

## TEST REPORT

ACCORDING TO: FCC 47CFR part 15 subpart C § 15.247 (FHSS) and subpart B  
RSS-247 issue 2, RSS-Gen issue 4, ICES-003 Issue 6:2016

FOR:

**Digital Security Controls Ltd.  
Supervised Wireless PowerG  
Smoke Detector**

**Model: PG9936**

**FCC ID:F5317PG9936**

**IC:160A-PG9936**

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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**Contact name:** Mr. Dan Nita

## 2 Equipment under test attributes

**Product name:** Supervised Wireless PowerG Smoke Detector  
**Product type:** Transceiver  
**Model(s):** PG9936  
**Serial number:** 0-500325  
**Hardware version:** 90-208631  
**Software release:** JS-703284  
**Receipt date:** 17-Aug-17

## 3 Manufacturer information

**Manufacturer name:** Visonic Ltd.  
**Address:** Habarzel street 24, Tel Aviv 69710, Israel  
**Telephone:** +972 3645 6832  
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**E-Mail:** zurir@tycoint.com  
**Contact name:** Mr. Zuri Rubin

## 4 Test details

**Project ID:** 29963  
**Location:** Primary: Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel  
Satellite: Hermon Laboratories Ltd. Hefetz-Haim 10, Tel Aviv 6744124, Israel  
**Test started:** 09-Aug-17  
**Test completed:** 29-Aug-17  
**Test specification(s):** FCC 47CFR part 15, subpart C, §15.247(FHSS) and subpart B;  
RSS-247 issue 2, RSS-Gen issue 4, ICES-003 issue 6:2016

## 5 Tests summary

| Test                                                                                     | Status                                                            |
|------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| <b>Transmitter characteristics</b>                                                       |                                                                   |
| 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                                                      |
| <b>Unintentional emissions</b>                                                           |                                                                   |
| 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                                                              |

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.  
The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

|                     | Name and Title                              | Date               | Signature                                                                             |
|---------------------|---------------------------------------------|--------------------|---------------------------------------------------------------------------------------|
| <b>Tested by:</b>   | Mrs. E. Pitt, test engineer                 | August 29, 2017    |  |
|                     | Mr. I. Zilberstein, test engineer           |                    |  |
| <b>Reviewed by:</b> | Mrs. M. Cherniavsky, certification engineer | September 11, 2017 |  |
| <b>Approved by:</b> | Mr. S. Samokha, project manager             | September 13, 2017 |  |

## 6 EUT description

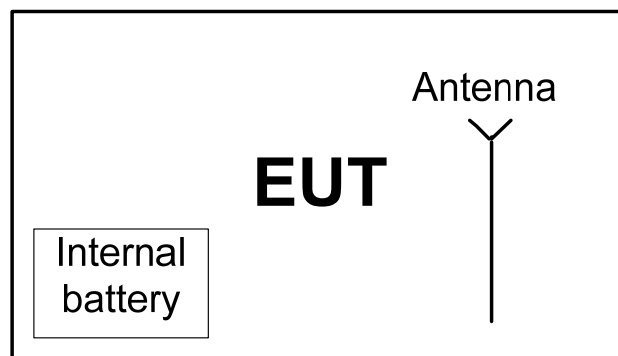
### 6.1 General information

The EUT is a Supervised Wireless PowerG Smoke Detector. The EUT is equipped with an integral antenna and is powered by 3 VDC internal battery.

### 6.2 Changes made in EUT

No changes were implemented in the EUT during the testing.

### 6.3 Test configuration



## 6.4 EUT test positions

Photograph 6.4.1 EUT in X-axis orthogonal position



Photograph 6.4.2 EUT in Y-axis orthogonal position



## 6.5 Transmitter characteristics

|                                                                               |                                                                                                          |                                                           |                                   |                                  |                               |  |
|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-----------------------------------|----------------------------------|-------------------------------|--|
| <b>Type of equipment</b>                                                      |                                                                                                          |                                                           |                                   |                                  |                               |  |
| 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)                                          |                                                           |                                   |                                  |                               |  |
| <b>Intended use</b>                                                           |                                                                                                          | <b>Condition of use</b>                                   |                                   |                                  |                               |  |
|                                                                               | 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 |                                   |                                  |                               |  |
| <b>Assigned frequency ranges</b>                                              |                                                                                                          | 902 – 928 MHz                                             |                                   |                                  |                               |  |
| <b>Operating frequencies</b>                                                  |                                                                                                          | 912.750 – 919.106 MHz                                     |                                   |                                  |                               |  |
| <b>Maximum rated output power</b>                                             |                                                                                                          | At transmitter 50 $\Omega$ RF output connector            |                                   |                                  | dBm                           |  |
|                                                                               |                                                                                                          | Peak output power                                         |                                   |                                  | 11.4 dBm                      |  |
| <b>Is transmitter output power variable?</b>                                  |                                                                                                          | X                                                         | No                                |                                  |                               |  |
|                                                                               |                                                                                                          |                                                           | Yes                               | continuous variable              |                               |  |
|                                                                               |                                                                                                          |                                                           |                                   | stepped variable with stepsize   |                               |  |
|                                                                               |                                                                                                          |                                                           |                                   | minimum RF power                 |                               |  |
|                                                                               |                                                                                                          |                                                           |                                   | maximum RF power                 |                               |  |
| <b>Antenna connection</b>                                                     |                                                                                                          |                                                           |                                   |                                  |                               |  |
| unique coupling                                                               | standard connector                                                                                       | X                                                         | integral                          | with temporary RF connector      |                               |  |
|                                                                               |                                                                                                          |                                                           |                                   | X without temporary RF connector |                               |  |
| <b>Antenna/s technical characteristics</b>                                    |                                                                                                          |                                                           |                                   |                                  |                               |  |
| Type                                                                          | Manufacturer                                                                                             | Model number                                              |                                   | Gain                             |                               |  |
| Integral                                                                      | Ocean                                                                                                    | H306097                                                   |                                   | -2 dBi                           |                               |  |
| <b>Transmitter aggregate data rate/s</b>                                      |                                                                                                          | 50 kbps                                                   |                                   |                                  |                               |  |
| <b>Type of modulation</b>                                                     |                                                                                                          | GFSK                                                      |                                   |                                  |                               |  |
| <b>Modulating test signal (baseband)</b>                                      |                                                                                                          | PRBS                                                      |                                   |                                  |                               |  |
| <b>Transmitter power source</b>                                               |                                                                                                          |                                                           |                                   |                                  |                               |  |
| X                                                                             | Battery                                                                                                  | <b>Nominal rated voltage</b>                              | 3.0 V                             | Battery type                     | 3 AAA Duracell Procell PC2400 |  |
|                                                                               | DC                                                                                                       | <b>Nominal rated voltage</b>                              |                                   |                                  |                               |  |
|                                                                               | AC mains                                                                                                 | <b>Nominal rated voltage</b>                              |                                   | Frequency                        |                               |  |
| <b>Common power source for transmitter and receiver</b>                       |                                                                                                          |                                                           |                                   | X                                | yes                           |  |
|                                                                               |                                                                                                          |                                                           |                                   |                                  | no                            |  |
| <b>Spread spectrum technique used</b>                                         |                                                                                                          | X                                                         | Frequency hopping (FHSS)          |                                  |                               |  |
|                                                                               |                                                                                                          |                                                           | Digital transmission system (DTS) |                                  |                               |  |
|                                                                               |                                                                                                          |                                                           | Hybrid                            |                                  |                               |  |
| <b>Spread spectrum parameters for transmitters tested per FCC 15.247 only</b> |                                                                                                          |                                                           |                                   |                                  |                               |  |
| <b>FHSS</b>                                                                   | Total number of hops                                                                                     | 50                                                        |                                   |                                  |                               |  |
|                                                                               | Bandwidth per hop                                                                                        | 103.3 kHz                                                 |                                   |                                  |                               |  |
|                                                                               | Max. separation of hops                                                                                  | 135 kHz                                                   |                                   |                                  |                               |  |

|                                                                                        |                                |                               |                       |
|----------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), 20 dB bandwidth |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, section 7.8.7                                      |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                           |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 27-Aug-17                                                              |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                              | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1010 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                        |                                |                               |                       |

## 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.

Figure 7.1.1 The 20 dB bandwidth test setup







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|                                                                                        |                                |                               |                       |
|----------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), 20 dB bandwidth |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, section 7.8.7                                      |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                           |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 27-Aug-17                                                              |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                              | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1010 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                        |                                |                               |                       |

Table 7.1.2 The 20 dB bandwidth test results

ASSIGNED FREQUENCY BAND: 902-928 MHz  
 DETECTOR USED: Peak  
 SWEEP TIME: Auto  
 VIDEO BANDWIDTH:  $\geq$  RBW  
 MODULATION ENVELOPE REFERENCE POINTS: 20.0 dBc  
 FREQUENCY HOPPING: Disabled

| Carrier frequency, MHz | Type of modulation | Data rate, kbps | Symbol rate, Msymbols/s | 20 dB bandwidth, kHz | Limit, kHz | Margin, kHz | Verdict |
|------------------------|--------------------|-----------------|-------------------------|----------------------|------------|-------------|---------|
| 912.74                 | GFSK               | 50              | NA                      | 103.33               | 250        | -146.67     | Pass    |
| 915.85                 |                    |                 |                         | 101.59               | 250        | -148.41     | Pass    |
| 919.10                 |                    |                 |                         | 101.01               | 250        | -148.99     | Pass    |

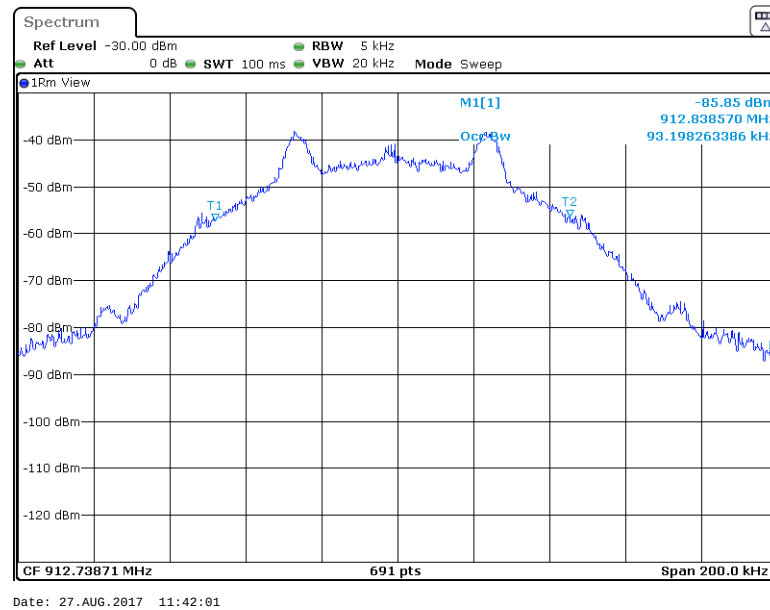
## Reference numbers of test equipment used

|         |         |    |  |  |  |  |  |  |
|---------|---------|----|--|--|--|--|--|--|
| HL 4355 | HL 4135 | HL |  |  |  |  |  |  |
|---------|---------|----|--|--|--|--|--|--|

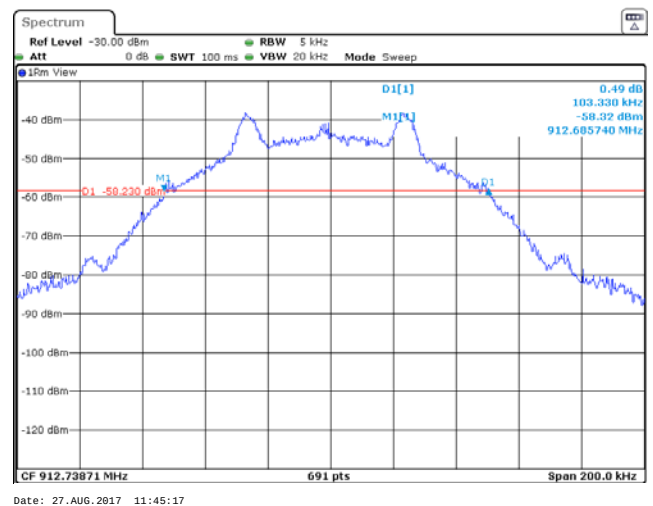
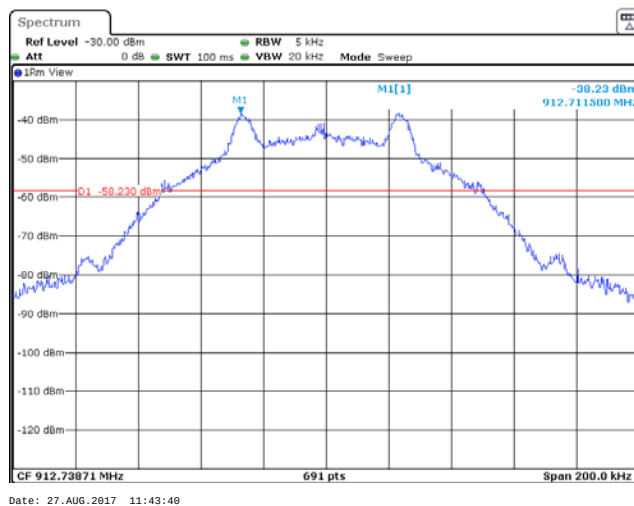
Full description is given in Appendix A.

|                     |                         |                                                             |                |
|---------------------|-------------------------|-------------------------------------------------------------|----------------|
| 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:          |                         | Verdict: PASS                                               |                |
| Date(s):            |                         |                                                             |                |
| 27-Aug-17           |                         |                                                             |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1010 hPa                                      | Power: Battery |
| Remarks:            |                         |                                                             |                |

Plot 7.1.1 The 99% bandwidth test result at low frequency

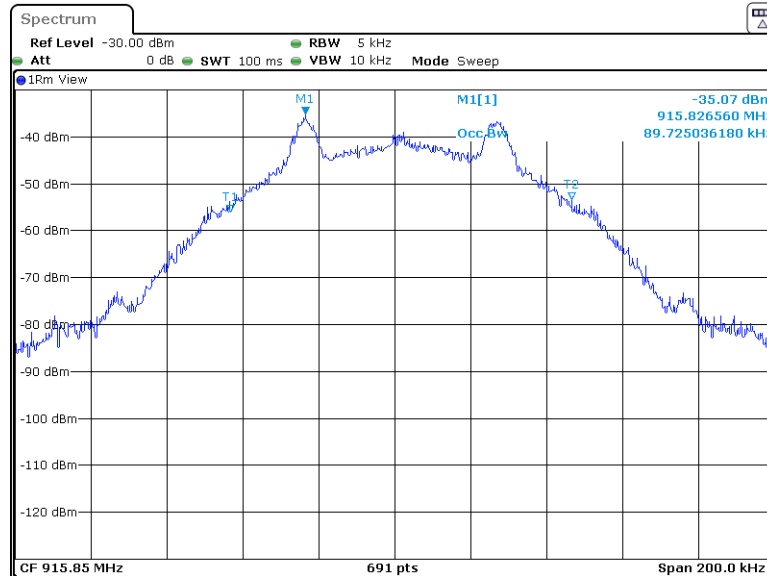


Plot 7.1.2 The 20 dB bandwidth test result at low frequency



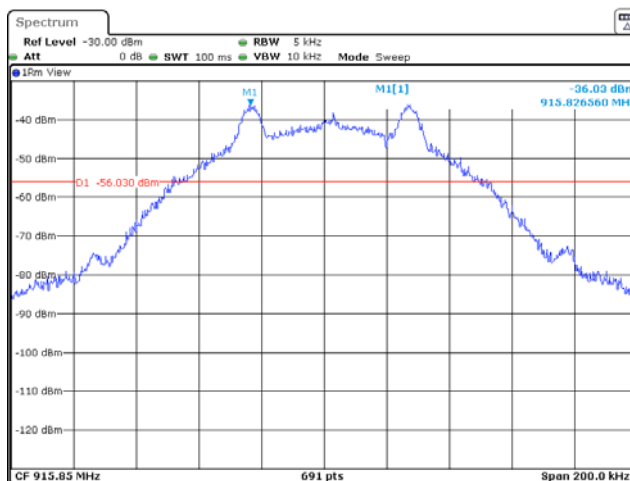
|                     |                         |                                                             |                |
|---------------------|-------------------------|-------------------------------------------------------------|----------------|
| Test specification: |                         | 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:          |                         | Verdict: PASS                                               |                |
| Date(s):            |                         |                                                             |                |
| 27-Aug-17           |                         |                                                             |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1010 hPa                                      | Power: Battery |
| Remarks:            |                         |                                                             |                |

Plot 7.1.3 The 99% bandwidth test result at mid frequency



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Plot 7.1.4 The 20 dB bandwidth test result at mid frequency



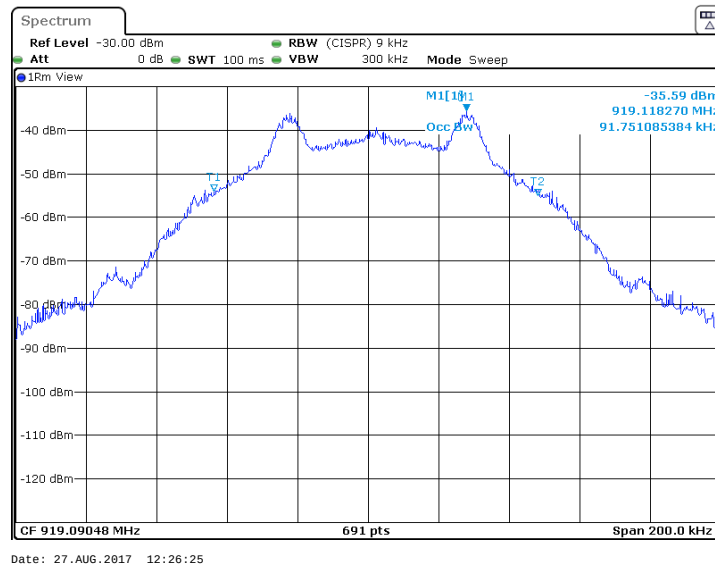
Date: 27.AUG.2017 12:52:57



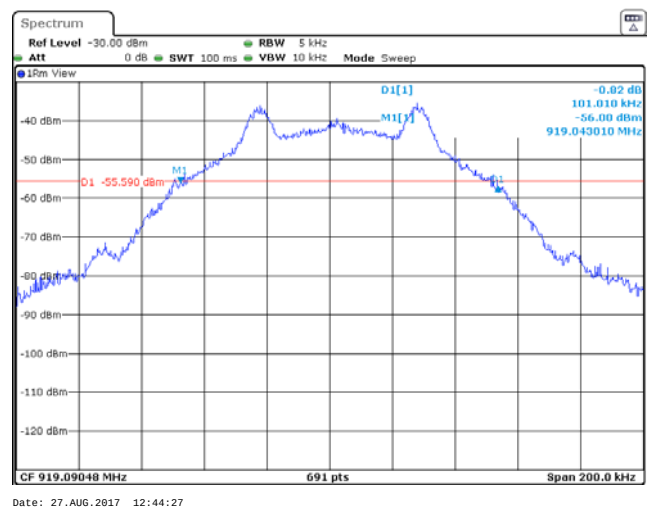
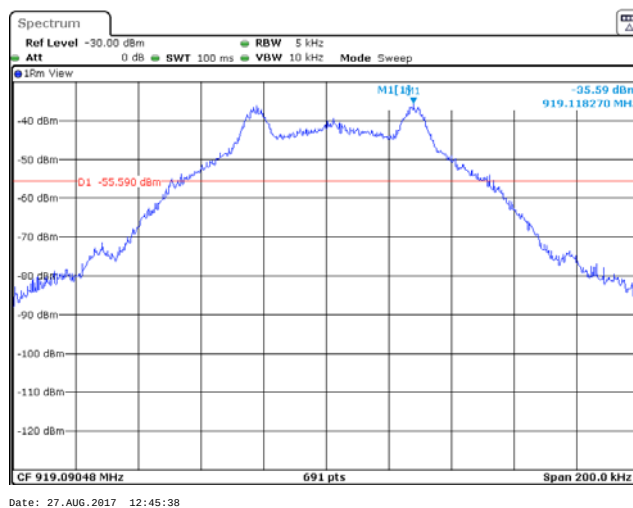
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|                                                                                 |                         |                        |                |
|---------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| 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): 27-Aug-17                                                              |                         |                        |                |
| Temperature: 23 °C                                                              | Relative Humidity: 55 % | Air Pressure: 1010 hPa | Power: Battery |
| Remarks:                                                                        |                         |                        |                |

Plot 7.1.5 The 99% bandwidth test result at high frequency



Plot 7.1.6 The 20 dB bandwidth test result at high frequency



|                                                                                             |                                |                               |                       |
|---------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(b), Frequency separation |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, section 7.8.2                                           |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 27-Aug-17                                                                   |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                   | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1010 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                             |                                |                               |                       |

## 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,<br>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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Date of Issue: 13-Sep-17

|                                                                                             |                                |                               |                       |
|---------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(b), Frequency separation |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, section 7.8.2                                           |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 27-Aug-17                                                                   |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                   | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1010 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                             |                                |                               |                       |

Table 7.2.2 Carrier frequency separation test results

ASSIGNED FREQUENCY: 902-928 MHz  
 MODULATION: GFSK  
 BIT RATE: 50 kbps  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH:  $\geq 1\%$  of the span  
 VIDEO BANDWIDTH:  $\geq$  RBW  
 FREQUENCY HOPPING: Enabled  
 20 dB BANDWIDTH: 103.3 kHz

| Carrier frequency separation, kHz | Limit, kHz | Margin* | Verdict |
|-----------------------------------|------------|---------|---------|
| 135                               | 103.3      | 31.7    | Pass    |

\* - Margin = Carrier frequency separation – specification limit.

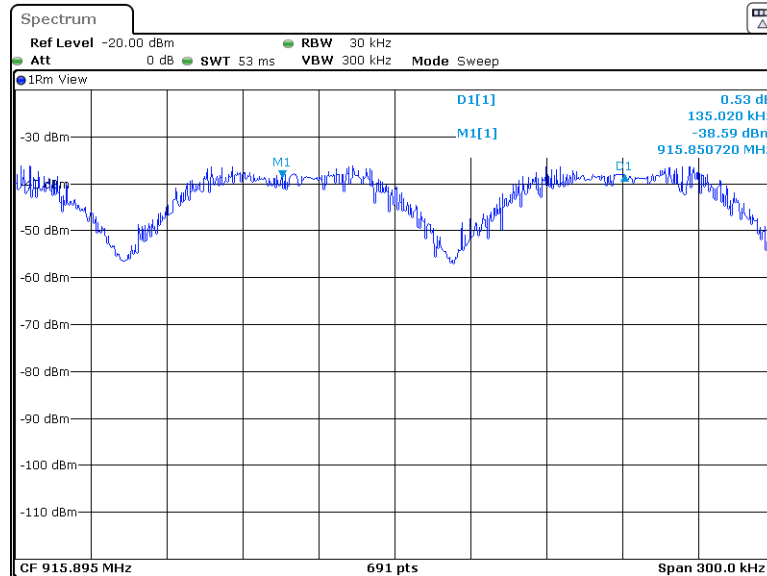
## Reference numbers of test equipment used

|         |         |  |  |  |  |  |  |
|---------|---------|--|--|--|--|--|--|
| HL 4135 | HL 4355 |  |  |  |  |  |  |
|---------|---------|--|--|--|--|--|--|

Full description is given in Appendix A.

|                                                                                      |                         |                        |                |
|--------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| 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): 27-Aug-17                                                                   |                         |                        |                |
| Temperature: 23 °C                                                                   | Relative Humidity: 55 % | Air Pressure: 1010 hPa | Power: Battery |
| Remarks:                                                                             |                         |                        |                |

Plot 7.2.1 Carrier frequency separation



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|                                                                                                      |                                |                               |                       |
|------------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), Number of hopping frequencies |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, section 7.8.3                                                    |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                         |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 27-Aug-17                                                                            |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                            | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1010 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                                      |                                |                               |                       |

## 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)<br>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 the associated plots.

Figure 7.3.1 Hopping frequencies test setup







HERMON LABORATORIES

|                                                                                                      |                                |                               |                       |
|------------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), Number of hopping frequencies |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, section 7.8.3                                                    |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                         |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 27-Aug-17                                                                            |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                            | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1010 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                                      |                                |                               |                       |

Table 7.3.2 Hopping frequencies test results

ASSIGNED FREQUENCY: 902-928 MHz  
MODULATION: GFSK  
BIT RATE: 50 kbps  
DETECTOR USED: Peak  
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.

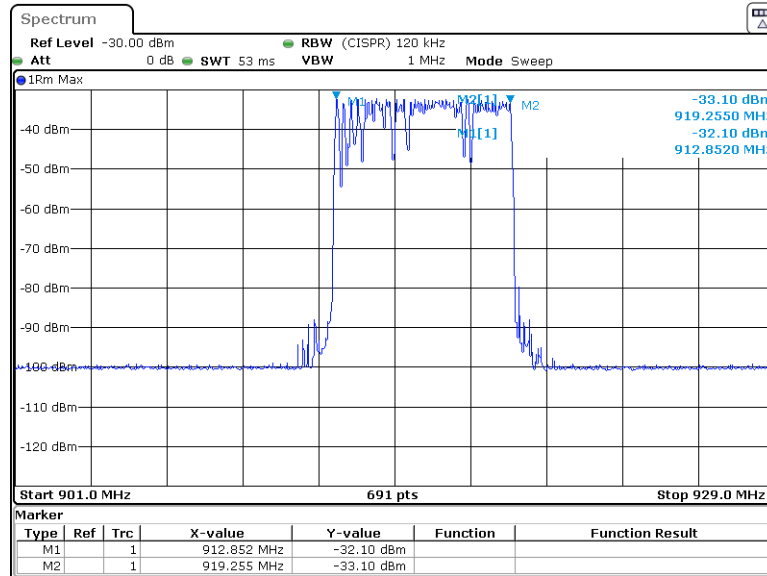
Reference numbers of test equipment used

|         |         |  |  |  |  |  |  |
|---------|---------|--|--|--|--|--|--|
| HL 4135 | HL 4355 |  |  |  |  |  |  |
|---------|---------|--|--|--|--|--|--|

Full description is given in Appendix A.

|                                                                                                      |                                |                               |                       |
|------------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), Number of hopping frequencies |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, section 7.8.3                                                    |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                         |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 27-Aug-17                                                                            |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                            | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1010 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                                      |                                |                               |                       |

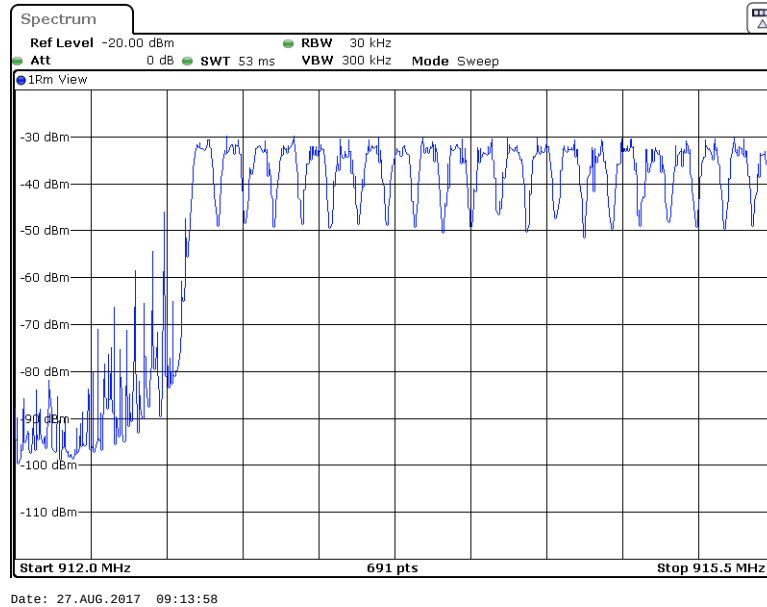
Plot 7.3.1 Number of hopping frequencies



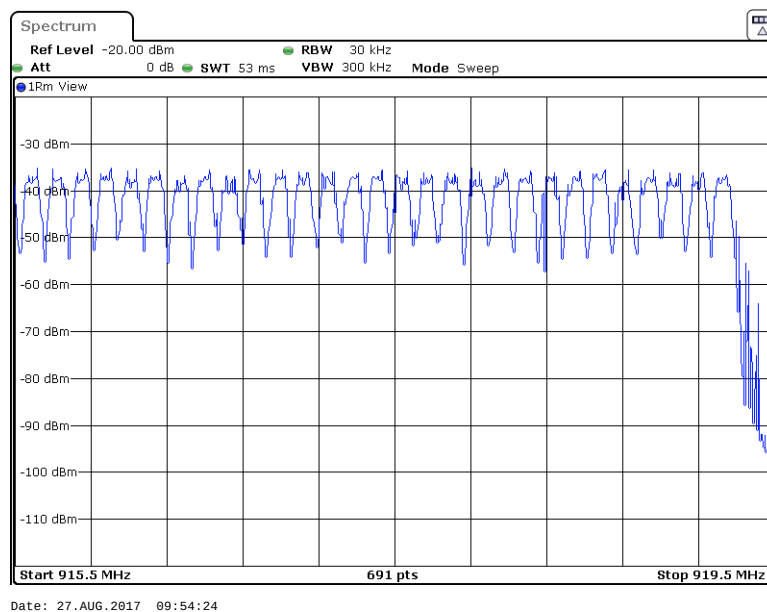
Date: 27.AUG.2017 08:43:06

|                                                                                               |                         |                        |                |
|-----------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| 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): 27-Aug-17                                                                            |                         |                        |                |
| Temperature: 23 °C                                                                            | Relative Humidity: 55 % | Air Pressure: 1010 hPa | Power: Battery |
| Remarks:                                                                                      |                         |                        |                |

**Plot 7.3.2 Number of hopping frequencies (21 channels)**



**Plot 7.3.3 Number of hopping frequencies (29 channels)**



|                                                                                                  |                                |                               |                       |
|--------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), Average time of occupancy |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, section 7.8.4                                                |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                     |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 28-Aug-17                                                                        |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                        | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1012 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                                  |                                |                               |                       |

## 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                   | $\geq 50$                     |
| 902.0 – 928.0                 | 0.4                                  | 10.0                   | $< 50$                        |
| 2400.0 – 2483.5               | 0.4                                  | $0.4 \times N$         | $N (\geq 15)$                 |
| 5725.0 – 5850.0               | 0.4                                  | 30.0                   | $\geq 75$                     |

### 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.

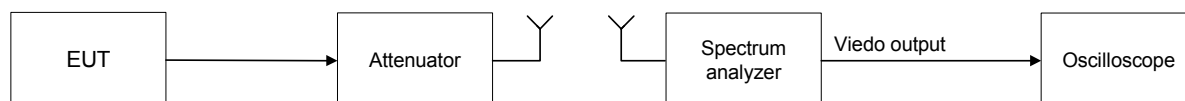
7.4.2.2 The spectrum analyzer span was set to zero centered on a hopping channel.

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 the associated plots.

Figure 7.4.1 Average time of occupancy test setup





|                                                                                                  |                                |                               |                       |
|--------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), Average time of occupancy |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, section 7.8.4                                                |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                     |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 28-Aug-17                                                                        |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                        | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1012 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                                  |                                |                               |                       |

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: 20 s  
 FREQUENCY HOPPING: Enabled

| Carrier frequency, MHz | Single transmission duration, ms | Number of pulses during 20 sec | Average time of occupancy, ms | Bit rate, kbps | Symbol rate, Msymbol/s | Limit, s | Margin, s* | Verdict |
|------------------------|----------------------------------|--------------------------------|-------------------------------|----------------|------------------------|----------|------------|---------|
| 912.75                 | 4.75                             | 1                              | 4.75                          | 50             | NA                     | 0.4      | -0.39525   | Pass    |

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

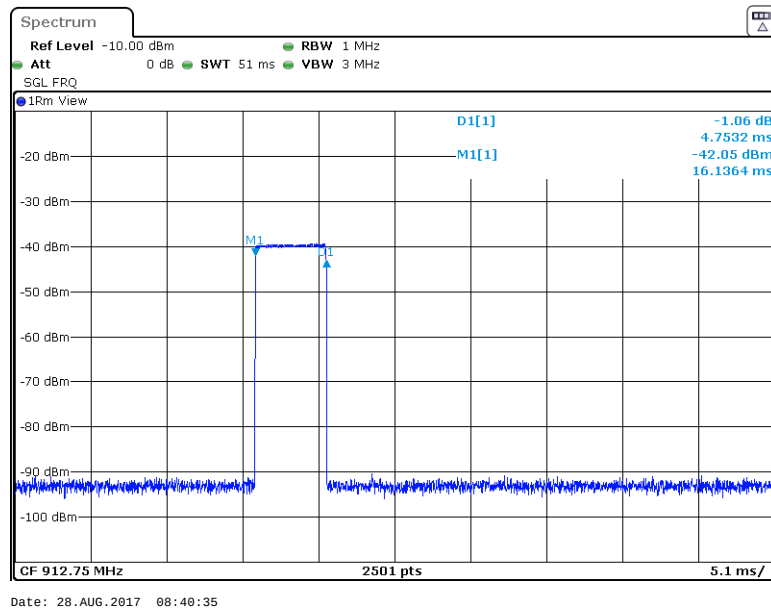
**Reference numbers of test equipment used**

|         |         |  |  |  |  |  |  |
|---------|---------|--|--|--|--|--|--|
| HL 4135 | HL 4355 |  |  |  |  |  |  |
|---------|---------|--|--|--|--|--|--|

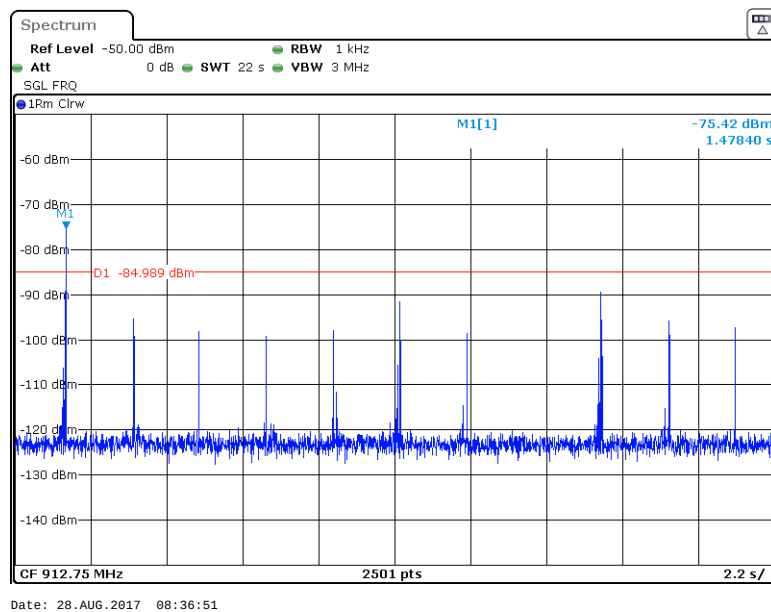
Full description is given in Appendix A.

|                                                                                           |                         |                        |                |
|-------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| 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): 28-Aug-17                                                                        |                         |                        |                |
| Temperature: 23 °C                                                                        | Relative Humidity: 55 % | Air Pressure: 1012 hPa | Power: Battery |
| Remarks:                                                                                  |                         |                        |                |

Plot 7.4.1 Single transmission duration



Plot 7.4.2 Single transmission period





|                                                                                         |                                |                               |                       |
|-----------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(b), RSS-247 section 5.4(a), Peak output power |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, section 7.8.5                                       |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                            |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 09-Aug-17                                                               |                                |                               |                       |
| <b>Temperature:</b> 25.4 °C                                                             | <b>Relative Humidity:</b> 52 % | <b>Air Pressure:</b> 1008 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                         |                                |                               |                       |

## 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.

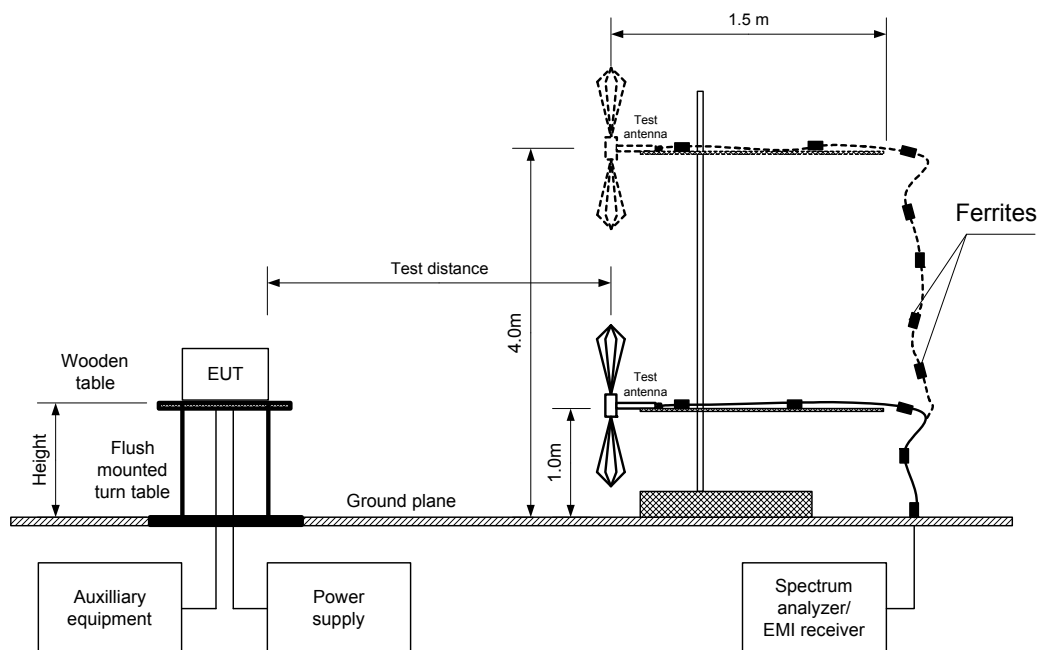
The above equation was converted in logarithmic units for 3 m test distance:

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

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

|                                                                                         |                                |                               |                       |
|-----------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(b), RSS-247 section 5.4(a), Peak output power |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, section 7.8.5                                       |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                            |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 09-Aug-17                                                               |                                |                               |                       |
| <b>Temperature:</b> 25.4 °C                                                             | <b>Relative Humidity:</b> 52 % | <b>Air Pressure:</b> 1008 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                         |                                |                               |                       |

Figure 7.5.1 Setup for carrier field strength measurements







|                                                                                         |                                |                               |                       |
|-----------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(b), RSS-247 section 5.4(a), Peak output power |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, section 7.8.5                                       |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                            |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 09-Aug-17                                                               |                                |                               |                       |
| <b>Temperature:</b> 25.4 °C                                                             | <b>Relative Humidity:</b> 52 % | <b>Air Pressure:</b> 1008 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                         |                                |                               |                       |

Table 7.5.2 Peak output power test results

ASSIGNED FREQUENCY: 902-928 MHz  
 TEST DISTANCE: 3 m  
 TEST SITE: Semi anechoic chamber  
 EUT HEIGHT: 0.8 m  
 DETECTOR USED: Peak  
 TEST ANTENNA TYPE: Biconilog (30 MHz – 1000 MHz)  
 MODULATION: GFSK  
 BIT RATE: 50 kbps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 120 MHz  
 VIDEO BANDWIDTH: 300 MHz  
 FREQUENCY HOPPING: Disabled

## Retest after changes

| 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 |
|----------------|--------------------------|----------------------|-------------------|-------------------|-----------------------|--------------------------|------------|---------------|---------|
| 912.764        | 104.57                   | H                    | 1.0               | 360               | -2.0                  | 11.37                    | 30.0       | -15.63        | Pass    |
| 915.837        | 104.14                   | V                    | 1.4               | 360               | -2.0                  | 10.94                    | 30.0       | -16.04        | Pass    |
| 919.072        | 104.25                   | V                    | 1.1               | 0                 | -2.0                  | 11.05                    | 30.0       | -15.95        | 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 in Y-axis orthogonal position.

## Reference numbers of test equipment used

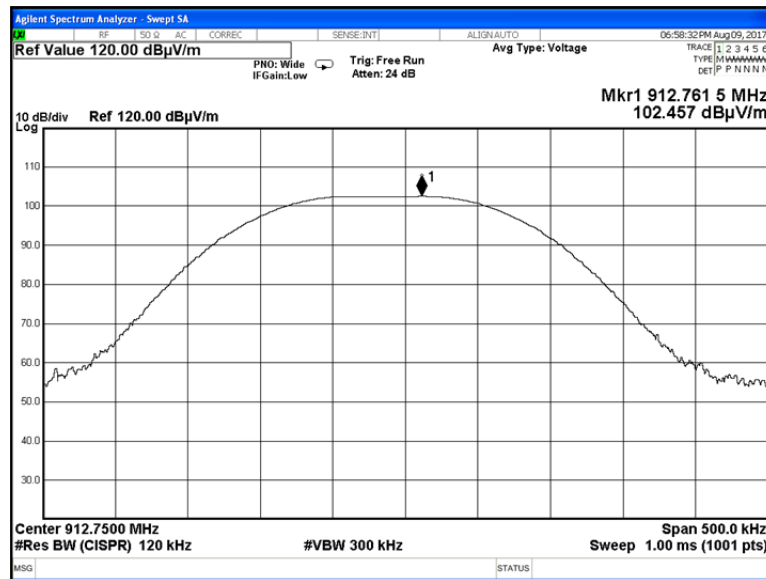
|         |         |         |         |         |         |  |  |
|---------|---------|---------|---------|---------|---------|--|--|
| HL 4541 | HL 4542 | HL 4575 | HL 4604 | HL 5102 | HL 5105 |  |  |
|---------|---------|---------|---------|---------|---------|--|--|

Full description is given in Appendix A.

|                      |                         |                                                              |                |
|----------------------|-------------------------|--------------------------------------------------------------|----------------|
| 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:           |                         | Verdict: PASS                                                |                |
| Date(s):             |                         |                                                              |                |
| 09-Aug-17            |                         |                                                              |                |
| Temperature: 25.4 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa                                       | Power: Battery |
| Remarks:             |                         |                                                              |                |

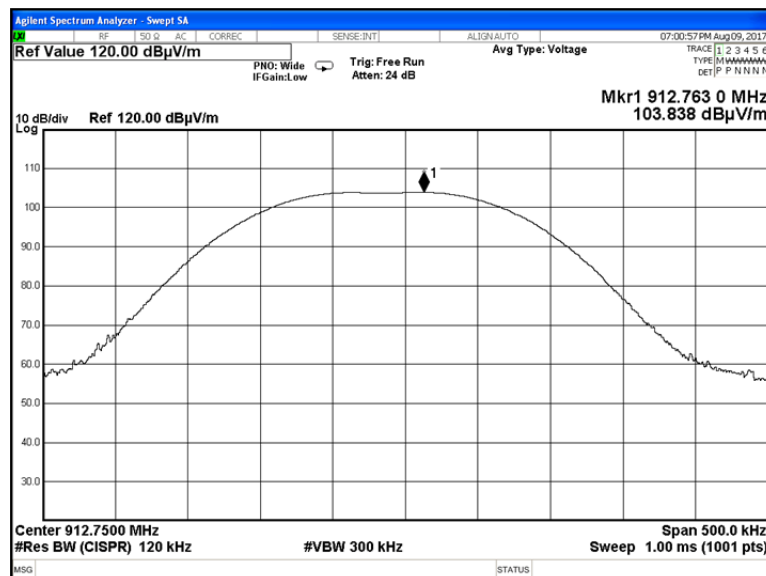
Plot 7.5.1 Field strength of carrier at low frequency and Unom

Antenna polarization: Vertical  
EUT position: X-axis



Plot 7.5.2 Field strength of carrier at low frequency and Unom

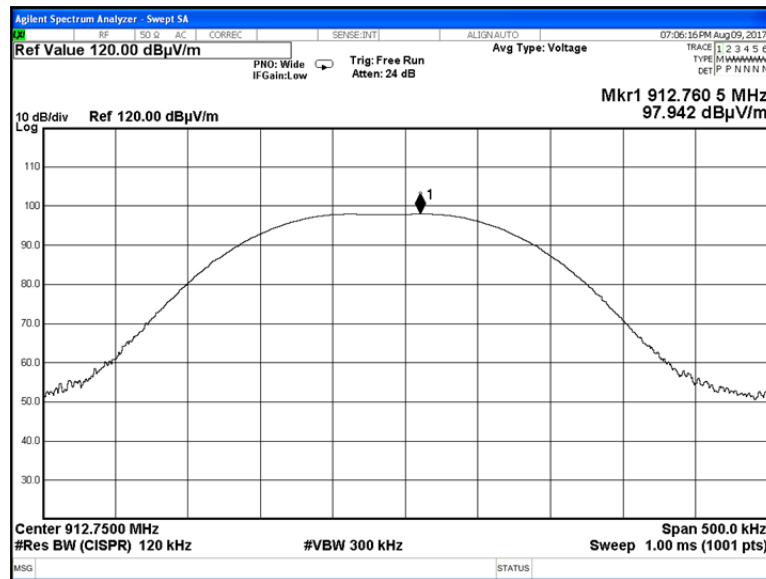
Antenna polarization: Horizontal  
EUT position: X-axis



|                      |                         |                                                              |                |
|----------------------|-------------------------|--------------------------------------------------------------|----------------|
| 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:           |                         | Verdict: PASS                                                |                |
| Date(s):             |                         |                                                              |                |
| 09-Aug-17            |                         |                                                              |                |
| Temperature: 25.4 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa                                       | Power: Battery |
| Remarks:             |                         |                                                              |                |

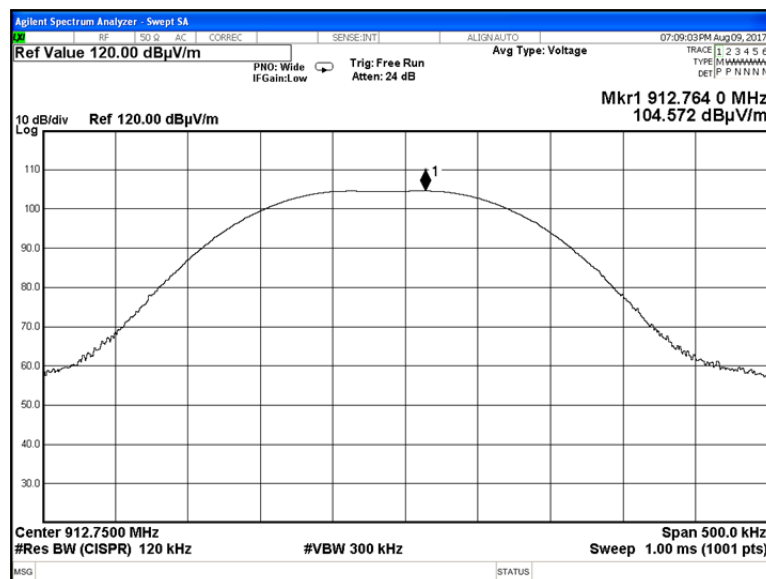
Plot 7.5.3 Field strength of carrier at low frequency and Unom

Antenna polarization: Vertical  
EUT position: Y-axis



Plot 7.5.4 Field strength of carrier at low frequency and Unom

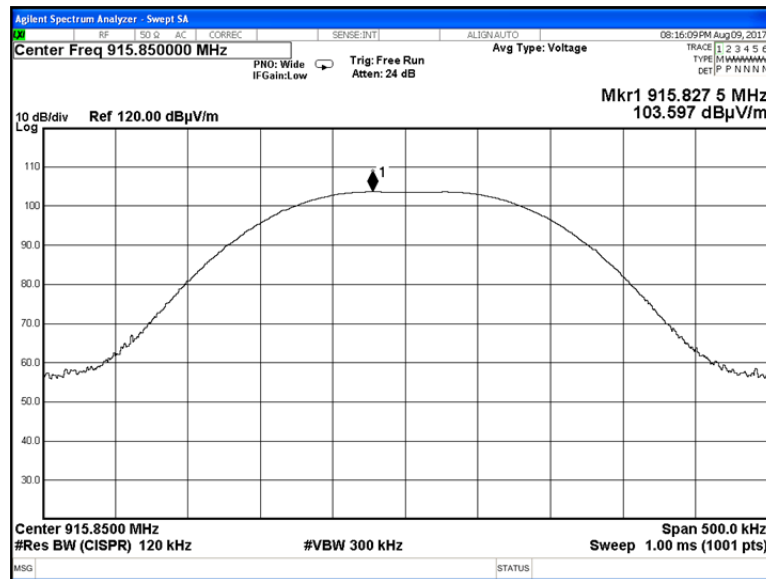
Antenna polarization: Horizontal  
EUT position: Y-axis



|                      |                         |                                                              |                |
|----------------------|-------------------------|--------------------------------------------------------------|----------------|
| 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:           |                         | Verdict: PASS                                                |                |
| Date(s):             |                         |                                                              |                |
| 09-Aug-17            |                         |                                                              |                |
| Temperature: 25.4 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa                                       | Power: Battery |
| Remarks:             |                         |                                                              |                |

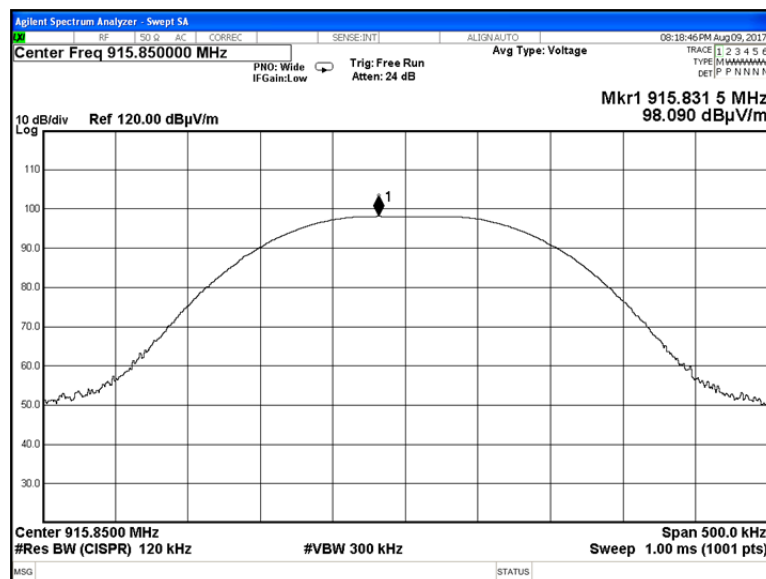
Plot 7.5.5 Field strength of carrier at mid frequency and Unom

Antenna polarization: Vertical  
EUT position: X-axis



Plot 7.5.6 Field strength of carrier at mid frequency and Unom

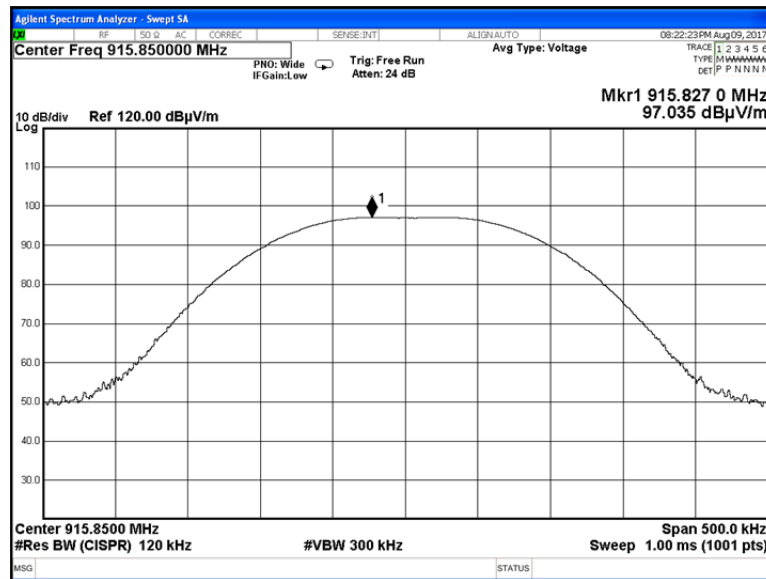
Antenna polarization: Horizontal  
EUT position: X-axis



|                      |                         |                                                              |                |
|----------------------|-------------------------|--------------------------------------------------------------|----------------|
| 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:           |                         | Verdict: PASS                                                |                |
| Date(s):             |                         |                                                              |                |
| 09-Aug-17            |                         |                                                              |                |
| Temperature: 25.4 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa                                       | Power: Battery |
| Remarks:             |                         |                                                              |                |

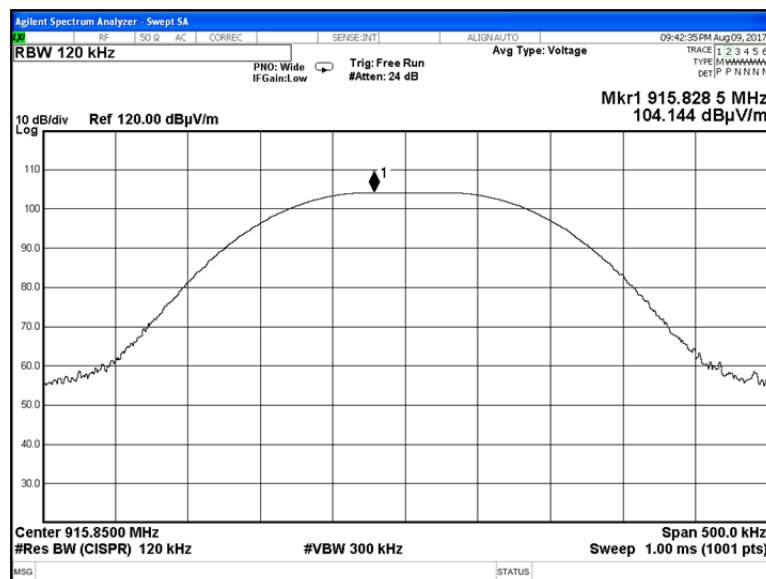
Plot 7.5.7 Field strength of carrier at mid frequency and Unom

Antenna polarization: Vertical  
EUT position: Y-axis



Plot 7.5.8 Field strength of carrier at mid frequency and Unom

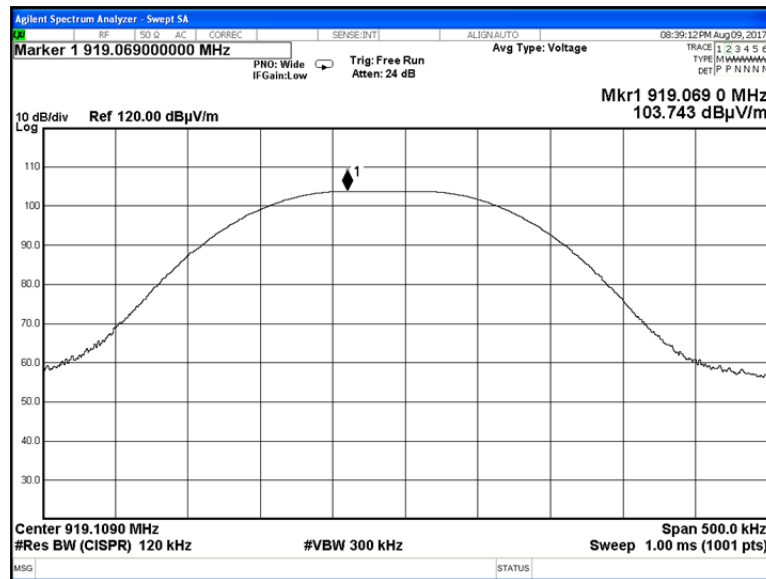
Antenna polarization: Horizontal  
EUT position: Y-axis



|                      |                         |                                                              |                |
|----------------------|-------------------------|--------------------------------------------------------------|----------------|
| 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:           |                         | Verdict: PASS                                                |                |
| Date(s):             |                         |                                                              |                |
| 09-Aug-17            |                         |                                                              |                |
| Temperature: 25.4 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa                                       | Power: Battery |
| Remarks:             |                         |                                                              |                |

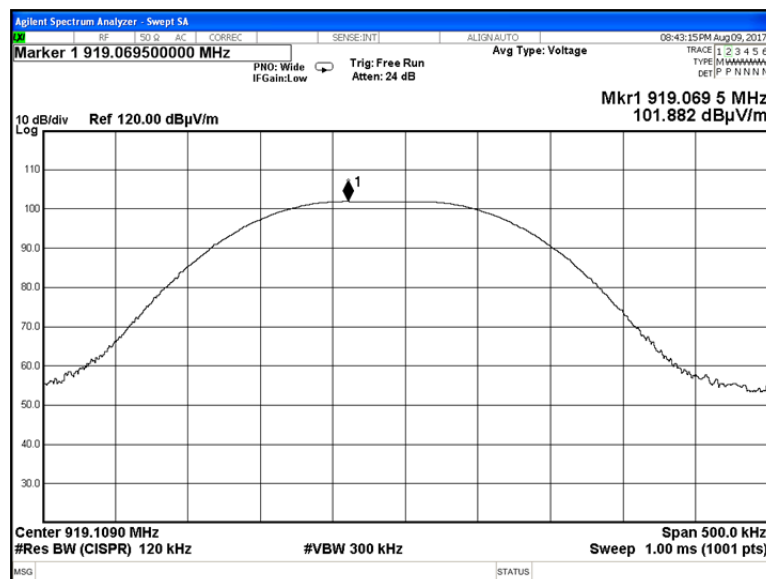
Plot 7.5.9 Field strength of carrier at high frequency and Unom

Antenna polarization: Vertical  
EUT position: X-axis



Plot 7.5.10 Field strength of carrier at high frequency and Unom

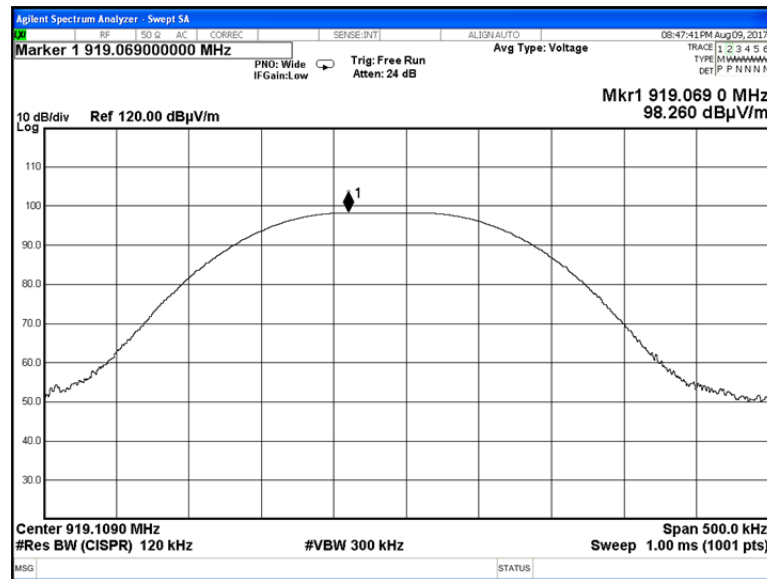
Antenna polarization: Horizontal  
EUT position: X-axis



|                      |                         |                                                              |                |
|----------------------|-------------------------|--------------------------------------------------------------|----------------|
| 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:           |                         | Verdict: PASS                                                |                |
| Date(s):             |                         |                                                              |                |
| 09-Aug-17            |                         |                                                              |                |
| Temperature: 25.4 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa                                       | Power: Battery |
| Remarks:             |                         |                                                              |                |

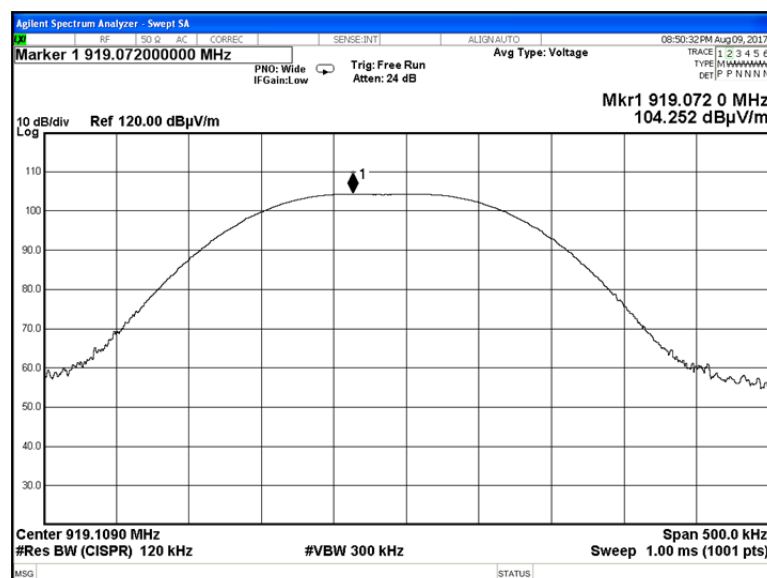
Plot 7.5.11 Field strength of carrier at high frequency and Unom

Antenna polarization: Vertical  
EUT position: Y-axis



Plot 7.5.12 Field strength of carrier at high frequency and Unom

Antenna polarization: Horizontal  
EUT position: Y-axis





|                                                                                                |                                |                               |                       |
|------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6                                          |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                   |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 28-Aug-17                                                                      |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                      | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1012 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                                |                                |                               |                       |

## 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 <sup>th</sup> harmonic | 74.0                                                       | NA              | 54.0            |                                                                                           |

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

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

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

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

\*\*\* - 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.

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

7.6.2.1 The EUT was set up as shown in Figure 7.6.1, 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° and the measuring antenna was rotated around its vertical axis.

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

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

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

7.6.3.2 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.

7.6.3.3 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:          |                         | Verdict: PASS                                                       |                |
| Date(s):            |                         |                                                                     |                |
| 28-Aug-17           |                         |                                                                     |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1012 hPa                                              | Power: Battery |
| Remarks:            |                         |                                                                     |                |

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

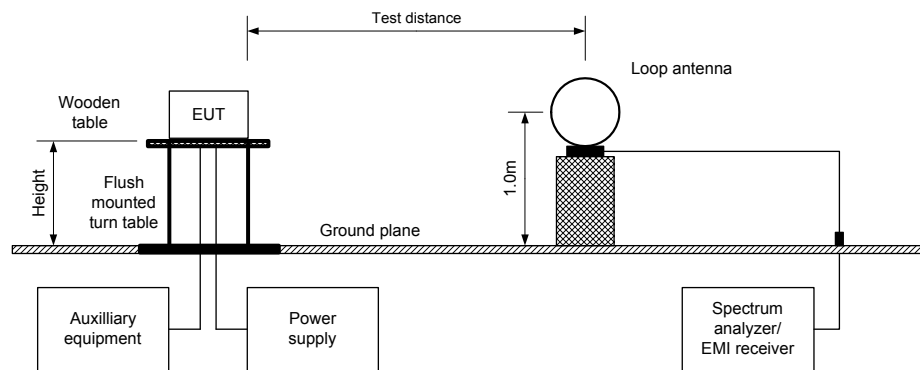
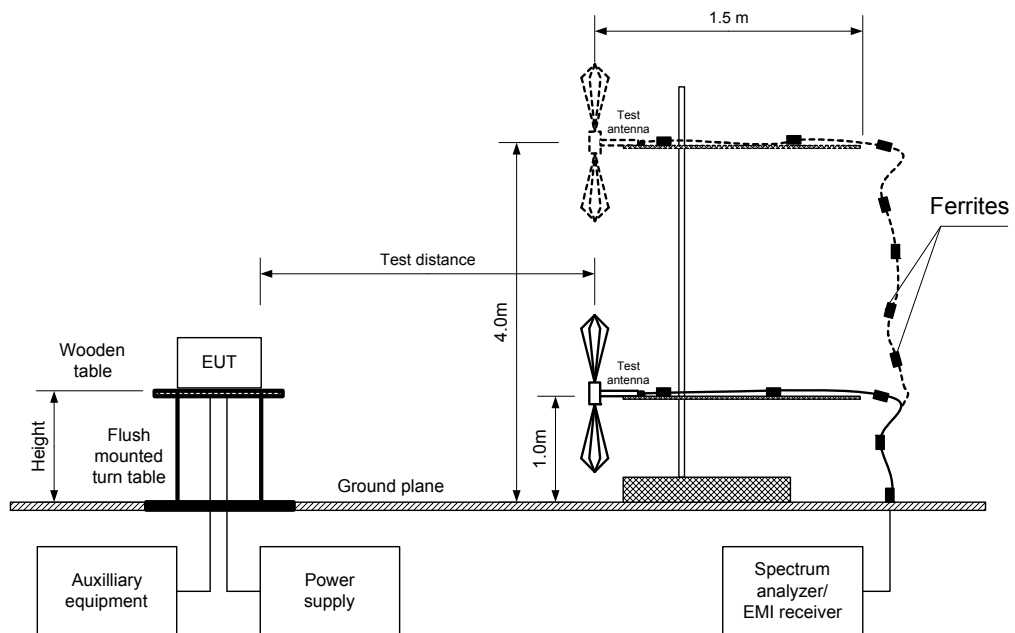
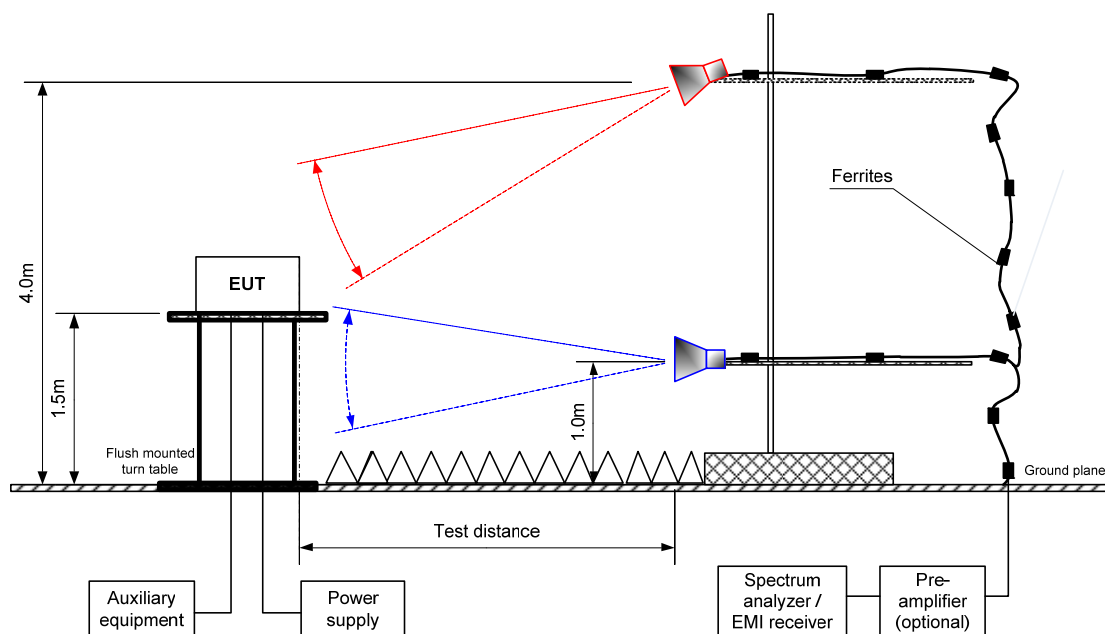


Figure 7.6.2 Setup for spurious emission field strength measurements above 30 MHz



|                                                                                                |                                |                               |                       |
|------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6                                          |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                   |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 28-Aug-17                                                                      |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                      | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1012 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                                |                                |                               |                       |

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





|                                                                                                |                                |                               |                       |
|------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6                                          |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                   |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 28-Aug-17                                                                      |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                      | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1012 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                                |                                |                               |                       |

Table 7.6.2 Field strength of emissions outside restricted bands

ASSIGNED FREQUENCY: 902-928 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 -9500 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: GFSK  
 DUTY CYCLE: 100 %  
 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  |                                      |                      |                   |                   |                                     |                                |            |              |         |
| 1825.50                | 53.79                                | Horizontal           | 1.3               | 0.0               | 103.876                             | 48.68                          | 20.0       | 28.68        | Pass    |
| 5476.50                | 36.18                                | Horizontal           | 1.4               | 0.0               |                                     | 74.11                          |            | 54.11        |         |
| Mid carrier frequency  |                                      |                      |                   |                   |                                     |                                |            |              |         |
| 1831.70                | 55.61                                | Horizontal           | 1.7               | 0                 | 104.291                             | 48.68                          | 20.0       | 28.68        | Pass    |
| 5495.10                | 30.18                                | Horizontal           | 1.4               | 0.0               |                                     | 74.11                          |            | 54.11        |         |
| High carrier frequency |                                      |                      |                   |                   |                                     |                                |            |              |         |
| 1838.22                | 57.36                                | Horizontal           | 1.9               | 0                 | 104.191                             | 46.83                          | 20.0       | 26.83        | Pass    |
| 5514.65                | 32.98                                | Horizontal           | 1.4               | 0.0               |                                     | 71.21                          |            | 51.21        |         |

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

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



HERMON LABORATORIES

|                                                                                                |                                |                               |                       |
|------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6                                          |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                   |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 28-Aug-17                                                                      |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                      | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1012 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                                |                                |                               |                       |

**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  
 DUTY CYCLE: 100 %  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 1000 kHz  
 TEST ANTENNA TYPE: Double ridged guide  
 FREQUENCY HOPPING: Disabled  
 ASSIGNED FREQUENCY: 902-928 MHz

| Assigned Frequency:    |              |           |                   | 902-928 MHz                    |                 |              |                                   |                      |                 |               |         |
|------------------------|--------------|-----------|-------------------|--------------------------------|-----------------|--------------|-----------------------------------|----------------------|-----------------|---------------|---------|
| Frequency, MHz         | Antenna      |           | Azimuth, degrees* | Peak field strength(VBW=3 MHz) |                 |              | Average field strength(VBW=10 Hz) |                      |                 |               | 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  |              |           |                   |                                |                 |              |                                   |                      |                 |               |         |
| 2738.25                | Vertical     | 1.7       | 0                 | 57.11                          | 74.0            | -16.89       | 57.11                             | 40.11                | 54.0            | -13.89        | Pass    |
| 3651.00                | Vertical     | 1.5       | 0                 | 42.36                          | 74.0            | -31.64       | 42.36                             | 25.36                | 54.0            | -28.64        |         |
| 4563.75                | Vertical     | 1.5       | 0                 | 45.65                          | 74.0            | -28.35       | 45.65                             | 28.65                | 54.0            | -25.35        |         |
| Mid carrier frequency  |              |           |                   |                                |                 |              |                                   |                      |                 |               |         |
| 2747.55                | Vertical     | 1.4       | 272               | 59.32                          | 74.0            | -14.68       | 59.32                             | 42.32                | 54.0            | -11.68        | Pass    |
| 3663.40                | Vertical     | 1.5       | 0                 | 45.07                          | 74.0            | -28.93       | 45.07                             | 28.07                | 54.0            | -25.93        |         |
| 4579.25                | Vertical     | 1.5       | 0                 | 48.57                          | 74.0            | -25.43       | 48.57                             | 31.57                | 54.0            | -22.43        |         |
| High carrier frequency |              |           |                   |                                |                 |              |                                   |                      |                 |               |         |
| 2757.33                | Vertical     | 1.7       | 0                 | 56.46                          | 74.0            | -17.54       | 56.46                             | 39.46                | 54.0            | -14.54        | Pass    |
| 3676.44                | Vertical     | 1.5       | 0                 | 39.40                          | 74.0            | -34.6        | 39.40                             | 22.40                | 54.0            | -31.60        |         |
| 4595.55                | Vertical     | 1.7       | 0                 | 48.59                          | 74.0            | -25.41       | 48.59                             | 31.59                | 54.0            | -22.41        |         |

\*- 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       | Period, ms | Duration, ms       | Period, ms |                                 |                    |
| 4.66               | 39.1       | NA                 | NA         | NA                              | -17                |

\*- Average factor was calculated as follows

for pulse train longer than 100 ms:

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



|                                                                                                |                                |                               |                       |
|------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6                                          |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                   |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 28-Aug-17                                                                      |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                      | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1012 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                                |                                |                               |                       |

**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  
 ASSIGNED FREQUENCY: 902-928 MHz  
 BIT RATE: Mbps  
 DUTY CYCLE: 100 %  
 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 signals 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 1915 | HL 3818 | HL 4222 | HL 4294 | HL 4295 | HL 4535 | HL 4541 | HL 4542 |
| HL 4543 | HL 4549 | HL 4575 | HL 4603 | HL 4604 | HL 4933 | HL 5105 | HL 5111 |

Full description is given in Appendix A.



|                     |                         |                                                                     |                |
|---------------------|-------------------------|---------------------------------------------------------------------|----------------|
| 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:          |                         | Verdict: PASS                                                       |                |
| Date(s):            |                         |                                                                     |                |
| 28-Aug-17           |                         |                                                                     |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1012 hPa                                              | Power: Battery |
| 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   |               |

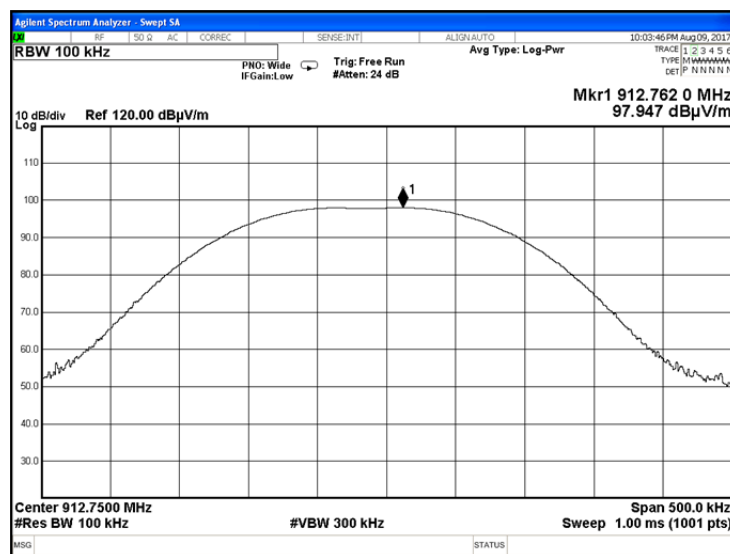
Table 7.6.7 Restricted bands according to RSS-Gen

| 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    |

|                     |                         |                                                                     |                |
|---------------------|-------------------------|---------------------------------------------------------------------|----------------|
| 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:          |                         | Verdict: PASS                                                       |                |
| Date(s):            |                         |                                                                     |                |
| 28-Aug-17           |                         |                                                                     |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1012 hPa                                              | Power: Battery |
| Remarks:            |                         |                                                                     |                |

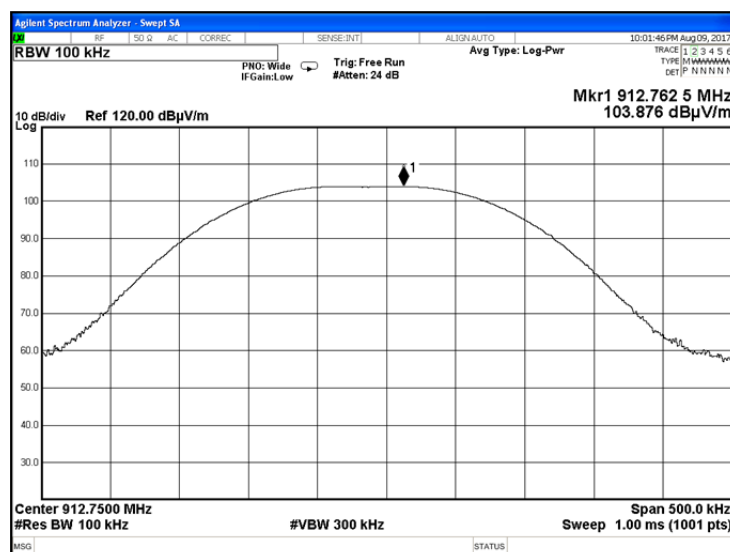
Plot 7.6.1 Radiated emission measurements at the low carrier frequency

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



Plot 7.6.2 Radiated emission measurements at the low carrier frequency

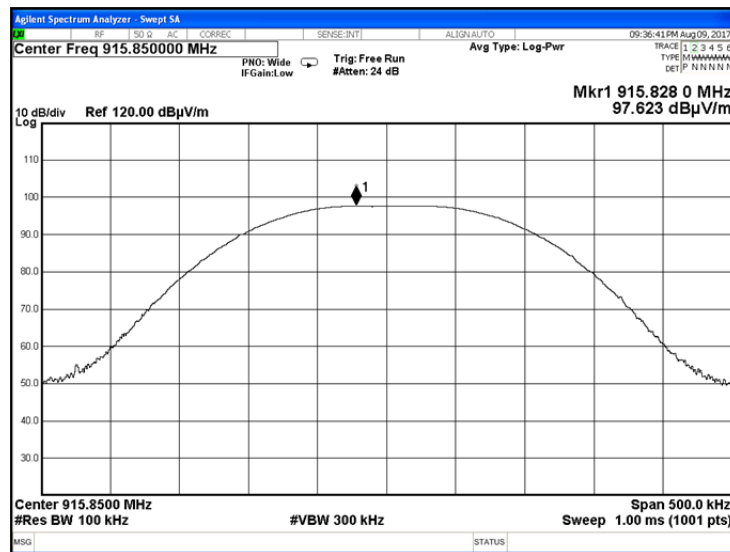
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal



|                     |                         |                                                                     |                |
|---------------------|-------------------------|---------------------------------------------------------------------|----------------|
| 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:          |                         | Verdict: PASS                                                       |                |
| Date(s):            |                         |                                                                     |                |
| 28-Aug-17           |                         |                                                                     |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1012 hPa                                              | Power: Battery |
| Remarks:            |                         |                                                                     |                |

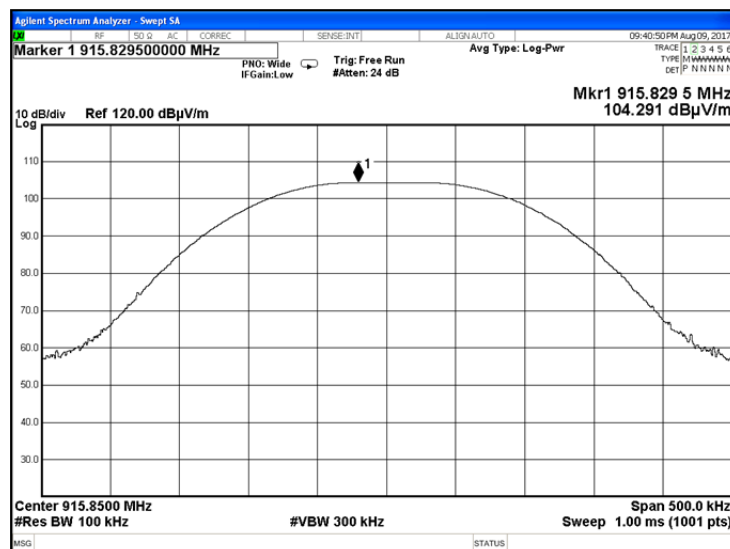
**Plot 7.6.3 Radiated emission measurements at the mid carrier frequency**

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



**Plot 7.6.4 Radiated emission measurements at the mid carrier frequency**

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

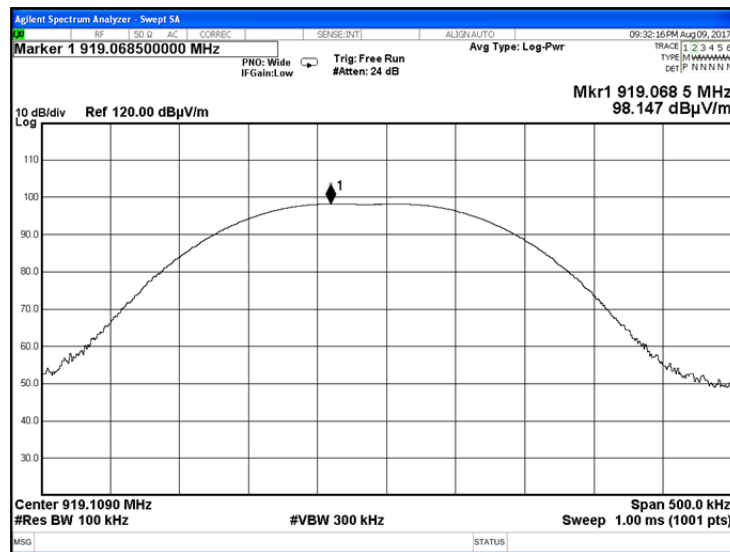




|                     |                         |                                                                     |                |
|---------------------|-------------------------|---------------------------------------------------------------------|----------------|
| Test specification: |                         | Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions |                |
| Test procedure:     |                         | ANSI C63.10, sections 6.5, 6.6                                      |                |
| Test mode:          |                         | Verdict: PASS                                                       |                |
| Date(s):            |                         |                                                                     |                |
| 28-Aug-17           |                         |                                                                     |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1012 hPa                                              | Power: Battery |
| Remarks:            |                         |                                                                     |                |

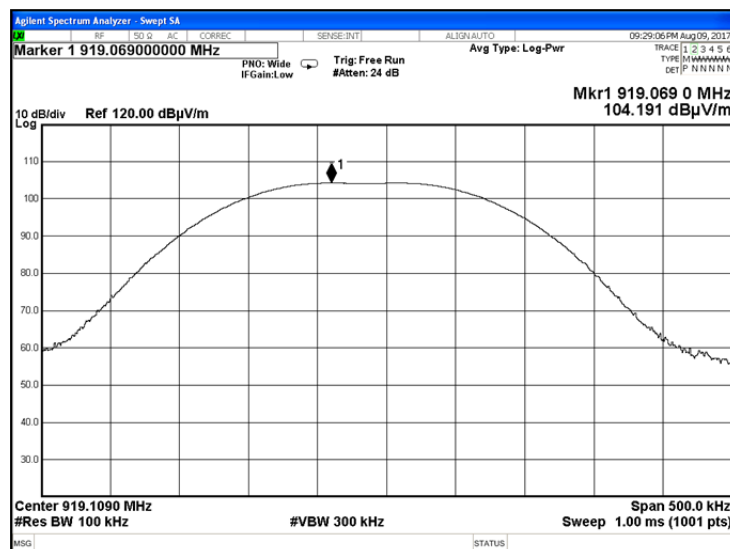
Plot 7.6.5 Radiated emission measurements at the high carrier frequency

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



Plot 7.6.6 Radiated emission measurements at the high carrier frequency

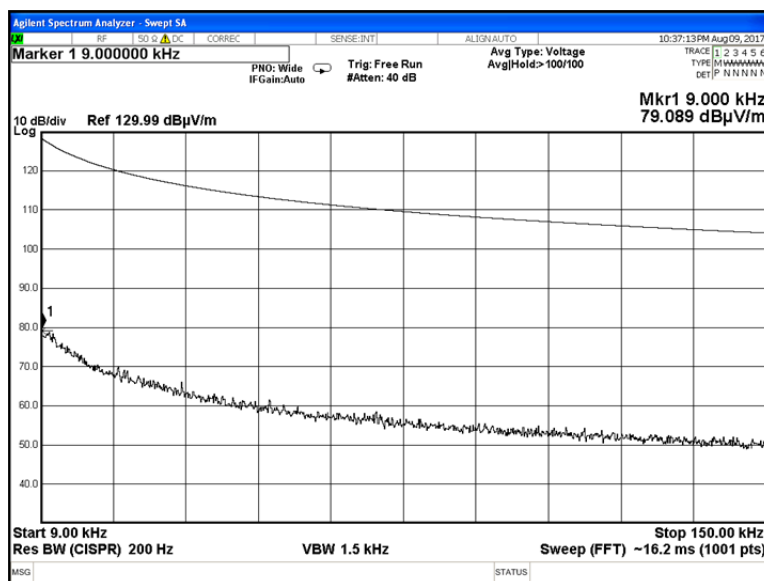
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal



|                     |                         |                                                                     |                |
|---------------------|-------------------------|---------------------------------------------------------------------|----------------|
| 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:          |                         | Verdict: PASS                                                       |                |
| Date(s):            |                         |                                                                     |                |
| 28-Aug-17           |                         |                                                                     |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1012 hPa                                              | Power: Battery |
| Remarks:            |                         |                                                                     |                |

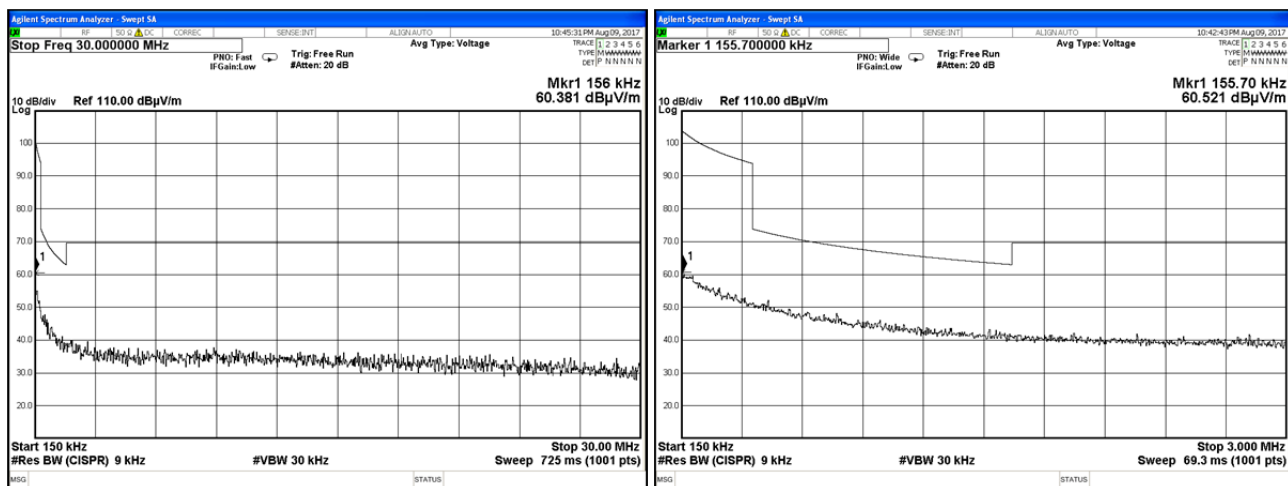
Plot 7.6.7 Radiated emission measurements from 9 to 150 kHz at the low, mid and high carrier frequency

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



Plot 7.6.8 Radiated emission measurements from 0.15 to 30 MHz at the low, mid and high carrier frequency

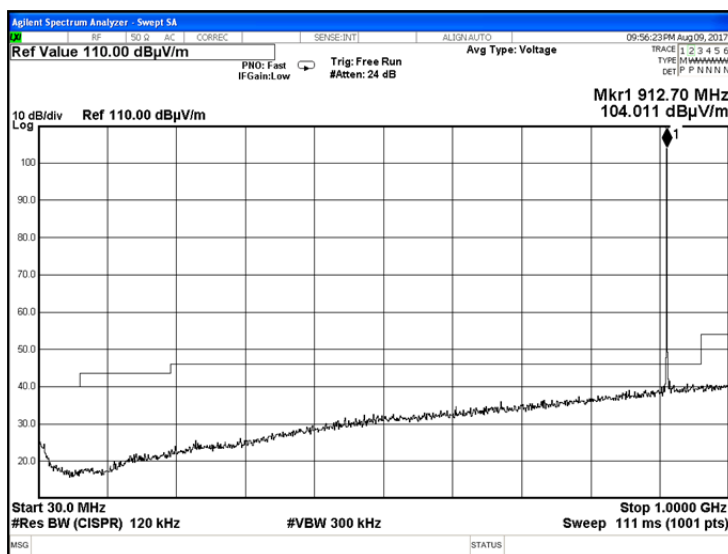
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical



|                                                                                                |                                |                               |                       |
|------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6                                          |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                   |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 28-Aug-17                                                                      |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                      | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1012 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                                |                                |                               |                       |

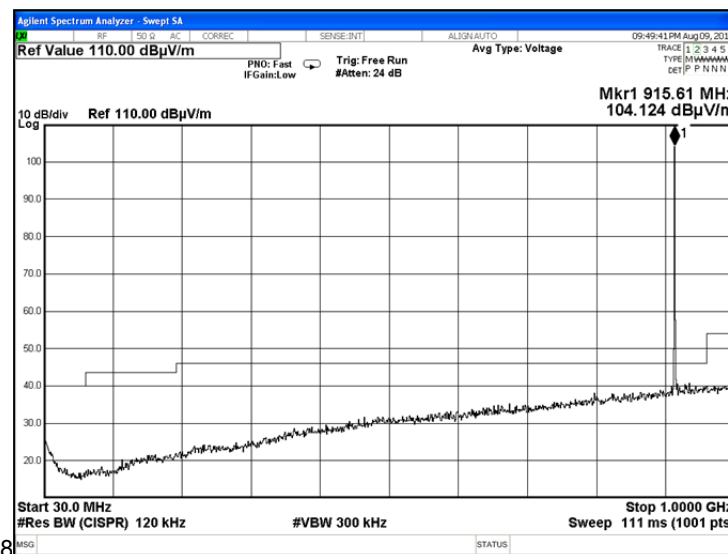
Plot 7.6.9 Radiated emission measurements from 30 to 1000 MHz at the low carrier frequency

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



Plot 7.6.10 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



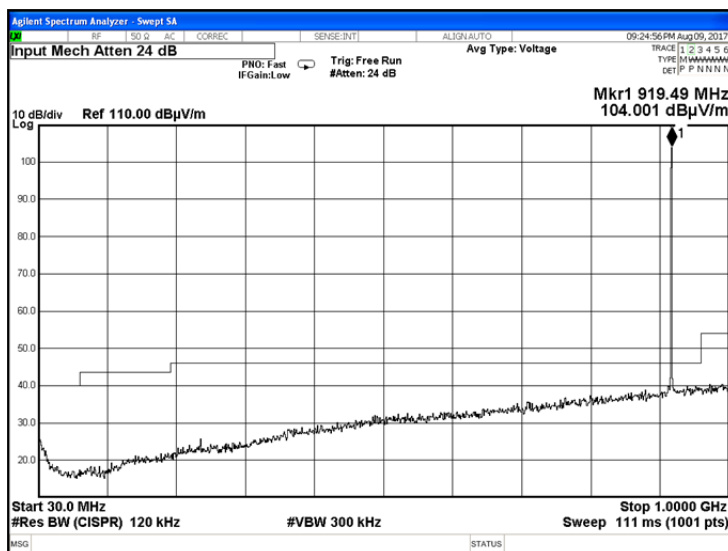


HERMON LABORATORIES

|                                                                                         |                         |                        |                |
|-----------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| 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): 28-Aug-17                                                                      |                         |                        |                |
| Temperature: 23 °C                                                                      | Relative Humidity: 55 % | Air Pressure: 1012 hPa | Power: Battery |
| Remarks:                                                                                |                         |                        |                |

Plot 7.6.11 Radiated emission measurements from 30 to 1000 MHz at the high carrier frequency

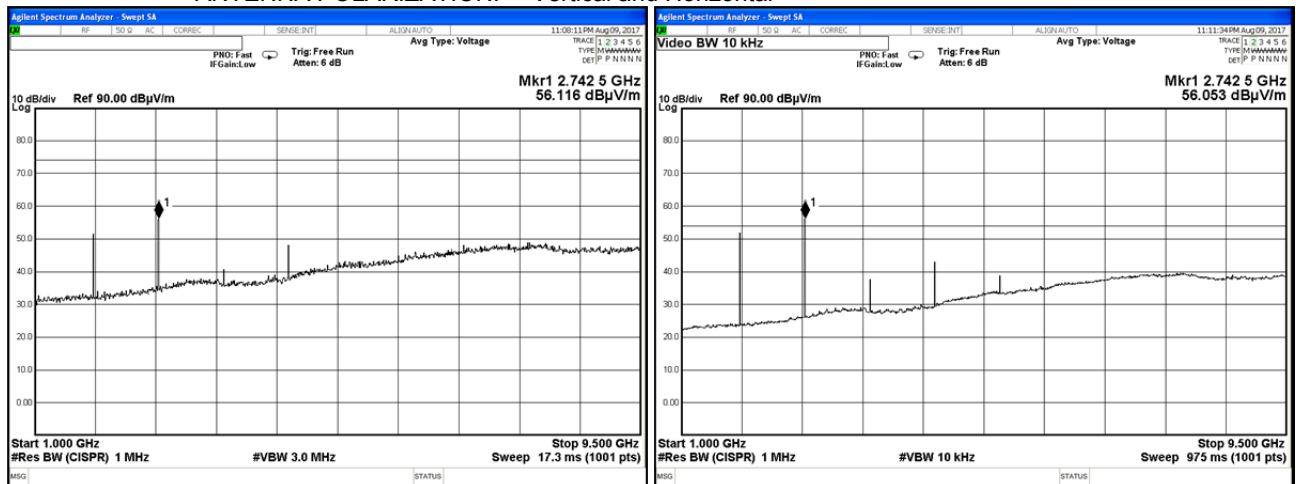
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal



|                     |                         |                                                                     |                |
|---------------------|-------------------------|---------------------------------------------------------------------|----------------|
| 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:          |                         | Verdict: PASS                                                       |                |
| Date(s):            |                         |                                                                     |                |
| 28-Aug-17           |                         |                                                                     |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1012 hPa                                              | Power: Battery |
| Remarks:            |                         |                                                                     |                |

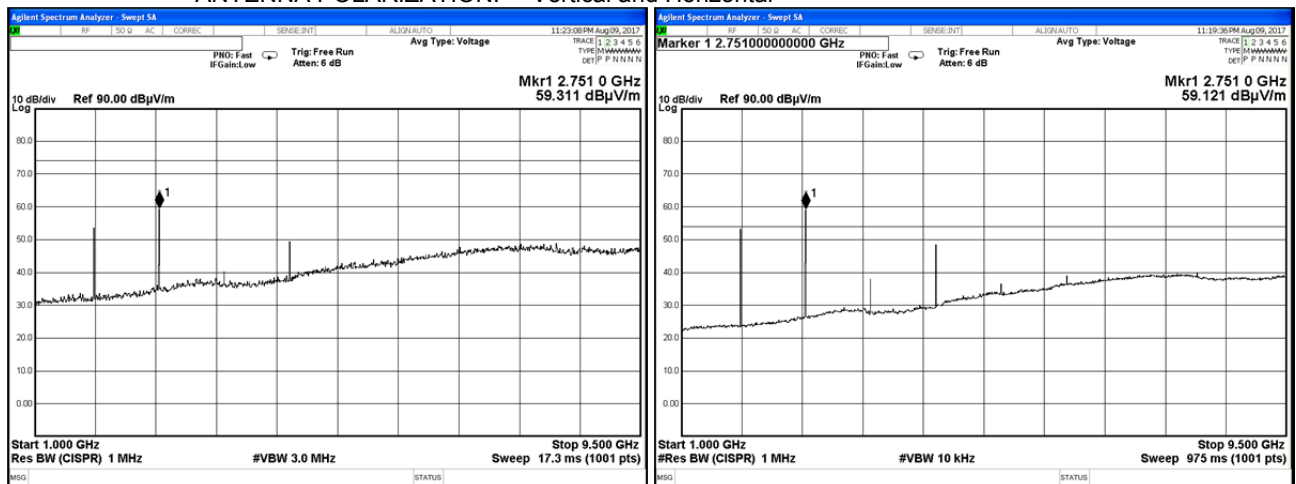
Plot 7.6.12 Radiated emission measurements from 1000 to 9500 MHz at the low carrier frequency

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



Plot 7.6.13 Radiated emission measurements from 1000 to 9500 MHz at the mid carrier frequency

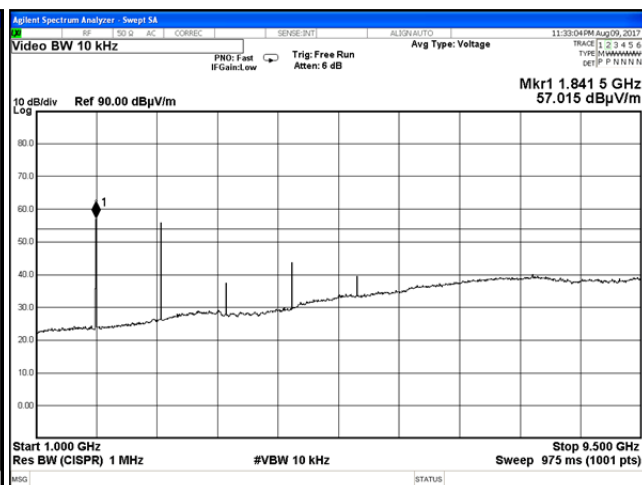
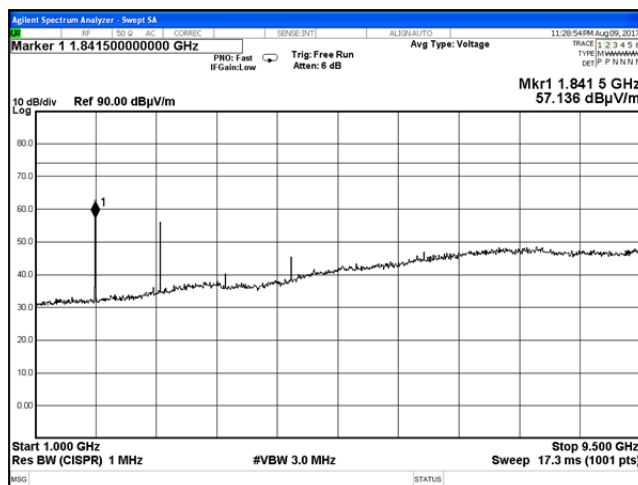
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal



|                                                                                                |                                |                               |                       |
|------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6                                          |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                   |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 28-Aug-17                                                                      |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                      | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1012 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                                |                                |                               |                       |

Plot 7.6.14 Radiated emission measurements from 1000 to 9500 MHz at the high carrier frequency

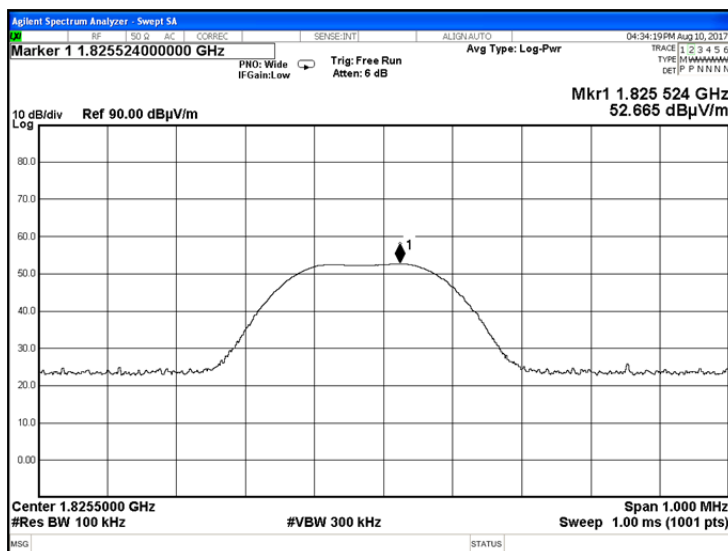
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal



|                                                                                                |                                |                               |                       |
|------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6                                          |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                   |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 28-Aug-17                                                                      |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                      | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1012 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                                |                                |                               |                       |

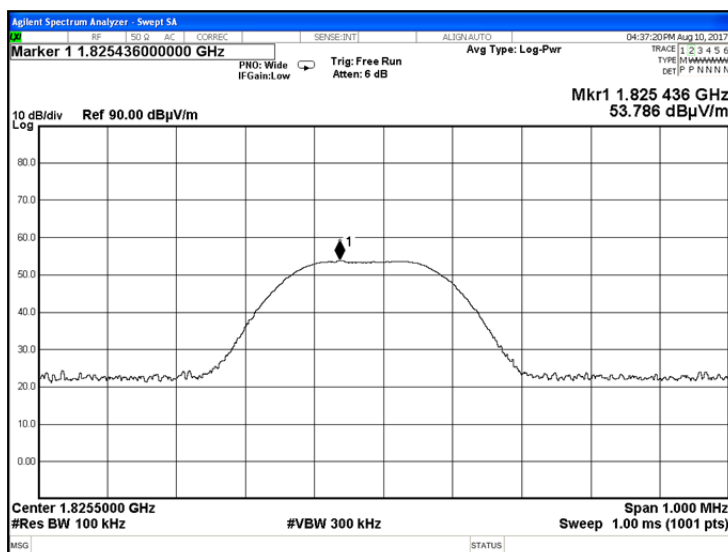
Plot 7.6.15 Radiated emission measurements at the second harmonic of low carrier frequency

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



Plot 7.6.16 Radiated emission measurements at the second harmonic of low carrier frequency

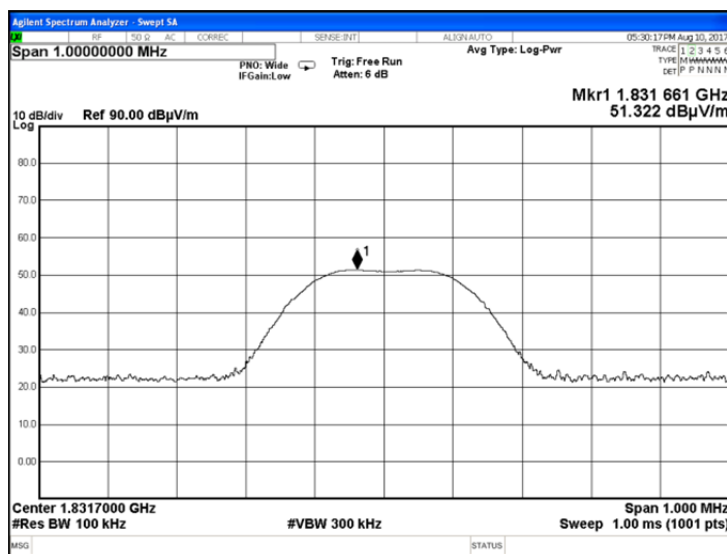
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal



|                                                                                                |                                |                               |                       |
|------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6                                          |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                   |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 28-Aug-17                                                                      |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                      | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1012 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                                |                                |                               |                       |

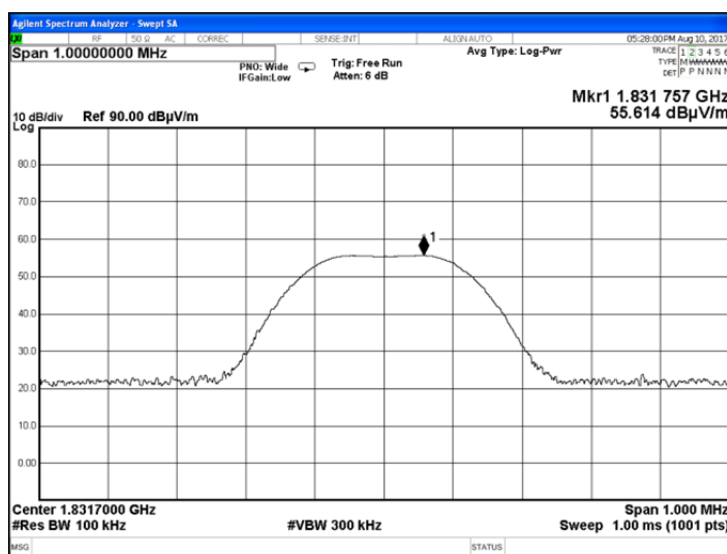
Plot 7.6.17 Radiated emission measurements at the second harmonic of mid carrier frequency

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



Plot 7.6.18 Radiated emission measurements at the second harmonic of mid carrier frequency

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

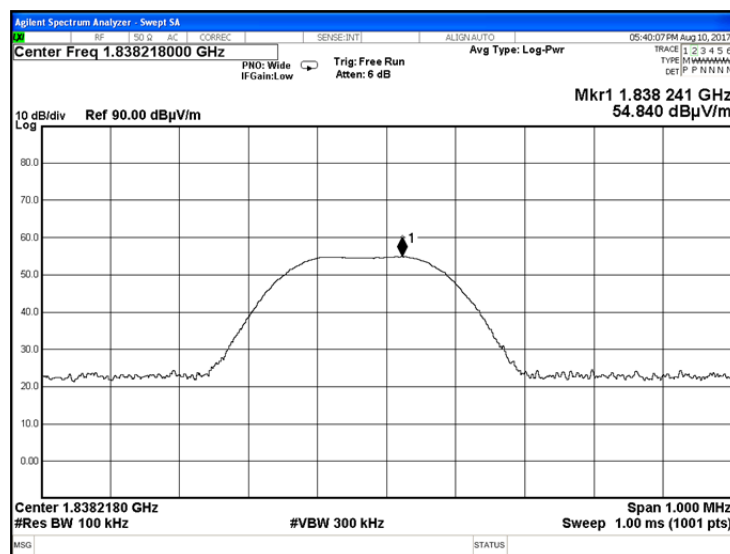




|                     |                         |                                                                     |                |
|---------------------|-------------------------|---------------------------------------------------------------------|----------------|
| Test specification: |                         | Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions |                |
| Test procedure:     |                         | ANSI C63.10, sections 6.5, 6.6                                      |                |
| Test mode:          |                         | Verdict: PASS                                                       |                |
| Date(s):            |                         |                                                                     |                |
| 28-Aug-17           |                         |                                                                     |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1012 hPa                                              | Power: Battery |
| Remarks:            |                         |                                                                     |                |

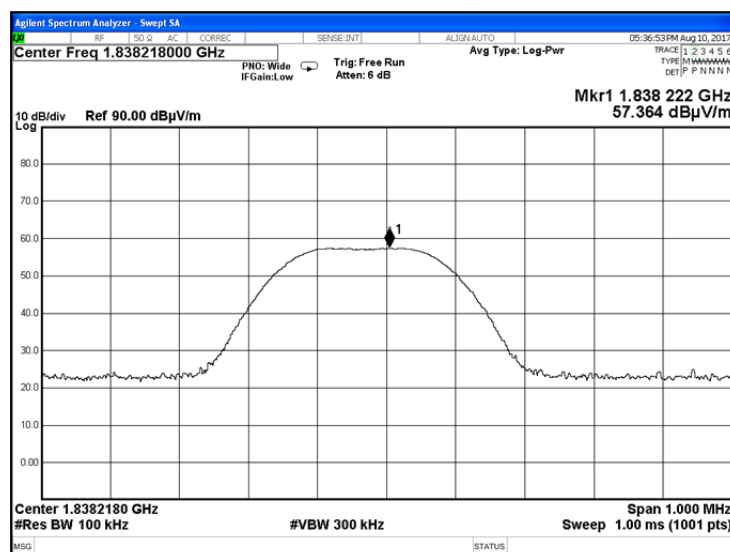
Plot 7.6.19 Radiated emission measurements at the second harmonic of high carrier frequency

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



Plot 7.6.20 Radiated emission measurements at the second harmonic of high carrier frequency

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



|                     |                         |                                                                     |                |
|---------------------|-------------------------|---------------------------------------------------------------------|----------------|
| 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:          |                         | Verdict: PASS                                                       |                |
| Date(s):            |                         |                                                                     |                |
| 28-Aug-17           |                         |                                                                     |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1012 hPa                                              | Power: Battery |
| Remarks:            |                         |                                                                     |                |

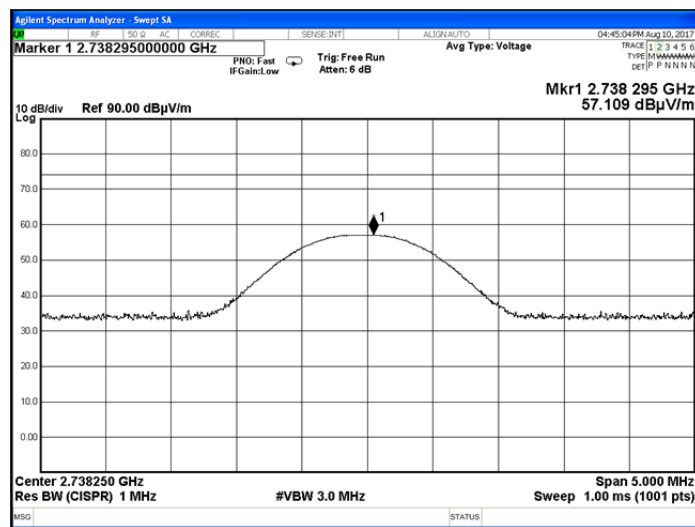
Plot 7.6.21 Radiated emission measurements at the third harmonic of low carrier frequency

TEST SITE:

TEST DISTANCE:

ANTENNA POLARIZATION:

DETECTOR: Peak



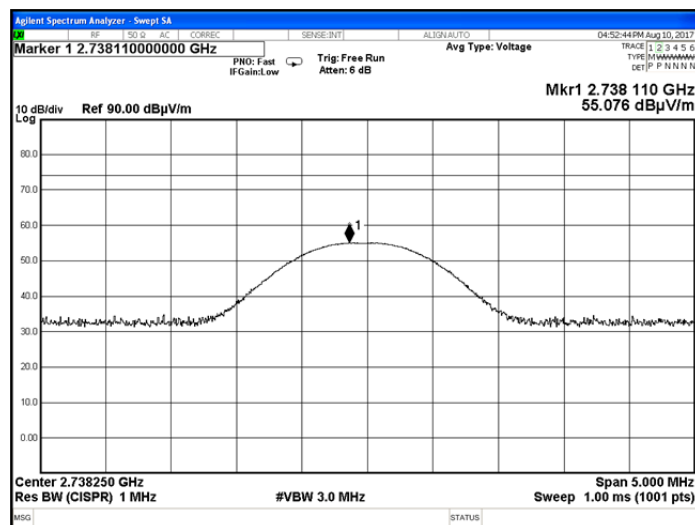
Plot 7.6.22 Radiated emission measurements at the third harmonic of low carrier frequency

TEST SITE:

TEST DISTANCE:

ANTENNA POLARIZATION:

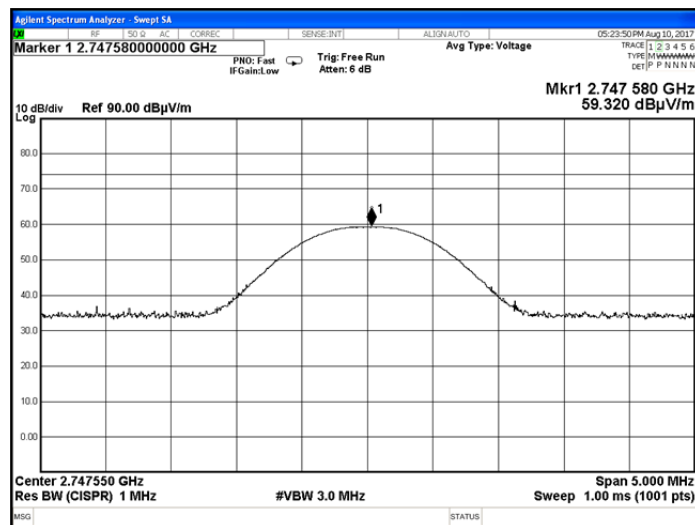
DETECTOR: Peak



|                     |                         |                                                                     |                |
|---------------------|-------------------------|---------------------------------------------------------------------|----------------|
| 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:          |                         | Verdict: PASS                                                       |                |
| Date(s):            |                         |                                                                     |                |
| 28-Aug-17           |                         |                                                                     |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1012 hPa                                              | Power: Battery |
| Remarks:            |                         |                                                                     |                |

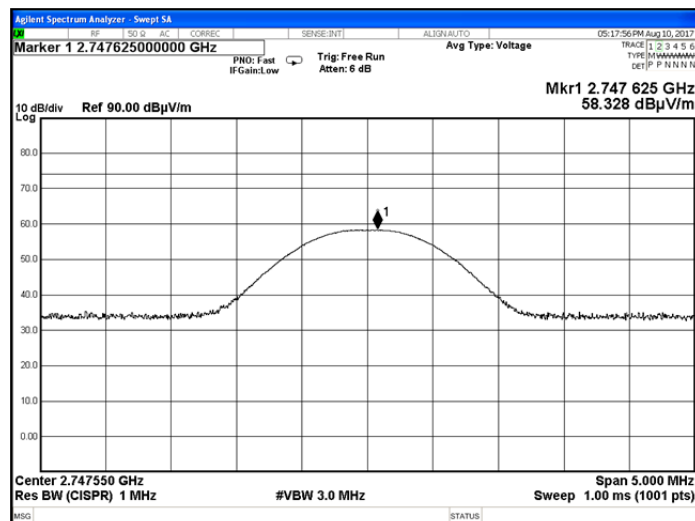
**Plot 7.6.23 Radiated emission measurements at the third harmonic of mid carrier frequency**

TEST SITE: Semi Anechoic Chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical  
DETECTOR: Peak



**Plot 7.6.24 Radiated emission measurements at the third harmonic of mid carrier frequency**

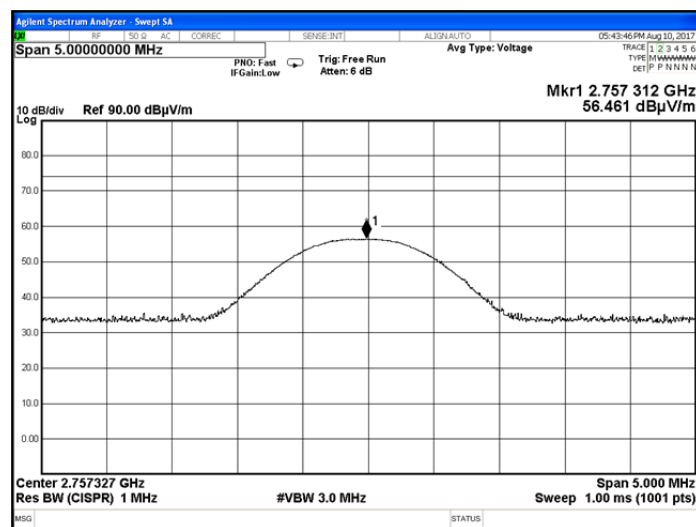
TEST SITE: Semi Anechoic Chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal  
DETECTOR: Peak



|                     |                         |                                                                     |                |
|---------------------|-------------------------|---------------------------------------------------------------------|----------------|
| 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:          |                         | Verdict: PASS                                                       |                |
| Date(s):            |                         |                                                                     |                |
| 28-Aug-17           |                         |                                                                     |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1012 hPa                                              | Power: Battery |
| Remarks:            |                         |                                                                     |                |

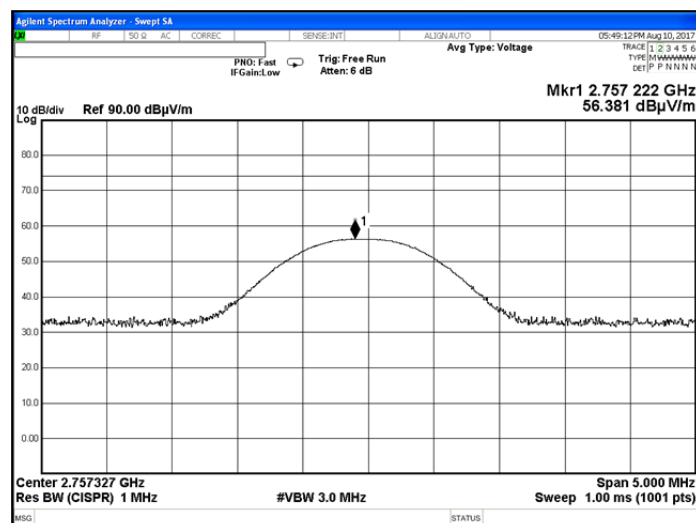
**Plot 7.6.25 Radiated emission measurements at the third harmonic of high carrier frequency**

TEST SITE: Semi Anechoic Chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical  
DETECTOR: Peak



**Plot 7.6.26 Radiated emission measurements at the third harmonic of high carrier frequency**

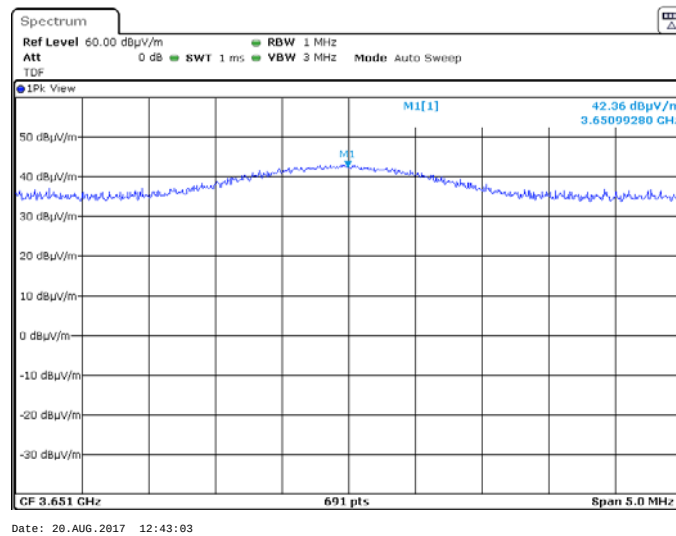
TEST SITE: Semi Anechoic Chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal  
DETECTOR: Peak



|                     |                         |                                                                     |                |
|---------------------|-------------------------|---------------------------------------------------------------------|----------------|
| 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:          |                         | Verdict: PASS                                                       |                |
| Date(s):            |                         |                                                                     |                |
| 28-Aug-17           |                         |                                                                     |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1012 hPa                                              | Power: Battery |
| Remarks:            |                         |                                                                     |                |

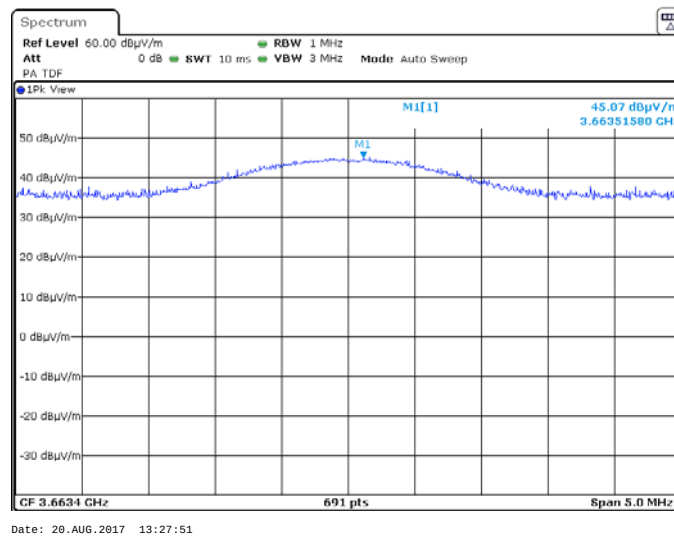
Plot 7.6.27 Radiated emission measurements at the fourth harmonic of low carrier frequency

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal  
DETECTOR: Peak



Plot 7.6.28 Radiated emission measurements at the fourth harmonic of mid carrier frequency

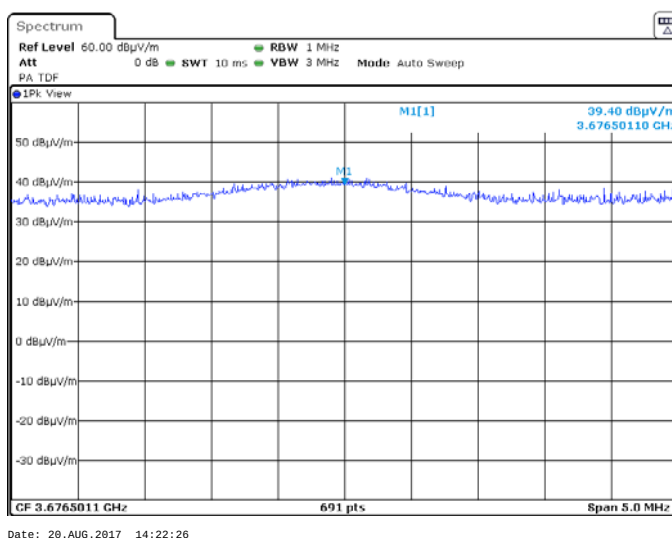
TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical  
DETECTOR: Peak



|                                                                                                |                                |                               |                       |
|------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6                                          |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                   |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 28-Aug-17                                                                      |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                      | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1012 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                                |                                |                               |                       |

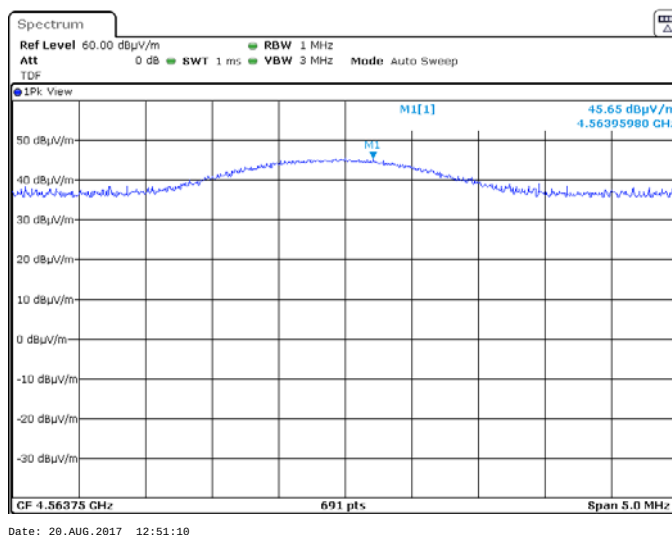
Plot 7.6.29 Radiated emission measurements at the fourth harmonic of high carrier frequency

TEST SITE: Semi Anechoic Chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical  
DETECTOR: Peak



Plot 7.6.30 Radiated emission measurements at the fifth harmonic of low carrier frequency

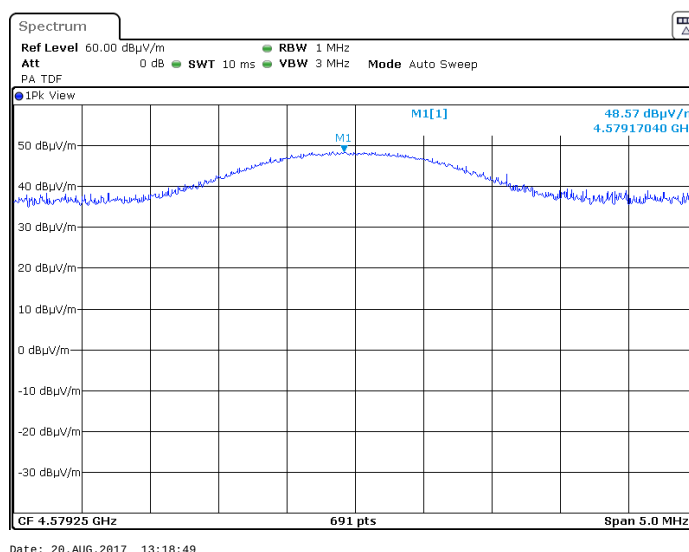
TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal  
DETECTOR: Peak



|                                                                                                |                                |                               |                       |
|------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6                                          |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                   |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 28-Aug-17                                                                      |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                      | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1012 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                                |                                |                               |                       |

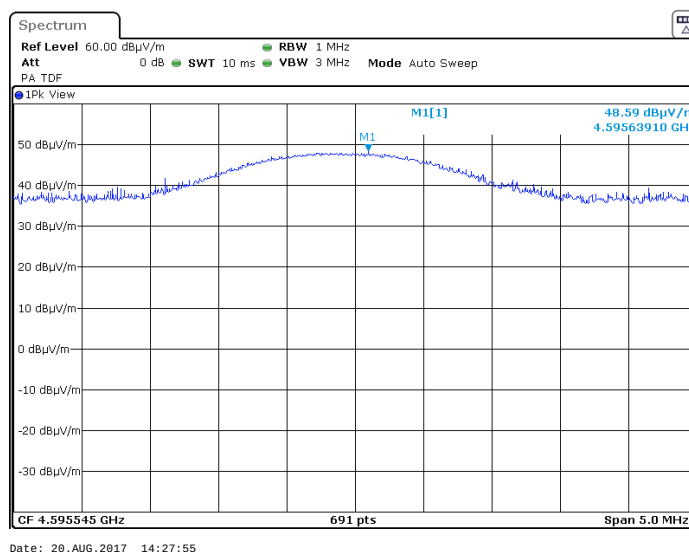
**Plot 7.6.31 Radiated emission measurements at the fifth harmonic of mid carrier frequency**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal  
DETECTOR: Peak



**Plot 7.6.32 Radiated emission measurements at the fifth harmonic of high carrier frequency**

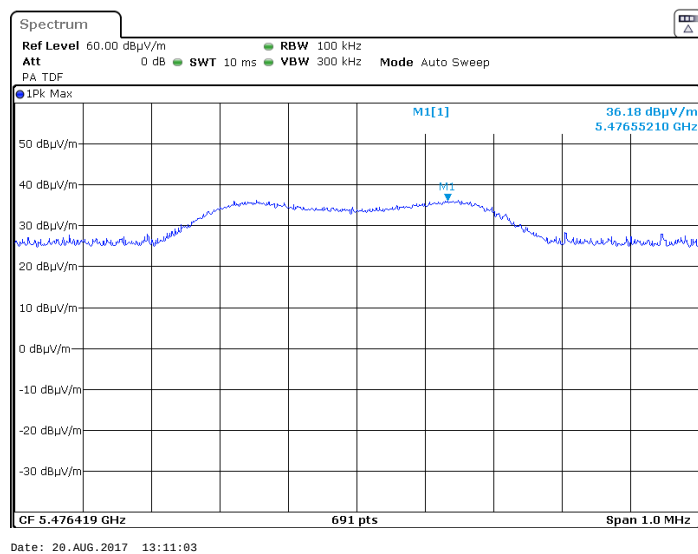
TEST SITE: Semi Anechoic Chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical  
DETECTOR: Peak



|                     |                         |                                                                     |                |
|---------------------|-------------------------|---------------------------------------------------------------------|----------------|
| 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:          |                         | Verdict: PASS                                                       |                |
| Date(s):            |                         |                                                                     |                |
| 28-Aug-17           |                         |                                                                     |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1012 hPa                                              | Power: Battery |
| Remarks:            |                         |                                                                     |                |

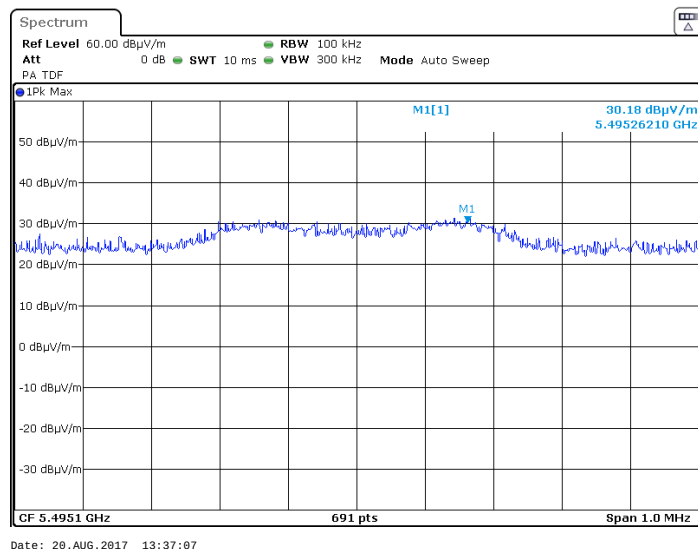
**Plot 7.6.33 Radiated emission measurements at the sixth harmonic of low carrier frequency**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal



**Plot 7.6.34 Radiated emission measurements at the sixth harmonic of mid carrier frequency**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal



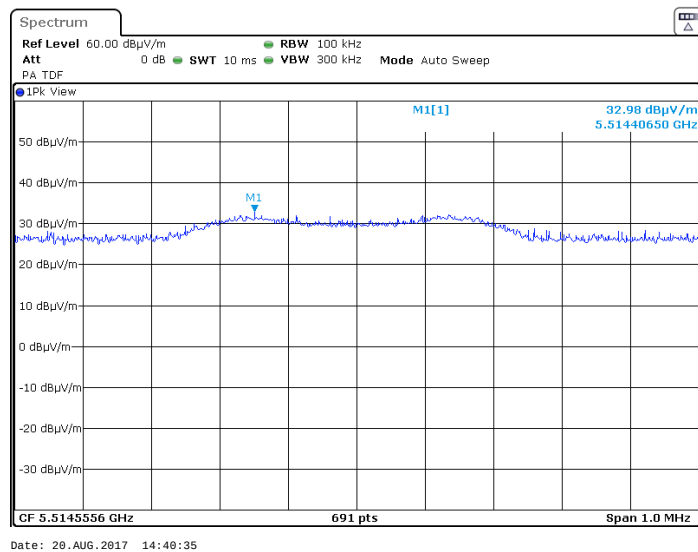


|                     |                         |                                                                     |                |
|---------------------|-------------------------|---------------------------------------------------------------------|----------------|
| Test specification: |                         | Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions |                |
| Test procedure:     |                         | ANSI C63.10, sections 6.5, 6.6                                      |                |
| Test mode:          |                         | Verdict: PASS                                                       |                |
| Date(s):            |                         |                                                                     |                |
| 28-Aug-17           |                         |                                                                     |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1012 hPa                                              | Power: Battery |
| Remarks:            |                         |                                                                     |                |

**Plot 7.6.35 Radiated emission measurements at the sixth harmonic of high carrier frequency**

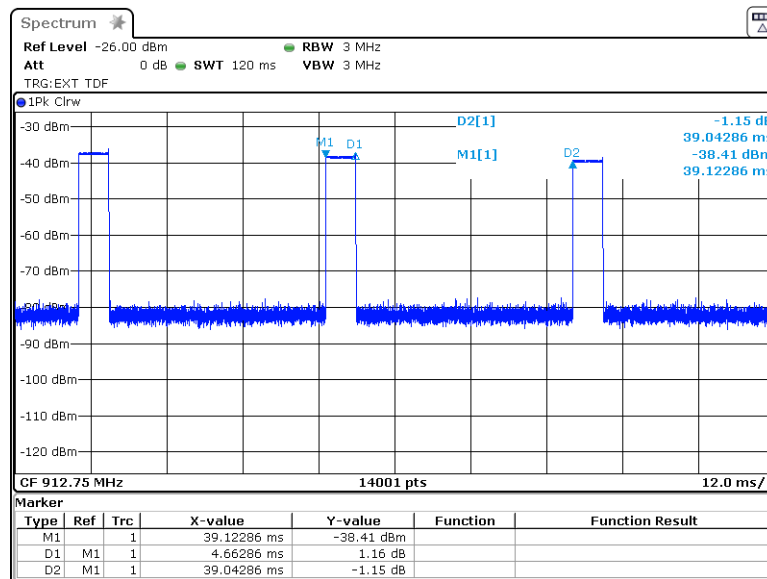
TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION: Vertical

Semi Anechoic Chamber  
3 m  
ANTENNA POLARIZATION: Horizontal



|                     |                         |                                                                     |                |
|---------------------|-------------------------|---------------------------------------------------------------------|----------------|
| 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:          |                         | Verdict: PASS                                                       |                |
| Date(s):            |                         |                                                                     |                |
| 28-Aug-17           |                         |                                                                     |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1012 hPa                                              | Power: Battery |
| Remarks:            |                         |                                                                     |                |

Plot 7.6.36 Transmission pulse duration and period



Date: 20.AUG.2017 09:05:10

|                                                                                            |                                |                               |                       |
|--------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Emissions at band edges |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, section 7.8.6                                          |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                               |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 27-Aug-17                                                                  |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                  | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1010 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                            |                                |                               |                       |

## 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(μV/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





|                                                                                                   |                                |                               |                       |
|---------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> <b>Section 15.247(d), RSS-247 section 5.5, Emissions at band edges</b> |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10, section 7.8.6                                                 |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                      |                                | <b>Verdict:</b> <b>PASS</b>   |                       |
| <b>Date(s):</b> 27-Aug-17                                                                         |                                |                               |                       |
| <b>Temperature:</b> 23 °C                                                                         | <b>Relative Humidity:</b> 55 % | <b>Air Pressure:</b> 1010 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                                   |                                |                               |                       |

Table 7.7.2 Band edge emission test results

ASSIGNED FREQUENCY RANGE: 902-928 MHz  
 DETECTOR USED: Peak  
 MODULATION: GFSK  
 BIT RATE: 50 kbps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 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 |                         |                          |                                |            |             |         |
| 912.750                    | -101.62                 | -37.58                   | 64.04                          | 20.0       | 44.04       | Pass    |
| 919.109                    | -102.85                 | -32.42                   | 70.43                          |            | 50.43       |         |
| Frequency hopping enabled  |                         |                          |                                |            |             |         |
| 912.750                    | -101.72                 | -37.56                   | 64.16                          | 20.0       | 44.16       | Pass    |
| 919.109                    | -101.36                 | -29.00                   | 72.36                          |            | 52.36       |         |

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

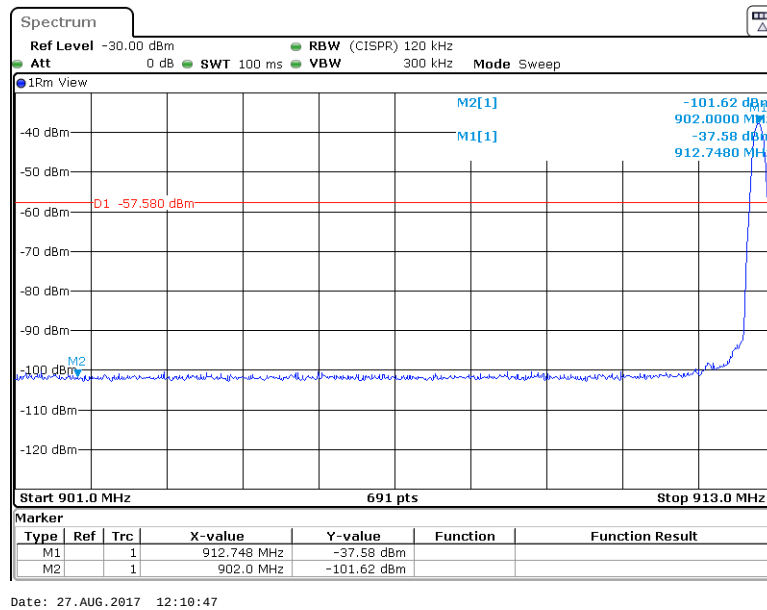
**Reference numbers of test equipment used**

|         |         |  |  |  |  |  |  |
|---------|---------|--|--|--|--|--|--|
| HL 4135 | HL 4355 |  |  |  |  |  |  |
|---------|---------|--|--|--|--|--|--|

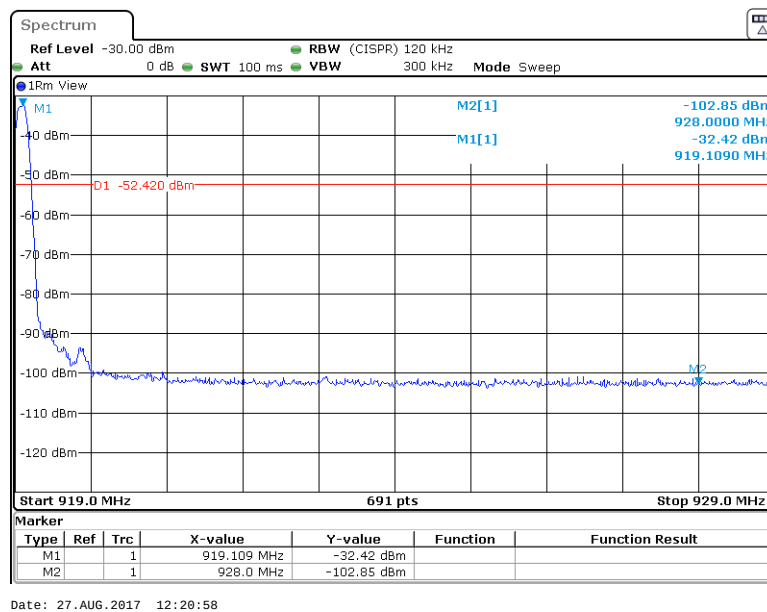
Full description is given in Appendix A.

|                     |                         |                                                                 |                |
|---------------------|-------------------------|-----------------------------------------------------------------|----------------|
| 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:          |                         | Verdict: PASS                                                   |                |
| Date(s):            |                         |                                                                 |                |
| 27-Aug-17           |                         |                                                                 |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1010 hPa                                          | Power: Battery |
| Remarks:            |                         |                                                                 |                |

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

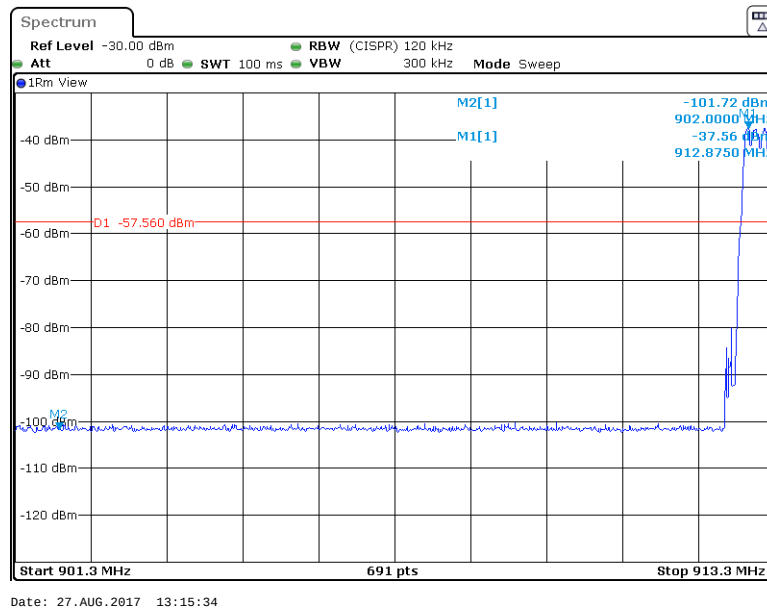


Plot 7.7.2 The highest band edge emission at high carrier frequency with hopping function disabled

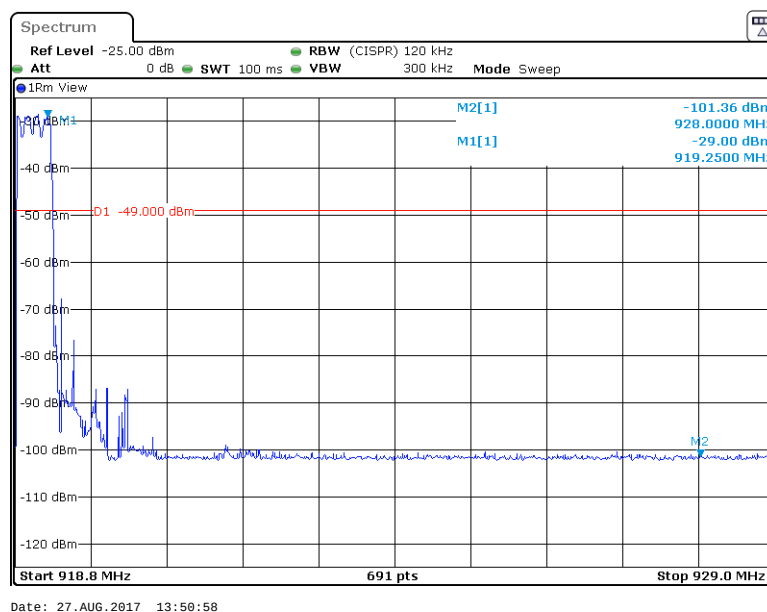


|                     |                         |                                                                 |                |
|---------------------|-------------------------|-----------------------------------------------------------------|----------------|
| Test specification: |                         | Section 15.247(d), RSS-247 section 5.5, Emissions at band edges |                |
| Test procedure:     |                         | ANSI C63.10, section 7.8.6                                      |                |
| Test mode:          |                         | Verdict: PASS                                                   |                |
| Date(s):            |                         |                                                                 |                |
| 27-Aug-17           |                         |                                                                 |                |
| Temperature: 23 °C  | Relative Humidity: 55 % | Air Pressure: 1010 hPa                                          | Power: Battery |
| 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                                                |                         | Verdict: PASS          |                |
| Test mode: Compliance                                                            |                         |                        |                |
| Date(s): 27-Aug-17                                                               |                         |                        |                |
| Temperature: 23 °C                                                               | Relative Humidity: 55 % | Air Pressure: 1010 hPa | Power: Battery |
| Remarks:                                                                         |                         |                        |                |

## 7.8 Antenna requirements

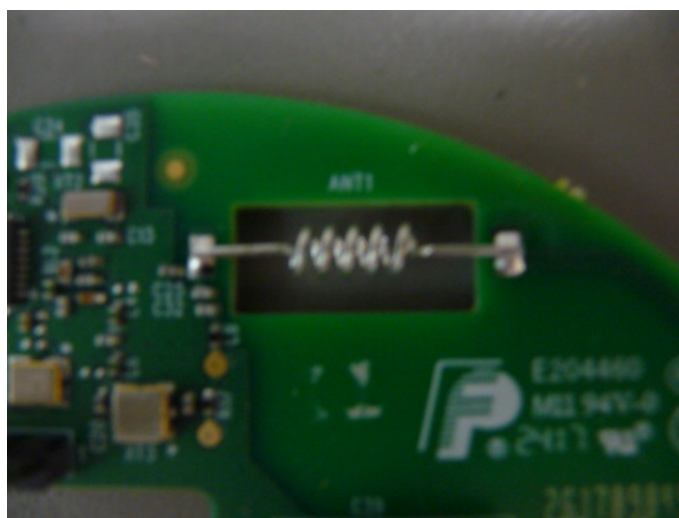
The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed 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                |         |

Photograph 7.8.1 Antenna assembly



|                                                                                                        |                                |                               |                       |
|--------------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Class B,Radiated emission |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.4, Section 12.2.5                                                      |                                |                               |                       |
| <b>Test mode:</b> Compliance                                                                           |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 29-Aug-17                                                                              |                                |                               |                       |
| <b>Temperature:</b> 28 °C                                                                              | <b>Relative Humidity:</b> 45 % | <b>Air Pressure:</b> 1006 hPa | <b>Power:</b> Battery |
| <b>Remarks:</b>                                                                                        |                                |                               |                       |

## 8 Unintentional emissions

### 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 8.1.2.

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:  $\text{Lim}_{S2} = \text{Lim}_{S1} + 20 \log(S1/S2)$ , where  $S1$  and  $S2$  – standard defined and test distance respectively in meters.

Table 8.1.2 Radiated emission limits according to RSS-Gen, Section 7.1.2

| Frequency, MHz                   | Field strength limit at 3 m test distance, dB(μV/m) |
|----------------------------------|-----------------------------------------------------|
| 30 - 88                          | 40.0                                                |
| 88 - 216                         | 43.5                                                |
| 216 - 960                        | 46.0                                                |
| 960 - 5 <sup>th</sup> harmonic** | 54.0                                                |

\*\* - harmonic of the highest frequency the EUT generates, uses, operates or tunes to.

#### 8.1.2 Test procedure

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

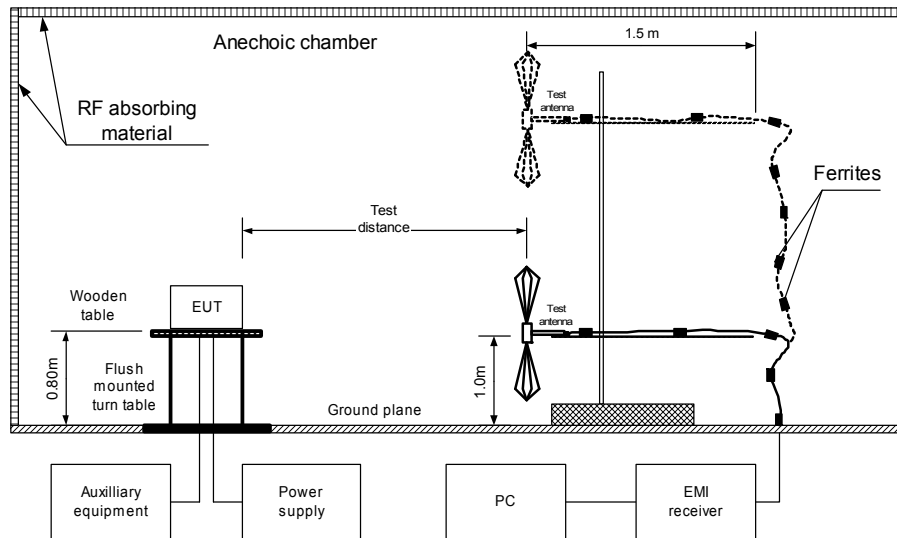
**8.1.2.2** The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position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

**8.1.2.3** The worst test results (the lowest margins) were recorded in Table 8.1.3 and shown in the associated plots.



|                                                                                                 |                         |                        |                |
|-------------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Class B,Radiated emission |                         |                        |                |
| Test procedure: ANSI C63.4, Section 12.2.5                                                      |                         |                        |                |
| Test mode: Compliance                                                                           |                         | Verdict: PASS          |                |
| Date(s): 29-Aug-17                                                                              |                         |                        |                |
| Temperature: 28 °C                                                                              | Relative Humidity: 45 % | Air Pressure: 1006 hPa | Power: Battery |
| Remarks:                                                                                        |                         |                        |                |

Figure 8.1.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment



Photograph 8.1.1 Setup for radiated emission measurements





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|                                                                                                 |                         |                        |                |
|-------------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Class B,Radiated emission |                         |                        |                |
| Test procedure: ANSI C63.4, Section 12.2.5                                                      |                         |                        |                |
| Test mode: Compliance                                                                           |                         | Verdict: PASS          |                |
| Date(s): 29-Aug-17                                                                              |                         |                        |                |
| Temperature: 28 °C                                                                              | Relative Humidity: 45 % | Air Pressure: 1006 hPa | Power: Battery |
| Remarks:                                                                                        |                         |                        |                |

Table 8.1.3 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 emissions were 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,<br><br>MHz   | Peak                              |                    |                | Average                           |                    |                | Antenna<br>polarization | Antenna<br>height,<br>m | Turn-table<br>position**,<br>degrees | Verdict |
|-------------------------|-----------------------------------|--------------------|----------------|-----------------------------------|--------------------|----------------|-------------------------|-------------------------|--------------------------------------|---------|
|                         | Measured<br>emission,<br>dB(μV/m) | Limit,<br>dB(μV/m) | Margin,<br>dB* | Measured<br>emission,<br>dB(μV/m) | Limit,<br>dB(μV/m) | Margin,<br>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**

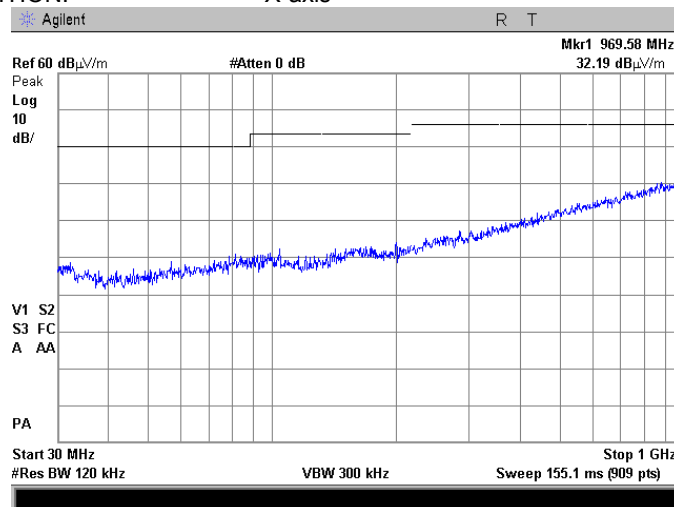
|         |         |         |         |         |         |  |  |
|---------|---------|---------|---------|---------|---------|--|--|
| HL 0604 | HL 2909 | HL 3615 | HL 4277 | HL 4353 | HL 4933 |  |  |
|---------|---------|---------|---------|---------|---------|--|--|

Full description is given in Appendix A.

|                                                                                                 |                         |                        |                |
|-------------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Class B,Radiated emission |                         |                        |                |
| Test procedure: ANSI C63.4, Section 12.2.5                                                      |                         |                        |                |
| Test mode: Compliance                                                                           |                         | Verdict: PASS          |                |
| Date(s): 29-Aug-17                                                                              |                         |                        |                |
| Temperature: 28 °C                                                                              | Relative Humidity: 45 % | Air Pressure: 1006 hPa | Power: Battery |
| Remarks:                                                                                        |                         |                        |                |

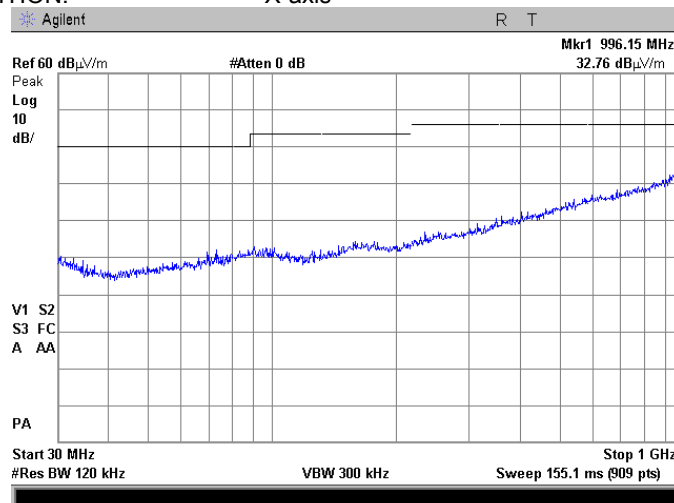
Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization

TEST SITE: Semi anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive / Stand-by  
EUT POSITION: X-axis



Plot 8.1.2 Radiated emission measurements in 30 - 1000 MHz range, horizontal antenna polarization

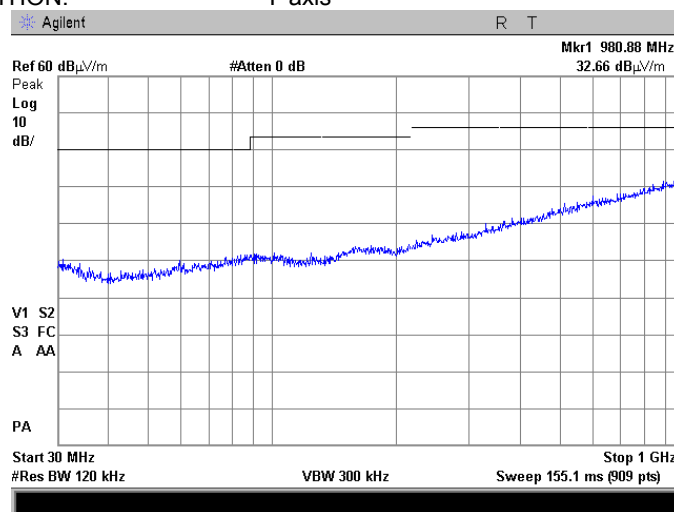
TEST SITE: Semi anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive / Stand-by  
EUT POSITION: X-axis



|                                                                                                 |                         |                        |                |
|-------------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Class B,Radiated emission |                         |                        |                |
| Test procedure: ANSI C63.4, Section 12.2.5                                                      |                         |                        |                |
| Test mode: Compliance                                                                           |                         | Verdict: PASS          |                |
| Date(s): 29-Aug-17                                                                              |                         |                        |                |
| Temperature: 28 °C                                                                              | Relative Humidity: 45 % | Air Pressure: 1006 hPa | Power: Battery |
| Remarks:                                                                                        |                         |                        |                |

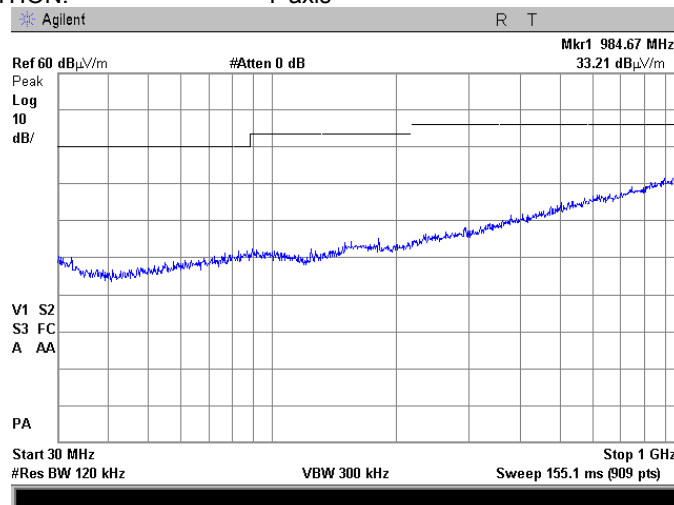
**Plot 8.1.3 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization**

TEST SITE: Semi anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive / Stand-by  
EUT POSITION: Y-axis



**Plot 8.1.4 Radiated emission measurements in 30 - 1000 MHz range, horizontal antenna polarization**

TEST SITE: Semi anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive / Stand-by  
EUT POSITION: Y-axis

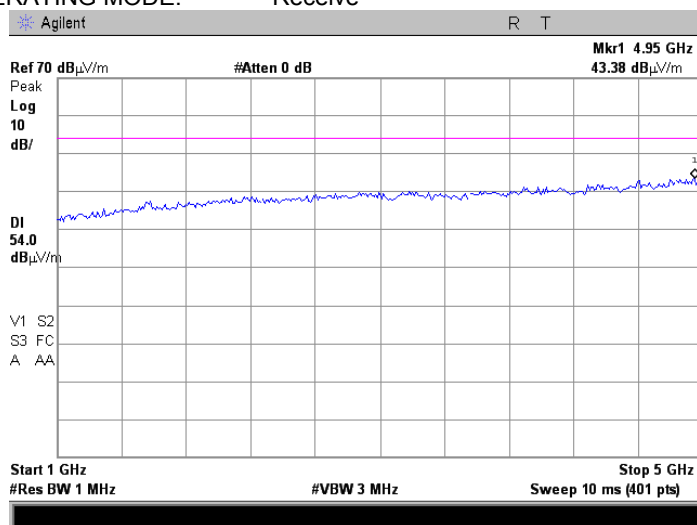




|                                                                                                 |                         |                        |                |
|-------------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------|
| Test specification: Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Class B,Radiated emission |                         |                        |                |
| Test procedure: ANSI C63.4, Section 12.2.5                                                      |                         |                        |                |
| Test mode: Compliance                                                                           |                         | Verdict: PASS          |                |
| Date(s): 29-Aug-17                                                                              |                         |                        |                |
| Temperature: 28 °C                                                                              | Relative Humidity: 45 % | Air Pressure: 1006 hPa | Power: Battery |
| Remarks:                                                                                        |                         |                        |                |

## Plot 8.1.5 Radiated emission measurements in 1000-5000 MHz range

TEST SITE: Semi anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal  
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 |
|-------|--------------------------------------------------------------------|-----------------------------|-----------------------------|---------------|------------------|-----------------|
| 0604  | Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz            | EMCO                        | 3141                        | 9611-1011     | 12-May-17        | 12-May-18       |
| 1915  | Antenna, Loop, Active Receiving, 1 kHz - 30 MHz                    | EMC Test Systems            | 6507                        | 1457          | 19-Jan-17        | 19-Jan-18       |
| 2909  | Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz                       | Agilent Technologies        | E4407B                      | MY414447 62   | 09-Mar-17        | 09-Mar-18       |
| 3615  | Cable RF, 6.5 m, N type-N type, DC-6 GHz                           | Suhner Switzerland          | RG 214/U                    | NA            | 04-Jun-17        | 04-Jun-18       |
| 3818  | PSA Series Spectrum Analyzer, 3 Hz- 44 GHz                         | Agilent Technologies        | E4446A                      | MY482502 88   | 07-May-17        | 07-May-18       |
| 4135  | Shield Box                                                         | TESCOM CO., LTD             | TC-5916A                    | 5916A000 136  | 06-Apr-17        | 06-Apr-18       |
| 4222  | High Pass Filter, 50 Ohm, 3150 to 6500 MHz                         | Mini-Circuits               | VHF-2700+                   | NA            | 01-Oct-15        | 01-Oct-17       |
| 4277  | Test Cable , DC-18 GHz, 3.05 m, N/M - N/M                          | Mini-Circuits               | APC-10FT-NMNM+              | 0748A         | 26-Sep-16        | 26-Sep-17       |
| 4294  | Microwave Cable Assembly, 18.0 GHz, 3.4 m, SMA/SMA                 | Huber-Suhner                | Sucoflex P103               | NA            | 18-Dec-16        | 18-Dec-17       |
| 4295  | Microwave Cable Assembly, 18.0 GHz, 3.4 m, SMA/SMA                 | Huber-Suhner                | Sucoflex P103               | NA            | 16-Oct-16        | 16-Oct-17       |
| 4353  | Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M | MegaPhase                   | NC29-N1N1-244               | 12025101 003  | 15-Mar-17        | 15-Mar-18       |
| 4355  | Signal and Spectrum Analyzer, 9 kHz to 7 GHz                       | Rohde & Schwarz             | FSV 7                       | 191000086 881 | 20-Apr-17        | 20-Apr-18       |
| 4535  | Microwave Cable Assembly, 6.5 GHz, 5.0 m, N/M type-N/M type        | Suhner Switzerland          | 214-U                       | NA            | 04-Jun-17        | 04-Jun-18       |
| 4541  | Microwave Cable Assembly, 4.0 GHz, 1.0 m, N/M type-N/M type        | Suhner Switzerland          | 214-U                       | NA            | 25-Sep-16        | 25-Sep-17       |
| 4542  | Amplifier, 9 kHz to 1 GHz, 32 dB gain                              | Sonoma Instrument           | 310                         | 0002A056 39   | 15-Mar-17        | 15-Mar-18       |
| 4543  | Broadband preamplifier, 0.5 to 18 GHz, 35 dB gain                  | Schwarzbeck mess-elektronik | BBV 9718                    | 9718-134      | 15-Mar-17        | 15-Mar-18       |
| 4549  | Cable RF, 6.8 m, N/N - type, up to 3 GHz                           | Suhner Switzerland          | NA                          | 07262         | 14-Mar-17        | 14-Mar-18       |
| 4575  | EXA Signal Analyzer, 9 kHz - 26.5 GHz                              | Agilent Technologies        | N9010A                      | MY480301 10   | 06-Apr-17        | 06-Apr-18       |
| 4603  | Horn Antenna, 1 - 18 GHz                                           | Schwarzbeck mess-elektronik | BBHA 9120 D                 | 9120D-611     | 14-Oct-16        | 14-Oct-17       |
| 4604  | Biconilog Antenna, 26 - 2000 MHz                                   | EMCO                        | 3142B                       | 9909-1421     | 12-May-17        | 12-May-18       |
| 4933  | Active Horn Antenna, 1 GHz to 18 GHz                               | Com-Power Corporation       | AHA-118                     | 701046        | 14-Oct-16        | 14-Oct-17       |
| 5102  | RF cable, 18 GHz, 6 m, N-type                                      | Huber-Suhner                | SF106A/1 1N/11N/6 000MM     | 500848/6A     | 27-Jul-17        | 27-Jul-18       |
| 5105  | RF cable, 18 GHz, 6 m, N-type                                      | Huber-Suhner                | SF106A/1 1N/11N/6 000MM     | 500851/6A     | 27-Jul-17        | 27-Jul-18       |
| 5111  | RF cable, 40 GHz, 5.5 m, K-type                                    | Huber-Suhner                | SF102EA/ 11SK/11S K/5500M M | 502493/2E A   | 27-Jul-17        | 27-Jul-18       |

## 10 APPENDIX B 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: $\pm 1.7$ dB<br>12.4 GHz to 40 GHz: $\pm 2.3$ dB                                                                                                                                                                                                                                             |
| Conducted emissions at RF antenna connector                                                          | 9 kHz to 2.9 GHz: $\pm 2.6$ dB<br>2.9 GHz to 6.46 GHz: $\pm 3.5$ dB<br>6.46 GHz to 13.2 GHz: $\pm 4.3$ dB<br>13.2 GHz to 22.0 GHz: $\pm 5.0$ dB<br>22.0 GHz to 26.8 GHz: $\pm 5.5$ dB<br>26.8 GHz to 40.0 GHz: $\pm 4.8$ dB                                                                                  |
| Occupied bandwidth                                                                                   | $\pm 8.0$ %                                                                                                                                                                                                                                                                                                  |
| Duty cycle, timing (Tx ON / OFF) and average factor measurements                                     | $\pm 1.0$ %                                                                                                                                                                                                                                                                                                  |
| Conducted emissions with LISN                                                                        | 9 kHz to 150 kHz: $\pm 3.9$ dB<br>150 kHz to 30 MHz: $\pm 3.8$ dB                                                                                                                                                                                                                                            |
| Radiated emissions at 3 m measuring distance<br>Horizontal polarization<br><br>Vertical polarization | Biconilog antenna: $\pm 5.3$ dB<br>Biconical antenna: $\pm 5.0$ dB<br>Log periodic antenna: $\pm 5.3$ dB<br>Double ridged horn antenna: $\pm 5.3$ dB<br>Biconilog antenna: $\pm 6.0$ dB<br>Biconical antenna: $\pm 5.7$ dB<br>Log periodic antenna: $\pm 6.0$ dB<br>Double ridged horn antenna: $\pm 6.0$ dB |

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

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

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

## 11 APPENDIX 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-808 for OATS, R-1082 for anechoic chamber, G-869 for RE measurements above 1 GHz, C-845 for conducted emissions site and T-1606 for conducted emissions at telecommunication ports).

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

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## 12 APPENDIX D Specification references

|                         |                                                                                                                                                                     |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC 47CFR part 15: 2016 | Radio Frequency Devices                                                                                                                                             |
| ANSI C63.10: 2013       | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices                                                                      |
| ANSI C63.2: 1996        | American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications                                            |
| ANSI C63.4: 2014        | American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz |
| RSS-247 Issue 2: 2017   | Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence- Exempt Local Area Network (LE-LAN) Devices                                       |
| RSS-Gen Issue 4: 2014   | General Requirements for Compliance of Radio Apparatus                                                                                                              |
| ICES-003: 2016, Issue 6 | Information Technology Equipment (Including Digital Apparatus) – Limits and methods of measurement                                                                  |



## 13 APPENDIX E Test equipment correction factors

Antenna factor  
Active loop antenna  
EMC Test Systems  
Model 6507, S/N 1457, HL 1915

| Frequency, kHz | Measured antenna factor, dBS/m |
|----------------|--------------------------------|
| 10             | -22.7                          |
| 20             | -27.6                          |
| 50             | -31.3                          |
| 75             | -31.8                          |
| 100            | -32.2                          |
| 150            | -32.3                          |
| 250            | -32.6                          |
| 500            | -32.8                          |
| 750            | -33.0                          |
| 1000           | -33.1                          |
| 2000           | -33.4                          |
| 3000           | -33.7                          |
| 4000           | -34.0                          |
| 5000           | -34.3                          |
| 10000          | -34.9                          |
| 15000          | -35.6                          |
| 20000          | -35.9                          |
| 25000          | -36.1                          |
| 30000          | -36.7                          |

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

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

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

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

**Antenna factor**  
**Horn antenna**  
Schwarzbeck mess-elektronik, Model BBHA 9120 D, serial number: 9120D-611, HL 4603

| Frequency, MHz | Measured antenna factor, dB/m |
|----------------|-------------------------------|
| 1000           | 25.2                          |
| 1500           | 25.7                          |
| 2000           | 26.1                          |
| 2500           | 27.5                          |
| 3000           | 28.3                          |
| 3500           | 29.0                          |
| 4000           | 30.0                          |
| 4500           | 30.8                          |
| 5000           | 31.9                          |
| 5500           | 32.2                          |
| 6000           | 33.1                          |
| 6500           | 34.6                          |
| 7000           | 35.9                          |
| 7500           | 36.6                          |
| 8000           | 37.2                          |
| 8500           | 36.6                          |
| 9000           | 36.9                          |
| 9500           | 37.5                          |
| 10000          | 38.4                          |
| 10500          | 39.5                          |
| 11000          | 40.3                          |
| 11500          | 40.0                          |
| 12000          | 39.2                          |
| 12500          | 38.7                          |
| 13000          | 39.6                          |
| 13500          | 40.8                          |
| 14000          | 41.6                          |
| 14500          | 42.1                          |
| 15000          | 41.2                          |
| 15500          | 39.1                          |
| 16000          | 38.5                          |
| 16500          | 39.9                          |
| 17000          | 41.0                          |
| 17500          | 44.1                          |
| 18000          | 55.6                          |

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

**Antenna factor**  
**Biconilog Antenna, 26 - 2000 MHz**  
**EMCO, Model 3142B, serial number: 9909-1421, HL 4604**

| Frequency, MHz | Measured, dB/m |
|----------------|----------------|
| 30             | 17.9           |
| 35             | 14.8           |
| 40             | 12.1           |
| 45             | 10.0           |
| 50             | 8.7            |
| 60             | 8.1            |
| 70             | 7.3            |
| 80             | 6.6            |
| 90             | 7.6            |
| 100            | 7.9            |
| 120            | 7.0            |
| 140            | 7.7            |
| 160            | 9.6            |
| 180            | 10.0           |
| 200            | 10.2           |
| 250            | 12.7           |
| 300            | 13.4           |
| 400            | 16.7           |
| 500            | 18.2           |
| 600            | 20.2           |
| 700            | 22.0           |
| 800            | 22.7           |
| 900            | 24.1           |
| 1000           | 25.0           |

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



HERMON LABORATORIES

Antenna factor, HL 4933

**Active Horn Antenna Factor Calibration**

1 GHz to 18 GHz

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

**Cable loss**  
**Cable coaxial, RG-214/U, N type-N type, 6.5 m**  
**Suhner Switzerland, HL 3615**

| Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 10                | 0.13              | 1750              | 2.47              | 3550              | 4.10              | 5350              | 5.76              |
| 30                | 0.24              | 1800              | 2.53              | 3600              | 4.17              | 5400              | 5.84              |
| 50                | 0.31              | 1850              | 2.59              | 3650              | 4.21              | 5450              | 5.88              |
| 100               | 0.47              | 1900              | 2.61              | 3700              | 4.23              | 5500              | 5.90              |
| 150               | 0.58              | 1950              | 2.66              | 3750              | 4.33              | 5550              | 5.96              |
| 200               | 0.68              | 2000              | 2.74              | 3800              | 4.36              | 5600              | 6.02              |
| 250               | 0.77              | 2050              | 2.76              | 3850              | 4.38              | 5650              | 6.02              |
| 300               | 0.86              | 2100              | 2.80              | 3900              | 4.46              | 5700              | 6.09              |
| 350               | 0.94              | 2150              | 2.84              | 3950              | 4.52              | 5750              | 6.14              |
| 400               | 1.01              | 2200              | 2.89              | 4000              | 4.48              | 5800              | 6.15              |
| 450               | 1.08              | 2250              | 2.94              | 4050              | 4.52              | 5850              | 6.22              |
| 500               | 1.16              | 2300              | 2.98              | 4100              | 4.64              | 5900              | 6.29              |
| 550               | 1.21              | 2350              | 3.03              | 4150              | 4.62              | 5950              | 6.32              |
| 600               | 1.28              | 2400              | 3.07              | 4200              | 4.69              | 6000              | 6.39              |
| 650               | 1.35              | 2450              | 3.11              | 4250              | 4.75              | 6050              | 6.40              |
| 700               | 1.41              | 2500              | 3.15              | 4300              | 4.79              | 6100              | 6.48              |
| 750               | 1.48              | 2550              | 3.21              | 4350              | 4.83              | 6150              | 6.57              |
| 800               | 1.54              | 2600              | 3.25              | 4400              | 4.90              | 6200              | 6.62              |
| 850               | 1.58              | 2650              | 3.29              | 4450              | 4.95              | 6250              | 6.68              |
| 900               | 1.65              | 2700              | 3.33              | 4500              | 4.98              | 6300              | 6.74              |
| 950               | 1.67              | 2750              | 3.39              | 4550              | 5.04              | 6350              | 6.79              |
| 1000              | 1.74              | 2800              | 3.45              | 4600              | 5.08              | 6400              | 6.82              |
| 1050              | 1.79              | 2850              | 3.48              | 4650              | 5.12              | 6450              | 6.83              |
| 1100              | 1.84              | 2900              | 3.51              | 4700              | 5.15              | 6500              | 6.91              |
| 1150              | 1.91              | 2950              | 3.58              | 4750              | 5.22              |                   |                   |
| 1200              | 1.94              | 3000              | 3.62              | 4800              | 5.26              |                   |                   |
| 1250              | 1.99              | 3050              | 3.65              | 4850              | 5.29              |                   |                   |
| 1300              | 2.06              | 3100              | 3.69              | 4900              | 5.33              |                   |                   |
| 1350              | 2.11              | 3150              | 3.75              | 4950              | 5.36              |                   |                   |
| 1400              | 2.16              | 3200              | 3.77              | 5000              | 5.38              |                   |                   |
| 1450              | 2.21              | 3250              | 3.80              | 5050              | 5.46              |                   |                   |
| 1500              | 2.25              | 3300              | 3.85              | 5100              | 5.49              |                   |                   |
| 1550              | 2.30              | 3350              | 3.90              | 5150              | 5.56              |                   |                   |
| 1600              | 2.35              | 3400              | 3.94              | 5200              | 5.58              |                   |                   |
| 1650              | 2.38              | 3450              | 4.00              | 5250              | 5.64              |                   |                   |
| 1700              | 2.42              | 3500              | 4.03              | 5300              | 5.69              |                   |                   |

**Cable loss**  
**Test cable, Mini-Circuits, S/N 0748A, 18 GHz, 3.05 m, N/M - N/M**  
**APC-10FT-NMNM+, HL 4277**

| Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 10             | 0.12           | 4400           | 3.19           | 9000           | 4.82           | 13600          | 5.97           |
| 30             | 0.21           | 4500           | 3.24           | 9100           | 4.87           | 13700          | 6.01           |
| 50             | 0.28           | 4600           | 3.29           | 9200           | 4.90           | 13800          | 6.04           |
| 100            | 0.40           | 4700           | 3.34           | 9300           | 4.96           | 13900          | 6.09           |
| 200            | 0.59           | 4800           | 3.37           | 9400           | 4.99           | 14000          | 6.12           |
| 300            | 0.73           | 4900           | 3.41           | 9500           | 5.03           | 14100          | 6.16           |
| 400            | 0.86           | 5000           | 3.45           | 9600           | 5.07           | 14200          | 6.20           |
| 500            | 0.97           | 5100           | 3.48           | 9700           | 5.11           | 14300          | 6.22           |
| 600            | 1.07           | 5200           | 3.52           | 9800           | 5.13           | 14400          | 6.26           |
| 700            | 1.15           | 5300           | 3.56           | 9900           | 5.15           | 14500          | 6.29           |
| 800            | 1.23           | 5400           | 3.58           | 10000          | 5.17           | 14600          | 6.33           |
| 900            | 1.31           | 5500           | 3.62           | 10100          | 5.19           | 14700          | 6.33           |
| 1000           | 1.39           | 5600           | 3.65           | 10200          | 5.19           | 14800          | 6.35           |
| 1100           | 1.46           | 5700           | 3.69           | 10300          | 5.21           | 14900          | 6.38           |
| 1200           | 1.54           | 5800           | 3.72           | 10400          | 5.22           | 15000          | 6.38           |
| 1300           | 1.60           | 5900           | 3.76           | 10500          | 5.22           | 15100          | 6.40           |
| 1400           | 1.67           | 6000           | 3.80           | 10600          | 5.22           | 15200          | 6.42           |
| 1500           | 1.74           | 6100           | 3.84           | 10700          | 5.25           | 15300          | 6.46           |
| 1600           | 1.79           | 6200           | 3.89           | 10800          | 5.25           | 15400          | 6.51           |
| 1700           | 1.86           | 6300           | 3.92           | 10900          | 5.26           | 15500          | 6.55           |
| 1800           | 1.92           | 6400           | 3.96           | 11000          | 5.29           | 15600          | 6.56           |
| 1900           | 1.98           | 6500           | 4.00           | 11100          | 5.30           | 15700          | 6.59           |
| 2000           | 2.04           | 6600           | 4.04           | 11200          | 5.31           | 15800          | 6.60           |
| 2100           | 2.09           | 6700           | 4.07           | 11300          | 5.35           | 15900          | 6.64           |
| 2200           | 2.14           | 6800           | 4.11           | 11400          | 5.36           | 16000          | 6.65           |
| 2300           | 2.20           | 6900           | 4.14           | 11500          | 5.39           | 16100          | 6.65           |
| 2400           | 2.25           | 7000           | 4.17           | 11600          | 5.41           | 16200          | 6.67           |
| 2500           | 2.31           | 7100           | 4.21           | 11700          | 5.45           | 16300          | 6.69           |
| 2600           | 2.36           | 7200           | 4.23           | 11800          | 5.48           | 16400          | 6.71           |
| 2700           | 2.42           | 7300           | 4.27           | 11900          | 5.51           | 16500          | 6.72           |
| 2800           | 2.46           | 7400           | 4.30           | 12000          | 5.53           | 16600          | 6.73           |
| 2900           | 2.51           | 7500           | 4.34           | 12100          | 5.56           | 16700          | 6.75           |
| 3000           | 2.56           | 7600           | 4.37           | 12200          | 5.59           | 16800          | 6.80           |
| 3100           | 2.60           | 7700           | 4.40           | 12300          | 5.61           | 16900          | 6.82           |
| 3200           | 2.65           | 7800           | 4.44           | 12400          | 5.62           | 17000          | 6.85           |
| 3300           | 2.70           | 7900           | 4.47           | 12500          | 5.65           | 17100          | 6.90           |
| 3400           | 2.75           | 8000           | 4.49           | 12600          | 5.68           | 17200          | 6.96           |
| 3500           | 2.80           | 8100           | 4.53           | 12700          | 5.71           | 17300          | 7.02           |
| 3600           | 2.85           | 8200           | 4.57           | 12800          | 5.73           | 17400          | 7.07           |
| 3700           | 2.90           | 8300           | 4.60           | 12900          | 5.76           | 17500          | 7.06           |
| 3800           | 2.95           | 8400           | 4.63           | 13000          | 5.80           | 17600          | 7.06           |
| 3900           | 2.98           | 8500           | 4.67           | 13100          | 5.83           | 17700          | 7.08           |
| 4000           | 3.02           | 8600           | 4.69           | 13200          | 5.86           | 17800          | 7.09           |
| 4100           | 3.07           | 8700           | 4.73           | 13300          | 5.88           | 17900          | 7.07           |
| 4200           | 3.10           | 8800           | 4.76           | 13400          | 5.91           | 18000          | 7.08           |
| 4300           | 3.14           | 8900           | 4.79           | 13500          | 5.94           |                |                |

**Cable loss**  
**Microwave Cable Assembly, 18.0 GHz, 3.4 m, SMA/SMA, Huber-Suhner,**  
**Sucoflex P103, HL 4294**

| Frequency,<br>MHz | Cable<br>loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable<br>loss, dB | Frequency,<br>MHz | Cable<br>loss, dB |
|-------------------|----------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 10                | 0.11                 | 4900              | 2.09              | 10000             | 2.90              | 15100             | 3.61              |
| 30                | 0.17                 | 5000              | 2.10              | 10100             | 2.92              | 15200             | 3.67              |
| 50                | 0.22                 | 5100              | 2.14              | 10200             | 2.95              | 15300             | 3.63              |
| 100               | 0.30                 | 5200              | 2.16              | 10300             | 2.96              | 15400             | 3.64              |
| 200               | 0.42                 | 5300              | 2.17              | 10400             | 2.99              | 15500             | 3.68              |
| 300               | 0.51                 | 5400              | 2.19              | 10500             | 2.99              | 15600             | 3.71              |
| 400               | 0.59                 | 5500              | 2.19              | 10600             | 3.03              | 15700             | 3.74              |
| 500               | 0.66                 | 5600              | 2.22              | 10700             | 3.03              | 15800             | 3.71              |
| 600               | 0.72                 | 5700              | 2.24              | 10800             | 3.04              | 15900             | 3.74              |
| 700               | 0.77                 | 5800              | 2.23              | 10900             | 3.05              | 16000             | 3.71              |
| 800               | 0.82                 | 5900              | 2.26              | 11000             | 3.09              | 16100             | 3.73              |
| 900               | 0.88                 | 6000              | 2.27              | 11100             | 3.07              | 16200             | 3.76              |
| 1000              | 0.93                 | 6100              | 2.26              | 11200             | 3.08              | 16300             | 3.82              |
| 1100              | 0.98                 | 6200              | 2.29              | 11300             | 3.11              | 16400             | 3.90              |
| 1200              | 1.02                 | 6300              | 2.30              | 11400             | 3.12              | 16500             | 3.81              |
| 1300              | 1.06                 | 6400              | 2.34              | 11500             | 3.11              | 16600             | 3.88              |
| 1400              | 1.10                 | 6500              | 2.34              | 11600             | 3.15              | 16700             | 3.87              |
| 1500              | 1.14                 | 6600              | 2.36              | 11700             | 3.16              | 16800             | 3.89              |
| 1600              | 1.19                 | 6700              | 2.36              | 11800             | 3.18              | 16900             | 3.95              |
| 1700              | 1.23                 | 6800              | 2.39              | 11900             | 3.19              | 17000             | 4.02              |
| 1800              | 1.27                 | 6900              | 2.39              | 12000             | 3.23              | 17100             | 4.04              |
| 1900              | 1.30                 | 7000              | 2.44              | 12100             | 3.25              | 17200             | 3.99              |
| 2000              | 1.35                 | 7100              | 2.46              | 12200             | 3.22              | 17300             | 4.03              |
| 2100              | 1.38                 | 7200              | 2.44              | 12300             | 3.25              | 17400             | 4.03              |
| 2200              | 1.42                 | 7300              | 2.48              | 12400             | 3.25              | 17500             | 4.06              |
| 2300              | 1.45                 | 7400              | 2.47              | 12500             | 3.28              | 17600             | 4.05              |
| 2400              | 1.48                 | 7500              | 2.48              | 12600             | 3.27              | 17700             | 4.12              |
| 2500              | 1.51                 | 7600              | 2.50              | 12700             | 3.27              | 17800             | 4.14              |
| 2600              | 1.55                 | 7700              | 2.53              | 12800             | 3.30              | 17900             | 4.18              |
| 2700              | 1.59                 | 7800              | 2.56              | 12900             | 3.30              | 18000             | 4.14              |
| 2800              | 1.62                 | 7900              | 2.55              | 13000             | 3.27              |                   |                   |
| 2900              | 1.65                 | 8000              | 2.56              | 13100             | 3.32              |                   |                   |
| 3000              | 1.66                 | 8100              | 2.56              | 13200             | 3.32              |                   |                   |
| 3100              | 1.69                 | 8200              | 2.57              | 13300             | 3.32              |                   |                   |
| 3200              | 1.71                 | 8300              | 2.59              | 13400             | 3.35              |                   |                   |
| 3300              | 1.74                 | 8400              | 2.62              | 13500             | 3.38              |                   |                   |
| 3400              | 1.76                 | 8500              | 2.67              | 13600             | 3.39              |                   |                   |
| 3500              | 1.78                 | 8600              | 2.65              | 13700             | 3.42              |                   |                   |
| 3600              | 1.80                 | 8700              | 2.68              | 13800             | 3.47              |                   |                   |
| 3700              | 1.85                 | 8800              | 2.68              | 13900             | 3.45              |                   |                   |
| 3800              | 1.88                 | 8900              | 2.68              | 14000             | 3.49              |                   |                   |
| 3900              | 1.90                 | 9000              | 2.74              | 14100             | 3.50              |                   |                   |
| 4000              | 1.91                 | 9100              | 2.74              | 14200             | 3.55              |                   |                   |
| 4100              | 1.93                 | 9200              | 2.76              | 14300             | 3.59              |                   |                   |
| 4200              | 1.96                 | 9300              | 2.78              | 14400             | 3.58              |                   |                   |
| 4300              | 1.97                 | 9400              | 2.79              | 14500             | 3.56              |                   |                   |
| 4400              | 1.99                 | 9500              | 2.80              | 14600             | 3.57              |                   |                   |
| 4500              | 2.02                 | 9600              | 2.83              | 14700             | 3.57              |                   |                   |
| 4600              | 2.02                 | 9700              | 2.84              | 14800             | 3.57              |                   |                   |
| 4700              | 2.04                 | 9800              | 2.86              | 14900             | 3.64              |                   |                   |
| 4800              | 2.05                 | 9900              | 2.92              | 15000             | 3.64              |                   |                   |



**Cable loss**  
**Microwave Cable Assembly, 18.0 GHz, 3.4 m, SMA/SMA, Huber-Suhner, S/N 4295,**  
**Sucoflex P103, HL 4295**

| Frequency,<br>MHz | Cable<br>loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable<br>loss, dB | Frequency,<br>MHz | Cable<br>loss, dB |
|-------------------|----------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 10                | 0.11                 | 5000              | 2.09              | 10200             | 2.97              | 15400             | 3.63              |
| 30                | 0.18                 | 5100              | 2.12              | 10300             | 3.01              | 15500             | 3.65              |
| 50                | 0.23                 | 5200              | 2.13              | 10400             | 3.00              | 15600             | 3.63              |
| 100               | 0.31                 | 5300              | 2.16              | 10500             | 3.05              | 15700             | 3.64              |
| 200               | 0.38                 | 5400              | 2.19              | 10600             | 3.09              | 15800             | 3.64              |
| 300               | 0.43                 | 5500              | 2.21              | 10700             | 3.05              | 15900             | 3.66              |
| 400               | 0.52                 | 5600              | 2.21              | 10800             | 3.09              | 16000             | 3.71              |
| 500               | 0.60                 | 5700              | 2.24              | 10900             | 3.10              | 16100             | 3.67              |
| 600               | 0.67                 | 5800              | 2.24              | 11000             | 3.08              | 16200             | 3.71              |
| 700               | 0.72                 | 5900              | 2.25              | 11100             | 3.11              | 16300             | 3.70              |
| 800               | 0.78                 | 6000              | 2.27              | 11200             | 3.12              | 16400             | 3.71              |
| 900               | 0.83                 | 6100              | 2.25              | 11300             | 3.12              | 16500             | 3.72              |
| 1000              | 0.89                 | 6200              | 2.29              | 11400             | 3.20              | 16600             | 3.84              |
| 1100              | 0.94                 | 6300              | 2.34              | 11500             | 3.16              | 16700             | 3.78              |
| 1200              | 0.98                 | 6400              | 2.37              | 11600             | 3.16              | 16800             | 3.85              |
| 1300              | 1.03                 | 6500              | 2.33              | 11700             | 3.20              | 16900             | 3.88              |
| 1400              | 1.06                 | 6600              | 2.34              | 11800             | 3.19              | 17000             | 3.85              |
| 1500              | 1.11                 | 6700              | 2.39              | 11900             | 3.21              | 17100             | 3.88              |
| 1600              | 1.14                 | 6800              | 2.46              | 12000             | 3.28              | 17200             | 3.92              |
| 1700              | 1.19                 | 6900              | 2.45              | 12100             | 3.23              | 17300             | 3.90              |
| 1800              | 1.22                 | 7000              | 2.44              | 12200             | 3.26              | 17400             | 4.00              |
| 1900              | 1.26                 | 7100              | 2.43              | 12300             | 3.30              | 17500             | 4.02              |
| 2000              | 1.30                 | 7200              | 2.44              | 12400             | 3.25              | 17600             | 4.00              |
| 2100              | 1.34                 | 7300              | 2.51              | 12500             | 3.26              | 17700             | 3.96              |
| 2200              | 1.37                 | 7400              | 2.54              | 12600             | 3.30              | 17800             | 4.01              |
| 2300              | 1.40                 | 7500              | 2.49              | 12700             | 3.26              | 17900             | 4.02              |
| 2400              | 1.44                 | 7600              | 2.52              | 12800             | 3.34              | 18000             | 4.08              |
| 2500              | 1.47                 | 7700              | 2.59              | 12900             | 3.37              |                   |                   |
| 2600              | 1.50                 | 7800              | 2.57              | 13000             | 3.30              |                   |                   |
| 2700              | 1.55                 | 7900              | 2.55              | 13100             | 3.35              |                   |                   |
| 2800              | 1.58                 | 8000              | 2.57              | 13200             | 3.31              |                   |                   |
| 2900              | 1.60                 | 8100              | 2.58              | 13300             | 3.33              |                   |                   |
| 3000              | 1.63                 | 8200              | 2.64              | 13400             | 3.42              |                   |                   |
| 3100              | 1.64                 | 8300              | 2.70              | 13500             | 3.43              |                   |                   |
| 3200              | 1.67                 | 8400              | 2.65              | 13600             | 3.40              |                   |                   |
| 3300              | 1.69                 | 8500              | 2.66              | 13700             | 3.47              |                   |                   |
| 3400              | 1.73                 | 8600              | 2.68              | 13800             | 3.45              |                   |                   |
| 3500              | 1.74                 | 8700              | 2.70              | 13900             | 3.43              |                   |                   |
| 3600              | 1.76                 | 8800              | 2.74              | 14000             | 3.52              |                   |                   |
| 3700              | 1.79                 | 8900              | 2.74              | 14100             | 3.51              |                   |                   |
| 3800              | 1.82                 | 9000              | 2.76              | 14200             | 3.54              |                   |                   |
| 3900              | 1.85                 | 9100              | 2.82              | 14300             | 3.55              |                   |                   |
| 4000              | 1.87                 | 9200              | 2.79              | 14400             | 3.52              |                   |                   |
| 4100              | 1.90                 | 9300              | 2.82              | 14500             | 3.52              |                   |                   |
| 4200              | 1.92                 | 9400              | 2.83              | 14600             | 3.56              |                   |                   |
| 4300              | 1.93                 | 9500              | 2.83              | 14700             | 3.55              |                   |                   |
| 4400              | 1.94                 | 9600              | 2.86              | 14800             | 3.55              |                   |                   |
| 4500              | 1.97                 | 9700              | 2.93              | 14900             | 3.59              |                   |                   |
| 4600              | 1.99                 | 9800              | 2.89              | 15000             | 3.56              |                   |                   |
| 4700              | 2.01                 | 9900              | 2.91              | 15100             | 3.59              |                   |                   |
| 4800              | 2.02                 | 10000             | 2.94              | 15200             | 3.59              |                   |                   |
| 4900              | 2.04                 | 10100             | 2.94              | 15300             | 3.59              |                   |                   |

**Cable loss**  
**Microwave Cable Assembly, 6.5 GHz, 5.0 m, N/M type-N/M type**  
**Suhner Switzerland, HL 4535**

| Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 10                | 0.10              | 1700              | 1.79              | 4400              | 3.53              |
| 15                | 0.13              | 1800              | 1.86              | 4500              | 3.60              |
| 20                | 0.15              | 1900              | 1.93              | 4600              | 3.72              |
| 30                | 0.18              | 2000              | 2.00              | 4700              | 3.80              |
| 40                | 0.21              | 2100              | 2.06              | 4800              | 3.87              |
| 50                | 0.24              | 2200              | 2.13              | 4900              | 3.94              |
| 60                | 0.26              | 2300              | 2.19              | 5000              | 3.99              |
| 70                | 0.29              | 2400              | 2.25              | 5100              | 4.06              |
| 80                | 0.31              | 2500              | 2.32              | 5200              | 4.12              |
| 90                | 0.33              | 2600              | 2.38              | 5300              | 4.17              |
| 100               | 0.35              | 2700              | 2.45              | 5400              | 4.25              |
| 150               | 0.43              | 2800              | 2.51              | 5500              | 4.31              |
| 200               | 0.50              | 2900              | 2.57              | 5600              | 4.40              |
| 300               | 0.63              | 3000              | 2.64              | 5700              | 4.47              |
| 400               | 0.74              | 3100              | 2.73              | 5800              | 4.54              |
| 500               | 0.85              | 3200              | 2.79              | 5900              | 4.64              |
| 600               | 0.94              | 3300              | 2.86              | 6000              | 4.73              |
| 700               | 1.03              | 3400              | 2.91              | 6100              | 4.79              |
| 800               | 1.12              | 3500              | 2.97              | 6200              | 4.89              |
| 900               | 1.20              | 3600              | 3.02              | 6300              | 5.00              |
| 1000              | 1.28              | 3700              | 3.07              | 6400              | 5.06              |
| 1100              | 1.35              | 3800              | 3.14              | 6500              | 5.13              |
| 1200              | 1.43              | 3900              | 3.20              |                   |                   |
| 1300              | 1.50              | 4000              | 3.25              |                   |                   |
| 1400              | 1.58              | 4100              | 3.32              |                   |                   |
| 1500              | 1.65              | 4200              | 3.38              |                   |                   |
| 1600              | 1.72              | 4300              | 3.46              |                   |                   |

**Cable loss**  
**Microwave Cable Assembly, 4.0 GHz, 1.0 m, N/M type-N/M type**  
**Suhner Switzerland, HL 4541**

| Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB |
|-------------------|-------------------|-------------------|-------------------|
| 10                | 0.02              | 1700              | 0.45              |
| 15                | 0.03              | 1800              | 0.46              |
| 20                | 0.03              | 1900              | 0.48              |
| 30                | 0.04              | 2000              | 0.49              |
| 40                | 0.04              | 2100              | 0.52              |
| 50                | 0.05              | 2200              | 0.54              |
| 60                | 0.06              | 2300              | 0.55              |
| 70                | 0.06              | 2400              | 0.56              |
| 80                | 0.07              | 2500              | 0.58              |
| 90                | 0.07              | 2600              | 0.59              |
| 100               | 0.08              | 2700              | 0.61              |
| 150               | 0.10              | 2800              | 0.63              |
| 200               | 0.12              | 2900              | 0.64              |
| 300               | 0.15              | 3000              | 0.67              |
| 400               | 0.18              | 3100              | 0.70              |
| 500               | 0.20              | 3200              | 0.74              |
| 600               | 0.23              | 3300              | 0.77              |
| 700               | 0.25              | 3400              | 0.80              |
| 800               | 0.28              | 3500              | 0.82              |
| 900               | 0.30              | 3600              | 0.86              |
| 1000              | 0.31              | 3700              | 0.88              |
| 1100              | 0.33              | 3800              | 0.94              |
| 1200              | 0.35              | 3900              | 0.95              |
| 1300              | 0.37              | 4000              | 0.99              |
| 1400              | 0.39              |                   |                   |
| 1500              | 0.41              |                   |                   |
| 1600              | 0.43              |                   |                   |

**Cable loss**  
**RF Cable, Huber-Suhner, 18 GHz, 6 m, N- type,**  
**SF106A/11N/11N/6000MM, S/N 500848/6A**  
**HL 5102**

| Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB |
|-------------------|-------------------|-------------------|-------------------|
| 0.1               | 0.00              | 5500              | 2.43              |
| 50                | 0.23              | 6000              | 2.54              |
| 100               | 0.31              | 6500              | 2.65              |
| 200               | 0.44              | 7000              | 2.76              |
| 300               | 0.54              | 7500              | 2.87              |
| 400               | 0.62              | 8000              | 2.98              |
| 500               | 0.69              | 8500              | 3.06              |
| 600               | 0.76              | 9000              | 3.16              |
| 700               | 0.82              | 9500              | 3.27              |
| 800               | 0.87              | 10000             | 3.36              |
| 900               | 0.94              | 10500             | 3.45              |
| 1000              | 0.98              | 11000             | 3.55              |
| 1100              | 1.03              | 11500             | 3.63              |
| 1200              | 1.08              | 12000             | 3.72              |
| 1300              | 1.13              | 12500             | 3.82              |
| 1400              | 1.17              | 13000             | 3.90              |
| 1500              | 1.21              | 13500             | 3.99              |
| 1600              | 1.25              | 14000             | 4.06              |
| 1700              | 1.30              | 14500             | 4.15              |
| 1800              | 1.33              | 15000             | 4.24              |
| 1900              | 1.37              | 15500             | 4.30              |
| 2000              | 1.41              | 16000             | 4.37              |
| 2500              | 1.59              | 16500             | 4.45              |
| 3000              | 1.75              | 17000             | 4.53              |
| 3500              | 1.90              | 17500             | 4.62              |
| 4000              | 2.04              | 18000             | 4.67              |
| 4500              | 2.17              |                   |                   |
| 5000              | 2.30              |                   |                   |

**Cable loss**  
**RF Cable, Huber-Suhner, 18 GHz, 6 m, N- type,**  
**SF106A/11N/11N/6000MM, S/N 500851/6A**  
**HL 5105**

| Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB |
|-------------------|-------------------|-------------------|-------------------|
| 0.1               | 0.01              | 5500              | 2.41              |
| 50                | 0.22              | 6000              | 2.53              |
| 100               | 0.31              | 6500              | 2.64              |
| 200               | 0.43              | 7000              | 2.75              |
| 300               | 0.53              | 7500              | 2.85              |
| 400               | 0.61              | 8000              | 2.96              |
| 500               | 0.68              | 8500              | 3.05              |
| 600               | 0.75              | 9000              | 3.15              |
| 700               | 0.81              | 9500              | 3.26              |
| 800               | 0.87              | 10000             | 3.34              |
| 900               | 0.93              | 10500             | 3.44              |
| 1000              | 0.98              | 11000             | 3.53              |
| 1100              | 1.03              | 11500             | 3.61              |
| 1200              | 1.07              | 12000             | 3.71              |
| 1300              | 1.12              | 12500             | 3.81              |
| 1400              | 1.16              | 13000             | 3.89              |
| 1500              | 1.21              | 13500             | 3.97              |
| 1600              | 1.25              | 14000             | 4.05              |
| 1700              | 1.28              | 14500             | 4.13              |
| 1800              | 1.32              | 15000             | 4.21              |
| 1900              | 1.37              | 15500             | 4.29              |
| 2000              | 1.40              | 16000             | 4.36              |
| 2500              | 1.58              | 16500             | 4.43              |
| 3000              | 1.74              | 17000             | 4.49              |
| 3500              | 1.89              | 17500             | 4.58              |
| 4000              | 2.03              | 18000             | 4.67              |
| 4500              | 2.17              |                   |                   |
| 5000              | 2.29              |                   |                   |

**Cable loss**  
**RF Cable, Huber-Suhner, 40 GHz, 5.5 m, K type,**  
**SF102EA/11SK/11SK/5500MM, S/N 502493/2EA**  
**HL 5111**

| Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB |
|-------------------|-------------------|-------------------|-------------------|
| 100               | 0.68              | 20500             | 10.17             |
| 200               | 0.97              | 21000             | 10.30             |
| 300               | 1.18              | 21500             | 10.43             |
| 500               | 1.52              | 22000             | 10.58             |
| 1000              | 2.14              | 22500             | 10.73             |
| 1500              | 2.62              | 23000             | 10.85             |
| 2000              | 3.03              | 23500             | 10.98             |
| 2500              | 3.39              | 24000             | 11.11             |
| 3000              | 3.72              | 24500             | 11.20             |
| 3500              | 4.03              | 25000             | 11.32             |
| 4000              | 4.32              | 25500             | 11.47             |
| 4500              | 4.59              | 26000             | 11.59             |
| 5000              | 4.84              | 26500             | 11.72             |
| 5500              | 5.09              | 27000             | 11.83             |
| 6000              | 5.32              | 27500             | 11.94             |
| 6500              | 5.55              | 28000             | 12.04             |
| 7000              | 5.77              | 28500             | 12.16             |
| 7500              | 5.99              | 29000             | 12.28             |
| 8000              | 6.19              | 29500             | 12.40             |
| 8500              | 6.40              | 30000             | 12.50             |
| 9000              | 6.60              | 30500             | 12.59             |
| 9500              | 6.79              | 31000             | 12.68             |
| 10000             | 6.98              | 31500             | 12.80             |
| 10500             | 7.16              | 32000             | 12.94             |
| 11000             | 7.34              | 32500             | 13.09             |
| 11500             | 7.51              | 33000             | 13.23             |
| 12000             | 7.68              | 33500             | 13.32             |
| 12500             | 7.84              | 34000             | 13.44             |
| 13000             | 8.00              | 34500             | 13.54             |
| 13500             | 8.15              | 35000             | 13.68             |
| 14000             | 8.31              | 35500             | 13.81             |
| 14500             | 8.46              | 36000             | 13.90             |
| 15000             | 8.62              | 36500             | 13.99             |
| 15500             | 8.76              | 37000             | 14.12             |
| 16000             | 8.91              | 37500             | 14.22             |
| 16500             | 9.06              | 38000             | 14.33             |
| 17000             | 9.21              | 38500             | 14.47             |
| 17500             | 9.35              | 39000             | 14.54             |
| 18000             | 9.49              | 39500             | 14.62             |
| 18500             | 9.62              | 40000             | 14.75             |
| 19000             | 9.76              |                   |                   |
| 19500             | 9.90              |                   |                   |
| 20000             | 10.05             |                   |                   |

## 14 APPENDIX F Abbreviations and acronyms

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

END OF DOCUMENT