

ISED CABid: ES1909

Lab. Company Number: 4621A

Test Report No:

77037RRF.017A2

## Partial Test Report

USA FCC Part 15.247, 15.209

CANADA RSS-247, RSS-Gen

|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (*) Identification of item tested         | XS4 Original+ Electronic Lock Series including all mechanical variants                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| (*) Trademark                             | SALTO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| (*) Model and /or type reference          | W40T (Type reference: E2131)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| (*) Derived model not tested              | XS4 One S Electronic Lock Series including all mechanical variants                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Other identification of the product       | FCC ID: UKCW40MH. Contains: TCZ-10105567G1<br>IC: 10088A-W40MH. Contains: 1175F-10105567G1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| (*) Features                              | Bluetooth LE (SoC and Module)<br>HW version: 1.0<br>SW version: 0174 (Control FW) + 0186 (FUS FW) + 0187 (BLE FW) + 0197 (HSE FW) + 0219 (Motor and battery connection FW)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Applicant                                 | SALTO SYSTEMS, S.L.<br>Arkotz 9, Polígono Lanbarren<br>20180 Oiartzun, Gipuzkoa, SPAIN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Test method requested, standard           | USA FCC Part 15.247 (10-1-21 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz.<br>USA FCC Part 15.209 (10-1-21 Edition): Radiated emission limits; general requirements.<br>CANADA RSS-247 Issue 3 (August 2023).<br>CANADA RSS-Gen Issue 5 amendment 2 (February 2021).<br>Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid Systems Devices Operating Under Section 15.247 of the FCC Rules.<br>558074 D01 Meas Guidance v05r02 dated April 2, 2019.<br>ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices. |
| Approved by (name / position & signature) | José Manuel Gómez Galván<br>EMC Consumer & RF<br>Lab. Manager<br><br>Firmado digitalmente por 53680346W JOSE MANUEL GOMEZ (CA29507456)                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Date of issue                             | 2024-02-07                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Report template No                        | FDT08_24<br>(*) "Data provided by the client"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

# Index

|                                                                     |           |
|---------------------------------------------------------------------|-----------|
| INDEX .....                                                         | 2         |
| ACRONYMS .....                                                      | 3         |
| COMPETENCES AND GUARANTEES .....                                    | 3         |
| GENERAL CONDITIONS .....                                            | 4         |
| UNCERTAINTY .....                                                   | 4         |
| DATA PROVIDED BY THE CLIENT .....                                   | 4         |
| USAGE OF SAMPLES .....                                              | 5         |
| TEST SAMPLE DESCRIPTION .....                                       | 6         |
| IDENTIFICATION OF THE CLIENT .....                                  | 7         |
| TESTING PERIOD AND PLACE .....                                      | 7         |
| DOCUMENT HISTORY .....                                              | 7         |
| ENVIRONMENTAL CONDITIONS .....                                      | 7         |
| REMARKS AND COMMENTS .....                                          | 8         |
| TESTING VERDICTS .....                                              | 9         |
| SUMMARY .....                                                       | 9         |
| <b>APPENDIX A: TEST RESULTS. BLUETOOTH LOW ENERGY 4.2 (1M).....</b> | <b>11</b> |

## Acronyms

| Acronym ID      | Acronym Description                 |
|-----------------|-------------------------------------|
| BW              | Bandwidth                           |
| Detector        | Detector used                       |
| Ebw             | Emission Bandwidth                  |
| Equipment       | Equipment Type                      |
| Freq            | Frequency                           |
| Freq Rng        | Frequency Range                     |
| Inband Peak Lvl | Inband Peak Level                   |
| Lvl             | Level                               |
| MP              | Measurement Point                   |
| Mod             | Modulation                          |
| Mode            | MIMO Mode                           |
| Occ Ch BW       | Occupied Channel Bandwidth          |
| PSD             | Power Spectrum Density              |
| PeakPower       | Maximum Peak Conducted Output Power |
| Pol             | Polarization                        |
| Port            | Active Port                         |
| Unwanted Freq   | Unwanted Emissions Frequency        |
| Unwanted Lvl    | Unwanted Emissions Level            |

## Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification S.A.U. is an FCC-recognized accredited testing laboratory with appropriate scope of accreditation that covers the performed tests in this report.

DEKRA Testing and Certification S.A.U. is an ISED-recognized accredited testing laboratory, CABid: ES1909, Company Number: 4621A, with the appropriate scope of accreditation that covers the performed tests in this report.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification S.A.U. has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification S.A.U. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification S.A.U. at the time of performance of the test.

DEKRA Testing and Certification S.A.U. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

**IMPORTANT:** No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Testing and Certification S.A.U.

## General conditions

---

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification S.A.U.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification S.A.U. and the Accreditation Bodies.

## Uncertainty

---

Uncertainty (factor  $k=2$ ) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

The total uncertainty of the measurement system for the radiated emissions of EUT from 30 MHz to 1 GHz is:  
Measurement uncertainty  $\leq \pm 5,35$  dB with factor ( $k = 2$ ).

The total uncertainty of the measurement system for the radiated emissions of EUT from 1 GHz to 17 GHz is:  
Measurement uncertainty  $\leq \pm 4,32$  dB with factor ( $k = 2$ ).

The total uncertainty of the measurement system for the radiated emissions of EUT from 17 GHz to 26 GHz is:  
Measurement uncertainty  $\leq \pm 5,51$  dB with factor ( $k = 2$ ).

The total uncertainty of the measurement system for the conducted testing of EUT is:

RF Peak Output Power: Measurement uncertainty  $\leq \pm 0,80$  dB

Power Spectral Density: Measurement uncertainty  $\leq \pm 0,99$  dB

6dB Bandwidth: Measurement uncertainty  $\leq \pm 2,84$  %

Occupied Channel Bandwidth: Measurement uncertainty  $\leq \pm 1,17$  %

Conducted Band-edge spurious emissions: Measurement uncertainty  $\leq \pm 1,76$  dB

## Data provided by the client

---

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample consists of a XS4 Original+ Hilton Electronic Lock Series with RFID Mifare (ISO14443A & ISO15693 standard based) and Bluetooth LE technology.
3. The sample undergoing test, XS4 Original+ Electronic Lock, have been selected as a representative sample of XS4 Original+ and XS4 One S Electronic Lock Series.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

## Usage of samples

Samples undergoing test have been selected by: The client.

| Id   | Control Number | Description                   | Model | Serial N° | Date of Reception | Application        |
|------|----------------|-------------------------------|-------|-----------|-------------------|--------------------|
| S/01 | 77037B_67.1    | XS4 Original+ Electronic Lock | W40T  | --        | 2023-09-28        | Element Under Test |
| S/02 | 77037B_42.1    | XS4 Original+ Electronic Lock | W40T  | --        | 2023-09-28        | Element Under Test |
| S/02 | 77037B_43.1    | PCB                           | --    | --        | 2023-09-28        | Auxiliary Element  |

Notes referenced to samples during the project:

| Id   | Type                              |
|------|-----------------------------------|
| S/01 | Sample used for radiated testing  |
| S/02 | Sample used for conducted testing |

Test sample description

|                                               |                                                                                                            |                                  |                          |                      |          |                                   |     |
|-----------------------------------------------|------------------------------------------------------------------------------------------------------------|----------------------------------|--------------------------|----------------------|----------|-----------------------------------|-----|
| Ports..... :                                  | Port name and description                                                                                  |                                  | Cable                    |                      |          |                                   |     |
|                                               |                                                                                                            |                                  | Specified max length [m] | Attached during test | Shielded | Coupled to patient <sup>(3)</sup> |     |
|                                               | .....                                                                                                      | .....                            | [ ]                      | [ ]                  | [ ]      |                                   |     |
| Supplementary information to the ports..... : | .....                                                                                                      |                                  |                          |                      |          |                                   |     |
| Rated power supply .....                      | Voltage and Frequency                                                                                      |                                  |                          | Reference poles      |          |                                   |     |
|                                               |                                                                                                            |                                  |                          | L1                   | L2       | L3                                | N   |
|                                               | [ ]                                                                                                        | AC: .....                        | [ ]                      | [ ]                  | [ ]      | [ ]                               | [ ] |
|                                               | [X]                                                                                                        | DC: 4.5 Vdc (3 x LR03 batteries) |                          |                      |          |                                   |     |
| Rated Power .....                             | N/A                                                                                                        |                                  |                          |                      |          |                                   |     |
| Clock frequencies..... :                      | 27.12 MHz, 32 MHz, 32.768 kHz                                                                              |                                  |                          |                      |          |                                   |     |
| Other parameters .....                        | N/A                                                                                                        |                                  |                          |                      |          |                                   |     |
| Software version .....                        | 0174 (Control FW) + 0186 (FUS FW) + 0187 (BLE FW) + 0197 (HSE FW) + 0219 (Motor and battery connection FW) |                                  |                          |                      |          |                                   |     |
| Hardware version .....                        | 1.0                                                                                                        |                                  |                          |                      |          |                                   |     |
| Dimensions in cm (W x H x D) .....            | 4.0 x 28.2 x 2.0                                                                                           |                                  |                          |                      |          |                                   |     |
| Mounting position .....                       | [ ]                                                                                                        | Table top equipment              |                          |                      |          |                                   |     |
|                                               | [ ]                                                                                                        | Wall/Ceiling mounted equipment   |                          |                      |          |                                   |     |
|                                               | [ ]                                                                                                        | Floor standing equipment         |                          |                      |          |                                   |     |
|                                               | [ ]                                                                                                        | Hand-held equipment              |                          |                      |          |                                   |     |
|                                               | [X]                                                                                                        | Other: Door mounting             |                          |                      |          |                                   |     |
| Modules/parts..... :                          | Module/parts of test item                                                                                  |                                  |                          | Type                 |          | Manufacturer                      |     |
|                                               | SoC + Antenna                                                                                              |                                  |                          | BLE                  |          | ST + JOHANSON                     |     |
|                                               | Bluetooth LE module                                                                                        |                                  |                          | BLE module           |          | SUPRA                             |     |
|                                               | .....                                                                                                      |                                  |                          | .....                |          | .....                             |     |
| Accessories (not part of the test item) ..... | Description                                                                                                |                                  |                          | Type                 |          | Manufacturer                      |     |
|                                               | .....                                                                                                      |                                  |                          | .....                |          | .....                             |     |
| Documents as provided by the applicant..... : | Description                                                                                                |                                  |                          | File name            |          | Issue date                        |     |
|                                               | User manual                                                                                                |                                  |                          | .....                |          | .....                             |     |
|                                               | FW Explanation                                                                                             |                                  |                          | .....                |          | .....                             |     |
|                                               | .....                                                                                                      |                                  |                          | .....                |          | .....                             |     |

<sup>(3)</sup> Only for Medical Equipment

## Identification of the client

SALTO SYSTEMS, S.L.  
Arkotz 9, Polígono Lanbarren  
20180, Oiartzun, Gipuzkoa, SPAIN

## Testing period and place

|               |                                        |
|---------------|----------------------------------------|
| Test Location | DEKRA Testing and Certification S.A.U. |
| Date (start)  | 2023-10-03                             |
| Date (finish) | 2023-10-24                             |

## Document history

| Report number  | Date       | Description                                                                                                                              |
|----------------|------------|------------------------------------------------------------------------------------------------------------------------------------------|
| 77037RRF.017   | 2023-11-07 | First release.                                                                                                                           |
| 77037RRF.017A1 | 2024-12-21 | Second release. Modification due to missing information. This modification test report cancels and replaces the test report 77037RRF.017 |
| 77037RRF.017A2 | 2024-02-07 | Second release. Modification due to typo. This modification test report cancels and replaces the test report 77037RRF.017A1              |

## Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

|                   |                              |
|-------------------|------------------------------|
| Temperature       | Min. = 15 °C<br>Max. = 35 °C |
| Relative humidity | Min. = 20 %<br>Max. = 75 %   |

In the semianechoic chamber, the following limits were not exceeded during the test.

|                   |                              |
|-------------------|------------------------------|
| Temperature       | Min. = 15 °C<br>Max. = 35 °C |
| Relative humidity | Min. = 20 %<br>Max. = 75 %   |

In the chamber for conducted measurements, the following limits were not exceeded during the test:

|             |                              |
|-------------|------------------------------|
| Temperature | Min. = 15 °C<br>Max. = 35 °C |
|-------------|------------------------------|

|                   |                            |
|-------------------|----------------------------|
| Relative humidity | Min. = 20 %<br>Max. = 75 % |
|-------------------|----------------------------|

## Remarks and comments

The tests have been performed by the technical personnel: Pablo Redondo and Rafael Fernandez.

Used instrumentation:

| Control No. | Equipment                                  | Model           | Manufacturer                | Next Calibration |
|-------------|--------------------------------------------|-----------------|-----------------------------|------------------|
| 4825        | SEMIANECHOIC ABSORBER LINED CHAMBER IV     | FACT 3 200 STP  | ETS LINDGREN                | N/A              |
| 4826        | SHIELDED ROOM                              | S101            | ETS LINDGREN                | N/A              |
| 4578        | HYBRID BILOG ANTENNA 30MHz-6GHz            | 3142E           | ETS LINDGREN                | 2026-06-01       |
| 6142        | PRE-AMPLIFIER G>38dB 30MHz-6GHz            | BLNA 0360-01N   | BONN ELEKTRONIK             | 2024-06-28       |
| 6165        | EMI TEST RECEIVER 9kHz-7GHz                | ESR7            | ROHDE AND SCHWARZ           | 2023-11-08       |
| 4611        | HORN ANTENNA 1-18GHz                       | BBHA 9120 D     | SCHWARZBECK MESS-ELEKTRONIK | 2026-01-16       |
| 4657        | HORN ANTENNA 18-40GHz                      | BBHA 9170       | SCHWARZBECK                 | 2026-06-12       |
| 8856        | PRE-AMPLIFIER G>30dB 18-40GHz              | BLMA 1840-4A    | BONN ELEKTRONIK             | 2023-11-02       |
| 5705        | PRE-AMPLIFIER G>40dB 1-18 GHz              | BLMA 0118-1M    | BONN ELEKTRONIK             | 2024-07-26       |
| 6157        | SIGNAL AND SPECTRUM ANALYZER 10Hz-40GHz    | FSV40           | ROHDE AND SCHWARZ           | 2025-01-18       |
| 4848        | SOFTWARE FOR EMC/RF TESTING                | EMC32           | ROHDE AND SCHWARZ           | N/A              |
| 6668        | SIGNAL AND SPECTRUM ANALYZER 10Hz-40GHz    | FSV40           | ROHDE AND SCHWARZ           | 2024-12-14       |
| 8848        | OPEN SWITCH UNIT UP TO 7.5 GHz             | OSP-B157W8 PLUS | ROHDE & SCHWARZ             | 2024-12-21       |
| 7796        | EXTENSION FOR OPEN SWITCH UNIT UP TO 40GHz | OSP-B157Wx      | ROHDE AND SCHWARZ           | 2024-03-16       |
| 0922        | DC POWER SUPPLY 40 V / 40 A                | NGPE 40/40      | ROHDE AND SCHWARZ           | N/A              |
| 7759        | DIGITAL MULTIMETER                         | 175             | FLUKE                       | 2024-11-02       |
| 7798        | SOFTWARE FOR EMC/RF TESTING                | WMS32           | ROHDE AND SCHWARZ           | N/A              |

## Testing verdicts

|                |     |
|----------------|-----|
| Fail           | F   |
| Inconclusive   | I   |
| Not applicable | N/A |
| Not measured   | N/M |
| Pass           | P   |

## Summary

### Bluetooth Low Energy 4.2 (1M) of SoC

| FCC PART 15 PARAGRAPH/ RSS-247                |                                              |         |        |
|-----------------------------------------------|----------------------------------------------|---------|--------|
| Requirement – Test case                       |                                              | Verdict | Remark |
| FCC 15.247 (a)(2) / RSS-247 5.2. (a)          | 6 dB Bandwidth                               | P       | -      |
| FCC 15.247 (b) / RSS-247 5.4. (d)             | Maximum output power and antenna gain        | P       | -      |
| FCC 15.247 (d) / RSS-247 5.5.                 | Band-edge emissions compliance (Transmitter) | P       | -      |
| FCC 15.247 (e) / RSS-247 5.2. (b)             | Power spectral density                       | P       | -      |
| FCC 15.247 (d) / RSS-247 5.5.                 | Emission limitations radiated (Transmitter)  | P       | -      |
| <u>Supplementary information and remarks:</u> |                                              |         |        |
| None                                          |                                              |         |        |

Bluetooth Low Energy 4.2 (1M) of Module

| FCC PART 15 PARAGRAPH/ RSS-247                |                                              |         |        |
|-----------------------------------------------|----------------------------------------------|---------|--------|
| Requirement – Test case                       |                                              | Verdict | Remark |
| FCC 15.247 (a)(2) / RSS-247 5.2. (a)          | 6 dB Bandwidth                               | N/M     | (1)    |
| FCC 15.247 (b) / RSS-247 5.4. (d)             | Maximum output power and antenna gain        | N/M     | (1)    |
| FCC 15.247 (d) / RSS-247 5.5.                 | Band-edge emissions compliance (Transmitter) | N/M     | (1)    |
| FCC 15.247 (e) / RSS-247 5.2. (b)             | Power spectral density                       | N/M     | (1)    |
| FCC 15.247 (d) / RSS-247 5.5.                 | Emission limitations radiated (Transmitter)  | N/M     | (1)    |
| <u>Supplementary information and remarks:</u> |                                              |         |        |
| 1. Test not requested by the client           |                                              |         |        |

# Appendix A: Test results. Bluetooth Low Energy 4.2 (1M)

INDEX

TEST CONDITIONS .....13

TEST CASES DETAILS .....16

*Occupied Channel Bandwidth 99% .....16*

*RSS-247 5.2 (a) / FCC 15.247 (a) (2) 6 dB Bandwidth .....20*

*RSS-247 5.2 (b) / FCC 15.247 (e) Power spectral density .....24*

*RSS-247 5.4 (d) / FCC 15.247 (b) (3) Maximum Peak Conducted output power .....28*

*RSS-247 5.5 / FCC 15.247 (d) Band-edge emissions compliance (Transmitter) .....32*

*RSS-247 5.5 / FCC 15.247 (d) Emission limitations radiated (Transmitter).....38*

# TEST CONDITIONS

(\*): Data provided by the client.

POWER SUPPLY (\*):

Vnominal: 4.5Vdc  
Type of Power Supply: External power supply (3 x LR03 batteries)

ANTENNA (\*):

Type of Antenna: Integral antenna (chip)  
Maximum Declared Antenna Gain: 0.5dBi

TEST FREQUENCIES (\*):

| Modulation | Data rates  | Low Channel: | Middle Channel | High Channel |
|------------|-------------|--------------|----------------|--------------|
| BTLE GFSK  | 1M 1 Mbit/s | 2402 MHz     | 2440 MHz       | 2480 MHz     |

During transmitter test the EUT was controlled by a SW tool provided by the client to operate in a continuous transmit mode on the modulation schemes and test channels as required.

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is connected to the TS8997 using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-17 GHz Double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1.5 m for the frequency range 17 GHz-26 GHz (17 GHz-40 GHz horn antenna).

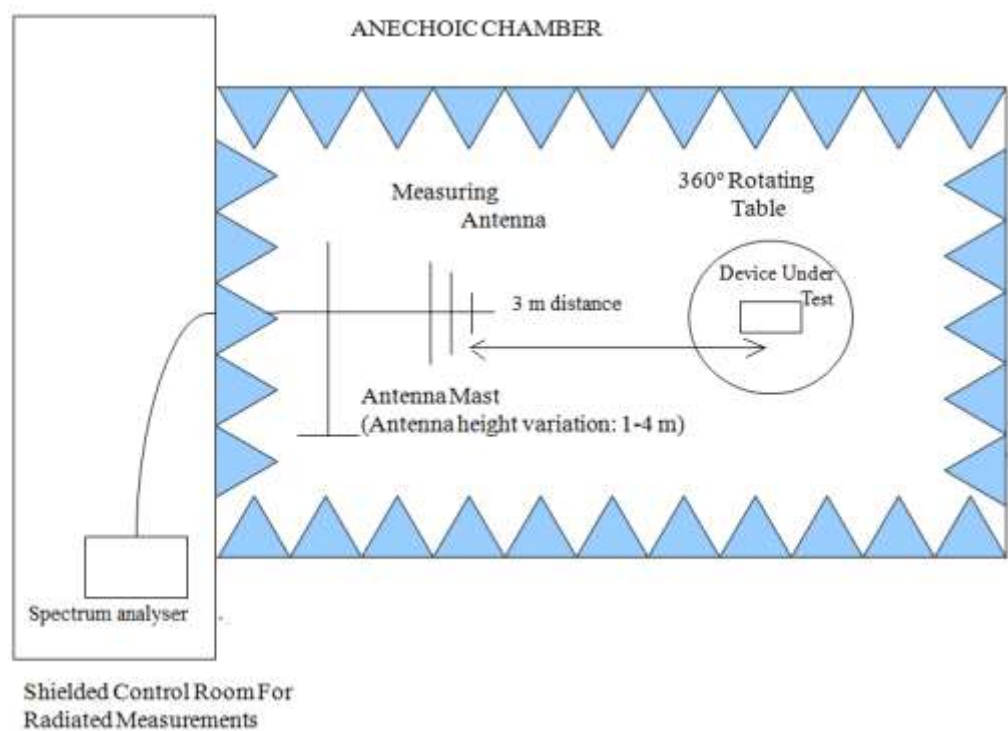
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

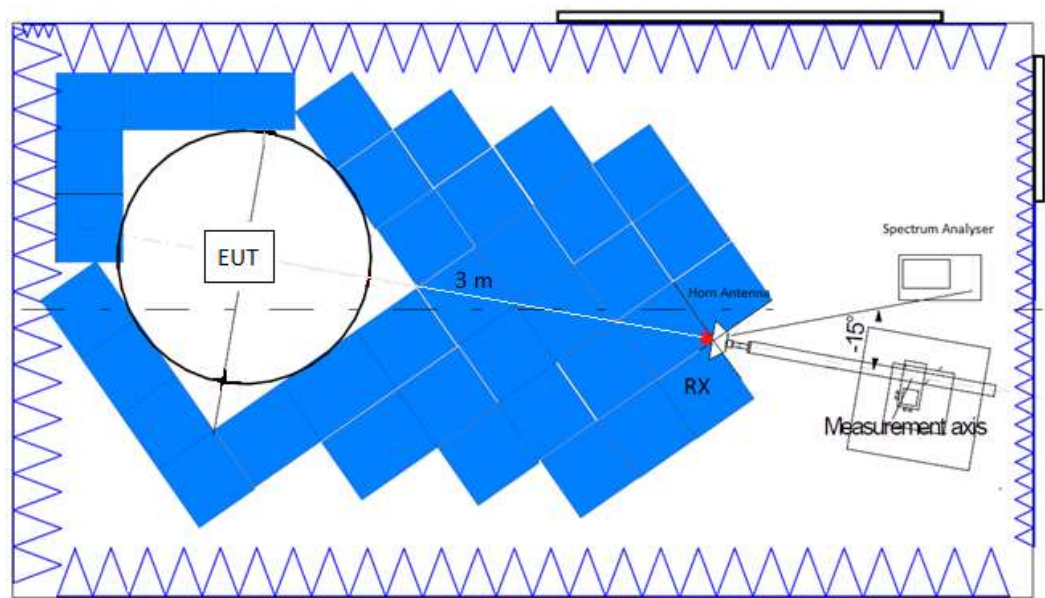
Measurements were made in both horizontal and vertical planes of polarization.

A resolution bandwidth/video bandwidth of 100 kHz / 300 kHz was used for frequencies below 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

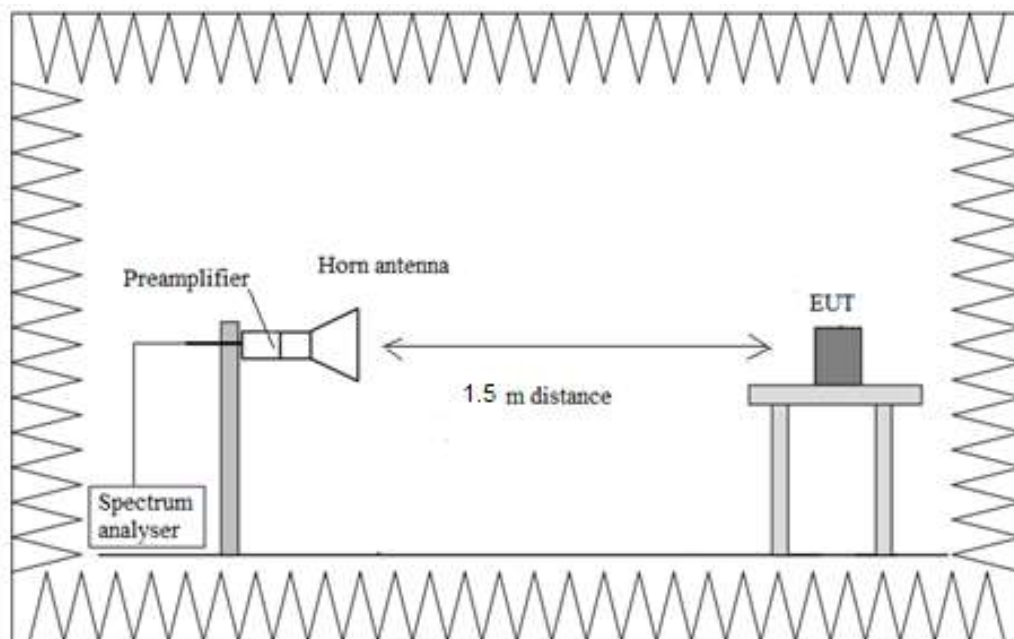
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup  $f > 17$  GHz:



# TEST CASES DETAILS

## Occupied Channel Bandwidth 99%

### Results

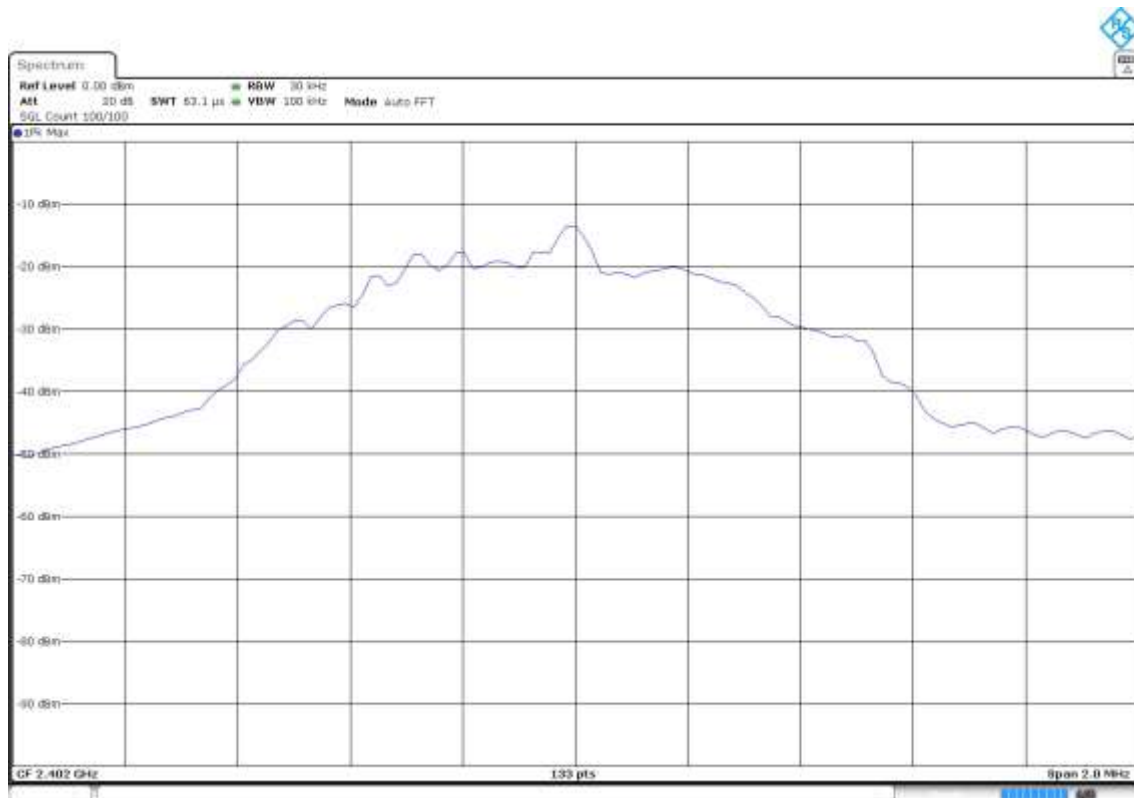
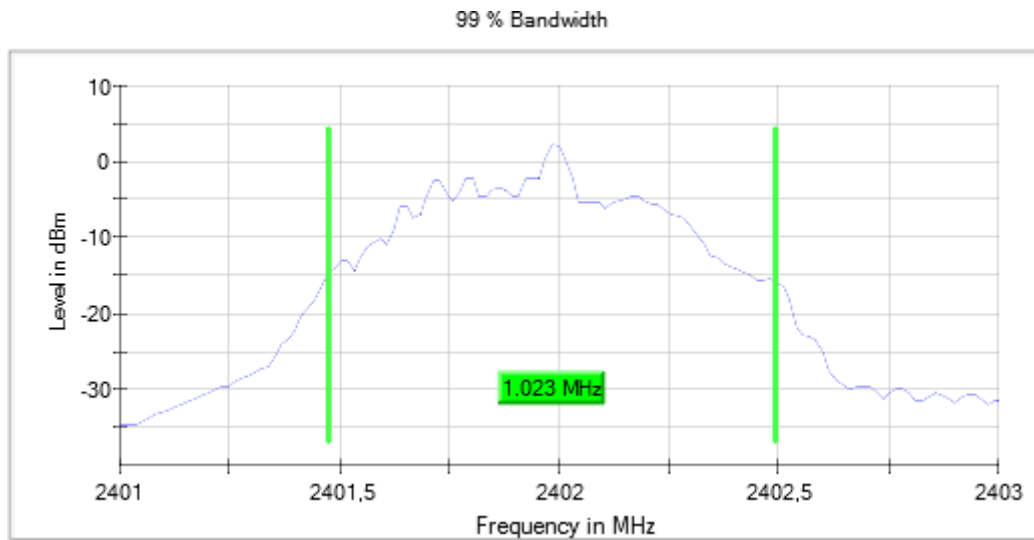
Modulation: BTLE 4.2 (GFSK 1 Mbit/s)

| Freq (MHz) | Occ Ch BW (MHz) |
|------------|-----------------|
| 2402.00000 | 1.023           |
| 2440.00000 | 1.008           |
| 2480.00000 | 1.008           |

## Attachments

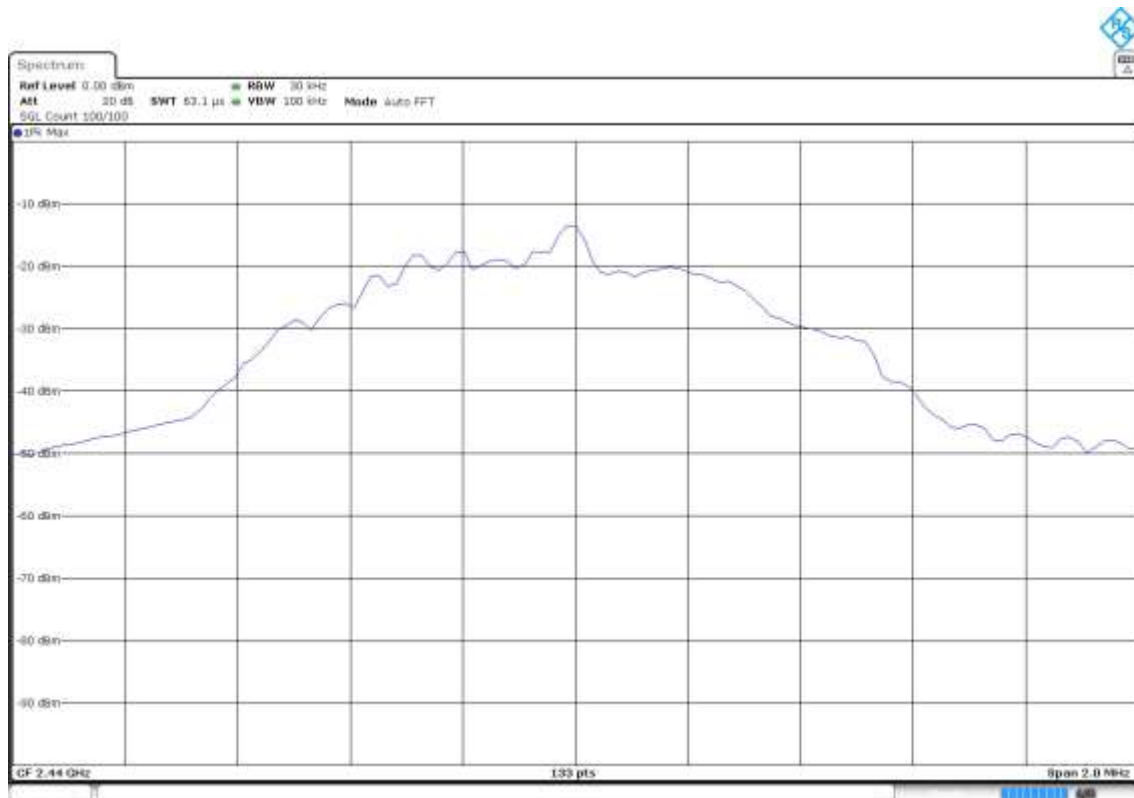
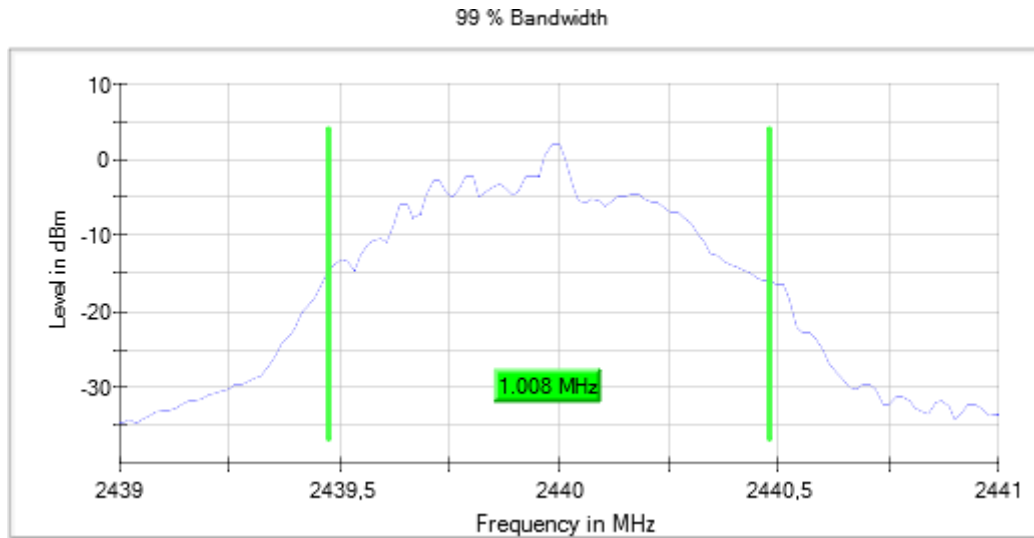
Equipment Type = Digital Transmission System (DTS) Bandwidth MHz = 1  
 Modulation = BTLE 4.2 (GFSK 1 Mbit/s) Frequency MHz = 2402.00000  
 MIMO Mode = SISO Active Port = 1

## Images:



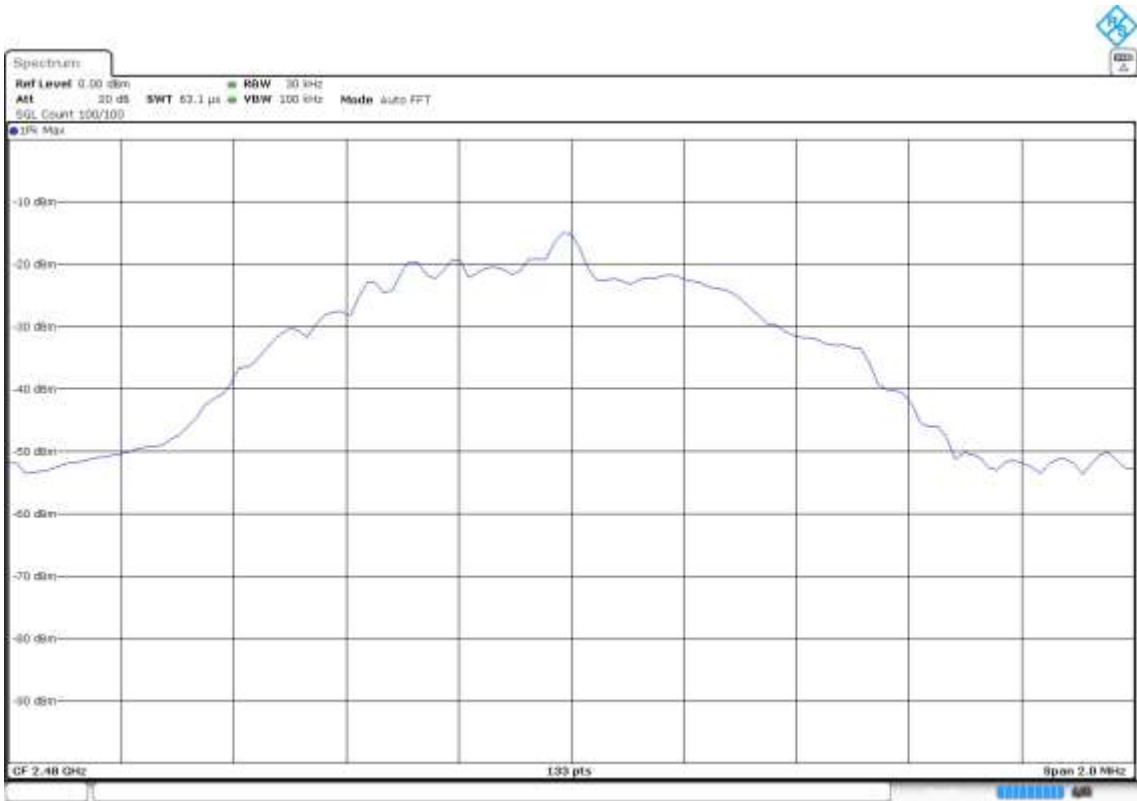
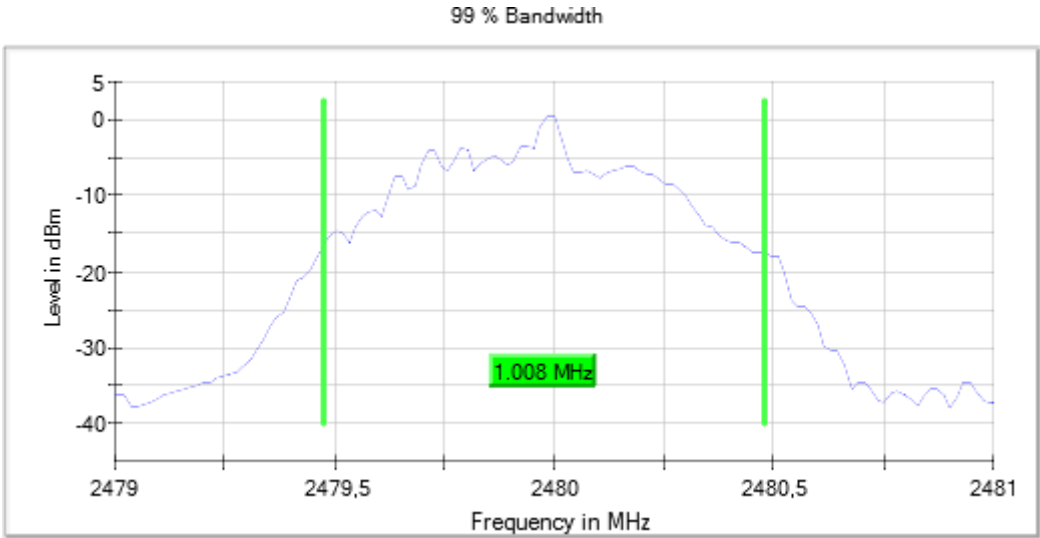
Equipment Type = Digital Transmission System (DTS)    Bandwidth MHz = 1  
 Modulation = BTLE 4.2 (GFSK 1 Mbit/s)    Frequency MHz = 2440.00000  
 MIMO Mode = SISO    Active Port = 1

**Images:**



Equipment Type = Digital Transmission System (DTS)    Bandwidth MHz = 1  
Modulation = BTLE 4.2 (GFSK 1 Mbit/s)    Frequency MHz = 2480.00000  
MIMO Mode = SISO    Active Port = 1

Images:



RSS-247 5.2 (a) / FCC 15.247 (a) (2) 6 dB Bandwidth

Limits

The minimum 6 dB bandwidth shall be at least 500 kHz.

Results

Modulation: BTLE 4.2 (GFSK 1 Mbit/s)

| Freq (MHz) | 6 dB Bandwidth (MHz) |
|------------|----------------------|
| 2402.00000 | 0.693                |
| 2440.00000 | 0.693                |
| 2480.00000 | 0.693                |

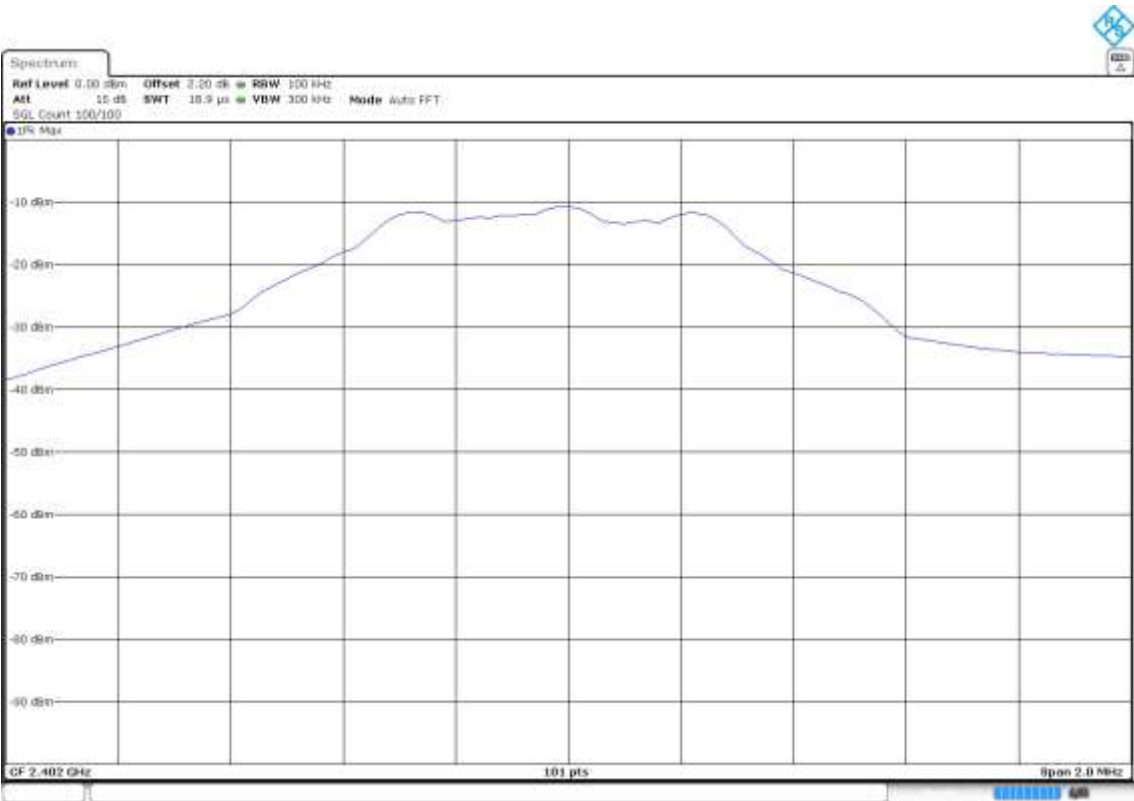
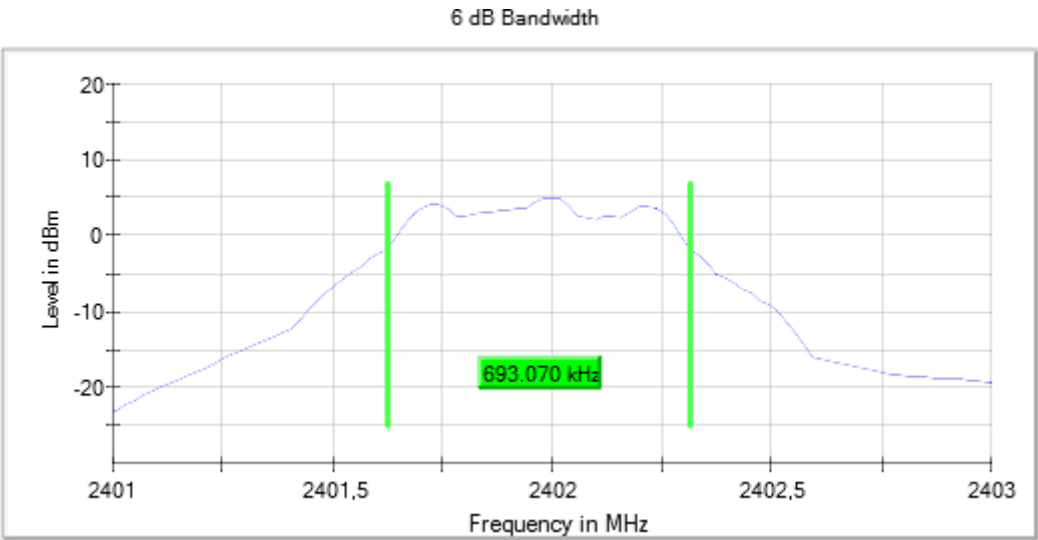
Verdict

Pass

Attachments

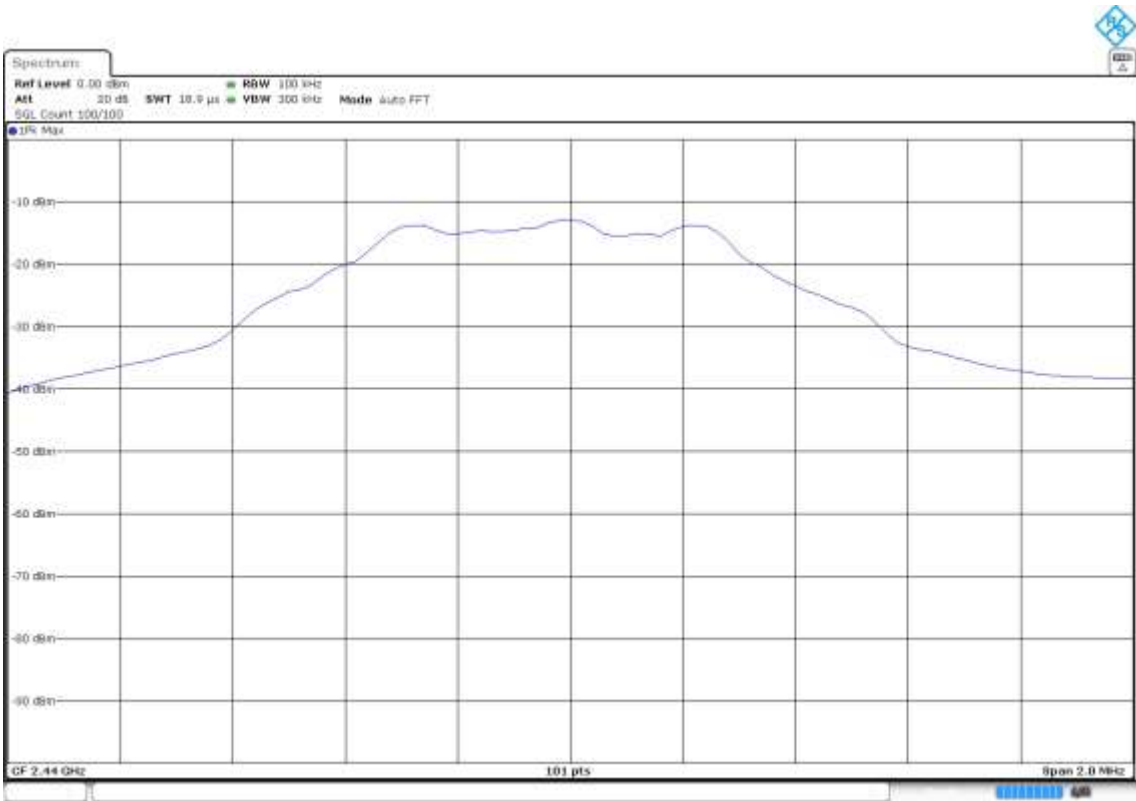
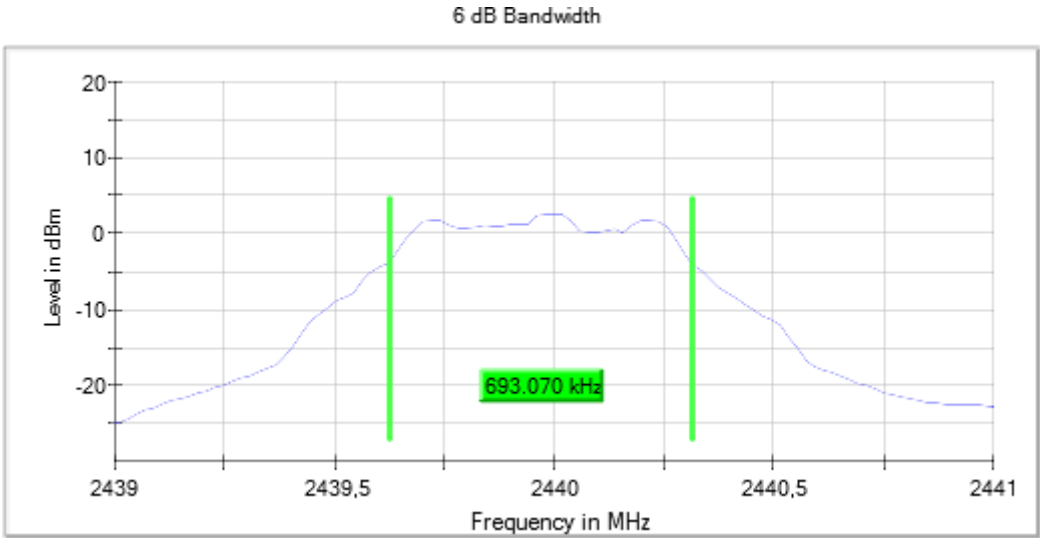
Bandwidth MHz = 1                      Modulation = BTLE 4.2 (GFSK 1 Mbit/s)  
Frequency MHz = 2402.00000      MIMO Mode = SISO  
Active Port = 1

Images:



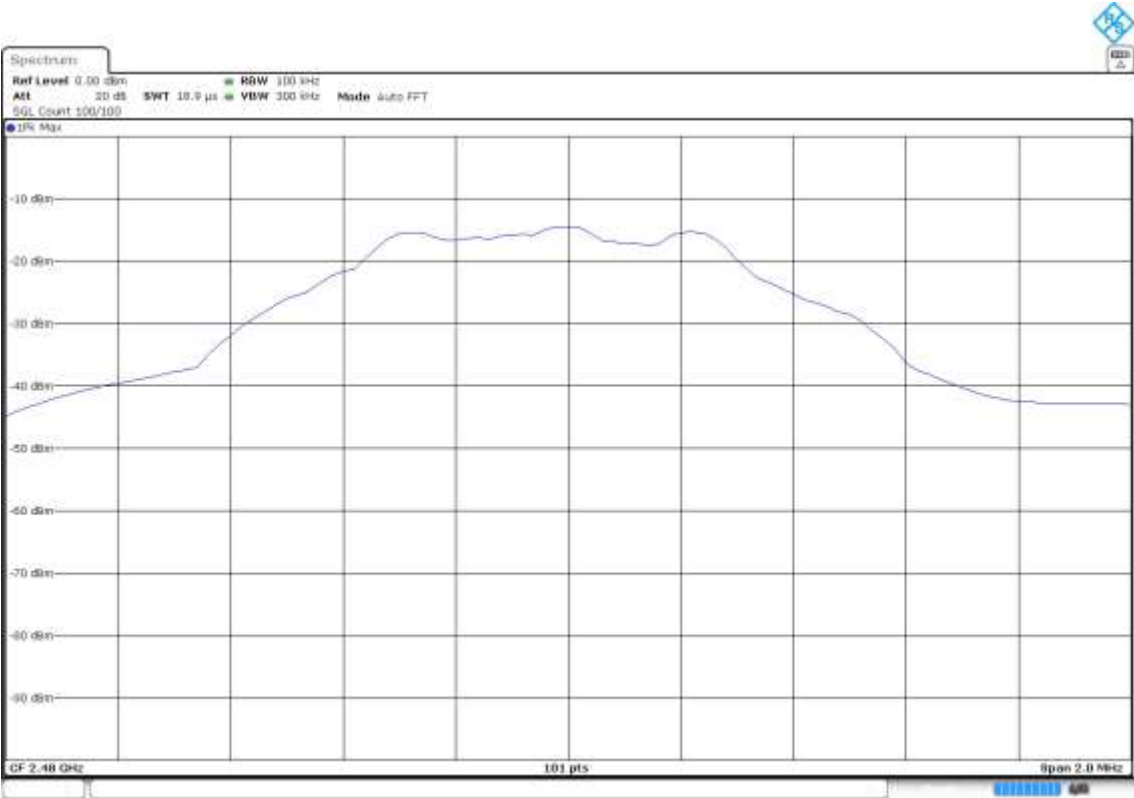
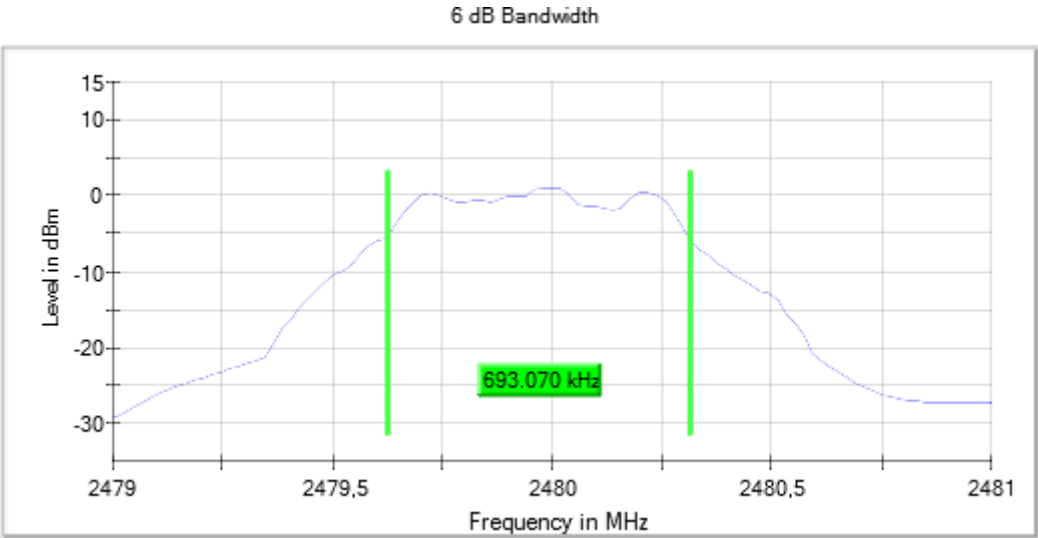
Bandwidth MHz = 1                      Modulation = BTLE 4.2 (GFSK 1 Mbit/s)  
Frequency MHz = 2440.00000      MIMO Mode = SISO  
Active Port = 1

Images:



Bandwidth MHz = 1                      Modulation = BTLE 4.2 (GFSK 1 Mbit/s)  
Frequency MHz = 2480.00000    MIMO Mode = SISO  
Active Port = 1

Images:



# RSS-247 5.2 (b) / FCC 15.247 (e) Power spectral density

**Limits**

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.

**Results**

Modulation: BTLE 4.2 (GFSK 1 Mbit/s)

| Freq (MHz) | Measured Freq (MHz) | PSD (dBm) |
|------------|---------------------|-----------|
| 2402.0000  | 2401.9925           | -3.35     |
| 2440.0000  | 2439.9925           | -3.15     |
| 2480.0000  | 2479.9925           | -4.75     |

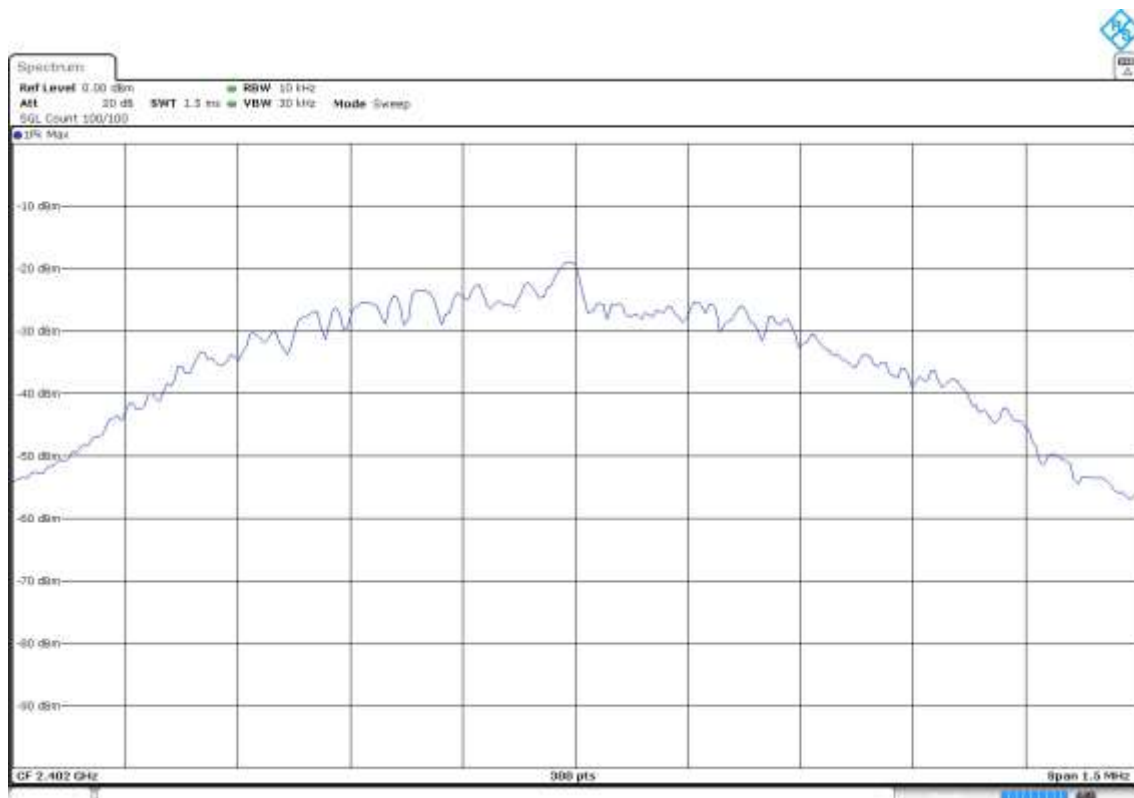
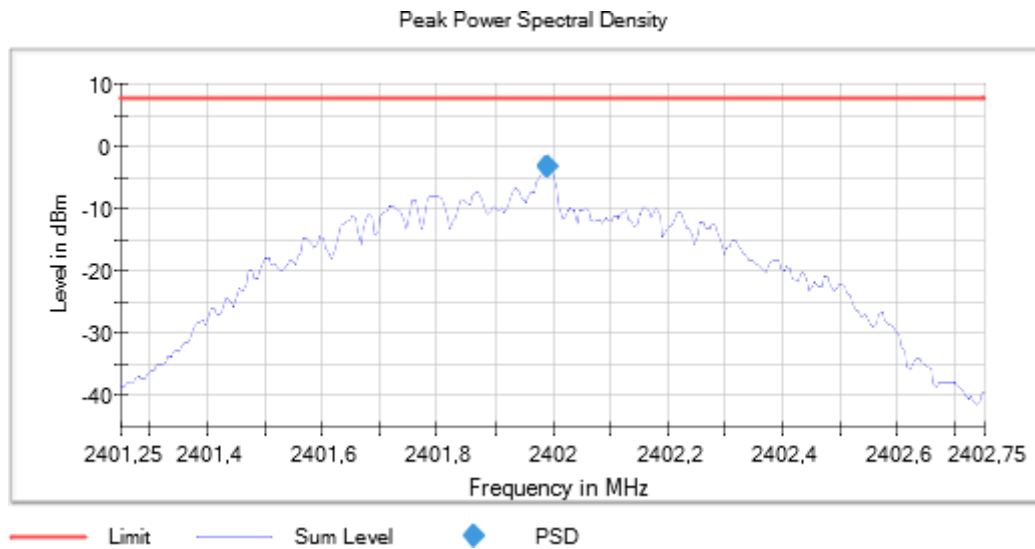
**Verdict**

Pass

## Attachments

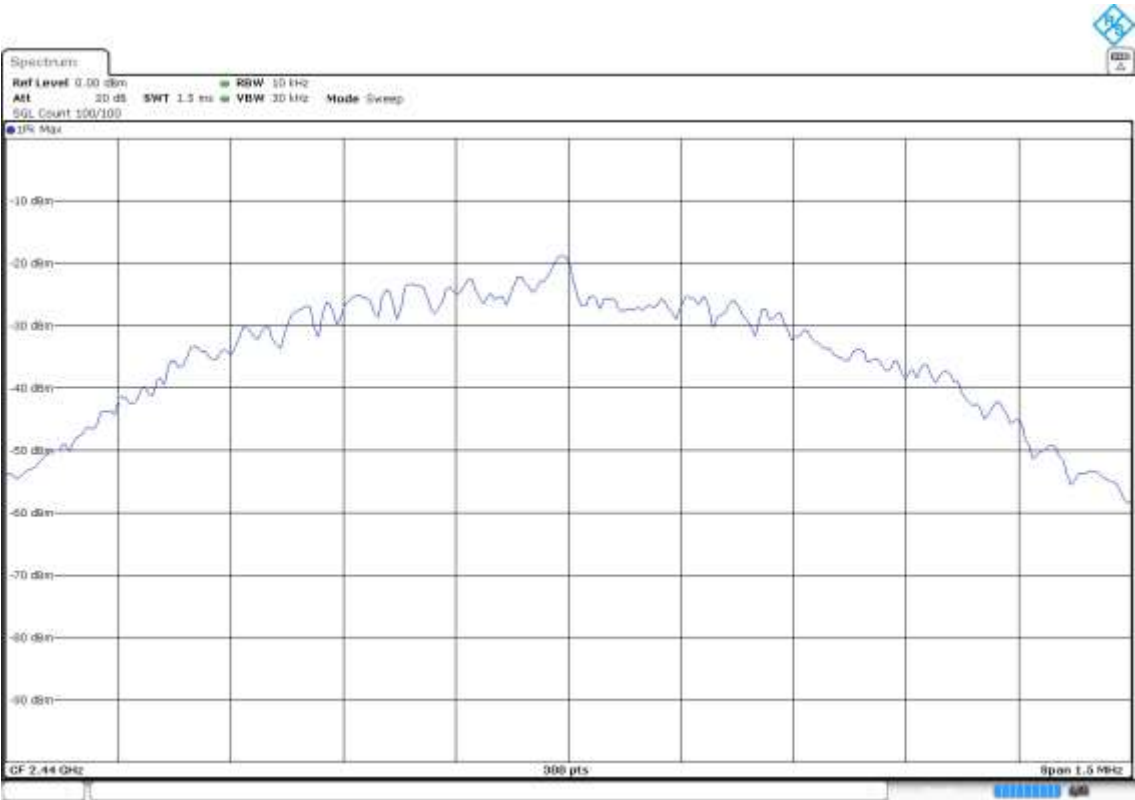
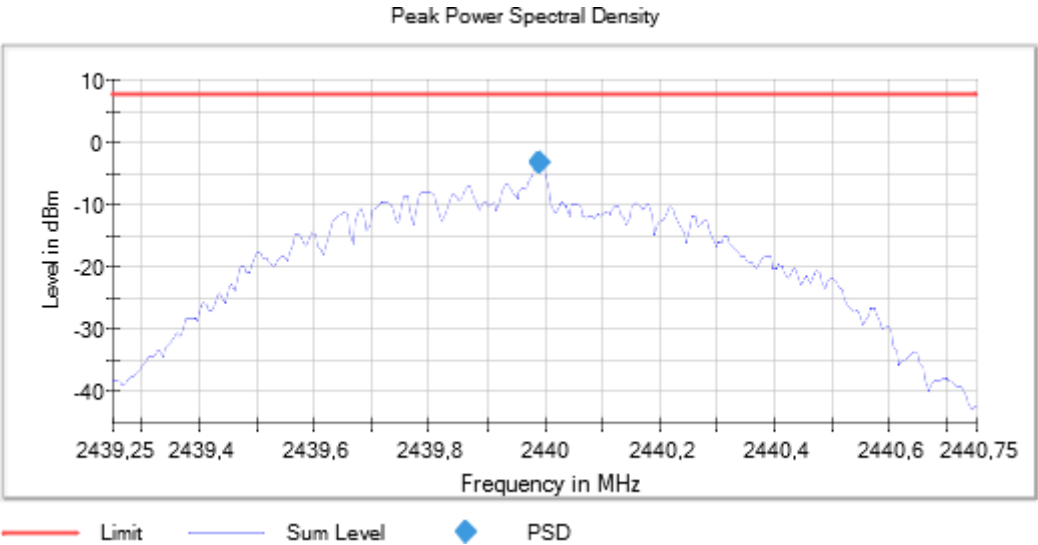
Equipment Type = Digital Transmission System (DTS)    Bandwidth MHz = 1  
 Modulation = BTLE 4.2 (GFSK 1 Mbit/s)    Frequency MHz = 2402.00000  
 MIMO Mode = SISO    Active Port = 1

## Images:



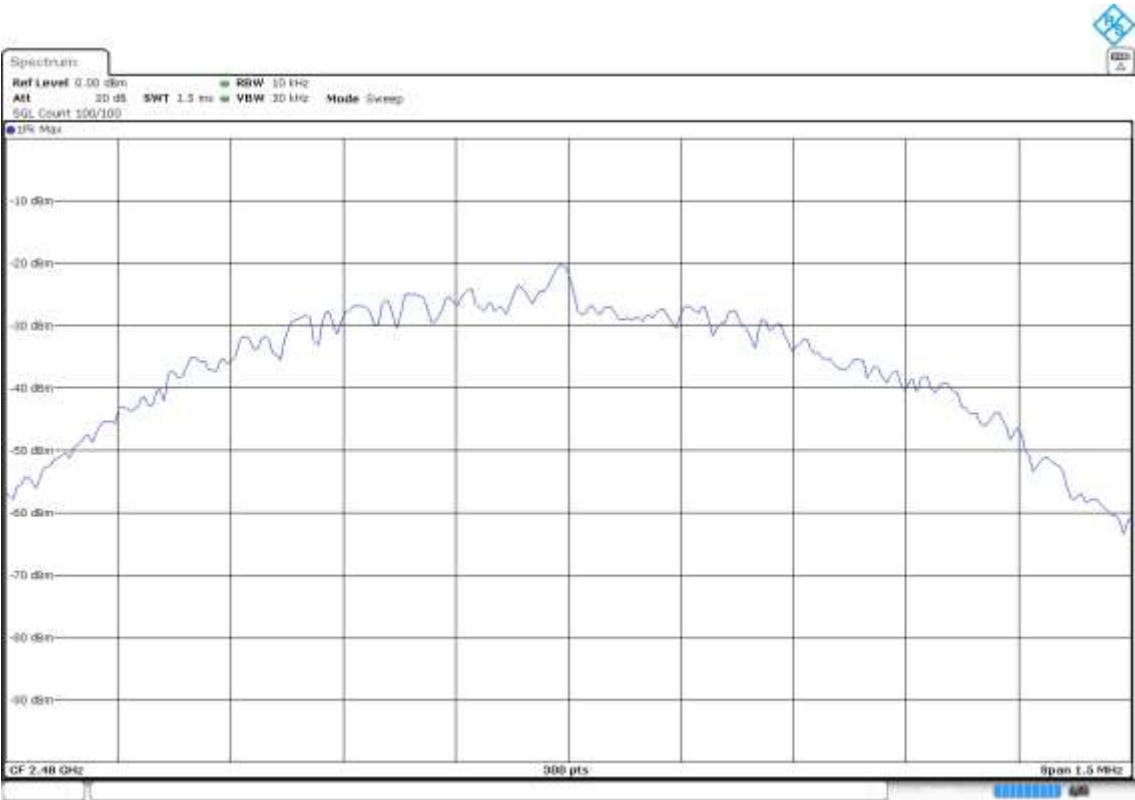
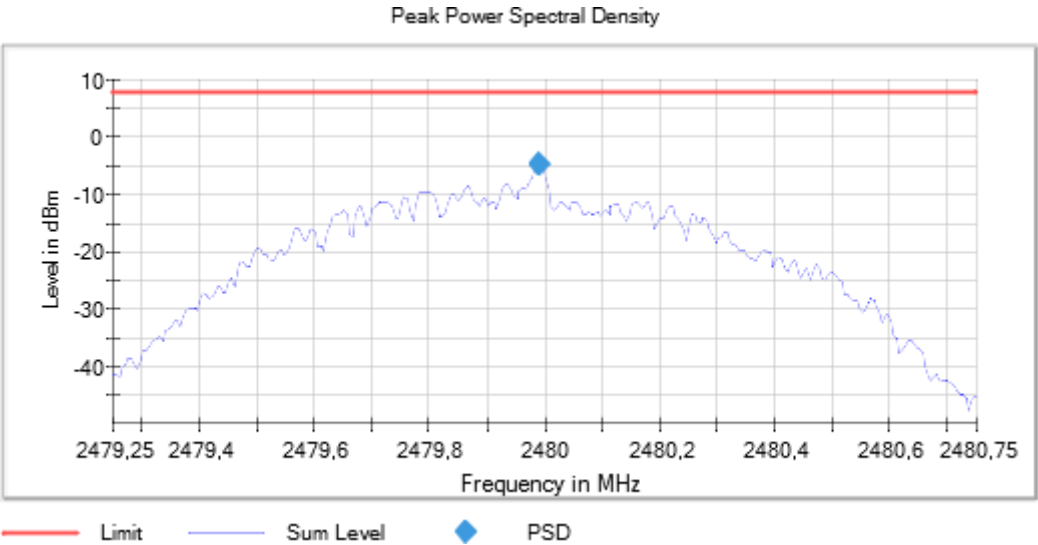
Equipment Type = Digital Transmission System (DTS)    Bandwidth MHz = 1  
Modulation = BTLE 4.2 (GFSK 1 Mbit/s)    Frequency MHz = 2440.00000  
MIMO Mode = SISO    Active Port = 1

Images:



Equipment Type = Digital Transmission System (DTS)    Bandwidth MHz = 1  
Modulation = BTLE 4.2 (GFSK 1 Mbit/s)    Frequency MHz = 2480.00000  
MIMO Mode = SISO    Active Port = 1

Images:



RSS-247 5.4 (d) / FCC 15.247 (b) (3) Maximum Peak Conducted output power

Limits

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).  
The e.i.r.p. shall not exceed 4 W (36 dBm) (RSS-247).

The maximum peak conducted output power level in the fundamental emission was measured using the method according to point 11.9.1.1 "RBW ≥ DTS bandwidth" of ANSI C.63.10-2013.

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

Maximum Declared Antenna Gain: +0.5 dBi

Results

Modulation: BTLE 4.2 (GFSK 1 Mbit/s)

| Freq (MHz) | Maximum Conducted Power (dBm) | Maximum EIRP Power (dBm) |
|------------|-------------------------------|--------------------------|
| 2402.00000 | 2.724                         | 3.224                    |
| 2440.00000 | 2.770                         | 3.270                    |
| 2480.00000 | 1.283                         | 1.783                    |

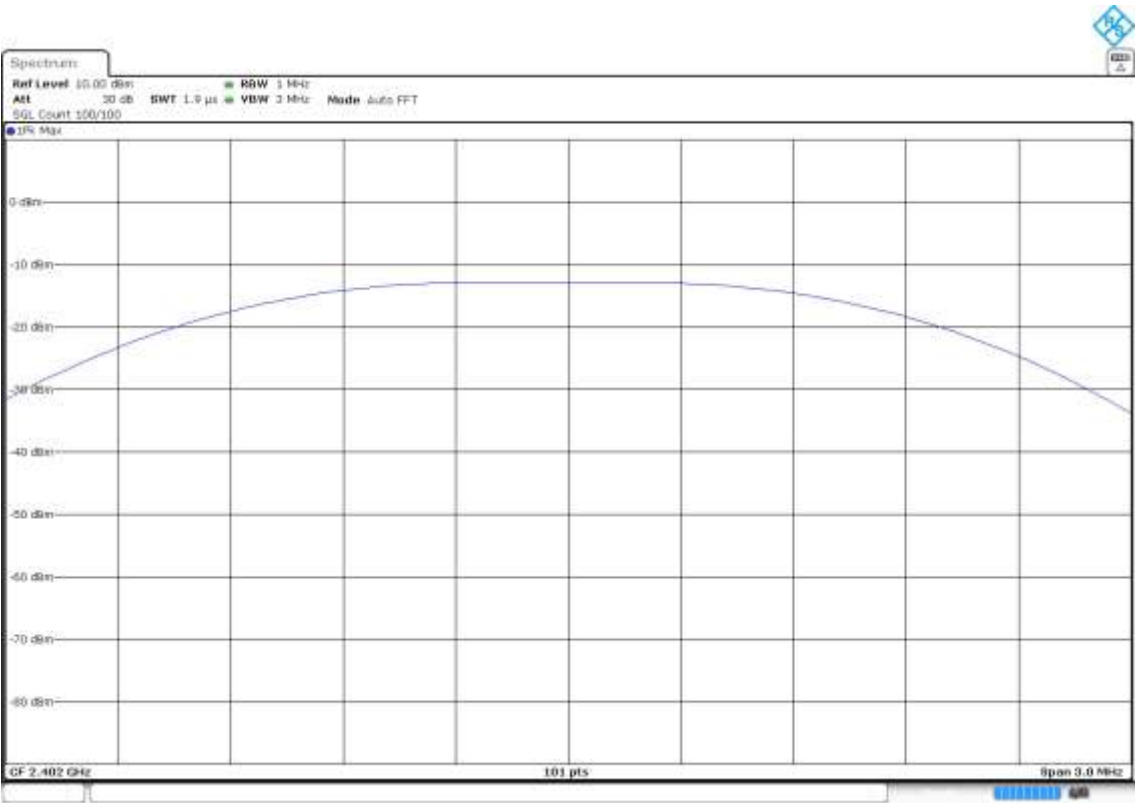
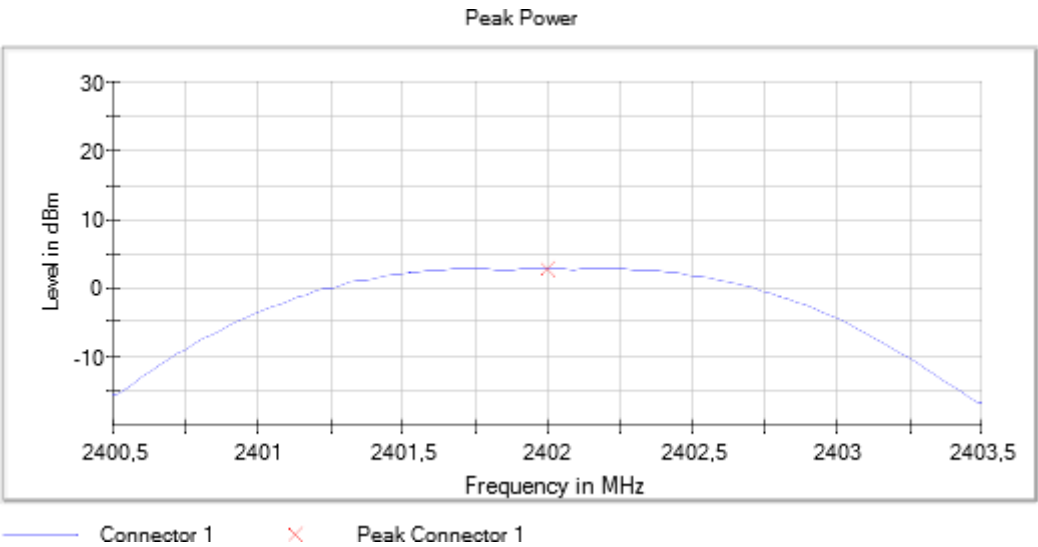
Verdict

Pass

Attachments

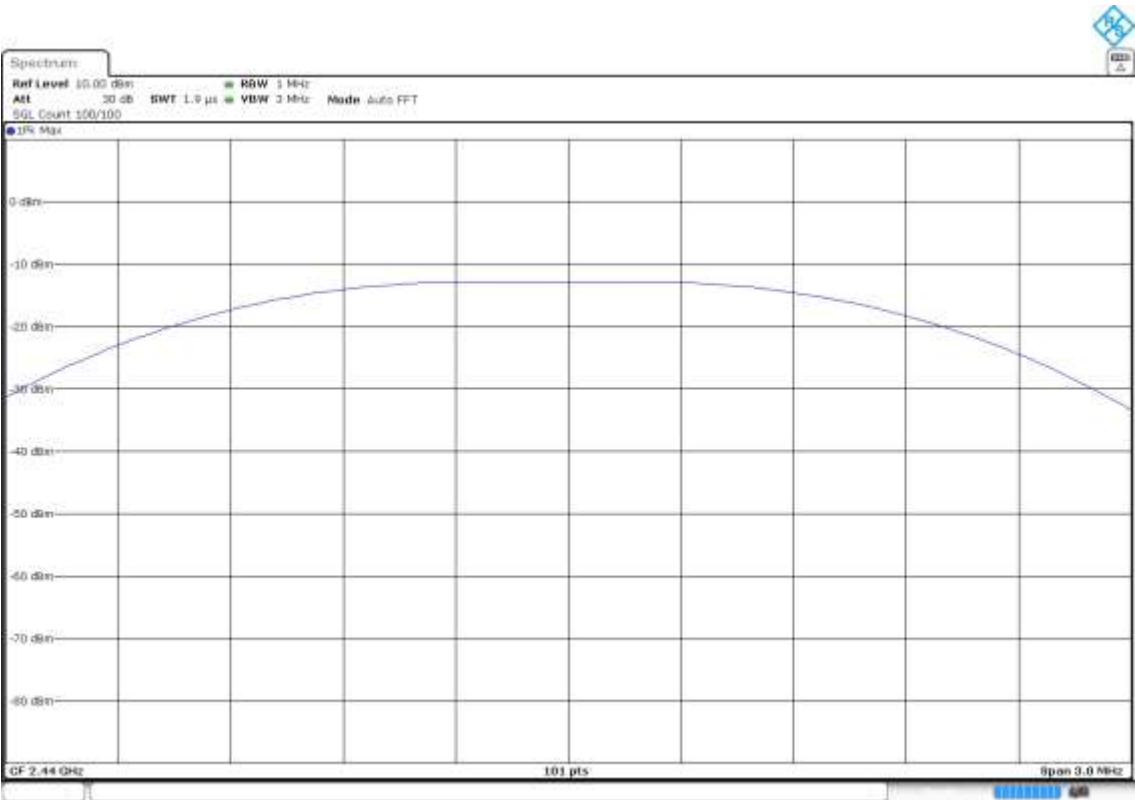
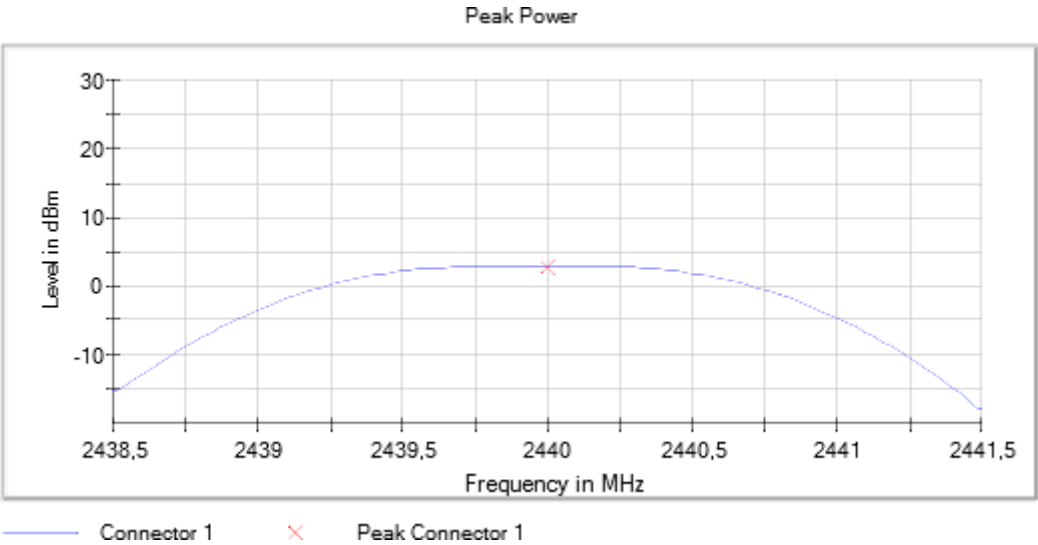
Equipment Type = Digital Transmission System (DTS)    Bandwidth MHz = 1  
Modulation = BTLE 4.2 (GFSK 1 Mbit/s)    Frequency MHz = 2402.00000  
MIMO Mode = SISO    Active Port = 1

Images:



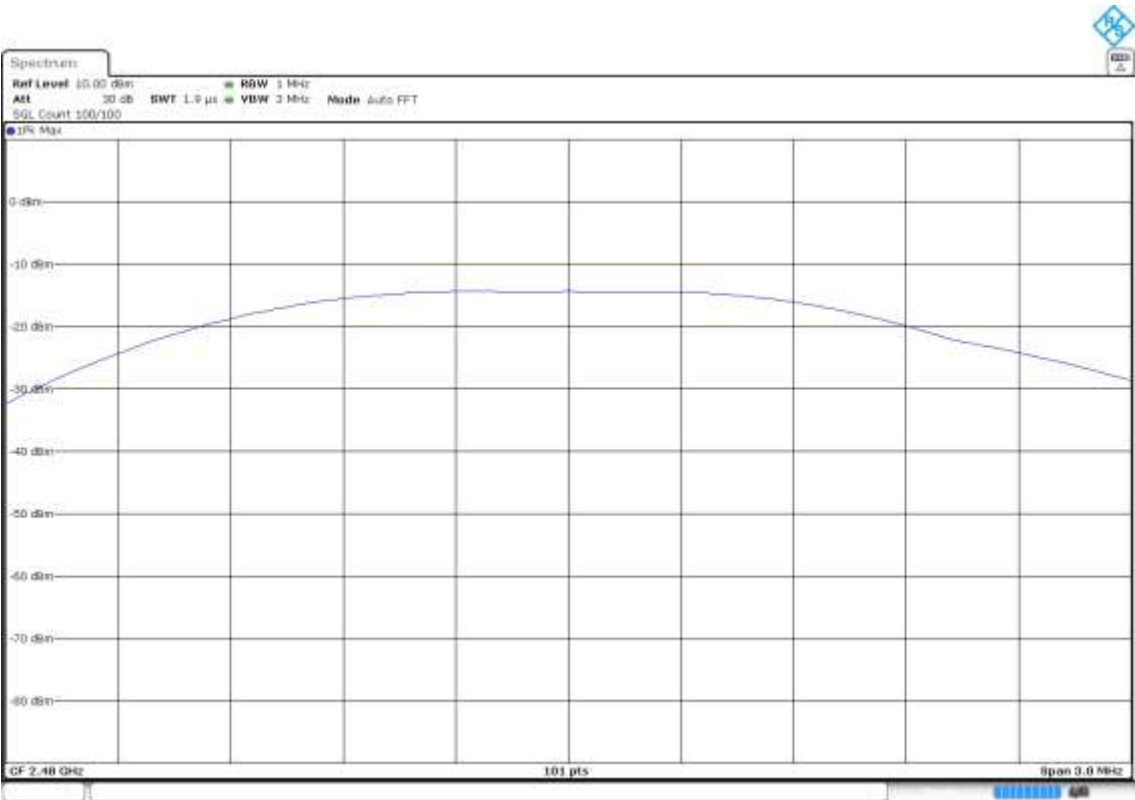
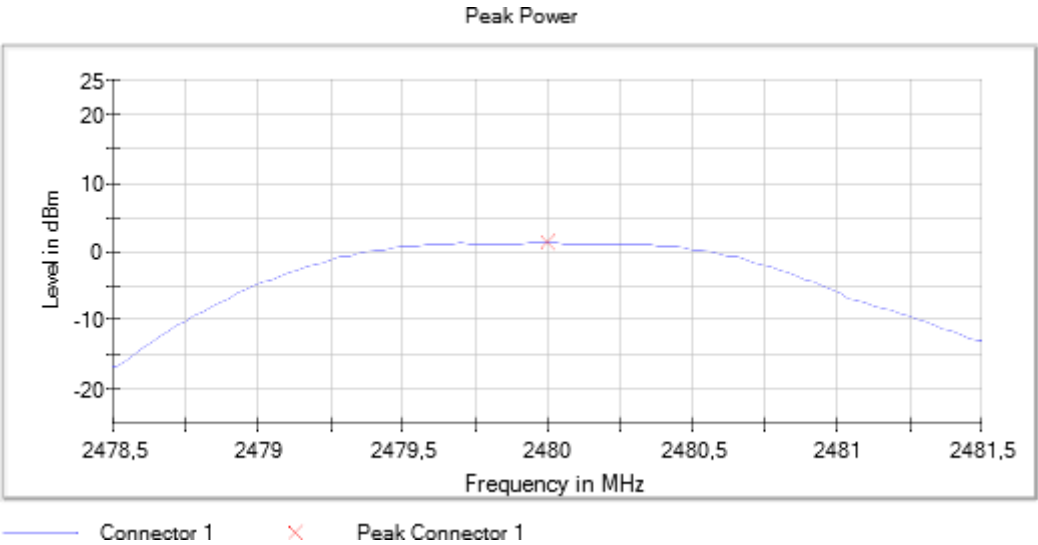
Equipment Type = Digital Transmission System (DTS)    Bandwidth MHz = 1  
Modulation = BTLE 4.2 (GFSK 1 Mbit/s)    Frequency MHz = 2440.00000  
MIMO Mode = SISO    Active Port = 1

Images:



Equipment Type = Digital Transmission System (DTS)    Bandwidth MHz = 1  
Modulation = BTLE 4.2 (GFSK 1 Mbit/s)    Frequency MHz = 2480.00000  
MIMO Mode = SISO    Active Port = 1

Images:



# RSS-247 5.5 / FCC 15.247 (d) Band-edge emissions compliance (Transmitter)

**Limits**

In any 100 kHz bandwidths outside the frequency band in which the 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, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

**Results**

Modulation: BTLE 4.2 (GFSK 1 Mbit/s)

| Freq (MHz) | Freq (MHz)  | Lvl (dBm) | Limit (dBm) |
|------------|-------------|-----------|-------------|
| 2402.00000 | 2399.225000 | -49.172   | -17.112     |
|            | 2399.175000 | -49.245   |             |
|            | 2399.275000 | -50.623   |             |
|            | 2399.125000 | -51.019   |             |
|            | 2381.725000 | -51.449   |             |
|            | 2381.775000 | -51.467   |             |
|            | 2387.425000 | -51.648   |             |
|            | 2387.375000 | -51.717   |             |
|            | 2331.025000 | -51.869   |             |
|            | 2372.675000 | -51.885   |             |
|            | 2345.075000 | -51.952   |             |
|            | 2372.625000 | -51.964   |             |
|            | 2323.625000 | -52.043   |             |
|            | 2399.325000 | -52.070   |             |
|            | 2313.125000 | -52.075   |             |

| Freq (MHz) | Freq (MHz)  | Lvl (dBm) | Limit (dBm) |
|------------|-------------|-----------|-------------|
| 2480.00000 | 2487.275000 | -50.839   | -18.481     |
|            | 2486.675000 | -51.098   |             |
|            | 2486.725000 | -51.104   |             |
|            | 2483.975000 | -51.139   |             |
|            | 2487.225000 | -51.142   |             |
|            | 2484.025000 | -51.277   |             |
|            | 2489.375000 | -51.642   |             |
|            | 2488.625000 | -51.674   |             |
|            | 2489.425000 | -51.705   |             |
|            | 2484.475000 | -51.746   |             |
|            | 2486.475000 | -51.800   |             |
|            | 2496.025000 | -51.807   |             |
|            | 2486.175000 | -51.841   |             |
|            | 2486.625000 | -51.856   |             |
|            | 2484.075000 | -51.860   |             |

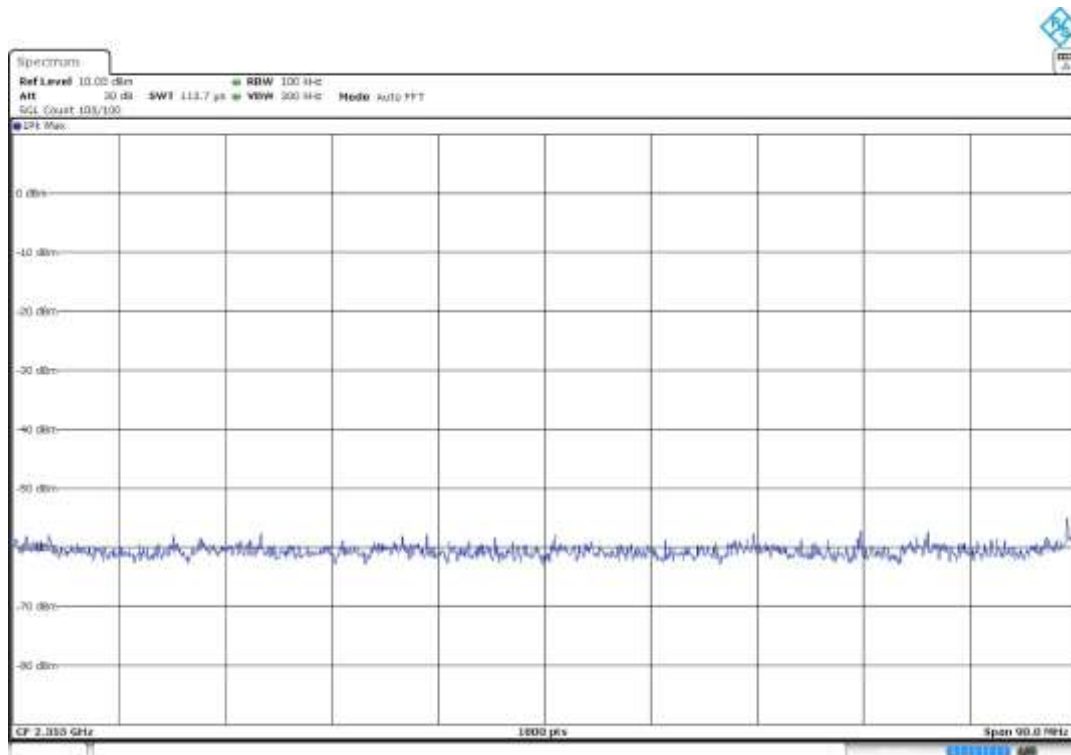
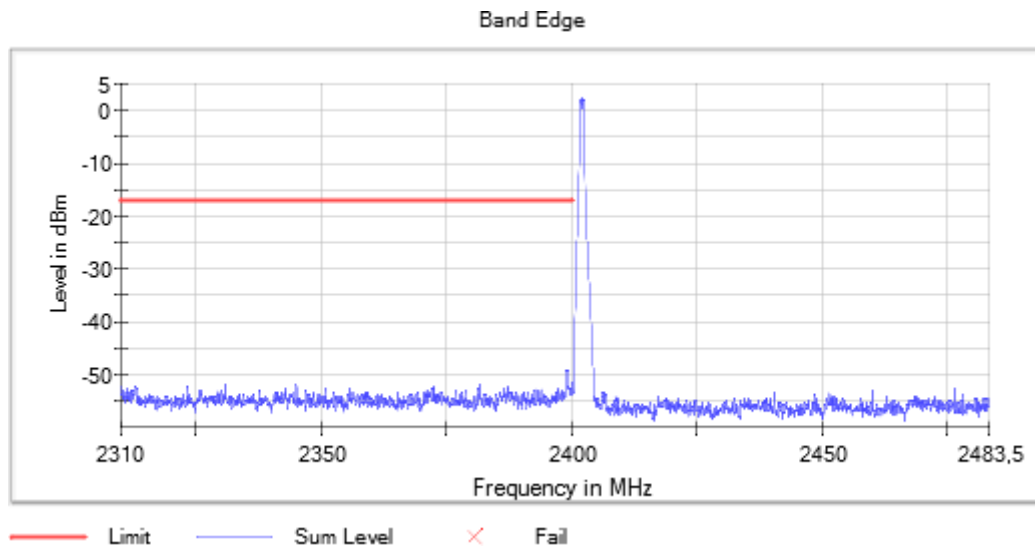
Verdict

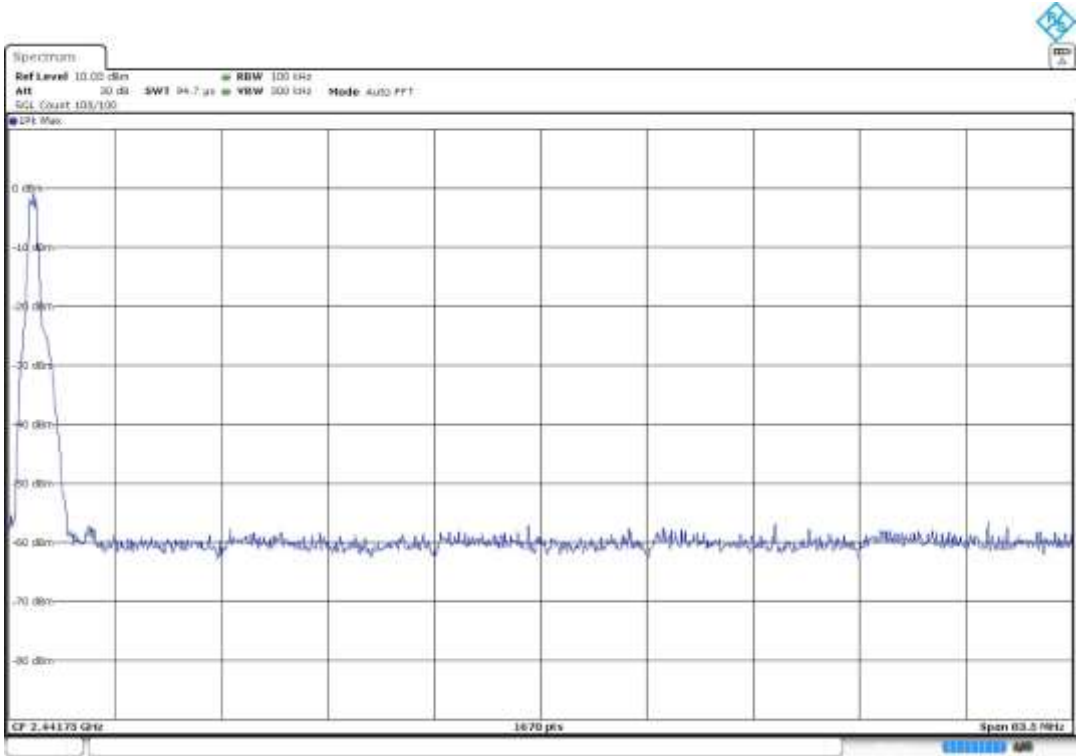
Pass

## Attachments

Equipment Type = Digital Transmission System (DTS) Bandwidth MHz = 1  
 Modulation = BTLE 4.2 (GFSK 1 Mbit/s) Frequency MHz = 2402.00000  
 MIMO Mode = SISO Measurement Point = 1  
 Active Port = 1

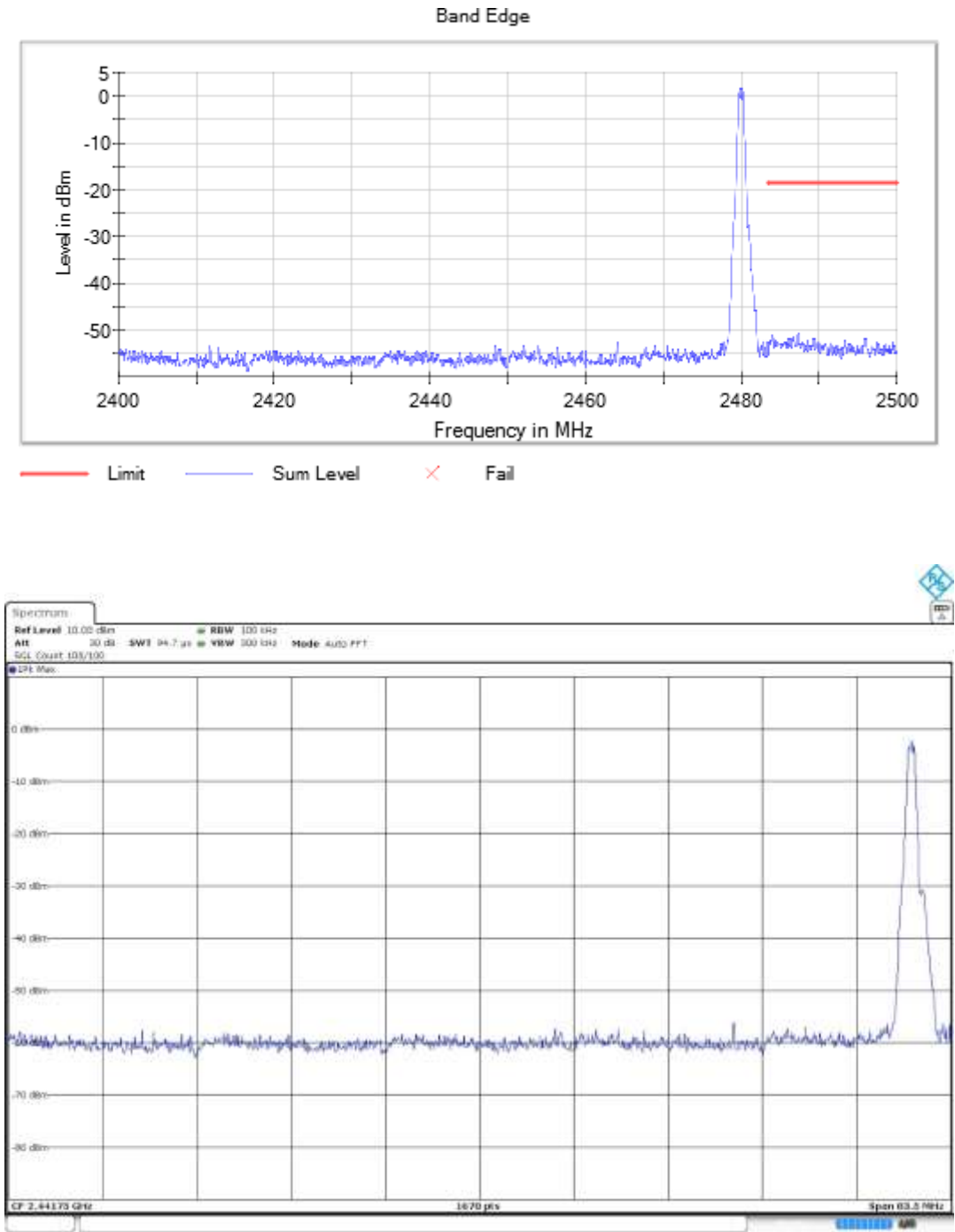
## Images:

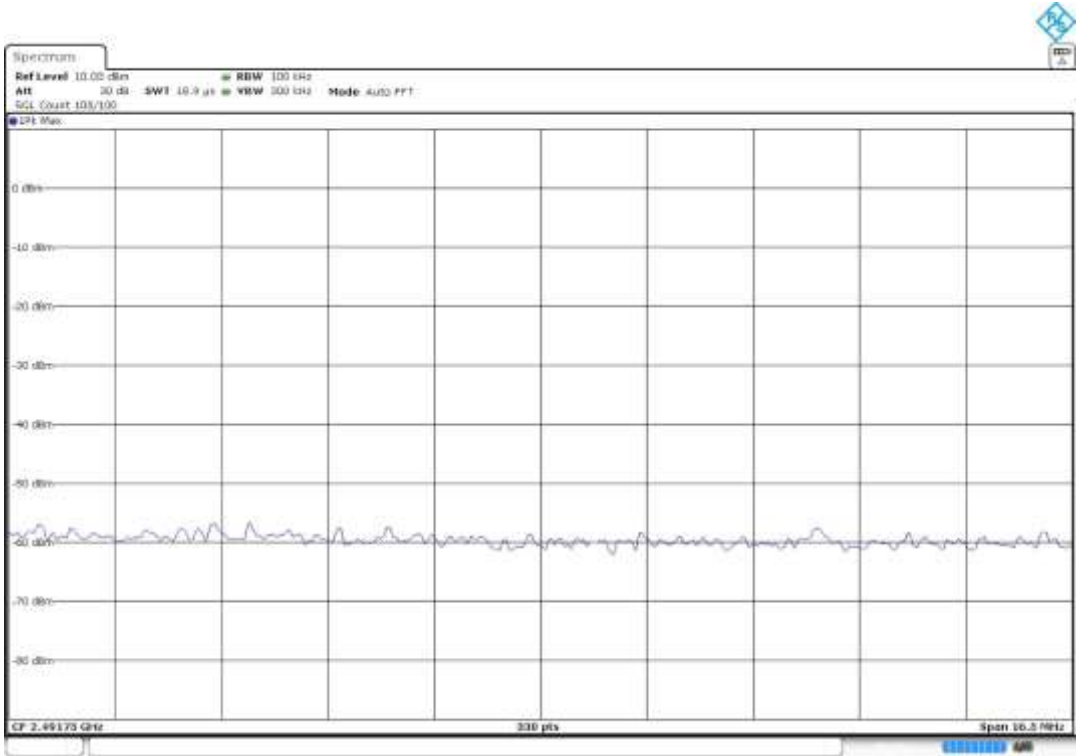




Equipment Type = Digital Transmission System (DTS)    Bandwidth MHz = 1  
Modulation = BTLE 4.2 (GFSK 1 Mbit/s)    Frequency MHz = 2480.00000  
MIMO Mode = SISO    Measurement Point = 1  
Active Port = 1

Images:





## RSS-247 5.5 / FCC 15.247 (d) Emission limitations radiated (Transmitter)

### Limits

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)/RSS-Gen):

| Frequency Range (MHz) | Field strength ( $\mu\text{V/m}$ ) | Field strength ( $\text{dB}\mu\text{V/m}$ ) | Measurement distance (m) |
|-----------------------|------------------------------------|---------------------------------------------|--------------------------|
| 0.009-0.490           | 2400/F(kHz)                        | -                                           | 300                      |
| 0.490-1.705           | 24000/F(kHz)                       | -                                           | 30                       |
| 1.705 - 30.0          | 30                                 | -                                           | 30                       |
| 30 - 88               | 100                                | 40                                          | 3                        |
| 88 - 216              | 150                                | 43.5                                        | 3                        |
| 216 - 960             | 200                                | 46                                          | 3                        |
| Above 960             | 500                                | 54                                          | 3                        |

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RSS-247: Attenuation below the general field strength limits specified in RSS-Gen is not required.

### Results

Modulation: BTLE 4.2 (GFSK 1 Mbit/s)

Computation of duty-cycle correction factor



According to ANSI C63.10, paragraph 7.5, we can determinate the Duty Cycle in this way:

Duty cycle correction factor  $\delta = 20 * \log (\text{Tx ON (ms)} * \text{Number of pulses within 100 ms}) / 100 \text{ ms}$

$\delta = 20 \log (1.99\text{ms}/100\text{ms}) = -34.02 \text{ dB}$ .

Frequency range 30 MHz – 1 GHz:

Spurious frequencies detected at less than 20 dB below the limit:

| Freq Rng (GHz) | Freq (MHz) | Unwanted Freq (MHz) | Unwanted Lvl (dBµV/m) | Pol | Detector |
|----------------|------------|---------------------|-----------------------|-----|----------|
| [0.03, 1]      | 2402.00000 | 64.011              | 21.48                 | H   | QP       |
|                | 2440.00000 | 40.670              | 21.08                 | V   | QP       |
|                |            | 64.017              | 21.24                 | H   | QP       |
|                | 2480.00000 | 63.980              | 21.15                 | H   | QP       |

Frequency range 1 GHz – 26 GHz:

The results below show the maximum measured levels in the 1 – 26 GHz range including the restricted bands 2.31 – 2.39 GHz and 2.4835 – 2.5 GHz.

Spurious frequencies with peak levels above the average limit (54 dBµV/m at 3 m) are measured with average detector for compliance checking with the average limit.

According to 558074 D01 15.247 Meas Guidance v05r02:  
Several measurement methods are available for making average measurements for radiated and antenna-port conducted spurious emission provided that:

- i. The spurious emission fall in restricted band
- ii. Emission are temporally related to the fundamental
- iii. The maximum duty cycle used in determining the reduction factor is hardwired such that under no condition can it be changed or modified by either the device or end user
- iv. documented justification for use of Section 15.35(c) including the measurements used to determine the worst-case duty cycle must be included in the test report, and
- v. the duty cycle correction factor is the worst case operational duty cycle based on the maximum transmission time in any 100 msec period.

If the above criteria are satisfied, one of the following measurement techniques may be used:

Applying a duty cycle correction to the Peak measurement – First, a Peak measurement is made using the Peak detector function of a spectrum analyzer. The spectrum analyzer settings should be such that it meets the requirements of 11.12.2.4 in ANSI C63.10 for making a Peak measurement. Then the operational duty cycle of the EUT may be subtracted from the Peak reading to derive the RMS average value. If the EUT supports more than one operational duty cycle the worst-case value should be used, i.e., the highest operational duty cycle.

\* Real Duty Cycle correction factor: -34.02 dB

| Freq (MHz) | Freq Rng (GHz) | Unwanted Freq (MHz) | Unwanted Lvl (dBμV/m) | Corrected RMS Unwanted Lvl (dBμV/m) | Pol | Detector |
|------------|----------------|---------------------|-----------------------|-------------------------------------|-----|----------|
| 2402.00000 | [3, 17]        | 4803.3750           | 53.29                 | --                                  | V   | PK       |
|            |                |                     | --                    | 19.27                               |     | AVG      |
|            |                | 9606.6875 (*)       | 55.18                 | --                                  | V   | PK       |
|            |                | 12011.1875          | 52.70                 | --                                  | V   | PK       |
|            |                |                     | --                    | 18.68                               |     | AVG      |
| 2440.00000 |                | 4879.0625           | 52.06                 | --                                  | V   | PK       |
|            |                |                     | --                    | 18.04                               |     | AVG      |
|            |                | 7319.0000           | 51.52                 | --                                  | H   | PK       |
|            |                |                     | --                    | 17.50                               |     | AVG      |
|            |                | 9760.6875 (**)      | 54.35                 | --                                  | V   | PK       |
|            | 12199.3125     | 51.66               | --                    | V                                   | PK  |          |
|            |                | --                  | 17.64                 |                                     | AVG |          |

| Freq (MHz) | Freq Rng (GHz) | Unwanted Freq (MHz) | Unwanted Lvl (dBµV/m) | Corrected RMS Unwanted Lvl (dBµV/m) | Pol | Detector |
|------------|----------------|---------------------|-----------------------|-------------------------------------|-----|----------|
| 2480.00000 | [3, 17]        | 4960.4375           | 49.85                 | --                                  | V   | PK       |
|            |                |                     | --                    | 15.83                               |     | AVG      |
|            |                | 7440.6250           | 52.08                 | --                                  | H   | PK       |
|            |                |                     | --                    | 18.06                               |     | AVG      |
|            |                | 12401.4375          | 50.11                 | --                                  | V   | PK       |
|            |                |                     | --                    | 16.09                               |     | AVG      |

(\*): This frequency is not within any restricted band. The emission levels were measured with a RBW = 100 kHz and the measured radiated carrier level was 90.07 dBµV/m with RBW = 100 kHz. The emission level is therefore more than 20 dB below the carrier level as indicated in FCC 15.247 (d).

(\*\*): This frequency is not within any restricted band. The emission level was measured with a RBW = 100 kHz and the measured radiated carrier level was 90.76 dBµV/m with RBW = 100 kHz. The emission level is therefore more than 20 dB below the carrier level as indicated in FCC 15.247 (d).

Verdict

Pass

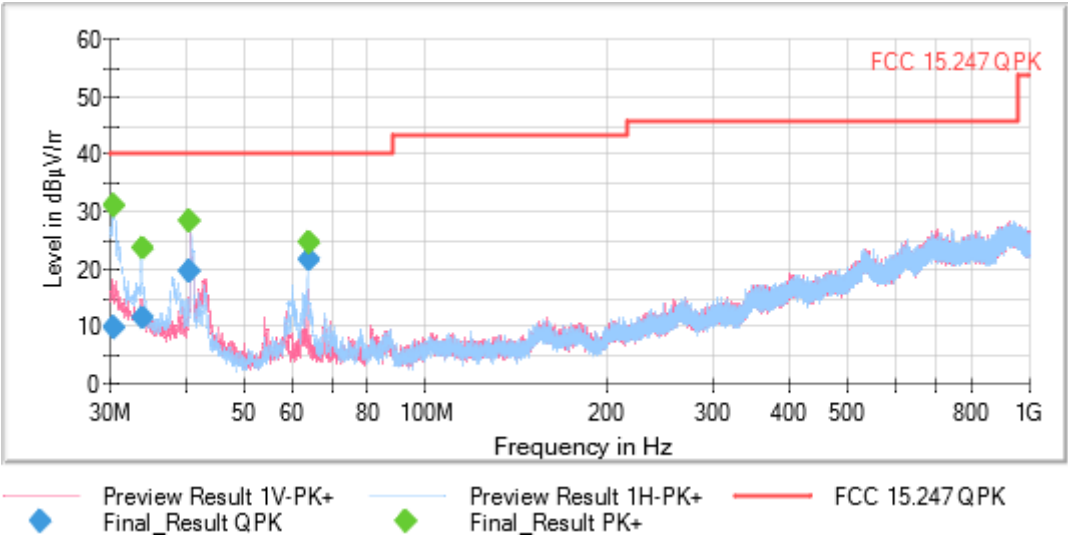
Attachments

Spectrum Analyzer Parameters:

| Subrange           | Step Size  | Detectors | Bandwidth | Sweep Time | Preamplifier |
|--------------------|------------|-----------|-----------|------------|--------------|
| Receiver: [ESR 7]  |            |           |           |            |              |
| 30 MHz - 1 GHz     | 30,312 kHz | PK+       | 100 kHz   | 1 s        | 0 dB         |
| 1 GHz - 3 GHz      | 30,769 kHz | PK+ ; AVG | 1 MHz     | 1 s        | 0 dB         |
| Receiver: [FSV 40] |            |           |           |            |              |
| 3 GHz - 17 GHz     | 437,5 kHz  | PK+ ; AVG | 1 MHz     | 1 s        | 0 dB         |
| 17 GHz - 26 GHz    | 300 kHz    | PK+ ; AVG | 1 MHz     | 1 s        | 0 dB         |

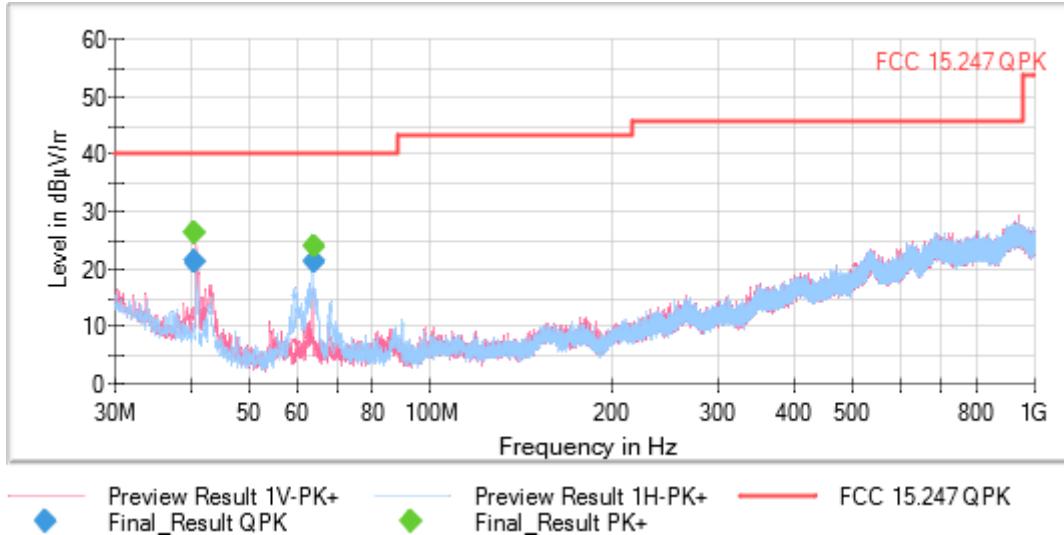
Frequency Range GHz = [0.03, 1]      Equipment Type = Digital Transmission System (DTS)  
Modulation = BTLE 4.2 (GFSK 1 Mbit/s)      Frequency MHz = 2402.00000  
MIMO Mode = SISO      Measurement Point = 1  
Active Port = 1

Images:



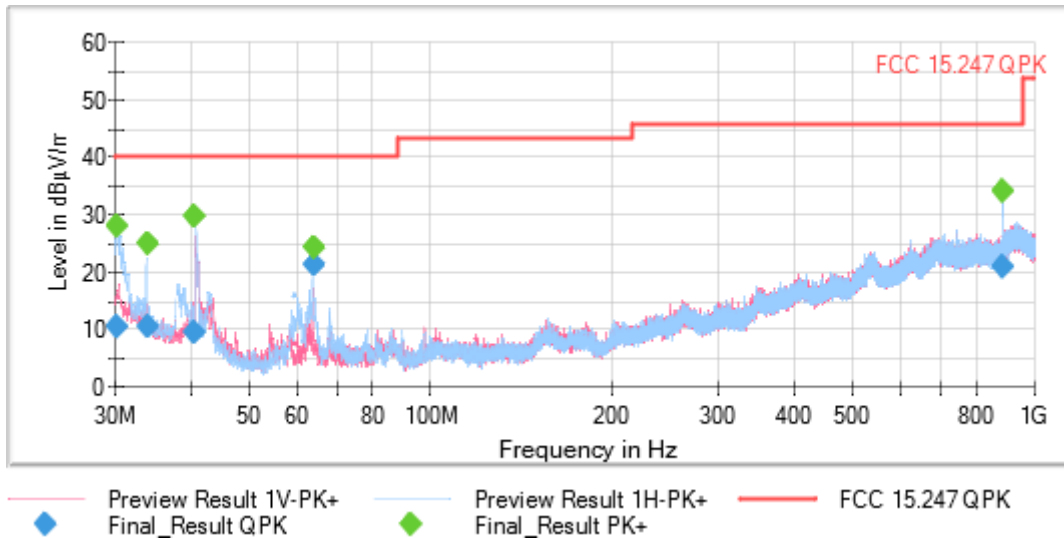
Frequency Range GHz = [0.03, 1]      Equipment Type = Digital Transmission System (DTS)  
Modulation = BTLE 4.2 (GFSK 1 Mbit/s)      Frequency MHz = 2440.00000  
MIMO Mode = SISO      Measurement Point = 1  
Active Port = 1

Images:



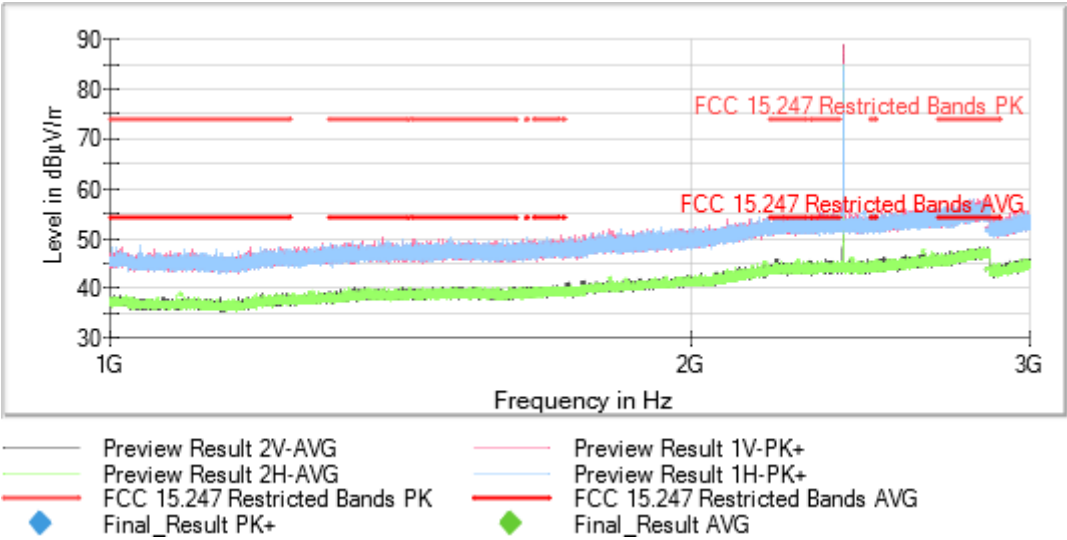
Frequency Range GHz = [0.03, 1]      Equipment Type = Digital Transmission System (DTS)  
Modulation = BTLE 4.2 (GFSK 1 Mbit/s)      Frequency MHz = 2480.00000  
MIMO Mode = SISO      Measurement Point = 1  
Active Port = 1

Images:

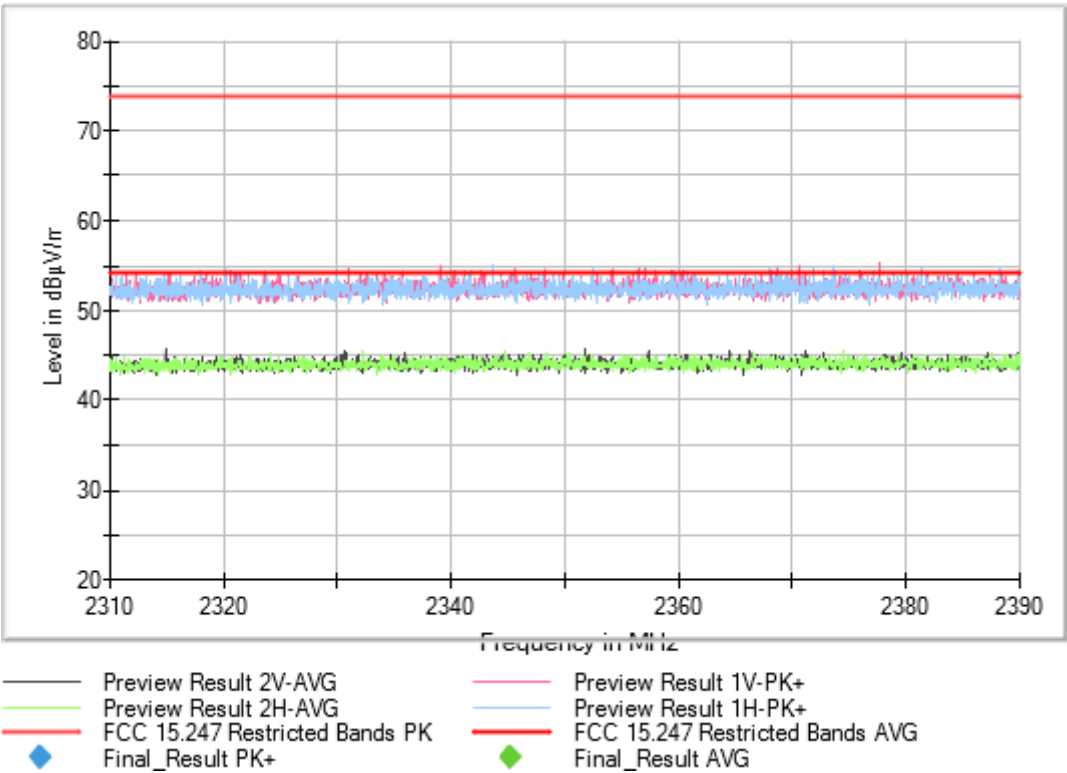


Frequency Range GHz = [1, 3]      Equipment Type = Digital Transmission System (DTS)  
Modulation = BTLE 4.2 (GFSK 1 Mbit/s)      Frequency MHz = 2402.00000  
MIMO Mode = SISO      Measurement Point = 1  
Active Port = 1

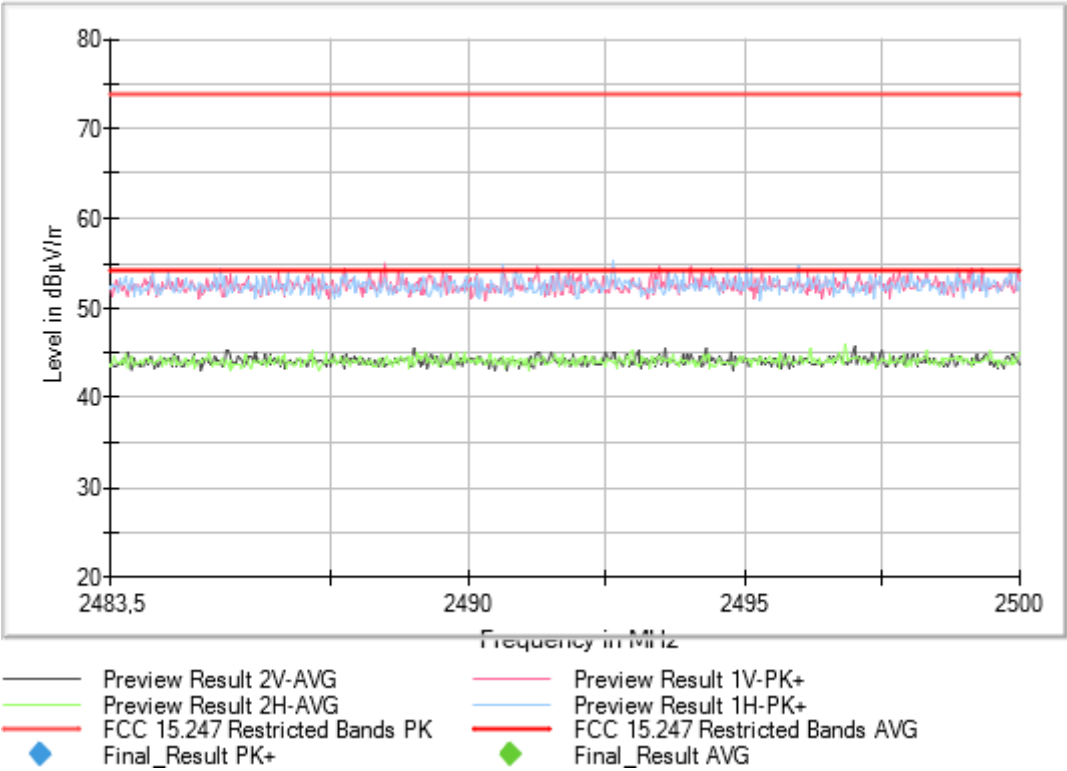
Images:



Full Spectrum

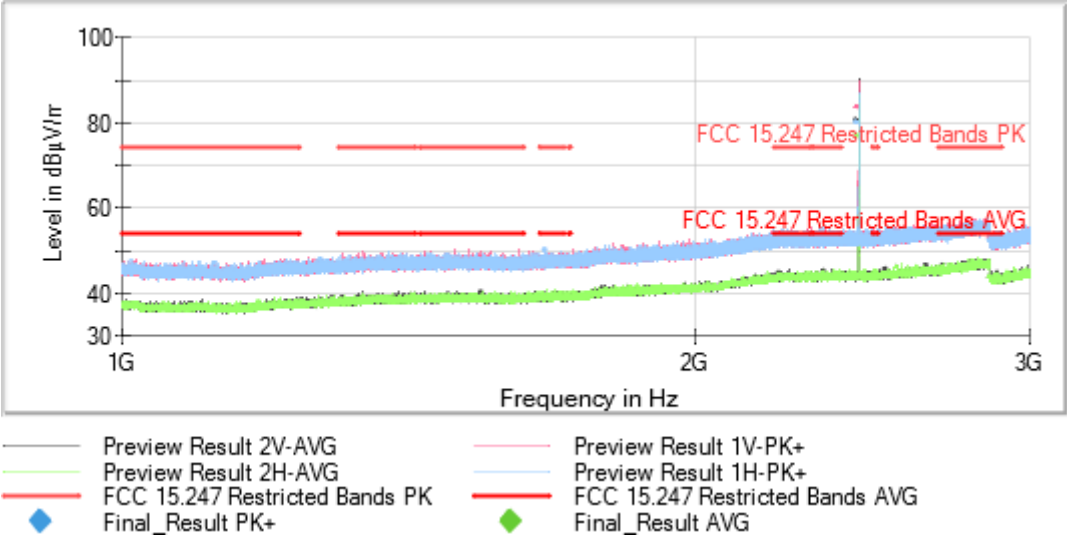


Full Spectrum

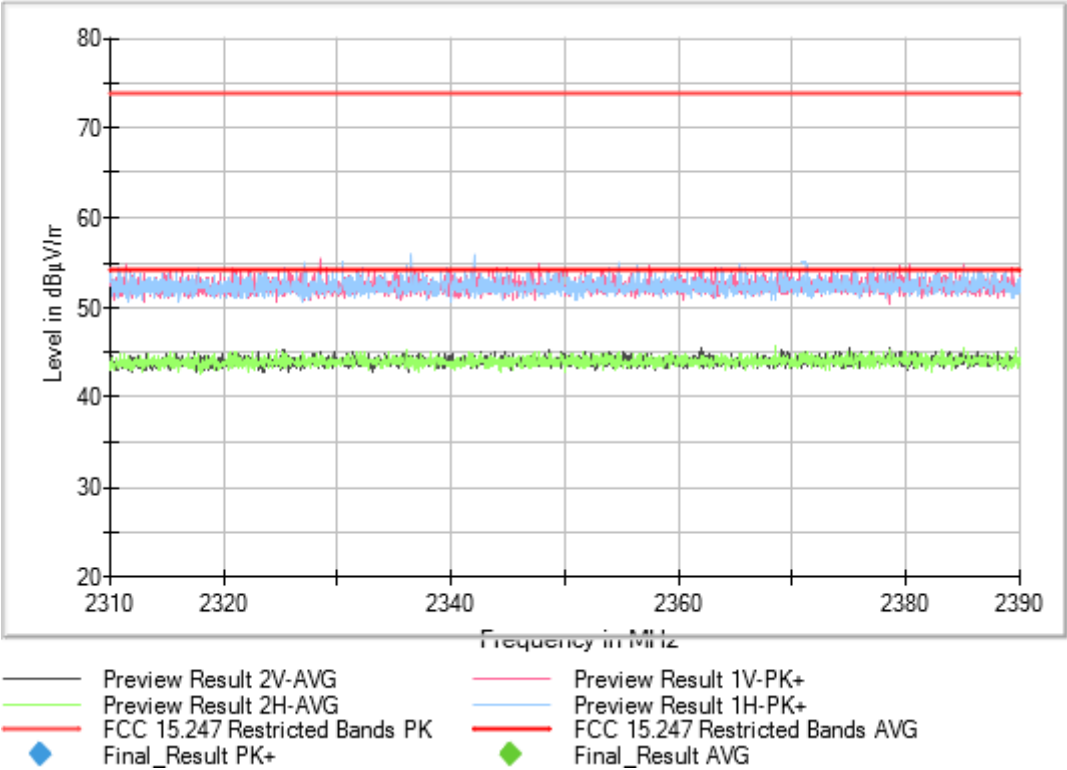


Frequency Range GHz = [1, 3]                      Equipment Type = Digital Transmission System (DTS)  
Modulation = BTLE 4.2 (GFSK 1 Mbit/s)      Frequency MHz = 2440.00000  
MIMO Mode = SISO                                  Measurement Point = 1  
Active Port = 1

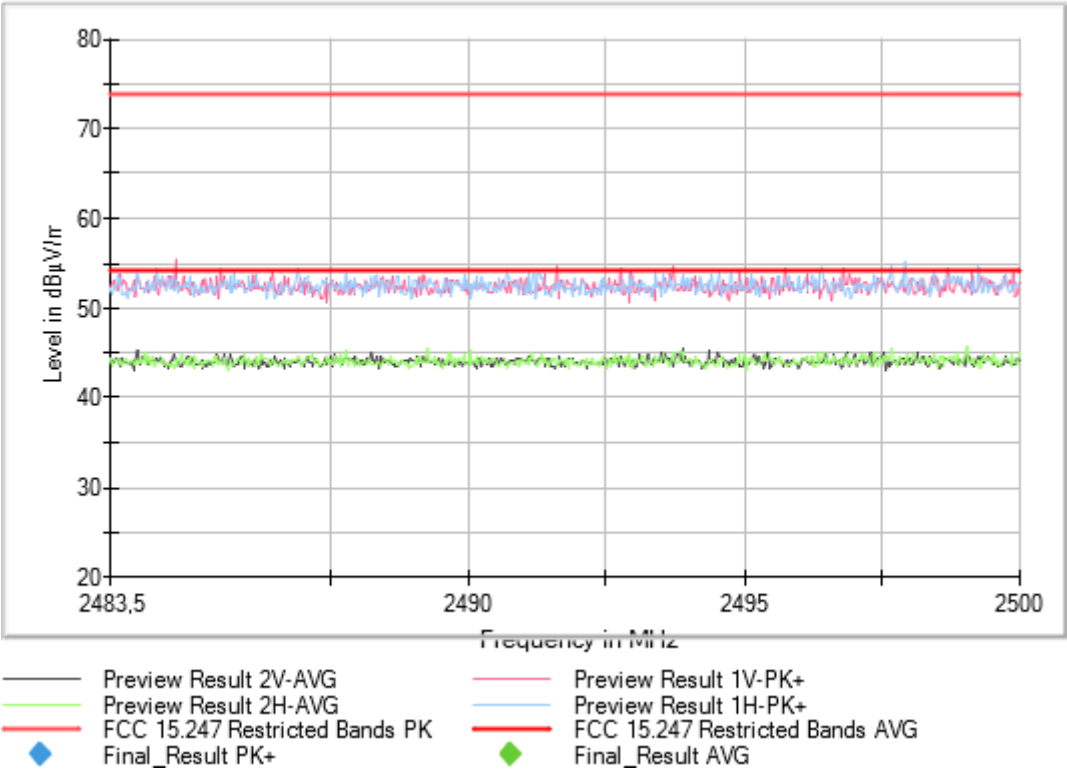
Images:



Full Spectrum

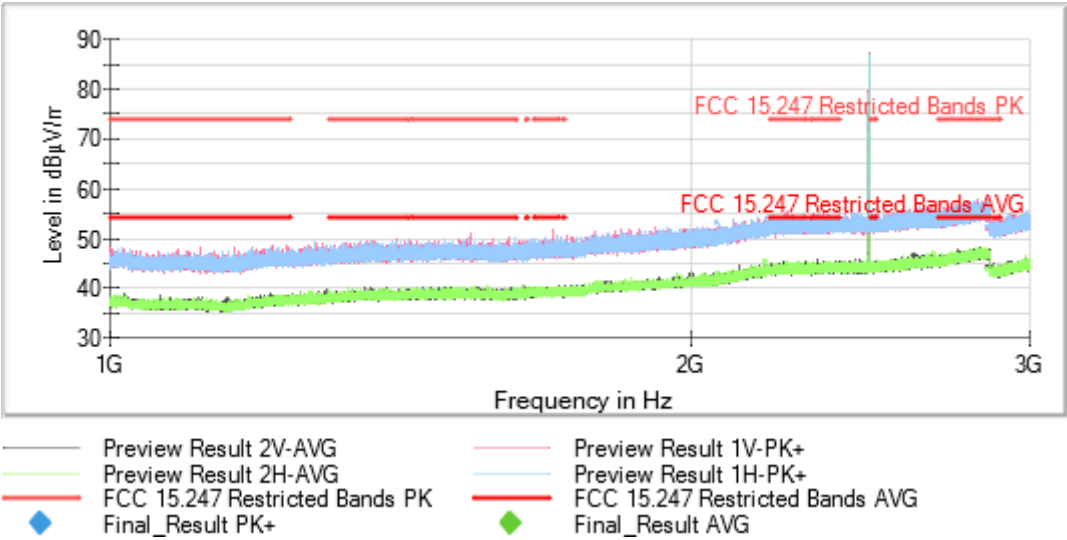


Full Spectrum

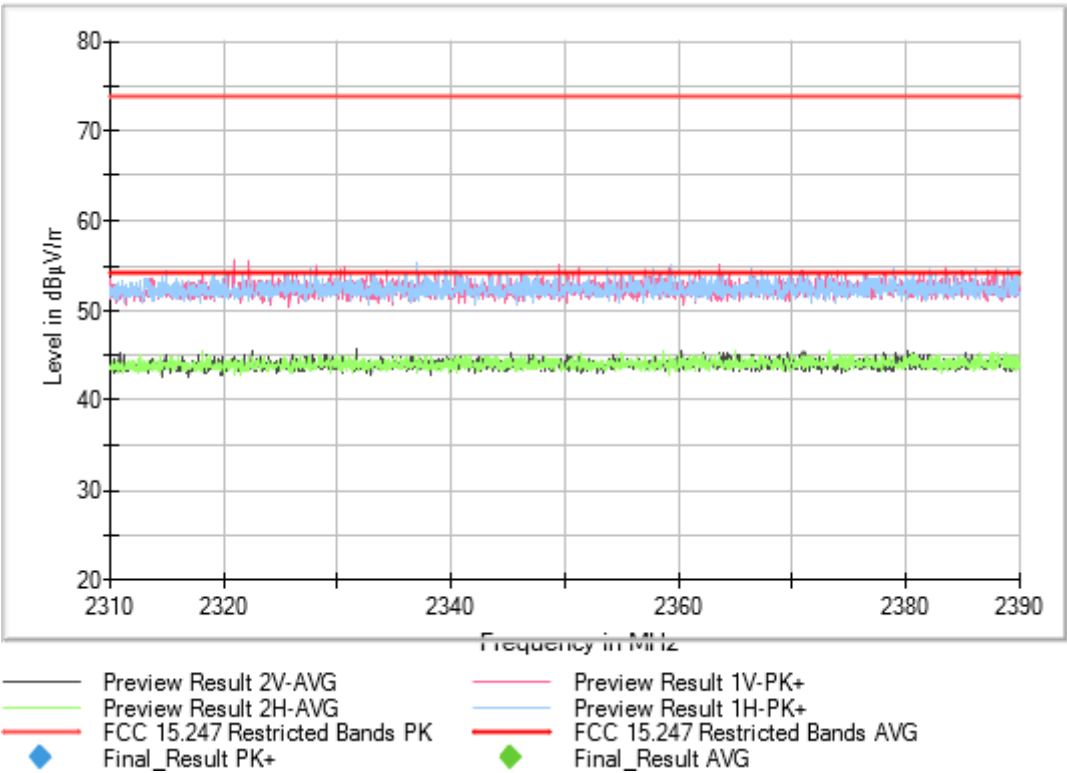


Frequency Range GHz = [1, 3]      Equipment Type = Digital Transmission System (DTS)  
Modulation = BTLE 4.2 (GFSK 1 Mbit/s)      Frequency MHz = 2480.00000  
MIMO Mode = SISO      Measurement Point = 1  
Active Port = 1

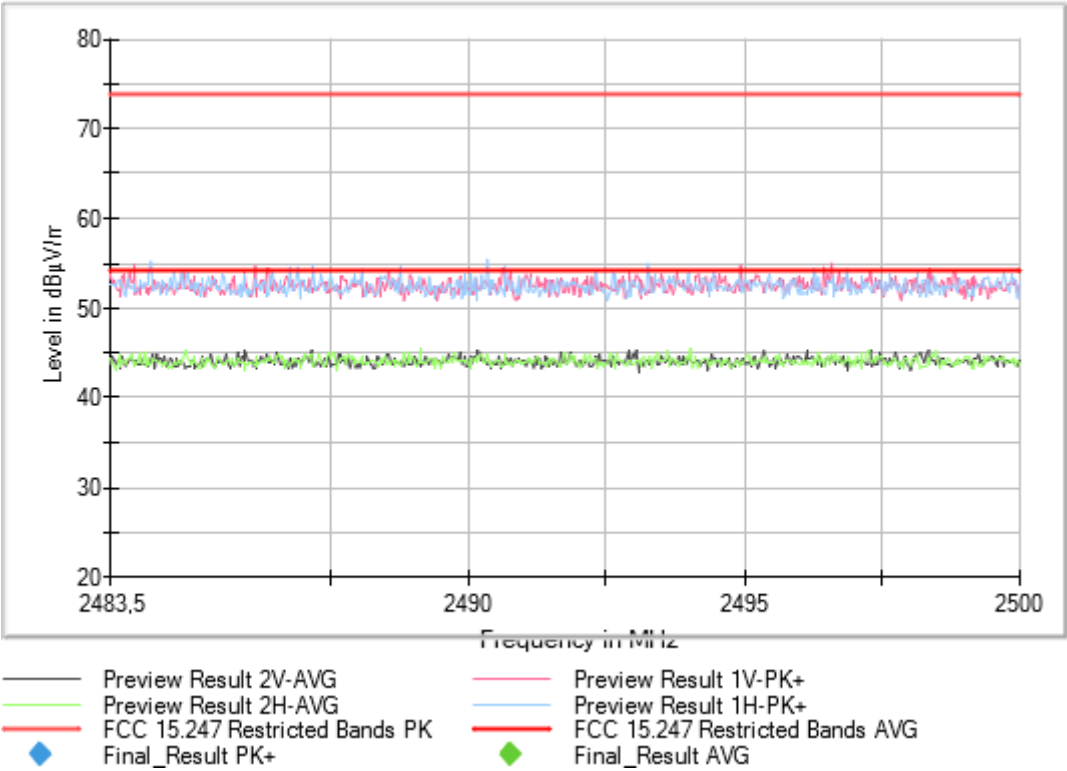
Images:



Full Spectrum

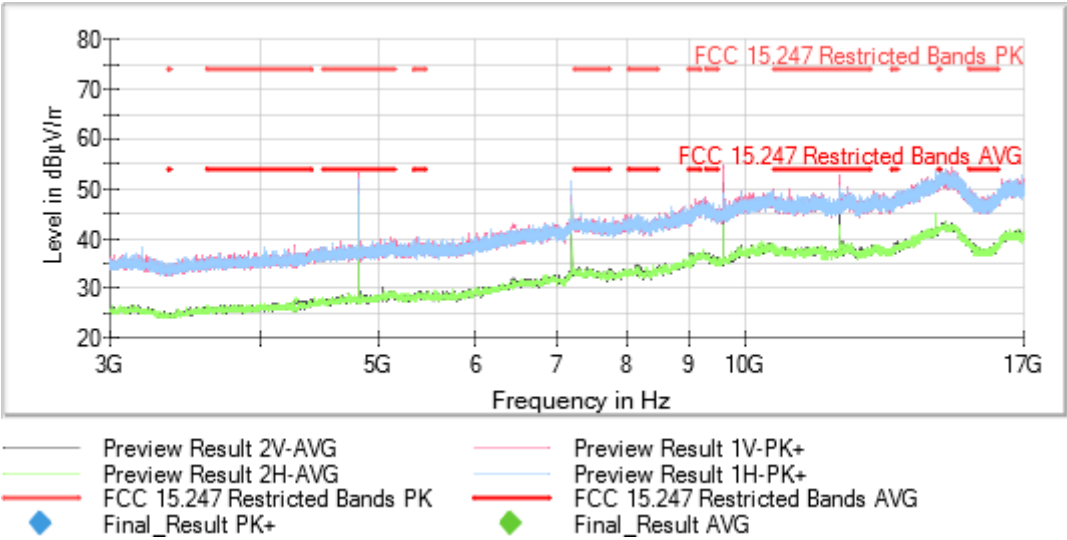


Full Spectrum



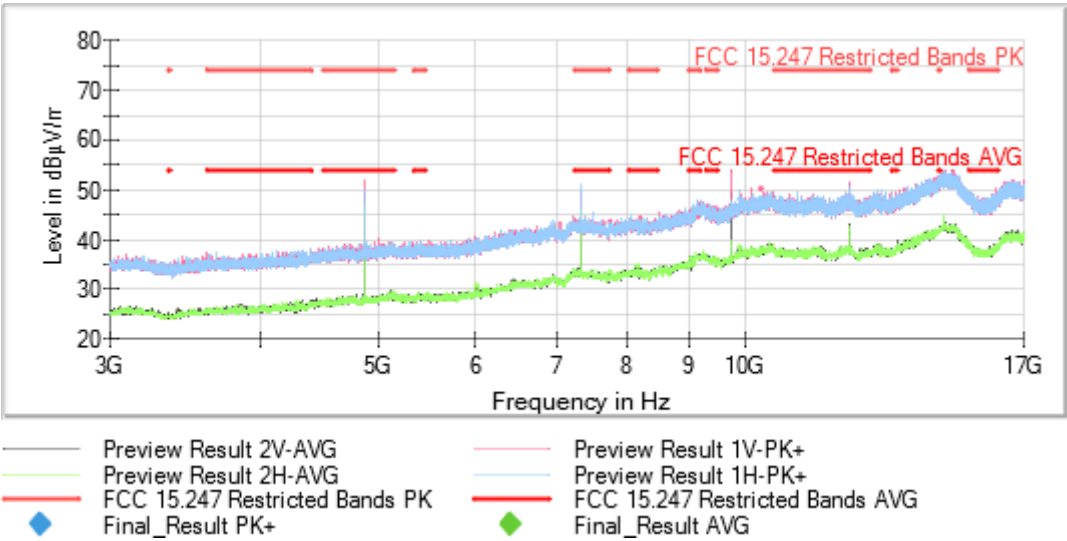
Frequency Range GHz = [3, 17]                      Equipment Type = Digital Transmission System (DTS)  
Modulation = BTLE 4.2 (GFSK 1 Mbit/s)      Frequency MHz = 2402.00000  
MIMO Mode = SISO                                      Measurement Point = 1  
Active Port = 1

Images:



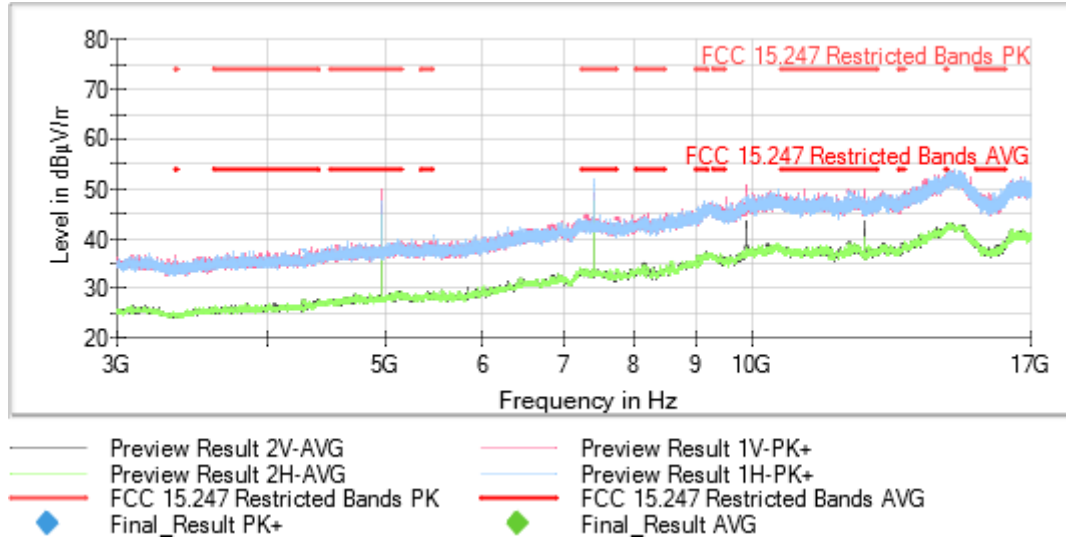
Frequency Range GHz = [3, 17]                      Equipment Type = Digital Transmission System (DTS)  
Modulation = BTLE 4.2 (GFSK 1 Mbit/s)      Frequency MHz = 2440.00000  
MIMO Mode = SISO                                      Measurement Point = 1  
Active Port = 1

Images:



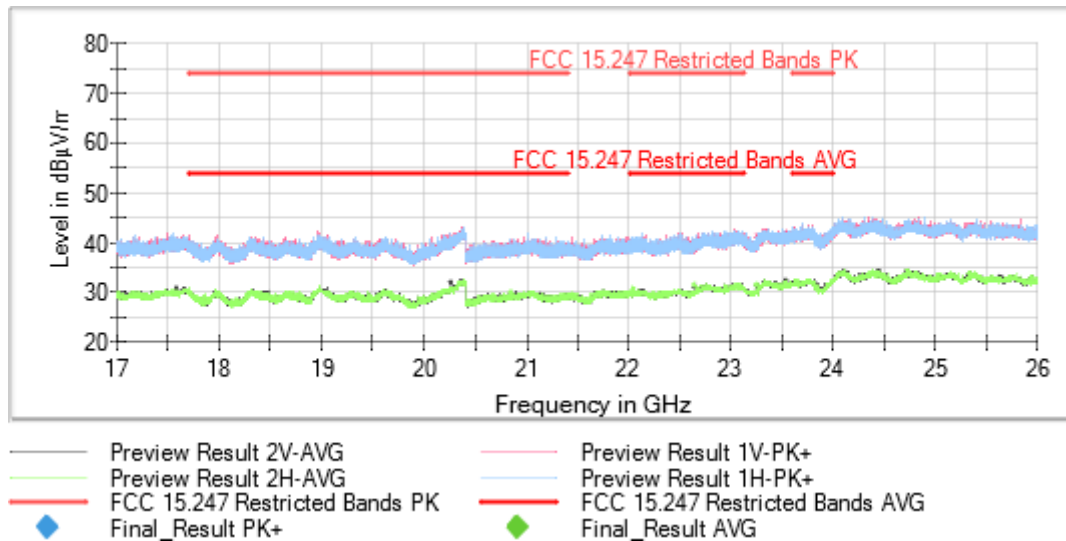
Frequency Range GHz = [3, 17]      Equipment Type = Digital Transmission System (DTS)  
Modulation = BTLE 4.2 (GFSK 1 Mbit/s)      Frequency MHz = 2480.00000  
MIMO Mode = SISO      Measurement Point = 1  
Active Port = 1

Images:



Frequency Range GHz = [17, 26]      Equipment Type = Digital Transmission System (DTS)  
Modulation = BTLE 4.2 (GFSK 1 Mbit/s)      Frequency MHz = The spurious signals detected do not depend on the operating channel  
MIMO Mode = SISO      Measurement Point = 1  
Active Port = 1

Images:



This plot is valid for all channels