0.47 / -0.52 dB |
| 17100 | 7.27 | +0.47 / -0.52 dB |
| 17200 | 7.28 | +0.47 / -0.52 dB |
| 17300 | 7.28 | +0.47 / -0.52 dB |
| 17400 | 7.30 | +0.47 / -0.52 dB |
| 17500 | 7.34 | +0.47 / -0.52 dB |
| 17600 | 7.35 | +0.47 / -0.52 dB |
| 17700 | 7.39 | +0.47 / -0.52 dB |
| 17800 | 7.41 | +0.47 / -0.52 dB |
| 17900 | 7.41 | +0.47 / -0.52 dB |
| 18000 | 7.44 | +0.47 / -0.52 dB |

HL 5111: RF cable
Huber-Suhner, SF102EA/11SK/11SK/5500MM, s/n 502493/2EA

| Set / Applied, MHz | Measured, dB | Uncertainty, dB |
|--------------------|--------------|-----------------|
| 100 | 0.70 | ±0.07 |
| 200 | 0.99 | ±0.08 |
| 300 | 1.21 | ±0.08 |
| 500 | 1.56 | ±0.08 |
| 1000 | 2.20 | ±0.08 |
| 1500 | 2.69 | ±0.08 |
| 2000 | 3.11 | ±0.08 |
| 2500 | 3.50 | ±0.10 |
| 3000 | 3.85 | ±0.10 |
| 3500 | 4.16 | ±0.10 |
| 4000 | 4.47 | ±0.10 |
| 4500 | 4.74 | ±0.10 |
| 5000 | 5.03 | ±0.10 |
| 5500 | 5.30 | ±0.10 |
| 6000 | 5.57 | ±0.10 |
| 6500 | 5.76 | ±0.10 |
| 7000 | 6.00 | ±0.10 |
| 7500 | 6.20 | ±0.10 |
| 8000 | 6.44 | ±0.10 |
| 8500 | 6.67 | ±0.10 |
| 9000 | 6.82 | ±0.10 |
| 9500 | 7.04 | ±0.10 |
| 10000 | 7.18 | ±0.10 |
| 10500 | 7.36 | ±0.10 |
| 11000 | 7.55 | ±0.10 |
| 11500 | 7.75 | ±0.10 |
| 12000 | 7.90 | ±0.10 |
| 12500 | 8.08 | ±0.13 |
| 13000 | 8.19 | ±0.13 |
| 13500 | 8.39 | ±0.13 |
| 14000 | 8.58 | ±0.13 |
| 14500 | 8.76 | ±0.18 |
| 15000 | 8.92 | ±0.18 |
| 15500 | 9.03 | ±0.18 |
| 16000 | 9.18 | ±0.18 |
| 16500 | 9.34 | ±0.18 |
| 17000 | 9.51 | ±0.18 |
| 17500 | 9.66 | ±0.18 |
| 18000 | 9.80 | ±0.18 |
| 18500 | 9.94 | ±0.23 |
| 19000 | 10.05 | ±0.23 |
| 19500 | 10.22 | ±0.23 |

| Set / Applied, MHz | Measured, dB | Uncertainty, dB |
|--------------------|--------------|-----------------|
| 20000 | 10.32 | ±0.23 |
| 20500 | 10.48 | ±0.23 |
| 21000 | 10.60 | ±0.23 |
| 21500 | 10.73 | ±0.23 |
| 22000 | 10.87 | ±0.23 |
| 22500 | 10.97 | ±0.29 |
| 23000 | 11.09 | ±0.29 |
| 23500 | 11.26 | ±0.29 |
| 24000 | 11.37 | ±0.29 |
| 24500 | 11.50 | ±0.29 |
| 25000 | 11.61 | ±0.23 |
| 25500 | 11.72 | ±0.23 |
| 26000 | 11.87 | ±0.23 |
| 26500 | 11.99 | ±0.23 |
| 27000 | 12.09 | ±0.33 |
| 27500 | 12.24 | ±0.33 |
| 28000 | 12.34 | ±0.40 |
| 28500 | 12.47 | ±0.40 |
| 29000 | 12.61 | ±0.40 |
| 29500 | 12.70 | ±0.40 |
| 30000 | 12.86 | ±0.40 |
| 30500 | 12.92 | ±0.33 |
| 31000 | 13.09 | ±0.33 |
| 31500 | 13.16 | ±0.33 |
| 32000 | 13.33 | ±0.33 |
| 32500 | 13.40 | ±0.33 |
| 33000 | 13.62 | ±0.33 |
| 33500 | 13.70 | ±0.33 |
| 34000 | 13.88 | ±0.33 |
| 34500 | 13.97 | ±0.40 |
| 35000 | 14.05 | ±0.40 |
| 35500 | 14.23 | ±0.40 |
| 36000 | 14.25 | ±0.40 |
| 36500 | 14.46 | ±0.40 |
| 37000 | 14.49 | ±0.33 |
| 37500 | 14.72 | ±0.33 |
| 38000 | 14.77 | ±0.33 |
| 38500 | 14.97 | ±0.33 |
| 39000 | 15.04 | ±0.33 |
| 39500 | 15.22 | ±0.33 |
| 40000 | 15.63 | ±0.47 |

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 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 |

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, 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, 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 and environmental simulation (for exact scope please refer to Certificate No. 839.01).

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13 APPENDIX E

Specification references

FCC 47CFR part 15: 2017

ANSI C63.2: 2016

ANSI C63.4: 2014

ANSI C63.10: 2013

RSS-247: 2017, Issue 2

RSS-Gen: 2018, Issue 5

ICES-003: 2016, Issue 6

558074 D01 DTS

Meas_Guidance v05

Radio Frequency Devices.

American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.

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.

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

Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices

General Requirements for Compliance of Radio Apparatus

Information Technology Equipment (Including Digital Apparatus) – Limits and methods of measurement

Guidance for compliance measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices operating under section 15.247 of the FCC rules

14 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