# d/b/a Philips Healthcare – a division of Philips

# TEST REPORT

**SCOPE OF WORK**
EMC TESTING – Wearable Biosensor G10

**REPORT NUMBER**
103732466BOX-015b

**ISSUE DATE** **[REVISED DATE]**
11-January-2019 August 8, 2019

**PAGES**
67

**DOCUMENT CONTROL NUMBER**
Non-Specific Radio Report Shell Rev. December 2017


# EMISSIONS TEST REPORT

(FULL COMPLIANCE)

**Report Number:** 103732466BOX-015b
**Project Number:** G103732466

**Report Issue Date:** 01/11/2019
**Report Re-issue Date:** 08/08/2019

**Model(s) Tested:** Wearable Biosensor G10
**Model(s) Partially Tested:** None
**Model(s) Not Tested but declared equivalent by the client:** None

**Standards:** CFR47 FCC Part 15.247 Subpart C: 01/2019,
CFR47 FCC Part 15 Subpart B: 01/2019,
RSS-247 Issue 2 February 2017,
ICES-003 Issue 6 Published: January 2016 Updated: April 2017,
RSS-Gen Issue 5 April 2018,
RSS-102 Issue 5 March 2015

Tested by:
Intertek Testing Services NA, Inc.
70 Codman Hill Road
Boxborough, MA 01719
USA

Client:
d/b/a Philips Healthcare - a division of Philips North
50 Milk Street 18th Floor
Boston, MA 02109
USA

Report prepared by

Kouma Sinn / EMC Staff Engineer

Report reviewed by

Vathana Ven / EMC Staff Engineer

Table of Contents

## 1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

## 2 Test Summary

| Section | Test full name | Result |
|---|---|---|
| 3 | Client Information | -- |
| 4 | Description of Equipment Under Test and Variant Models | -- |
| 5 | System Setup and Method | -- |
| 6 | Maximum Peak Output Power and Human RF exposure<br>CFR47 FCC Part 15 Subpart C:01/2019, Section 15.247 (b)(3)<br>RSS-247 Issue 2 February 2017, RSS-102 Issue 5 March 2015 | Pass |
| 7 | 6 dB Bandwidth and Occupied Bandwidth<br>CFR47 FCC Part 15 Subpart C: 01/2019, Section 15.247 (a)(2)<br>RSS-247 Issue 2 February 2017 | Pass |
| 8 | Maximum Power Spectral Density<br>CFR47 FCC Part 15 Subpart C: 01/2019, Section 15.247 (e)<br>RSS-247 Issue 2 February 2017 | Pass |
| 9 | Band Edge Compliance<br>CFR47 FCC Part 15 Subpart C: 01/2019, Section 15.247 (d)<br>RSS-247 Issue 2: 02/2017) | Pass |
| 10 | Transmitter spurious emissions<br>CFR47 FCC Part 15 Subpart C: 01/2019, Section 15.247 (d)<br>RSS-247 Issue 2 February 2017 | Pass |
| -- | AC Mains Conducted Emissions<br>FCC 47CFR Part 15.107: 01/2019<br>ICES-003 Issue 6 Published: January 2016 Updated: April 2017 | N/A |
| 11 | Revision History | -- |

Notes: The EUT powers from internal battery with no connection to AC mains. The Bluetooth Low Energy module does not utilize receiver mode in normal operation per client.

## 3 Client Information

**This EUT was tested at the request of:**

**Client:** Philips Healthcare - a division of Philips North
50 Milk Street 18th Floor
Boston, MA 02109
USA

**Contact:** Wen Lu
**Telephone:** +1 (978) 659-2406
**Fax:** None
**Email:** wen.lu@philips.com

## 4 Description of Equipment Under Test and Variant Models

**Manufacturer:** Philips Healthcare - a division of Philips North
50 Milk Street 18th Floor
Boston, MA 02109
USA

| Equipment Under Test | | | |
|---|---|---|---|
| Description | Manufacturer | Model Number | Serial Number |
| Wearable Biosensor | d/b/a Philips Healthcare - a division of Philips North | G10 | G10_0009FBB8C02D Lot # 00110918 |
| Wearable Biosensor* | d/b/a Philips Healthcare - a division of Philips North | G10 | 0009FBB84000 |

*Equipment received on August 1, 2019.

| | |
|---|---|
| Receive Date: | 12/03/2018 and 08/01/2019 |
| Received Condition: | Good |
| Type: | Production |

| Description of Equipment Under Test (provided by client) |
|---|
| Philips wearable biosensor G10 Biosensor is a chest-worn sensor that is intended to periodically collect, store, and transmit physiological data to a qualified system for use by healthcare professionals. The physiological data measured by the biosensor includes respiration rate and heart rate. In addition, the biosensor is intended to measure and wirelessly transmit contextual parameters: activity level, activity type, and posture. G10 Biosensor sends the collected patient data wirelessly through Bluetooth to a compatible IT equipment like Seta Bridge Solution or directly to a qualified system. G10 Biosensor is a wireless, single use, single location chest worn device. The biosensor has 120 hours of wear life, after which it will turn off automatically. |

| Equipment Under Test Power Configuration | | | |
|---|---|---|---|
| Rated Voltage | Rated Current | Rated Frequency | Number of Phases |
| 3 VDC Battery | N/A – 120 hours of wear life | N/A | N/A |

**Operating modes of the EUT:**

| No. | Descriptions of EUT Exercising |
|---|---|
| 1 | Communication Link |
| 2 | Idle mode |
| 3 | Transmit |

**Software used by the EUT:**

| No. | Descriptions of EUT Exercising |
|---|---|
| 1 | Test script, Philips G10 – Gecko Test V1.0.2.5, was provided by client for testing |

| Radio/Receiver Characteristics | |
|---|---|
| **Frequency Band(s)** | 2402-2480 MHz |
| **Modulation Type(s)** | GMSK |
| **Maximum Output Power** | Low Channel: -2.2 dBm (Conducted),<br>Mid Channel: -2.3 dBm (Conducted),<br>High Channel: -2.9 dBm (Conducted) |
| **Test Channels** | Low Channel: 2402 MHz,<br>Mid Channel: 2440 MHz,<br>High Channel: 2480 MHz |
| **Occupied Bandwidth** | Low Channel: 1.078 MHz,<br>Mid Channel: 1.048 MHz,<br>High Channel: 1.068 MHz |
| **Frequency Hopper: Number of Hopping Channels** | N/A |
| **Frequency Hopper: Channel Dwell Time** | N/A |
| **Frequency Hopper: Max interval between two instances of use of the same channel** | N/A |
| **MIMO Information (# of Transmit and Receive antenna ports)** | 1 |
| **Equipment Type** | Standalone |
| **ETSI LBT/Adaptivity** | Non-Adaptive |
| **ETSI Adaptivity Type** | N/A |
| **ETSI Temperature Category (I, II, III)** | N/A |
| **ETSI Receiver Category (1, 2, 3)** | N/A – The EUT normal operation does not utilize receive mode. |
| **Antenna Type and Gain** | Integrated, -2 dBi |

**Variant Models:**

The following variant models were not tested as part of this evaluation, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

None

## 5 System Setup and Method

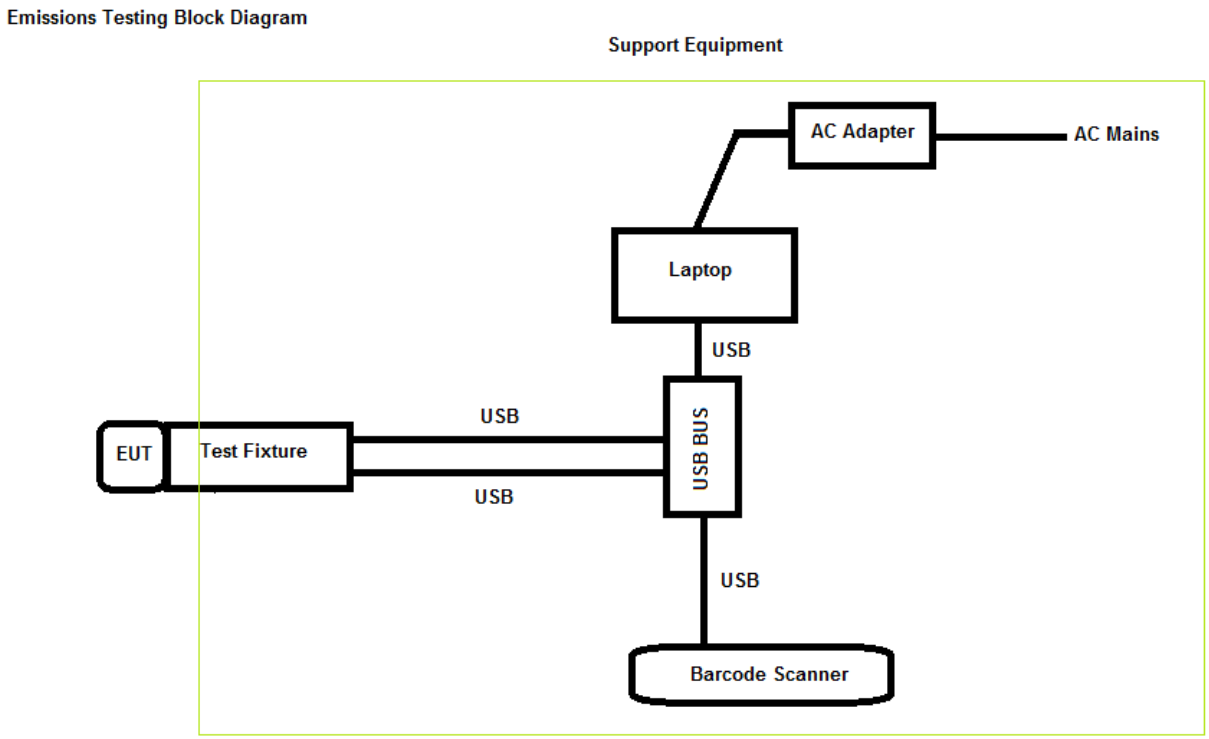
| Cables | | | | | |
|---|---|---|---|---|---|
| ID | Description | Length (m) | Shielding | Ferrites | Termination |
| -- | None | -- | -- | -- | -- |

| Support Equipment | | | |
|---|---|---|---|
| Description | Manufacturer | Model Number | Serial Number |
| Patient simulator | None | None | None |
| Circuit Board | None | None | None |
| Laptop | HP | EliteBook 8470p | None |
| Barcode Scanner | None | None | None |

### 5.1 Method:

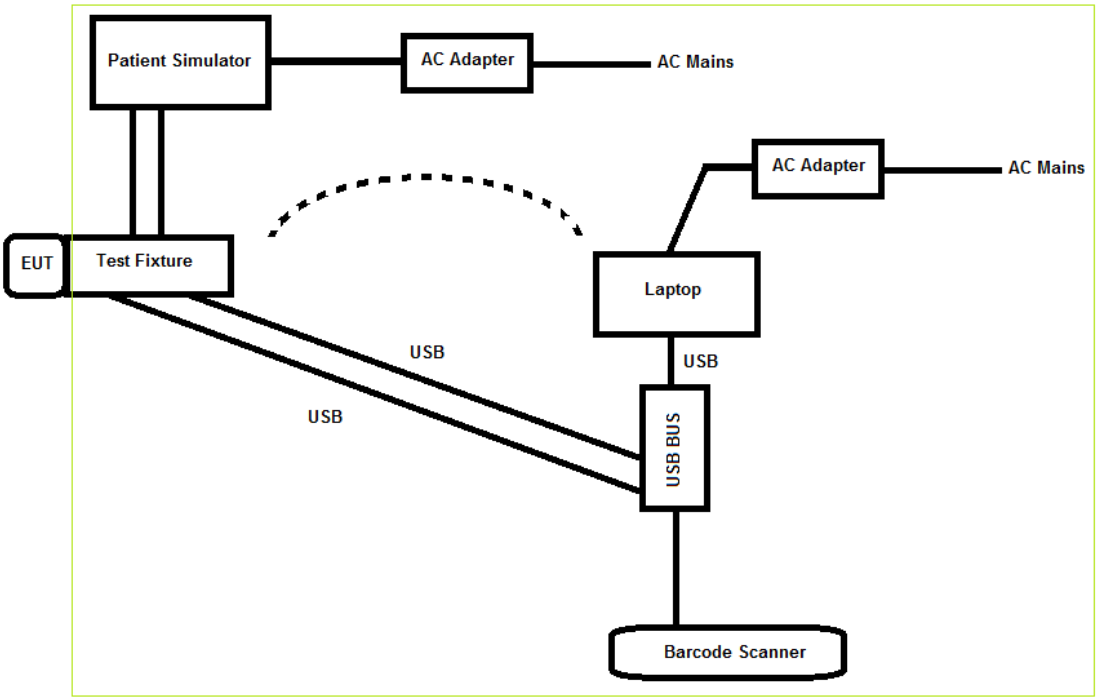
Configuration as required by Configuration as required by FCC Part 15 Subpart C 15.247: 01/2019, FCC Part 15 Subpart B: 01/2019, RSS 247 Issue 2: 02/2017, ICES 003 Issue 6: 01/2016 updated 06/2016, ANSI C 63.10: 2013, ANSI C 63.4: 2014, and FCC KDB 558074 D01 15.247 Meas Guidance v05r02.

### 5.2 EUT Block Diagram:



Immunity Testing Block Diagram

Support Equipment



# 6 Maximum Peak Output Power and Human RF exposure

## 6.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, RSS-102, ANSI C63.10, and FCC KDB 558074 D01 15.247 Meas Guidance v05r02.

**TEST SITE:** EMC Lab

**The EMC Lab** has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

## 6.2 Test Equipment Used:

| Asset | Description | Manufacturer | Model | Serial | Cal Date | Cal Due |
|---|---|---|---|---|---|---|
| DS40' | Temp, humidity, pressure gauge | Digi Sense | 68000-49 | 181717625 | 11/06/2018 | 11/06/2019 |
| ROS005-1' | Signal and Spectrum Analyzer | Rohde and Shwartz | FSW43 | 100646 | 10/15/2018 | 10/15/2019 |
| ROS005-4' | Control Platform | Rodhe and Schwarz | OSP120 | 101428 | 11/20/2018 | 11/20/2019 |
| None | Coaxial Cable (DUT1) | UTIFLEX MICRO-COAX | UFA210A-1-0787-300300 | 101709 | 02/01/2018 | 02/01/2019 |
| None | 20 dB Attenuator (DUT1) | Pasternack | E7004-20 | None | 02/01/2018 | 02/01/2019 |
| None | Coaxial Cable (Receiver/RF In | Micro-coax | UFA210A-0-0-0196-300300 | 101706 | 02/01/2018 | 02/01/2019 |

**Software Utilized:**

| Name | Manufacturer | Version |
|---|---|---|
| R&S EMC32/AMS32/WMS32 | Rohde & Schwarz | 10.30.00 |

## 6.3 Results:

The sample tested was found to Comply.

§15.247 (b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt or 30 dBm.

## 6.4 Setup Photographs:

Confidential

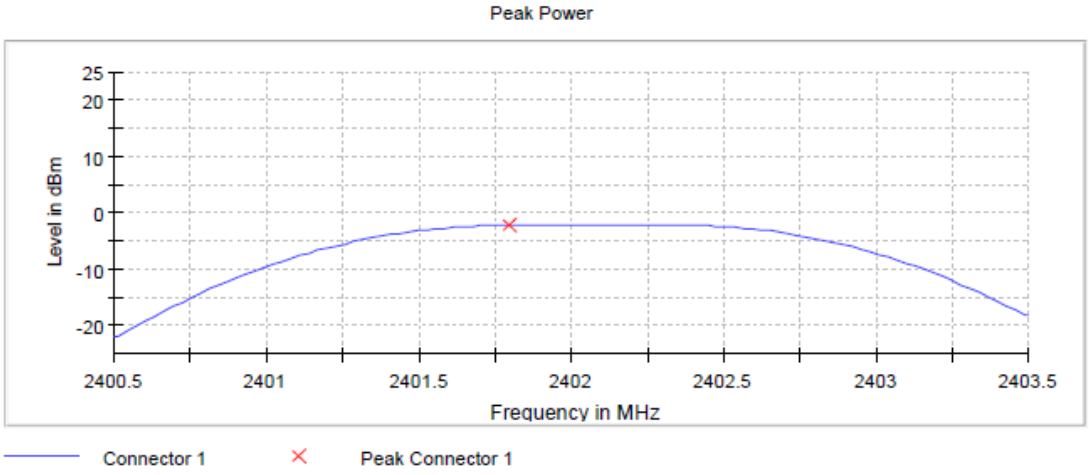
## 6.5 Plots/Data:

# Peak output power (Sweep) (2402 MHz; 0.000 dBm; 1 MHz)

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 0.8 dB

## Result

| DUT Frequency (MHz) | Peak Power (dBm) | Limit Max (dBm) | Result |
|---|---|---|---|
| 2402.000000 | -2.2 | 30.0 | PASS |

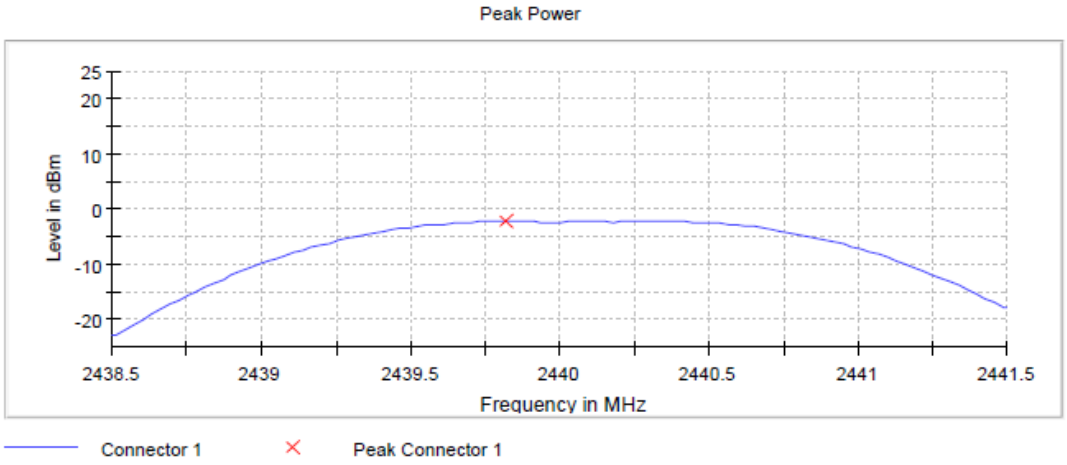


# Peak output power (Sweep) (2440 MHz; 0.000 dBm; 1 MHz)

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 0.8 dB

## Result

| DUT Frequency (MHz) | Peak Power (dBm) | Limit Max (dBm) | Result |
|---|---|---|---|
| 2440.000000 | -2.3 | 30.0 | PASS |

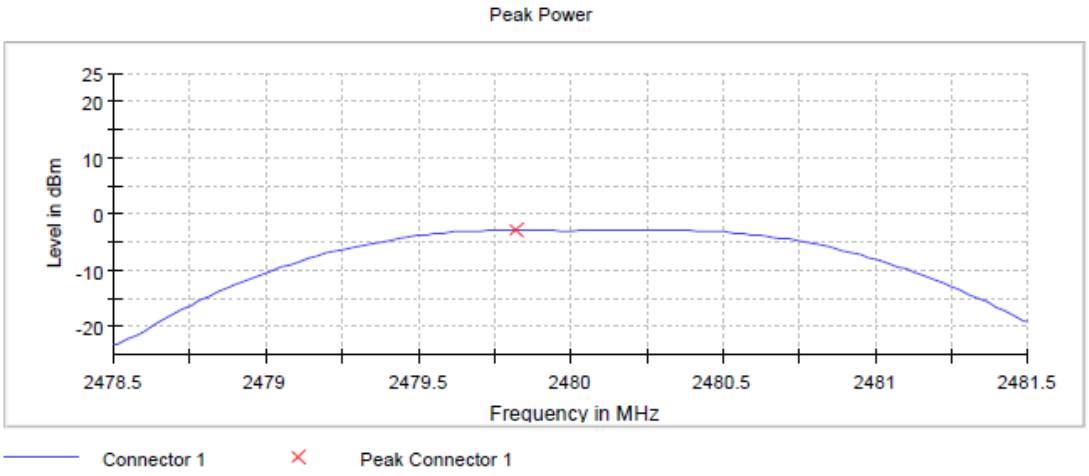


# Peak output power (Sweep) (2480 MHz; 0.000 dBm; 1 MHz)

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 0.8 dB

## Result

| DUT Frequency (MHz) | Peak Power (dBm) | Limit Max (dBm) | Result |
|---|---|---|---|
| 2480.000000 | -2.9 | 30.0 | PASS |



**SAR Exemption Calculation**

Maximum Conducted Output Power of Transmitter = -2.2 dBm = 0.60 mW

**FCC SAR Exemption per KDB 447498**

a) For 100 MHz to 6 GHz and *test separation distances* ≤ 50 mm, the 1-g and 10-g *SAR test exclusion thresholds* are determined by the following:

[(*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)] · [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR,[30] where

- $f_{(GHz)}$ is the RF channel transmit frequency in GHz

= (0.60/5)*(sqrt(2.402))

**= 0.186 < 3.0 (below the limit SAR Exempt per FCC)**

**RSS 102 SAR Exemption**

**Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance[4,5]**

| Frequency (MHz) | Exemption Limits (mW) | | | | |
|---|---|---|---|---|---|
| | At separation distance of ≤5 mm | At separation distance of 10 mm | At separation distance of 15 mm | At separation distance of 20 mm | At separation distance of 25 mm |
| ≤300 | 71 mW | 101 mW | 132 mW | 162 mW | 193 mW |
| 450 | 52 mW | 70 mW | 88 mW | 106 mW | 123 mW |
| 835 | 17 mW | 30 mW | 42 mW | 55 mW | 67 mW |
| 1900 | 7 mW | 10 mW | 18 mW | 34 mW | 60 mW |
| 2450 | 4 mW | 7 mW | 15 mW | 30 mW | 52 mW |
| 3500 | 2 mW | 6 mW | 16 mW | 32 mW | 55 mW |
| 5800 | 1 mW | 6 mW | 15 mW | 27 mW | 41 mW |

The exemption limits in Table 1 are based on measurements and simulations of half-wave dipole antennas at separation distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from a linear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from a third order polynomial fit.

The conducted output power of the transmitter 0.60 mW @ 2402 MHz is less than 2 mW limit specified at 3500 MHz, device meets SAR exclusion.

| | | | |
|---|---|---|---|
| Test Personnel: | Kouma Sinn KPS | Test Date: | 12/05/2018 |
| Supervising/Reviewing Engineer: (Where Applicable) | N/A | | |
| Product Standard: | CFR47 FCC Part 15.247 RSS-247, RSS-102 | Limit Applied: | See report section 6.3 |
| Input Voltage: | Internal Battery | Ambient Temperature: | 22 ºC |
| Pretest Verification w/ Ambient Signals or BB Source: | N/A | Relative Humidity: | 15 % |
| | | Atmospheric Pressure: | 1010 mbars |

Deviations, Additions, or Exclusions: None

# 7 6 dB Bandwidth and Occupied Bandwidth

## 7.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, ANSI C63.10, and FCC KDB 558074 D01 15.247 Meas Guidance v05r02.

**TEST SITE:** EMC Lab

**The EMC Lab** has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

## 7.2 Test Equipment Used:

| Asset | Description | Manufacturer | Model | Serial | Cal Date | Cal Due |
|---|---|---|---|---|---|---|
| DS40' | Temp, humidity, pressure gauge | Digi Sense | 68000-49 | 181717625 | 11/06/2018 | 11/06/2019 |
| ROS005-1' | Signal and Spectrum Analyzer | Rohde and Shwartz | FSW43 | 100646 | 10/15/2018 | 10/15/2019 |
| ROS005-4' | Control Platform | Rodhe and Schwarz | OSP120 | 101428 | 11/20/2018 | 11/20/2019 |
| None | Coaxial Cable (DUT1) | UTIFLEX MICRO-COAX | UFA210A-1-0787-300300 | 101709 | 02/01/2018 | 02/01/2019 |
| None | 20 dB Attenuator (DUT1) | Pasternack | E7004-20 | None | 02/01/2018 | 02/01/2019 |
| None | Coaxial Cable (Receiver/RF In | Micro-coax | UFA210A-0-0-0196-300300 | 101706 | 02/01/2018 | 02/01/2019 |

**Software Utilized:**

| Name | Manufacturer | Version |
|---|---|---|
| R&S EMC32/AMS32/WMS32 | Rohde & Schwarz | 10.30.00 |

Test equipment used on August 1, 2019

| Asset | Description | Manufacturer | Model | Serial | Cal Date | Cal Due |
|---|---|---|---|---|---|---|
| DS40' | Temp, humidity, pressure gauge | Digi Sense | 68000-49 | 181717625 | 11/06/2018 | 11/06/2019 |
| ROS005-1' | Signal and Spectrum Analyzer | Rohde and Shwartz | FSW43 | 100646 | 10/15/2018 | 10/15/2019 |
| HORN3 | HORN ANTENNA | EMCO | 3115 | 9610-4980 | 05/30/2019 | 05/30/2020 |
| CBLHF2012-2M-1' | 2m 9kHz-40GHz Coaxial Cable - SET1 | Huber & Suhner | SF102 | 252675001 | 02/01/2019 | 02/01/2020 |

**Software Utilized:**

| Name | Manufacturer | Version |
|---|---|---|
| None | -- | -- |

## 7.3 Results:

The sample tested was found to Comply.

§15.247 (a) (2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

## 7.4 Setup Photographs:

Confidential

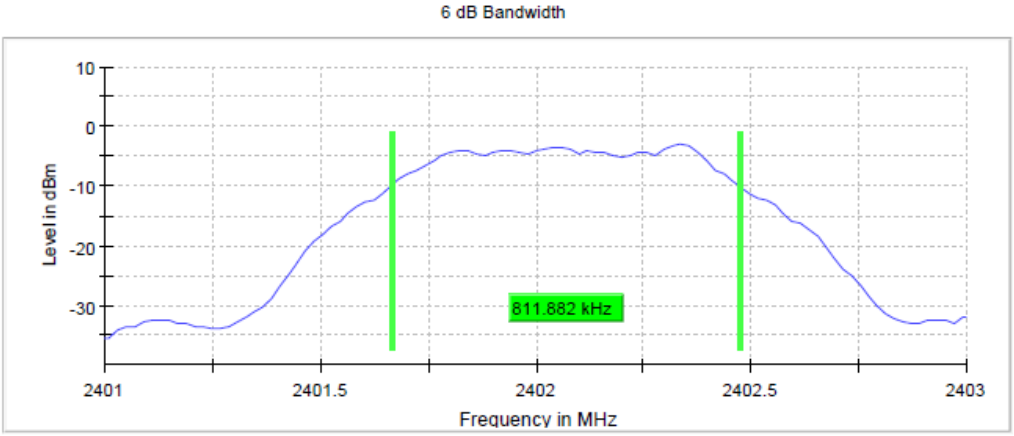
## 7.5 Plots/Data:

## Minimum Emission Bandwidth 6 dB (2402 MHz; 0.000 dBm; 1 MHz)

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

### 6 dB Bandwidth

| DUT Frequency (MHz) | Bandwidth (MHz) | Limit Min (MHz) | Limit Max (MHz) | Band Edge Left (MHz) | Band Edge Right (MHz) | Max Level (dBm) | Result |
|---|---|---|---|---|---|---|---|
| 2402.000000 | 0.811882 | 0.500000 | --- | 2401.663366 | 2402.475248 | -3.1 | PASS |



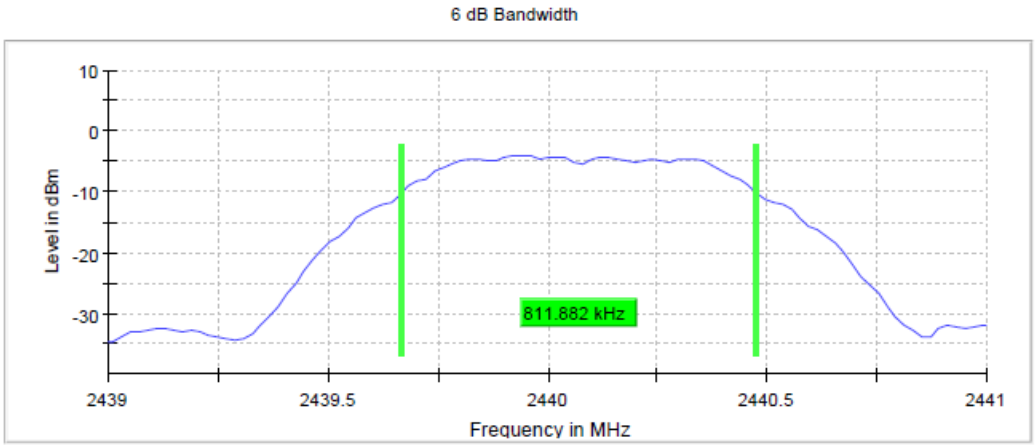

Bandwidth

# Minimum Emission Bandwidth 6 dB (2440 MHz; 0.000 dBm; 1 MHz)

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

## 6 dB Bandwidth

| DUT Frequency (MHz) | Bandwidth (MHz) | Limit Min (MHz) | Limit Max (MHz) | Band Edge Left (MHz) | Band Edge Right (MHz) | Max Level (dBm) | Result |
|---|---|---|---|---|---|---|---|
| 2440.000000 | 0.811882 | 0.500000 | --- | 2439.663366 | 2440.475248 | -4.1 | PASS |



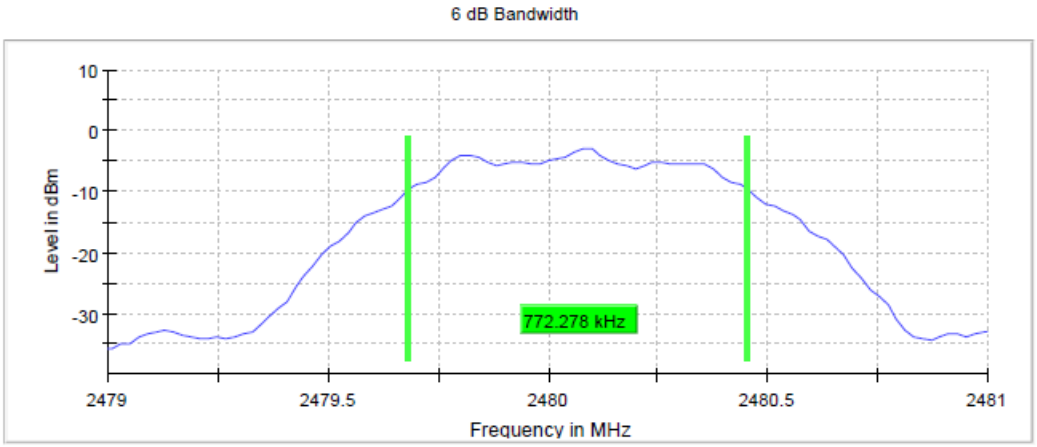

Bandwidth

# Minimum Emission Bandwidth 6 dB (2480 MHz; 0.000 dBm; 1 MHz)

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

## 6 dB Bandwidth

| DUT Frequency (MHz) | Bandwidth (MHz) | Limit Min (MHz) | Limit Max (MHz) | Band Edge Left (MHz) | Band Edge Right (MHz) | Max Level (dBm) | Result |
|---|---|---|---|---|---|---|---|
| 2480.000000 | 0.772278 | 0.500000 | --- | 2479.683168 | 2480.455446 | -3.0 | PASS |



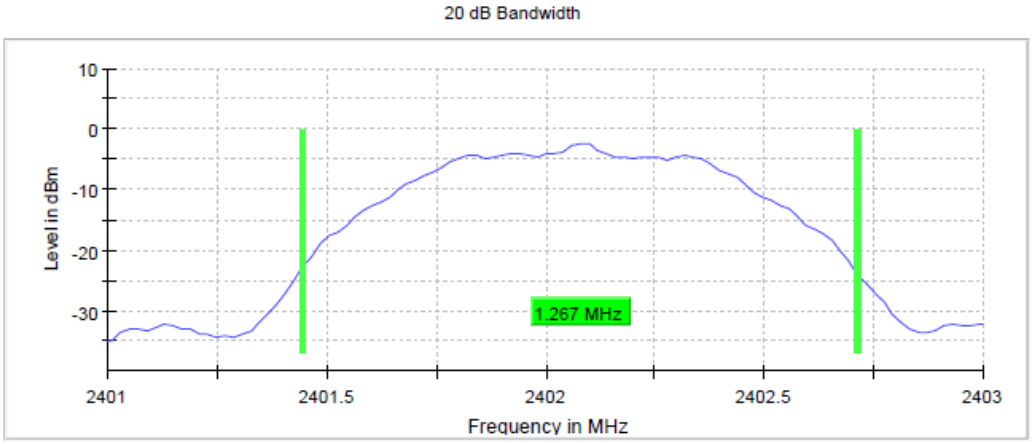

Bandwidth

# Emission Bandwidth 20 dB (2402 MHz; 0.000 dBm; 1 MHz)

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

## 20 dB Bandwidth

| DUT Frequency (MHz) | Bandwidth (MHz) | Limit Min (MHz) | Limit Max (MHz) | Band Edge Left (MHz) | Band Edge Right (MHz) | Max Level (dBm) | Result |
|---|---|---|---|---|---|---|---|
| 2402.000000 | 1.267326 | --- | --- | 2401.445545 | 2402.712871 | -2.3 | PASS |



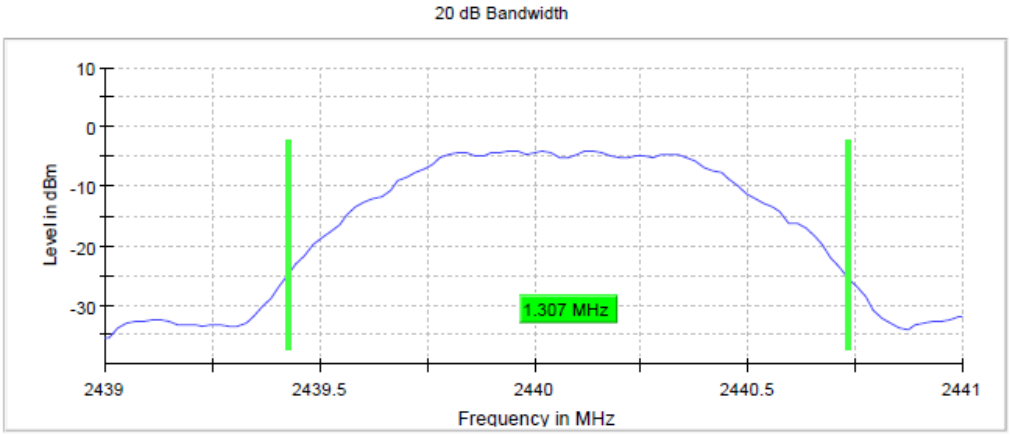

Bandwidth

# Emission Bandwidth 20 dB (2440 MHz; 0.000 dBm; 1 MHz)

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

## 20 dB Bandwidth

| DUT Frequency (MHz) | Bandwidth (MHz) | Limit Min (MHz) | Limit Max (MHz) | Band Edge Left (MHz) | Band Edge Right (MHz) | Max Level (dBm) | Result |
|---|---|---|---|---|---|---|---|
| 2440.000000 | 1.306930 | --- | --- | 2439.425743 | 2440.732673 | -4.0 | PASS |



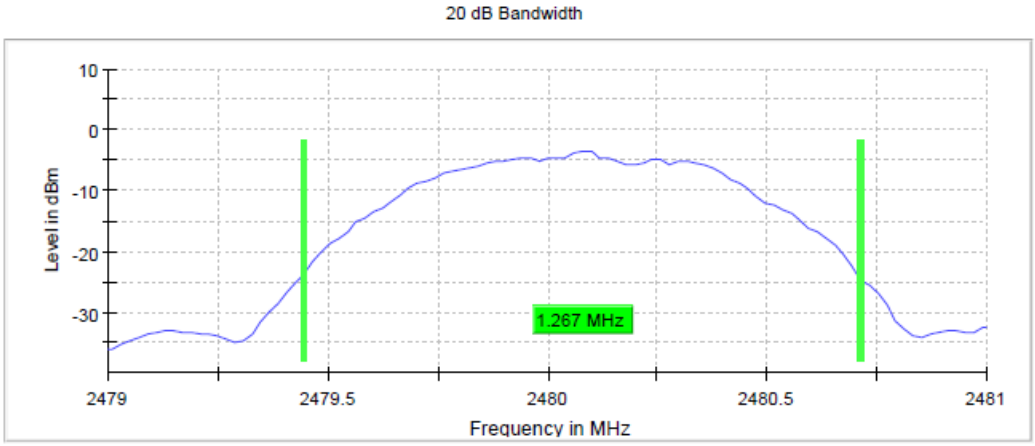

Bandwidth

# Emission Bandwidth 20 dB (2480 MHz; 0.000 dBm; 1 MHz)

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

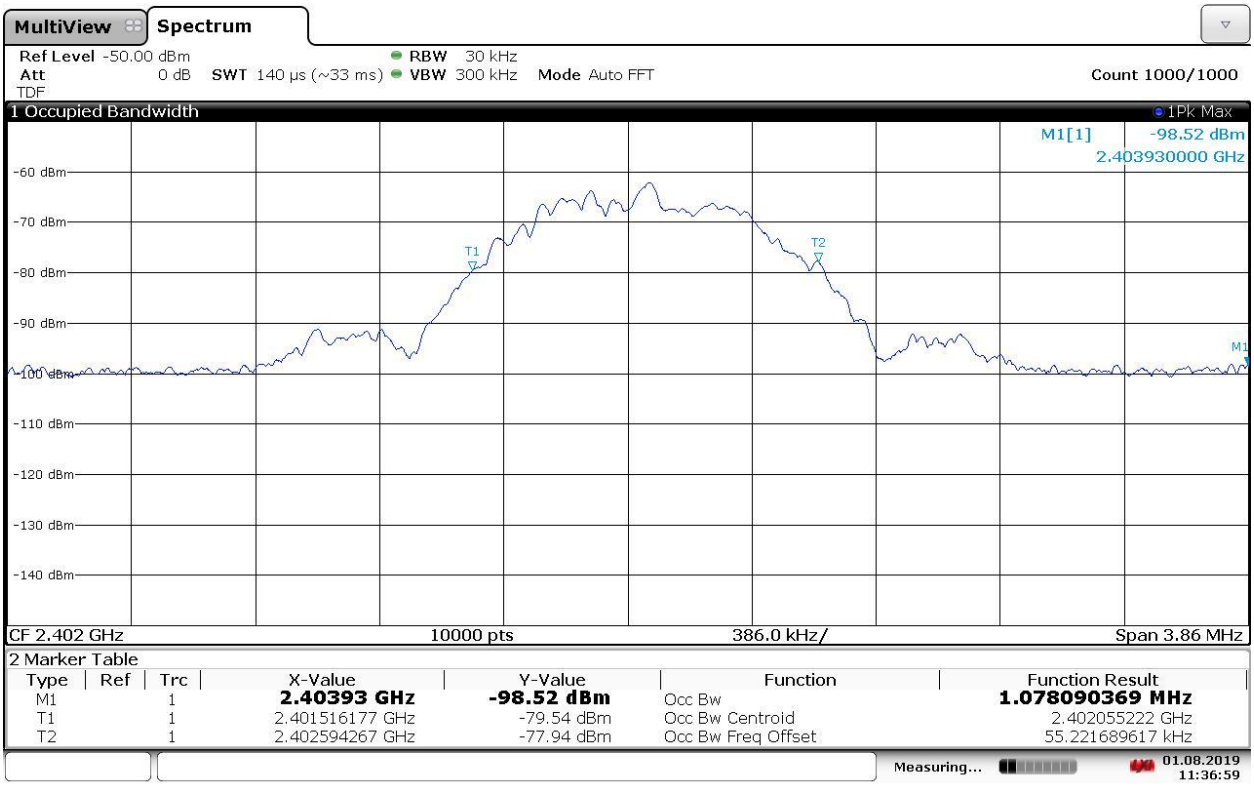
## 20 dB Bandwidth

| DUT Frequency (MHz) | Bandwidth (MHz) | Limit Min (MHz) | Limit Max (MHz) | Band Edge Left (MHz) | Band Edge Right (MHz) | Max Level (dBm) | Result |
|---|---|---|---|---|---|---|---|
| 2480.000000 | 1.267326 | --- | --- | 2479.445545 | 2480.712871 | -3.5 | PASS |




Bandwidth

# Emission Occupied Bandwidth (Low Channel: 2402 MHz)

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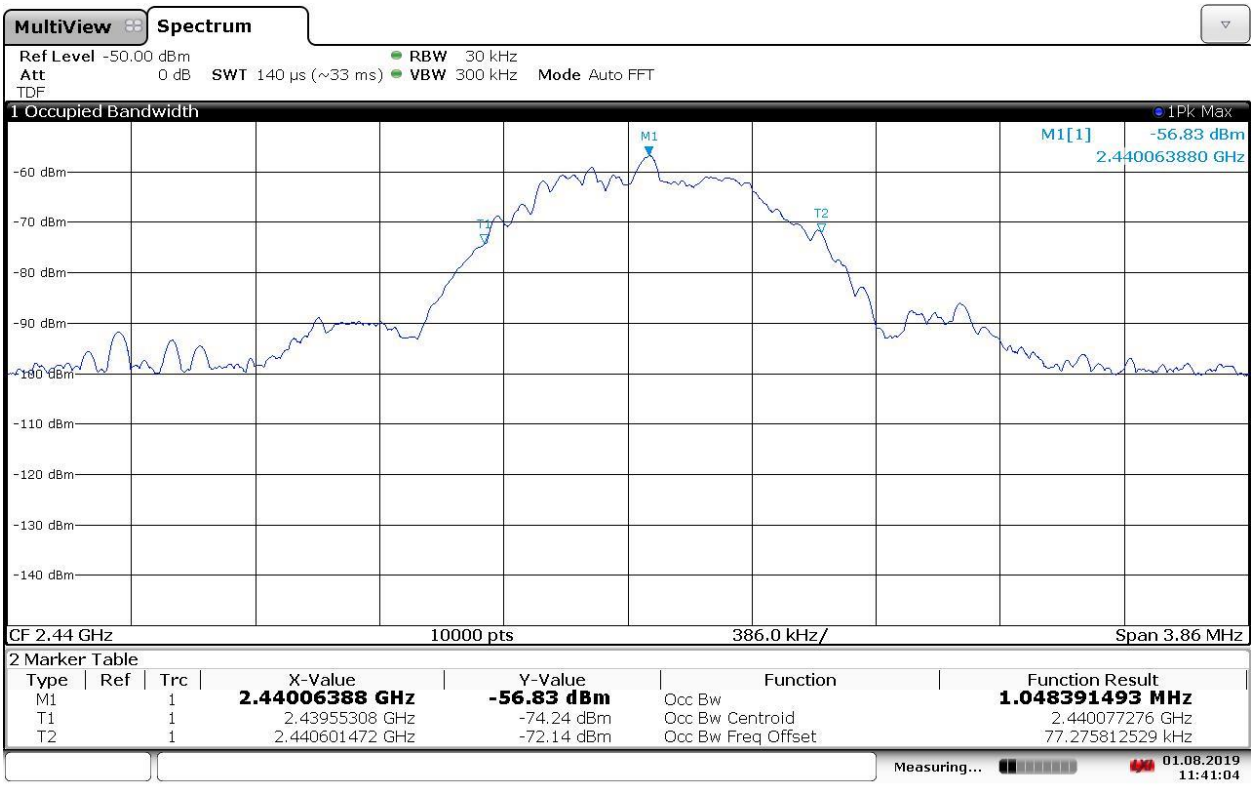
# Emission Occupied Bandwidth (Mid Channel: 2440 MHz)

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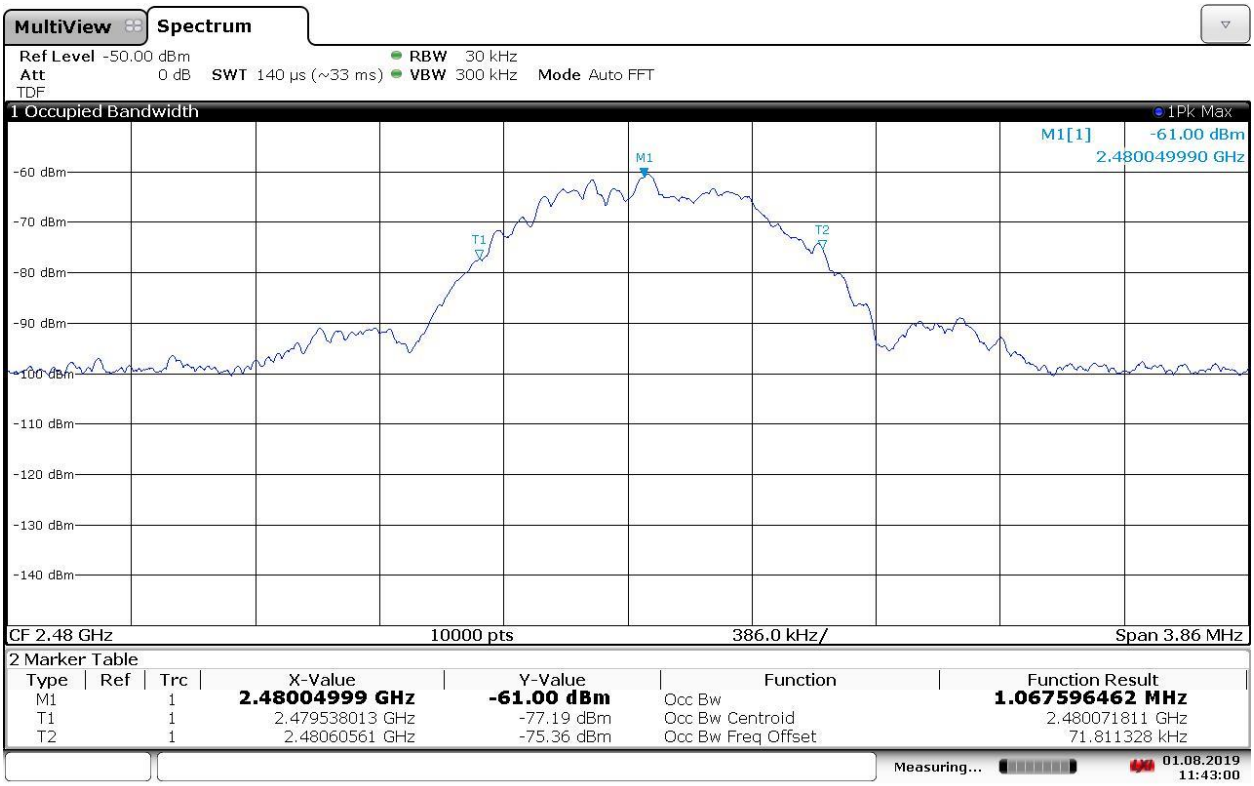
# Emission Occupied Bandwidth (Low Channel: 2480 MHz)

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| | | | |
|---|---|---|---|
| Test Personnel: | Kouma Sinn KPS | Test Date: | 12/05/2018, 08/01/2019 |
| Supervising/Reviewing Engineer: (Where Applicable) | N/A | | |
| Product Standard: | CFR47 FCC Part 15.247 RSS-247 | Limit Applied: | See report section 7.3 |
| Input Voltage: | Internal Battery | Ambient Temperature: | 22, 21 ºC |
| Pretest Verification w/ Ambient Signals or BB Source: | N/A | Relative Humidity: | 15, 59 % |
| | | Atmospheric Pressure: | 1010, 1009 mbars |

Deviations, Additions, or Exclusions: None

# 8 Maximum Power Spectral Density

## 8.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, RSS-102, ANSI C63.10, and FCC KDB 558074 D01 15.247 Meas Guidance v05r02.

**TEST SITE:** EMC Lab

**The EMC Lab** has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

## 8.2 Test Equipment Used:

| Asset | Description | Manufacturer | Model | Serial | Cal Date | Cal Due |
|---|---|---|---|---|---|---|
| DS40' | Temp, humidity, pressure gauge | Digi Sense | 68000-49 | 181717625 | 11/06/2018 | 11/06/2019 |
| ROS005-1' | Signal and Spectrum Analyzer | Rohde and Shwartz | FSW43 | 100646 | 10/15/2018 | 10/15/2019 |
| ROS005-4' | Control Platform | Rodhe and Schwarz | OSP120 | 101428 | 11/20/2018 | 11/20/2019 |
| None | Coaxial Cable (DUT1) | UTIFLEX MICRO-COAX | UFA210A-1-0787-300300 | 101709 | 02/01/2018 | 02/01/2019 |
| None | 20 dB Attenuator (DUT1) | Pasternack | E7004-20 | None | 02/01/2018 | 02/01/2019 |
| None | Coaxial Cable (Receiver/RF In | Micro-coax | UFA210A-0-0-0196-300300 | 101706 | 02/01/2018 | 02/01/2019 |

**Software Utilized:**

| Name | Manufacturer | Version |
|---|---|---|
| R&S EMC32/AMS32/WMS32 | Rohde & Schwarz | 10.30.00 |

## 8.3 Results:

The sample tested was found to Comply.

§15.247 (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

## 8.4 Setup Photographs:

Confidential

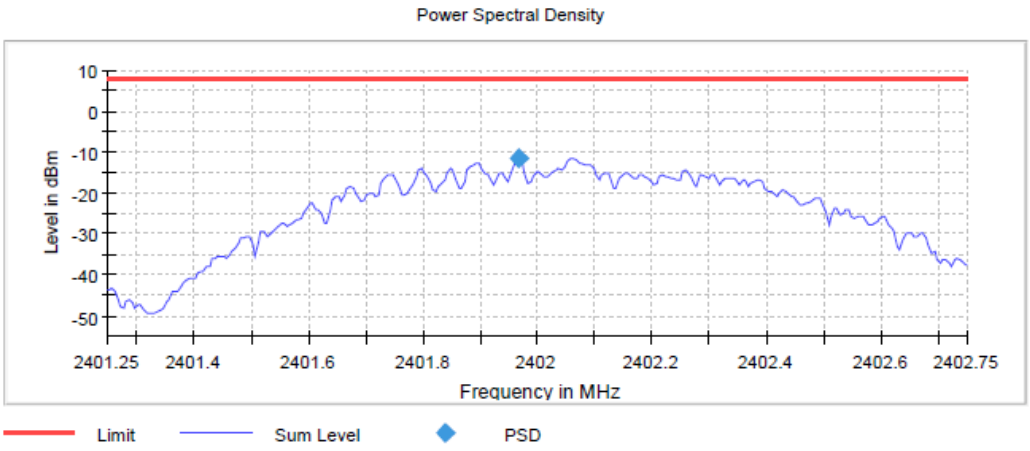
## 8.5 Plots/Data:

### Peak Power Spectral Density (2402 MHz; 0.000 dBm; 1 MHz)

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 1.1 dB

**Result**

| DUT Frequency (MHz) | Frequency (MHz) | PSD (dBm) | Limit Max (dBm) | Result |
|---|---|---|---|---|
| 2402.000000 | 2401.967500 | -11.515 | 8.0 | PASS |



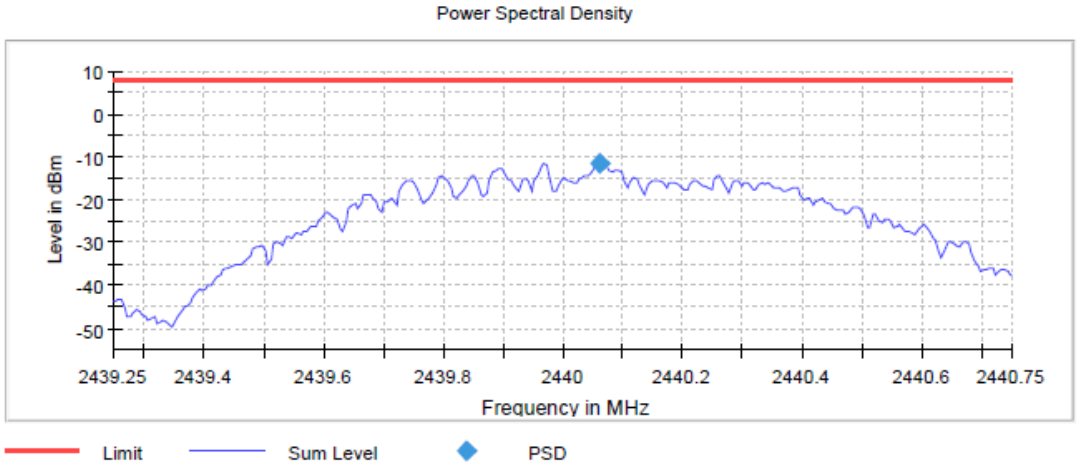

PSD Connector 1

# Peak Power Spectral Density (2440 MHz; 0.000 dBm; 1 MHz)

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 1.1 dB

## Result

| DUT Frequency (MHz) | Frequency (MHz) | PSD (dBm) | Limit Max (dBm) | Result |
|---|---|---|---|---|
| 2440.000000 | 2440.062500 | -11.586 | 8.0 | PASS |



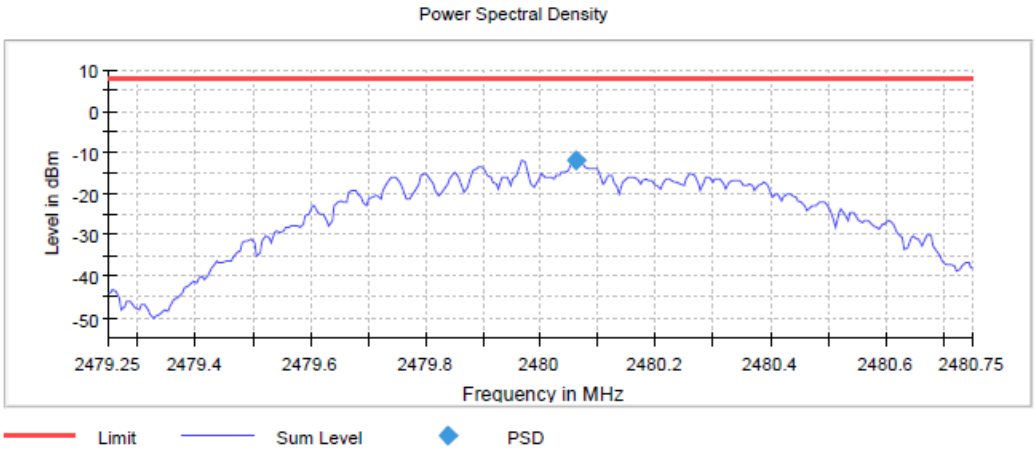

PSD Connector 1

# Peak Power Spectral Density (2480 MHz; 0.000 dBm; 1 MHz)

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 1.1 dB

## Result

| DUT Frequency (MHz) | Frequency (MHz) | PSD (dBm) | Limit Max (dBm) | Result |
|---|---|---|---|---|
| 2480.000000 | 2480.062500 | -12.012 | 8.0 | PASS |




PSD Connector 1

| | | | |
|---|---|---|---|
| Test Personnel: | Kouma Sinn KPS | Test Date: | 12/05/2018 |
| Supervising/Reviewing Engineer: (Where Applicable) | N/A | | |
| Product Standard: | CFR47 FCC Part 15.247 RSS-247 | Limit Applied: | See report section 8.3 |
| Input Voltage: | Internal Battery | Ambient Temperature: | 22 ºC |
| Pretest Verification w/ Ambient Signals or BB Source: | N/A | Relative Humidity: | 15 % |
| | | Atmospheric Pressure: | 1010 mbars |

Deviations, Additions, or Exclusions: None

# 9 Band Edge Compliance

## 9.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, ANSI C63.10, and FCC KDB 558074 D01 15.247 Meas Guidance v05r02.

**TEST SITE:** EMC Lab & 10m ALSE

**The EMC Lab** has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

**The 10m ALSE** is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

**Measurement Uncertainty**

| Measurement | Frequency Range | Expanded Uncertainty (k=2) | Ucispr |
|---|---|---|---|
| Radiated Emissions, 10m | 30-1000 MHz | 4.6dB | 6.3 dB |
| Radiated Emissions, 3m | 30-1000 MHz | 5.3 dB | 6.3 dB |
| Radiated Emissions, 3m | 1-6 GHz | 4.5 dB | 5.2 dB |
| Radiated Emissions, 3m | 6-15 GHz | 5.2 dB | 5.5 dB |
| Radiated Emissions, 3m | 15-18 GHz | 5.0 dB | 5.5 dB |
| Radiated Emissions, 3m | 18-40 GHz | 5.0 dB | 5.5 dB |

As shown in the table above our radiated emissions $U_{lab}$ is less than the corresponding $U_{CISPR}$ reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

**Sample Calculation**

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

**Example:**

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

## 9.2 Test Equipment Used:

| Asset | Description | Manufacturer | Model | Serial | Cal Date | Cal Due |
|---|---|---|---|---|---|---|
| DS40' | Temp, humidity, pressure gauge | Digi Sense | 68000-49 | 181717625 | 11/06/2018 | 11/06/2019 |
| ROS005-1' | Signal and Spectrum Analyzer | Rohde and Shwartz | FSW43 | 100646 | 10/15/2018 | 10/15/2019 |
| ROS005-4' | Control Platform | Rodhe and Schwarz | OSP120 | 101428 | 11/20/2018 | 11/20/2019 |
| None | Coaxial Cable (DUT1) | UTIFLEX MICRO-COAX | UFA210A-1-0787-300300 | 101709 | 02/01/2018 | 02/01/2019 |
| None | 20 dB Attenuator (DUT1) | Pasternack | E7004-20 | None | 02/01/2018 | 02/01/2019 |
| None | Coaxial Cable (Receiver/RF In | Micro-coax | UFA210A-0-0-0196-300300 | 101706 | 02/01/2018 | 02/01/2019 |
| 145128 | EMI Receiver (20 Hz - 40 Ghz) | Rohde & Schwarz | ESIB 40 | 839283/001 | 03/28/2019 | 03/28/2020 |
| ETS005 | 1-18GHz horn antenna | ETS-Lindgren | 3117 | 00218279 | 05/14/2018 | 05/14/2019 |
| 145-416 | Cables 145-420 145-423 145-425 145-408 | Huber + Suhner | 3m Track B cables | multiple | 07/25/2018 | 07/25/2019 |

**Software Utilized:**

| Name | Manufacturer | Version |
|---|---|---|
| R&S EMC32/AMS32/WMS32 | Rohde & Schwarz | 10.30.00 |

## 9.3 Results:

The sample tested was found to Comply.

15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c))

## 9.4 Setup Photograph:

Confidential

### 9.5 Plots/Data:

## Band Edge low (2402 MHz; 0.000 dBm; 1 MHz)

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 0.6 dB

## Result

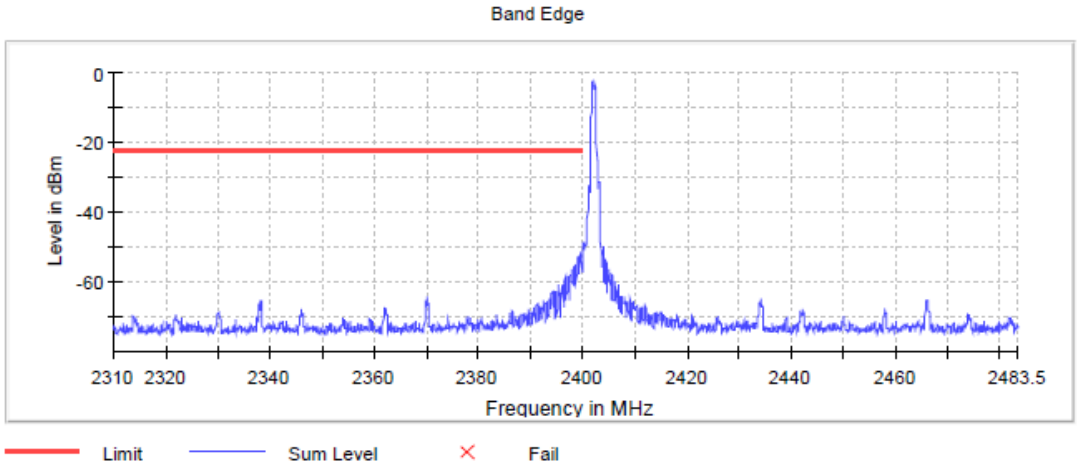
| DUT Frequency (MHz) | Result |
|---|---|
| 2402.000000 | PASS |

## Inband Peak

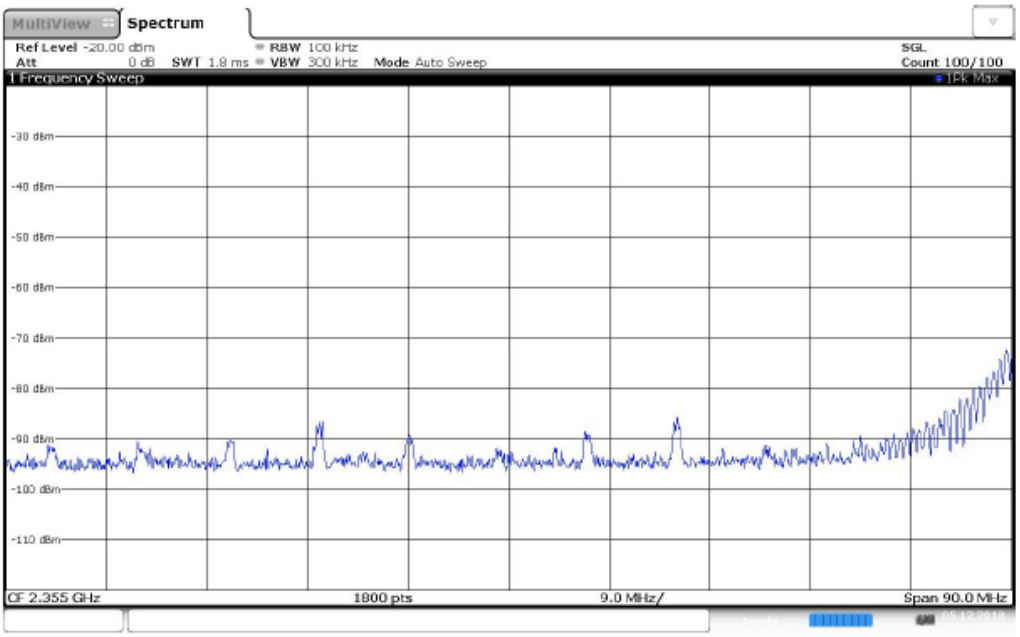
| Frequency (MHz) | Level (dBm) |
|---|---|
| 2402.075000 | -2.4 |

## Measurements

| Frequency (MHz) | Level (dBm) | Margin (dB) | Limit (dBm) | Result |
|---|---|---|---|---|
| 2399.525000 | -51.3 | 28.9 | -22.4 | PASS |
| 2399.575000 | -51.5 | 29.1 | -22.4 | PASS |
| 2399.475000 | -51.8 | 29.4 | -22.4 | PASS |
| 2399.625000 | -51.8 | 29.4 | -22.4 | PASS |
| 2399.675000 | -52.1 | 29.7 | -22.4 | PASS |
| 2399.975000 | -52.5 | 30.0 | -22.4 | PASS |
| 2399.425000 | -52.9 | 30.5 | -22.4 | PASS |
| 2398.975000 | -53.1 | 30.6 | -22.4 | PASS |
| 2399.725000 | -53.1 | 30.7 | -22.4 | PASS |
| 2399.025000 | -53.1 | 30.7 | -22.4 | PASS |
| 2398.925000 | -53.7 | 31.3 | -22.4 | PASS |
| 2399.075000 | -53.8 | 31.3 | -22.4 | PASS |
| 2398.875000 | -53.8 | 31.3 | -22.4 | PASS |
| 2399.375000 | -54.0 | 31.5 | -22.4 | PASS |
| 2399.775000 | -54.3 | 31.9 | -22.4 | PASS |

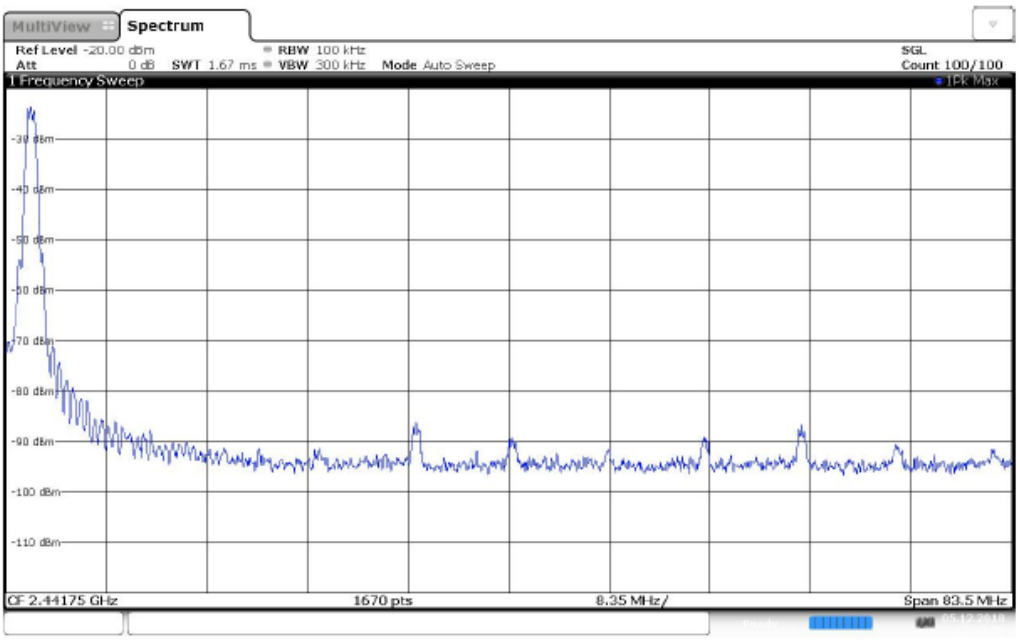


Band Edge Connector 1_0




12:03:37 05.12.2018

Band Edge Connector 1_1




12:03:50 05.12.2018

# Band Edge high (2480 MHz; 0.000 dBm; 1 MHz)

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 0.6 dB

## Result

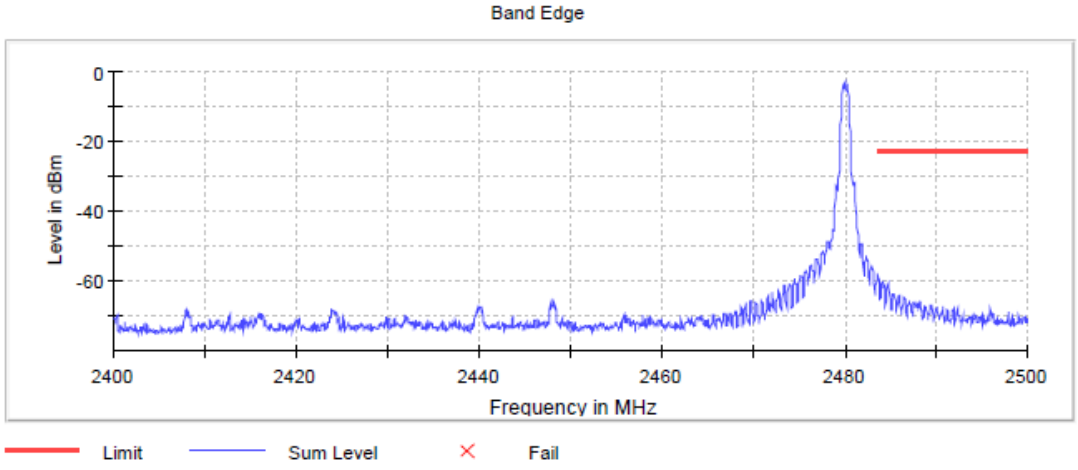
| DUT Frequency (MHz) | Result |
|---|---|
| 2480.000000 | PASS |

## Inband Peak

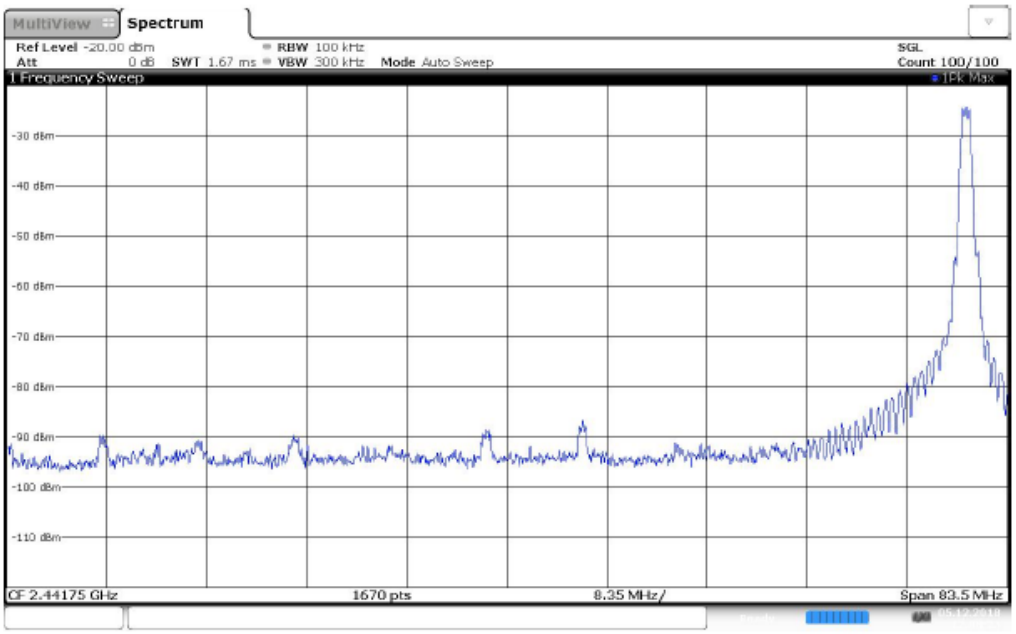
| Frequency (MHz) | Level (dBm) |
|---|---|
| 2480.075000 | -3.0 |

## Measurements

| Frequency (MHz) | Level (dBm) | Margin (dB) | Limit (dBm) | Result |
|---|---|---|---|---|
| 2483.575000 | -58.1 | 35.2 | -23.0 | PASS |
| 2483.625000 | -58.3 | 35.3 | -23.0 | PASS |
| 2483.675000 | -58.6 | 35.6 | -23.0 | PASS |
| 2483.525000 | -59.0 | 36.1 | -23.0 | PASS |
| 2483.725000 | -60.0 | 37.0 | -23.0 | PASS |
| 2484.175000 | -60.6 | 37.7 | -23.0 | PASS |
| 2484.125000 | -60.7 | 37.8 | -23.0 | PASS |
| 2484.075000 | -60.8 | 37.8 | -23.0 | PASS |
| 2484.225000 | -60.9 | 37.9 | -23.0 | PASS |
| 2484.775000 | -61.0 | 38.0 | -23.0 | PASS |
| 2484.725000 | -61.1 | 38.2 | -23.0 | PASS |
| 2484.825000 | -61.2 | 38.2 | -23.0 | PASS |
| 2484.025000 | -61.5 | 38.6 | -23.0 | PASS |
| 2483.775000 | -61.6 | 38.6 | -23.0 | PASS |
| 2484.325000 | -61.7 | 38.8 | -23.0 | PASS |

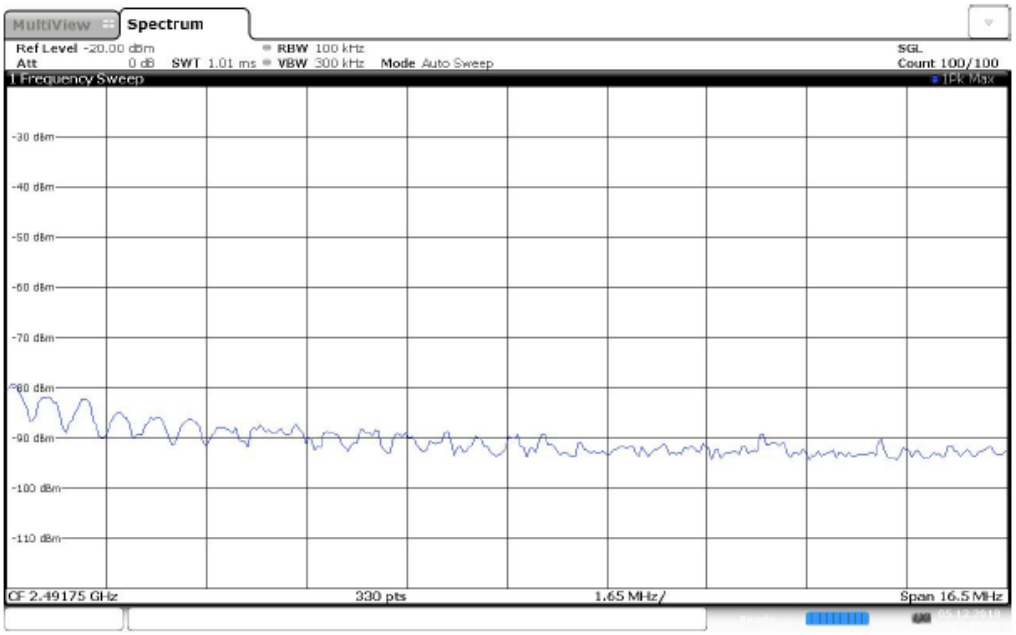


Band Edge Connector 1_0



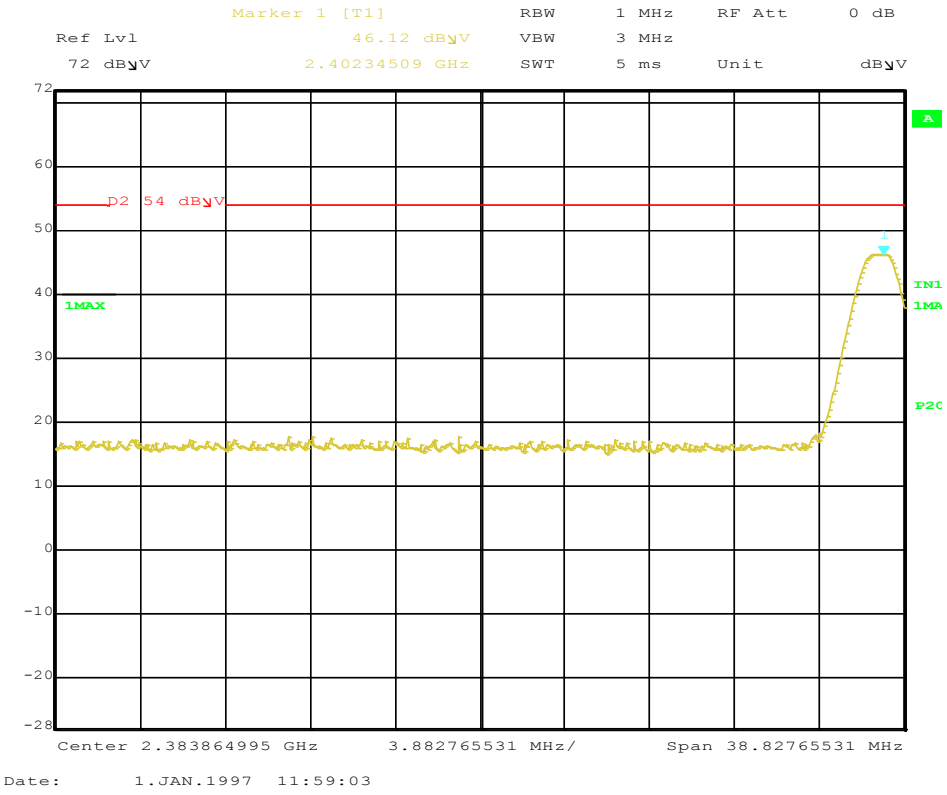

12:08:24 05.12.2018

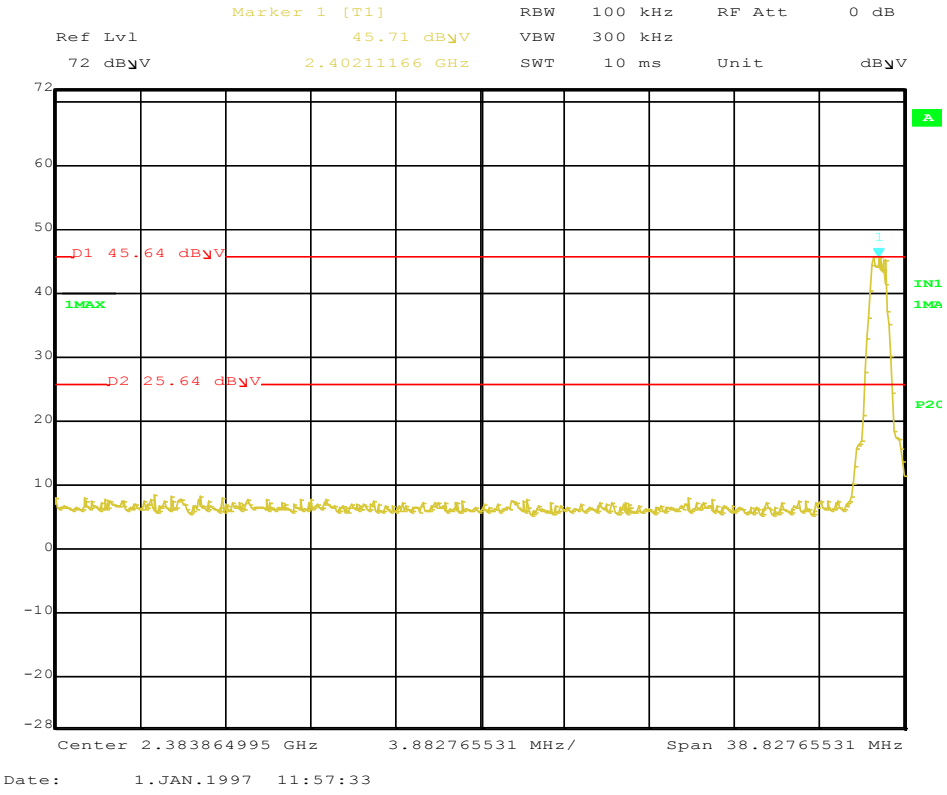
Band Edge Connector 1_1




12:08:35 05.12.2018

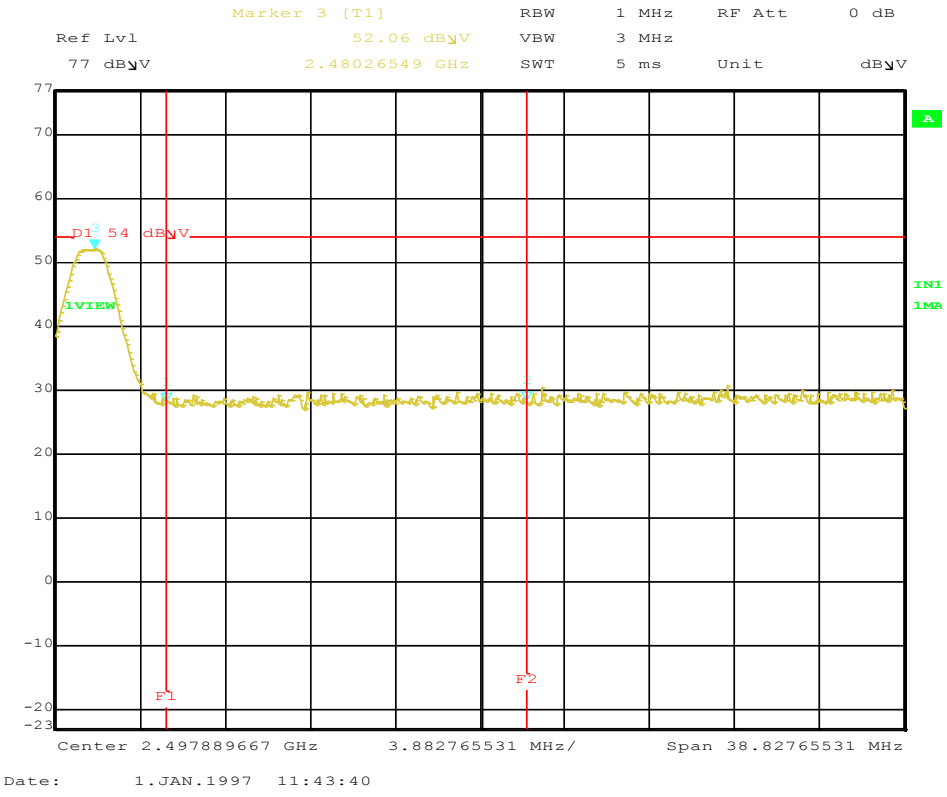
Radiated Emissions Lower Band Edge

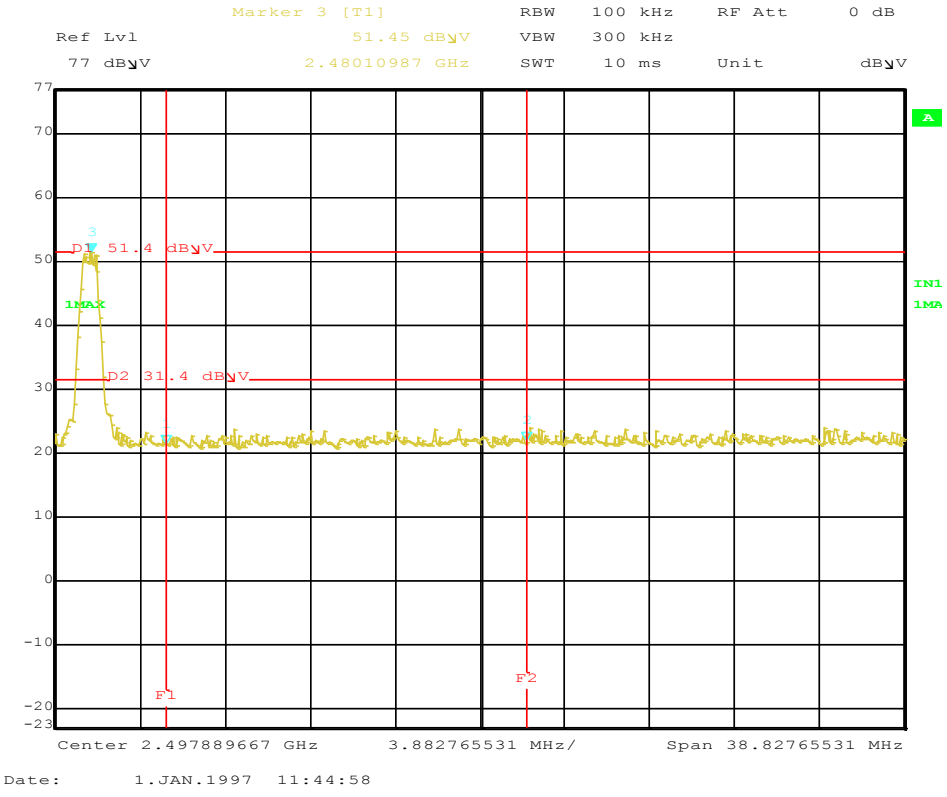



Notes: Worst-case – Z-axis with EMI receiving antenna in horizontal polarity.

Radiated Emissions Upper Band Edge




Notes: Worst-case – Z-axis with EMI receiving antenna in horizontal polarity.

| | | | |
|---|---|---|---|
| Test Personnel: | Kouma Sinn KPS | Test Date: | 12/05/2018, 12/16/2018 |
| Supervising/Reviewing Engineer: (Where Applicable) | N/A | | |
| Product Standard: | CFR47 FCC Part 15.247<br>RSS-247 | Limit Applied: | See report section 9.3 |
| Input Voltage: | Internal Battery | Ambient Temperature: | 22, 19 ºC |
| Pretest Verification w/ Ambient Signals or BB Source: | N/A | Relative Humidity: | 15, 26 % |
| | | Atmospheric Pressure: | 1010, 1005 mbars |

Deviations, Additions, or Exclusions: None

# 10 Transmitter spurious emissions

## 10.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.247, FCC Part 15 Subpart B, RSS 247 ICES 003, ANSI C 63.10, and ANSI C 63.4.

**TEST SITE:** EMC Lab & 10m ALSE

**The EMC Lab** has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

**The 10m ALSE** is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

**Measurement Uncertainty**

| Measurement | Frequency Range | Expanded Uncertainty (k=2) | Ucispr |
|---|---|---|---|
| Radiated Emissions, 10m | 30-1000 MHz | 4.6dB | 6.3 dB |
| Radiated Emissions, 3m | 30-1000 MHz | 5.3 dB | 6.3 dB |
| Radiated Emissions, 3m | 1-6 GHz | 4.5 dB | 5.2 dB |
| Radiated Emissions, 3m | 6-15 GHz | 5.2 dB | 5.5 dB |
| Radiated Emissions, 3m | 15-18 GHz | 5.0 dB | 5.5 dB |
| Radiated Emissions, 3m | 18-40 GHz | 5.0 dB | 5.5 dB |

As shown in the table above our radiated emissions $U_{lab}$ is less than the corresponding $U_{CISPR}$ reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

**Sample Calculation**

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

**Example:**

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

Alternately, when BAT-EMC Emission Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. The “Correction” includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the “Level” column.

## 10.2 Test Equipment Used:

Test equipment used from 30-1000 MHz

| Asset | Description | Manufacturer | Model | Serial | Cal Date | Cal Due |
|---|---|---|---|---|---|---|
| DS40' | Temp, humidity, pressure gauge | Digi Sense | 68000-49 | 181717625 | 11/06/2018 | 11/06/2019 |
| ROS005-1' | Signal and Spectrum Analyzer | Rohde and Shwartz | FSW43 | 100646 | 10/15/2018 | 10/15/2019 |
| None | 10 dB | HRS | AT-110v | 000646 | VBU | Verified |
| 145130 | Cable,SMA-SMA,1 meter,9kHz-40GHz, (Cable Kit 6) | Huber+Suhner | Sucoflex 102EA | 3153/2EA | 09/13/2018 | 09/13/2019 |

**Software Utilized:**

| Name | Manufacturer | Version |
|---|---|---|
| R&S EMC32/AMS32/WMS32 | Rohde & Schwarz | 10.30.00 |

Test equipment used from 1-25 GHz

| Asset | Description | Manufacturer | Model | Serial | Cal Date | Cal Due |
|---|---|---|---|---|---|---|
| BAR1' | Digital 4 Line Barometer | Mannix | 0ABA116 | BAR1 | 04/30/2018 | 04/30/2019 |
| ETS005' | 1-18GHz horn antenna | ETS-Lindgren | 3117 | 00218279 | 05/14/2018 | 05/14/2019 |
| REA002' | 2.5GHz High Pass Filter | Reactel, Inc | 7HS-2.5G/18G-S11 | 06-1 | 02/22/2018 | 02/22/2019 |
| 145-416' | Cables 145-420 145-423 145-425 145-408 | Huber + Suhner | 3m Track B cables | multiple | 07/25/2018 | 07/25/2019 |
| BONN001' | 1-18GHz low noise pre-amp | Bonn | BLMA 0118-M | 1811749 | 06/10/2018 | 06/10/2019 |
| 145128' | EMI Receiver (20 Hz - 40 Ghz) | Rohde & Schwarz | ESIB 40 | 839283/001 | 03/22/2018 | 03/22/2019 |
| HORN2' | HORN ANTENNA | EMCO | 3115 | 9602-4675 | 04/02/2018 | 04/02/2019 |
| CBL030' | High Frequency Cable 40GHz | Megaphase | TM40 K1K1 80 | CBL030 | 11/15/2018 | 11/15/2019 |
| CBLSHF204' | Cable, SMA - SMA, 9kHz -40GHz, (Cable Kit 5) | Huber + Suhner | Sucoflex 102EA | 234714001 | 11/15/2018 | 11/15/2019 |
| PRE8' | PREAMPLFIER 1- 40 GHz | MITEQ | NSP4000-NF | 507145 | 10/25/2018 | 10/25/2019 |
| 145130' | Cable,SMA-SMA,1 meter,9kHz-40GHz, (Cable Kit 6) | Huber+Suhner | Sucoflex 102EA | 3153/2EA | 09/13/2018 | 09/13/2019 |
| 145108' | EMI Test Receiver (20Hz - 40GHz) | Rohde & Schwarz | ESIB40 | 100209 | 06/01/2018 | 06/01/2019 |
| REA008' | band reject filter 2.4GHz | Reactel, Inc | 12RX7-2441.75-x140 S | 17-01 | 07/13/2018 | 07/13/2019 |

**Software Utilized:**

| Name | Manufacturer | Version |
|---|---|---|
| R&S EMC32/AMS32/WMS32 | Rohde & Schwarz | 10.30.00 |
| EMI Boxborough.xls | Intertek | 08/27/2010 |

## 10.3 Results:

The sample tested was found to Comply.

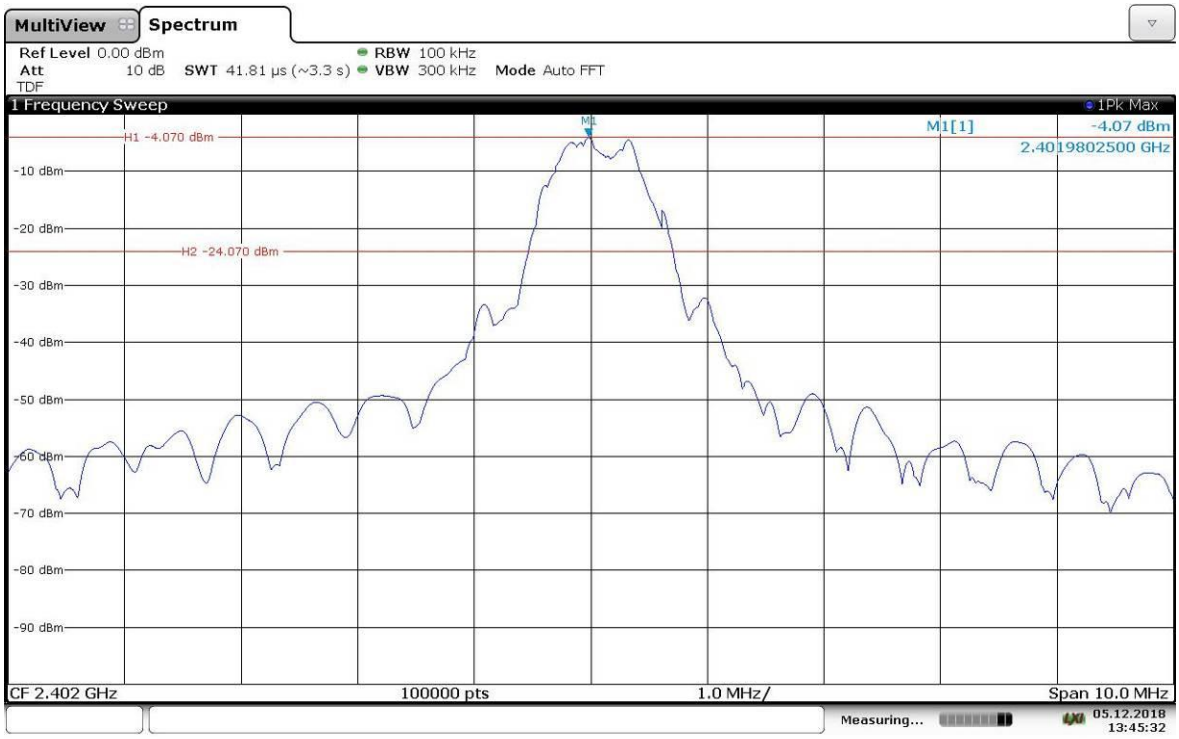
15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c))

### 10.4 Setup Photographs:

Confidential

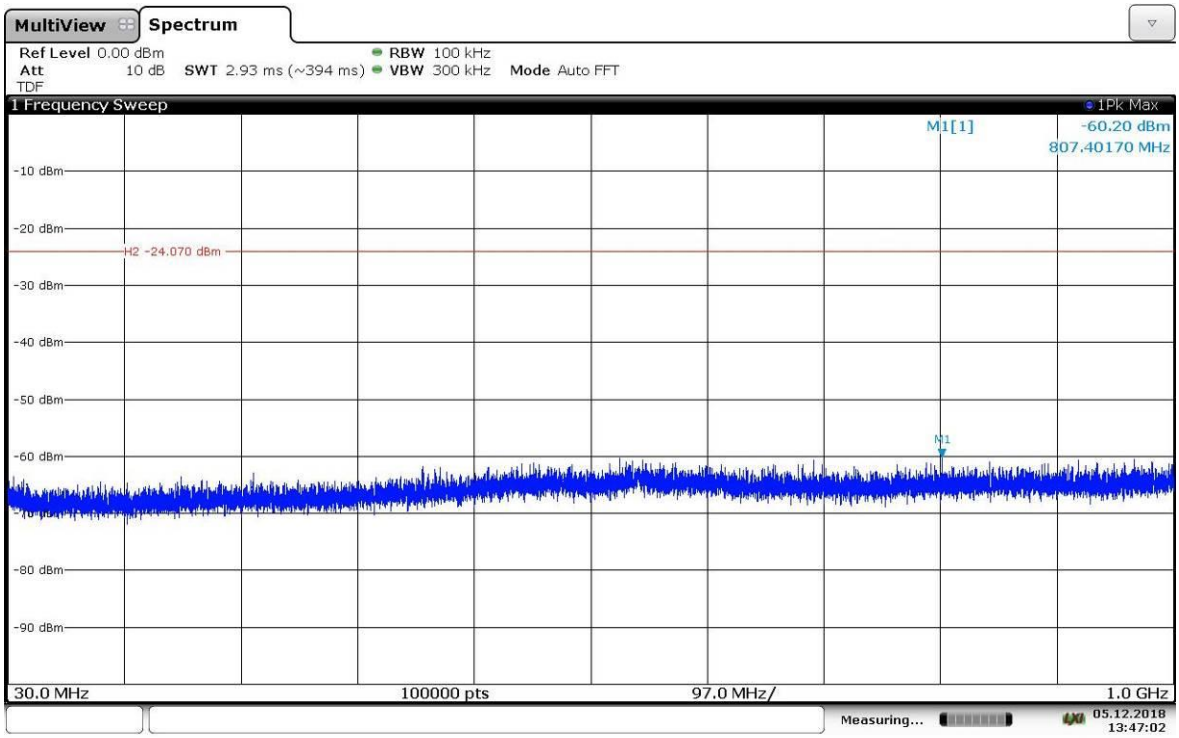
## 10.5 Plots/Data:

**Limit: 20 dB down from the carrier (Low Channel)**



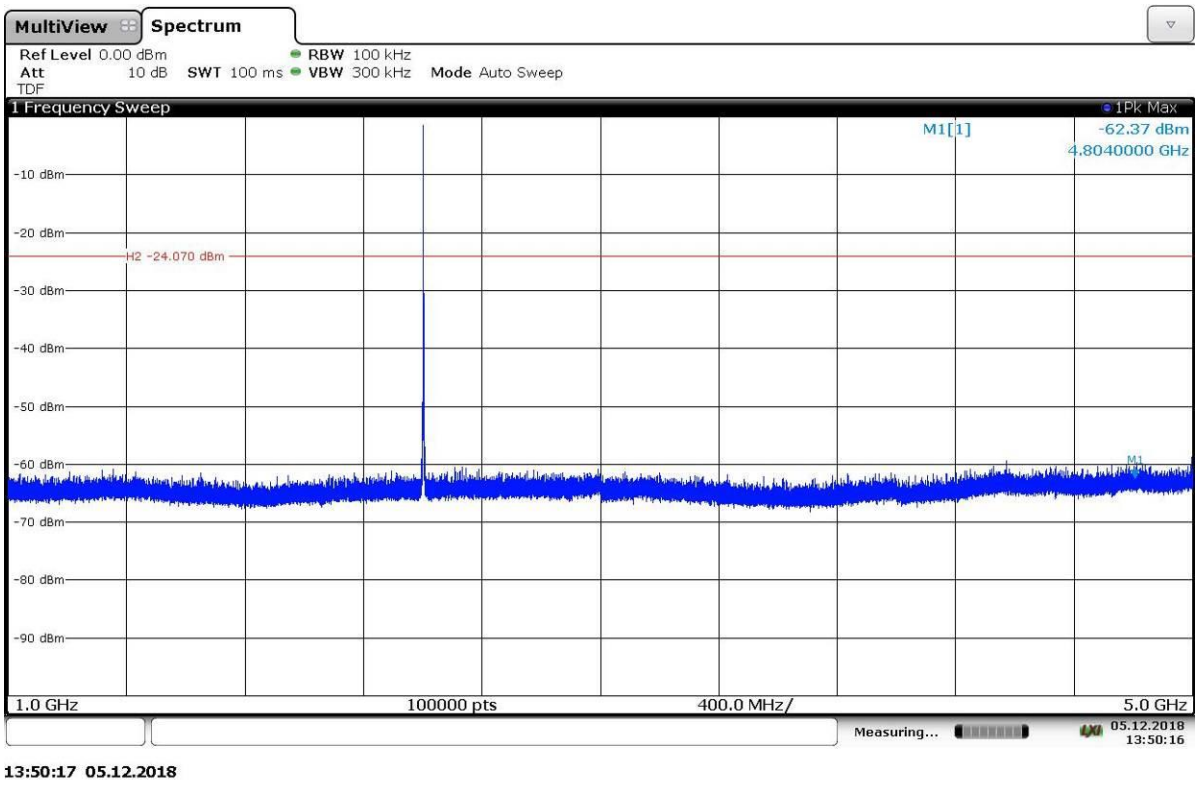

13:45:33 05.12.2018

**Low Channel Antenna Port Conducted Spurious Emissions, 30 MHz-1000 MHz**

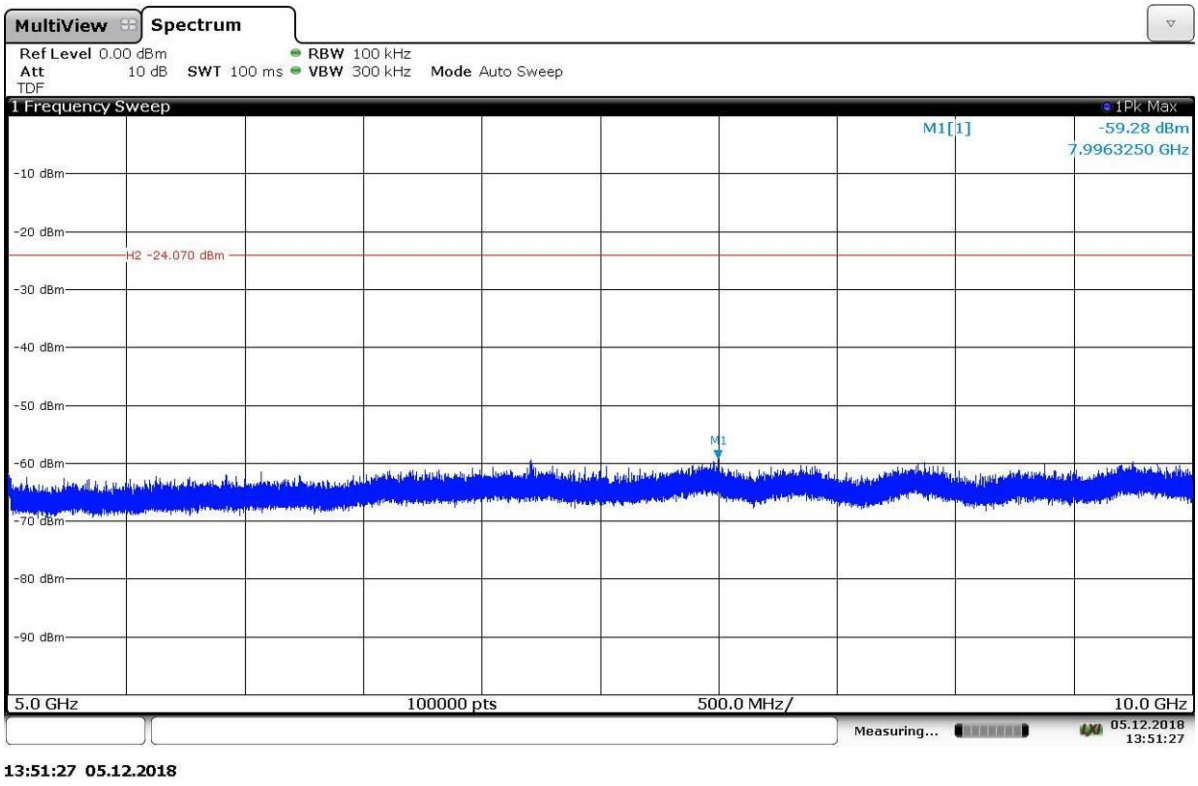



13:47:02 05.12.2018

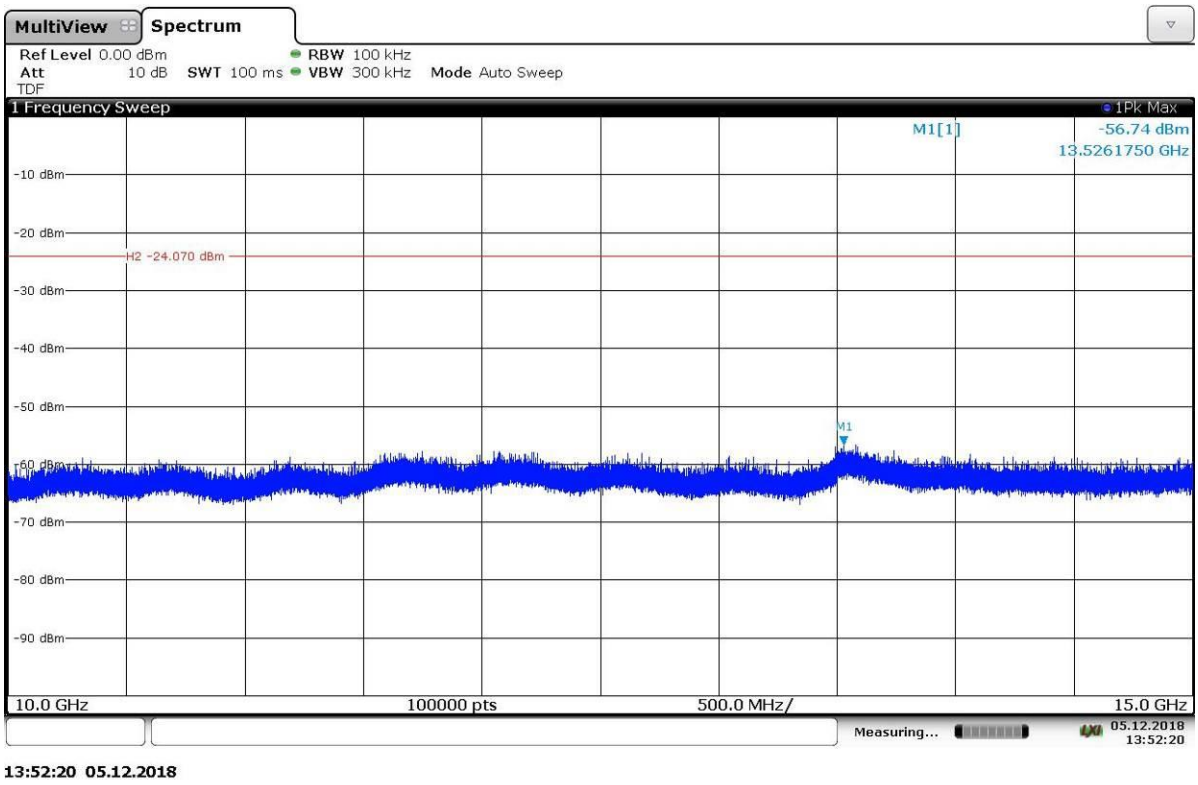
**Low Channel Antenna Port Conducted Spurious Emissions, 1-5 GHz**



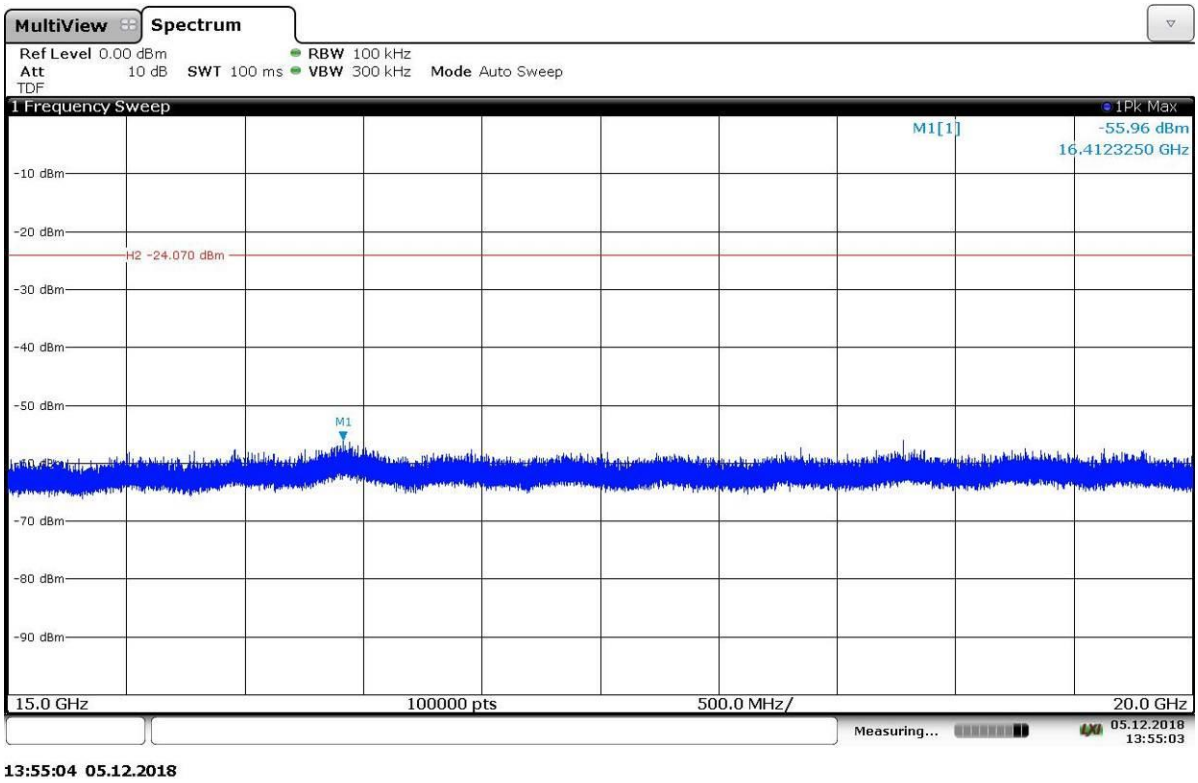

**Low Channel Antenna Port Conducted Spurious Emissions, 5-10 GHz**



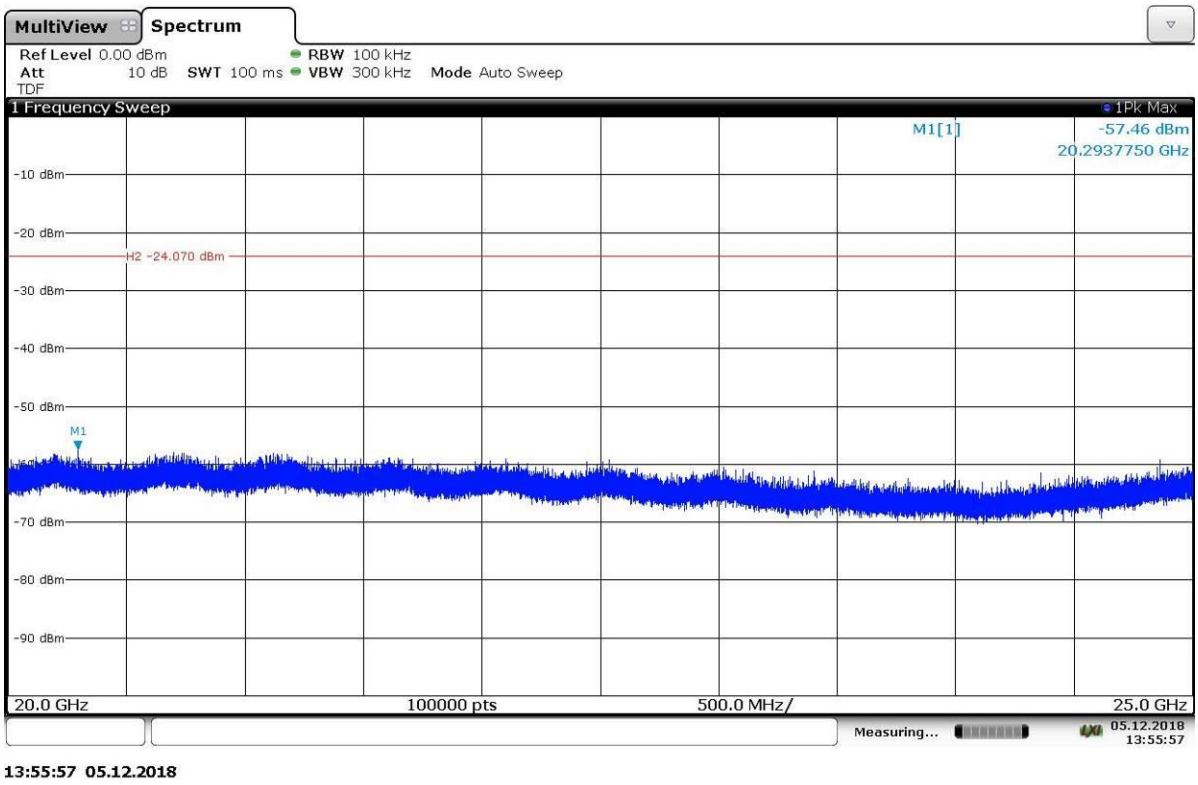

**Low Channel Antenna Port Conducted Spurious Emissions, 10-15 GHz**



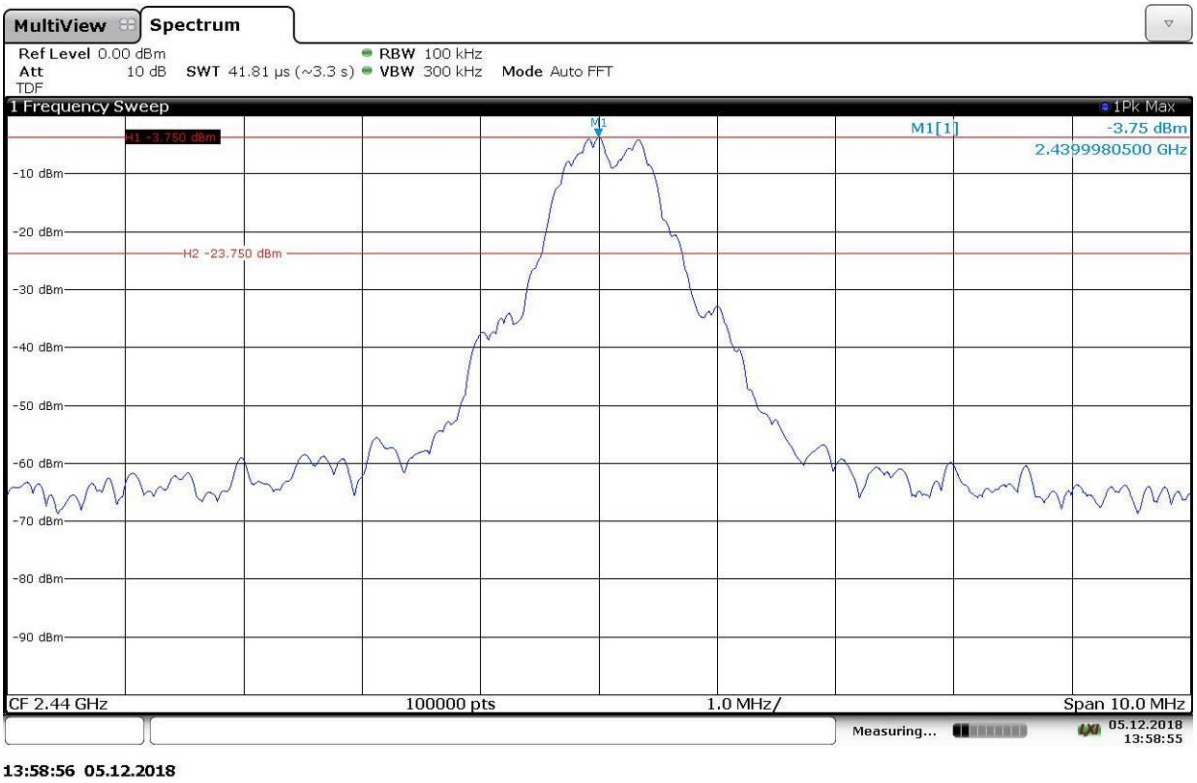

**Low Channel Antenna Port Conducted Spurious Emissions, 15-20 GHz**



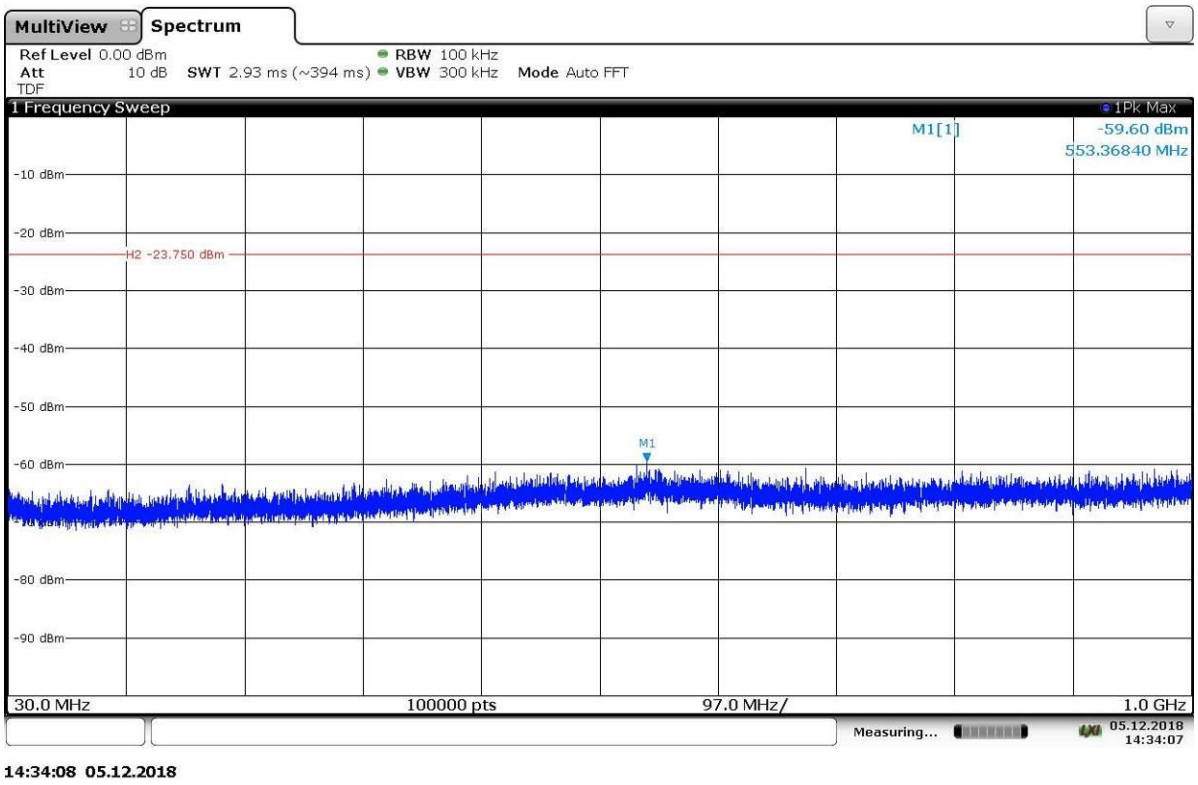

**Low Channel Antenna Port Conducted Spurious Emissions, 20-25 GHz**



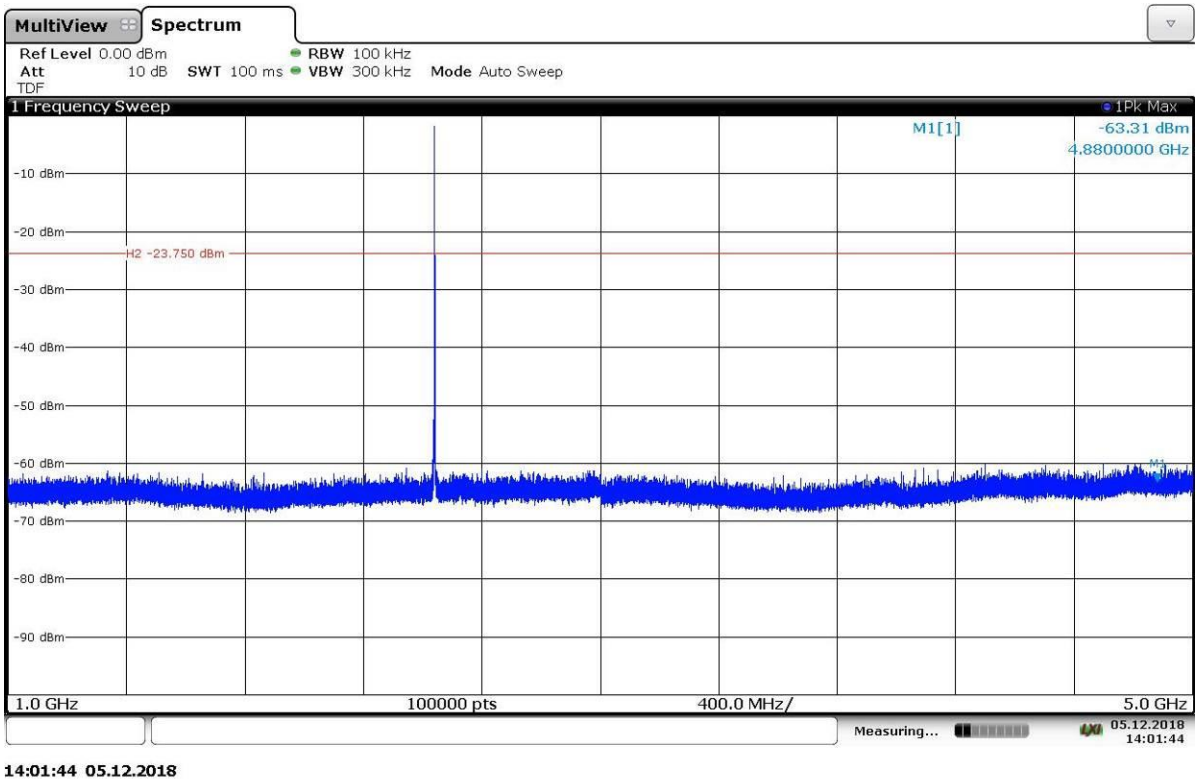

**Limit: 20 dB down from the carrier (Mid Channel)**



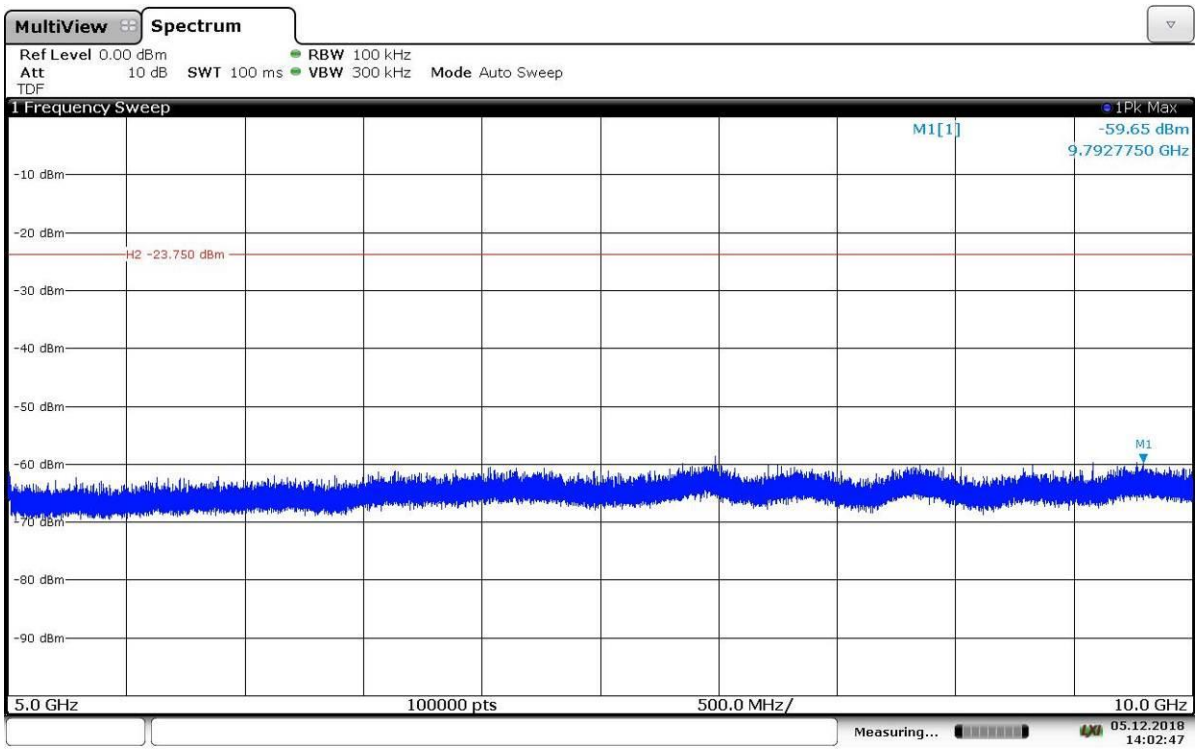

**Mid Channel Antenna Port Conducted Spurious Emissions, 30 MHz-1000 MHz**




**Mid Channel Antenna Port Conducted Spurious Emissions, 1-5 GHz**

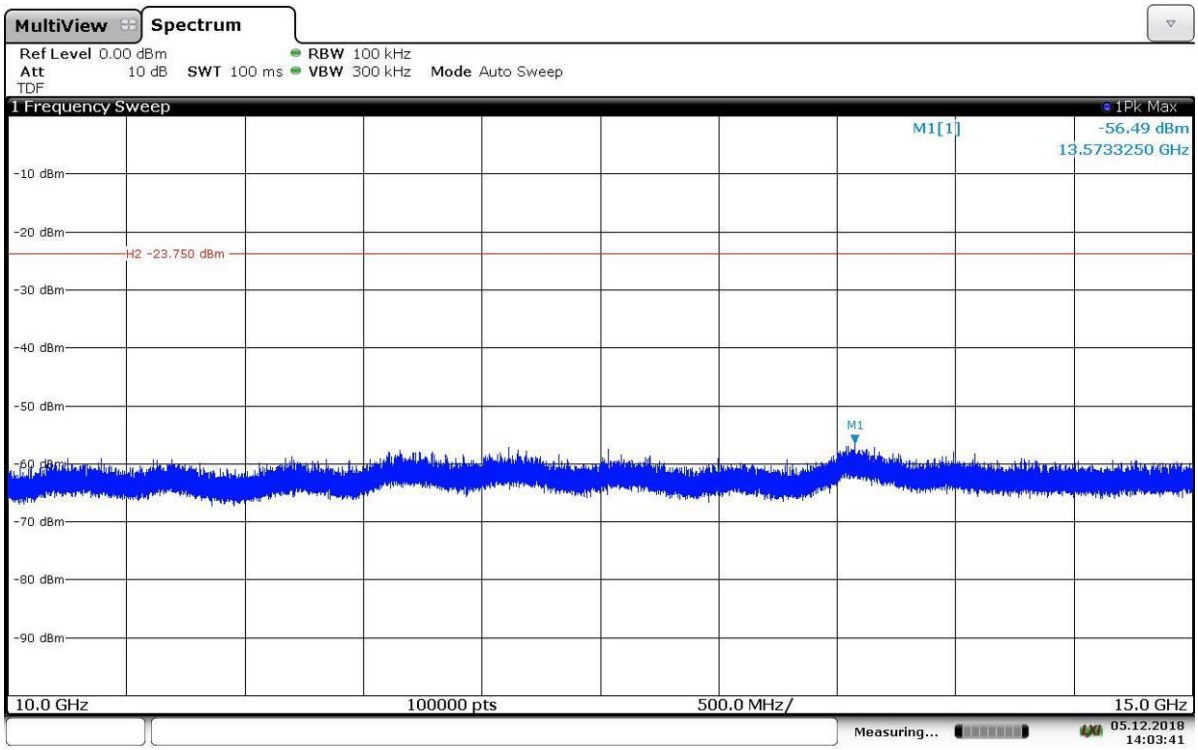



**Mid Channel Antenna Port Conducted Spurious Emissions, 5-10 GHz**



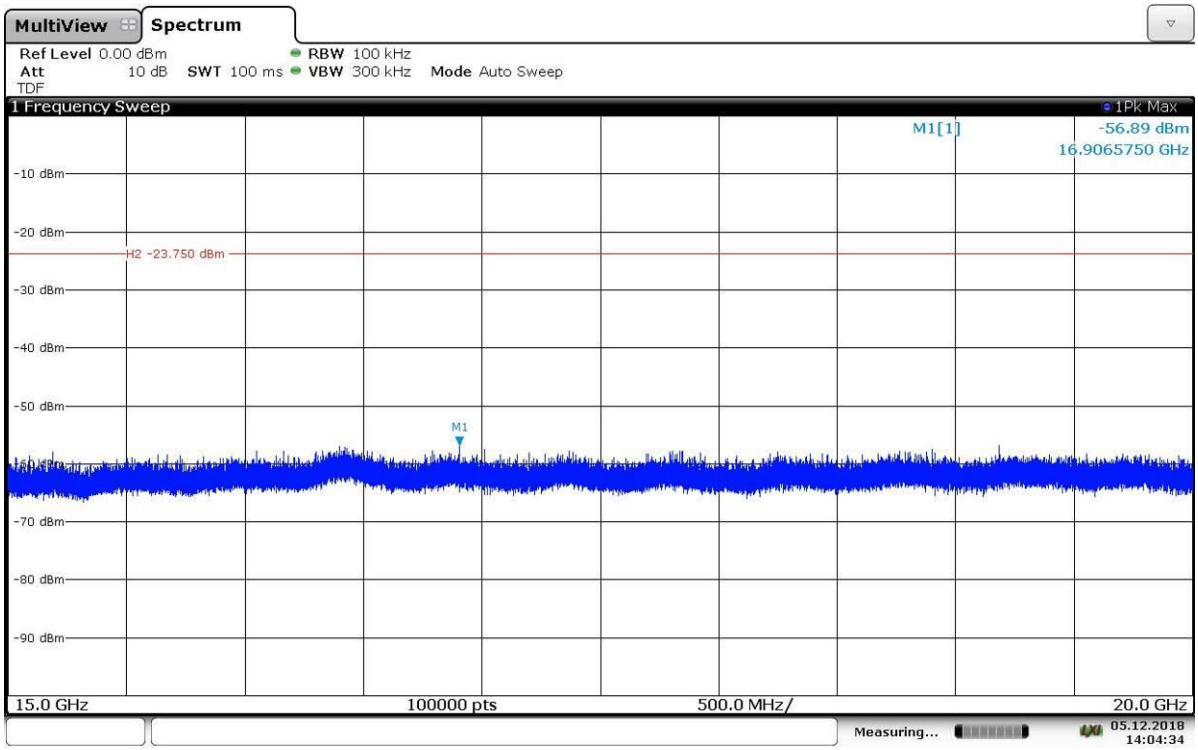

**14:02:47 05.12.2018**

**Mid Channel Antenna Port Conducted Spurious Emissions, 10-15 GHz**



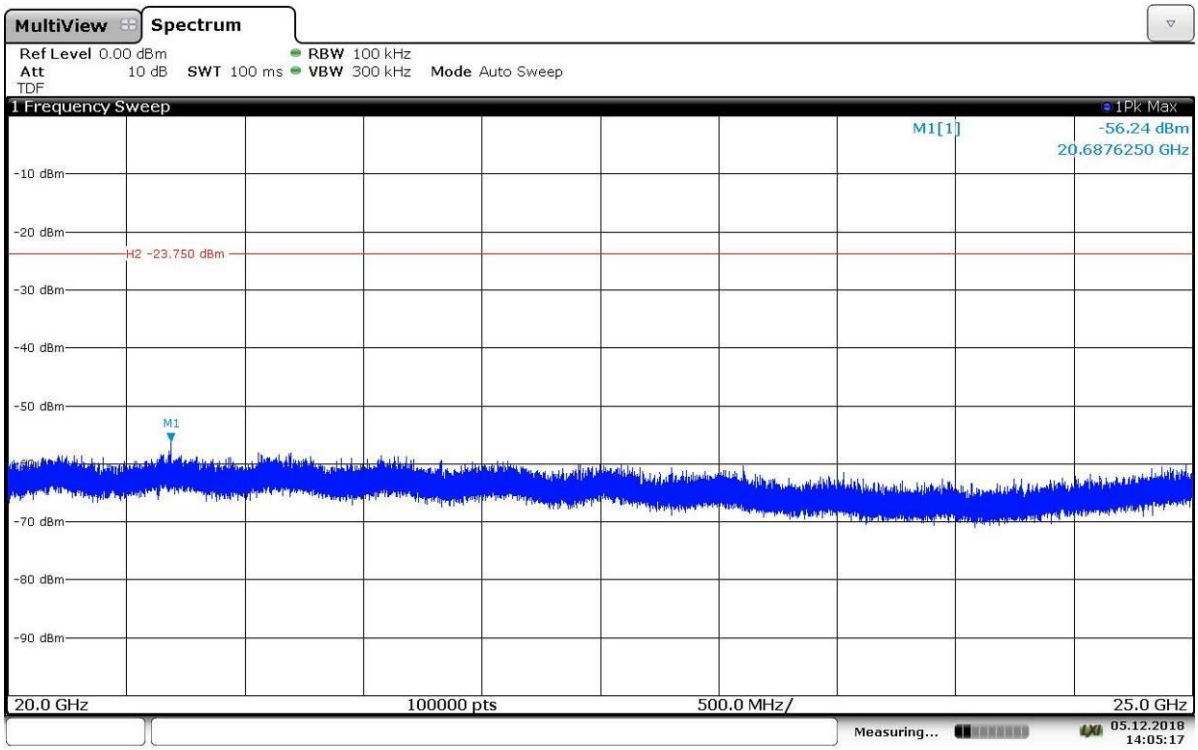

**14:03:41 05.12.2018**

**Mid Channel Antenna Port Conducted Spurious Emissions, 15-20 GHz**



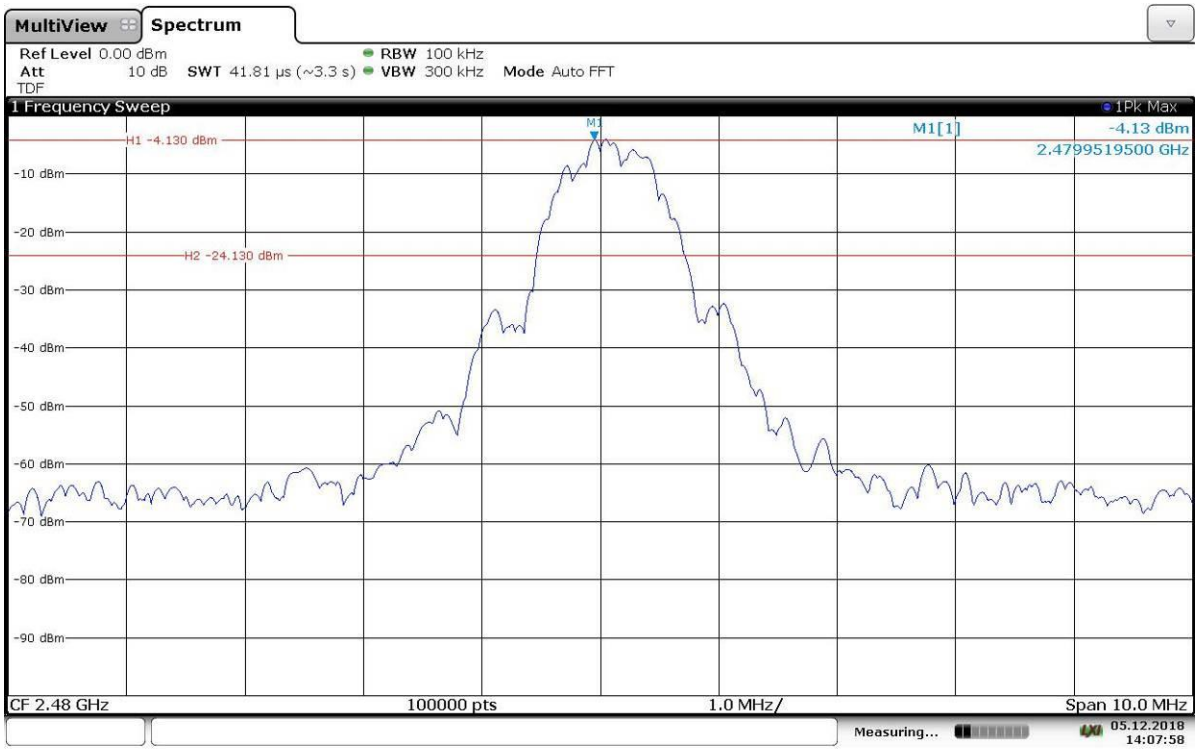

**14:04:34 05.12.2018**

**Mid Channel Antenna Port Conducted Spurious Emissions, 20-25 GHz**



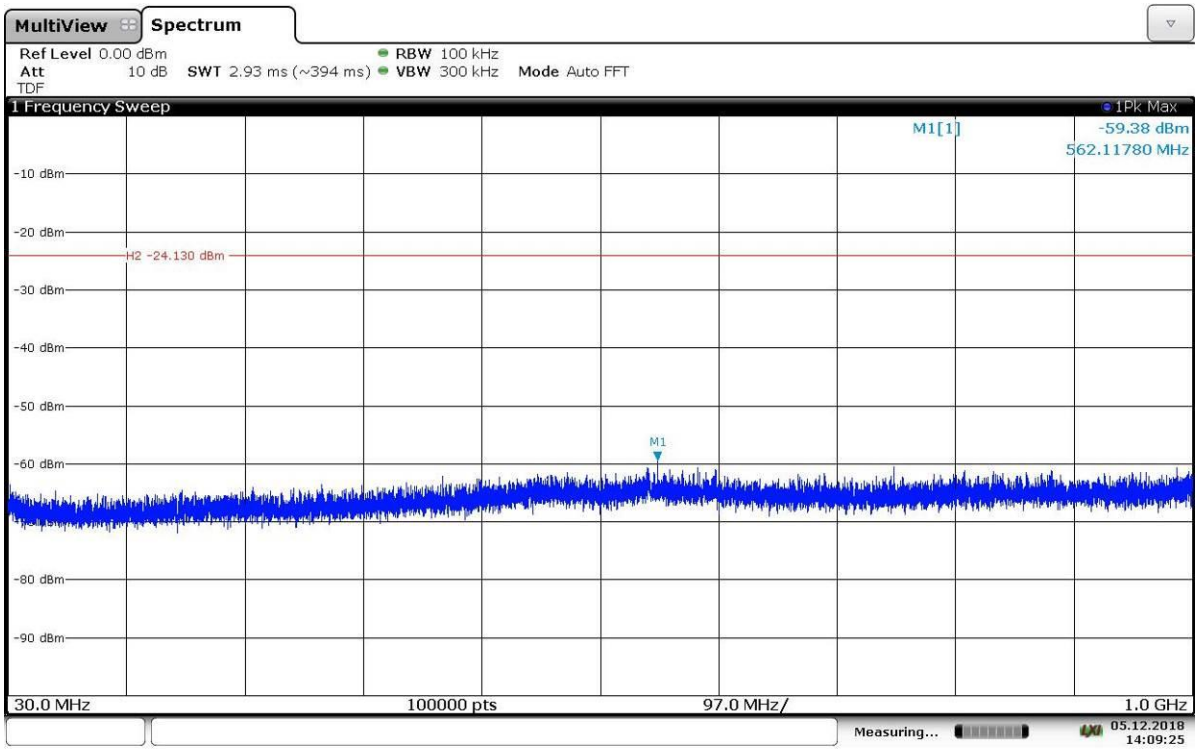

14:05:18 05.12.2018

**Limit: 20 dB down from the carrier (High Channel)**



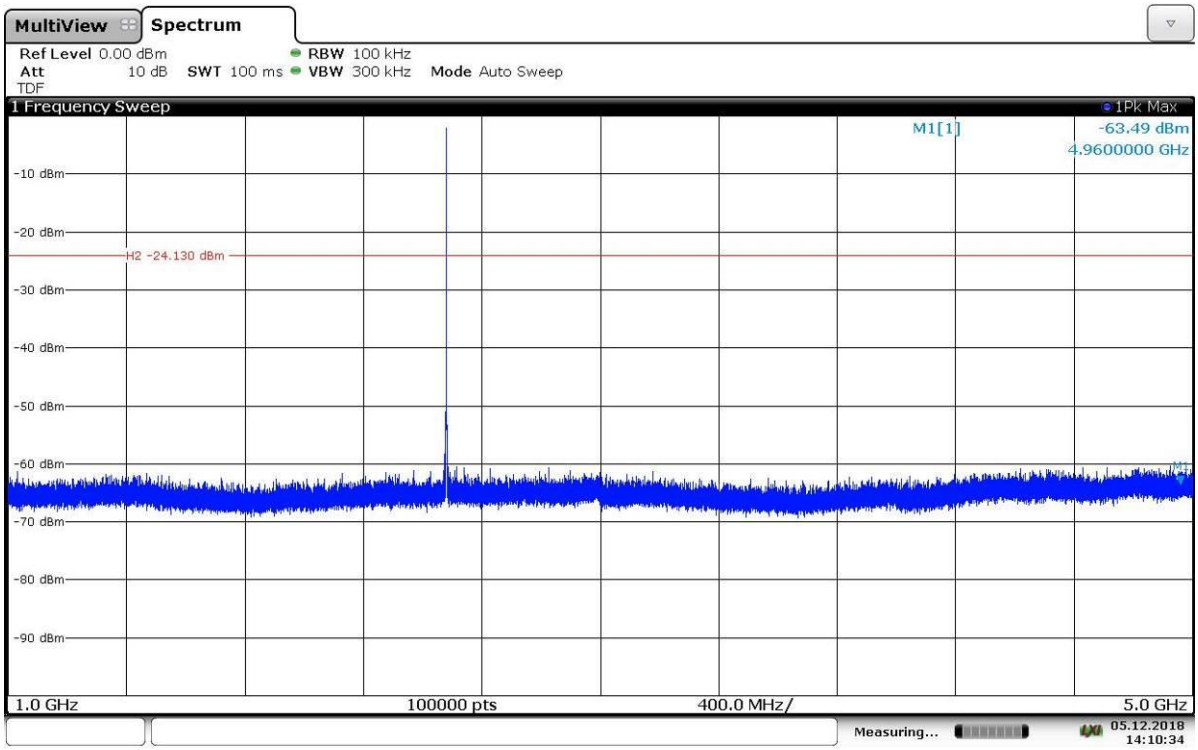

14:07:59 05.12.2018

**High Channel Antenna Port Conducted Spurious Emissions, 30-1000 MHz**



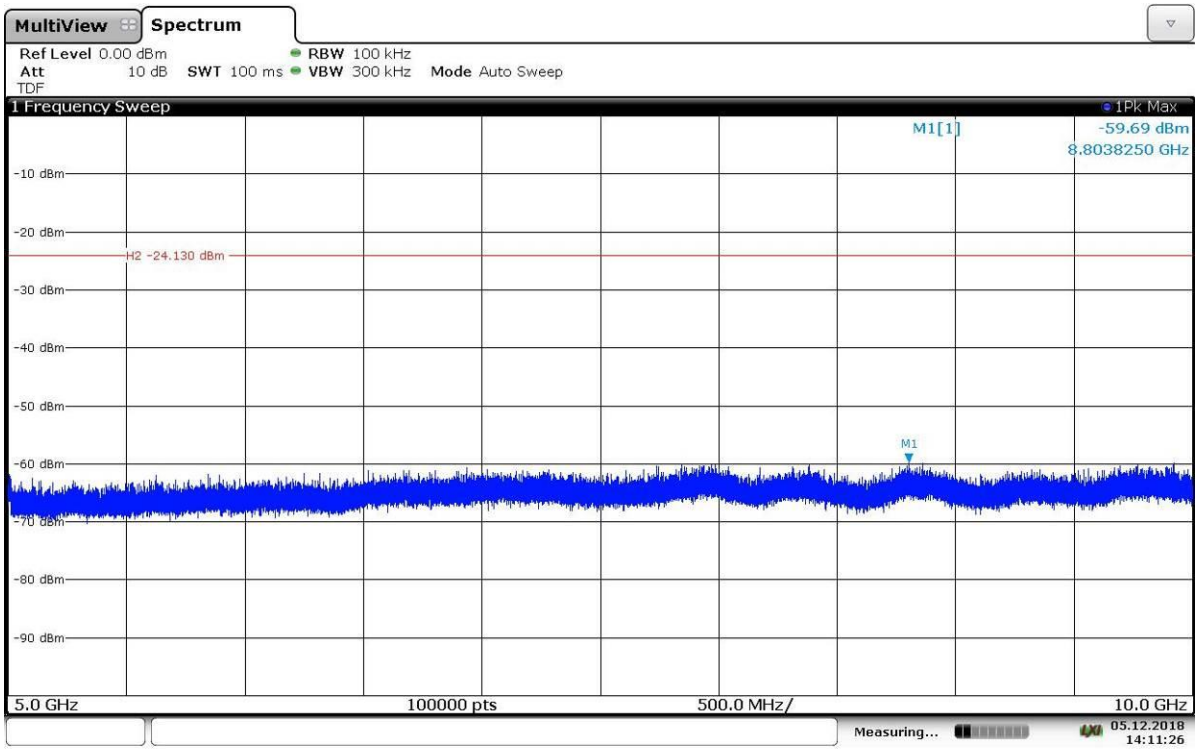

14:09:26 05.12.2018

**High Channel Antenna Port Conducted Spurious Emissions, 1-5 GHz**



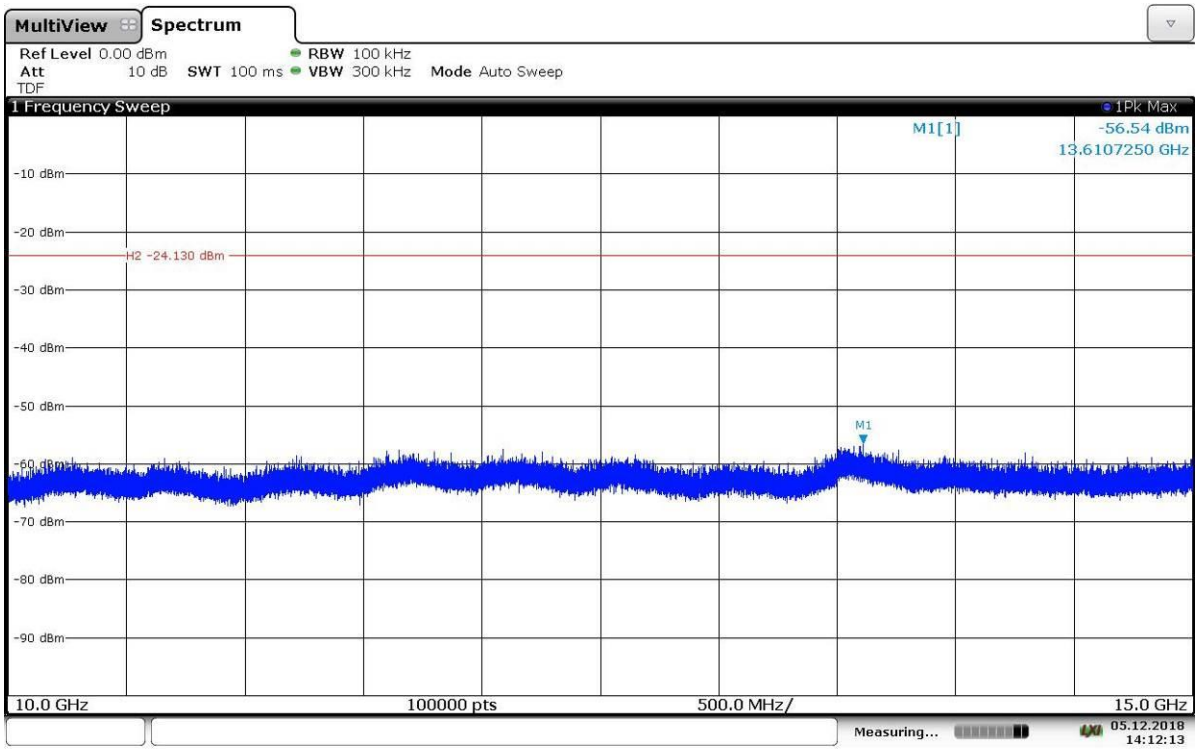

14:10:35 05.12.2018

**High Channel Antenna Port Conducted Spurious Emissions, 5-10 GHz**



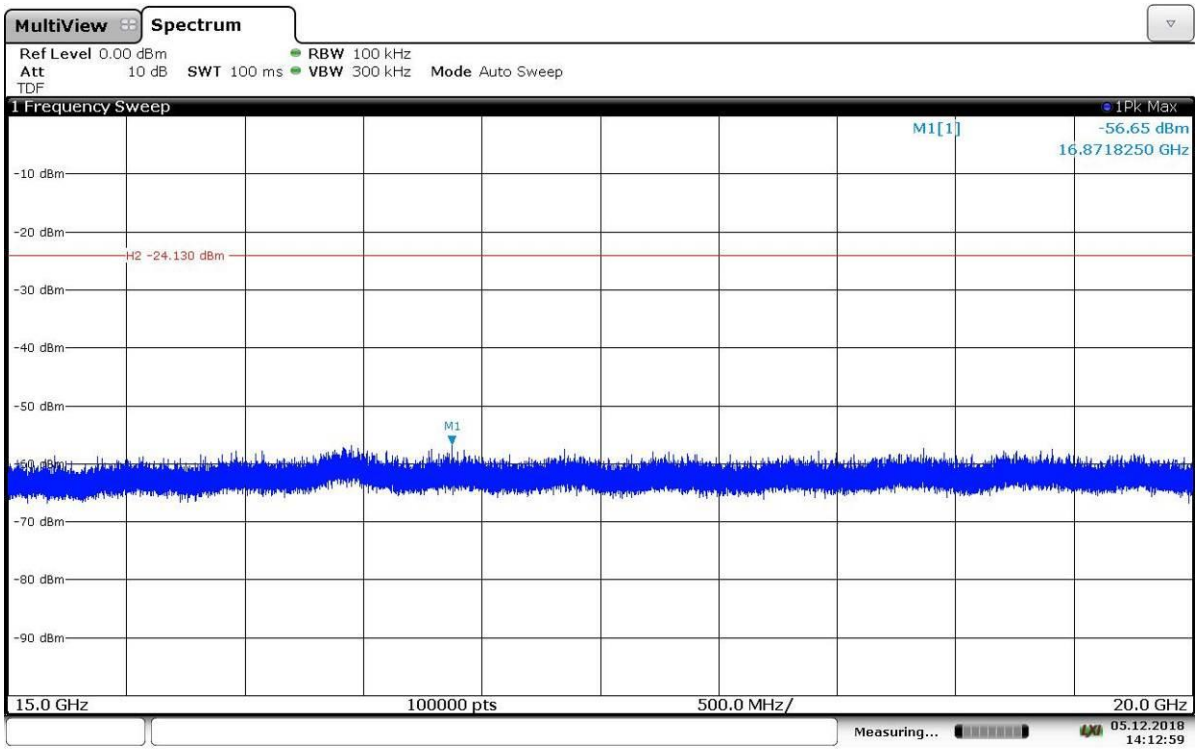

**14:11:27 05.12.2018**

**High Channel Antenna Port Conducted Spurious Emissions, 10-15 GHz**



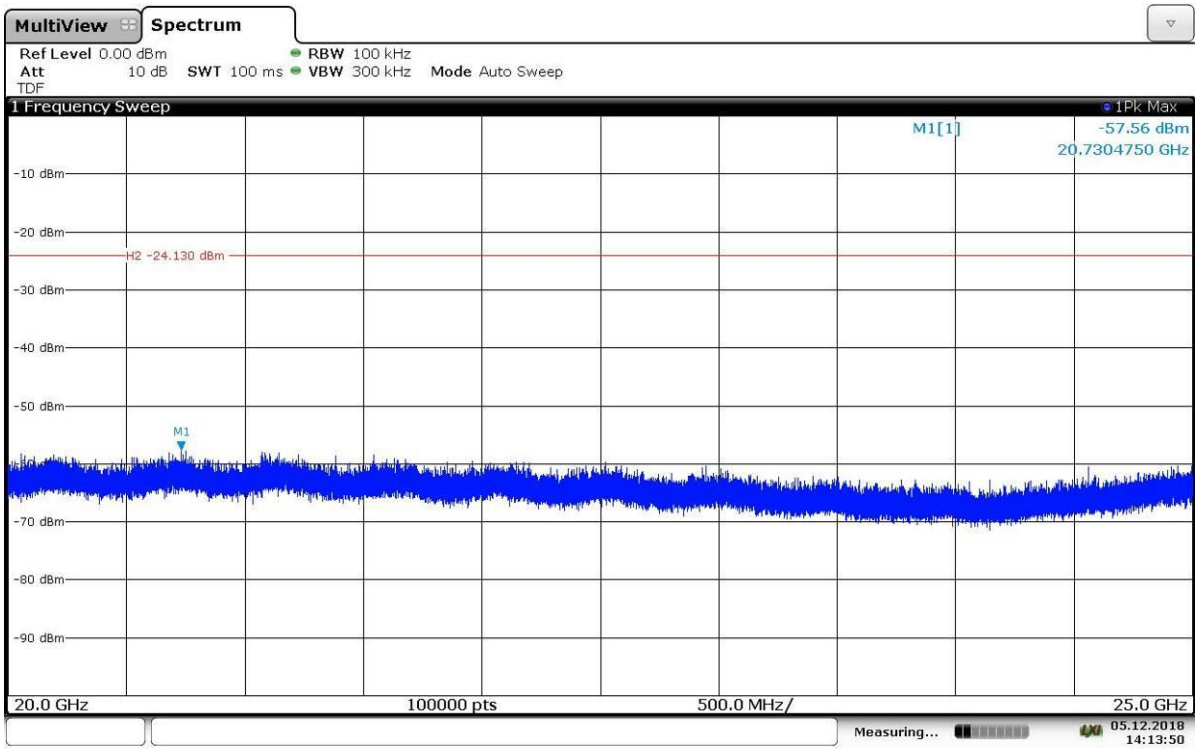

**14:12:14 05.12.2018**

**High Channel Antenna Port Conducted Spurious Emissions, 15-20 GHz**




**14:12:59 05.12.2018**

**High Channel Antenna Port Conducted Spurious Emissions, 20-25 GHz**



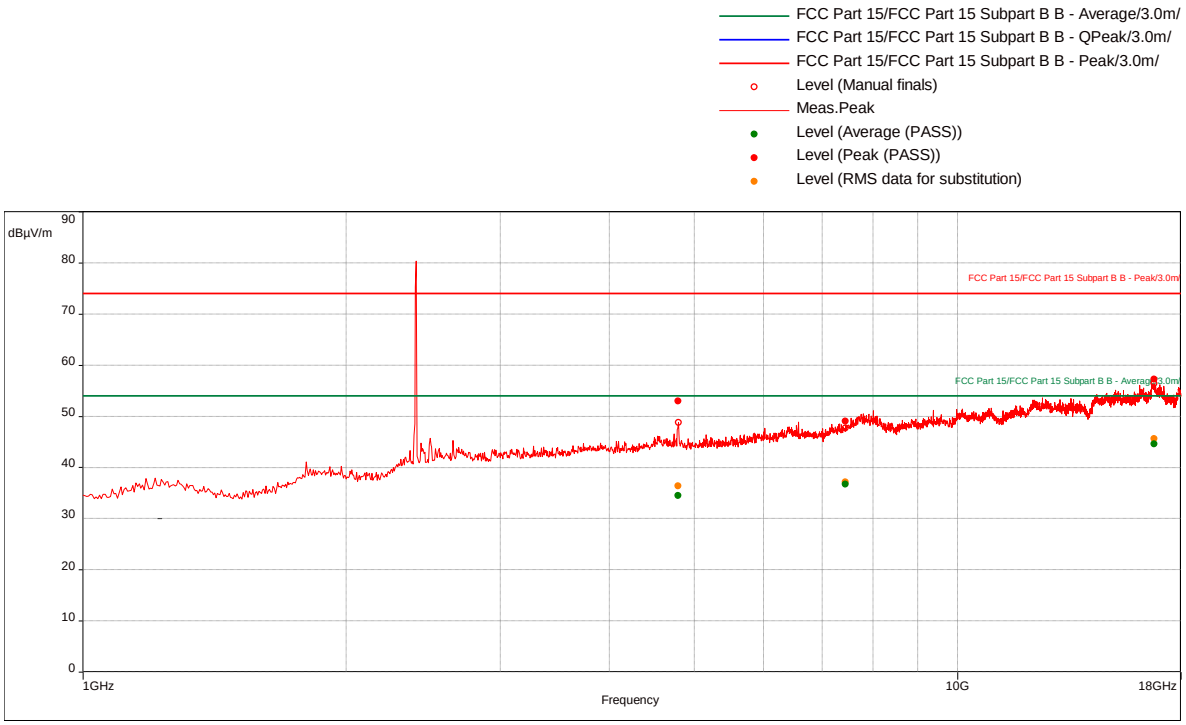

**14:13:51 05.12.2018**

## Transmit @ low channel, X-axis – 30 MHz-25 GHz

**Test Information:**

| | |
|---|---|
| Date and Time | 12/21/2018 4:06:39 PM |
| Client and Project Number | Philips |
| Engineer | Kouma Sinn |
| Temperature | 20 C |
| Humidity | 34 % |
| Atmospheric Pressure | 985mbar |
| Comments | 12-21-18_G10_Tx @ low channel, X-axis 1-18 GHz |

**Graph:**




**Results:**

Peak (PASS) (3)

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Azimuth (°) (dB) | Height (m) (dB) | Pol. (dB) | RBW (dB) | Correction (dB) |
|---|---|---|---|---|---|---|---|---|
| 4792.105263 | 52.97 | 74.00 | -21.03 | 180.00 | 1.33 | Vertical | 1000000.00 | -11.59 |
| 7438.421053 | 49.01 | 74.00 | -24.99 | 343.00 | 1.30 | Horizontal | 1000000.00 | -6.78 |
| 16777.10526 | 57.23 | 74.00 | -16.77 | 292.00 | 1.57 | Vertical | 1000000.00 | 3.78 |

Average (PASS) (3)

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Azimuth (°) (dB) | Height (m) (dB) | Pol. (dB) | RBW (dB) | Correction (dB) |
|---|---|---|---|---|---|---|---|---|
| 4792.105263 | 34.49 | 54.00 | -19.51 | 180.00 | 1.33 | Vertical | 1000000.00 | -11.59 |
| 7438.421053 | 36.71 | 54.00 | -17.29 | 343.00 | 1.30 | Horizontal | 1000000.00 | -6.78 |
| 16777.10526 | 44.54 | 54.00 | -9.46 | 292.00 | 1.57 | Vertical | 1000000.00 | 3.78 |

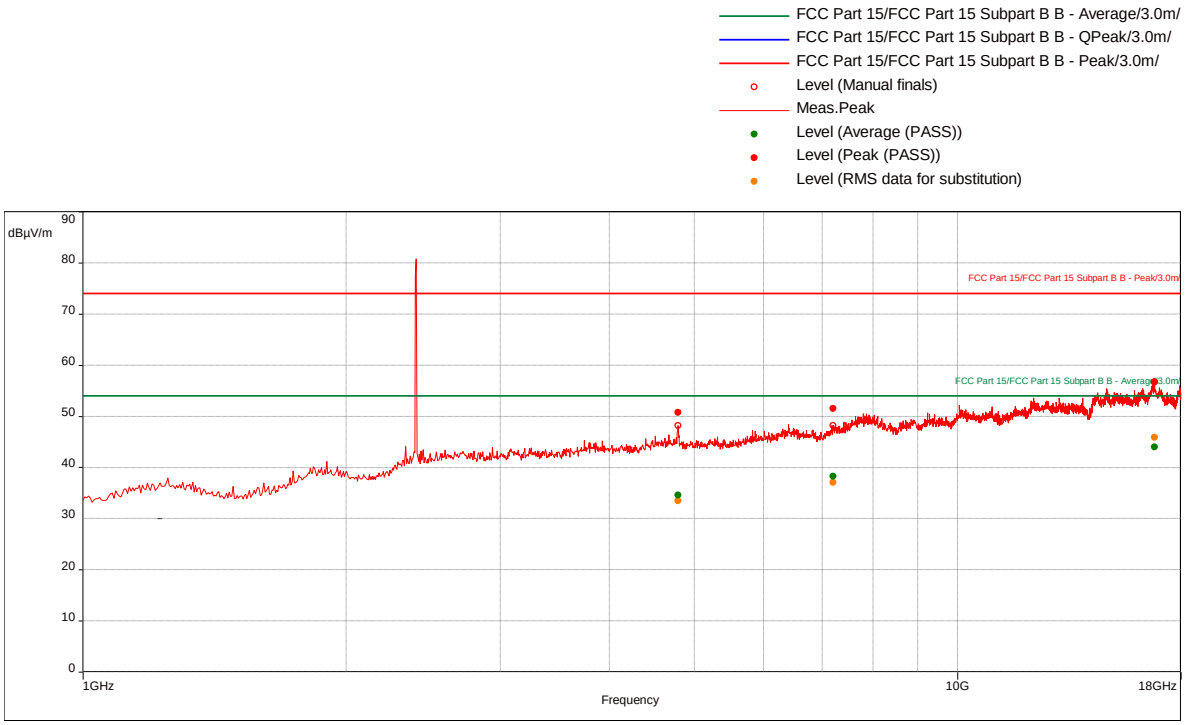
Notes: Scanned from 1-18 GHz using Nexio software (see plot above) and repeated test manually from 10-18 GHz at 10 cm to make sure there's no emissions present since the noise floor is high in this frequency range. Manually scan was performed from 1-2.4 GHz and 18-25 GHz.at 10 cm. No emissions were detected.

## Transmit @ low channel, Y-axis – 30 MHz-25 GHz

**Test Information:**

| | |
|---|---|
| Date and Time | 12/21/2018 5:57:09 PM |
| Client and Project Number | Philips |
| Engineer | Kouma Sinn |
| Temperature | 20 C |
| Humidity | 34 % |
| Atmospheric Pressure | 985mbar |
| Comments | 12-21-18_G10_Tx @ low channel, Y-axis 1-18GHz |

**Graph:**




**Results:**

Peak (PASS) (3)

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Azimuth (°) (dB) | Height (m) (dB) | Pol. (dB) | RBW (dB) | Correction (dB) |
|---|---|---|---|---|---|---|---|---|
| 4789.210526 | 50.70 | 74.00 | -23.30 | 128.00 | 1.00 | Vertical | 1000000.00 | -11.60 |
| 7205.263158 | 51.52 | 74.00 | -22.48 | 47.00 | 1.25 | Vertical | 1000000.00 | -7.65 |
| 16802.10526 | 56.64 | 74.00 | -17.36 | 121.00 | 3.54 | Vertical | 1000000.00 | 3.71 |

Average (PASS) (3)

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Azimuth (°) (dB) | Height (m) (dB) | Pol. (dB) | RBW (dB) | Correction (dB) |
|---|---|---|---|---|---|---|---|---|
| 4789.210526 | 34.57 | 54.00 | -19.43 | 128.00 | 1.00 | Vertical | 1000000.00 | -11.60 |
| 7205.263158 | 38.23 | 54.00 | -15.77 | 47.00 | 1.25 | Vertical | 1000000.00 | -7.65 |
| 16802.10526 | 43.98 | 54.00 | -10.02 | 121.00 | 3.54 | Vertical | 1000000.00 | 3.71 |

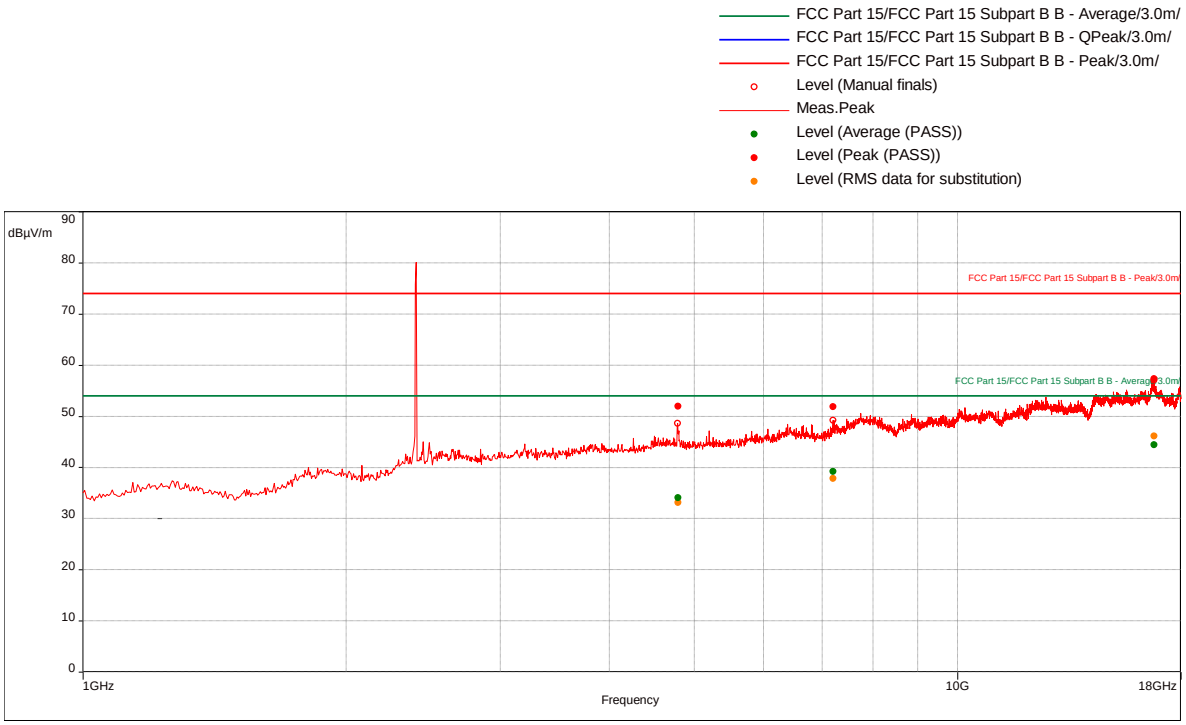
Notes: Scanned from 1-18 GHz using Nexio software (see plot above) and repeated test manually from 10-18 GHz at 10 cm to make sure there's no emissions present since the noise floor is high in this frequency range. Manually scan was performed from 1-2.4 GHz and 18-25 GHz.at 10 cm. No emissions were detected.

## Transmit @ low channel, Z-axis 1-18 GHz – 30 MHz-25 GHz

**Test Information:**

| | |
|---|---|
| Date and Time | 12/21/2018 6:18:59 PM |
| Client and Project Number | Philips |
| Engineer | Kouma Sinn |
| Temperature | 20 C |
| Humidity | 34 % |
| Atmospheric Pressure | 985mbar |
| Comments | 12-21-18_G10_Tx @ low channel, Z-axis 1-18GHz |

**Graph:**




**Results:**

Peak (PASS) (3)

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Azimuth (°) (dB) | Height (m) (dB) | Pol. (dB) | RBW (dB) | Correction (dB) |
|---|---|---|---|---|---|---|---|---|
| 4788.421053 | 51.96 | 74.00 | -22.04 | 181.00 | 1.21 | Vertical | 1000000.00 | -11.60 |
| 7205.263158 | 51.81 | 74.00 | -22.19 | 18.00 | 1.30 | Vertical | 1000000.00 | -7.65 |
| 16775.78947 | 57.36 | 74.00 | -16.64 | 334.00 | 2.92 | Horizontal | 1000000.00 | 3.78 |

Average (PASS) (3)

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Azimuth (°) (dB) | Height (m) (dB) | Pol. (dB) | RBW (dB) | Correction (dB) |
|---|---|---|---|---|---|---|---|---|
| 4788.421053 | 34.03 | 54.00 | -19.97 | 181.00 | 1.21 | Vertical | 1000000.00 | -11.60 |
| 7205.263158 | 39.20 | 54.00 | -14.80 | 18.00 | 1.30 | Vertical | 1000000.00 | -7.65 |
| 16775.78947 | 44.38 | 54.00 | -9.62 | 334.00 | 2.92 | Horizontal | 1000000.00 | 3.78 |

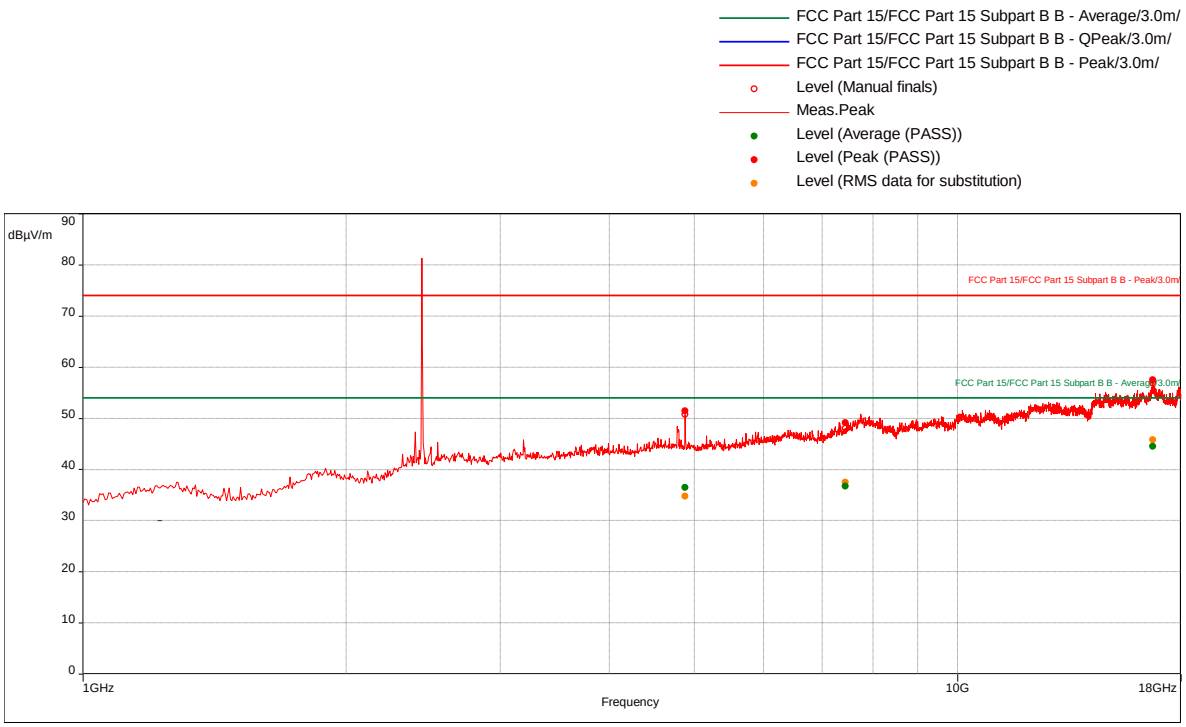
Notes: Scanned from 1-18 GHz using Nexio software (see plot above) and repeated test manually from 10-18 GHz at 10 cm to make sure there's no emissions present since the noise floor is high in this frequency range. Manually scan was performed from 1-2.4 GHz and 18-25 GHz.at 10 cm. No emissions were detected.

## Transmit @ mid channel, X-axis 1-18 GHz – 30 MHz-25 GHz

**Test Information:**

| | |
|---|---|
| Date and Time | 12/21/2018 4:28:29 PM |
| Client and Project Number | Philips |
| Engineer | Kouma Sinn |
| Temperature | 20 C |
| Humidity | 34 % |
| Atmospheric Pressure | 985mbar |
| Comments | 12-21-18_G10_Tx @ mid channel, X-axis 1-18GHz |

**Graph:**




**Results:**

Peak (PASS) (3)

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Azimuth (°) (dB) | Height (m) (dB) | Pol. (dB) | RBW (dB) | Correction (dB) |
|---|---|---|---|---|---|---|---|---|
| 4879.473684 | 51.46 | 74.00 | -22.54 | 276.00 | 1.29 | Horizontal | 1000000.00 | -11.85 |
| 7438.421053 | 49.14 | 74.00 | -24.86 | 173.00 | 3.42 | Vertical | 1000000.00 | -6.78 |
| 16715 | 57.45 | 74.00 | -16.55 | 313.00 | 3.73 | Vertical | 1000000.00 | 4.01 |

Average (PASS) (3)

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Azimuth (°) (dB) | Height (m) (dB) | Pol. (dB) | RBW (dB) | Correction (dB) |
|---|---|---|---|---|---|---|---|---|
| 4879.473684 | 36.43 | 54.00 | -17.57 | 276.00 | 1.29 | Horizontal | 1000000.00 | -11.85 |
| 7438.421053 | 36.68 | 54.00 | -17.32 | 173.00 | 3.42 | Vertical | 1000000.00 | -6.78 |
| 16715 | 44.46 | 54.00 | -9.54 | 313.00 | 3.73 | Vertical | 1000000.00 | 4.01 |

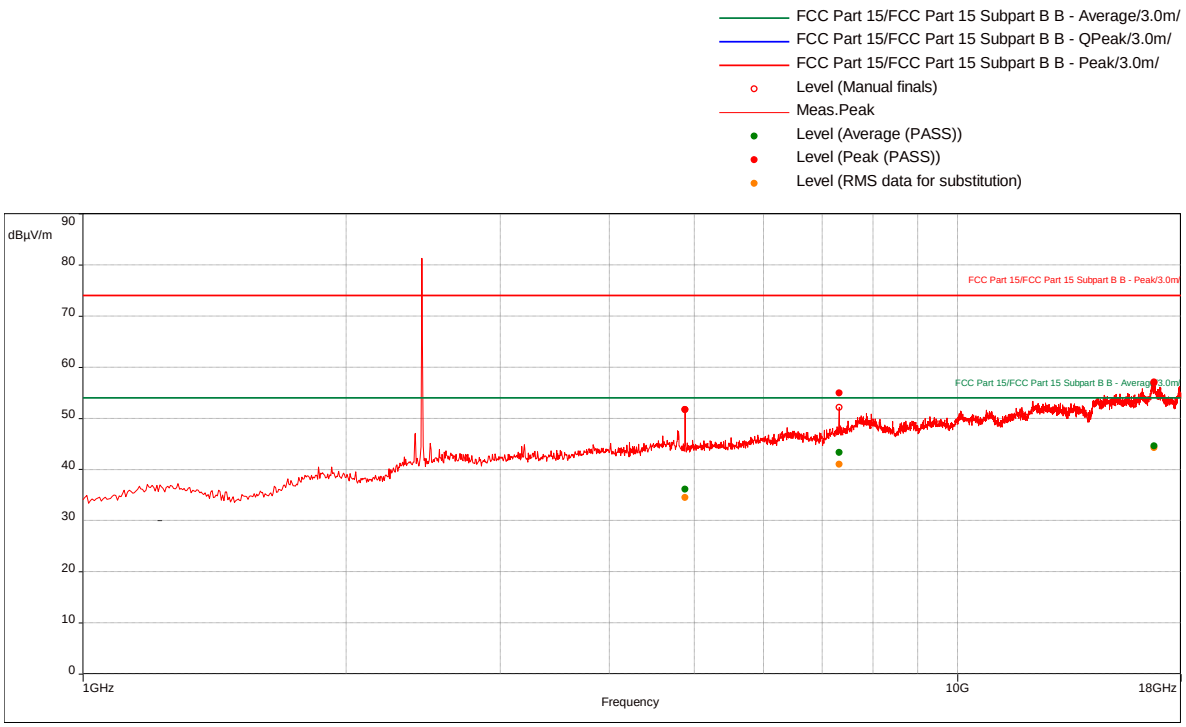
Notes: Scanned from 1-18 GHz using Nexio software (see plot above) and repeated test manually from 10-18 GHz at 10 cm to make sure there's no emissions present since the noise floor is high in this frequency range. Manually scan was performed from 1-2.4 GHz and 18-25 GHz.at 10 cm. No emissions were detected.

## Transmit @ mid channel, Y-axis 1-18 GHz – 30 MHz-25 GHz

**Test Information:**

| | |
|---|---|
| Date and Time | 12/21/2018 5:35:42 PM |
| Client and Project Number | Philips |
| Engineer | Kouma Sinn |
| Temperature | 20 C |
| Humidity | 34 % |
| Atmospheric Pressure | 985mbar |
| Comments | 12-21-18_G10_Tx @ mid channel, Y-axis 1-18GHz |

**Graph:**




**Results:**

Peak (PASS) (3)

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Azimuth (°) (dB) | Height (m) (dB) | Pol. (dB) | RBW (dB) | Correction (dB) |
|---|---|---|---|---|---|---|---|---|
| 4880.789474 | 51.70 | 74.00 | -22.30 | 322.00 | 1.00 | Vertical | 1000000.00 | -11.86 |
| 7319.473684 | 54.96 | 74.00 | -19.04 | 321.00 | 1.00 | Vertical | 1000000.00 | -7.34 |
| 16776.84211 | 57.10 | 74.00 | -16.90 | 299.00 | 3.46 | Horizontal | 1000000.00 | 3.78 |

Average (PASS) (3)

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Azimuth (°) (dB) | Height (m) (dB) | Pol. (dB) | RBW (dB) | Correction (dB) |
|---|---|---|---|---|---|---|---|---|
| 4880.789474 | 36.10 | 54.00 | -17.90 | 322.00 | 1.00 | Vertical | 1000000.00 | -11.86 |
| 7319.473684 | 43.33 | 54.00 | -10.67 | 321.00 | 1.00 | Vertical | 1000000.00 | -7.34 |
| 16776.84211 | 44.54 | 54.00 | -9.46 | 299.00 | 3.46 | Horizontal | 1000000.00 | 3.78 |

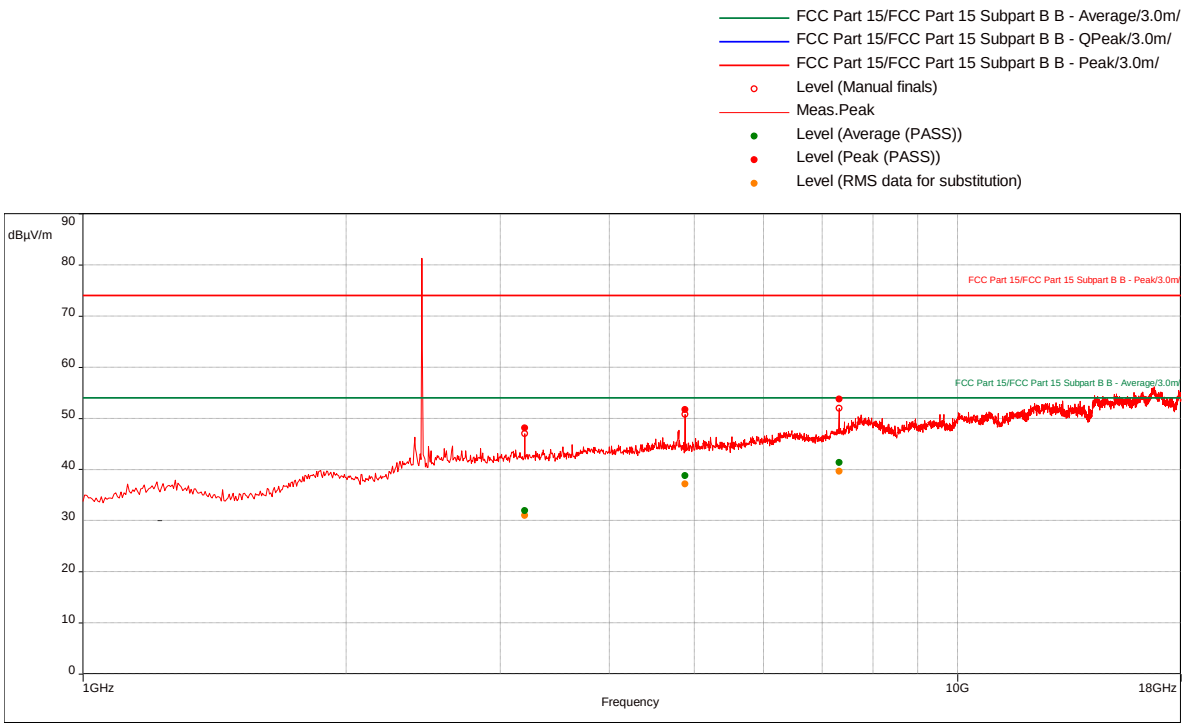
Notes: Scanned from 1-18 GHz using Nexio software (see plot above) and repeated test manually from 10-18 GHz at 10 cm to make sure there's no emissions present since the noise floor is high in this frequency range. Manually scan was performed from 1-2.4 GHz and 18-25 GHz.at 10 cm. No emissions were detected.

## Transmit @ mid channel, Z-axis 1-18 GHz – 30 MHz-25 GHz

**Test Information:**

| | |
|---|---|
| Date and Time | 12/21/2018 6:41:16 PM |
| Client and Project Number | Philips |
| Engineer | Kouma Sinn |
| Temperature | 20 C |
| Humidity | 34 % |
| Atmospheric Pressure | 985mbar |
| Comments | 12-21-18_G10_Tx @ mid channel, Z-axis 1-18GHz |

**Graph:**




**Results:**

Peak (PASS) (3)

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Azimuth (°) (dB) | Height (m) (dB) | Pol. (dB) | RBW (dB) | Correction (dB) |
|---|---|---|---|---|---|---|---|---|
| 3199.473684 | 48.06 | 74.00 | -25.94 | 216.00 | 1.45 | Vertical | 1000000.00 | -15.98 |
| 4880 | 51.70 | 74.00 | -22.30 | 10.00 | 1.45 | Horizontal | 1000000.00 | -11.86 |
| 7320.789474 | 53.71 | 74.00 | -20.29 | 17.00 | 1.00 | Vertical | 1000000.00 | -7.33 |

Average (PASS) (3)

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Azimuth (°) (dB) | Height (m) (dB) | Pol. (dB) | RBW (dB) | Correction (dB) |
|---|---|---|---|---|---|---|---|---|
| 3199.473684 | 31.92 | 54.00 | -22.08 | 216.00 | 1.45 | Vertical | 1000000.00 | -15.98 |
| 4880 | 38.76 | 54.00 | -15.24 | 10.00 | 1.45 | Horizontal | 1000000.00 | -11.86 |
| 7320.789474 | 41.30 | 54.00 | -12.70 | 17.00 | 1.00 | Vertical | 1000000.00 | -7.33 |

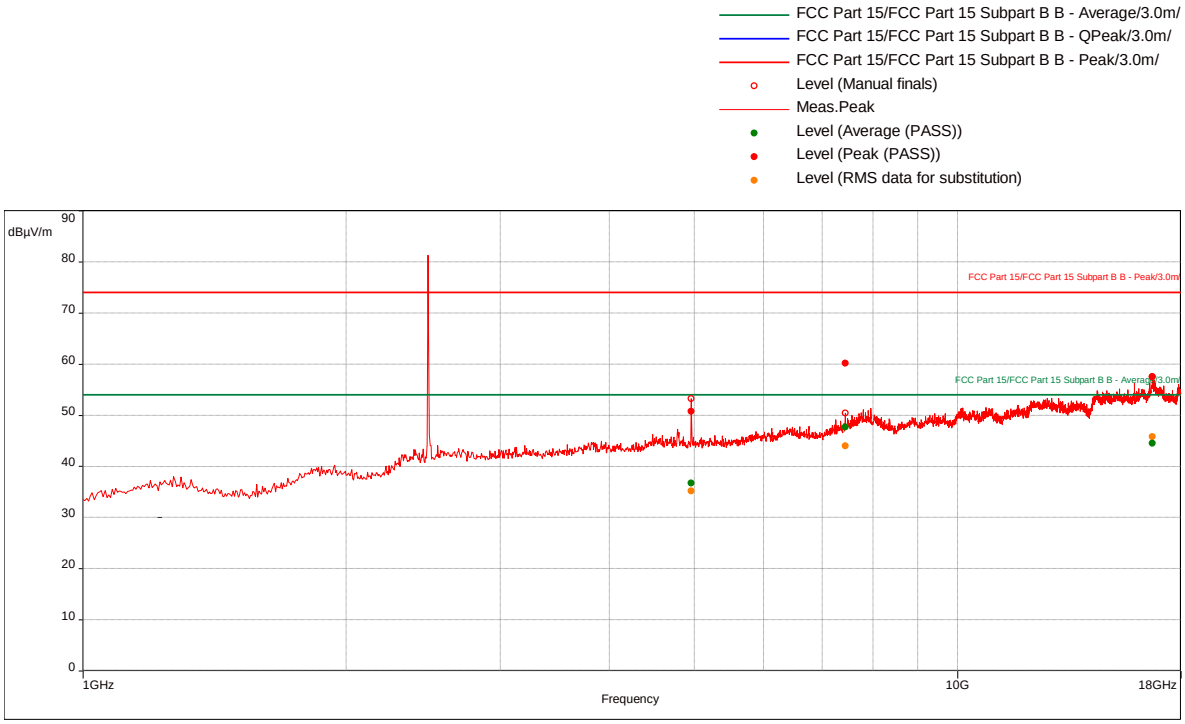
Notes: Scanned from 1-18 GHz using Nexio software (see plot above) and repeated test manually from 10-18 GHz at 10 cm to make sure there's no emissions present since the noise floor is high in this frequency range. Manually scan was performed from 1-2.4 GHz and 18-25 GHz.at 10 cm. No emissions were detected.

## Transmit @ high channel, X-axis – 30 MHz-25 GHz

**Test Information:**

| | |
|---|---|
| Date and Time | 12/21/2018 4:50:39 PM |
| Client and Project Number | Philips |
| Engineer | Kouma Sinn |
| Temperature | 20 C |
| Humidity | 34 % |
| Atmospheric Pressure | 985mbar |
| Comments | 12-21-18_G10_Tx @ high channel, X-axis 1-18GHz |

**Graph:**




**Results:**

Peak (PASS) (3)

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Azimuth (°) (dB) | Height (m) (dB) | Pol. (dB) | RBW (dB) | Correction (dB) |
|---|---|---|---|---|---|---|---|---|
| 4959.736842 | 50.75 | 74.00 | -23.25 | 357.00 | 2.19 | Horizontal | 1000000.00 | -11.80 |
| 7439.473684 | 60.19 | 74.00 | -13.81 | 253.00 | 1.30 | Horizontal | 1000000.00 | -6.77 |
| 16704.47368 | 57.50 | 74.00 | -16.50 | 359.00 | 2.96 | Vertical | 1000000.00 | 4.05 |

Average (PASS) (3)

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Azimuth (°) (dB) | Height (m) (dB) | Pol. (dB) | RBW (dB) | Correction (dB) |
|---|---|---|---|---|---|---|---|---|
| 4959.736842 | 36.72 | 54.00 | -17.28 | 357.00 | 2.19 | Horizontal | 1000000.00 | -11.80 |
| 7439.473684 | 47.69 | 54.00 | -6.31 | 253.00 | 1.30 | Horizontal | 1000000.00 | -6.77 |
| 16704.47368 | 44.49 | 54.00 | -9.51 | 359.00 | 2.96 | Vertical | 1000000.00 | 4.05 |

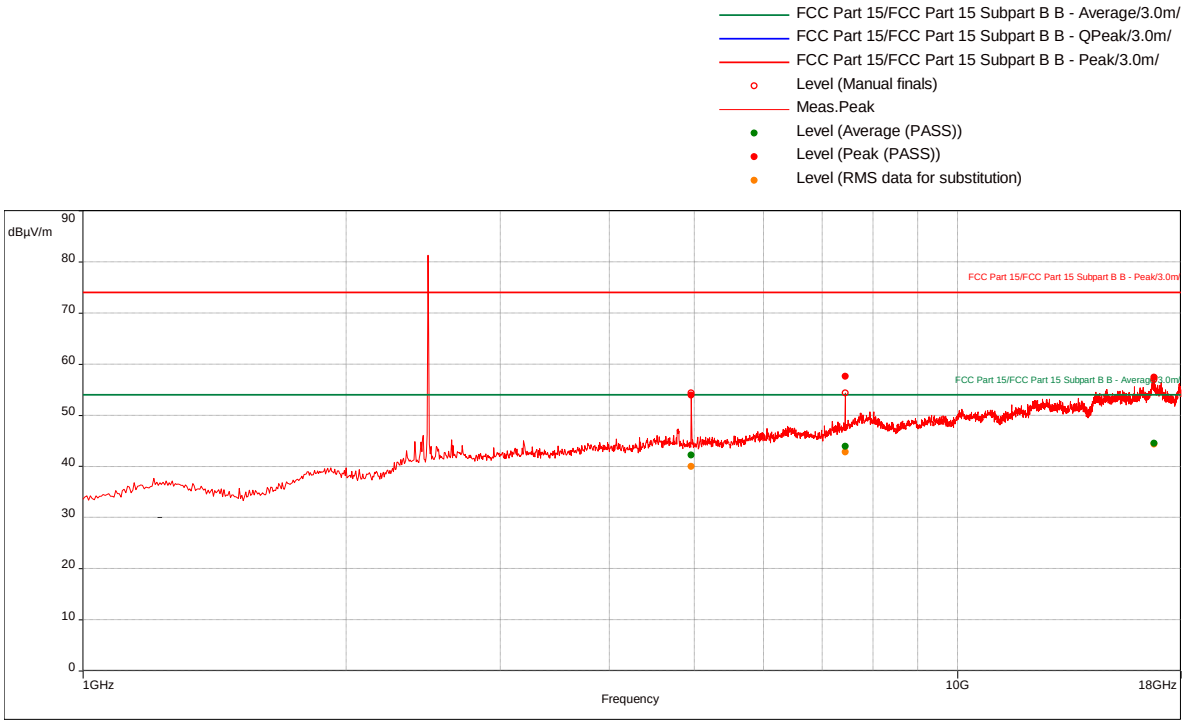
Notes: Scanned from 1-18 GHz using Nexio software (see plot above) and repeated test manually from 10-18 GHz at 10 cm to make sure there's no emissions present since the noise floor is high in this frequency range. Manually scan was performed from 1-2.4 GHz and 18-25 GHz.at 10 cm. No emissions were detected.

## Transmit @ high channel, Y-axis – 30 MHz-25 GHz

**Test Information:**

| | |
|---|---|
| Date and Time | 12/21/2018 5:13:11 PM |
| Client and Project Number | Philips |
| Engineer | Kouma Sinn |
| Temperature | 20 C |
| Humidity | 34 % |
| Atmospheric Pressure | 985mbar |
| Comments | 12-21-18_G10_Tx @ high channel, Y-axis 1-18GHz |

**Graph:**




**Results:**

Peak (PASS) (3)

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Azimuth (°) (dB) | Height (m) (dB) | Pol. (dB) | RBW (dB) | Correction (dB) |
|---|---|---|---|---|---|---|---|---|
| 4960 | 53.93 | 74.00 | -20.07 | 32.00 | 1.53 | Vertical | 1000000.00 | -11.80 |
| 7441.052632 | 57.55 | 74.00 | -16.45 | 359.00 | 1.46 | Vertical | 1000000.00 | -6.76 |
| 16768.42105 | 57.38 | 74.00 | -16.62 | 291.00 | 1.38 | Horizontal | 1000000.00 | 3.80 |

Average (PASS) (3)

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Azimuth (°) (dB) | Height (m) (dB) | Pol. (dB) | RBW (dB) | Correction (dB) |
|---|---|---|---|---|---|---|---|---|
| 4960 | 42.18 | 54.00 | -11.82 | 32.00 | 1.53 | Vertical | 1000000.00 | -11.80 |
| 7441.052632 | 43.90 | 54.00 | -10.10 | 359.00 | 1.46 | Vertical | 1000000.00 | -6.76 |
| 16768.42105 | 44.47 | 54.00 | -9.53 | 291.00 | 1.38 | Horizontal | 1000000.00 | 3.80 |

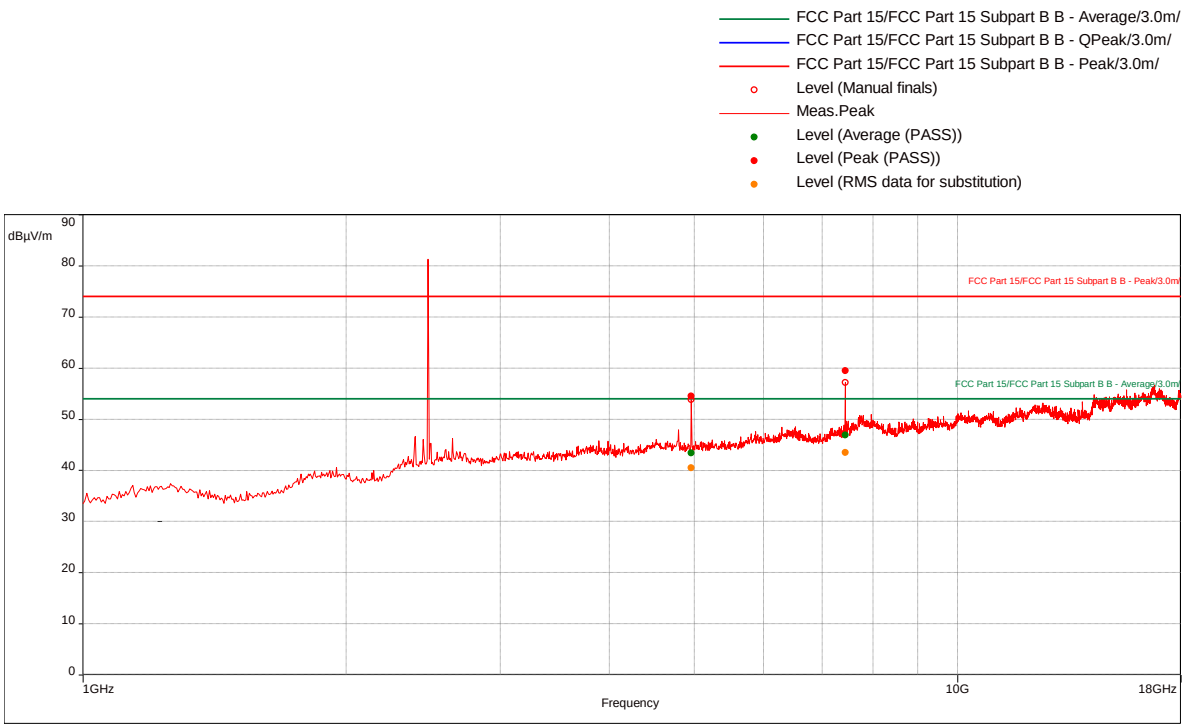
Notes: Scanned from 1-18 GHz using Nexio software (see plot above) and repeated test manually from 10-18 GHz at 10 cm to make sure there's no emissions present since the noise floor is high in this frequency range. Manually scan was performed from 1-2.4 GHz and 18-25 GHz.at 10 cm. No emissions were detected.

## Transmit @ high channel, Z-axis – 30 MHz-25 GHz

**Test Information:**

| | |
|---|---|
| Date and Time | 12/21/2018 8:51:49 PM |
| Client and Project Number | Philips |
| Engineer | Kouma Sinn |
| Temperature | 20 C |
| Humidity | 34 % |
| Atmospheric Pressure | 985mbar |
| Comments | 12-21-18_G10_Tx @ high channel, Z-axis 1-18GHz |

**Graph:**




**Results:**

Peak (PASS) (2)

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Azimuth (°) (dB) | Height (m) (dB) | Pol. (dB) | RBW (dB) | Correction (dB) |
|---|---|---|---|---|---|---|---|---|
| 4959.736842 | 54.52 | 74.00 | -19.48 | 32.00 | 1.00 | Vertical | 1000000.00 | -11.80 |
| 7439.473684 | 59.44 | 74.00 | -14.56 | 33.00 | 1.00 | Vertical | 1000000.00 | -6.77 |

Average (PASS) (2)

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Azimuth (°) (dB) | Height (m) (dB) | Pol. (dB) | RBW (dB) | Correction (dB) |
|---|---|---|---|---|---|---|---|---|
| 4959.736842 | 43.37 | 54.00 | -10.63 | 32.00 | 1.00 | Vertical | 1000000.00 | -11.80 |
| 7439.473684 | 46.91 | 54.00 | -7.09 | 33.00 | 1.00 | Vertical | 1000000.00 | -6.77 |

Notes: Scanned from 1-18 GHz using Nexio software (see plot above) and repeated test manually from 10-18 GHz at 10 cm to make sure there's no emissions present since the noise floor is high in this frequency range. Manually scan was performed from 1-2.4 GHz and 18-25 GHz.at 10 cm. No emissions were detected.

| | | | |
|---|---|---|---|
| Test Personnel: | Kouma Sinn KPS | Test Date: | 12/05/2018, 12/21/2018 |
| Supervising/Reviewing Engineer: (Where Applicable) | N/A | | |
| Product Standard: | CFR47 FCC Part 15.247 RSS-247 | Limit Applied: | See report section 10.3 |
| Input Voltage: | Internal Battery | Ambient Temperature: | 22, 20 ºC |
| Pretest Verification w/ Ambient Signals or BB Source: | N/A | Relative Humidity: | 15, 34 % |
| | | Atmospheric Pressure: | 1010, 985 mbars |

Deviations, Additions, or Exclusions: None

## 11 Revision History

| Revision Level | Date | Report Number | Prepared By | Reviewed By | Notes |
|---|---|---|---|---|---|
| 0 | 01/11/2019 | 103732466BOX-015b | KPS | VFV | Original Issue |
| 1 | 05/31/2019 | 103732466BOX-015b | KPS | VFV | See Note # 1 |
| 2 | 08/01/2019 | 103732466BOX-015b | KPS | VFV | See Note # 2 |
| 3 | 08/08/2019 | 103732466BOX-015b | KPS | VFV | See Note # 3 |
| | | | | | |
| | | | | | |

Note # 1: a) Removed extra output power plots, b) Reported output power as conducted power, c) Re-calculated the SAR exemption using conducted output power, d) Removed extra bandwidth plots, e) Removed extra power spectral density plots.

Note # 2: Added the occupied bandwidth data.

Note # 3: Removed the FCC KDB 558074 old version and updated the new one under ‘Method’ section. And also removed test setup photos for confidentiality.