HERMON LABORATORIES

ELECTRICAL TESTING
0839.01

Hermon Laboratories Ltd.
P.O. Box 23, Binyamina 3055001, Israel
Tel. +972 4628 8001
Fax. +972 4628 8277
E-mail: mail@hermonlabs.com

# TEST REPORT

**ACCORDING TO:**

**FCC 47CFR part 15 subpart C §15.247 (DTS) and subpart B,**
**RSS-247 Issue 2:2017, ICES-003 Issue 6:2016**

**FOR:**

## Wireless Systems Solutions LLC
## Remote Radio Head (RRH)
## Part Number: ARRH-048-85
## FCC ID: 2AWXX-ARRH04885CVT

This report is in conformity with ISO/ IEC 17025. The "A2LA Accredited" symbol endorsement applies only to the tests and calibrations that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested. This test report shall not be reproduced in any form except in full with the written approval of Hermon Laboratories Ltd.

# Table of contents

1 Applicant information ... 3
2 Equipment under test attributes ... 3
3 Manufacturer information ... 3
4 Test details ... 3
5 Tests summary ... 4
6 EUT description ... 5
6.1 General information ... 5
6.2 Test configuration ... 6
6.3 Changes made in EUT ... 6
6.4 Transmitter characteristics ... 7
7 Transmitter tests according to 47CFR part 15 subpart C requirements ... 8
7.1 Minimum 6 dB bandwidth ... 8
7.2 Peak output power ... 16
7.3 Field strength of spurious emissions ... 21
7.4 Spurious emissions at RF antenna connector for one beam configuration ... 33
7.5 Spurious emissions at RF antenna connector for 3 non overlapping beam configuration ... 181
7.6 Band edge emissions at RF antenna connector for one beam configuration ... 305
7.7 Band edge emissions at RF antenna connector for 3 non overlapping beam configuration ... 346
7.8 Peak spectral power density ... 383
7.9 Conducted emissions for 3 non overlapping beam configuration ... 436
7.10 Antenna requirements ... 439
8 Emission tests according to 47CFR part 15 subpart B requirements ... 440
8.1 Conducted emissions for 3 non overlapping beam configuration ... 440
8.2 Radiated emission measurements for 3 non overlapping beam configuration ... 443
9 APPENDIX A Test equipment and ancillaries used for tests ... 446
10 APPENDIX B Test equipment correction factors ... 448
11 APPENDIX C Test laboratory description ... 455
12 APPENDIX D Measurement uncertainties ... 456
13 APPENDIX E Specification references ... 457
14 APPENDIX F Abbreviations and acronyms ... 458

# 1 Applicant information

| | |
|---|---|
| **Client name:** | Wireless Systems Solutions LLC |
| **Address:** | 630 Davis Dr Suite 250, Morrisville, North Carolina 27703, USA |
| **Telephone:** | +972-55-9206877 |
| **Fax:** | NA |
| **E-mail:** | boaz@wirelesss2.net |
| **Contact name:** | Mr. Boaz Reuven |

# 2 Equipment under test attributes

| | |
|---|---|
| **Product name:** | Remote Radio Head (RRH) |
| **Product type:** | Transceiver |
| **Part Number:** | ARRH-048-85 |
| **Serial number:** | 00036 |
| **Hardware version:** | C3 |
| **Software release:** | 1.2.13 |
| **Receipt date** | 20-Mar-20 |

# 3 Manufacturer information

| | |
|---|---|
| **Manufacturer name:** | MC Assembly* |
| **Manufacturer name*:** | SMTC Corporation Acquires MC Assembly Holdings, Inc. |
| **Address:** | 425 North Dr, Melbourne, FL 32934, USA |
| **Telephone:** | 321-253-0541 |
| **Fax:** | NA |
| **E-Mail:** | blair.chendler@smtc.com |
| **Contact name:** | Mr. Blair Chendler |

# 4 Test details

| | |
|---|---|
| **Project ID:** | 31957 |
| **Location:** | Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel |
| **Test started:** | 05-Apr-20 |
| **Test completed:** | 24-May-20 |
| **Test specification(s):** | FCC 47CFR part 15 subpart C §15.247 (DTS) and subpart B,<br>RSS-247 Issue 2:2017, ICES-003 Issue 6:2016 |

# 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 | Pass |
| **Unintentional emissions** | |
| FCC section 15.107/ ICES-003, Section 6.1, Class B, Conducted emission | Pass |
| FCC section 15.109/ RSS-Gen section 7.1.2 /ICES-003, Section 6.2, Class B, Radiated emission | Pass |

This test report supersedes the previously issued test report identified by Doc ID: DAGRAD_FCC.31957_RRH

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

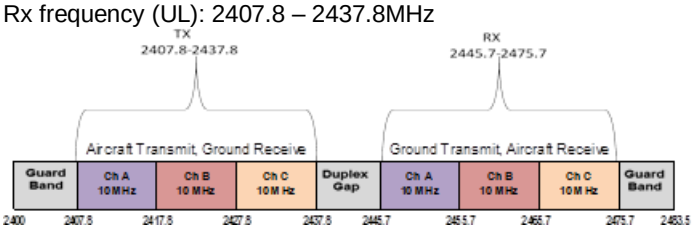
| | Name and Title | Date | Signature |
|---|---|---|---|
| **Tested by:** | Mr. A. Morozov, test engineer, EMC & Radio | 05-Apr-20 – 24-May-20 | |
| **Reviewed by:** | Mrs. S. Peysahov Sheynin, test engineer, EMC & Radio | 05-Aug-20 | |
| **Approved by:** | Mr. S. Samokha, technical manager, EMC & Radio | 06-Aug-20 | |

# 6 EUT description

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

## 6.1 General information

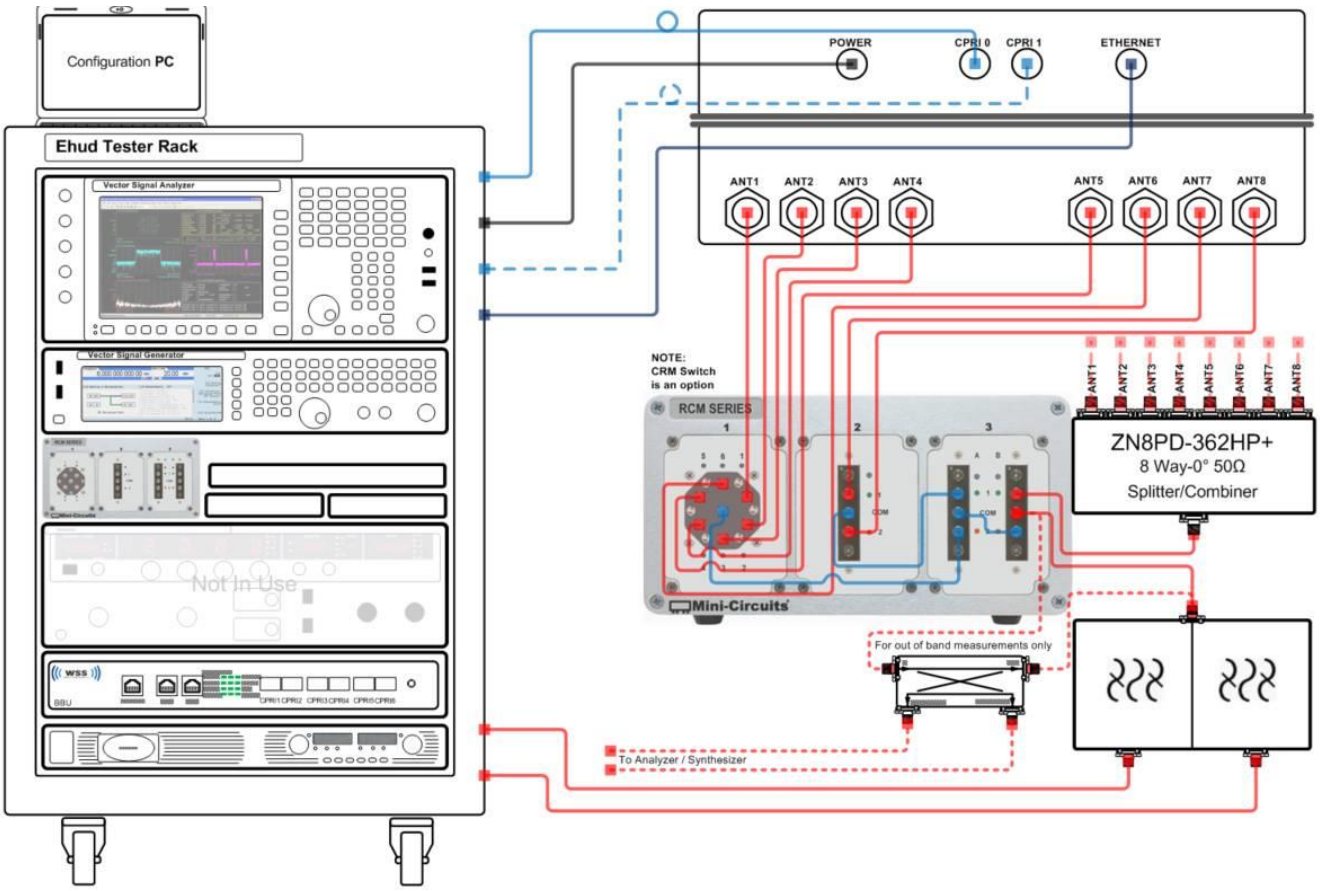
The System is intended for In-Flight Entertainment (IFE) and does not include any flight-critical data.
The system provides a broadband air to ground connectivity within the network, providing a multi-megabit, bi-directional throughput with low latency.
Tx frequency (DL): 2445.7 – 2475.7MHz
Rx frequency (UL): 2407.8 – 2437.8MHz




| | (UL) ABR Transmit QPSK or 16QAM | | (DL) RRH Transmit QPSK or 16QAM or 64QA | |
|---|---|---|---|---|
| Channel | Center Frequency | BW | Center Frequency | BW |
| A1 | 2410.3MHz | 5MHz | 2448.2MHz | 5MHz |
| A2 | 2415.3MHz | 5MHz | 2453.2MHz | 5MHz |
| B1 | 2420.3MHz | 5MHz | 2458.2MHz | 5MHz |
| B2 | 2425.3MHz | 5MHz | 2463.2MHz | 5MHz |
| C1 | 2430.3MHz | 5MHz | 2468.2MHz | 5MHz |
| C2 | 2435.3MHz | 5MHz | 2473.2MHz | 5MHz |
| A | 2412.8MHz | 10MHz | 2450.7MHz | 10MHz |
| B | 2422.8MHz | 10MHz | 2460.7MHz | 10MHz |
| C | 2432.8MHz | 10MHz | 2470.7MHz | 10MHz |

The system generates the LTE signal(s) in two modes, loopback and streamed data.
In loopback mode, the IQ data from the Rx port loops back (inside the FPGA) to the Tx while the other mode takes the streamed IQ (inside the FPGA).
Tx unit can transmit up to 34dBm at its Tx port.

## 6.2 Test configuration




## 6.3 Changes made in EUT

No changes were implemented in the EUT during testing.

## 6.4 Transmitter characteristics

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

| Intended use | | Condition of use |
|---|---|---|
| X | fixed | Always at a distance more than 2 m from all people |
| | 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 range** | 2400-2483.5 MHz |
| **Operating frequency** | 2448.2-2473.2 MHz |

| | | |
|---|---|---|
| **Maximum rated output power** | **Peak output power** | 27.64 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 |
| External | CCI | BFA8F-A5A | 18 dBi |

| | |
|---|---|
| **Modulation** | QPSK / 16QAM / 64QAM |
| **Transmitter aggregate data rate/s** | 22.15Mbps |
| **Modulating test signal (baseband)** | OFDM |

| Transmitter power source | | | | | |
|---|---|---|---|---|---|
| | Battery | **Nominal rated voltage** | VDC | Battery type | |
| X | DC | **Nominal rated voltage** | 48 VDC | | |
| | AC mains | **Nominal rated voltage** | | Frequency | |

| | | |
|---|---|---|
| **Spread spectrum technique used** | | Frequency hopping (FHSS) |
| | X | Digital transmission system (DTS) |
| | | Hybrid |

| | | | |
|---|---|---|---|
| **Test specification:** | **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):** | 13-Jun-19 | | |
| **Temperature:** 24.1 ºC | **Relative Humidity:** 46 % | **Air Pressure:** 1008 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

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

## 7.1 Minimum 6 dB bandwidth

### 7.1.1 General

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

**Table 7.1.1 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.

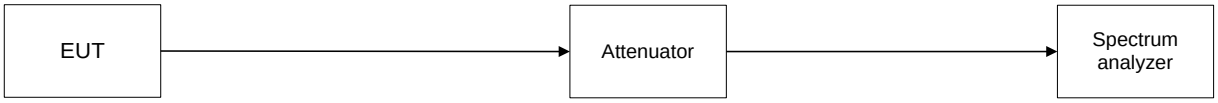
### 7.1.2 Test procedure

**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 RBW=100 kHz as frequency delta between reference points on modulation envelope and provided in Table 7.1.2 and associated plot.

**Figure 7.1.1 6 dB bandwidth test setup**



| | | | |
|---|---|---|---|
| **Test specification:** | **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):** | 13-Jun-19 | | |
| **Temperature:** 24.1 ºC | **Relative Humidity:** 46 % | **Air Pressure:** 1008 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

**Table 7.1.2 6 dB bandwidth test results**

ASSIGNED FREQUENCY BAND: 2400.0 - 2483.5 MHz
DETECTOR USED: Peak
SWEEP MODE: Max hold
SWEEP TIME: Auto
RESOLUTION BANDWIDTH: 100 kHz
VIDEO BANDWIDTH: 300 kHz
MODULATION ENVELOPE REFERENCE POINTS: 6.0 dBc

EMISSION BANDWIDTH: 5MHz

| Carrier frequency, MHz | 6 dB bandwidth, kHz | Limit, kHz | Margin, kHz* | Verdict |
|---|---|---|---|---|
| **QPSK** | | | | |
| 2448.2 | 4548 | 500 | 4048 | Pass |
| 2458.2 | 4533 | 500 | 4033 | Pass |
| 2473.2 | 4514 | 500 | 4014 | Pass |
| **16QAM** | | | | |
| 2448.2 | 4534 | 500 | 4034 | Pass |
| 2458.2 | 4538 | 500 | 4038 | Pass |
| 2473.2 | 4507 | 500 | 4007 | Pass |
| **64QAM** | | | | |
| 2448.2 | 4497 | 500 | 3997 | Pass |
| 2458.2 | 4533 | 500 | 4033 | Pass |
| 2473.2 | 4472 | 500 | 3972 | Pass |

EMISSION BANDWIDTH: 10MHz

| Carrier frequency, MHz | 6 dB bandwidth, kHz | Limit, kHz | Margin, kHz* | Verdict |
|---|---|---|---|---|
| **QPSK** | | | | |
| 2450.7 | 9023 | 500 | 8523 | Pass |
| 2460.7 | 9031 | 500 | 8531 | Pass |
| 2470.7 | 9022 | 500 | 8522 | Pass |
| **16QAM** | | | | |
| 2450.7 | 8994 | 500 | 8494 | Pass |
| 2460.7 | 9021 | 500 | 8521 | Pass |
| 2470.7 | 9009 | 500 | 8509 | Pass |
| **64QAM** | | | | |
| 2450.7 | 8972 | 500 | 8472 | Pass |
| 2460.7 | 9026 | 500 | 8526 | Pass |
| 2470.7 | 9030 | 500 | 8530 | Pass |

* - Margin = 6 dB bandwidth – Specification limit

**Reference numbers of test equipment used**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| HL 5175 | HL 5376 | HL 5409 | | | | | | |

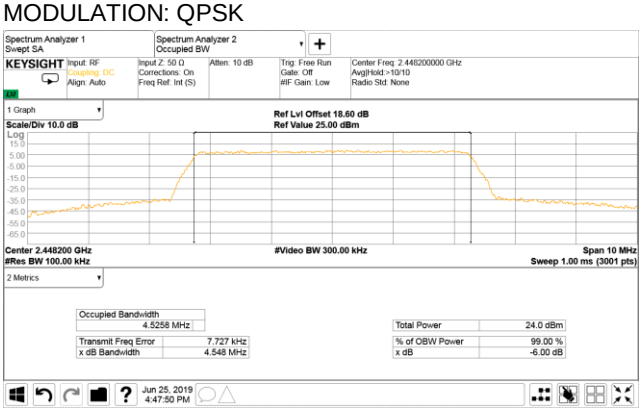
Full description is given in Appendix A.

| | | | |
|---|---|---|---|
| **Test specification:** | **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):** | 13-Jun-19 | | |
| **Temperature:** 24.1 ºC | **Relative Humidity:** 46 % | **Air Pressure:** 1008 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

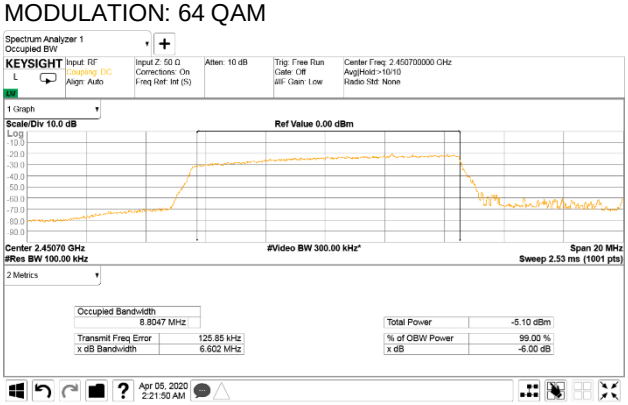
**Plot 7.1.1 6 dB bandwidth test result at low frequency, antenna chain # 1**

CHANNEL BANDWIDTH: 5 MHz

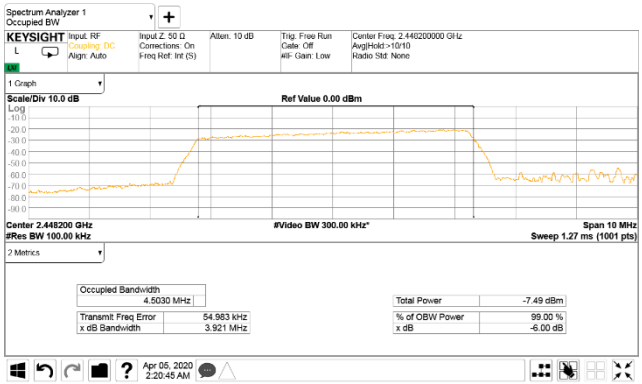
MODULATION: QPSK




MODULATION: 64 QAM




MODULATION: 16 QAM

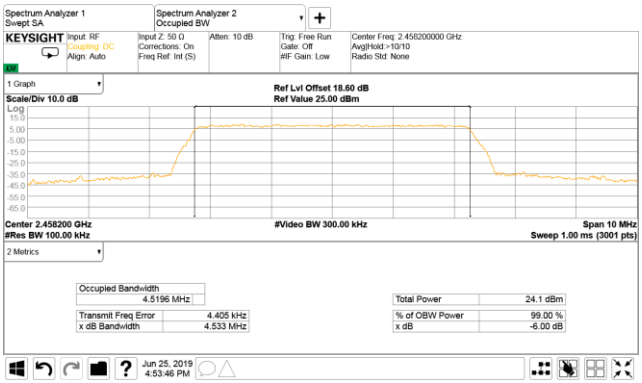


| | | | |
|---|---|---|---|
| **Test specification:** | **Section 15.247(a)2 / RSS-247 section 5.2(1), 6 dB bandwidth** | | |
| **Test procedure:** | ANSI C63.10 section 11.8.1 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date(s):** | 13-Jun-19 | | |
| **Temperature:** 24.1 ºC | **Relative Humidity:** 46 % | **Air Pressure:** 1008 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

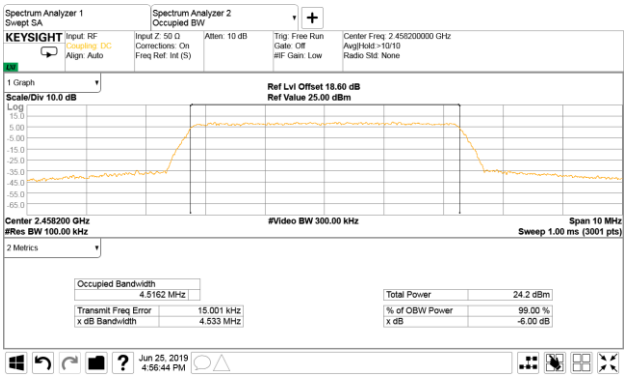
**Plot 7.1.2 6 dB bandwidth test result at mid frequency, antenna chain # 1**

CHANNEL BANDWIDTH: 5 MHz

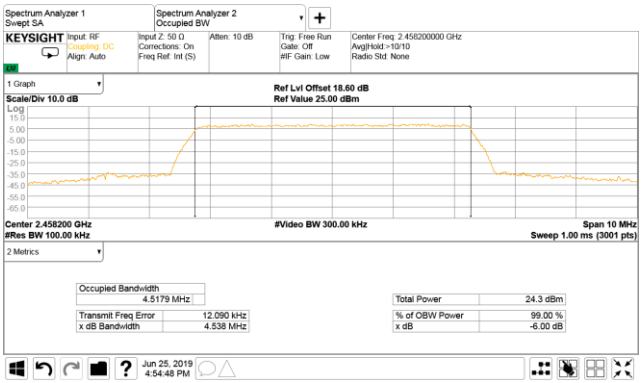
MODULATION: QPSK




MODULATION: 64 QAM




MODULATION: 16 QAM

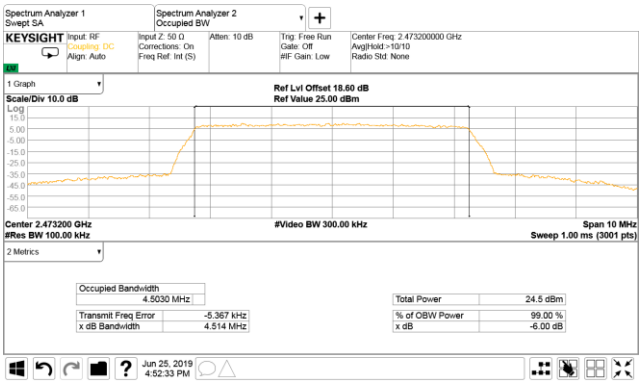


| | | | |
|---|---|---|---|
| **Test specification:** | **Section 15.247(a)2 / RSS-247 section 5.2(1), 6 dB bandwidth** | | |
| **Test procedure:** | ANSI C63.10 section 11.8.1 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date(s):** | 13-Jun-19 | | |
| **Temperature:** 24.1 ºC | **Relative Humidity:** 46 % | **Air Pressure:** 1008 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

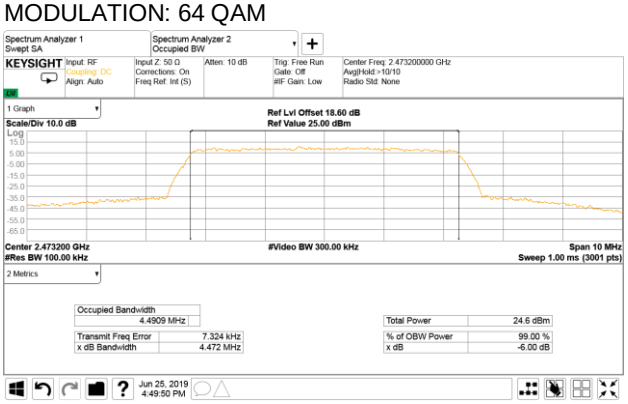
**Plot 7.1.3 6 dB bandwidth test result at high frequency, antenna chain # 1**

CHANNEL BANDWIDTH: 5 MHz

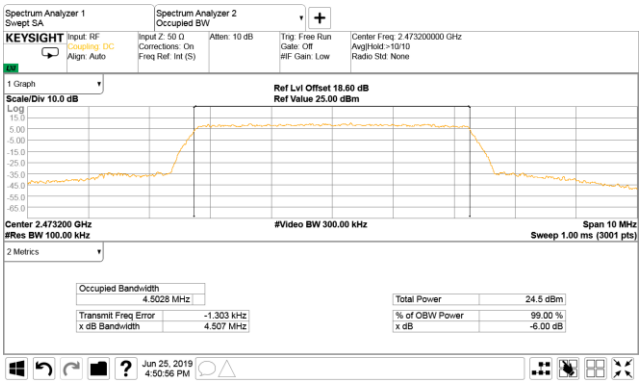
MODULATION: QPSK




MODULATION: 64 QAM




MODULATION: 16 QAM

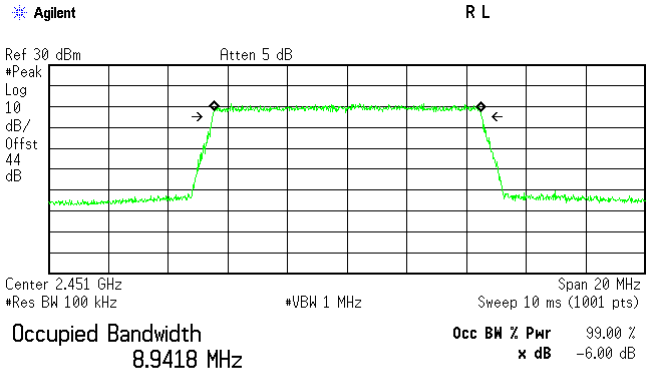


| | | | |
|---|---|---|---|
| **Test specification:** | **Section 15.247(a)2 / RSS-247 section 5.2(1), 6 dB bandwidth** | | |
| **Test procedure:** | ANSI C63.10 section 11.8.1 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date(s):** | 13-Jun-19 | | |
| **Temperature:** 24.1 ºC | **Relative Humidity:** 46 % | **Air Pressure:** 1008 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

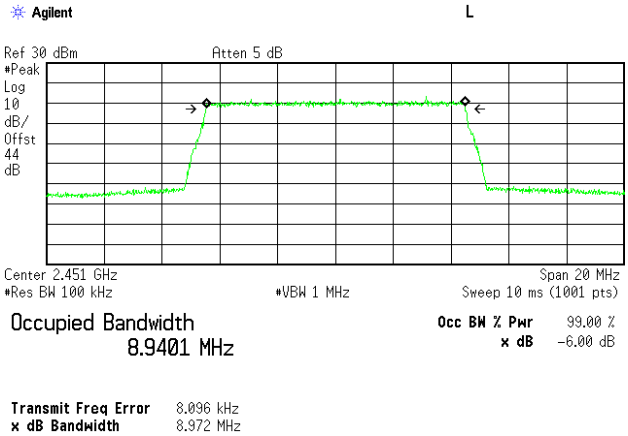
**Plot 7.1.4 6 dB bandwidth test result at low frequency, antenna chain # 1**

CHANNEL BANDWIDTH: 10 MHz

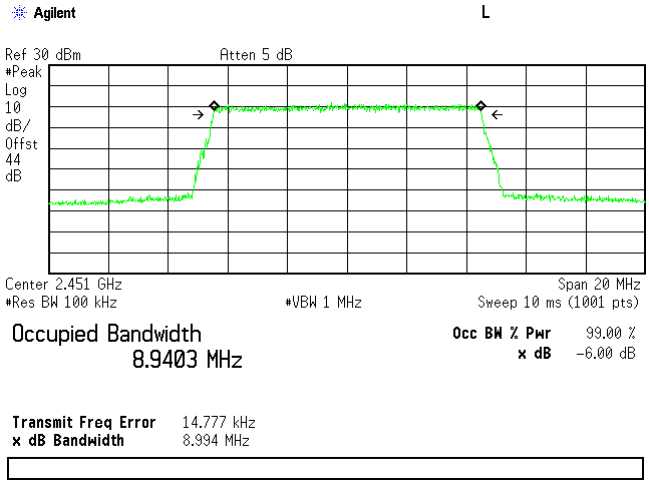
MODULATION: QPSK




MODULATION: 64 QAM




MODULATION: 16 QAM

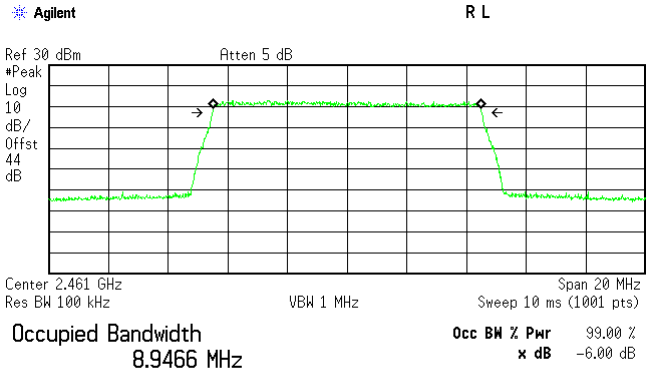


| | | | |
|---|---|---|---|
| **Test specification:** | **Section 15.247(a)2 / RSS-247 section 5.2(1), 6 dB bandwidth** | | |
| **Test procedure:** | ANSI C63.10 section 11.8.1 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date(s):** | 13-Jun-19 | | |
| **Temperature:** 24.1 ºC | **Relative Humidity:** 46 % | **Air Pressure:** 1008 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

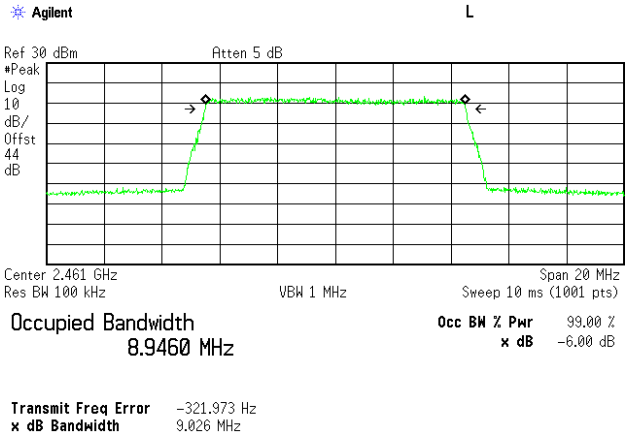
**Plot 7.1.5 6 dB bandwidth test result at mid frequency, antenna chain # 1**

CHANNEL BANDWIDTH: 10 MHz

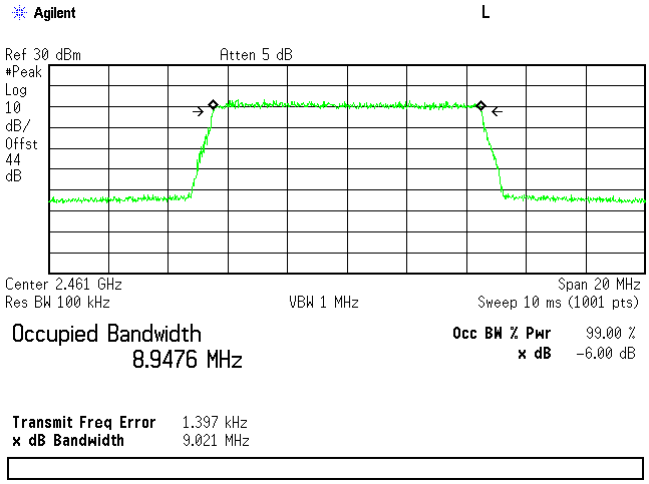
MODULATION: QPSK




MODULATION: 64 QAM




MODULATION: 16 QAM

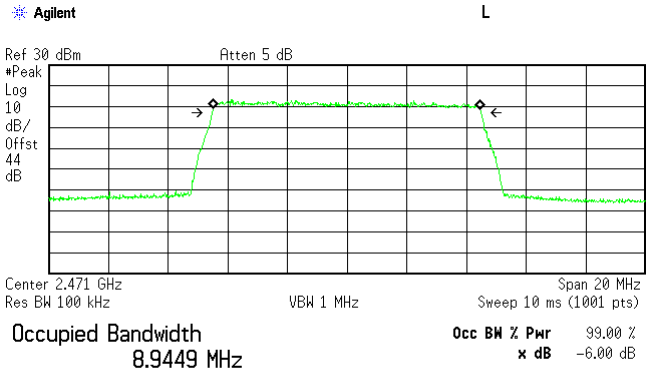


| | | | |
|---|---|---|---|
| **Test specification:** | **Section 15.247(a)2 / RSS-247 section 5.2(1), 6 dB bandwidth** | | |
| **Test procedure:** | ANSI C63.10 section 11.8.1 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date(s):** | 13-Jun-19 | | |
| **Temperature:** 24.1 ºC | **Relative Humidity:** 46 % | **Air Pressure:** 1008 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

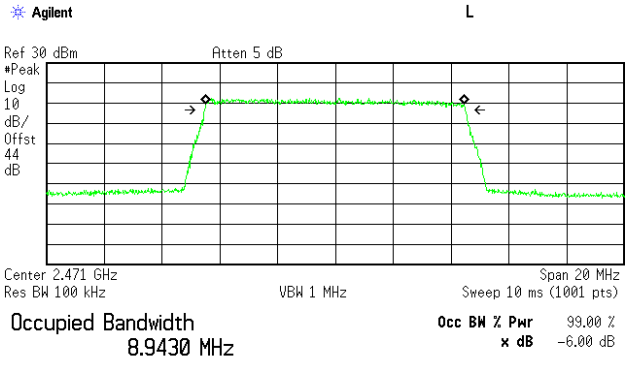
**Plot 7.1.6 6 dB bandwidth test result at high frequency, antenna chain # 1**

CHANNEL BANDWIDTH: 10 MHz

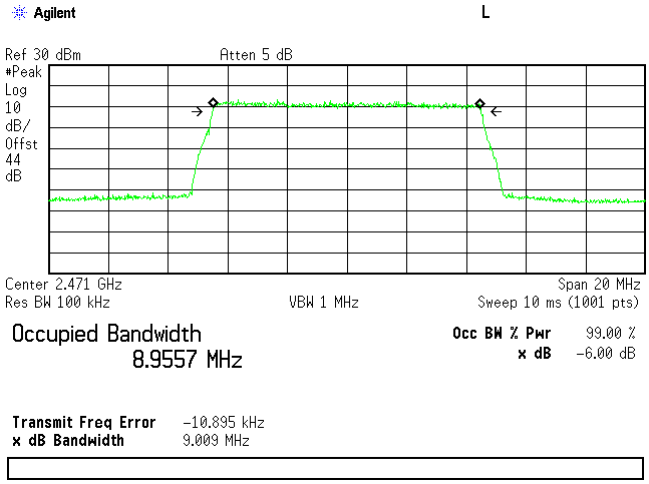
MODULATION: QPSK




MODULATION: 64 QAM




MODULATION: 16 QAM



| Test specification: | Section 15.247(b)3 / RSS-247 section 5.4(4), Peak output power | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.9 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 12-Jun-19 - 31-Jul-19 | | |
| Temperature: 24 ºC | Relative Humidity: 44 % | Air Pressure: 1004 hPa | Power: 48 VDC |
| Remarks: | | | |

## 7.2 Peak output power

### 7.2.1 General

This test was performed to measure the maximum peak output power at the transmitter RF antenna connector. 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* | |
|---|---|---|---|
| | | W | dBm |
| 902.0 – 928.0 | 6.0 | 1.0 | 30.0 |
| **2400.0 – 2483.5** | | | |
| 5725.0 – 5850.0 | | | |

*- If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power limit shall be reduced below the stated value as follows:

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

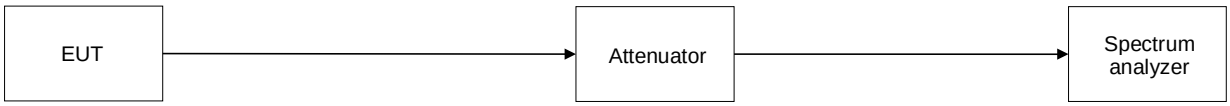
### 7.2.2 Test procedure

**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 for end user RF output power.

**7.2.2.3** The worst test results (the lowest margins) were recorded in Table 7.2.2 and Table 7.2.3.

**Figure 7.2.1 Peak output power test setup**



| | | | |
|---|---|---|---|
| **Test specification:** | **Section 15.247(b)3 / RSS-247 section 5.4(4), Peak output power** | | |
| **Test procedure:** | ANSI C63.10 section 11.9 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date(s):** | 12-Jun-19 - 31-Jul-19 | | |
| **Temperature:** 24 ºC | **Relative Humidity:** 44 % | **Air Pressure:** 1004 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

**Table 7.2.2 Peak output power test results for one beam**

ASSIGNED FREQUENCY: 2400.0 - 2483.5 MHz
MODULATING SIGNAL: PRBS
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
DETECTOR USED: Average

EUT 6 dB BANDWIDTH: 5 MHz

| Carrier frequency, MHz | Chain, #1, dBm | Chain, #2, dBm | Chain, #3, dBm | Chain, #4, dBm | Chain, #5, dBm | Chain, #6, dBm | Chain, #7, dBm | Chain, #8, dBm | Sum power, dBm |
|---|---|---|---|---|---|---|---|---|---|
| **Modulation QPSK** | | | | | | | | | |
| 2448.2 | 15.68 | 14.50 | 14.95 | 14.23 | 13.85 | 14.02 | 15.10 | 14.90 | 23.69 |
| 2458.2 | 15.14 | 14.12 | 14.77 | 14.15 | 13.80 | 14.06 | 14.87 | 15.15 | 23.54 |
| 2473.2 | 15.92 | 14.50 | 15.22 | 14.35 | 14.17 | 14.00 | 15.12 | 15.08 | 23.84 |
| **Modulation 16QAM** | | | | | | | | | |
| 2448.2 | 15.70 | 14.40 | 14.95 | 14.23 | 13.85 | 14.05 | 15.00 | 14.77 | 23.66 |
| 2458.2 | 15.54 | 14.13 | 14.76 | 14.16 | 13.80 | 14.05 | 14.87 | 15.16 | 23.60 |
| 2473.2 | 15.93 | 14.6 | 15.23 | 14.35 | 14.20 | 14.00 | 15.15 | 15.20 | 23.88 |
| **Modulation 64QAM** | | | | | | | | | |
| 2448.2 | 14.77 | 14.43 | 14.96 | 14.24 | 13.85 | 14.02 | 15.05 | 14.77 | 23.53 |
| 2458.2 | 15.59 | 14.14 | 14.78 | 14.15 | 13.80 | 14.05 | 14.85 | 15.20 | 23.61 |
| 2473.2 | 15.92 | 14.50 | 15.25 | 14.35 | 14.18 | 14.00 | 15.09 | 15.12 | 23.85 |

| Carrier frequency, MHz | Sum power, dBm | External attenuation, dB | Cable loss, dB | Total power, dBm | Limit, dBm | Margin*, dB | Verdict |
|---|---|---|---|---|---|---|---|
| **Modulation QPSK** | | | | | | | |
| 2448.2 | 23.69 | Included | 1.23 | 22.46 | 23.00 | -0.54 | Pass |
| 2458.2 | 23.54 | Included | 1.23 | 22.31 | 23.00 | -0.69 | Pass |
| 2473.2 | 23.84 | Included | 1.23 | 22.61 | 23.00 | -0.39 | Pass |
| **Modulation 16QAM** | | | | | | | |
| 2448.2 | 23.66 | Included | 1.23 | 22.43 | 23.00 | -0.57 | Pass |
| 2458.2 | 23.60 | Included | 1.23 | 22.37 | 23.00 | -0.63 | Pass |
| 2473.2 | 23.88 | Included | 1.23 | 22.65 | 23.00 | -0.35 | Pass |
| **Modulation 64QAM** | | | | | | | |
| 2448.2 | 23.53 | Included | 1.23 | 22.30 | 23.00 | -0.70 | Pass |
| 2458.2 | 23.61 | Included | 1.23 | 22.38 | 23.00 | -0.62 | Pass |
| 2473.2 | 23.85 | Included | 1.23 | 22.62 | 23.00 | -0.38 | Pass |

* - Margin = Total output power – specification limit.
** - Total power = Sum power + External attenuation – Cable loss
*** - Sum output power = ∑10log(Output power per Chain #x/10), where #x = 1,2,…,8 number of chain

| | | | |
|---|---|---|---|
| **Test specification:** | **Section 15.247(b)3 / RSS-247 section 5.4(4), Peak output power** | | |
| **Test procedure:** | ANSI C63.10 section 11.9 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date(s):** | 12-Jun-19 - 31-Jul-19 | | |
| **Temperature:** 24 ºC | **Relative Humidity:** 44 % | **Air Pressure:** 1004 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

EUT 6 dB BANDWIDTH: 10 MHz

| Carrier frequency, MHz | Chain, #1, dBm | Chain, #2, dBm | Chain, #3, dBm | Chain, #4, dBm | Chain, #5, dBm | Chain, #6, dBm | Chain, #7, dBm | Chain, #8, dBm | Sum power, dBm |
|---|---|---|---|---|---|---|---|---|---|
| **Modulation QPSK** | | | | | | | | | |
| 2450.7 | 15.65 | 14.40 | 15.05 | 14.27 | 13.82 | 13.91 | 15.10 | 15.01 | 23.69 |
| 2460.7 | 15.45 | 13.96 | 14.60 | 13.90 | 13.52 | 13.61 | 14.60 | 14.85 | 23.36 |
| 2470.7 | 16.10 | 14.81 | 15.48 | 14.65 | 14.42 | 14.10 | 15.42 | 15.40 | 24.09 |
| **Modulation 16QAM** | | | | | | | | | |
| 2450.7 | 15.74 | 14.46 | 15.13 | 14.35 | 13.92 | 14.02 | 15.16 | 15.08 | 23.77 |
| 2460.7 | 15.45 | 13.95 | 14.61 | 13.92 | 13.60 | 13.62 | 14.62 | 14.92 | 23.38 |
| 2470.7 | 16.14 | 14.85 | 15.20 | 14.70 | 14.50 | 14.15 | 15.45 | 15.43 | 24.09 |
| **Modulation 64QAM** | | | | | | | | | |
| 2450.7 | 15.78 | 14.50 | 15.20 | 14.38 | 13.95 | 14.05 | 15.18 | 15.10 | 23.81 |
| 2460.7 | 15.47 | 13.98 | 14.61 | 13.96 | 13.60 | 13.62 | 14.65 | 14.93 | 23.40 |
| 2470.7 | 16.17 | 14.86 | 15.30 | 14.70 | 14.30 | 14.20 | 15.45 | 15.43 | 24.10 |

| Carrier frequency, MHz | Sum power, dBm | External attenuation, dB | Cable loss, dB | Total power, dBm | Limit, dBm | Margin*, dB | Verdict |
|---|---|---|---|---|---|---|---|
| **Modulation QPSK** | | | | | | | |
| 2450.7 | 23.69 | Included | 1.23 | 22.46 | 23.00 | -0.54 | Pass |
| 2460.7 | 23.36 | Included | 1.23 | 22.13 | 23.00 | -0.87 | Pass |
| 2470.7 | 24.09 | Included | 1.23 | 22.86 | 23.00 | -0.14 | Pass |
| **Modulation 16QAM** | | | | | | | |
| 2450.7 | 23.77 | Included | 1.23 | 22.54 | 23.00 | -0.46 | Pass |
| 2460.7 | 23.38 | Included | 1.23 | 22.15 | 23.00 | -0.85 | Pass |
| 2470.7 | 24.09 | Included | 1.23 | 22.86 | 23.00 | -0.14 | Pass |
| **Modulation 64QAM** | | | | | | | |
| 2450.7 | 23.81 | Included | 1.23 | 22.58 | 23.00 | -0.42 | Pass |
| 2460.7 | 23.40 | Included | 1.23 | 22.17 | 23.00 | -0.83 | Pass |
| 2470.7 | 24.10 | Included | 1.23 | 22.87 | 23.00 | -0.13 | Pass |

* - Margin = Total output power – specification limit.
** - Total power = Sum power + External attenuation – Cable loss
*** - Sum output power = ∑10log(Output power per Chain #x/10), where #x = 1,2,…,8 number of chain

| | | | |
|---|---|---|---|
| **Test specification:** | **Section 15.247(b)3 / RSS-247 section 5.4(4), Peak output power** | | |
| **Test procedure:** | ANSI C63.10 section 11.9 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date(s):** | 12-Jun-19 - 31-Jul-19 | | |
| **Temperature:** 24 ºC | **Relative Humidity:** 44 % | **Air Pressure:** 1004 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

**Table 7.2.3 Peak output power test results for 3 non-overlapping beams**

ASSIGNED FREQUENCY: 2400.0 - 2483.5 MHz
MODULATING SIGNAL: PRBS
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
DETECTOR USED: Average

CONFIGURATION: Multi-beams
EUT 6 dB BANDWIDTH: 5 MHz

| Carrier frequency, MHz | Chain, #1, dBm | Chain, #2, dBm | Chain, #3, dBm | Chain, #4, dBm | Chain, #5, dBm | Chain, #6, dBm | Chain, #7, dBm | Chain, #8, dBm | Sum power, dBm |
|---|---|---|---|---|---|---|---|---|---|
| **Modulation QPSK** | | | | | | | | | |
| 2448.2 | 19.32 | 19.45 | 19.37 | 19.23 | 18.49 | 19.22 | 19.08 | 19.46 | 28.21 |
| 2458.2 | 19.37 | 19.47 | 19.52 | 19.37 | 18.54 | 19.33 | 19.13 | 19.42 | 28.28 |
| 2473.2 | 19.71 | 19.77 | 19.72 | 19.64 | 18.89 | 19.67 | 19.49 | 19.77 | 28.59 |
| **Modulation 16QAM** | | | | | | | | | |
| 2448.2 | 19.25 | 19.51 | 19.47 | 19.28 | 18.49 | 19.21 | 19.09 | 19.45 | 28.23 |
| 2458.2 | 19.45 | 19.49 | 19.56 | 19.39 | 18.57 | 19.37 | 19.22 | 19.5 | 28.33 |
| 2473.2 | 19.69 | 19.83 | 19.76 | 19.69 | 18.85 | 19.72 | 19.47 | 19.78 | 28.61 |
| **Modulation 64QAM** | | | | | | | | | |
| 2448.2 | 19.24 | 19.49 | 19.46 | 19.3 | 18.47 | 19.19 | 19.07 | 19.47 | 28.22 |
| 2458.2 | 19.33 | 19.53 | 19.57 | 19.32 | 18.5 | 19.38 | 19.27 | 19.45 | 28.31 |
| 2473.2 | 19.65 | 19.88 | 19.78 | 19.64 | 18.88 | 19.71 | 19.48 | 19.72 | 28.60 |

| Carrier frequency, MHz | Sum power, dBm | External attenuation, dB | Cable loss, dB | Total power, dBm | Limit, dBm | Margin*, dB | Verdict |
|---|---|---|---|---|---|---|---|
| **Modulation QPSK** | | | | | | | |
| 2448.2 | 28.21 | Included | 1.23 | 26.98 | 27.77 | -0.79 | Pass |
| 2458.2 | 28.28 | Included | 1.23 | 27.05 | 27.77 | -0.72 | Pass |
| 2473.2 | 28.59 | Included | 1.23 | 27.36 | 27.77 | -0.41 | Pass |
| **Modulation 16QAM** | | | | | | | |
| 2448.2 | 28.23 | Included | 1.23 | 27.00 | 27.77 | -0.77 | Pass |
| 2458.2 | 28.33 | Included | 1.23 | 27.10 | 27.77 | -0.67 | Pass |
| 2473.2 | 28.61 | Included | 1.23 | 27.38 | 27.77 | -0.39 | Pass |
| **Modulation 64QAM** | | | | | | | |
| 2448.2 | 28.22 | Included | 1.23 | 26.99 | 27.77 | -0.78 | Pass |
| 2458.2 | 28.31 | Included | 1.23 | 27.08 | 27.77 | -0.69 | Pass |
| 2473.2 | 28.60 | Included | 1.23 | 27.37 | 27.77 | -0.40 | Pass |

* - Margin = Total output power – specification limit.
** - Total power = Sum power + External attenuation – Cable loss
*** - Sum output power = ∑10log(Output power per Chain #x/10), where #x = 1,2,…,8 number of chain

| | | | |
|---|---|---|---|
| **Test specification:** | **Section 15.247(b)3 / RSS-247 section 5.4(4), Peak output power** | | |
| **Test procedure:** | ANSI C63.10 section 11.9 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date(s):** | 12-Jun-19 - 31-Jul-19 | | |
| **Temperature:** 24 ºC | **Relative Humidity:** 44 % | **Air Pressure:** 1004 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

EUT 6 dB BANDWIDTH: 10 MHz

| Carrier frequency, MHz | Chain, #1, dBm | Chain, #2, dBm | Chain, #3, dBm | Chain, #4, dBm | Chain, #5, dBm | Chain, #6, dBm | Chain, #7, dBm | Chain, #8, dBm | Sum power, dBm |
|---|---|---|---|---|---|---|---|---|---|
| **Modulation QPSK** | | | | | | | | | |
| 2450.7 | 19.93 | 19.99 | 20.09 | 19.93 | 19.26 | 19.87 | 19.86 | 20.01 | 28.87 |
| 2460.7 | 19.86 | 19.99 | 20.02 | 19.82 | 20.06 | 19.80 | 19.84 | 19.44 | 28.86 |
| 2470.7 | 19.84 | 20.01 | 20.14 | 19.78 | 19.22 | 19.86 | 19.88 | 19.99 | 28.85 |
| **Modulation 16QAM** | | | | | | | | | |
| 2450.7 | 19.85 | 20.01 | 20.06 | 19.92 | 19.22 | 19.81 | 19.91 | 20.04 | 28.86 |
| 2460.7 | 19.67 | 19.79 | 19.92 | 19.59 | 20.02 | 19.70 | 19.60 | 19.80 | 28.76 |
| 2470.7 | 19.81 | 19.97 | 20.05 | 19.75 | 19.09 | 19.83 | 19.85 | 19.94 | 28.80 |
| **Modulation 64QAM** | | | | | | | | | |
| 2450.7 | 19.91 | 20.03 | 20.06 | 19.84 | 19.19 | 19.86 | 19.93 | 20.03 | 28.86 |
| 2460.7 | 19.69 | 19.73 | 19.87 | 19.58 | 19.93 | 19.65 | 19.64 | 19.80 | 28.74 |
| 2470.7 | 19.91 | 19.96 | 20.10 | 19.76 | 19.51 | 19.71 | 19.85 | 20.06 | 28.86 |

| Carrier frequency, MHz | Sum power, dBm | External attenuation, dB | Cable loss, dB | Total power, dBm | Limit, dBm | Margin*, dB | Verdict |
|---|---|---|---|---|---|---|---|
| **Modulation QPSK** | | | | | | | |
| 2450.7 | 28.87 | Included | 1.23 | 27.64 | 27.77 | -0.13 | Pass |
| 2460.7 | 28.86 | Included | 1.23 | 27.63 | 27.77 | -0.14 | Pass |
| 2470.7 | 28.85 | Included | 1.23 | 27.62 | 27.77 | -0.15 | Pass |
| **Modulation 16QAM** | | | | | | | |
| 2450.7 | 28.86 | Included | 1.23 | 27.63 | 27.77 | -0.14 | Pass |
| 2460.7 | 28.76 | Included | 1.23 | 27.53 | 27.77 | -0.24 | Pass |
| 2470.7 | 28.80 | Included | 1.23 | 27.57 | 27.77 | -0.20 | Pass |
| **Modulation 64QAM** | | | | | | | |
| 2450.7 | 28.86 | Included | 1.23 | 27.63 | 27.77 | -0.14 | Pass |
| 2460.7 | 28.74 | Included | 1.23 | 27.51 | 27.77 | -0.26 | Pass |
| 2470.7 | 28.86 | Included | 1.23 | 27.63 | 27.77 | -0.14 | Pass |

* - Margin = Total output power – specification limit.
** - Total power = Sum power + External attenuation – Cable loss
*** - Sum output power = ∑10log(Output power per Chain #x/10), where #x = 1,2,…,8 number of chain

**Reference numbers of test equipment used**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL 3301 | HL 3302 | HL 4070 | | | | | |

Full description is given in Appendix A.

| Test specification: | Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.10 section 11.12.1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 12-Jun-19 - 31-Jul-19 | | |
| Temperature: 24 ºC | Relative Humidity: 44 % | Air Pressure: 1004 hPa | Power: 48 VDC |
| 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 – 10th 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, Figure 7.3.3, 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:** | **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):** | 12-Jun-19 - 31-Jul-19 | | |
| **Temperature:** 24 ºC | **Relative Humidity:** 44 % | **Air Pressure:** 1004 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

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

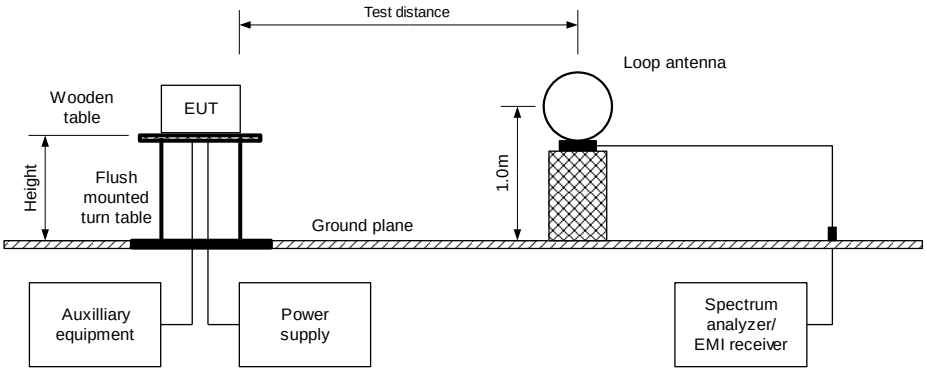
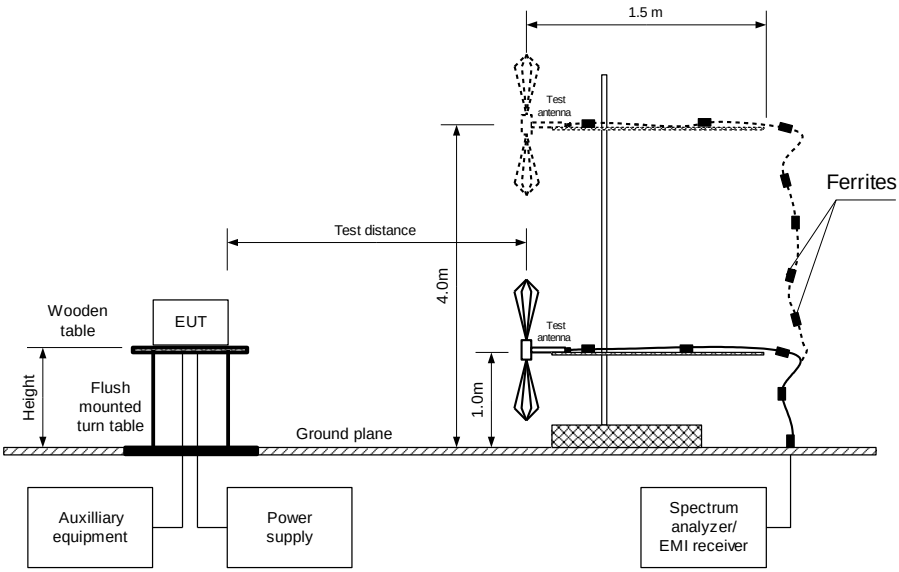
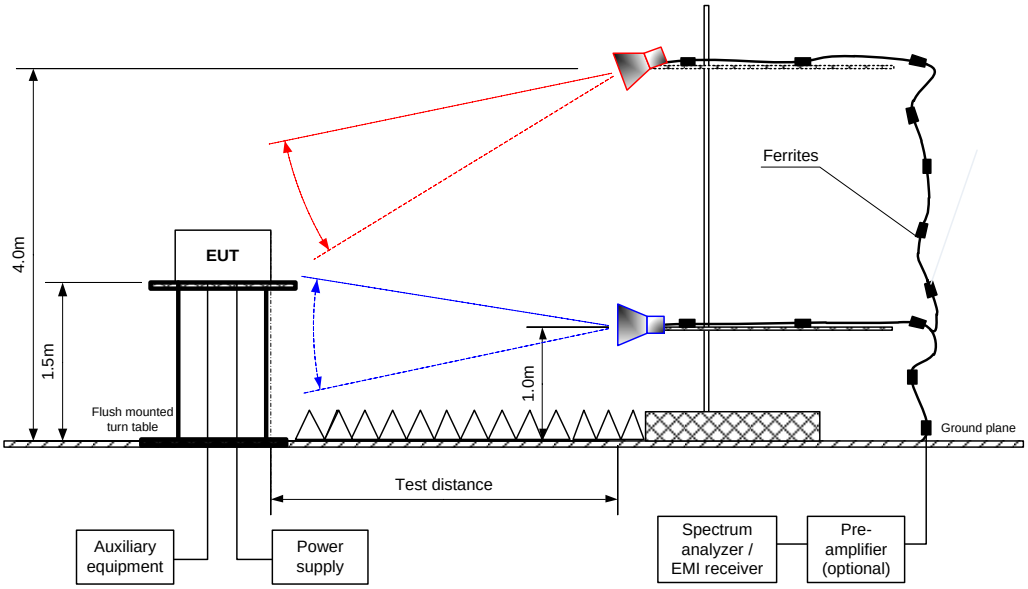



**Figure 7.3.2 Setup for spurious emission field strength measurements in 30 – 1000 MHz**



| | | | |
|---|---|---|---|
| **Test specification:** | **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):** | 12-Jun-19 - 31-Jul-19 | | |
| **Temperature:** 24 ºC | **Relative Humidity:** 44 % | **Air Pressure:** 1004 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

**Figure 7.3.3 Setup for spurious emission field strength measurements above1000 MHz**



| | | | |
|---|---|---|---|
| **Test specification:** | **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):** | 12-Jun-19 - 31-Jul-19 | | |
| **Temperature:** 24 ºC | **Relative Humidity:** 44 % | **Air Pressure:** 1004 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

**Table 7.3.2 Field strength of spurious emissions above 1 GHz within restricted bands**

| | |
|---|---|
| ASSIGNED FREQUENCY: | 2400 – 2483.5 MHz |
| INVESTIGATED FREQUENCY RANGE: | 1000 – 25000 MHz |
| TEST DISTANCE: | 3 m |
| MODULATION: | QPSK |
| MODULATING SIGNAL: | PRBS |
| DUTY CYCLE: | 100 % |
| TRANSMITTER OUTPUT POWER SETTINGS: | Maximum |
| DETECTOR USED: | Peak |
| RESOLUTION BANDWIDTH: | 1000 kHz |
| TEST ANTENNA TYPE: | Double ridged guide |

| 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** | | | | | | | | | | | |
| 1535.500 | V | 2.55 | -144 | 43.52 | 74.0 | -30.48 | 39.55 | NA | 54.0 | -14.45 | Pass |
| **Mid carrier frequency** | | | | | | | | | | | |
| 6881.397 | V | 1.02 | -112 | 55.00 | 74.0 | -19.00 | 40.55 | NA | 54.0 | -13.45 | Pass |
| **High carrier frequency** | | | | | | | | | | | |
| 6389.827 | V | 1.32 | 115 | 50.95 | 74.0 | -23.05 | 42.55 | NA | 54.0 | -11.45 | Pass |
| 6881.397 | V | 1.02 | -112 | 54.67 | 74.0 | -19.33 | 43.55 | NA | 54.0 | -10.45 | |

*****- 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 7.3.3 Average factor calculation**

| Transmission pulse | | Transmission burst | | Transmission train duration, ms | Average factor, dB |
|---|---|---|---|---|---|
| Duration, ms | Period, ms | Duration, ms | Period, ms | | |
| NA | NA | NA | NA | NA | NA |

*- Average factor was calculated as follows

for pulse train shorter than 100 ms: $$Average\,factor = 20\times\log_{10}\left(\frac{Pulse\,duration}{Pulse\,period}\times\frac{Burst\,duration}{Train\,duration}\times Number\,of\,bursts\,within\,pulse\,train\right)$$

for pulse train longer than 100 ms: $$Average\,factor = 20\times\log_{10}\left(\frac{Pulse\,duration}{Pulse\,period}\times\frac{Burst\,duration}{100ms}\times Number\,of\,bursts\,within\,100ms\right)$$

| | | | |
|---|---|---|---|
| **Test specification:** | **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):** | 12-Jun-19 - 31-Jul-19 | | |
| **Temperature:** 24 ºC | **Relative Humidity:** 44 % | **Air Pressure:** 1004 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

**Table 7.3.4 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: | QPSK |
| MODULATING SIGNAL: | PRBS |
| 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>Biconical (30 MHz – 200 MHz)<br>Log periodic (200 MHz – 1000 MHz)<br>Biconilog (30 MHz – 1000 MHz) |

| Frequency, MHz | Peak emission, dB(µV/m) | Quasi-peak | | | Antenna polarization | Antenna height, m | Turn-table position**, degrees | Verdict |
|---|---|---|---|---|---|---|---|---|
| | | Measured emission, dB(µV/m) | Limit, dB(µV/m) | Margin, dB* | | | | |
| **Low carrier frequency** | | | | | | | | |
| 37.644 | 31.36 | 28.99 | 40.0 | -11.01 | Vertical | 1.02 | 180.0 | Pass |
| 73.513 | 28.80 | 26.74 | 40.0 | -13.26 | Vertical | 1.00 | 102.0 | |
| 135.749 | 29.23 | 26.70 | 43.5 | -16.80 | Vertical | 1.00 | -96.0 | |
| **Mid carrier frequency** | | | | | | | | |
| 37.632 | 31.62 | 29.54 | 40.0 | -10.46 | Vertical | 1.04 | 140.0 | Pass |
| 73.489 | 28.76 | 26.84 | 40.0 | -13.16 | Vertical | 1.02 | 102.0 | |
| 132.185 | 29.00 | 26.23 | 43.5 | -17.27 | Vertical | 1.04 | 106.0 | |
| **High carrier frequency** | | | | | | | | |
| 37.616 | 31.23 | 28.97 | 40.0 | -11.03 | Vertical | 1.04 | 129.0 | Pass |
| 73.500 | 28.49 | 26.58 | 40.0 | -13.42 | Vertical | 1.02 | 111.0 | |
| 136.948 | 29.22 | 26.56 | 43.5 | -16.94 | Vertical | 1.02 | -106.0 | |

*****- Margin = Measured emission - specification limit.
******- EUT front panel refer to 0 degrees position of turntable.

| | | | |
|---|---|---|---|
| **Test specification:** | **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):** | 12-Jun-19 - 31-Jul-19 | | |
| **Temperature:** 24 ºC | **Relative Humidity:** 44 % | **Air Pressure:** 1004 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

**Table 7.3.5 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 7.3.6 Restricted bands according to RSS-Gen**

| MHz | MHz | MHz | MHz | MHz | GHz |
|---|---|---|---|---|---|
| 0.09 - 0.11 | 8.291 - 8.294 | 16.80425 - 16.80475 | 399.9 - 410 | 3260 - 3267 | 10.6 - 12.7 |
| 2.1735 - 2.1905 | 8.362 - 8.366 | 25.5 - 25.67 | 608 - 614 | 3332 – 3339 | 13.25 - 13.4 |
| 3.020 – 3.026 | 8.37625 - 8.38675 | 37.5 - 38.25 | 960 – 1427 | 3345.8 – 3358 | 14.47 – 14.5 |
| 4.125 – 4.128 | 8.41425 - 8.41475 | 73 - 74.6 | 1435 – 1626.5 | 3500 – 4400 | 15.35 – 16.2 |
| 4.17725 – 4.17775 | 12.29 – 12.293 | 74.8 - 75.2 | 1645.5 – 1646.5 | 4500 – 5150 | 17.7 – 21.4 |
| 4.20725 – 4.20775 | 12.51975 – 12.52025 | 108 – 138 | 1660 - 1710 | 5350 – 5460 | 22.01 – 23.12 |
| 5.677 – 5.683 | 12.57675 – 12.57725 | 156.52475 – 156.52525 | 1718.8 - 1722.2 | 7250 - 7750 | 23.6 - 24 |
| 6.215 - 6.218 | 13.36 – 13.41 | 156.7 - 156.9 | 2200 - 2300 | 8025 – 8500 | 31.2 - 31.8 |
| 6.26775 - 6.26825 | 16.42 - 16.423 | 240 - 285 | 2310 - 2390 | 9000 - 9200 | 36.43 - 36.5 |
| 6.31175 - 6.31225 | 16.69475 - 16.69525 | 322 - 335.4 | 2655 - 2900 | 9300 - 9500 | Above 38.6 |

**Reference numbers of test equipment used**

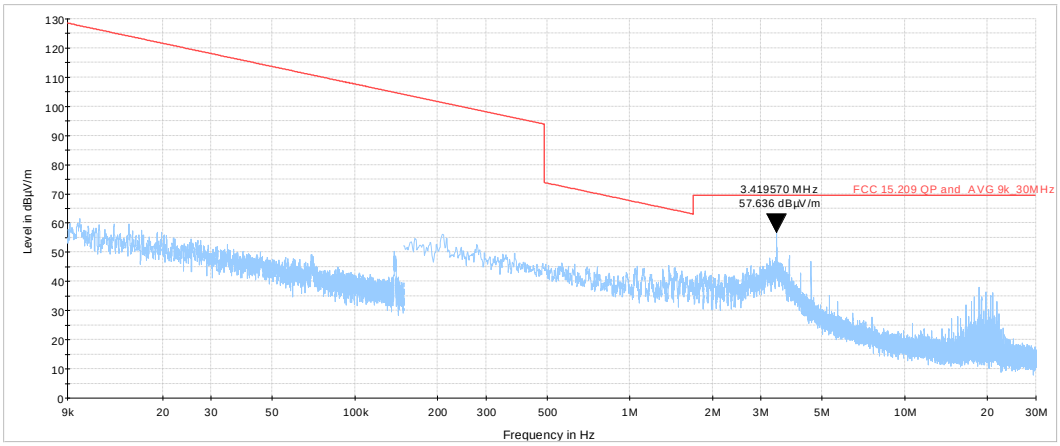
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL1926 | HL4360 | HL5288 | HL4933 | HL4956 | HL5405 | HL3903 | HL5111 |

Full description is given in Appendix A.

| | | | |
|---|---|---|---|
| **Test specification:** | **Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions** | | |
| **Test procedure:** | ANSI C63.10 section 11.12.1 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date(s):** | 12-Jun-19 - 31-Jul-19 | | |
| **Temperature:** 24 ºC | **Relative Humidity:** 44 % | **Air Pressure:** 1004 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

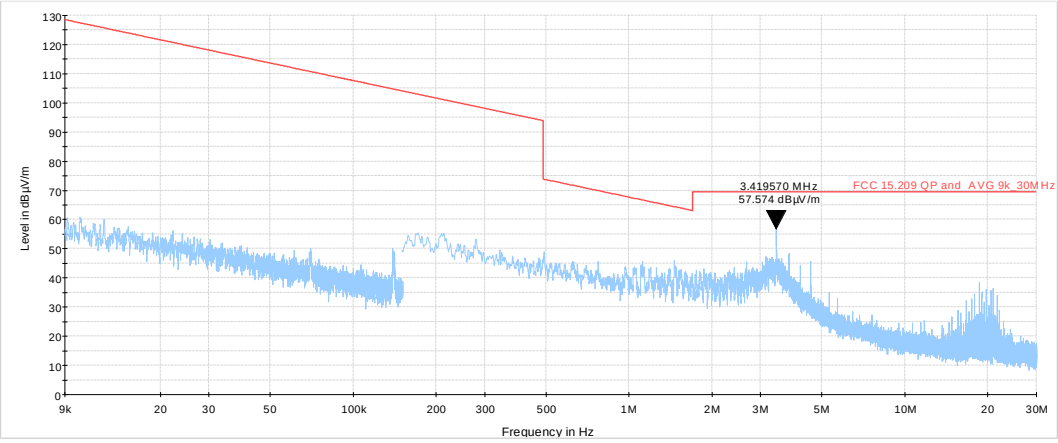
**Plot 7.3.1 Radiated emission measurements from 9 KHz to 30 MHz at low carrier frequency**

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




**Plot 7.3.2 Radiated emission measurements from 9 KHz to 30MHz at mid carrier frequency**

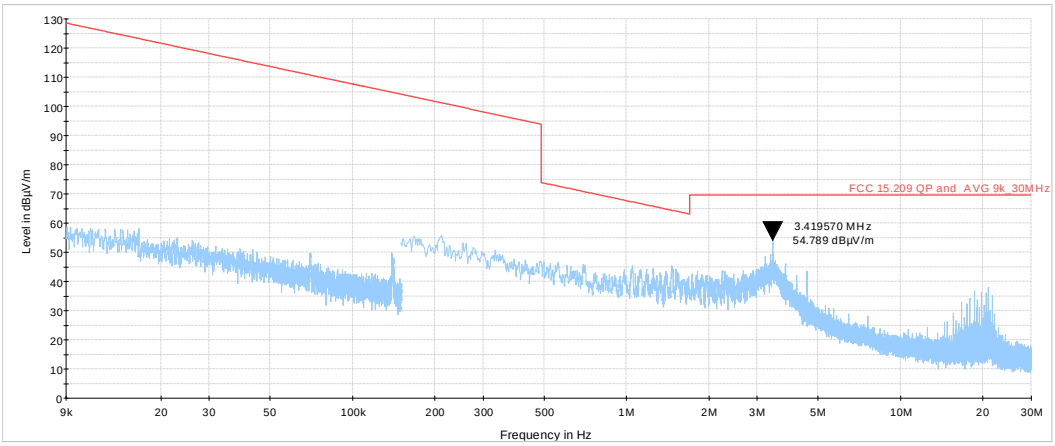
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical/Horizontal



| | | | |
|---|---|---|---|
| **Test specification:** | **Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions** | | |
| **Test procedure:** | ANSI C63.10 section 11.12.1 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date(s):** | 12-Jun-19 - 31-Jul-19 | | |
| **Temperature:** 24 ºC | **Relative Humidity:** 44 % | **Air Pressure:** 1004 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

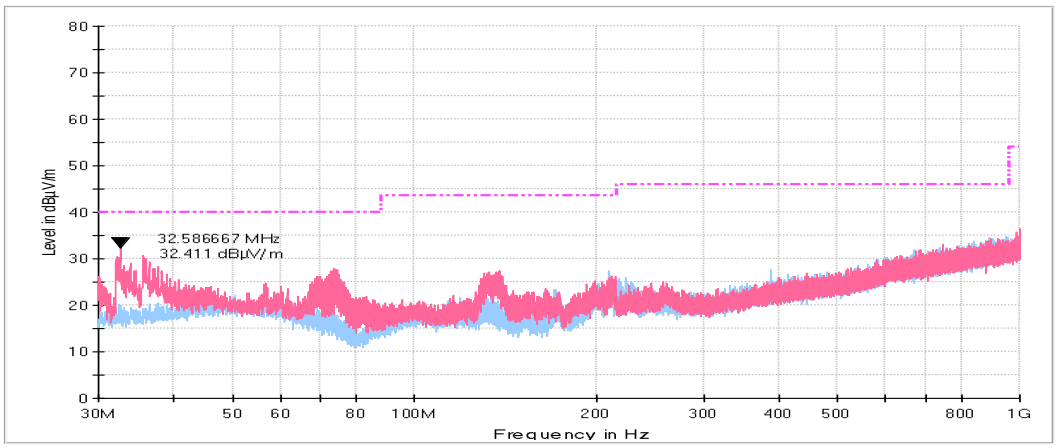
**Plot 7.3.3 Radiated emission measurements from 9 KHz to 30MHz high at carrier frequency**

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




**Plot 7.3.4 Radiated emission measurements from 30 MHz to 1000 MHz low at carrier frequency**

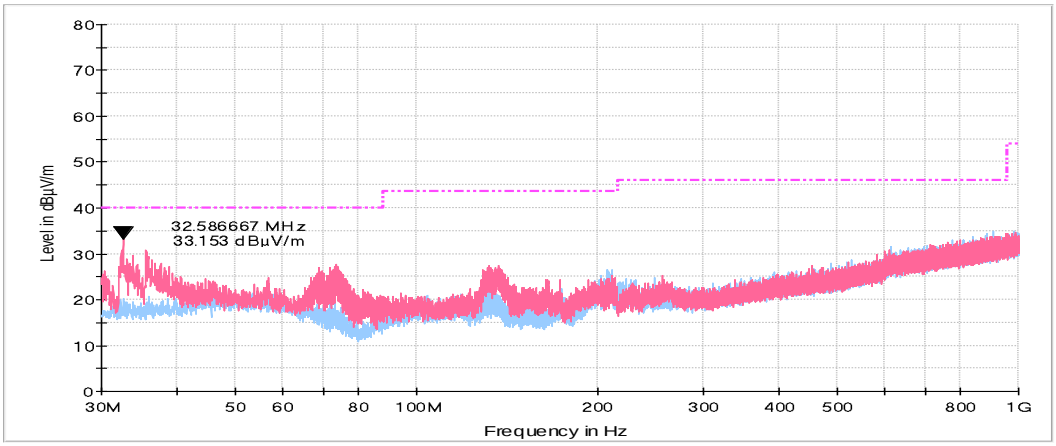
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical/Horizontal



| | | | |
|---|---|---|---|
| **Test specification:** | **Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions** | | |
| **Test procedure:** | ANSI C63.10 section 11.12.1 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date(s):** | 12-Jun-19 - 31-Jul-19 | | |
| **Temperature:** 24 ºC | **Relative Humidity:** 44 % | **Air Pressure:** 1004 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

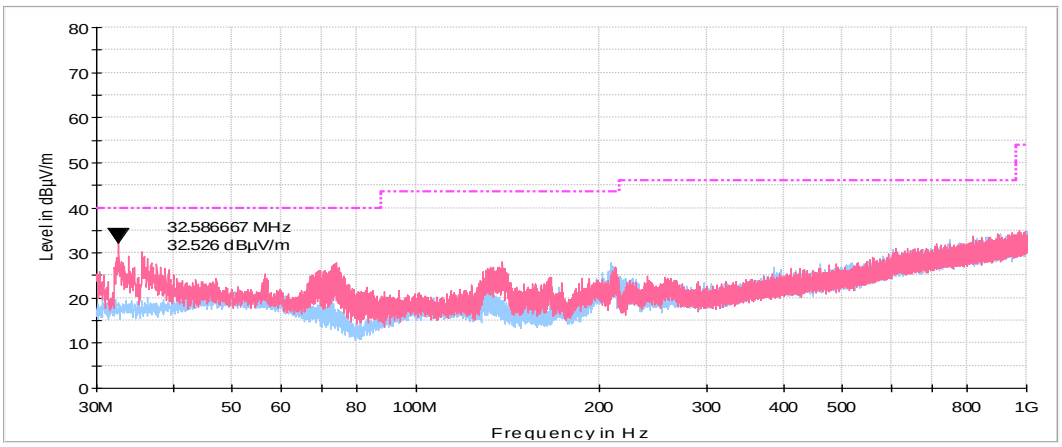
**Plot 7.3.5 Radiated emission measurements from 30 MHz to 1000 MHz mid at carrier frequency**

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




**Plot 7.3.6 Radiated emission measurements from 30 MHz to 1000 MHz at high carrier frequency**

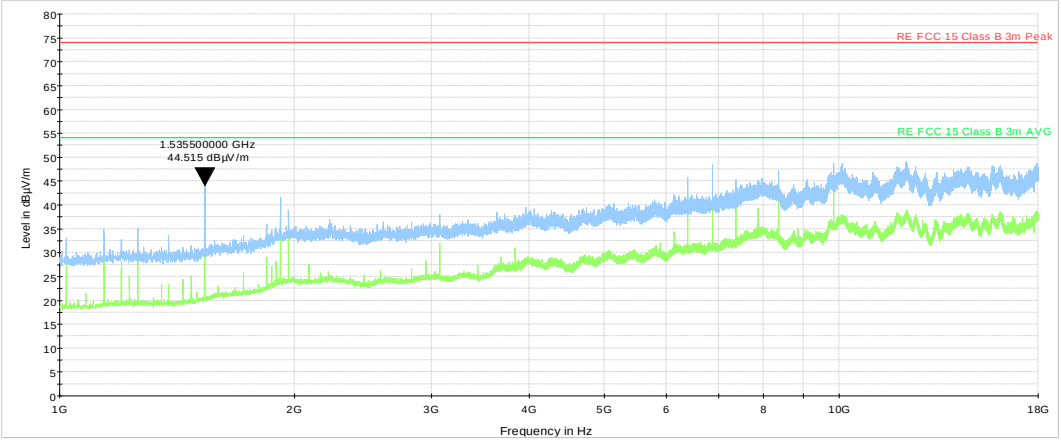
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical/Horizontal

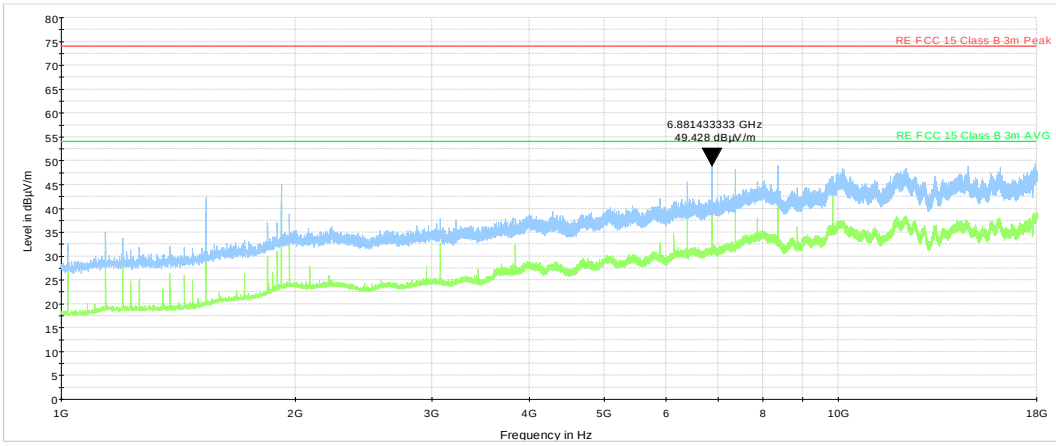


| | | | |
|---|---|---|---|
| **Test specification:** | **Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions** | | |
| **Test procedure:** | ANSI C63.10 section 11.12.1 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date(s):** | 12-Jun-19 - 31-Jul-19 | | |
| **Temperature:** 24 ºC | **Relative Humidity:** 44 % | **Air Pressure:** 1004 hPa | **Power:** 48 VDC |
| **Remarks:** | | | |

**Plot 7.3.7 Radiated emission measurements from 1GHz to 18GHz at the low carrier frequency**

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




**Plot 7.3.8 Radiated emission measurements from 1GHz to 18GHz at the mid carrier frequency**

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