HERMON LABORATORIES

ELECTRICAL TESTING
0839.01

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# TEST REPORT

**ACCORDING TO: FCC 47CFR part 15 subpart C § 15.247 (DTS) and subpart B, RSS-247 issue 1, RSS-Gen issue 4, ICES-003 Issue 5:2012**

**FOR:**

## Visonic Ltd.
## Wireless PIR Detector
## Model: MP-840
## FCC ID:WP3MP840
## IC:1467C-MP840

# Table of contents

# 1 Applicant information

| | |
|---|---|
| **Client name:** | Visonic Ltd. |
| **Address:** | 24 Habarzel street, Tel Aviv 69710, Israel |
| **Telephone:** | +972 3645 6832 |
| **Fax:** | +972 3645 6788 |
| **E-mail:** | zurir@tycoint.com |
| **Contact name:** | Mr. Zuri Rubin |

# 2 Equipment under test attributes

| | |
|---|---|
| **Product name:** | Wireless PIR Detector |
| **Product type:** | Transceiver |
| **Model(s):** | MP-840 |
| **Serial number:** | 0916582224 |
| **Hardware version:** | 90-208026 |
| **Software release:** | JS-703129 |
| **Receipt date** | 02-Feb-16 |

# 3 Manufacturer information

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

# 4 Test details

| | |
|---|---|
| **Project ID:** | 27985 |
| **Location:** | Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel |
| **Test started:** | 02-Feb-16 |
| **Test completed:** | 08-Mar-16 |
| **Test specification(s):** | FCC 47CFR part 15 subpart C § 15.247 (DTS);<br>RSS-247 issue 1, RSS-Gen issue 4 |

# 5 Tests summary

| Test | Status |
|---|---|
| **Transmitter characteristics** | |
| FCC section 15.247(a)2 / RSS-247 section 5.2(1), 6 dB bandwidth | Pass |
| FCC section 15.247(b)3/ RSS-247 section 5.4(4), Peak output power | Pass |
| FCC section 15.247(i) / RSS-102 section 2.5.2, RF exposure | Pass, the exhibit to the application of certification is provided |
| FCC section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions | Pass |
| FCC section 15.247(d)/ RSS-247 section 5.5, Emissions at band edges | Pass |
| FCC section 15.247(e) / RSS-247 section 5.2(2), Peak power density | Pass |
| FCC section 15.203 / RSS-Gen section 8.3, Antenna requirement | Pass |
| FCC section 15.207(a) / RSS-Gen section 8.8, Conducted emission | Not required |
| **Unintentional emissions** | |
| FCC section 15.107/ ICES-003, Section 6.1, Class B, Conducted emission at AC power port | Not required |
| FCC 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.

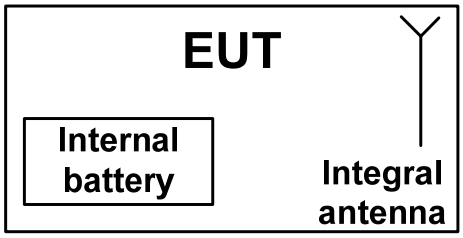
| | Name and Title | Date | Signature |
|---|---|---|---|
| **Tested by:** | Mrs. E. Pitt, test engineer | March 8, 2016 |  |
| **Reviewed by:** | Mrs. M. Cherniavsky, certification engineer | March 17, 2016 |  |
| **Approved by:** | Mr. M. Nikishin, EMC and Radio group manager | April 19, 2016 |  |

# 6 EUT description

## 6.1 General information

The EUT, MP-840, is a wireless PIR detector with RF module operating@2.4 GHz.

## 6.2 Test configuration




## 6.3 Changes made in the EUT

No changes were implemented in the EUT during the testing.

## 6.4 Transmitter characteristics

| Type of equipment | | |
|---|---|---|
| X | Stand-alone (Equipment with or without its own control provisions) | |
| | Combined equipment (Equipment where the radio part is fully integrated within another type of equipment) | |
| | Plug-in card (Equipment intended for a variety of host systems) | |

| Intended use | | Condition of use |
|---|---|---|
| | fixed | Always at a distance more than 2 m from all people |
| X | mobile | Always at a distance more than 20 cm from all people |
| | portable | May operate at a distance closer than 20 cm to human body |

| | |
|---|---|
| **Assigned frequency ranges** | 2400 -2483.5 MHz |
| **Operating frequencies** | 2405-2480 MHz |

| | | |
|---|---|---|
| **Maximum rated output power** | At transmitter 50 Ω RF output connector | dBm |
| | Peak output power | 16.28 dBm |

| | | | | |
|---|---|---|---|---|
| **Is transmitter output power variable?** | X | No | | |
| | | Yes | | continuous variable |
| | | | | stepped variable with stepsize dB |
| | | | minimum RF power | dBm |
| | | | maximum RF power | dBm |

| Antenna connection | | | | | |
|---|---|---|---|---|---|
| unique coupling | standard connector | X | integral | | with temporary RF connector |
| | | | | X | without temporary RF connector |

| Antenna/s technical characteristics | | | |
|---|---|---|---|
| Type | Manufacturer | Model number | Gain |
| Integral | Visonic | Printed | 3 dBi |

| | |
|---|---|
| **Transmitter aggregate data rate** | 250 kbps |
| **Type of modulation** | OQPSK |

| Transmitter power source | | | | | |
|---|---|---|---|---|---|
| X | Battery | **Nominal rated voltage** | 3 VDC | Battery type | Lithium CR123 |
| | DC | **Nominal rated voltage** | | | |
| | AC mains | **Nominal rated voltage** | | Frequency | |

| | | | |
|---|---|---|---|
| **Common power source for transmitter and receiver** | X | yes | no |

| Test specification: | FCC section 15.247(a)(2), RSS-247 section 5.2(1), 6 dB bandwidth | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.8.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

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

## 7.1 Minimum 6 dB bandwidth

### 7.1.1 General

This test was performed to measure the 6 dB bandwidth of the EUT carrier frequency. Specification test limits are given in Table 7.1.1, Table 7.1.2.

**Table 7.1.1 The 6 dB bandwidth limits**

| Assigned frequency, MHz | Modulation envelope reference points*, dBc | Minimum bandwidth, kHz |
|---|---|---|
| 902.0 – 928.0 | 6.0 | >500.0 |
| 2400.0 – 2483.5 | | |
| 5725.0 – 5850.0 | | |

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

**Table 7.1.2 The 99% bandwidth limits**

| Assigned frequency, MHz | Modulation envelope reference points | Limit, kHz |
|---|---|---|
| 902.0 – 928.0 | 99% | >500.0 |
| 2400.0 – 2483.5 | | |
| 5725.0 – 5850.0 | | |

### 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.

**7.1.2.3** The transmitter minimum 6 dB bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.1.3 and the associated plots.

**7.1.2.4** The 99% bandwidth results are provided in Table 7.1.4 and the associated plots.

**Figure 7.1.1 The 6 dB bandwidth test setup**

| Test specification: | FCC section 15.247(a)(2), RSS-247 section 5.2(1), 6 dB bandwidth | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.8.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Table 7.1.3 The 6 dB bandwidth test results**

ASSIGNED FREQUENCY BAND: 2400-2483.5 MHz
DETECTOR USED: Peak
SWEEP MODE: Max hold
SWEEP TIME: Auto
RESOLUTION BANDWIDTH: 100 kHz
VIDEO BANDWIDTH: 3 RBW
MODULATION: OQPSK
BIT RATE: 250 kbps

| Carrier frequency, MHz | 6 dB bandwidth, kHz | Limit, kHz | Margin, kHz | Verdict |
|---|---|---|---|---|
| 2405 | 1592 | 500 | 1092 | Pass |
| 2445 | 1594 | 500 | 1094 | Pass |
| 2475 | 1593 | 500 | 1093 | Pass |
| 2480 | 1548 | 500 | 1048 | Pass |

**Table 7.1.4 The 99% bandwidth test results**

ASSIGNED FREQUENCY BAND: 2400-2483.5 MHz
DETECTOR USED: Peak
SWEEP MODE: Max hold
SWEEP TIME: Auto
RESOLUTION BANDWIDTH: 100 kHz
VIDEO BANDWIDTH: 3 RBW
MODULATION: OQPSK
BIT RATE: 250 kbps

| Carrier frequency, MHz | 99% bandwidth, kHz | Limit, kHz | Margin, kHz | Verdict |
|---|---|---|---|---|
| 2405 | 2442 | 500 | 1942 | Pass |
| 2445 | 2442 | 500 | 1942 | Pass |
| 2475 | 2447 | 500 | 1947 | Pass |
| 2480 | 2429 | 500 | 1929 | Pass |

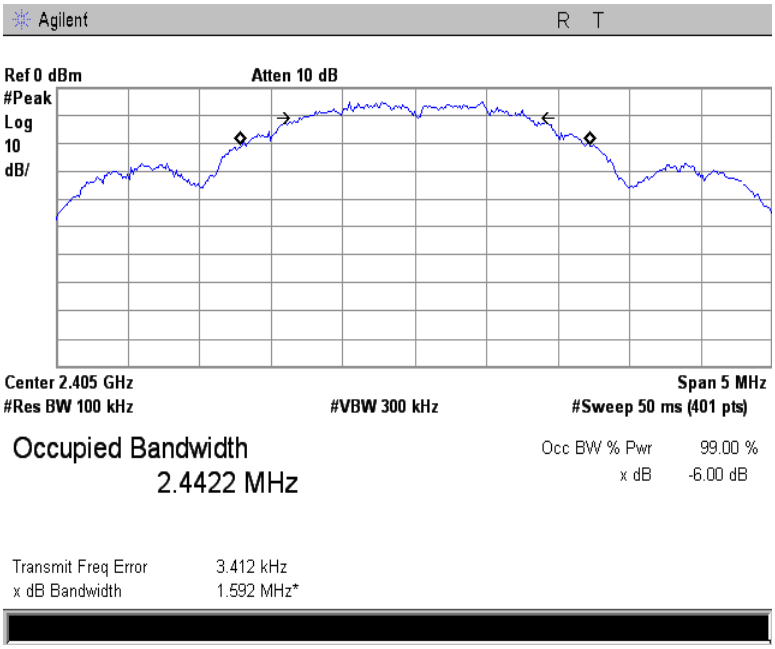
**Reference numbers of test equipment used**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| HL 521 | HL 1984 | HL 4353 | HL 4278 | | | | | |

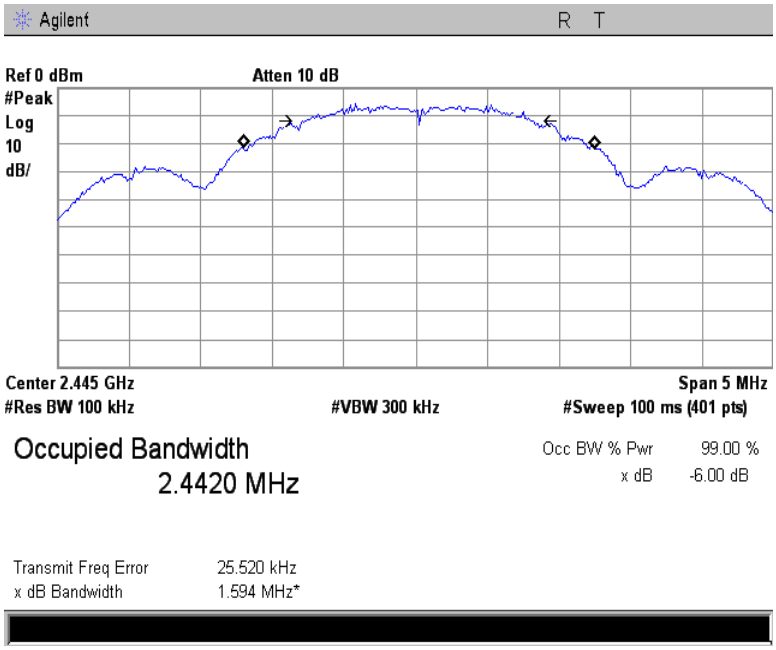
Full description is given in Appendix A.

| Test specification: | FCC section 15.247(a)(2), RSS-247 section 5.2(1), 6 dB bandwidth | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.8.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.1.1 The occupied bandwidth test result at low frequency ch.11**

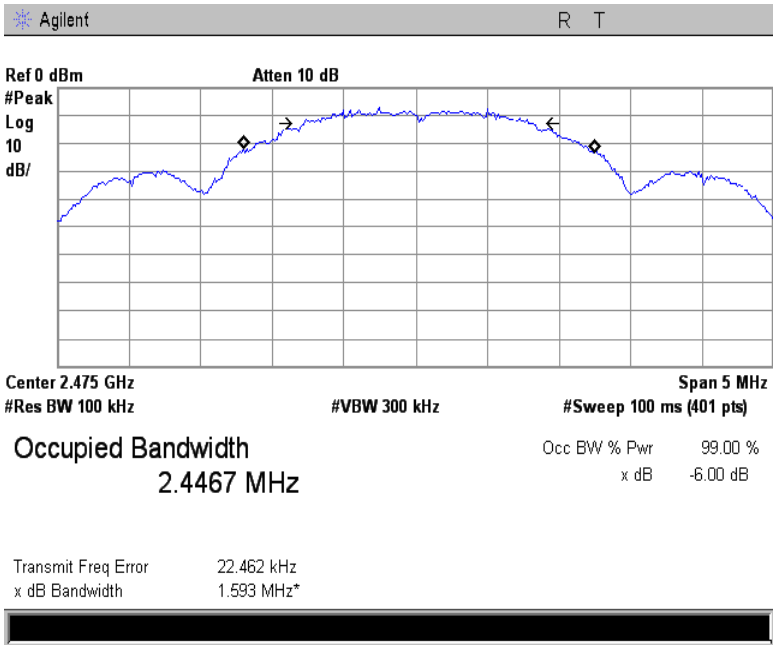



**Plot 7.1.2 The occupied bandwidth test result at mid frequency ch.19**

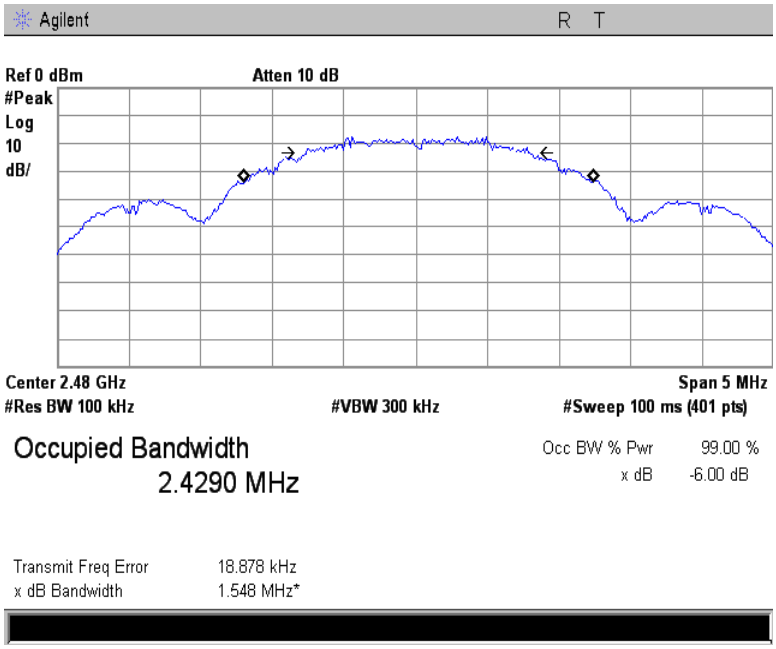


| Test specification: | FCC section 15.247(a)(2), RSS-247 section 5.2(1), 6 dB bandwidth | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.8.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.1.3 The occupied bandwidth test result at high frequency ch.25**




**Plot 7.1.4 The occupied bandwidth test result at high frequency ch.26**



| Test specification: | FCC section 15.247(b)(3), RSS-247 section 5.4(4), Peak output power (radiated) | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.9 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

## 7.2 Peak output power

### 7.2.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.2.1.

**Table 7.2.1 Peak output power limits**

| Assigned frequency range, MHz | Maximum antenna gain, dBi | Peak output power* | | Equivalent field strength limit @ 3m, dB(µV/m)** |
|---|---|---|---|---|
| | | W | dBm | |
| 902.0 – 928.0 | 6.0 | 1.0 | 30.0 | 131.2 |
| 2400.0 – 2483.5 | | | | |
| 5725.0 – 5850.0 | | | | |

*- 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.

**- Equivalent field strength limit was calculated from the peak output power as follows: E=sqrt(30×P×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.

### 7.2.2 Test procedure

**7.2.2.1** The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.

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

**7.2.2.3** The resolution bandwidth of spectrum analyzer was set wider than 6 dB bandwidth of the EUT and the field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated $360^0$ and the measuring antenna height was swept in both vertical and horizontal polarizations.

**7.2.2.4** The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.2.2 and associated plots.

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

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

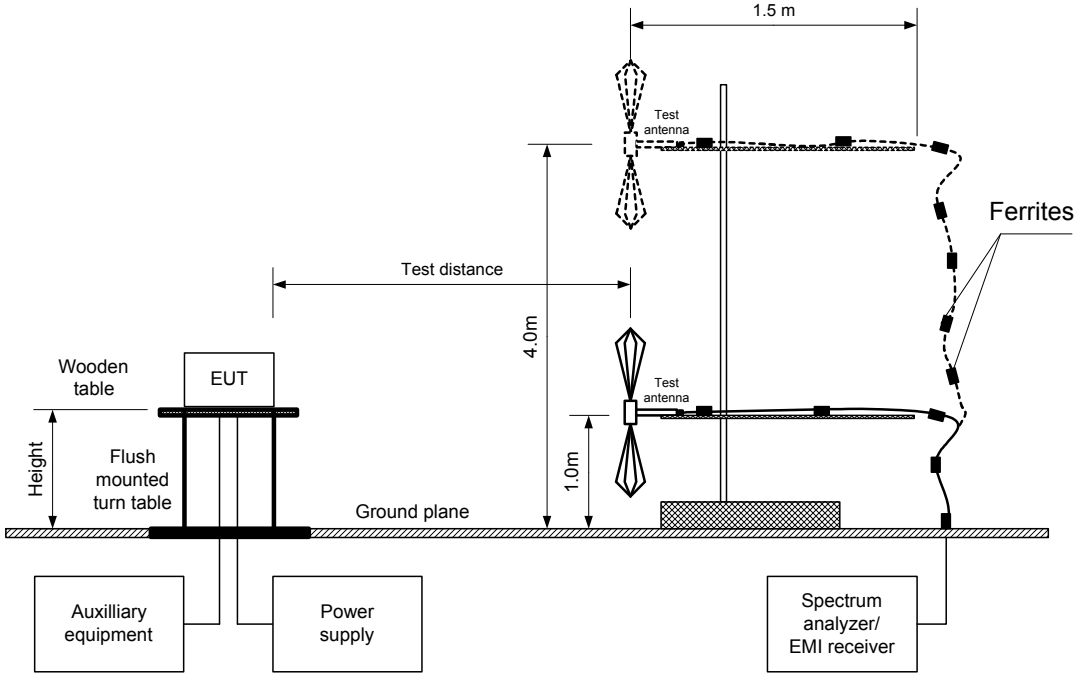
where P is the peak output power in W, E is the field strength in V/m, d is the test distance and G is the transmitter numeric antenna gain over an isotropic radiator.
The above equation was converted in logarithmic units for 3 m test distance:

Peak output power in dBm = Field strength in dB(µV/m) - Transmitter antenna gain in dBi – 95.2 dB

**7.2.2.6** The worst test results (the lowest margins) were recorded in Table 7.2.2.

| Test specification: | FCC section 15.247(b)(3), RSS-247 section 5.4(4), Peak output power (radiated) | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.9 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Figure 7.2.1 Setup for carrier field strength measurements**



| Test specification: | FCC section 15.247(b)(3), RSS-247 section 5.4(4), Peak output power (radiated) | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.9 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Table 7.2.2 Peak output power test results**

ASSIGNED FREQUENCY: 2400-2483.5 MHz
TEST DISTANCE: 3 m
TEST SITE: Semi anechoic chamber
EUT HEIGHT: 1.5 m
DETECTOR USED: Peak
TEST ANTENNA TYPE: Biconilog (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)
MODULATION: OQPSK
BIT RATE: 250 kbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
DETECTOR USED: Peak
EUT 6 dB BANDWIDTH: 1.65 MHz
RESOLUTION BANDWIDTH: 3 MHz
VIDEO BANDWIDTH: 3 MHz

| 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 |
|---|---|---|---|---|---|---|---|---|---|
| 2405 | 113.93 | Horizontal | 1.8 | 0 | 3 | 15.73 | 30 | -14.27 | Pass |
| 2445 | 113.48 | Horizontal | 1.3 | 0 | 3 | 15.28 | 30 | -14.72 | Pass |
| 2475 | 114.48 | Horizontal | 1.3 | 0 | 3 | 16.28 | 30 | -13.72 | Pass |
| 2480 | 105.36 | Horizontal | 1.8 | 0 | 3 | 7.16 | 30 | -22.84 | 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.

**Reference numbers of test equipment used**

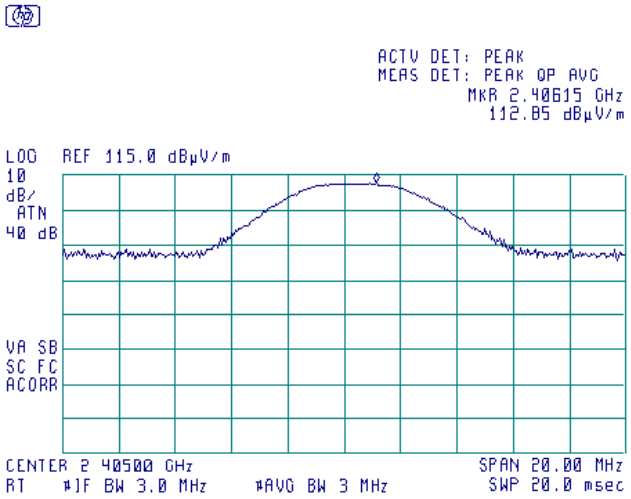
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL 0521 | HL 1984 | HL 4278 | HL 4353 | | | | |

Full description is given in Appendix A.

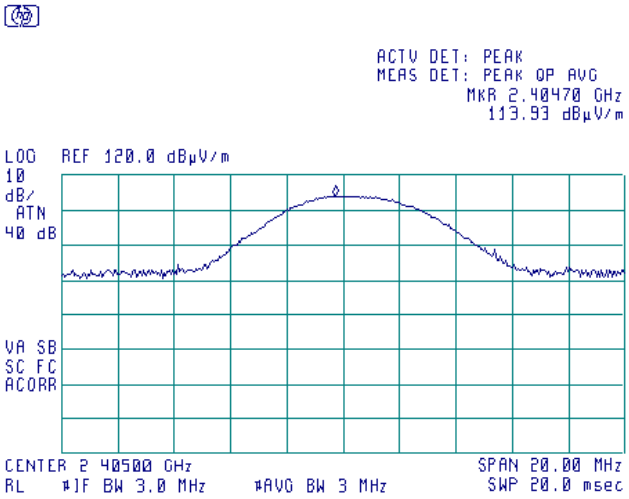
| Test specification: | FCC section 15.247(b)(3), RSS-247 section 5.4(4), Peak output power (radiated) | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.9 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.2.1 Field strength of carrier at low frequency ch.11**

ANTENNA POLARIZATION: Vertical

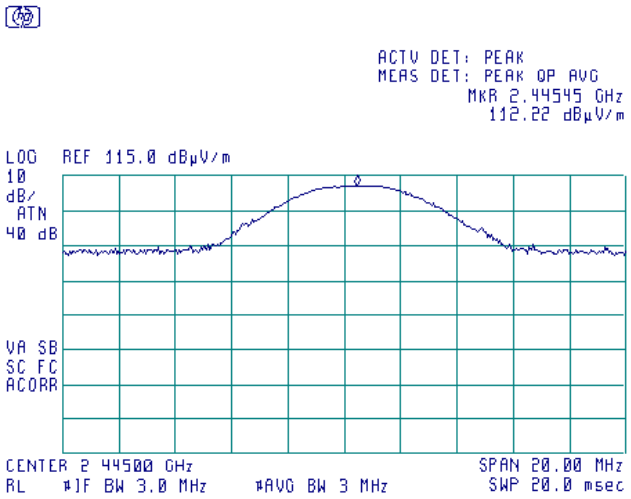



ANTENNA POLARIZATION: Horizontal

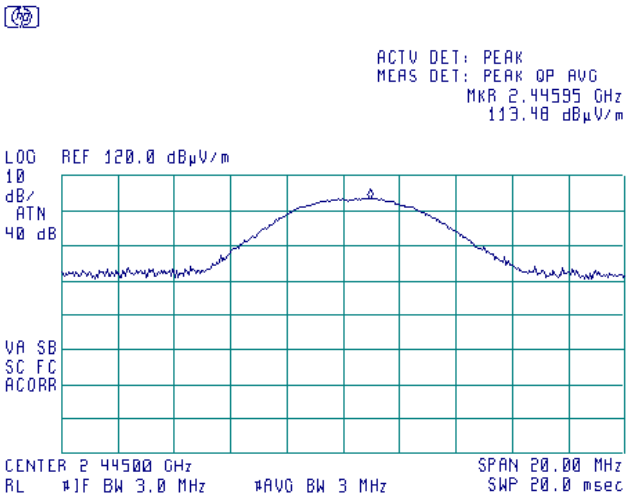



**Plot 7.2.2 Field strength of carrier at mid frequency ch.19**

ANTENNA POLARIZATION: Vertical



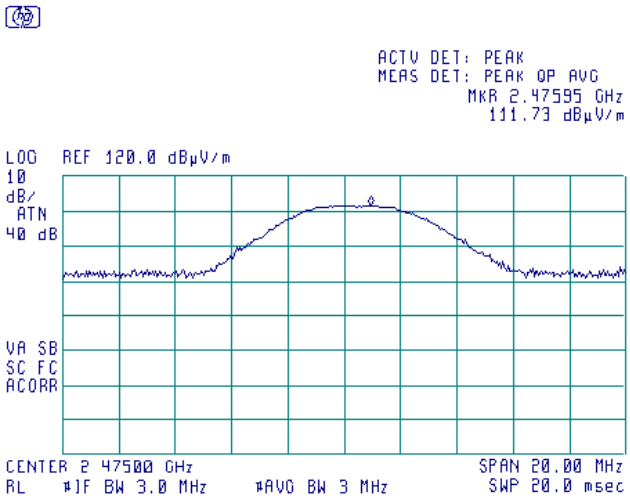

ANTENNA POLARIZATION: Horizontal



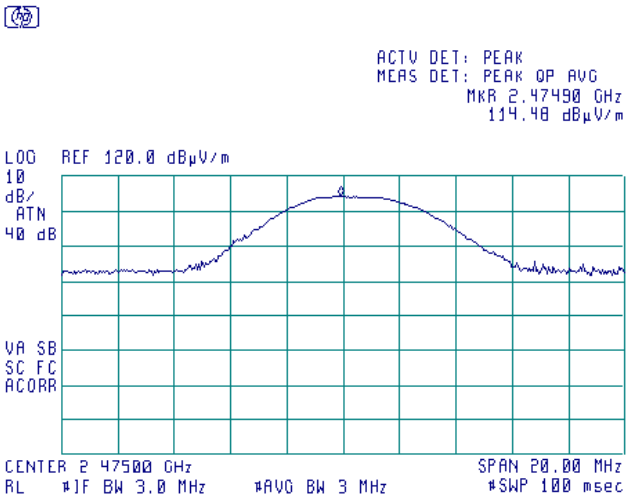
| Test specification: | FCC section 15.247(b)(3), RSS-247 section 5.4(4), Peak output power (radiated) | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.9 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.2.3 Field strength of carrier at high frequency ch.25**

ANTENNA POLARIZATION: Vertical

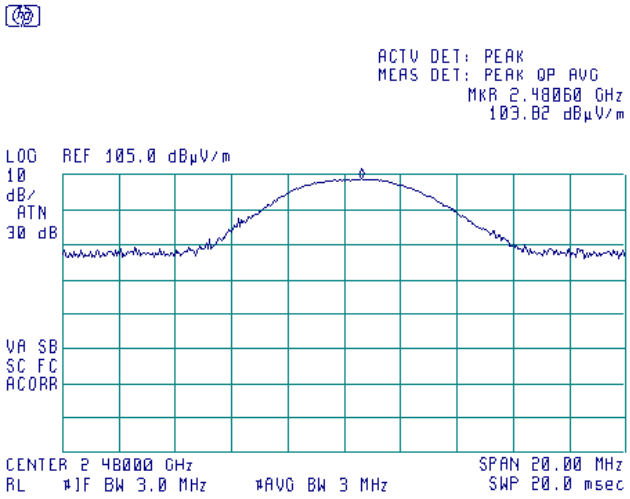



ANTENNA POLARIZATION: Horizontal

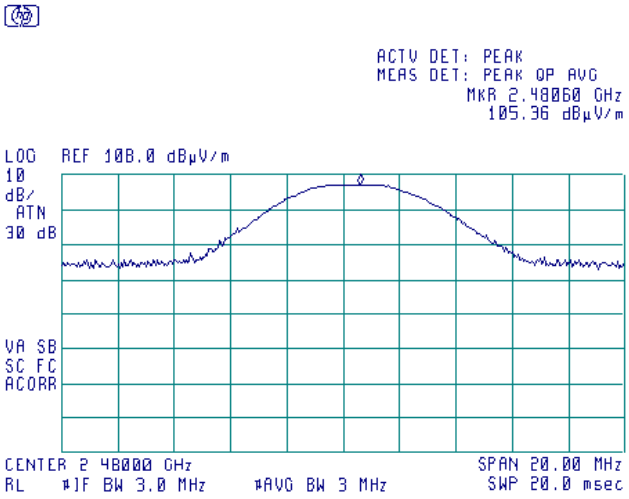



**Plot 7.2.4 Field strength of carrier at high frequency ch.26**

ANTENNA POLARIZATION: Vertical




ANTENNA POLARIZATION: Horizontal



| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

## 7.3 Field strength of spurious emissions

### 7.3.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.3.1.

**Table 7.3.1 Radiated spurious emissions limits**

| Frequency, MHz | Field strength at 3 m within restricted bands, dB(μV/m)* | | | Attenuation of field strength of spurious versus carrier outside restricted bands, dBc*** |
|---|---|---|---|---|
| | Peak | Quasi Peak | Average | |
| 0.009 – 0.090 | 148.5 – 128.5 | NA | 128.5 – 108.5** | 20.0 |
| 0.090 – 0.110 | NA | 108.5 – 106.8** | NA | |
| 0.110 – 0.490 | 126.8 – 113.8 | NA | 106.8 – 93.8** | |
| 0.490 – 1.705 | NA | 73.8 – 63.0** | NA | |
| 1.705 – 30.0* | | 69.5 | | |
| 30 – 88 | | 40.0 | | |
| 88 – 216 | | 43.5 | | |
| 216 – 960 | | 46.0 | | |
| 960 - 1000 | | 54.0 | | |
| 1000 – 10$^{th}$harmonic | 74.0 | NA | 54.0 | |

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

$$Lim_{S2} = Lim_{S1} + 40 \log (S_1/S_2),$$

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

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

*** - The field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency.

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

**7.3.2.1** The EUT was set up as shown in Figure 7.3.1, energized and the performance check was conducted.

**7.3.2.2** The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated $360^0$ and the measuring antenna was rotated around its vertical axis.

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

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

**7.3.3.1** The EUT was set up as shown in Figure 7.3.2, energized and the performance check was conducted.

**7.3.3.2** The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated $360^0$, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

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

| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Figure 7.3.1 Setup for spurious emission field strength measurements below 30 MHz**

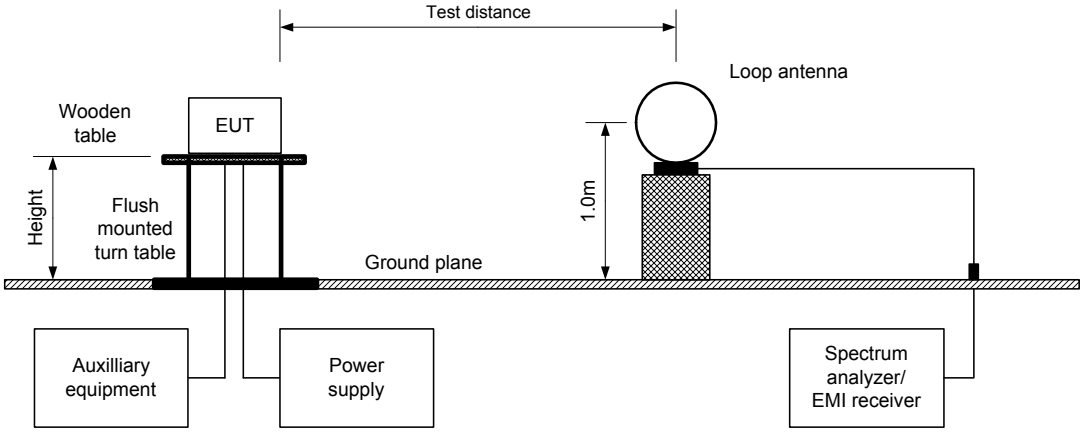
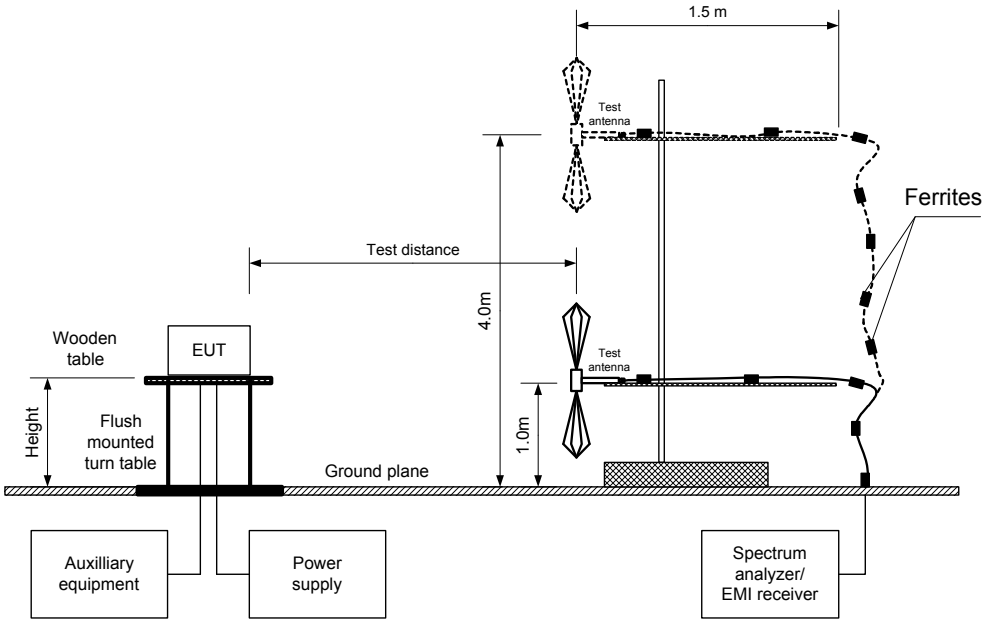



**Figure 7.3.2 Setup for spurious emission field strength measurements above 30 MHz**



| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Table 7.3.2 Field strength of emissions outside restricted bands**

INVESTIGATED FREQUENCY RANGE: 0.009 -25000 MHz
TEST DISTANCE: 3 m
MODULATION: OQPSK
BIT RATE: 250 kbps
DUTY CYCLE: 100 %
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
DETECTOR USED: Peak
RESOLUTION BANDWIDTH: 100 kHz
VIDEO BANDWIDTH: 300 kHz

| 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, channel 11** | | | | | | | | | |
| 9620 | 54.86 | Horizontal | 1.3 | 20 | 109.95 | 55.09 | 20.0 | 35.09 | Pass |
| 19240 | 47.57 | Horizontal | 1.4 | 70 | | 62.38 | | 42.38 | |
| **Mid carrier frequency, channel 19** | | | | | | | | | |
| 9780 | 57.65 | Horizontal | 1.3 | 20 | 109.59 | 51.94 | 20.0 | 31.94 | Pass |
| 19560 | 51.61 | Horizontal | 1.4 | 70 | | 57.98 | | 37.98 | |
| **High carrier frequency, channel 25** | | | | | | | | | |
| 9900 | 55.91 | Horizontal | 1.3 | 30 | 110.56 | 54.65 | 20.0 | 34.65 | Pass |
| 19800 | 48.54 | Horizontal | 1.4 | 70 | | 62.02 | | 42.02 | |
| **High carrier frequency, channel 26** | | | | | | | | | |
| No emissions were found | | | | | | | | | Pass |

*****- EUT front panel refers to 0 degrees position of turntable.
******- Margin = Attenuation below carrier – specification limit.

| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Table 7.3.3 Field strength of spurious emissions above 1 GHz within restricted bands**

INVESTIGATED FREQUENCY RANGE: 1000 – 25000 MHz
TEST DISTANCE: 3 m
MODULATION: OQPSK
BIT RATE: 250 kbps
DUTY CYCLE: 100 %
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
DETECTOR USED: Peak
RESOLUTION BANDWIDTH: 1000 kHz

| 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, channel 11** | | | | | | | | | | | |
| 4810 | Horizontal | 1.2 | 0 | 47.12 | 74 | -26.88 | 36.39 | 23.82 | 54 | -30.18 | Pass |
| 12025 | Horizontal | 1.4 | 80 | 66.83 | 74 | -7.17 | 57.74 | 45.17 | 54 | -8.83 | |
| **Mid carrier frequency, channel 19** | | | | | | | | | | | |
| 4890 | Horizontal | 1.2 | 0 | 48.21 | 74 | -25.79 | 38.17 | 25.60 | 54 | -28.40 | Pass |
| 12225 | Horizontal | 1.4 | 80 | 67.77 | 74 | -6.23 | 58.02 | 45.45 | 54 | -8.55 | |
| **High carrier frequency, channel 25** | | | | | | | | | | | |
| 4950 | Horizontal | 1.2 | 0 | 49.17 | 74 | -24.83 | 39.98 | 27.41 | 54 | -26.59 | Pass |
| 12380 | Horizontal | 14 | 80 | 66.58 | 74 | -7.42 | 57.50 | 44.93 | 54 | -9.07 | |
| **High carrier frequency, channel 26** | | | | | | | | | | | |
| No emissions were found | | | | | | | | | | | Pass |

*****- 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 7.3.4 Average factor calculation**

| Transmission pulse | | Transmission burst | | Transmission train duration, ms | Average factor, dB |
|---|---|---|---|---|---|
| Duration, ms | Number of pulses during 100 msec | Duration, ms | Period, ms | | |
| 1.96 | 12 | NA | NA | NA | -12.57 |

*- Average factor was calculated as follows
Average factor =20 log (1.96 x 12/100) = -12.57

| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Table 7.3.5 Field strength of spurious emissions below 1 GHz within restricted bands**

| | |
|---|---|
| ASSIGNED FREQUENCY: | 2400-2483.5 MHz |
| INVESTIGATED FREQUENCY RANGE: | 0.009 – 1000 MHz |
| TEST DISTANCE: | 3 m |
| MODULATION: | OQPSK |
| MODULATING SIGNAL: | PRBS |
| BIT RATE: | 250 kbps |
| DUTY CYCLE: | 100 % |
| TRANSMITTER OUTPUT POWER SETTINGS: | Maximum |
| RESOLUTION BANDWIDTH: | 0.2 kHz (9 kHz – 150 kHz)<br>9.0 kHz (150 kHz – 30 MHz)<br>120 kHz (30 MHz – 1000 MHz) |
| VIDEO BANDWIDTH: | > Resolution bandwidth |
| TEST ANTENNA TYPE: | Active loop (9 kHz – 30 MHz)<br>Biconilog (30 MHz – 1000 MHz) |

| Frequency, MHz | Peak emission, dB(μV/m) | Quasi-peak | | | Antenna polariz. | Antenna height, m | Turn-table position**, degrees | Verdict |
|---|---|---|---|---|---|---|---|---|
| | | 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 0446 | HL 0604 | HL 1984 | HL 2780 | HL 3347 | HL 3818 | HL 3901 | HL 4278 |
| HL 4338 | HL 4353 | HL 4932 | HL 4933 | HL 4956 | | | |

Full description is given in Appendix A.

| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Table 7.3.6 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 | |

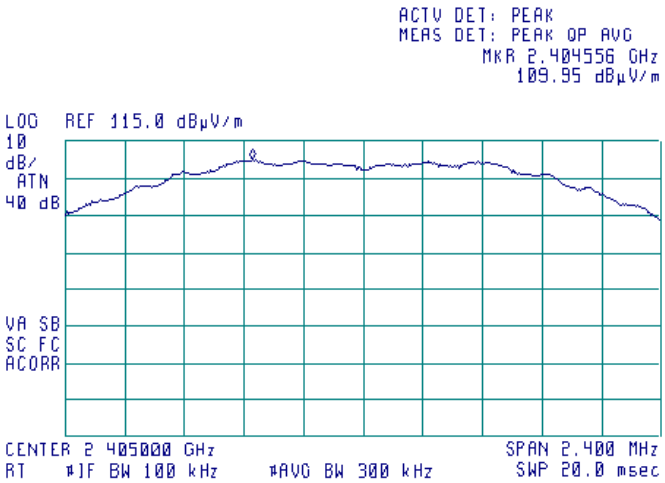
**Table 7.3.7 Restricted bands according to RSS-Gen**

| 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: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

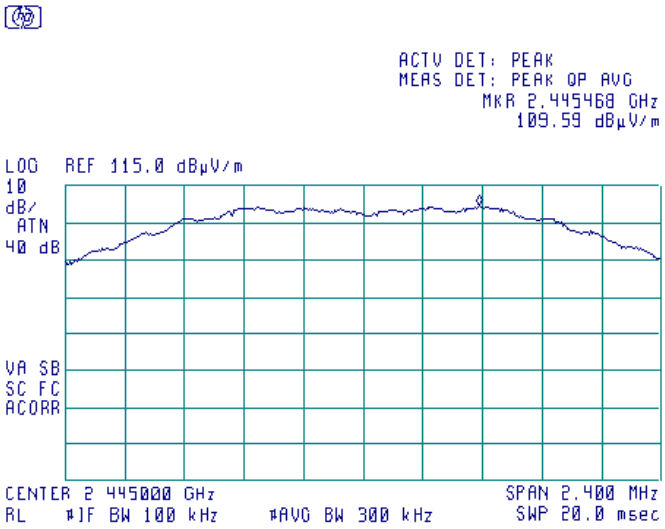
**Plot 7.3.1 Radiated emission measurements at the low carrier frequency ch.11**

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




**Plot 7.3.2 Radiated emission measurements at the mid carrier frequency ch.19**

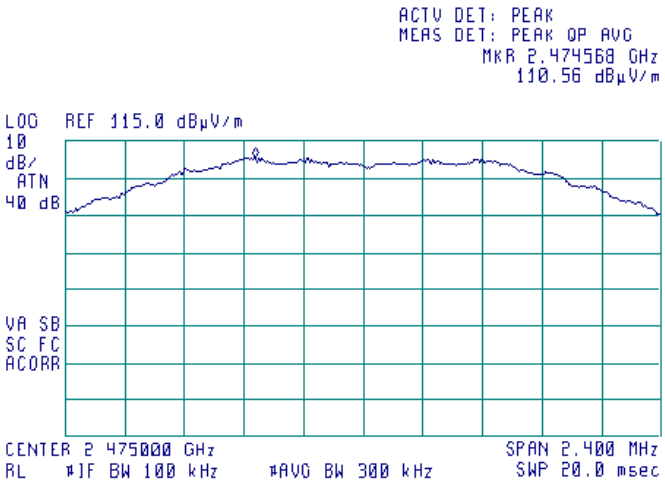
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal



| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

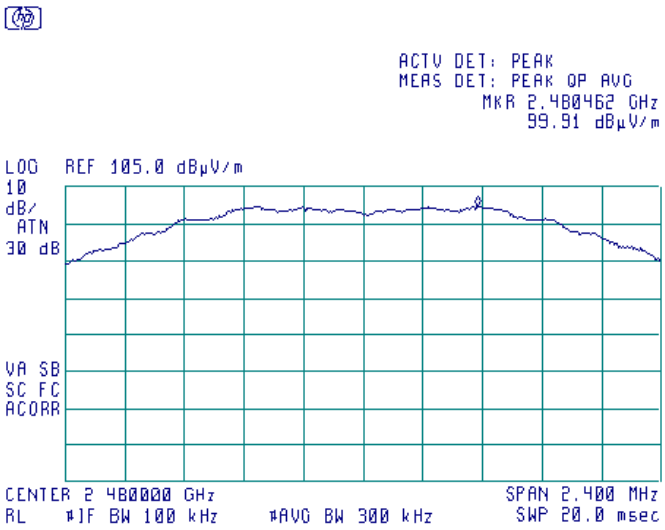
**Plot 7.3.3 Radiated emission measurements at the high carrier frequency ch.25**

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




**Plot 7.3.4 Radiated emission measurements at the high carrier frequency ch.26**

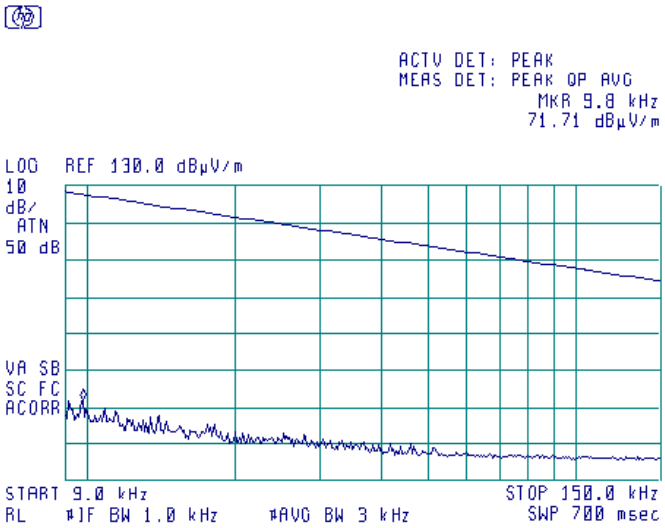
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal



| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

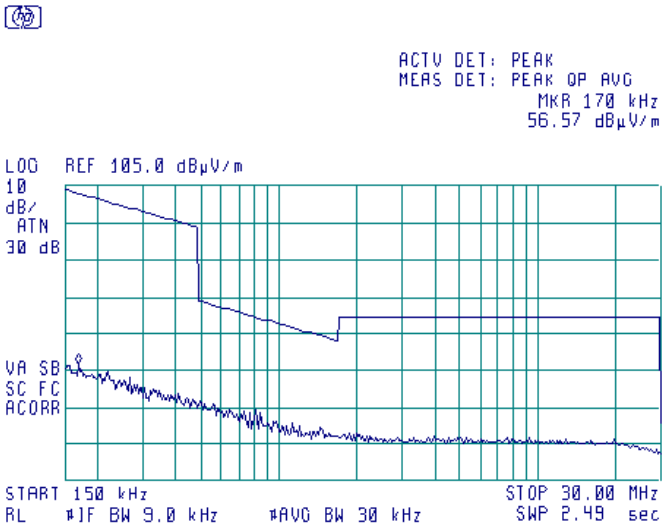
**Plot 7.3.5 Radiated emission measurements from 9 to 150 kHz at the low, mod, high carrier frequency**

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




**Plot 7.3.6 Radiated emission measurements from 0.15 to 30 MHz at the low, mid, high carrier frequency**

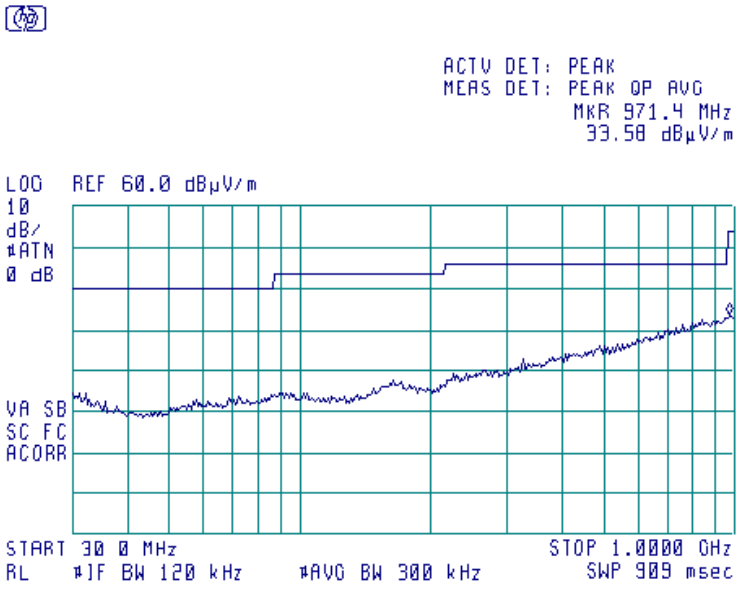
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.3.7 Radiated emission measurements from 30 to 1000 MHz at the low, mid, high carrier frequency**

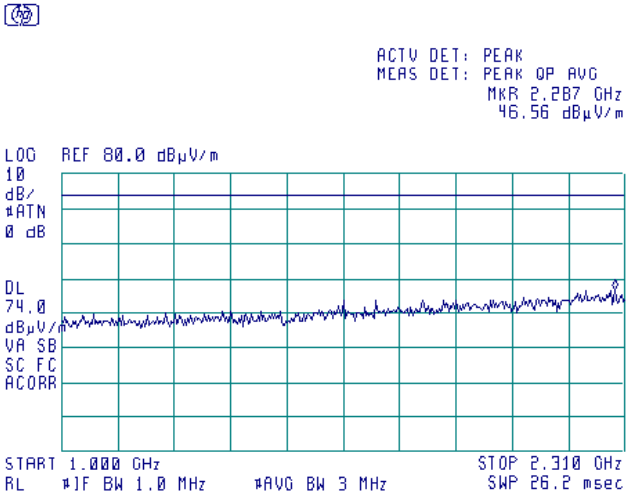
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

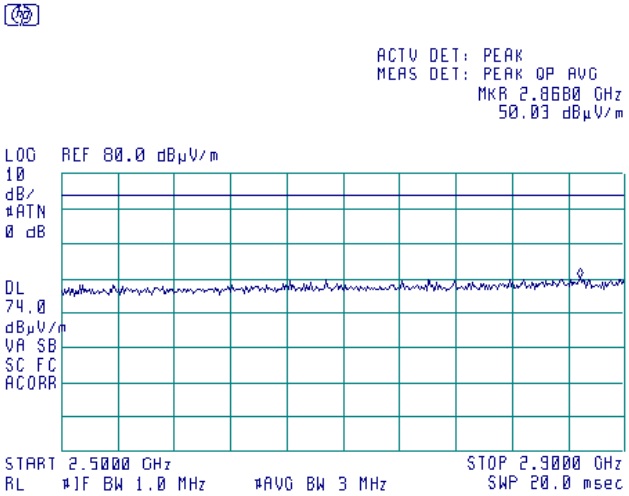


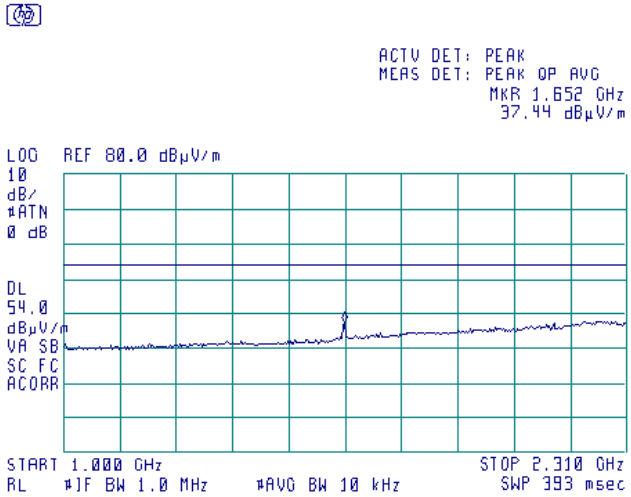
| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

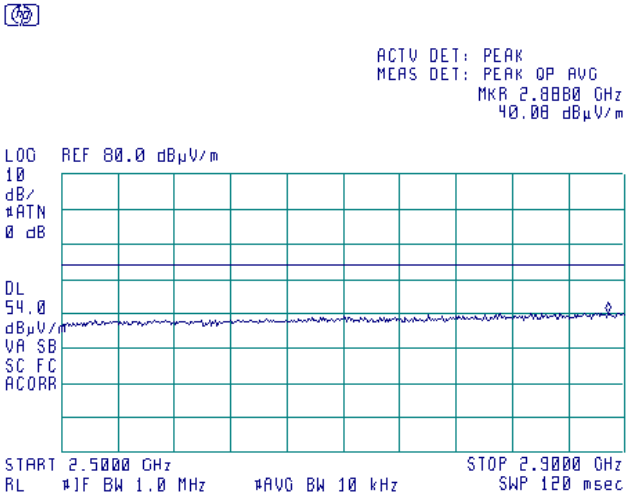
**Plot 7.3.8 Radiated emission measurements from 1000 to 2900 MHz at the low carrier frequency ch.11**

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



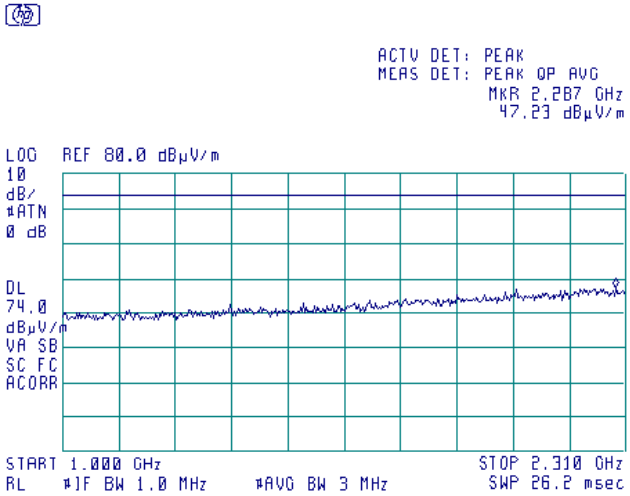



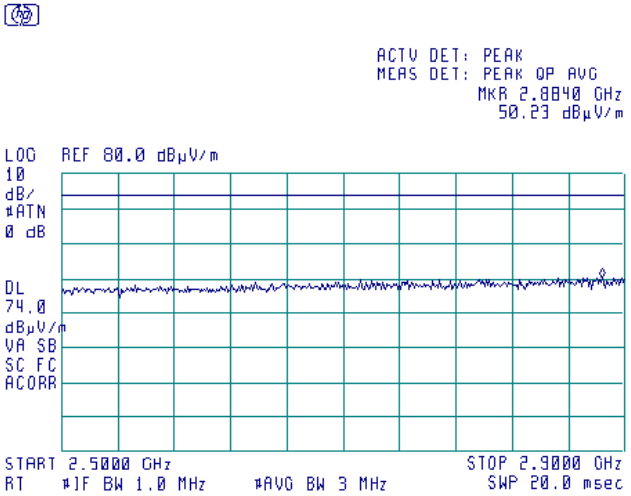



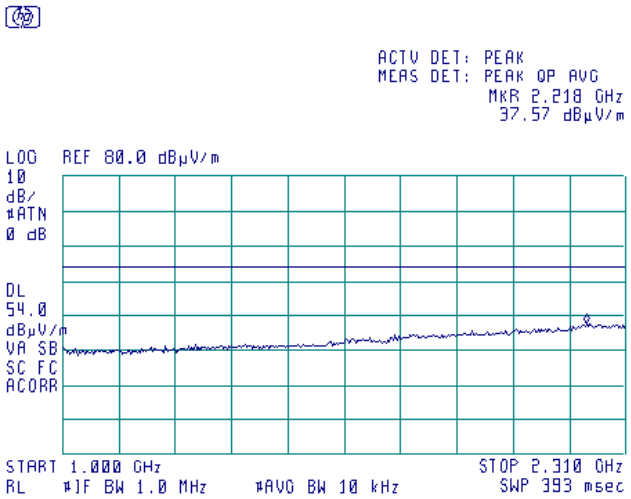
| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

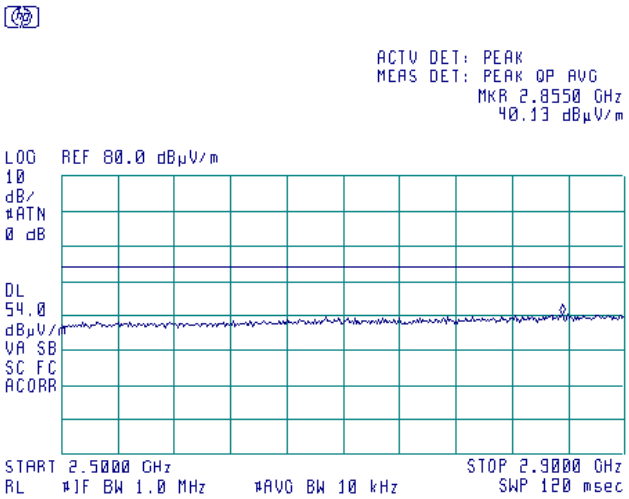
**Plot 7.3.9 Radiated emission measurements from 1000 to 2900 MHz at the mid carrier frequency ch.19**

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



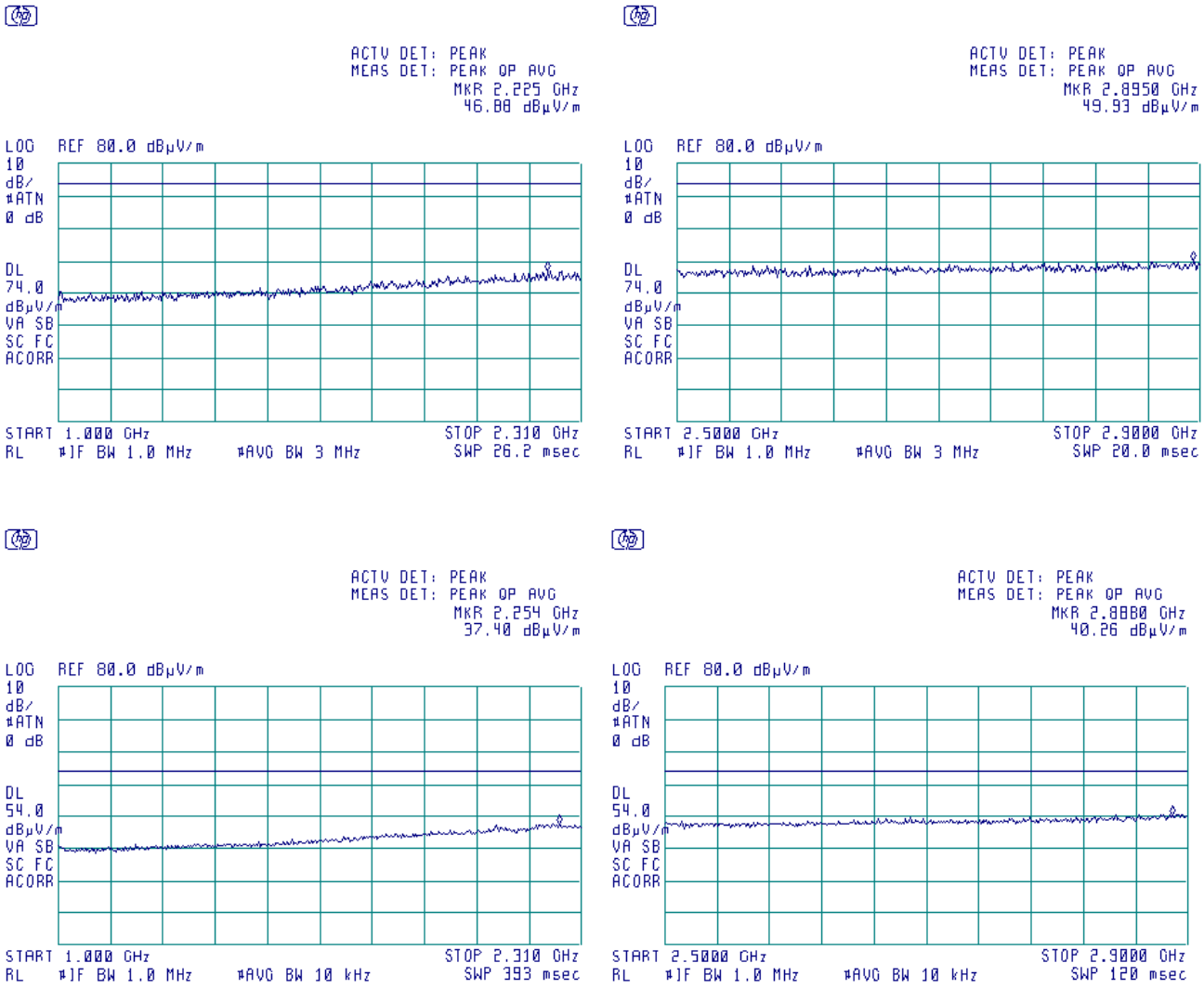



| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.3.10 Radiated emission measurements from 1000 to 2900 MHz at the high carrier frequency ch.25**

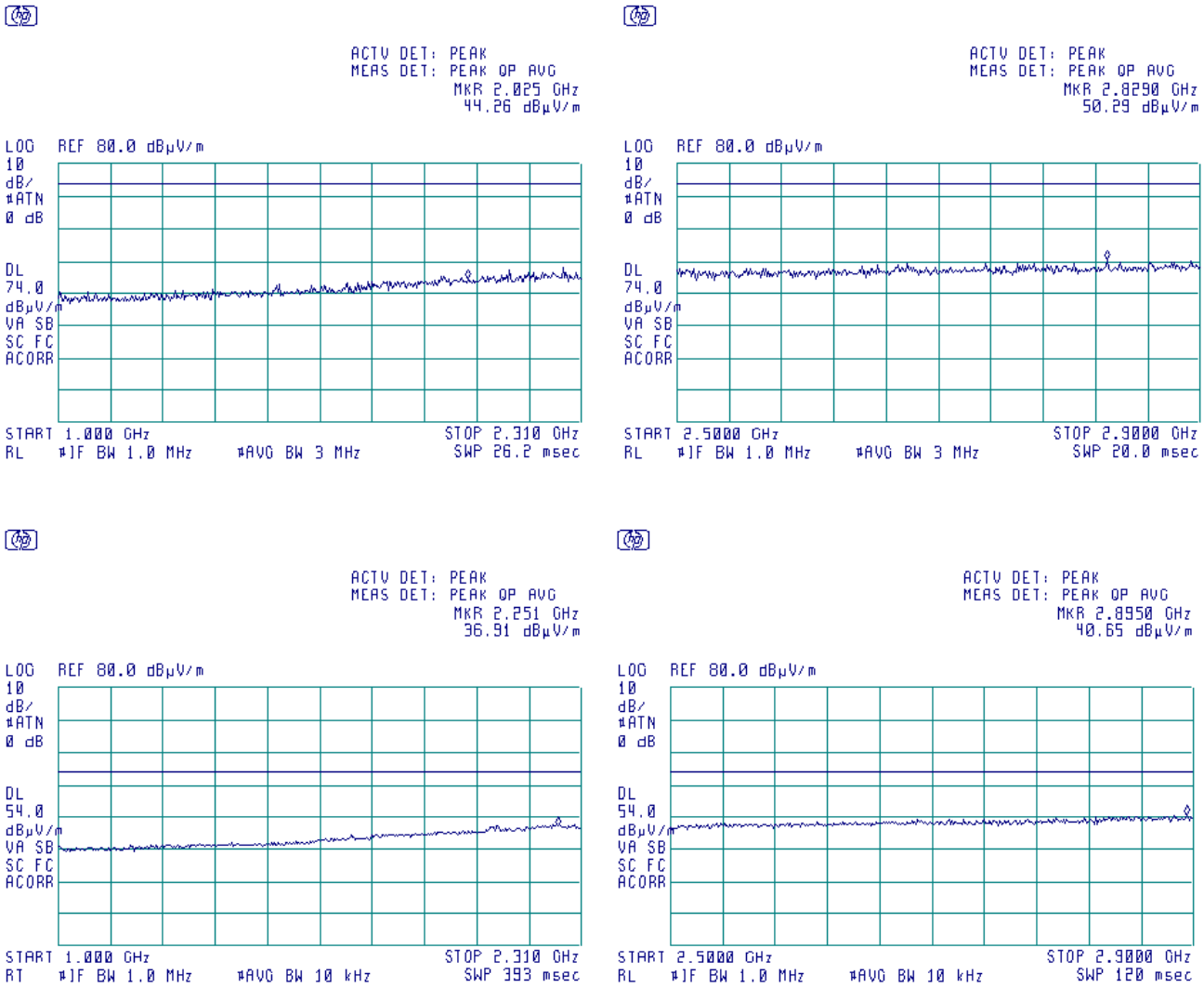
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.3.11 Radiated emission measurements from 1000 to 2900 MHz at the high carrier frequency ch.26**

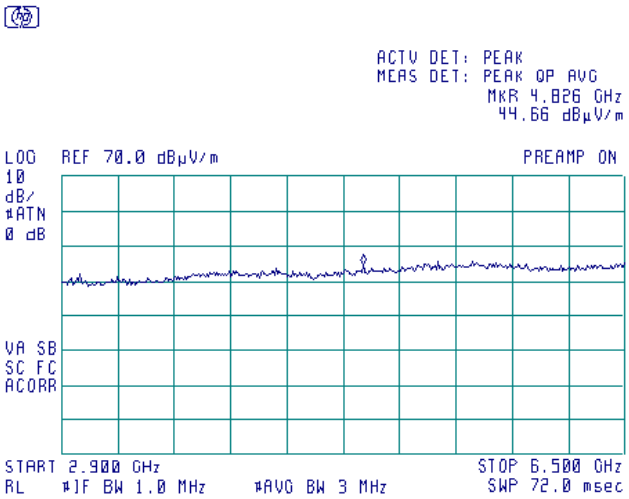
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

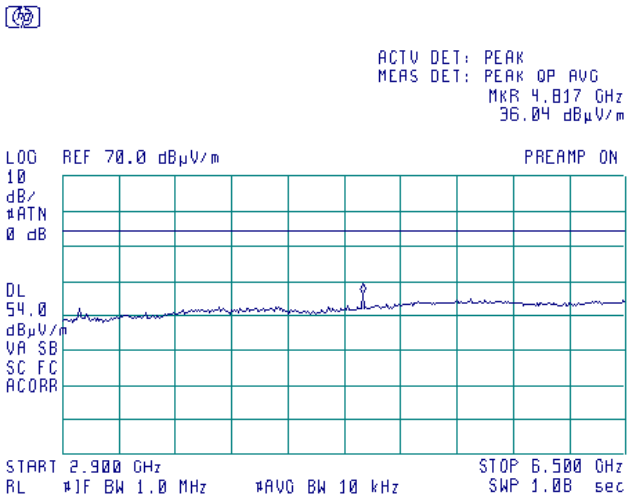


| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.3.12 Radiated emission measurements from 2900 to 6500 MHz at the low carrier frequency ch.11**

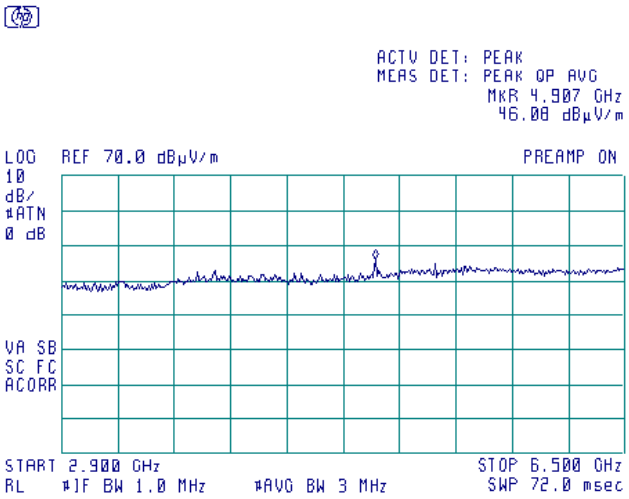
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

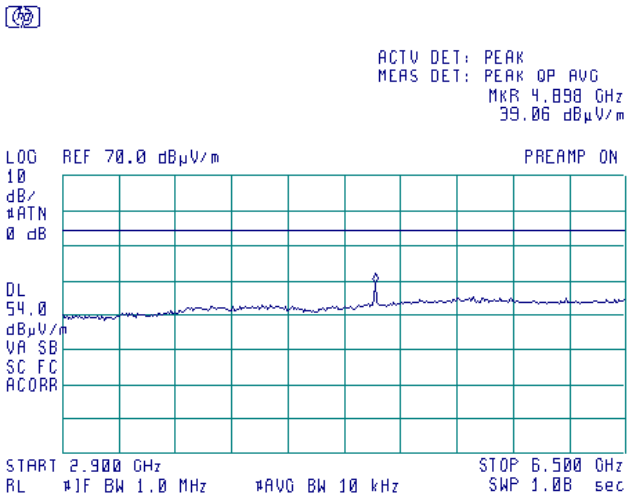



**Plot 7.3.13 Radiated emission measurements from 2900 to 6500 MHz at the mid carrier frequency ch.19**

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

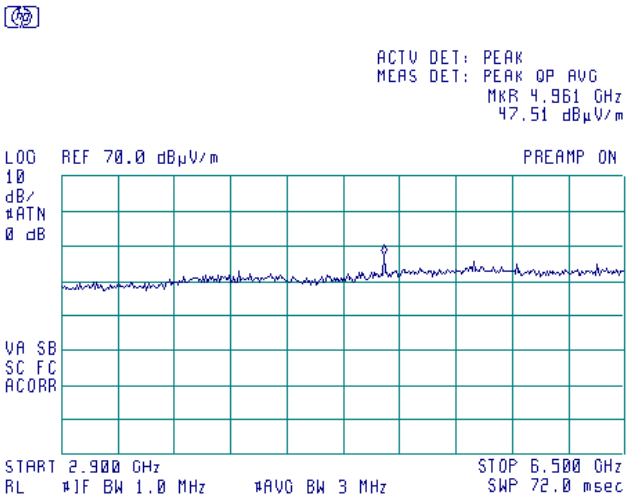


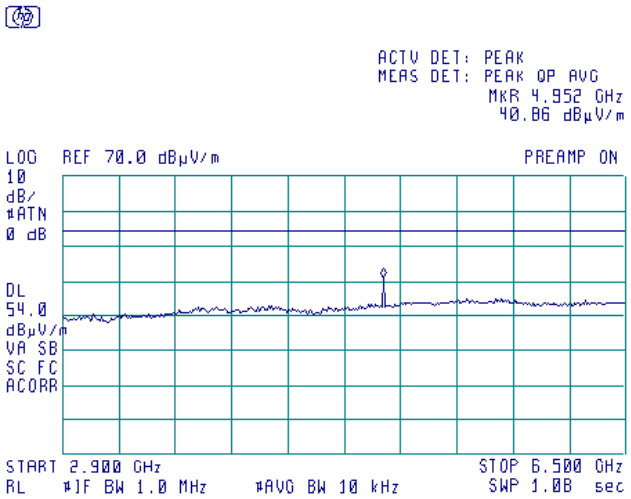



| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.3.14 Radiated emission measurements from 2900 to 6500 MHz at the high carrier frequency ch.25**

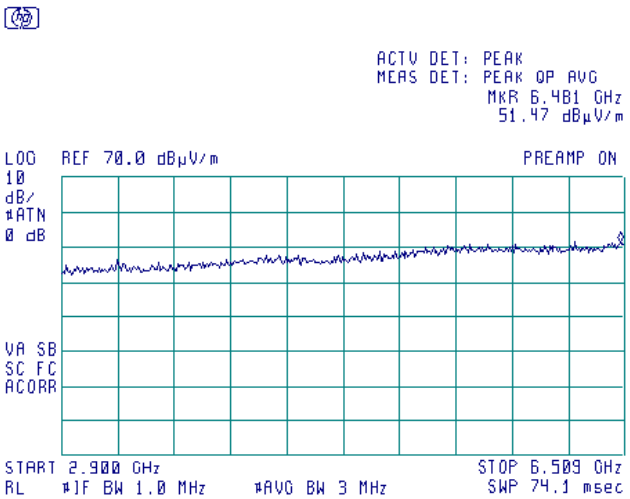
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

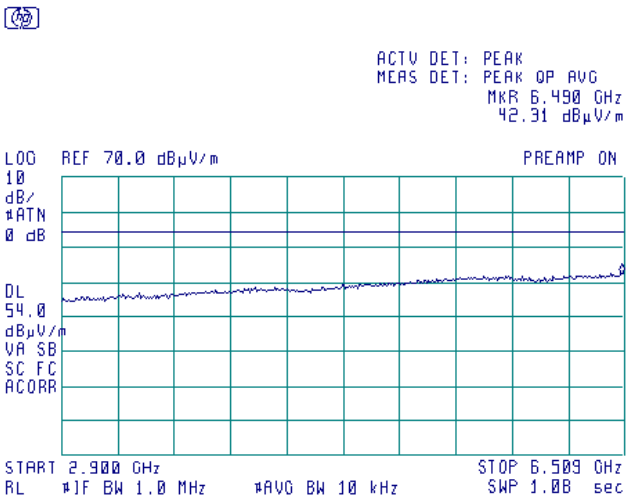



**Plot 7.3.15 Radiated emission measurements from 2900 to 6500 MHz at the high carrier frequency ch.26**

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

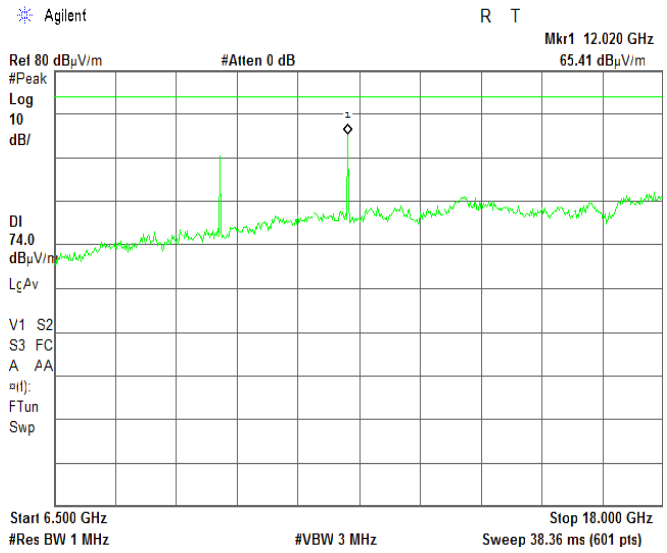


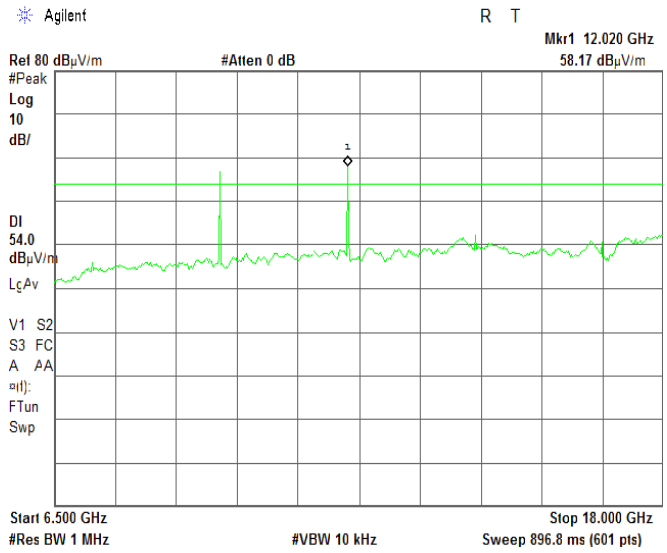



| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.3.16 Radiated emission measurements from 6500 to 18000 MHz at the low carrier frequency ch.11**

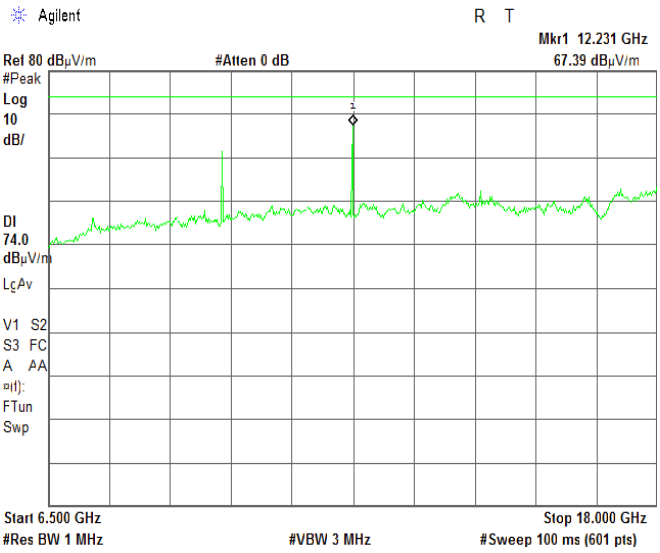
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

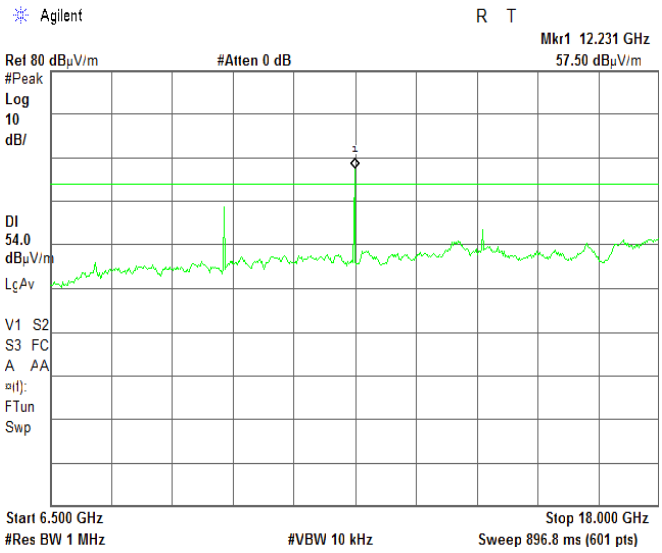



**Plot 7.3.17 Radiated emission measurements from 6500 to 18000 MHz at the mid carrier frequency ch.19**

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

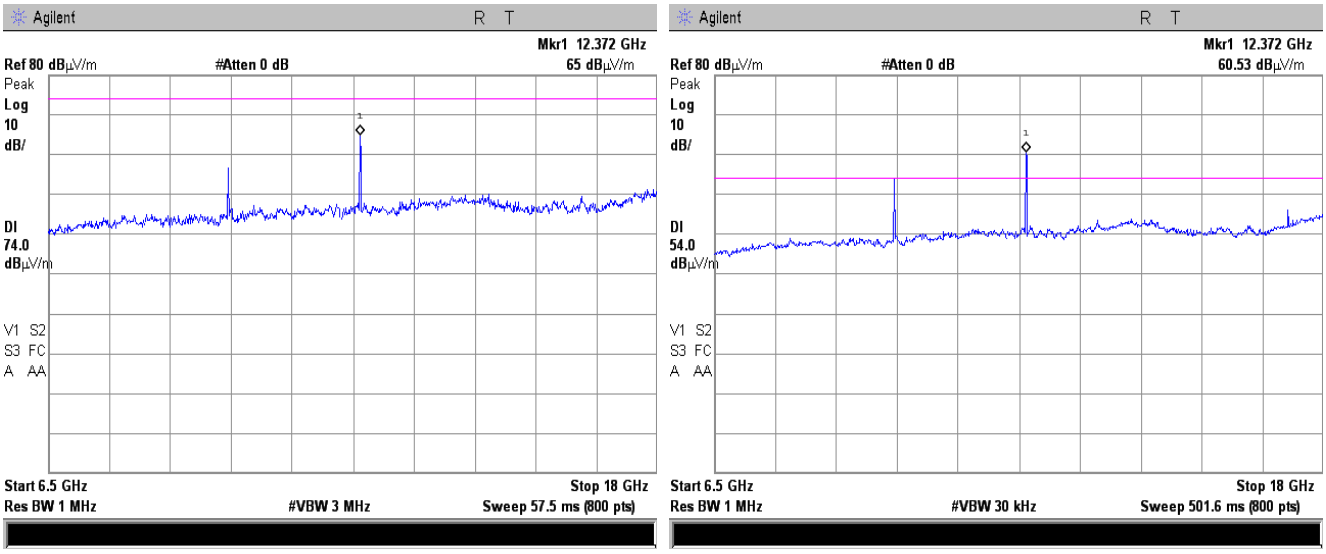


| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

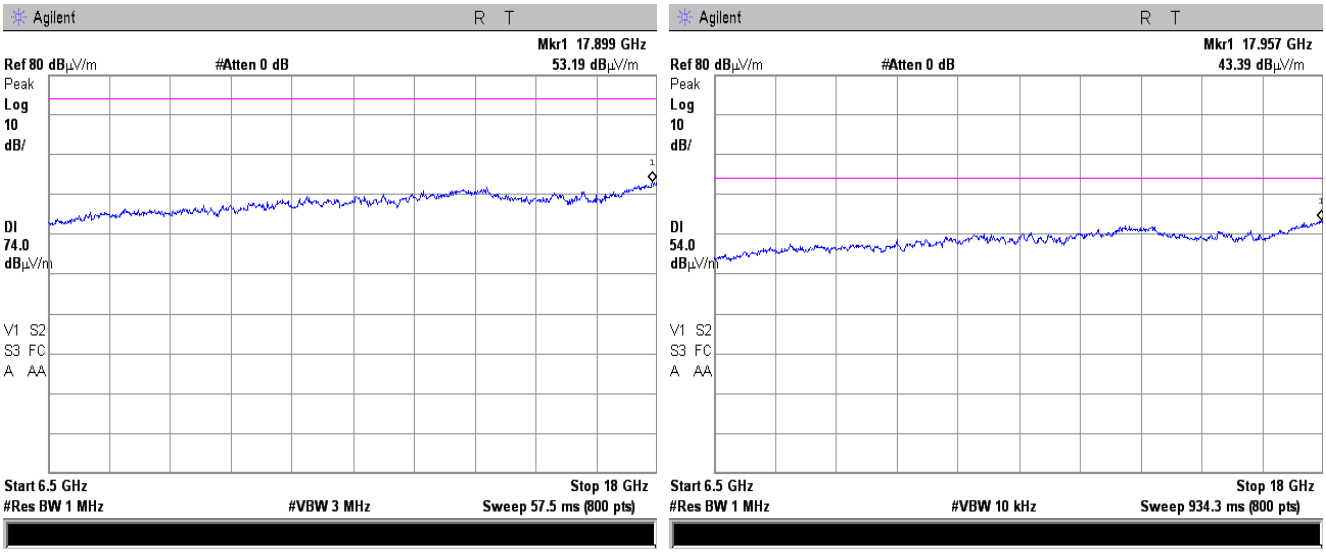
**Plot 7.3.18 Radiated emission measurements from 6500 to 18000 MHz at the high carrier frequency ch.25**

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




**Plot 7.3.19 Radiated emission measurements from 6500 to 18000 MHz at the high carrier frequency ch.26**

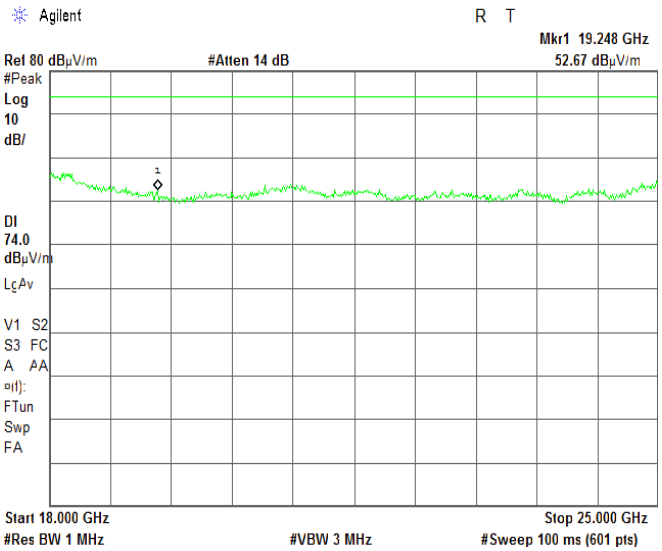
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

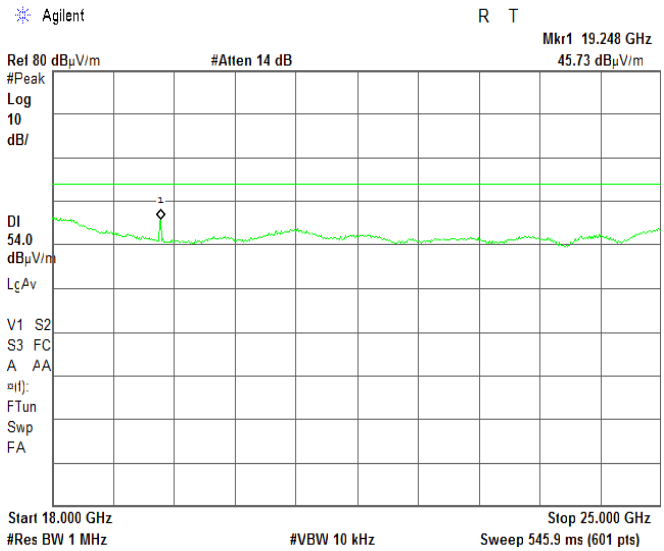


| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.3.20 Radiated emission measurements from 18000 to 25000 MHz at the low carrier frequency ch.11**

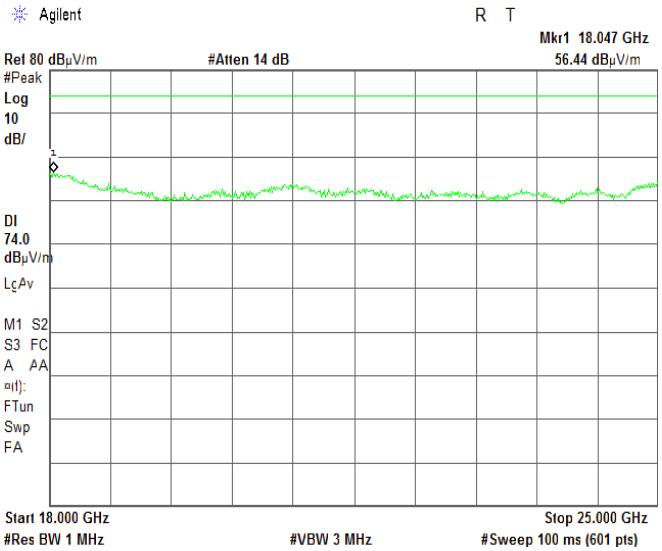
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

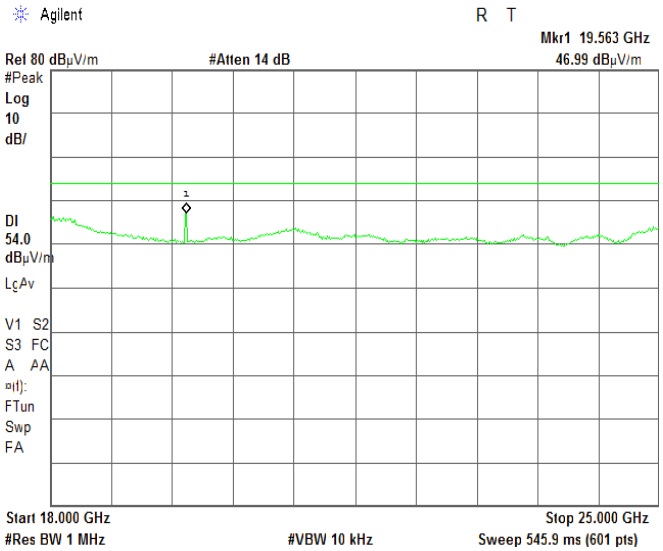



**Plot 7.3.21 Radiated emission measurements from 18000 to 25000 MHz at the mid carrier frequency ch.19**

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

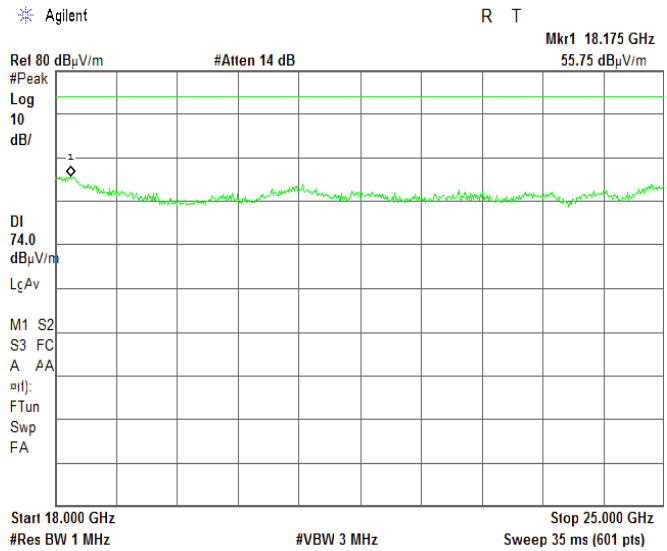


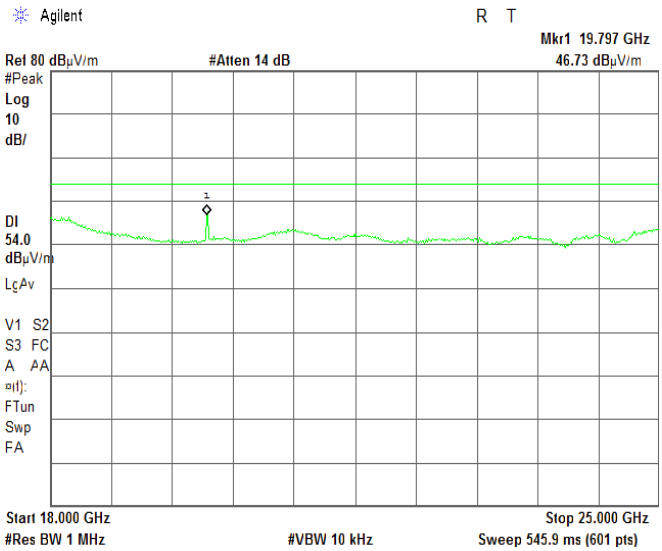



| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.3.22 Radiated emission measurements from 18000 to 25000 MHz at the high carrier frequency ch.25**

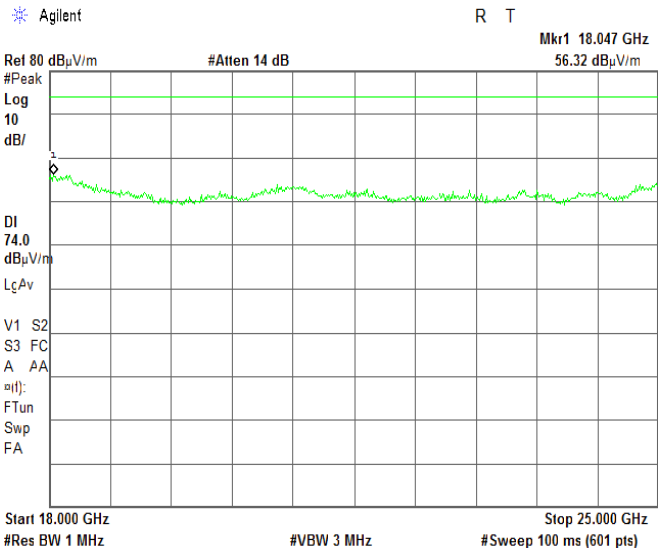
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

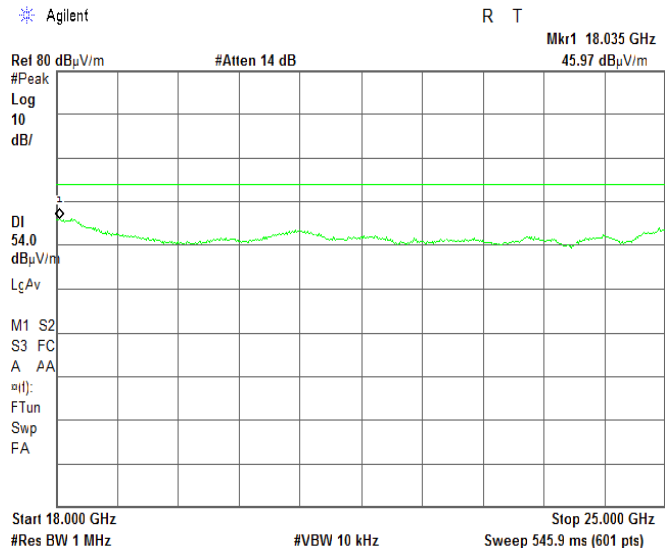



**Plot 7.3.23 Radiated emission measurements from 18000 to 25000 MHz at the high carrier frequency ch.26**

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

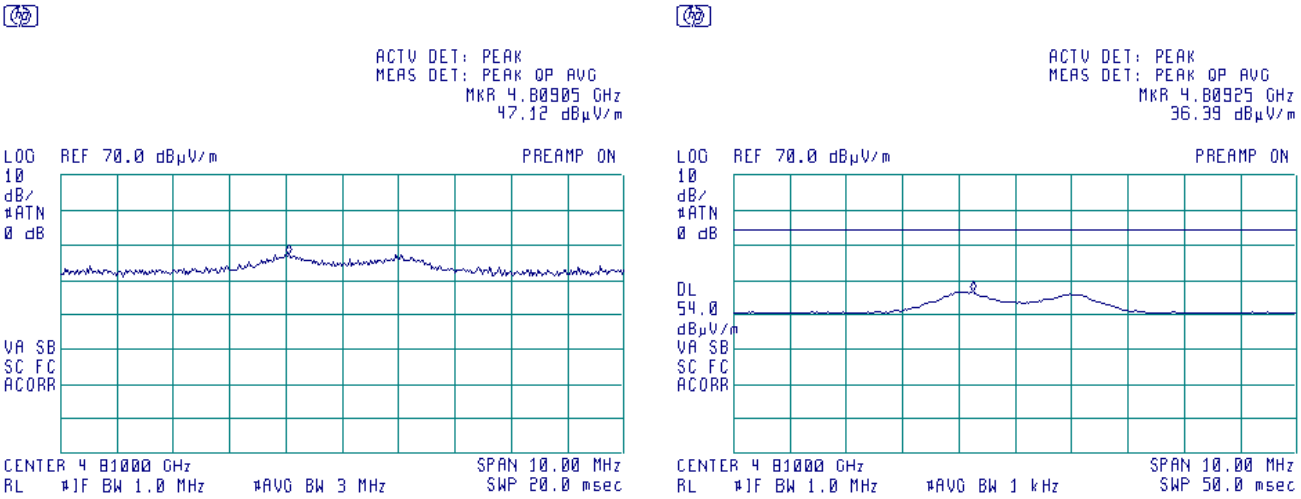


| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

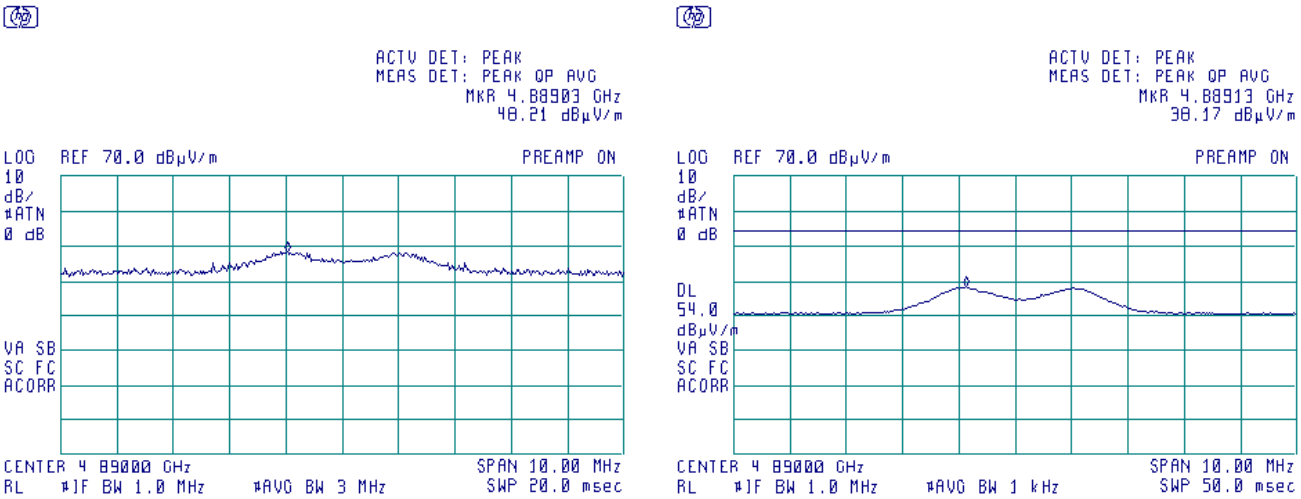
**Plot 7.3.24 Radiated emission measurements at the second harmonic of low carrier frequency ch.11**

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m




**Plot 7.3.25 Radiated emission measurements at the second harmonic of mid carrier frequency ch.19**

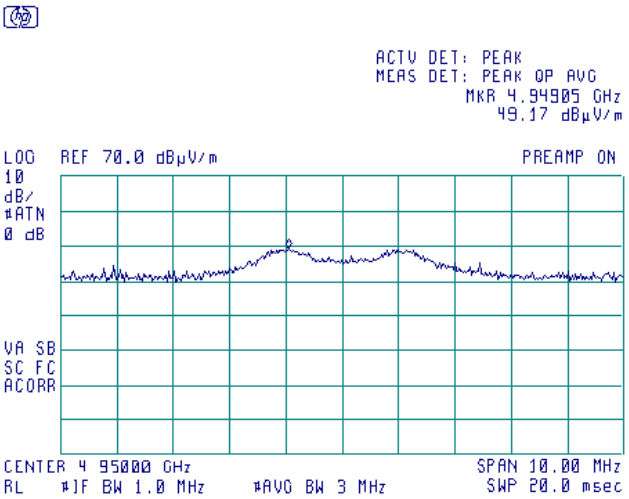
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m

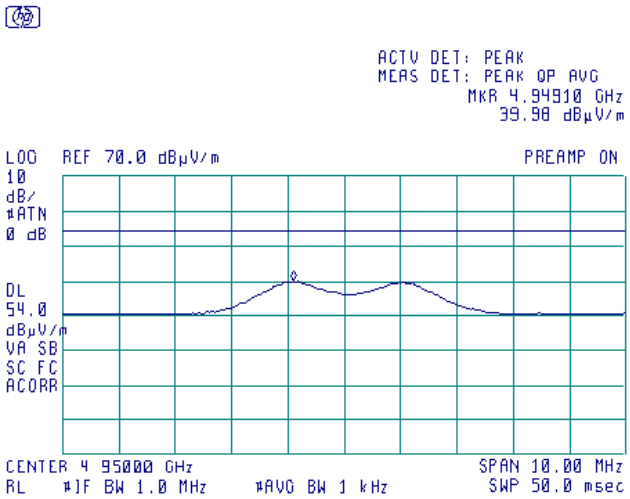


| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.3.26 Radiated emission measurements at the second harmonic of high carrier frequency ch 25**

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m

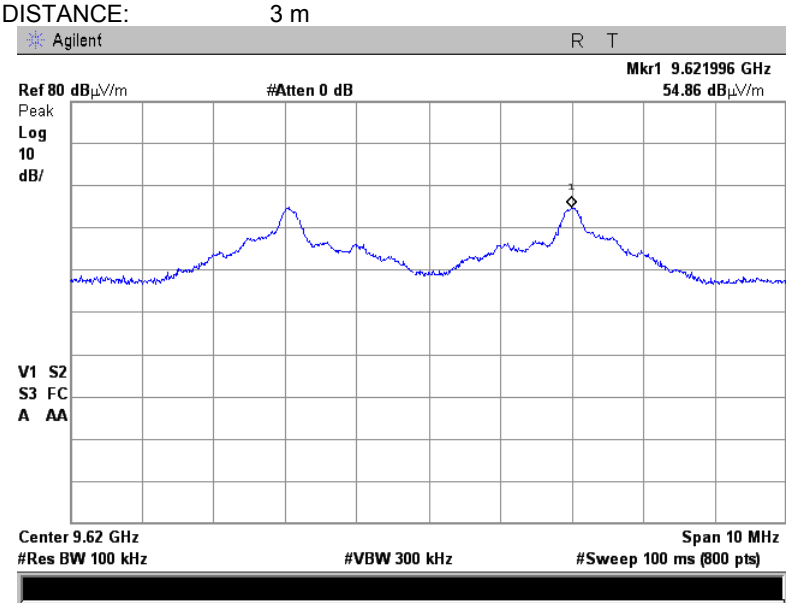


| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

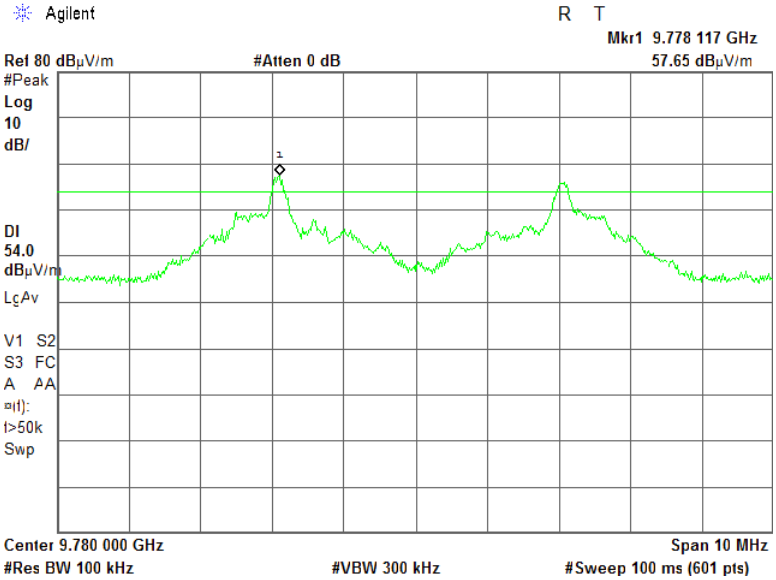
**Plot 7.3.27 Radiated emission measurements at the fourth harmonic of low carrier frequency ch.11**

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m




**Plot 7.3.28 Radiated emission measurements at the fourth harmonic of mid carrier frequency ch.19**

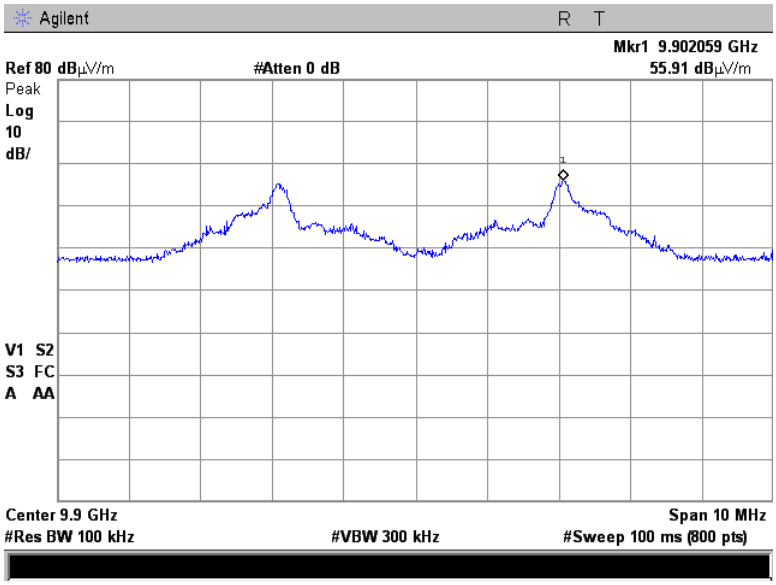
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.3.29 Radiated emission measurements at the fourth harmonic of high carrier frequency ch.25**

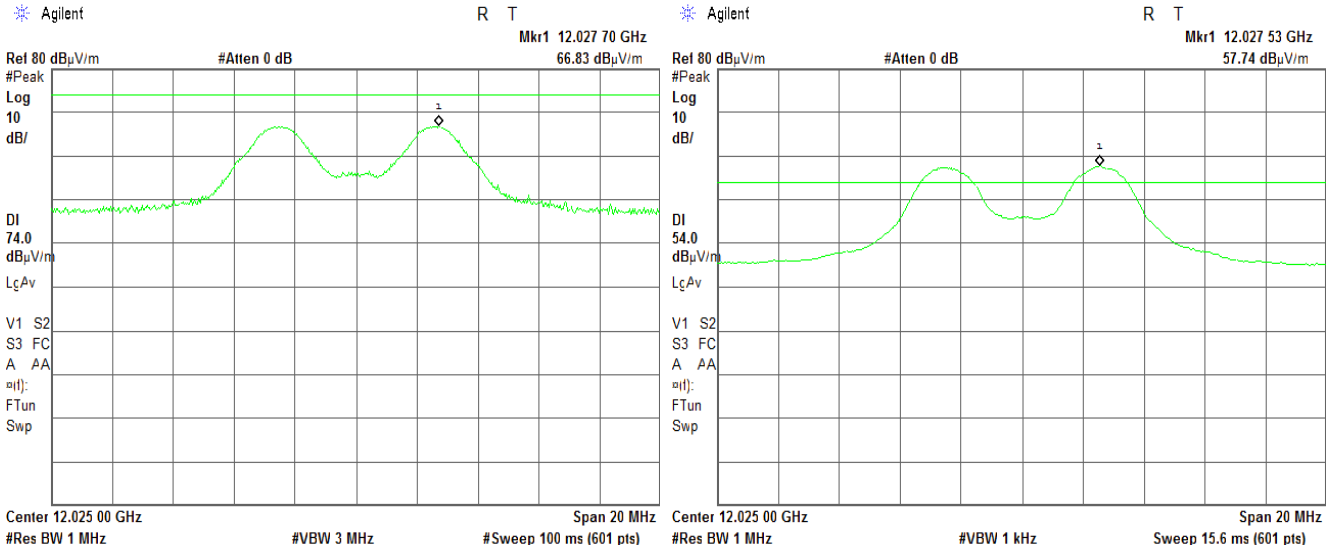
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

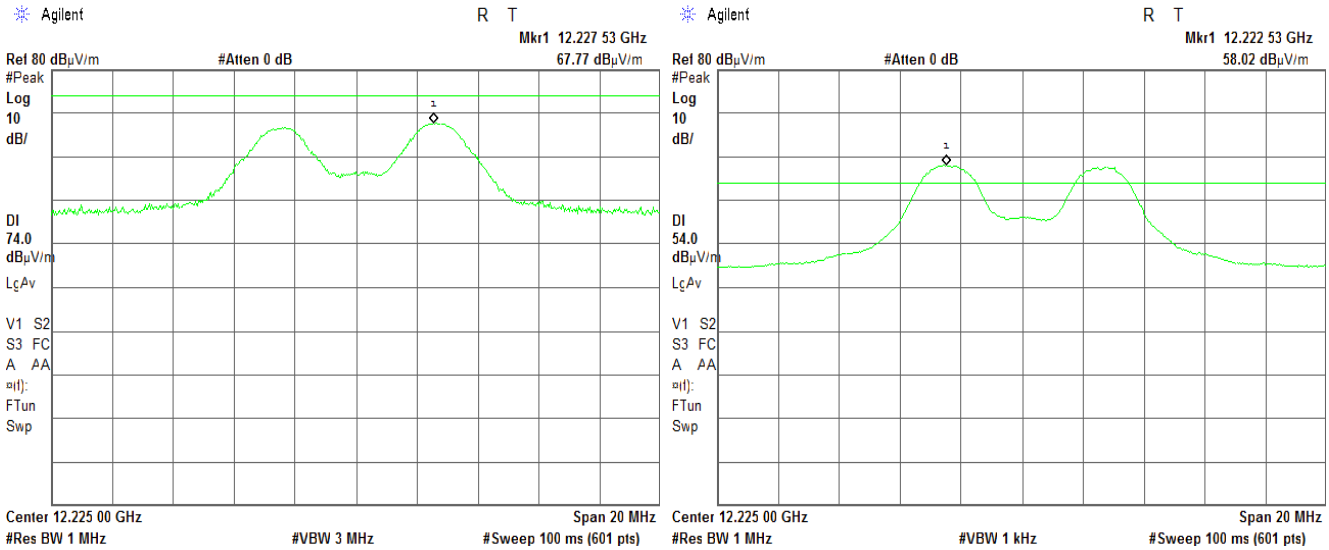
**Plot 7.3.30 Radiated emission measurements at the fifth harmonic of low carrier frequency ch.11**

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m




**Plot 7.3.31 Radiated emission measurements at the fifth harmonic of mid carrier frequency ch.19**

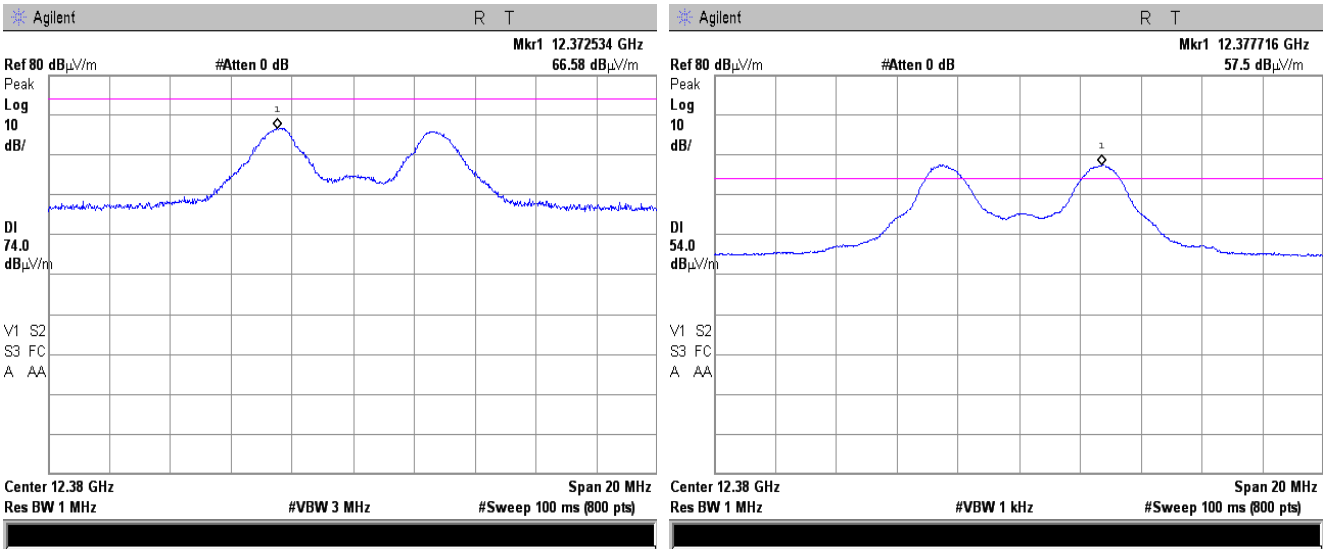
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

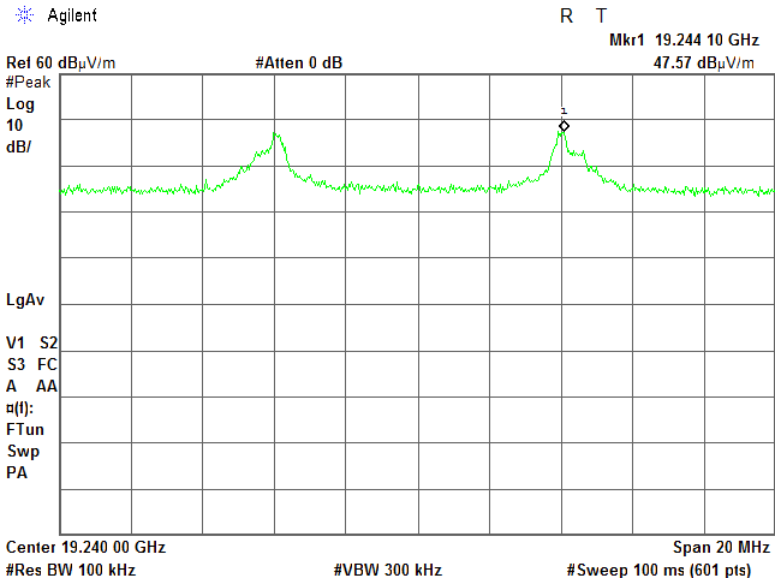
**Plot 7.3.32 Radiated emission measurements at the fifth harmonic of high carrier frequency ch.25**

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m




**Plot 7.3.33 Radiated emission measurements at the eighth harmonic of low carrier frequency ch.11**

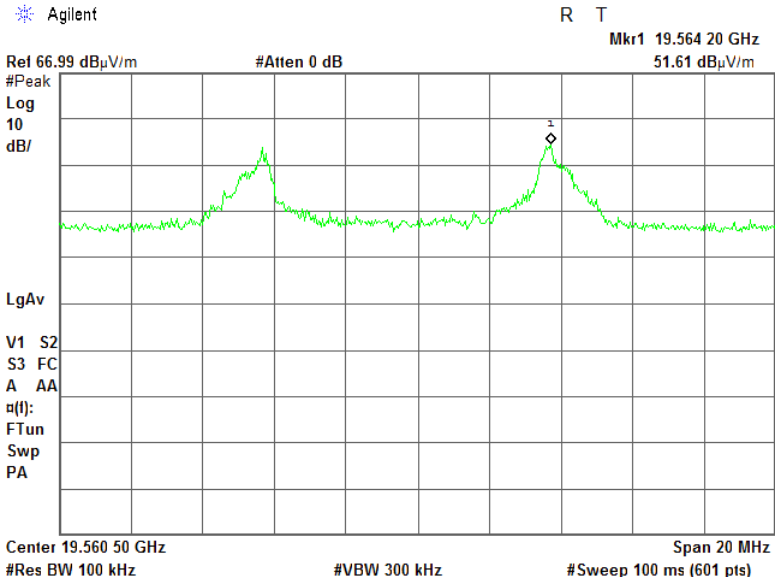
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

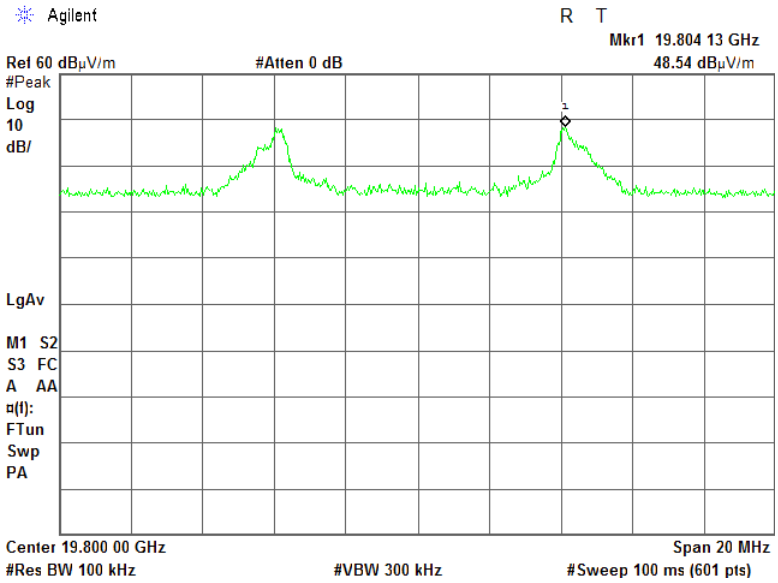
**Plot 7.3.34 Radiated emission measurements at the eighth harmonic of mid carrier frequency ch.19**

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



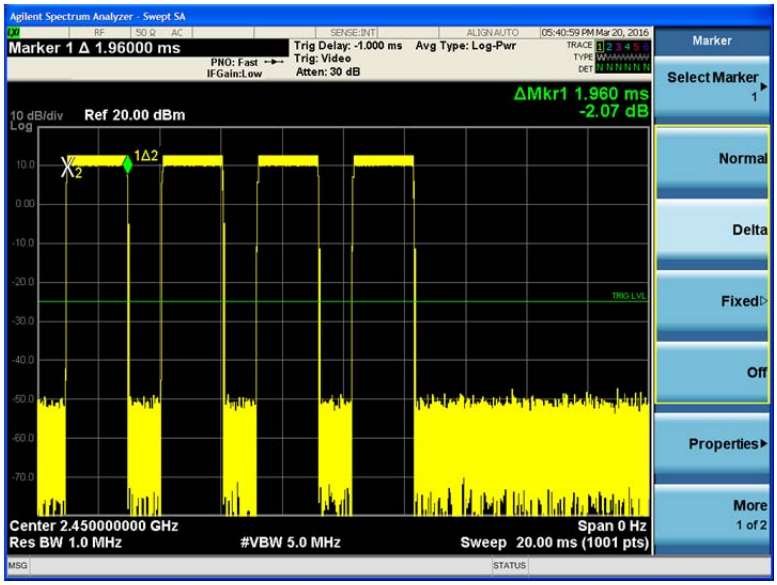

**Plot 7.3.35 Radiated emission measurements at the eighth harmonic of high carrier frequency ch.25**

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m

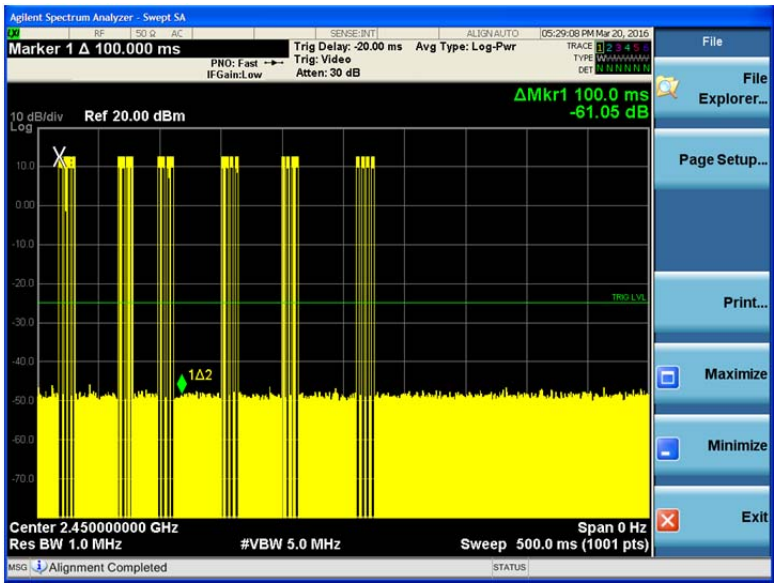


| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 - 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.3.36 Transmission pulse duration**




**Plot 7.3.37 Transmission pulse period**



| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Band edge emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

## 7.4 Band edge radiated emissions

### 7.4.1 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 7.4.1.

**Table 7.4.1 Band edge emission limits**

| Output power | Assigned frequency, MHz | Attenuation below carrier*, dBc | Field strength at 3 m within restricted bands, dB(μV/m) | |
|---|---|---|---|---|
| | | | Peak | Average |
| Peak | 902.0 – 928.0 | 20.0 | 74.0 | 54.0 |
| | 2400.0 – 2483.5 | | | |
| | 5725.0 – 5850.0 | | | |
| Averaged over a time interval | 902.0 – 928.0 | 30.0 | 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.

### 7.4.2 Test procedure

**7.4.2.1** The EUT was set up as shown in Figure 7.4.1, energized normally modulated at the maximum data rate and its proper operation was checked.

**7.4.2.2** The EUT was adjusted to produce maximum available to end user RF output power at the lowest carrier frequency.

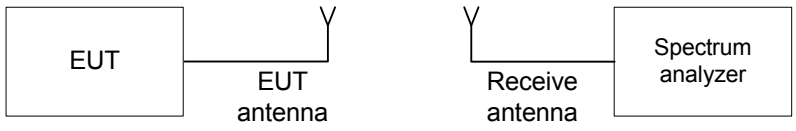
**7.4.2.3** The spectrum analyzer span was set to capture the carrier frequency and associated modulation products. The resolution bandwidth was set wider than 1 % of the frequency span.

**7.4.2.4** The spectrum analyzer was set in max hold mode and allowed trace to stabilize. The highest emission level within the authorized band was measured.

**7.4.2.5** The maximum band edge emission and modulation product outside of the band were measured as provided in Table 7.4.2 and associated plots and referenced to the highest emission level measured within the authorized band.

**7.4.2.6** The above procedure was repeated with the EUT adjusted to produce maximum RF output power at the highest carrier frequency.

**Figure 7.4.1 Band edge emission test setup**



| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Band edge emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Table 7.4.2 Band edge emission test results**

ASSIGNED FREQUENCY RANGE: 2400-2483.5 MHz
DETECTOR USED: Peak
MODULATION: OQPSK
BIT RATE: 250 kbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
VIDEO BANDWIDTH: ≥ RBW

| Frequency, MHz | Band edge emission, peak, dBµV/m | Limit, dBµV/m | Margin, dB** | Band edge emission, average, dBµV/m | Calculated band edge emission,** dBµV/m | Limit, dBµV/m | Margin, dB** | Verdict |
|---|---|---|---|---|---|---|---|---|
| Ch.11 2400.0 | 69.17 | 109.82 | -40.65 | NA | NA | NA | NA | Pass |
| Ch.25.2483.5 | 65.03 | 74.00 | -8.97 | 54.96 | 42.39 | 54 | -11.61 | |
| Ch.26 2483.5 | 72.65 | 74.00 | -1.35 | 64.02 | 51.45 | 54 | -2.55 | |

*****- Margin = Measured emission – specification limit.
******- Average factor (-12.57 dB) was applied.

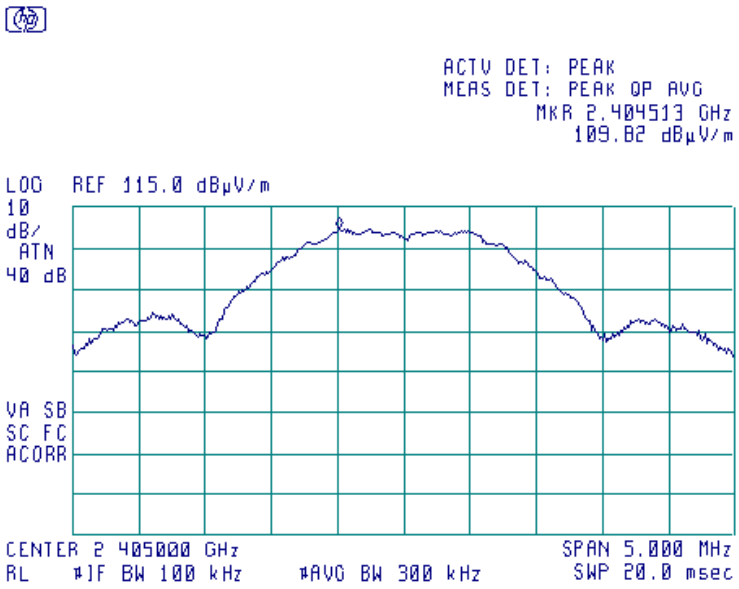
**Reference numbers of test equipment used**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL 0521 | HL 1984 | HL 4278 | HL 4353 | | | | |

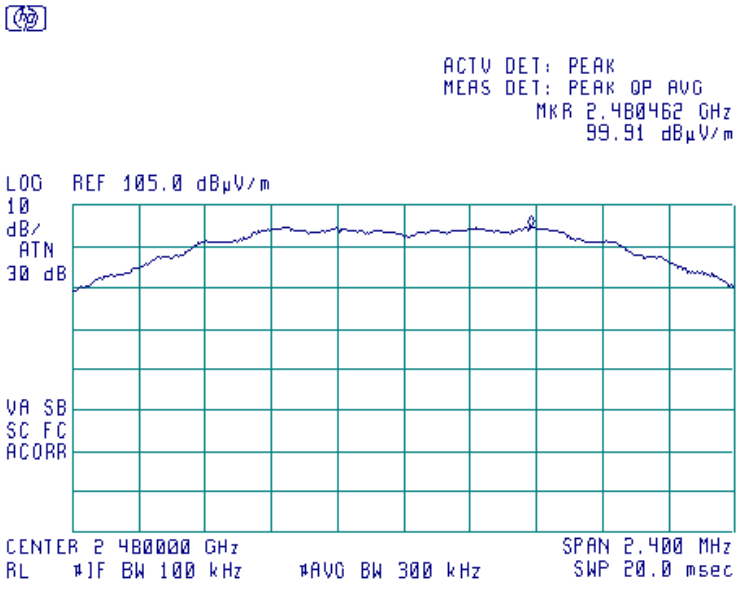
Full description is given in Appendix A.

| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Band edge emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.4.1 The highest emission level within the assigned band at low carrier frequency**

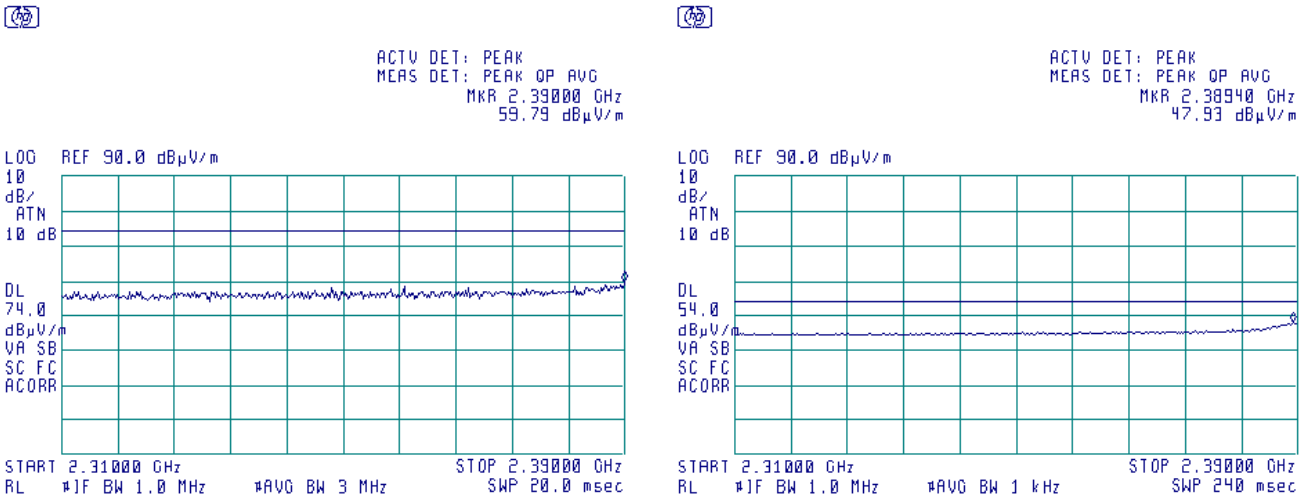


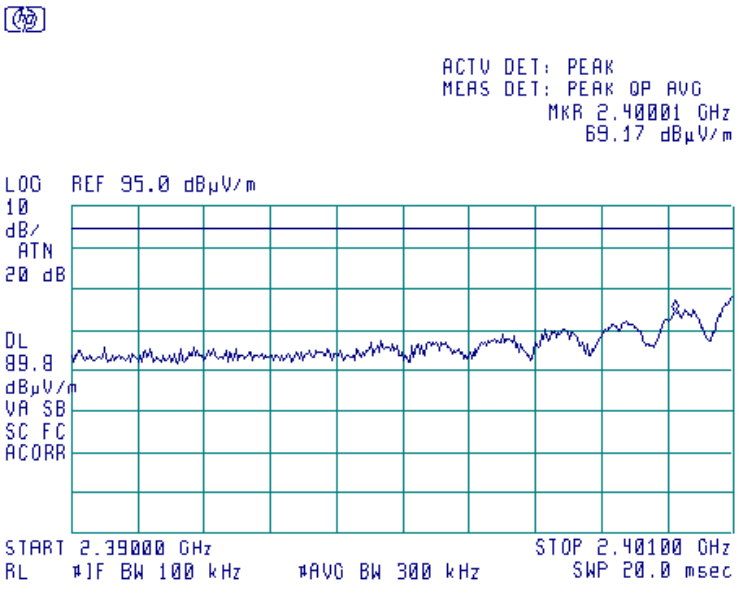

**Plot 7.4.2 The highest emission level within the assigned band at high carrier frequency ch.26**



| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Band edge emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

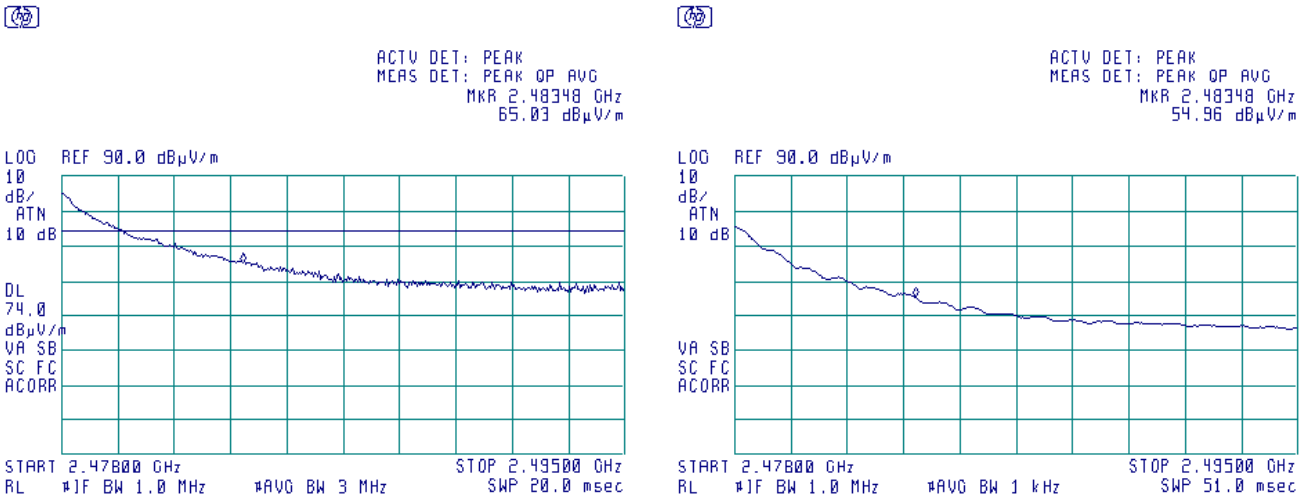
**Plot 7.4.3 The highest band edge emission at low carrier frequency ch.11**



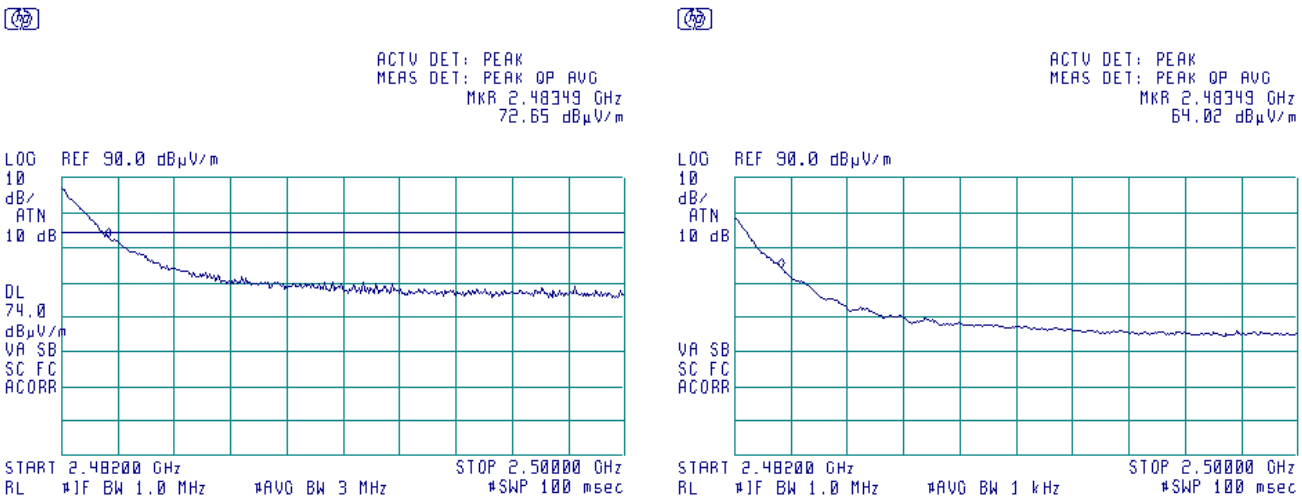



| Test specification: | FCC section 15.247(d), RSS-247 section 5.5, Band edge emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.4.4 The highest band edge emission at high carrier frequency ch.25**




**Plot 7.4.5 The highest band edge emission at high carrier frequency ch.26**



| Test specification: | FCC section 15.247(e), RSS-247 section 5.2(2), Peak power spectral density | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.10.2 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

## 7.5 Peak spectral power density

### 7.5.1 General

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

**Table 7.5.1 Peak spectral power density limits**

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

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

### 7.5.2 Test procedure for field strength measurements

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

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

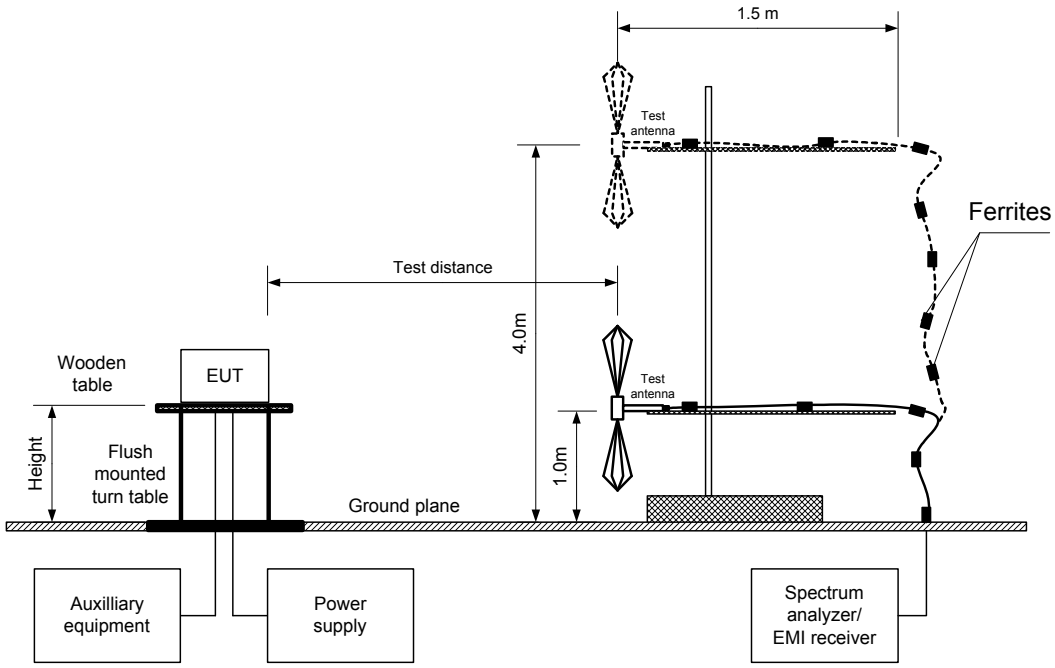
**7.5.2.3** The field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated $360^0$ and the measuring antenna height was swept in both vertical and horizontal polarizations.

**7.5.2.4** The frequency span of spectrum analyzer was set to capture the entire 6 dB band of the transmitter, in peak hold mode with resolution bandwidth set to 3.0 kHz, video bandwidth wider than resolution bandwidth, auto sweep time and sufficient number of sweeps was allowed for trace stabilization. The spectrum lines spacing was verified to be wider than 3 kHz. Otherwise the resolution bandwidth was reduced until individual spectrum lines were resolved and the power of individual spectrum lines was integrated over 3 kHz band.

**7.5.2.5** The peak of emission was zoomed with span set just wide enough to capture the emission peak area and sweep time was set equal to span width divided by resolution bandwidth. Spectrum analyzer was set in peak hold mode, sufficient number of sweeps was allowed for trace stabilization and peak spectral power density was measured as provided in Table 7.5.2 and associated plots.

| Test specification: | FCC section 15.247(e), RSS-247 section 5.2(2), Peak power spectral density | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.10.2 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Figure 7.5.1 Setup for carrier field strength measurements**



| Test specification: | FCC section 15.247(e), RSS-247 section 5.2(2), Peak power spectral density | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.10.2 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

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

ASSIGNED FREQUENCY: 2400-2483.5 MHz
TEST DISTANCE: 3 m
TEST SITE: OATS
EUT HEIGHT: 1.5 m
DETECTOR USED: Peak
TEST ANTENNA TYPE: Double ridged guide (above 1000 MHz)
MODULATION: OQPSK
BIT RATE: 250 kbps

| Frequency, MHz | Field strength, dB(μV/m) | EUT antenna gain, dBi | Limit, dB(μV/m) | Margin, dB* | Antenna polarization | Antenna height, m | RBW kHz | Verdict |
|---|---|---|---|---|---|---|---|---|
| 2405 | 98.20 | 3 | 103.2 | -8.00 | Horizontal | 1.8 | 3 | Pass |
| 2445 | 98.55 | 3 | 103.2 | -7.65 | Horizontal | 1.3 | 3 | Pass |
| 2475 | 98.05 | 3 | 103.2 | -17.05 | Horizontal | 1.3 | 3 | Pass |
| 2480 | 89.15 | 3 | 103.2 | -17.05 | Horizontal | 1.8 | 3 | Pass |

*****- Margin = Field strength - EUT antenna gain - calculated field strength limit.
******- EUT front panel refer to 0 degrees position of turntable.

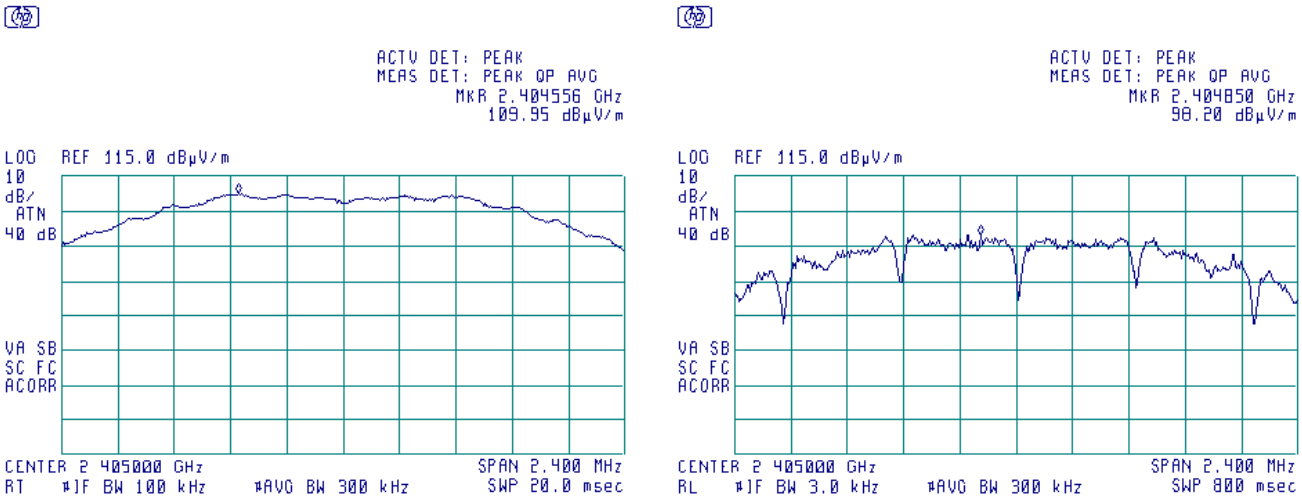
**Reference numbers of test equipment used**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL 0521 | HL 1984 | HL 4278 | HL 4353 | | | | |

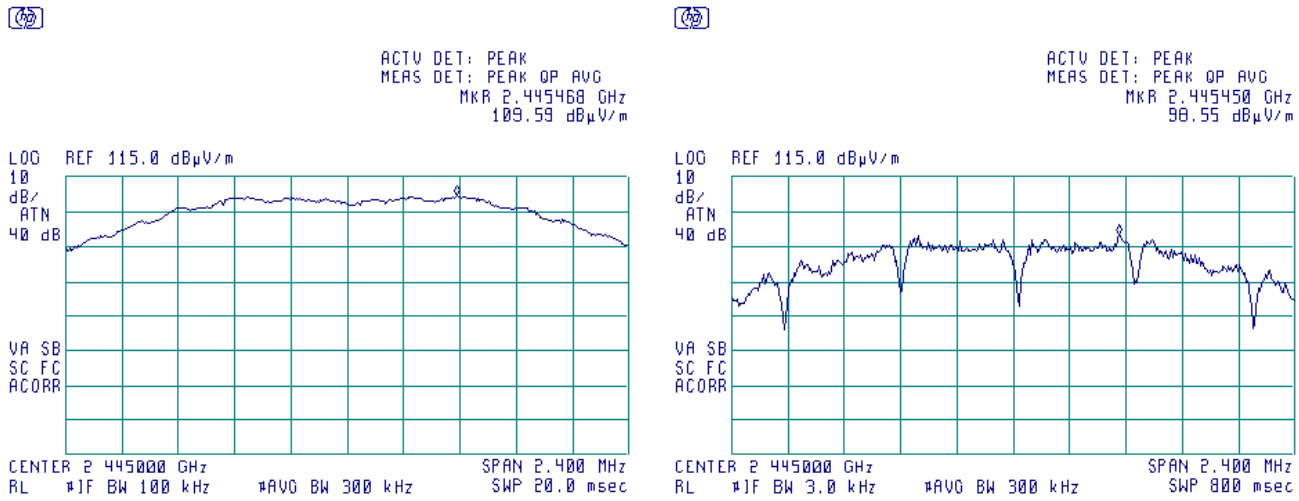
Full description is given in Appendix A.

| Test specification: | FCC section 15.247(e), RSS-247 section 5.2(2), Peak power spectral density | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.10.2 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.5.1 Peak spectral power density at low frequency zoomed at the peak, ch.11**

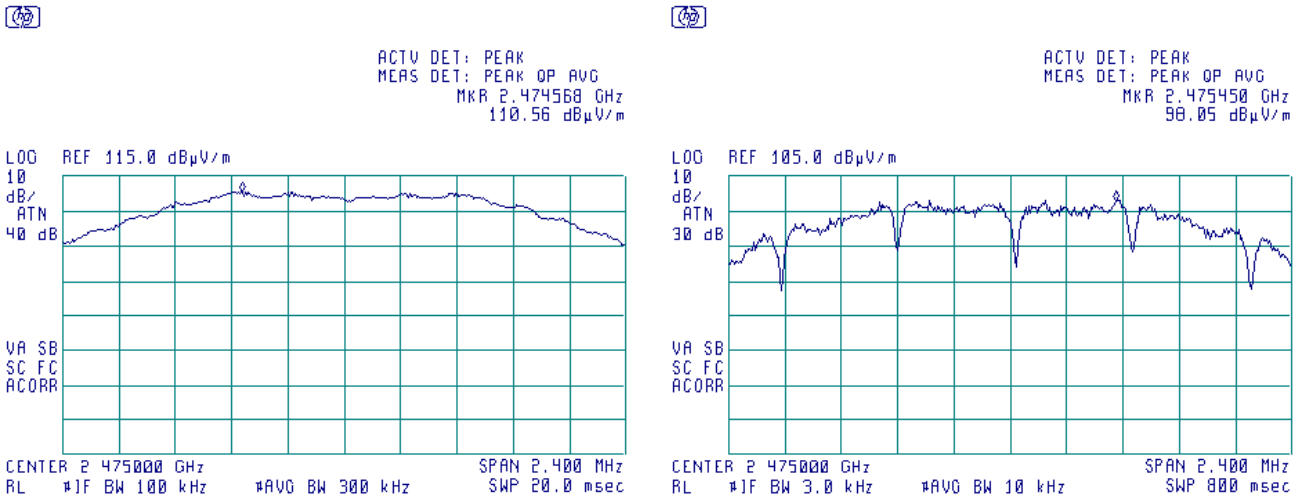



**Plot 7.5.2 Peak spectral power density at mid frequency zoomed at the peak, ch.19**

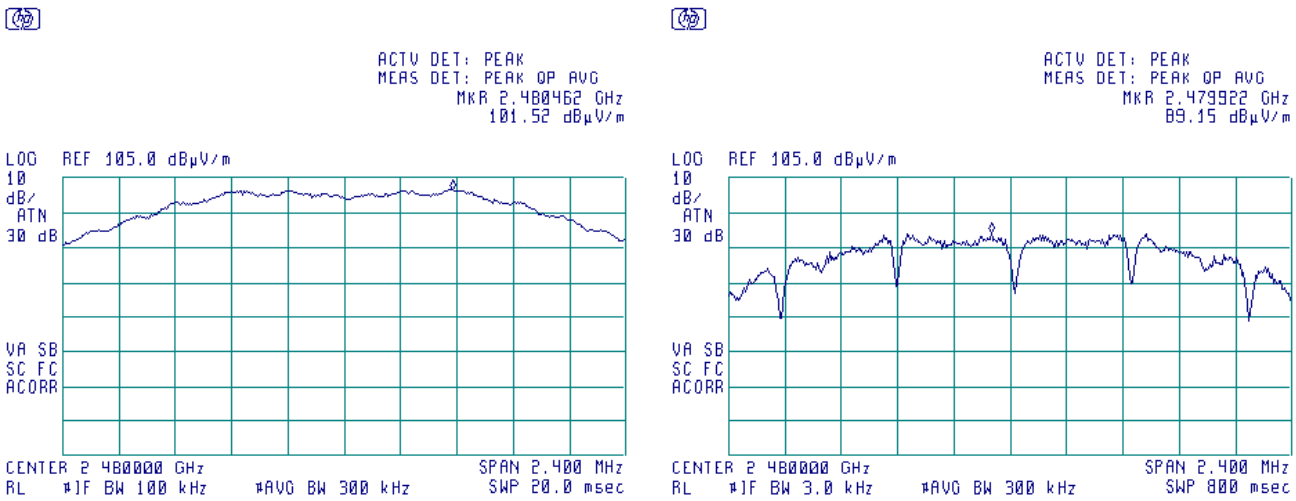


| Test specification: | FCC section 15.247(e), RSS-247 section 5.2(2), Peak power spectral density | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.10.2 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 02-Feb-16 | | |
| Temperature: 23 ºC | Air Pressure: 1021 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 7.5.3 Peak spectral power density at high frequency zoomed at the peak, ch.25**




**Plot 7.5.4 Peak spectral power density at high frequency zoomed at the peak, ch.26**



| Test specification: | FCC section 15.203, RSS-Gen section 8.3, Antenna requirement | | |
|---|---|---|---|
| Test procedure: | Visual inspection | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 08-Mar-16 | | |
| Temperature: 23 ºC | Air Pressure: hPa | Relative Humidity: 55 % | Power Supply: Battery |
| Remarks: | | | |

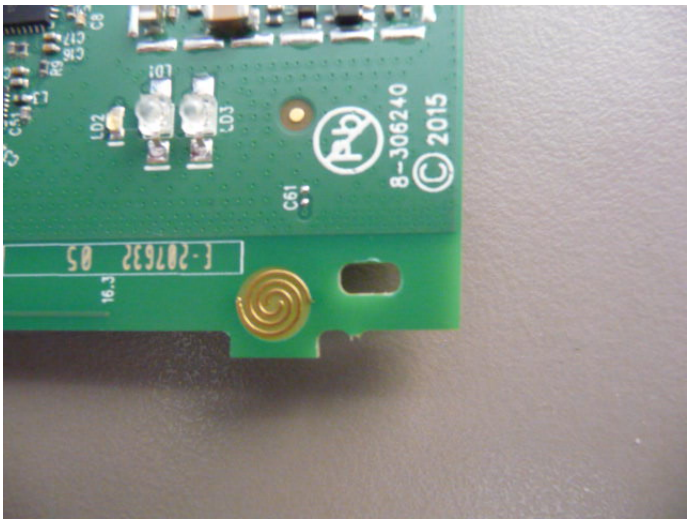
## 7.6 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.
The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.6.1.

**Table 7.6.1 Antenna requirements**

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

**Photograph 7.6.1 Antenna assembly**



| Test specification: | FCC Part 15, Section 109 / RSS-Gen, Section 7.1.2 / ICES-003, Section 6.2, Radiated emission | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Sections 11.6 and 12.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 21-Feb-16 - 22-Feb-16 | | |
| Temperature: 22 ºC | Air Pressure: 1010 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

# 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 limits according to FCC Part 15, Section 109**

| 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* |
| 960 - 5$^{th}$ harmonic** | 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: $Lim_{S2} = Lim_{S1} + 20 \log (S_1/S_2)$,
where $S_1$ and $S_2$ – 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$^{th}$ harmonic** | 54.0 |

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

### 8.1.2 Test procedure

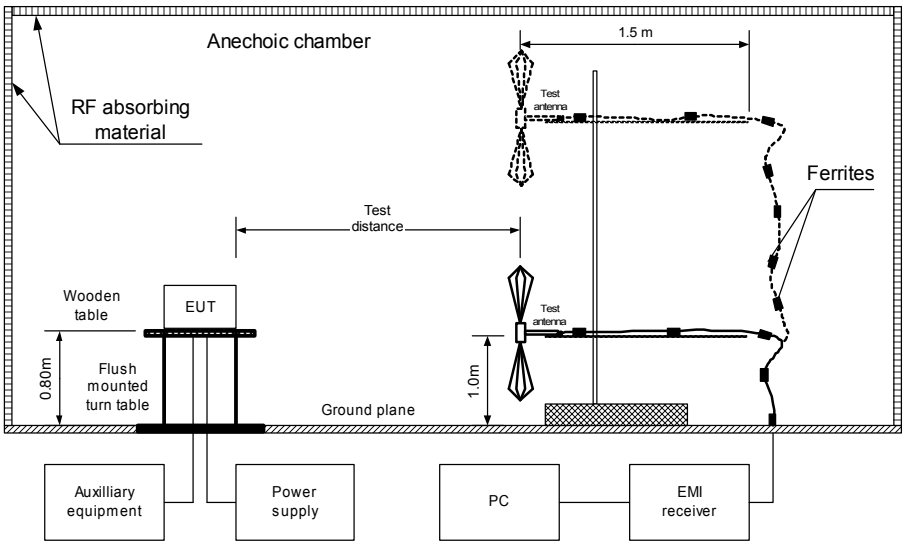
**8.1.2.1** The EUT was set up as shown in Figure 8.1.1 and associated photographs, energized and the performance check was conducted.

**8.1.2.2** The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated $360^0$, 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 provided in the associated tables and plots.

| Test specification: | FCC Part 15, Section 109 / RSS-Gen, Section 7.1.2 / ICES-003, Section 6.2, Radiated emission | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Sections 11.6 and 12.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 21-Feb-16 - 22-Feb-16 | | |
| Temperature: 22 ºC | Air Pressure: 1010 hPa | Relative Humidity: 54 % | Power Supply: 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**

| **Test specification:** | **FCC Part 15, Section 109 / RSS-Gen, Section 7.1.2 / ICES-003, Section 6.2, Radiated emission** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Sections 11.6 and 12.1.4 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date(s):** | 21-Feb-16 - 22-Feb-16 | | |
| **Temperature:** 22 ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 54 % | **Power Supply:** 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
FREQUENCY RANGE: 30 MHz – 1000 MHz
RESOLUTION BANDWIDTH: 120 kHz

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

TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 13000 MHz
RESOLUTION BANDWIDTH: 1000 kHz

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

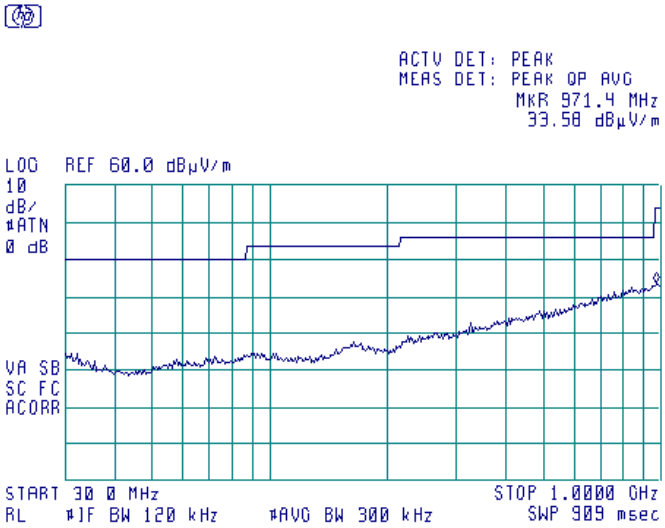
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL 0521 | HL 0604 | HL 3818 | HL 4276 | HL 4353 | HL 4720 | HL 4933 | |

Full description is given in Appendix A.

| Test specification: | FCC Part 15, Section 109 / RSS-Gen, Section 7.1.2 / ICES-003, Section 6.2, Radiated emission | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Sections 11.6 and 12.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 21-Feb-16 - 22-Feb-16 | | |
| Temperature: 22 ºC | Air Pressure: 1010 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

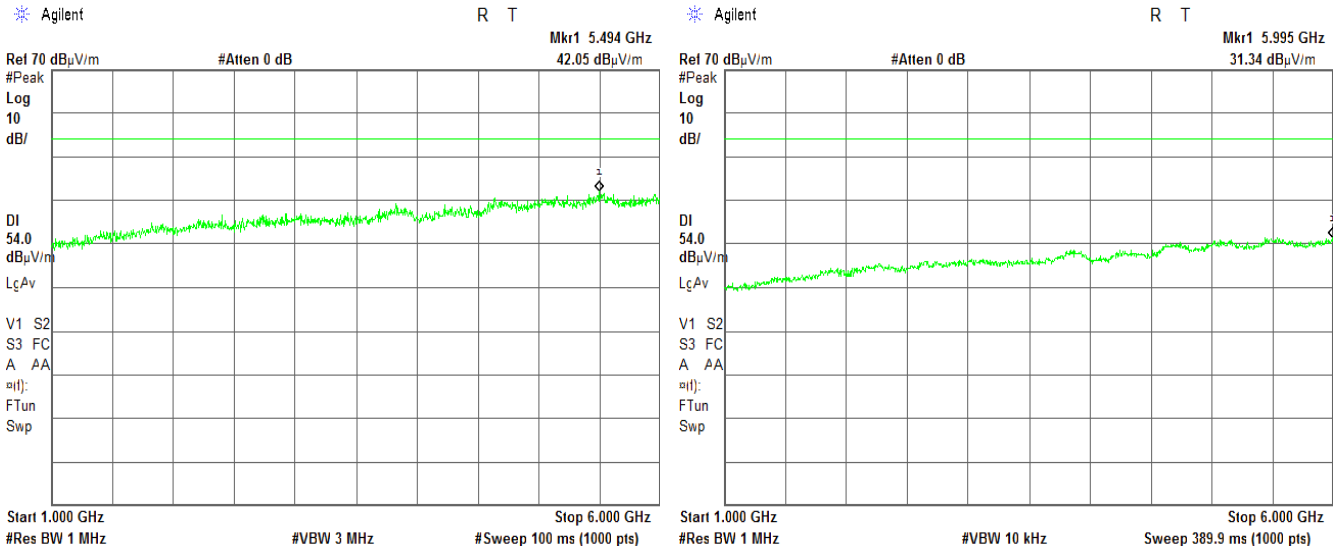
**Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical & horizontal antenna polarization**

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




**Plot 8.1.2 Radiated emission measurements in 1-6 GHz range, vertical & horizontal antenna polarization**

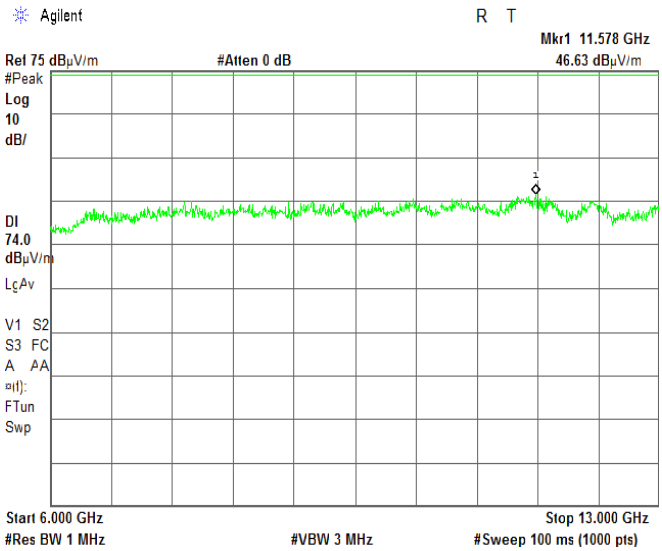
TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive

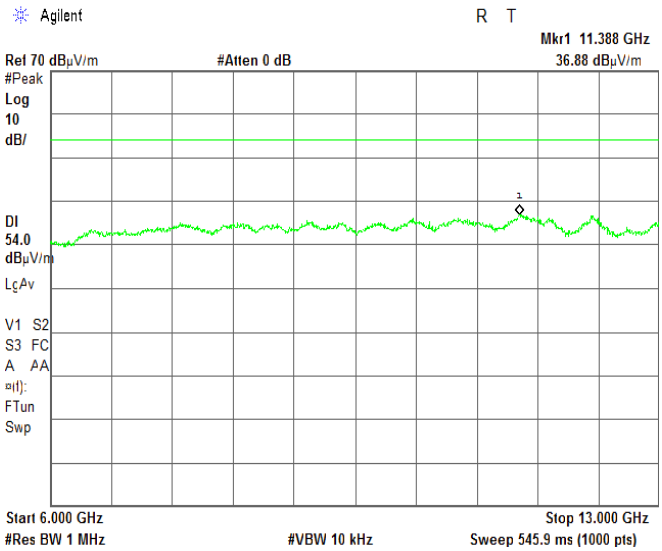


| Test specification: | FCC Part 15, Section 109 / RSS-Gen, Section 7.1.2 / ICES-003, Section 6.2, Radiated emission | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Sections 11.6 and 12.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 21-Feb-16 - 22-Feb-16 | | |
| Temperature: 22 ºC | Air Pressure: 1010 hPa | Relative Humidity: 54 % | Power Supply: Battery |
| Remarks: | | | |

**Plot 8.1.3 Radiated emission measurements in 6-13 GHz range, vertical & horizontal antenna polarization**

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



# 9 APPENDIX A Test equipment and ancillaries used for tests

| HL No | Description | Manufacturer | Model | Ser. No. | Last Cal./ Check | Due Cal./ Check |
|---|---|---|---|---|---|---|
| 0446 | Antenna, Loop, Active, 10 kHz - 30 MHz | EMCO | 6502 | 2857 | 18-Jan-16 | 18-Jan-17 |
| 0521 | EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz | Hewlett Packard | 8546A | 3617A 00319, 3448A002 53 | 27-Oct-15 | 27-Oct-16 |
| 0604 | Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz | EMCO | 3141 | 9611-1011 | 15-May-15 | 15-May-16 |
| 1984 | Antenna, Double-Ridged Waveguide Horn, 1 to 18 GHz, 300 W | EMC Test Systems | 3115 | 9911-5964 | 17-Apr-15 | 17-Apr-16 |
| 2780 | EMC analyzer, 100 Hz to 26.5 GHz | Agilent Technologies | E7405A | MY451024 62 | 08-Sep-15 | 08-Sep-16 |
| 3347 | High Pass Filter, 50 Ohm, 6000 to 11500 MHz. | Mini-Circuits | VHF-5500+ | NA | 01-Oct-15 | 01-Oct-17 |
| 3818 | PSA Series Spectrum Analyzer, 3 Hz- 44 GHz | Agilent Technologies | E4446A | MY482502 88 | 29-Apr-15 | 29-Apr-16 |
| 3901 | Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA | Huber-Suhner | SUCOFLEX 102A | 1225/2A | 15-Feb-16 | 15-Feb-17 |
| 4278 | Test Cable , DC-18 GHz, 4.6 m, N/M - N/M | Mini-Circuits | APC-15FT-NMNM+ | 0755A | 22-Nov-15 | 22-Nov-16 |
| 4338 | Reject Band Filter, 50 Ohm, 0 to 2170 and 3000 to 18000 MHz, SMA-FM / SMA-M | Micro-Tronics | BRM 50702-02 | 023 | 05-May-15 | 05-May-16 |
| 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-15 | 15-Mar-16 |
| 4720 | Low Loss Armored Test Cable, DC - 18 GHz, 4.5 m, N type-M/N type-M | MegaPhase | NC29-N1N1-177 | 51300101 002 | 30-Dec-15 | 30-Dec-16 |
| 4932 | Microwave preamplifier, 500 MHz to 18 GHz, 40 dB Gain | Com-Power Corporation | PAM-118A | 551029 | 19-Nov-15 | 19-Nov-16 |
| 4933 | Active Horn Antenna, 1 GHz to 18 GHz | Com-Power Corporation | AHA-118 | 701046 | 04-Sep-15 | 04-Sep-16 |
| 4956 | Active horn antenna, 18 to 40 GHz | Com-Power Corporation | AHA-840 | 105004 | 09-Nov-15 | 09-Nov-16 |

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

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.
Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.
In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.

# 11 APPENDIX C Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility.
Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47), Registration Numbers 90624 for OATS and 90623 for the anechoic chamber; 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, C-845 for conducted emissions site, T-1606 for conducted emissions at telecommunication ports), has a status of a Telefication - Listed Testing Laboratory, Certificate No. L138/00. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01). The FCC Designation Number is IL1001.

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Person for contact: Mr. Alex Usoskin, CEO.

# 12 APPENDIX D Specification references

| | |
|---|---|
| FCC 47CFR part 15: 2015 | 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: 2009 | 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 1: 2015 | 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 |

# 13 APPENDIX E Test equipment correction factors

**Antenna factor**
**Active loop antenna**
**Model 6502, S/N 2857, HL 0446**

| Frequency, MHz | Magnetic antenna factor, dB | Electric antenna factor, dB |
|---|---|---|
| 0.009 | -32.8 | 18.7 |
| 0.010 | -33.8 | 17.7 |
| 0.020 | -38.3 | 13.2 |
| 0.050 | -41.1 | 10.4 |
| 0.075 | -41.3 | 10.2 |
| 0.100 | -41.6 | 9.9 |
| 0.150 | -41.7 | 9.8 |
| 0.250 | -41.6 | 9.9 |
| 0.500 | -41.8 | 9.8 |
| 0.750 | -41.9 | 9.7 |
| 1.000 | -41.4 | 10.1 |
| 2.000 | -41.5 | 10.0 |
| 3.000 | -41.4 | 10.2 |
| 4.000 | -41.4 | 10.1 |
| 5.000 | -41.5 | 10.1 |
| 10.000 | -41.9 | 9.6 |
| 15.000 | -41.9 | 9.6 |
| 20.000 | -42.2 | 9.3 |
| 25.000 | -42.8 | 8.7 |
| 30.000 | -44.0 | 7.5 |

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

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field strength in dB(μV/m).

**Antenna factor**
**Double-ridged wave guide horn antenna**
**Model 3115, S/N 9911-5964, HL1984**

| Frequency, MHz | Antenna factor, dB(1/m) |
|---|---|
| 1000.0 | 24.7 |
| 1500.0 | 25.7 |
| 2000.0 | 27.6 |
| 2500.0 | 28.9 |
| 3000.0 | 31.2 |
| 3500.0 | 32.0 |
| 4000.0 | 32.5 |
| 4500.0 | 32.7 |
| 5000.0 | 33.6 |
| 5500.0 | 35.1 |
| 6000.0 | 35.4 |
| 6500.0 | 34.9 |
| 7000.0 | 36.1 |
| 7500.0 | 37.8 |
| 8000.0 | 38.0 |
| 8500.0 | 38.1 |
| 9000.0 | 39.1 |
| 9500.0 | 38.3 |
| 10000.0 | 38.6 |
| 10500.0 | 38.2 |
| 11000.0 | 38.7 |
| 11500.0 | 39.5 |
| 12000.0 | 40.0 |
| 12500.0 | 40.4 |
| 13000.0 | 40.5 |
| 13500.0 | 41.1 |
| 14000.0 | 41.6 |
| 14500.0 | 41.7 |
| 15000.0 | 38.7 |
| 15500.0 | 38.2 |
| 16000.0 | 38.8 |
| 16500.0 | 40.5 |
| 17000.0 | 42.5 |
| 17500.0 | 45.9 |
| 18000.0 | 49.4 |

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field strength in dB(μV/m).

**Antenna factor, HL 4933**

COM-POWER CORPORATION

# Active Horn Antenna Factor Calibration

*1 GHz to 18 GHz*

| | |
|---|---|
| ***Equipment:*** | **ACTIVE HORN ANTENNA** |
| ***Model:*** | **AHA-118** |
| ***Serial Number:*** | **701046** |
| ***Calibration Distance:*** | **3 Meter** |
| ***Polarization:*** | **Horizontal** |
| ***Calibration Date:*** | **11/12/2014** |

| *Frequency (GHz)* | *Preamplifier Gain (dB)* | *Antenna Factor with pre-amp (dB/m)* | *Frequency (GHz)* | *Preamplifier Gain (dB)* | *Antenna Factor with pre-amp (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*

***Antenna Factor to be added to receiver reading:***

Meter Reading (dBuV) + Antenna Factor (dB/m) = Corrected Reading (dBuV/m)

**Antenna factor, HL 4956**

COM-POWER CORPORATION

## Active Horn Antenna Factor Calibration

18 GHz to 40 GHz

| | |
|---|---|
| **Equipment:** | **ACTIVE HORN ANTENNA** |
| **Model:** | **AHA-840** |
| **Serial Number:** | **105004** |
| **Calibration Distance:** | **3 meter** |
| **Polarization:** | **Horizontal** |
| **Calibration Date:** | **1/26/2015** |

| Frequency (GHz) | Preamplifier Gain (dB) | Antenna Factor with pre-amp (dB/m) | Frequency (GHz) | Preamplifier Gain (dB) | Antenna Factor with pre-amp (dB/m) |
|---|---|---|---|---|---|
| 18 | 38.83 | -1.06 | 29.5 | 42.47 | -5.33 |
| 18.5 | 39.34 | -2.65 | 30 | 41.91 | -4.86 |
| 19 | 39.71 | -3.88 | 30.5 | 41.60 | -4.64 |
| 19.5 | 39.87 | -4.35 | 31 | 41.52 | -4.60 |
| 20 | 39.98 | -3.97 | 31.5 | 41.56 | -4.79 |
| 20.5 | 40.42 | -3.68 | 32 | 41.80 | -5.21 |
| 21 | 41.12 | -4.06 | 32.5 | 42.29 | -5.54 |
| 21.5 | 41.74 | -5.46 | 33 | 42.79 | -5.63 |
| 22 | 42.14 | -6.22 | 33.5 | 42.88 | -5.38 |
| 22.5 | 42.35 | -6.42 | 34 | 42.62 | -4.76 |
| 23 | 42.50 | -6.59 | 34.5 | 42.63 | -4.84 |
| 23.5 | 42.65 | -6.82 | 35 | 43.15 | -5.13 |
| 24 | 42.81 | -7.01 | 35.5 | 43.91 | -5.83 |
| 24.5 | 42.86 | -7.37 | 36 | 44.59 | -6.39 |
| 25 | 42.73 | -7.53 | 36.5 | 45.04 | -6.64 |
| 25.5 | 42.77 | -7.45 | 37 | 45.08 | -6.40 |
| 26 | 42.85 | -7.21 | 37.5 | 44.82 | -5.75 |
| 26.5 | 42.98 | -7.17 | 38 | 44.16 | -4.58 |
| 27 | 43.14 | -7.22 | 38.5 | 42.90 | -2.66 |
| 27.5 | 43.18 | -7.32 | 39 | 42.39 | -1.71 |
| 28 | 43.04 | -7.10 | 39.5 | 43.76 | -2.49 |
| 28.5 | 43.01 | -6.73 | 40 | 45.98 | -5.21 |

*Calibration per ANSI C63.5: 2006*

***Standard Site Method, Equations 1-6 (3-antenna)***

Corrected Reading (dBµV/m) = Meter Reading (dBµV) + AFE(dB/m)

**Cable loss**
**Microwave Cable Assembly, Huber-Suhner, 40 GHz, 3.5 m, SMA-SMA, S/N 1225/2A**
**HL 3901**

| Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB |
|---|---|---|---|---|---|
| 10 | 0.09 | 9500 | 4.29 | 21000 | 6.67 |
| 100 | 0.41 | 10000 | 4.40 | 22000 | 6.92 |
| 500 | 0.93 | 10500 | 4.52 | 23000 | 7.00 |
| 1000 | 1.33 | 11000 | 4.64 | 24000 | 7.18 |
| 1500 | 1.63 | 11500 | 4.76 | 25000 | 7.29 |
| 2000 | 1.90 | 12000 | 4.87 | 26000 | 7.55 |
| 2500 | 2.12 | 12500 | 4.99 | 27000 | 7.70 |
| 3000 | 2.33 | 13000 | 5.11 | 28000 | 7.88 |
| 3500 | 2.50 | 13500 | 5.20 | 29000 | 8.02 |
| 4000 | 2.67 | 14000 | 5.31 | 30000 | 8.15 |
| 4500 | 2.82 | 14500 | 5.42 | 31000 | 8.35 |
| 5000 | 2.99 | 15000 | 5.51 | 32000 | 8.40 |
| 5500 | 3.16 | 15500 | 5.58 | 33000 | 8.62 |
| 6000 | 3.32 | 16000 | 5.68 | 34000 | 8.73 |
| 6500 | 3.51 | 16500 | 5.78 | 35000 | 8.78 |
| 7000 | 3.65 | 17000 | 5.91 | 36000 | 8.94 |
| 7500 | 3.79 | 17500 | 5.99 | 37000 | 9.21 |
| 8000 | 3.92 | 18000 | 6.07 | 38000 | 9.37 |
| 8500 | 4.04 | 19000 | 6.36 | 39000 | 9.45 |
| 9000 | 4.18 | 20000 | 6.49 | 40000 | 9.52 |

**Cable loss**
**Test cable, Mini-Circuits, S/N 0755A, 18 GHz, 4.6 m, N/M - N/M**
**APC-15FT-NMNM+, HL 4278**

| Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB |
|---|---|---|---|---|---|---|---|
| 10 | 0.24 | 4900 | 4.19 | 10000 | 6.47 | 15100 | 8.33 |
| 30 | 0.26 | 5000 | 4.25 | 10100 | 6.50 | 15200 | 8.35 |
| 50 | 0.34 | 5100 | 4.29 | 10200 | 6.52 | 15300 | 8.37 |
| 100 | 0.50 | 5200 | 4.32 | 10300 | 6.57 | 15400 | 8.40 |
| 200 | 0.72 | 5300 | 4.38 | 10400 | 6.59 | 15500 | 8.42 |
| 300 | 0.90 | 5400 | 4.41 | 10500 | 6.61 | 15600 | 8.46 |
| 400 | 1.06 | 5500 | 4.46 | 10600 | 6.64 | 15700 | 8.50 |
| 500 | 1.20 | 5600 | 4.51 | 10700 | 6.64 | 15800 | 8.52 |
| 600 | 1.32 | 5700 | 4.56 | 10800 | 6.65 | 15900 | 8.56 |
| 700 | 1.44 | 5800 | 4.59 | 10900 | 6.68 | 16000 | 8.61 |
| 800 | 1.54 | 5900 | 4.64 | 11000 | 6.68 | 16100 | 8.64 |
| 900 | 1.64 | 6000 | 4.69 | 11100 | 6.69 | 16200 | 8.66 |
| 1000 | 1.74 | 6100 | 4.72 | 11200 | 6.70 | 16300 | 8.70 |
| 1100 | 1.83 | 6200 | 4.77 | 11300 | 6.74 | 16400 | 8.73 |
| 1200 | 1.92 | 6300 | 4.80 | 11400 | 6.78 | 16500 | 8.74 |
| 1300 | 2.01 | 6400 | 4.83 | 11500 | 6.81 | 16600 | 8.75 |
| 1400 | 2.09 | 6500 | 4.89 | 11600 | 6.84 | 16700 | 8.78 |
| 1500 | 2.18 | 6600 | 4.90 | 11700 | 6.87 | 16800 | 8.79 |
| 1600 | 2.25 | 6700 | 4.95 | 11800 | 6.92 | 16900 | 8.81 |
| 1700 | 2.33 | 6800 | 5.01 | 11900 | 6.98 | 17000 | 8.85 |
| 1800 | 2.39 | 6900 | 4.99 | 12000 | 7.02 | 17100 | 8.90 |
| 1900 | 2.47 | 7000 | 5.04 | 12100 | 7.08 | 17200 | 8.95 |
| 2000 | 2.53 | 7100 | 5.11 | 12200 | 7.15 | 17300 | 8.99 |
| 2100 | 2.60 | 7200 | 5.14 | 12300 | 7.20 | 17400 | 9.03 |
| 2200 | 2.67 | 7300 | 5.21 | 12400 | 7.26 | 17500 | 9.07 |
| 2300 | 2.73 | 7400 | 5.29 | 12500 | 7.31 | 17600 | 9.11 |
| 2400 | 2.80 | 7500 | 5.33 | 12600 | 7.36 | 17700 | 9.15 |
| 2500 | 2.87 | 7600 | 5.38 | 12700 | 7.41 | 17800 | 9.19 |
| 2600 | 2.93 | 7700 | 5.46 | 12800 | 7.46 | 17900 | 9.24 |
| 2700 | 3.00 | 7800 | 5.52 | 12900 | 7.51 | 18000 | 9.28 |
| 2800 | 3.06 | 7900 | 5.58 | 13000 | 7.55 | | |
| 2900 | 3.12 | 8000 | 5.64 | 13100 | 7.59 | | |
| 3000 | 3.18 | 8100 | 5.69 | 13200 | 7.65 | | |
| 3100 | 3.24 | 8200 | 5.75 | 13300 | 7.69 | | |
| 3200 | 3.30 | 8300 | 5.80 | 13400 | 7.72 | | |
| 3300 | 3.35 | 8400 | 5.84 | 13500 | 7.78 | | |
| 3400 | 3.42 | 8500 | 5.90 | 13600 | 7.82 | | |
| 3500 | 3.46 | 8600 | 5.97 | 13700 | 7.86 | | |
| 3600 | 3.52 | 8700 | 5.99 | 13800 | 7.91 | | |
| 3700 | 3.57 | 8800 | 6.04 | 13900 | 7.96 | | |
| 3800 | 3.61 | 8900 | 6.10 | 14000 | 8.01 | | |
| 3900 | 3.67 | 9000 | 6.13 | 14100 | 8.06 | | |
| 4000 | 3.71 | 9100 | 6.17 | 14200 | 8.10 | | |
| 4100 | 3.77 | 9200 | 6.23 | 14300 | 8.13 | | |
| 4200 | 3.83 | 9300 | 6.27 | 14400 | 8.16 | | |
| 4300 | 3.89 | 9400 | 6.30 | 14500 | 8.19 | | |
| 4400 | 3.94 | 9500 | 6.35 | 14600 | 8.21 | | |
| 4500 | 4.00 | 9600 | 6.37 | 14700 | 8.23 | | |
| 4600 | 4.05 | 9700 | 6.40 | 14800 | 8.26 | | |
| 4700 | 4.10 | 9800 | 6.44 | 14900 | 8.28 | | |
| 4800 | 4.16 | 9900 | 6.45 | 15000 | 8.30 | | |

**Cable loss**
**Low Loss Armored Test Cable, MegaPhase, 18 GHz, 6.2 m, N type-M/N type-M,**
**NC29-N1N1-244S/N 12025101 003,**
**HL 4353**

| Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB |
|---|---|---|---|
| 50 | 0.20 | 9000 | 2.71 |
| 100 | 0.27 | 9500 | 2.81 |
| 300 | 0.47 | 10000 | 2.90 |
| 500 | 0.61 | 10500 | 2.97 |
| 1000 | 0.87 | 11000 | 3.06 |
| 1500 | 1.07 | 11500 | 3.13 |
| 2000 | 1.24 | 12000 | 3.20 |
| 2500 | 1.39 | 12500 | 3.26 |
| 3000 | 1.53 | 13000 | 3.34 |
| 3500 | 1.65 | 13500 | 3.39 |
| 4000 | 1.77 | 14000 | 3.47 |
| 4500 | 1.89 | 14500 | 3.54 |
| 5000 | 1.99 | 15000 | 3.62 |
| 5500 | 2.07 | 15500 | 3.69 |
| 6000 | 2.20 | 16000 | 3.76 |
| 6500 | 2.30 | 16500 | 3.83 |
| 7000 | 2.39 | 17000 | 3.86 |
| 7500 | 2.51 | 17500 | 3.94 |
| 8000 | 2.58 | 18000 | 4.02 |
| 8500 | 2.65 | | |

**Cable loss**
**Low Loss Armored Test Cable, MegaPhase, 18 GHz, 4.5 m, N type-M/N type-M, NC29-N1N1-177, S/N 51300101 002**
**HL 4720**

| Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB |
|---|---|---|---|
| 50 | 0.14 | 9000 | 2.10 |
| 100 | 0.21 | 9500 | 2.26 |
| 300 | 0.36 | 10000 | 2.39 |
| 500 | 0.46 | 10500 | 2.36 |
| 1000 | 0.66 | 11000 | 2.36 |
| 1500 | 0.81 | 11500 | 2.44 |
| 2000 | 0.93 | 12000 | 2.51 |
| 2500 | 1.05 | 12500 | 2.71 |
| 3000 | 1.15 | 13000 | 2.71 |
| 3500 | 1.25 | 13500 | 2.69 |
| 4000 | 1.34 | 14000 | 2.78 |
| 4500 | 1.42 | 14500 | 2.84 |
| 5000 | 1.52 | 15000 | 2.85 |
| 5500 | 1.60 | 15500 | 2.98 |
| 6000 | 1.66 | 16000 | 3.02 |
| 6500 | 1.78 | 16500 | 3.09 |
| 7000 | 1.82 | 17000 | 3.11 |
| 7500 | 1.86 | 17500 | 3.16 |
| 8000 | 1.95 | 18000 | 3.32 |
| 8500 | 2.01 | | |

# 14 APPENDIX F Abbreviations and acronyms

| | |
|---|---|
| A | ampere |
| AC | alternating current |
| AM | amplitude modulation |
| AVRG | average (detector) |
| cm | centimeter |
| dB | decibel |
| dBm | decibel referred to one milliwatt |
| dB(μV) | decibel referred to one microvolt |
| dB(μV/m) | decibel referred to one microvolt per meter |
| dB(μA) | 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 |
| μs | microsecond |
| NA | not applicable |
| NB | narrow band |
| OATS | open area test site |
| Ω | Ohm |
| PM | pulse modulation |
| PS | power supply |
| ppm | part per million ($10^{-6}$) |
| QP | quasi-peak |
| RE | radiated emission |
| RF | radio frequency |
| rms | root mean square |
| Rx | receive |
| s | second |
| T | temperature |
| Tx | transmit |
| V | volt |
| WB | wideband |

END OF DOCUMENT