DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
C.I.F. A29507456

ISED CABid: ES1909

Lab. Company Number: 4621A

Test Report No:
78472RRF.003

Test Report
USA FCC Part 15.247, 15.209
CANADA RSS-247, RSS-Gen

(*) Identification of item tested	Wellness ring
(*) Trademark	OURA
(*) Model and /or type reference	OA11
(*) Other identification of the product	FCC ID: 2AD7V-OURA2401 IC: 20635-OURA2401
(*) Features	Sleep Analysis, Activity Monitoring, Readiness Score, Bluetooth LE HW version: 01 SW version: 0.5.5
Applicant	Oura Health Oy Elektroniikkatie 10, 90590 Oulu, Finland
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. USA FCC Part 15.209 (10-1-21 Edition): Radiated emission limits; general requirements. CANADA RSS-247 Issue 3 (August 2023). CANADA RSS-Gen Issue 5 amendment 2 (February 2021). 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. 558074 D01 Meas Guidance v05r02 dated April 2, 2019. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	José Manuel Gómez Galván EMC Consumer & RF Lab. Manager Firmado digitalmente por 53680346W JOSE MANUEL GOMEZ (C:A29507456)
Date of issue	2024-05-08
Report template No	FDT08_24 (*) "Data provided by the client"

Index

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 Spectral Density
Peak Power	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.

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 ≤ ± 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 ≤ ± 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 ≤ ± 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 ≤ ± 0,80 dB
RF Average Output Power: Measurement uncertainty ≤ ± 0,99 dB
Power Spectral Density: Measurement uncertainty ≤ ± 0,99 dB
6dB Bandwidth: Measurement uncertainty ≤ ± 2,84 %
Occupied Channel Bandwidth: Measurement uncertainty ≤ ± 1,17 %
Conducted Band-edge spurious emissions: Measurement uncertainty ≤ ± 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 Wellness ring. OURA is a revolutionary wellness ring and app, designed to help user gets more restful sleep and performs better. It enables user to learn how the lifestyle choices affect user's sleep, and how the quality of the sleep affects user's ability to perform. The OURA ring can automatically tell when user is sleeping. When user goes to sleep, the OURA ring analyzes the quality of the rest and recovery by measuring the heart rate (optically), respiration rate, body temperature, and movement. While user is awake, it monitors the duration and intensity of the activities, and the time user spends sitting. The OURA app integrates and visualizes this data to identify patterns between the sleep quality and daily activities. By understanding how well user slept and recharged, it can determine the readiness to perform and help user adjust the intensity and duration of the day's activities. It can also uncover actionable insights for changes to the daily activities that can help user sleep better..

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 Nº	Date of Reception	Application
S/01	78472_12.1	OA11 size 10 (Ring)	OA11	--	2024-03-05	Element Under Test
S/02	78472_83.1	OA11 size 10 (Ring)	OA11	--	2024-03-11	Element Under Test

Notes referenced to samples during the project:

Id	Type
S/01	Radiated
S/02	Conducted

Test sample description

<table>
<tr><td rowspan="7">Ports…… :</td><td rowspan="2">Port name and description</td><td colspan="4">Cable</td></tr>
<tr><td>Specified max length [m]</td><td>Attached during test</td><td>Shielded</td><td>Coupled to patient(3)</td></tr>
<tr><td>.....</td><td>.....</td><td>[ ]</td><td>[ ]</td><td>[ ]</td></tr>
<tr><td>.....</td><td>.....</td><td>[ ]</td><td>[ ]</td><td>[ ]</td></tr>
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<tr><td>.....</td><td>.....</td><td>[ ]</td><td>[ ]</td><td>[ ]</td></tr>
<tr><td>Supplementary information to the ports…… :</td><td colspan="5">.....</td></tr>
<tr><td rowspan="5">Rated power supply .....:</td><td colspan="2" rowspan="2">Voltage and Frequency</td><td colspan="5">Reference poles</td></tr>
<tr><td>L1</td><td>L2</td><td>L3</td><td>N</td><td>PE</td></tr>
<tr><td>[ ]</td><td>AC: .....</td><td>[ ]</td><td>[ ]</td><td>[ ]</td><td>[ ]</td><td>[ ]</td></tr>
<tr><td>[ ]</td><td>AC: .....</td><td>[ ]</td><td>[ ]</td><td>[ ]</td><td>[ ]</td><td>[ ]</td></tr>
<tr><td>[X]</td><td colspan="5">DC:3.7</td></tr>
<tr><td></td><td>[ ]</td><td colspan="5">DC: .....</td></tr>
<tr><td>Rated Power .....:</td><td colspan="6">.....</td></tr>
<tr><td>Clock frequencies.....:</td><td colspan="6">.....</td></tr>
<tr><td>Other parameters .....:</td><td colspan="6">.....</td></tr>
<tr><td>Software version .....:</td><td colspan="6">0.5.5</td></tr>
<tr><td>Hardware version .....:</td><td colspan="6">01</td></tr>
<tr><td>Dimensions in cm (W x H x D) ....:</td><td colspan="6">.....</td></tr>
<tr><td rowspan="5">Mounting position .....:</td><td>[ ]</td><td colspan="5">Table top equipment</td></tr>
<tr><td>[ ]</td><td colspan="5">Wall/Ceiling mounted equipment</td></tr>
<tr><td>[ ]</td><td colspan="5">Floor standing equipment</td></tr>
<tr><td>[X]</td><td colspan="5">Hand-held equipment</td></tr>
<tr><td>[ ]</td><td colspan="5">Other: .....</td></tr>
<tr><td>Modules/parts.....:</td><td colspan="3">Module/parts of test item</td><td>Type</td><td colspan="2">Manufacturer</td></tr>
</table>

	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
Accessories (not part of the test item) .....:	Description	Type	Manufacturer
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
Documents as provided by the applicant.....:	Description	File name	Issue date
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....

(3) Only for Medical Equipment

Identification of the client

Oura Health Oy
Elektroniikkatie 10, 90590 Oulu, Finland

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2024-03-08
Date (finish)	2024-03-13

Document history

Report number	Date	Description
78472RRF.003	2024-05-08	First release.

Environmental conditions

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Jia Hao Luo Chen, Ruben Mora Fernandez and Victoria Olmedo Villalba.

Used instrumentation:

Control No.	Equipment	Model	Manufacturer	Next Calibration
10304	EMI TEST RECEIVER 2Hz-44GHz	ESW44	ROHDE AND SCHWARZ	2026-02-19
05862	EMI TEST RECEIVER 9kHz-7GHz	ESR7	ROHDE AND SCHWARZ	2025-02-15
07040	EXTENSION FOR OPEN SWITCH UNIT UP TO 40GHz	OSP-B157Wx	Rohde&Schwarz	2025-04-19
07763	HORN ANTENNA 1-18GHz	BBHA 9120D	SCHWARZBECK MESS-ELEKTRONIK	2026-01-16
06495	HORN ANTENNA 18-40GHz	BBHA 9170	SCHWARZBECK	2024-03-19
09968	HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	ETS LINDGREN	2026-09-22
07862	PRE-AMPLIFIER G>30dB 18-40GHz	BLMA 1840-3G	BONN ELEKTRONIK	2025-04-02
07769	PREAMPLIFIER 30dB 500MHz-18GHz	BBV 9718 C	SCHWARZBECK	2025-03-13
07039	Rohde&Schwarz	OSP-B157W8	ROHDE & SCHWARZ	2025-05-25
08130	SEMIANECHOIC ABSORBER LINED CHAMBER	P29419	ALBATROSS	--
08134	SHIELDED ROOM	P29419	ALBATROSS PROJECTS GMBH	--
08661	SHIELDED ROOM	-	SIEPEL	--
08835	SIGNAL AND SPECTRUM ANALYZER 2Hz-50GHz	FSW50	ROHDE AND SCHWARZ	2025-02-08
04848	SOFTWARE FOR EMC/RF TESTING	EMC32	ROHDE AND SCHWARZ	--
07550	TEMPERATURE AND HUMIDITY PROBE	HWg-STE	HW GROUP	2024-05-02
07549	TEMPERATURE AND HUMIDITY PROBE	HWg-STE	HW GROUP	2024-05-02
07552	TEMPERATURE AND HUMIDITY PROBE	HWg-STE	HW GROUP	2024-05-02
07798	WMS32	WMS32	ROHDE AND SCHWARZ	--

Testing verdicts

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

Summary

Bluetooth Low Energy (1M & 2M)

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	--
Supplementary information and remarks: None			

Appendix A: Test results. Bluetooth Low Energy (1M & 2M)

INDEX

TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal:	3.7V DC
Type of Power Supply:	Battery

ANTENNA (*):

Type of Antenna:	Integral Antenna
Maximum Declared Antenna Gain:	-9.6dBi

TEST FREQUENCIES (*):

Modulation	Data rates	Low Channel:	Middle Channel	High Channel
BTLE GFSK	1 Mbit/s	2402 MHz	2440 MHz	2480 MHz
BTLE GFSK	2 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).

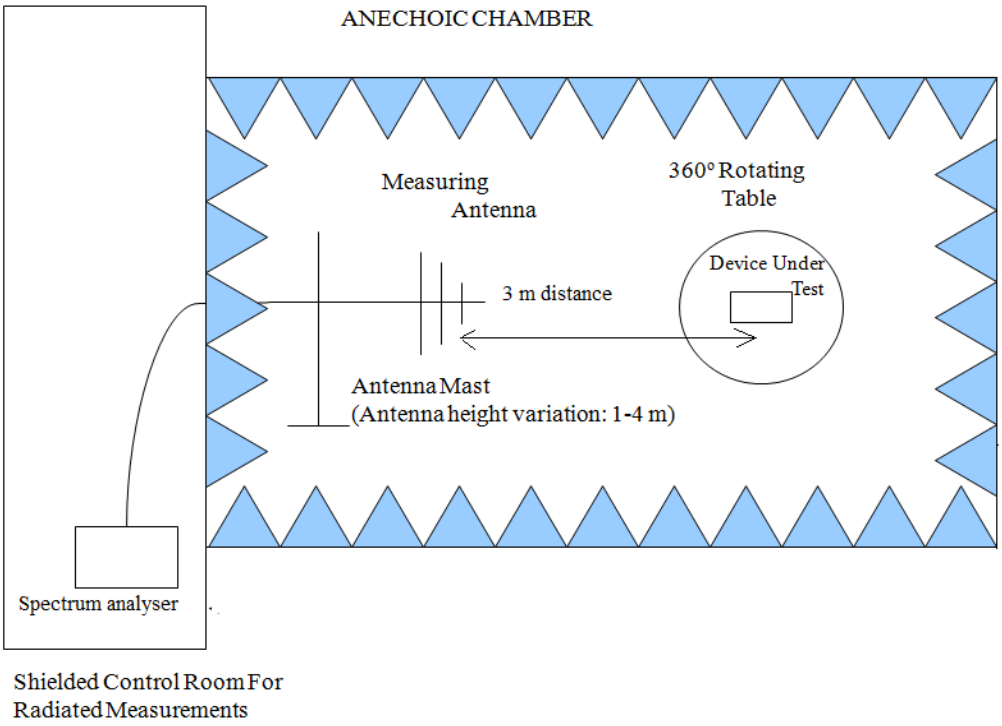
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

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 360º and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

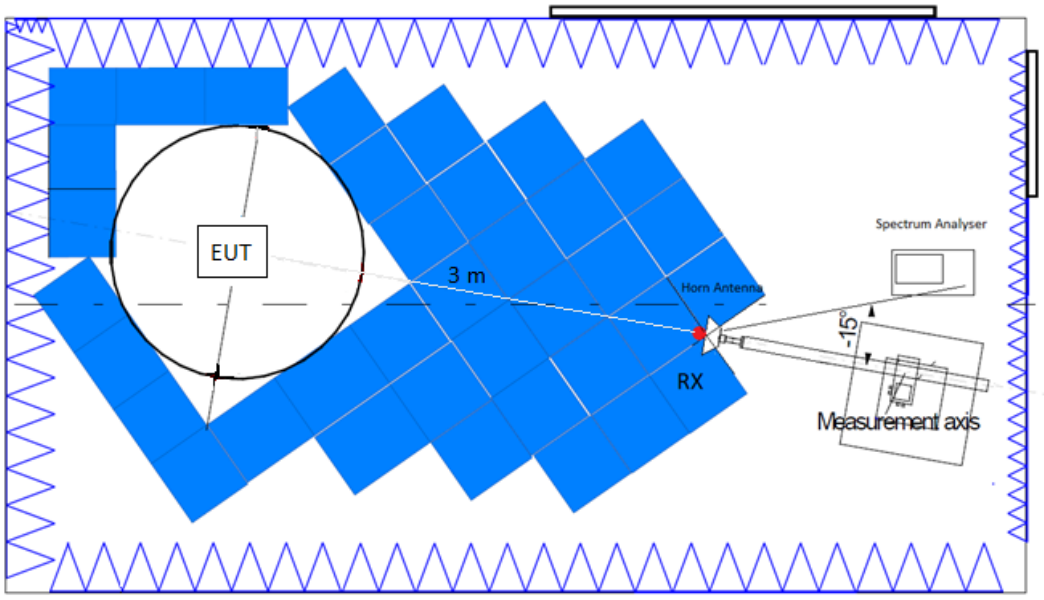
Measurements were made in both horizontal and vertical planes of polarization.

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.

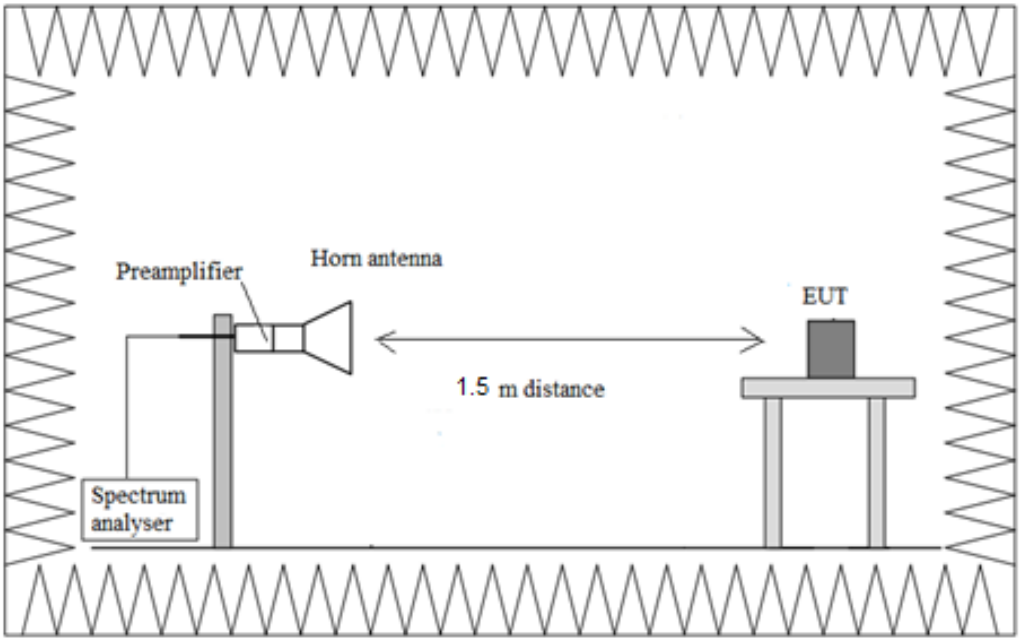
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup f > 17 GHz:



TEST CASES DETAILS

FCC 47 CFR Part 15.247 / RSS-247

Occupied Channel Bandwidth 99%

Modulation: BTLE (GFSK 1 Mbit/s)

Results

Freq (MHz)	Occ Ch BW (MHz)
2402.00000	1.065
2440.00000	1.080
2480.00000	1.090

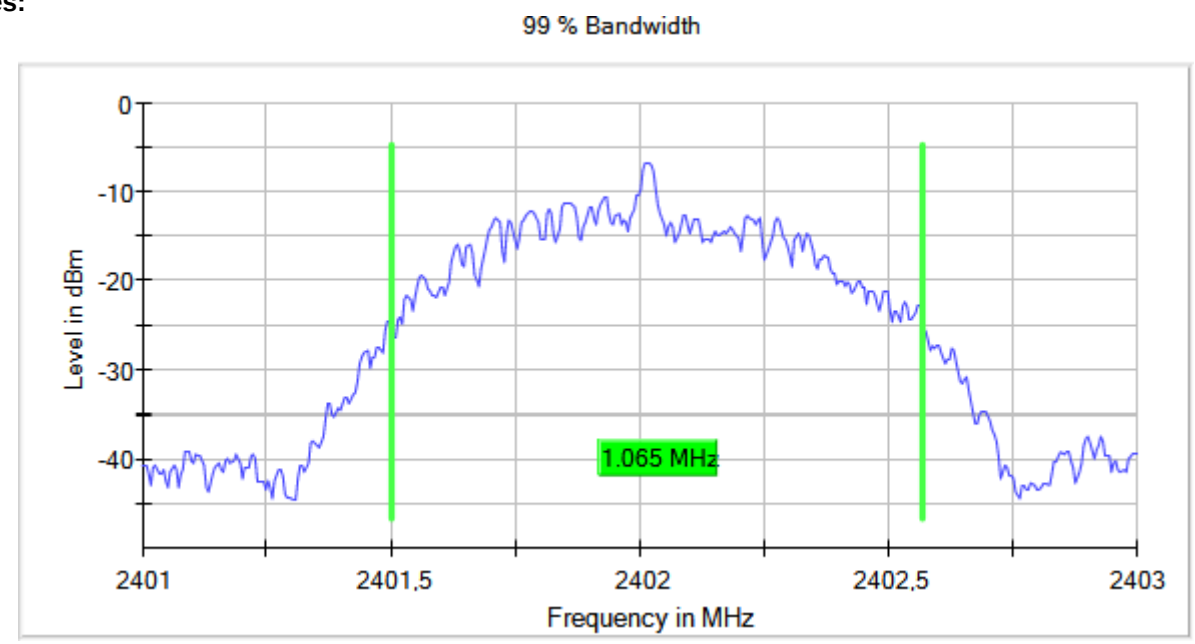
Verdict

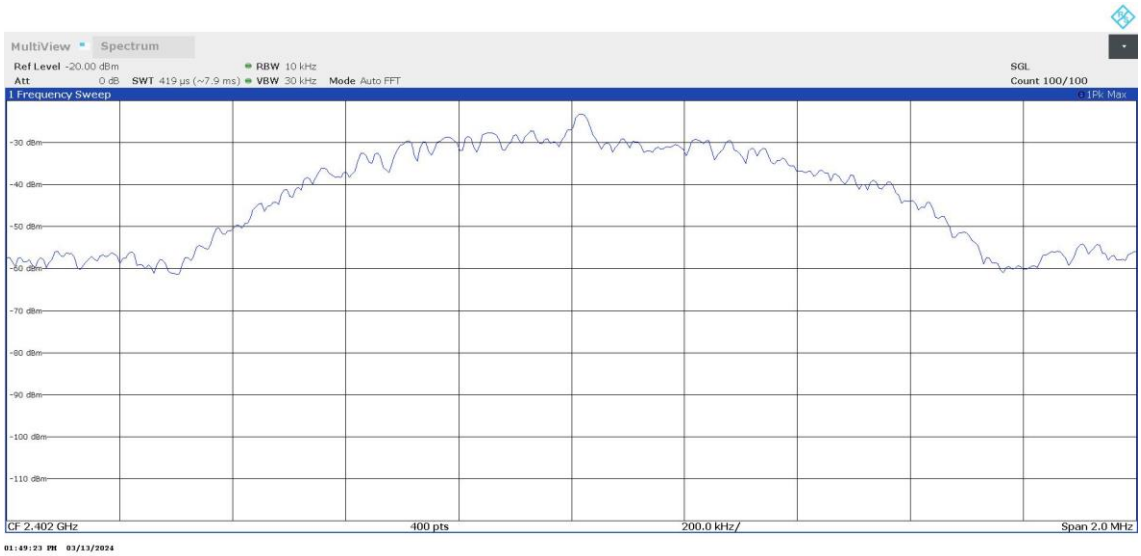
Pass

Attachments

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

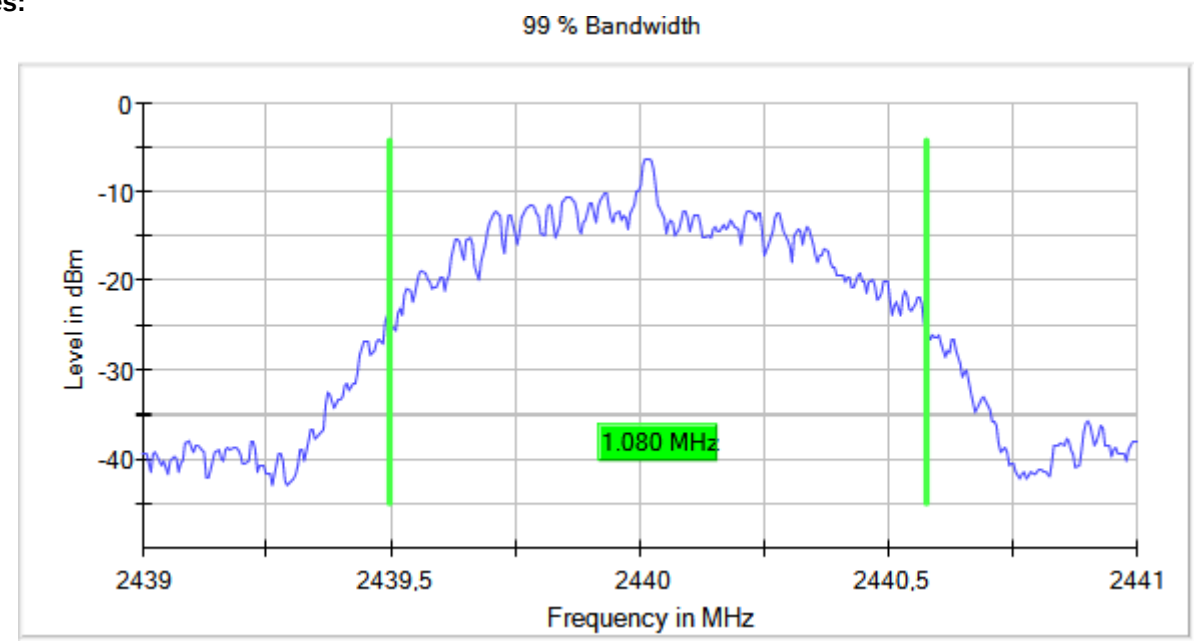
Images:

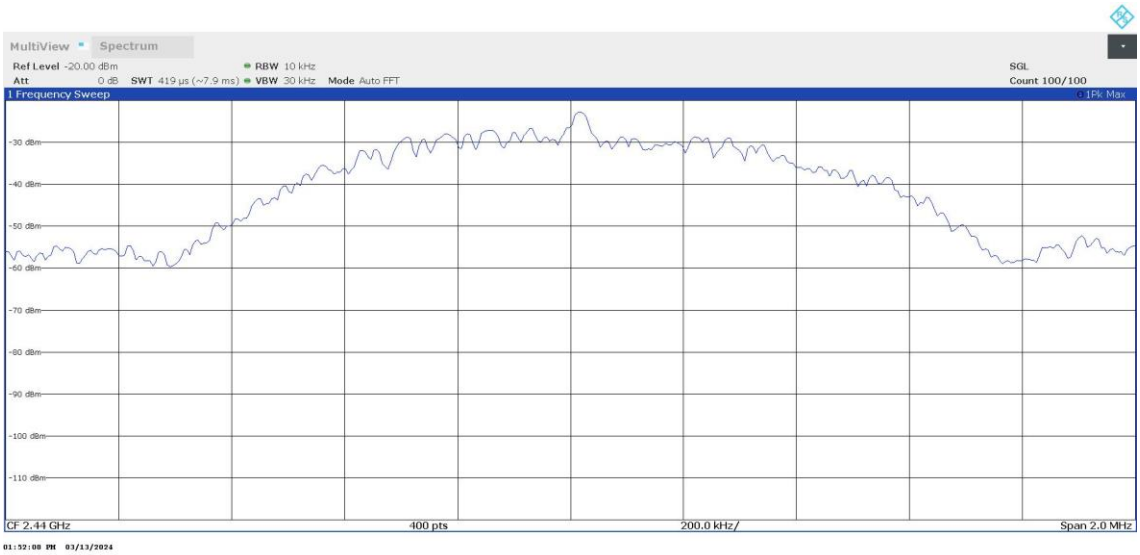




Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 1
Modulation = BTLE (GFSK 1 Mbit/s)
Frequency MHz = 2440.00000
MIMO Mode = SISO
Active Port = 1

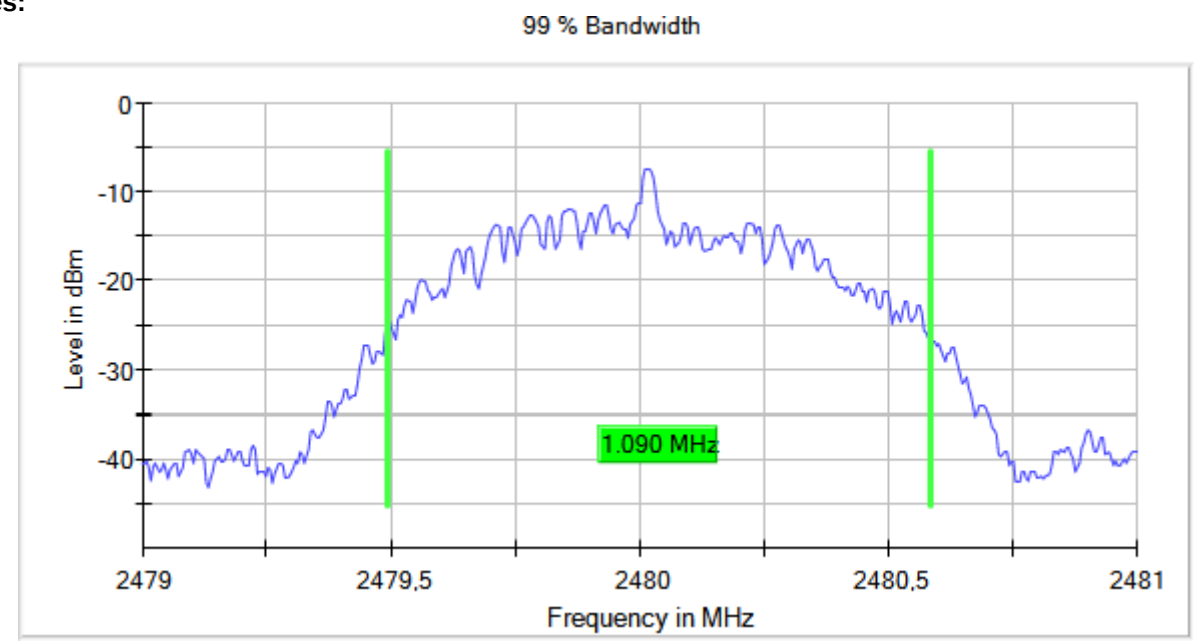
Images:

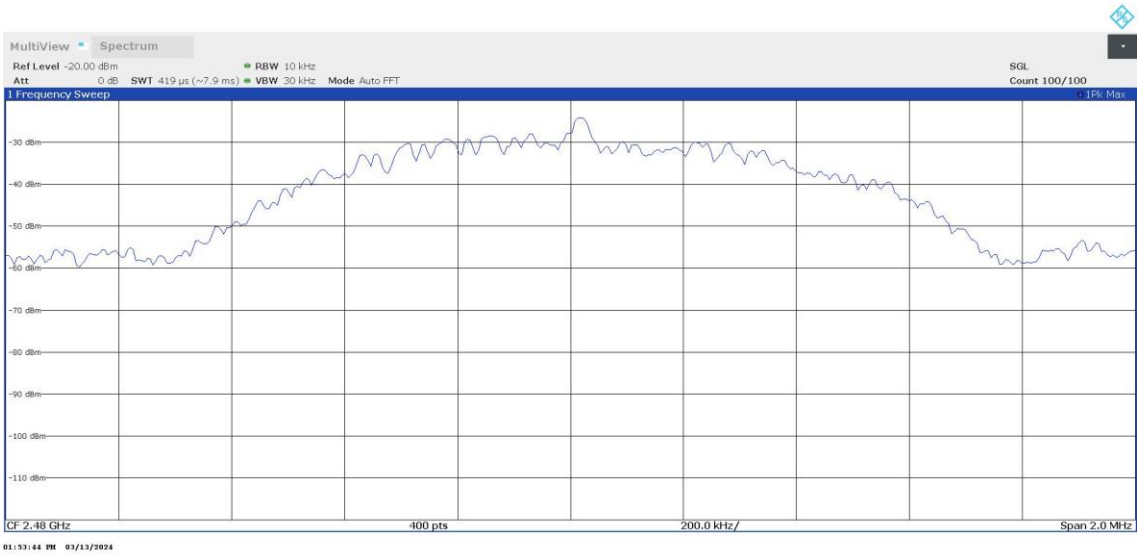




Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 1
Modulation = BTLE (GFSK 1 Mbit/s)
Frequency MHz = 2480.00000
MIMO Mode = SISO
Active Port = 1

Images:





Modulation: BTLE (GFSK 2 Mbit/s)

Results

Freq (MHz)	Occ Ch BW (MHz)
2402.00000	2.050
2440.00000	2.050
2480.00000	2.070

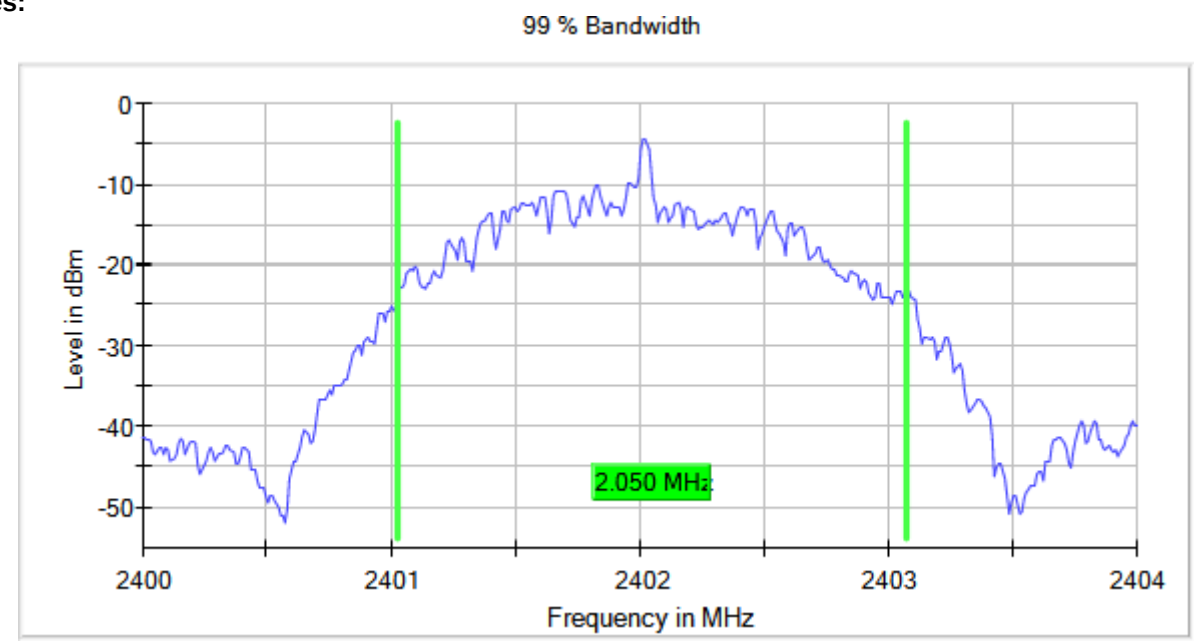
Verdict

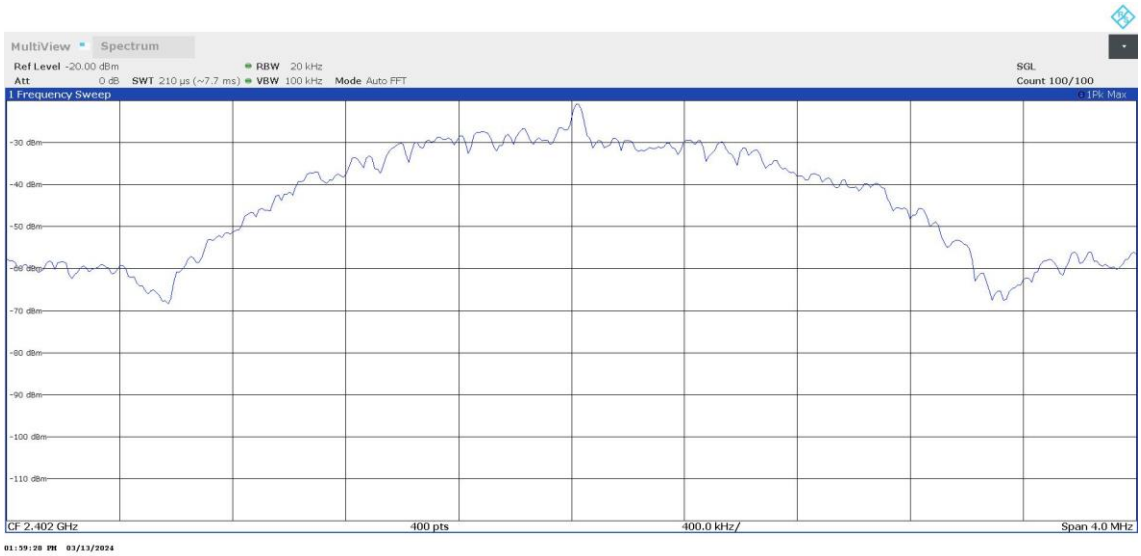
Pass

Attachments

Equipment Type = Digital Transmission System (DTS)	Bandwidth MHz = 2
Modulation = BTLE (GFSK 2 Mbit/s)	Frequency MHz = 2402.00000
MIMO Mode = SISO	Active Port = 1

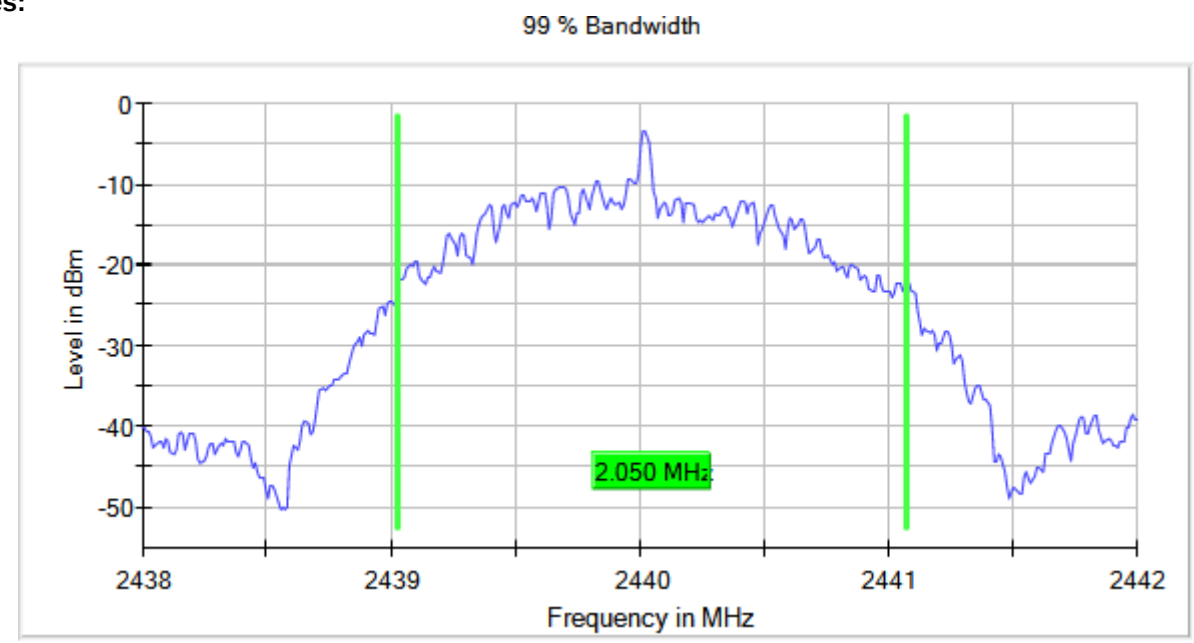
Images:

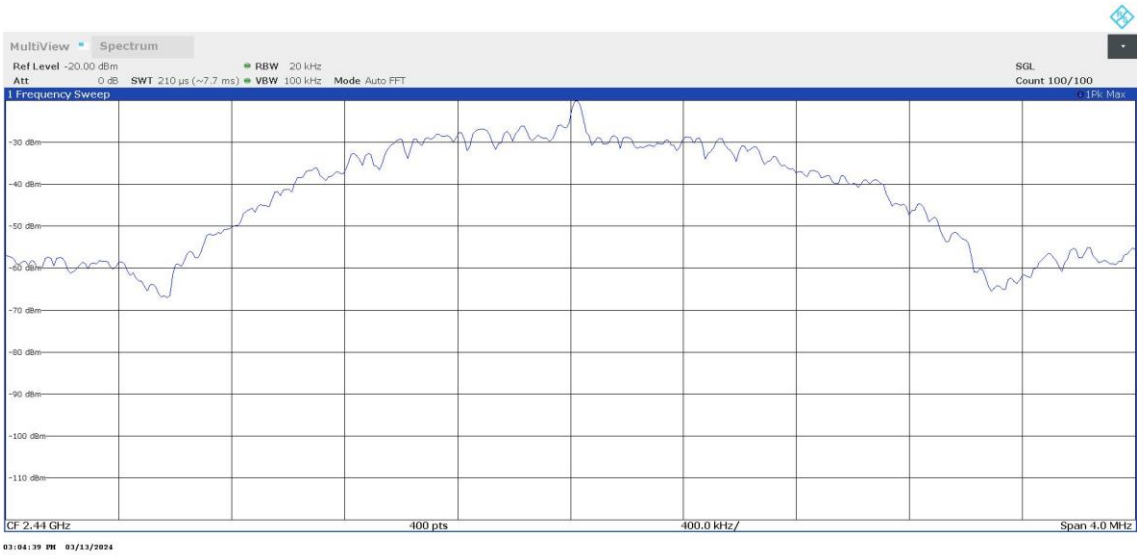




Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 2
Modulation = BTLE (GFSK 2 Mbit/s)
Frequency MHz = 2440.00000
MIMO Mode = SISO
Active Port = 1

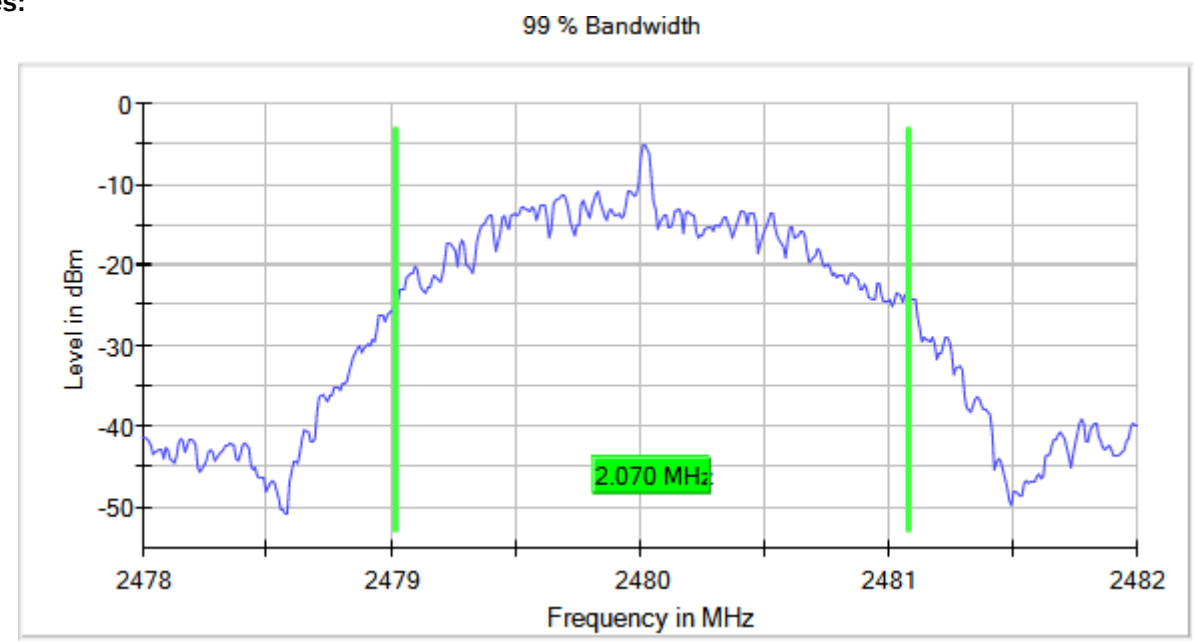
Images:

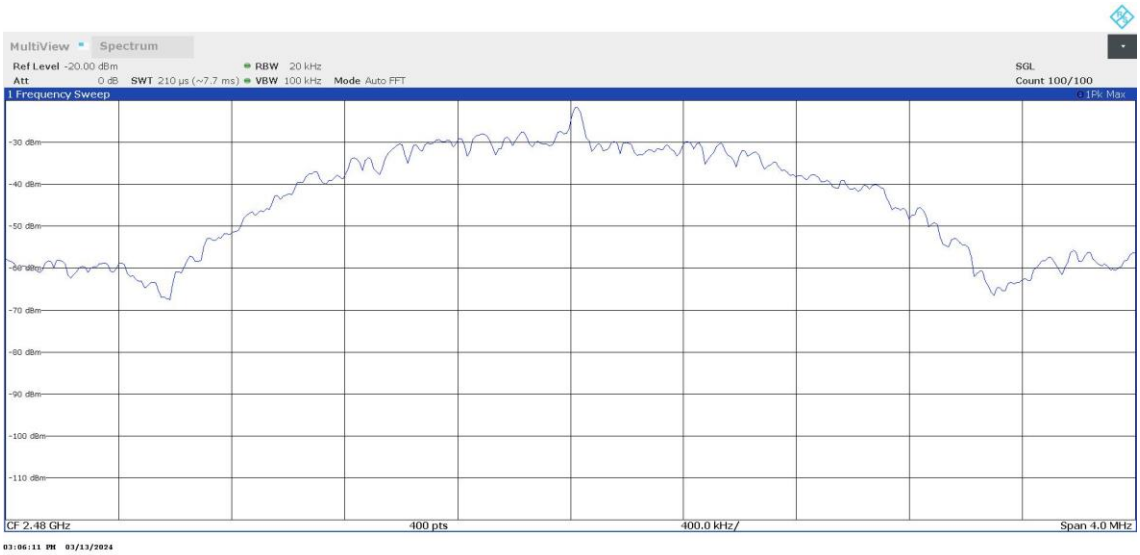




Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 2
Modulation = BTLE (GFSK 2 Mbit/s)
Frequency MHz = 2480.00000
MIMO Mode = SISO
Active Port = 1

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.

Modulation: BTLE (GFSK 1 Mbit/s)

Results

Freq (MHz)	Ebw (MHz)
2402.00000	0.792
2440.00000	0.832
2480.00000	0.832

Verdict

Pass

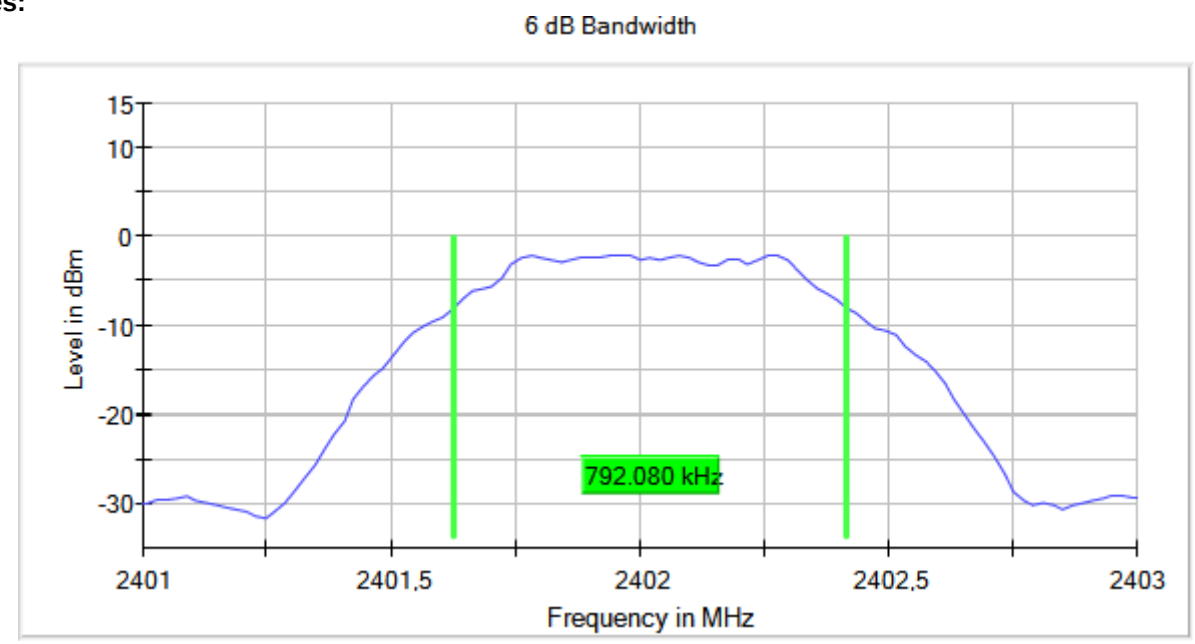
Attachments

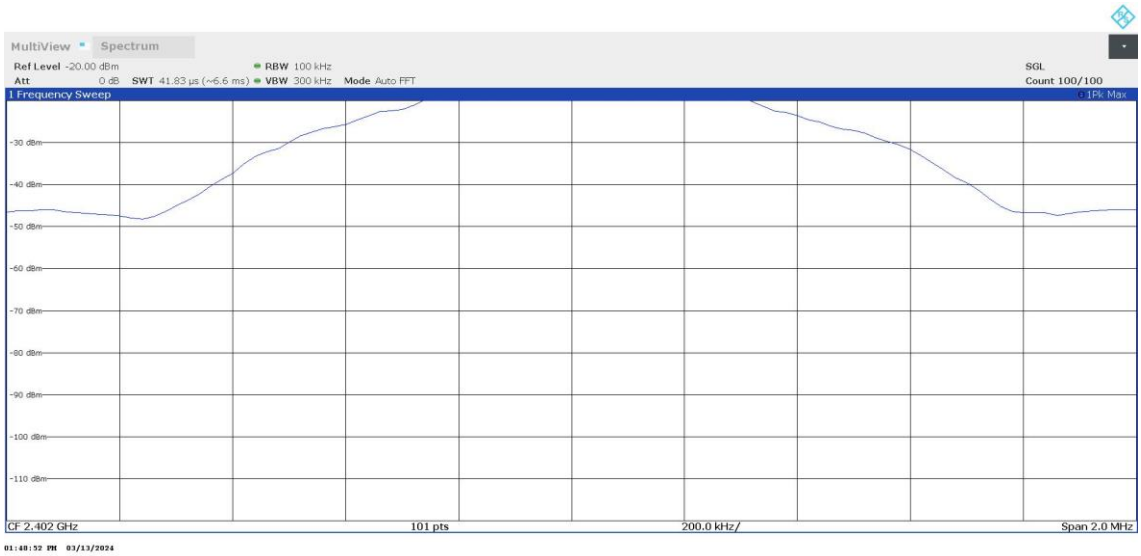
Bandwidth MHz = 1 Modulation = BTLE (GFSK 1 Mbit/s)

Frequency MHz = 2402.00000 MIMO Mode = SISO

Active Port = 1

Images:



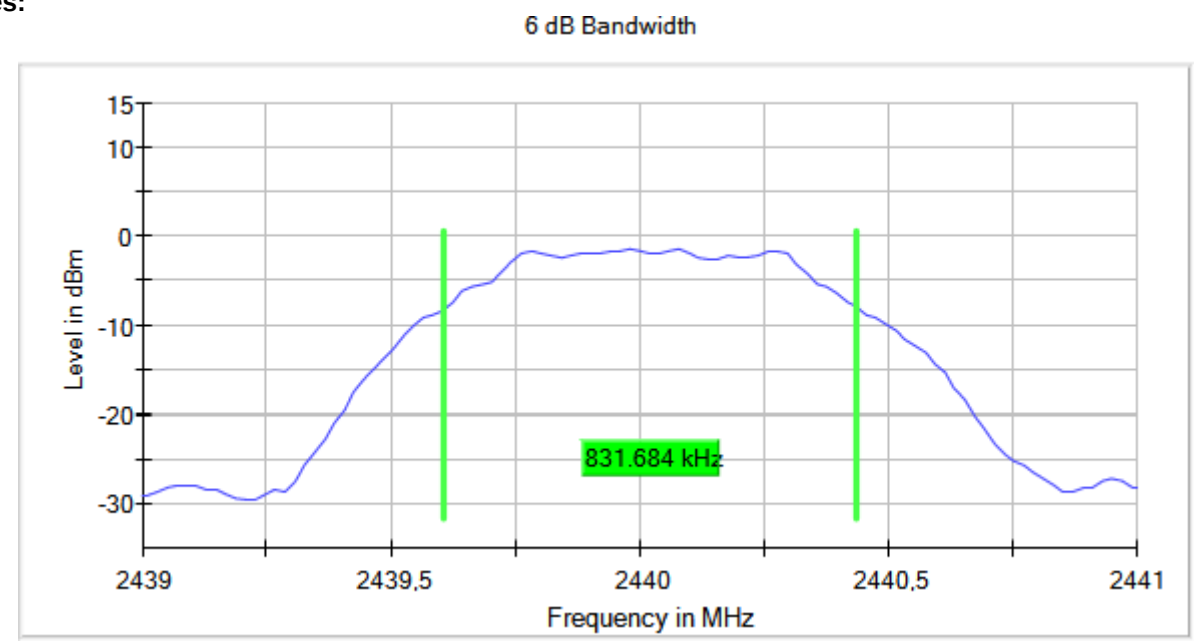


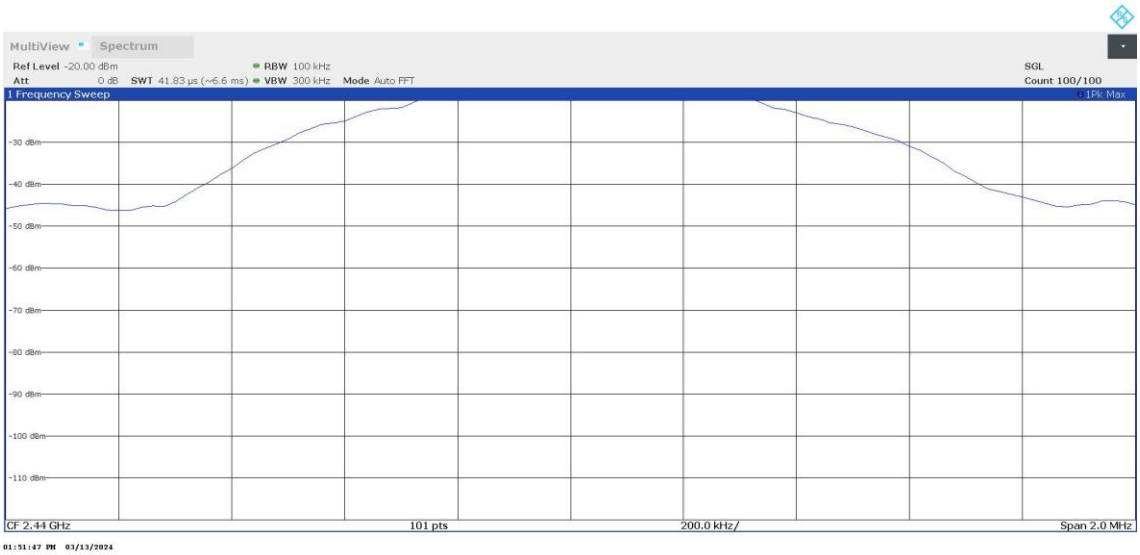
Bandwidth MHz = 1 Modulation = BTLE (GFSK 1 Mbit/s)

Frequency MHz = 2440.00000 MIMO Mode = SISO

Active Port = 1

Images:



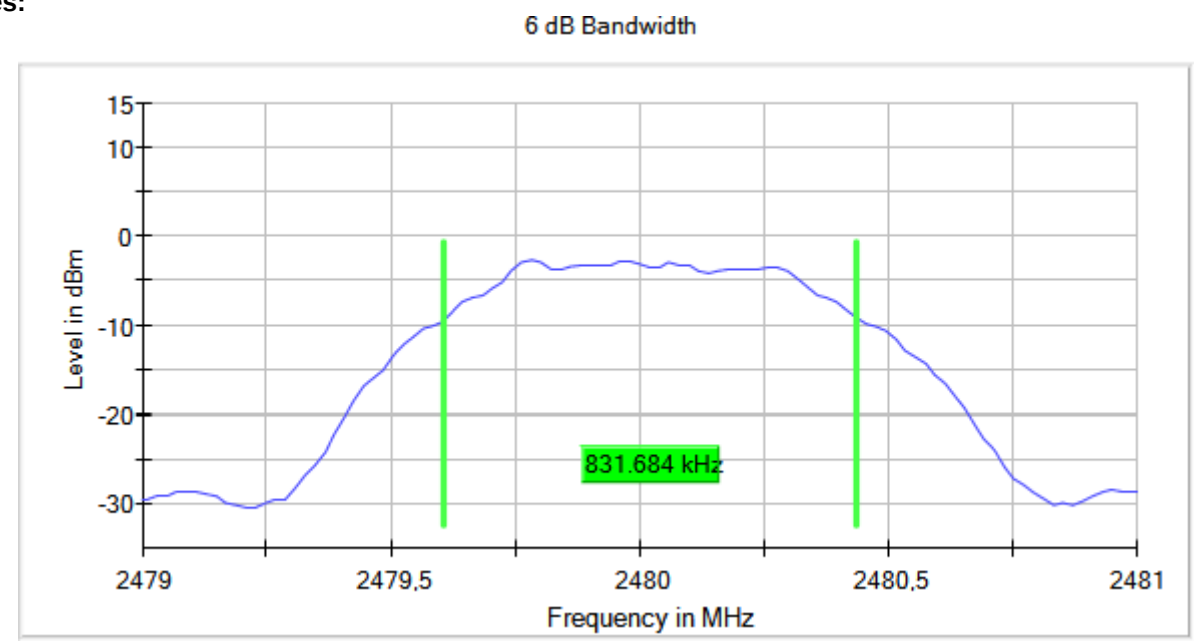


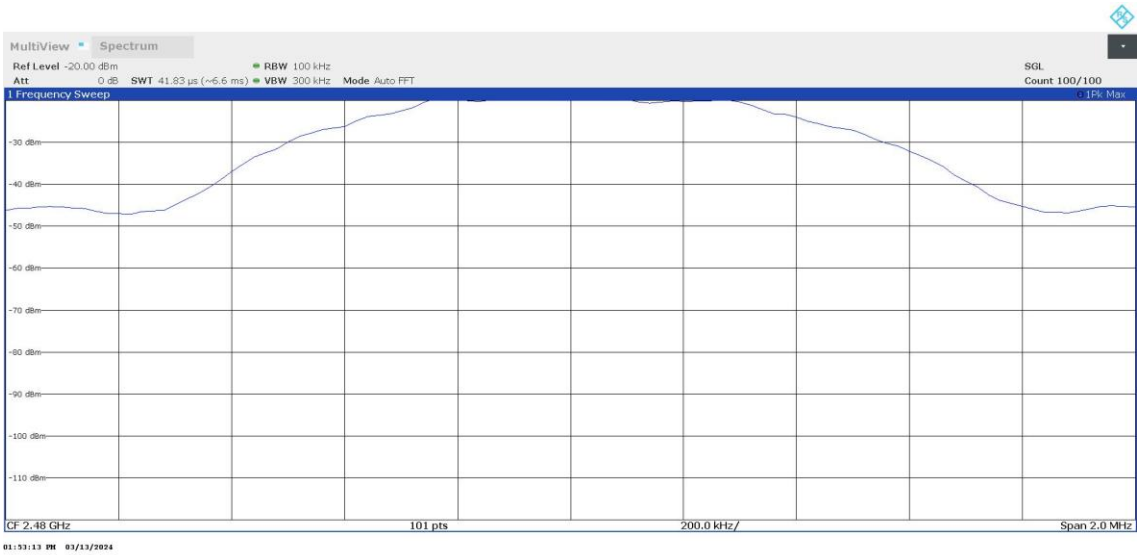
Bandwidth MHz = 1 Modulation = BTLE (GFSK 1 Mbit/s)

Frequency MHz = 2480.00000 MIMO Mode = SISO

Active Port = 1

Images:





Modulation: BTLE (GFSK 2 Mbit/s)

Results

Freq (MHz)	Ebw (MHz)
2402.00000	1.426
2440.00000	1.465
2480.00000	1.426

Verdict

Pass

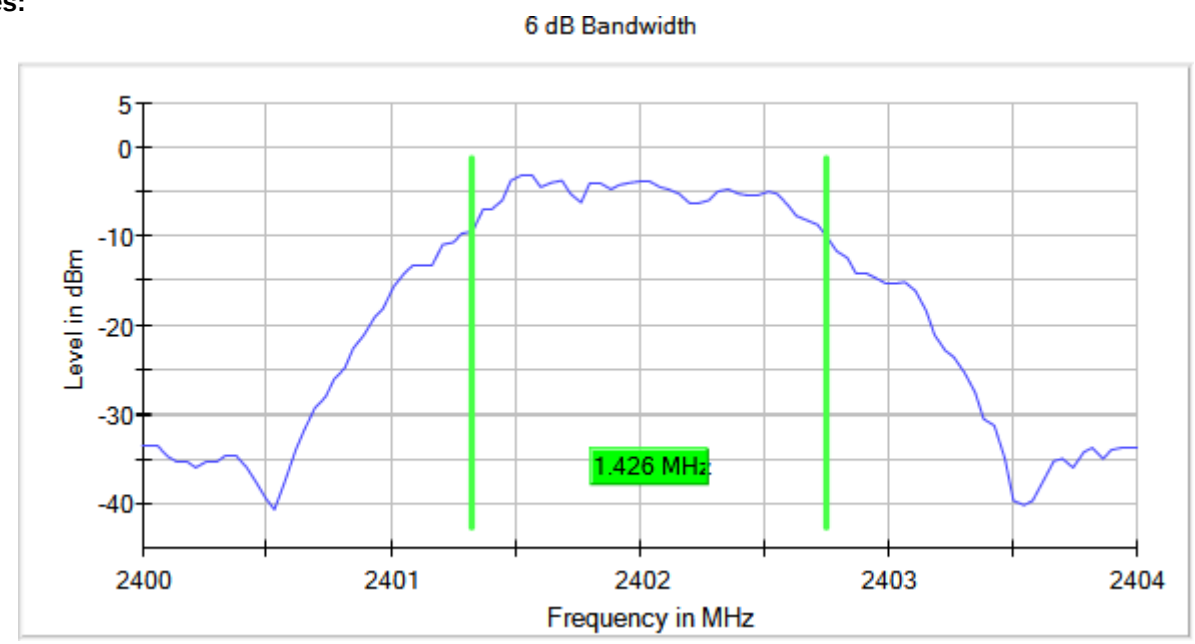
Attachments

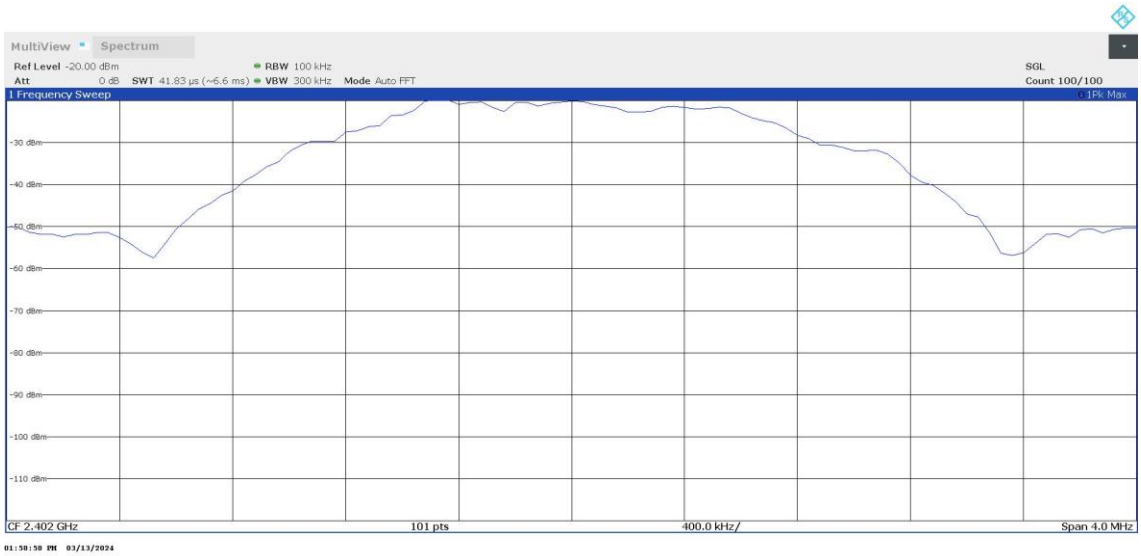
Bandwidth MHz = 2 Modulation = BTLE (GFSK 2 Mbit/s)

Frequency MHz = 2402.00000 MIMO Mode = SISO

Active Port = 1

Images:



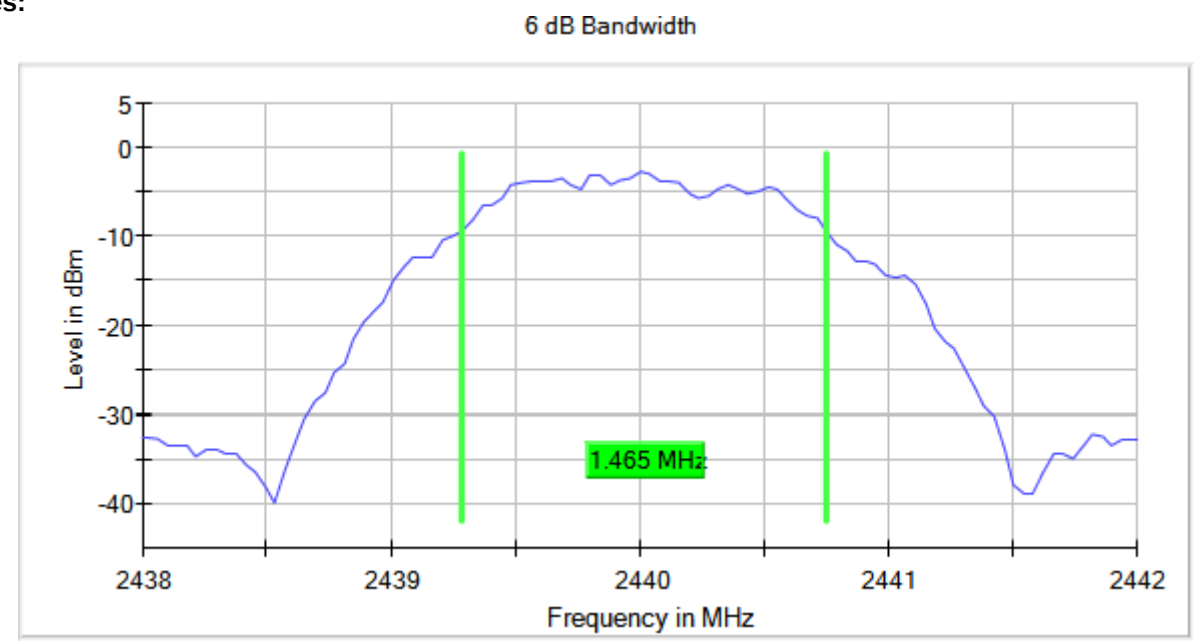


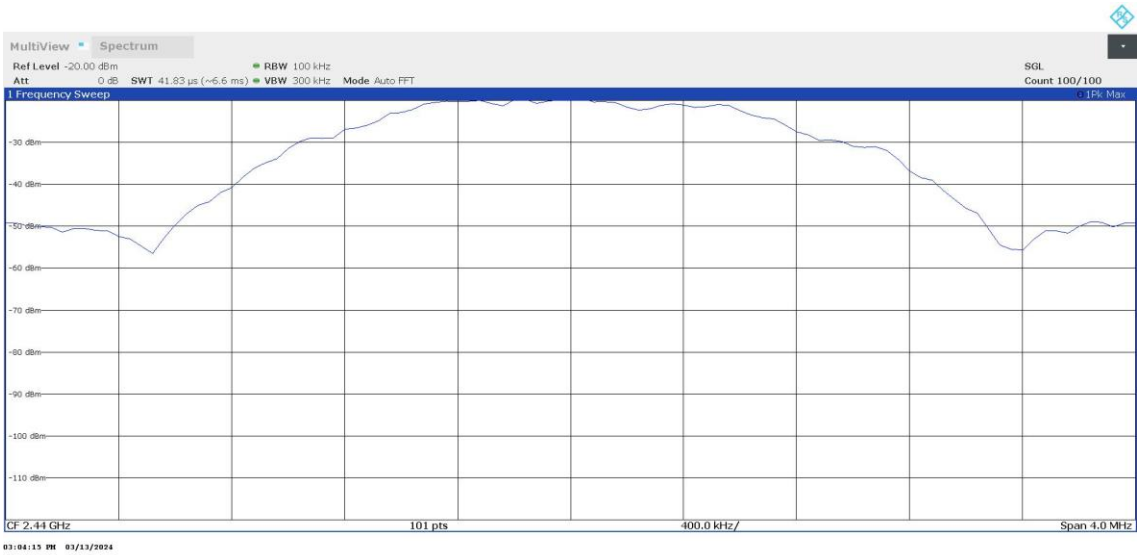
Bandwidth MHz = 2 Modulation = BTLE (GFSK 2 Mbit/s)

Frequency MHz = 2440.00000 MIMO Mode = SISO

Active Port = 1

Images:



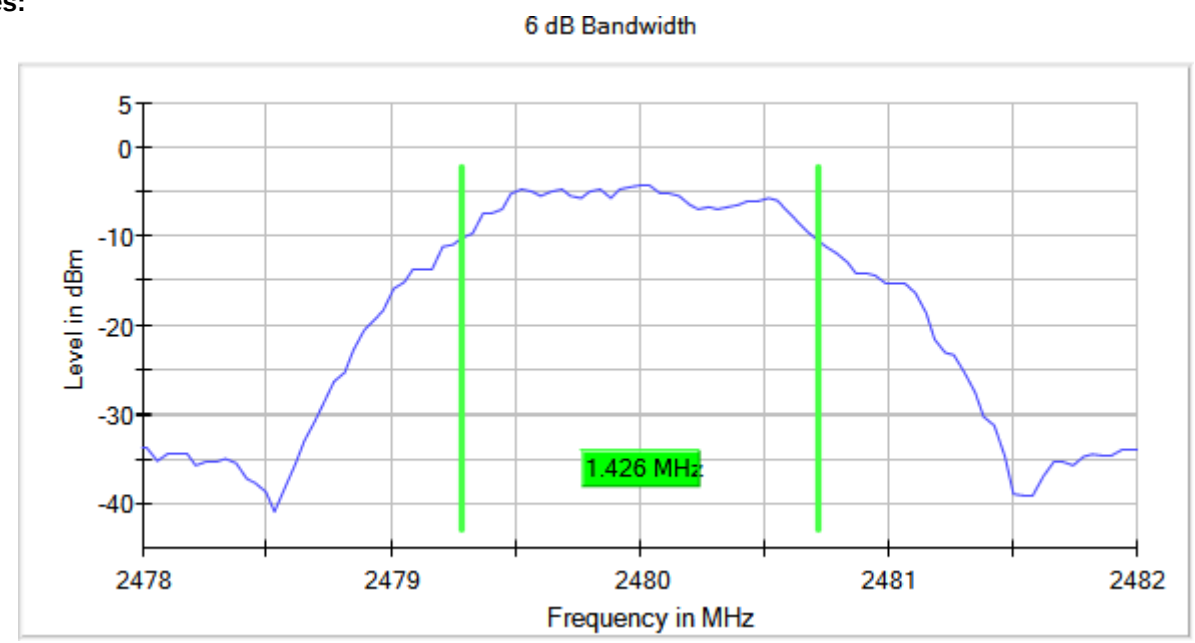


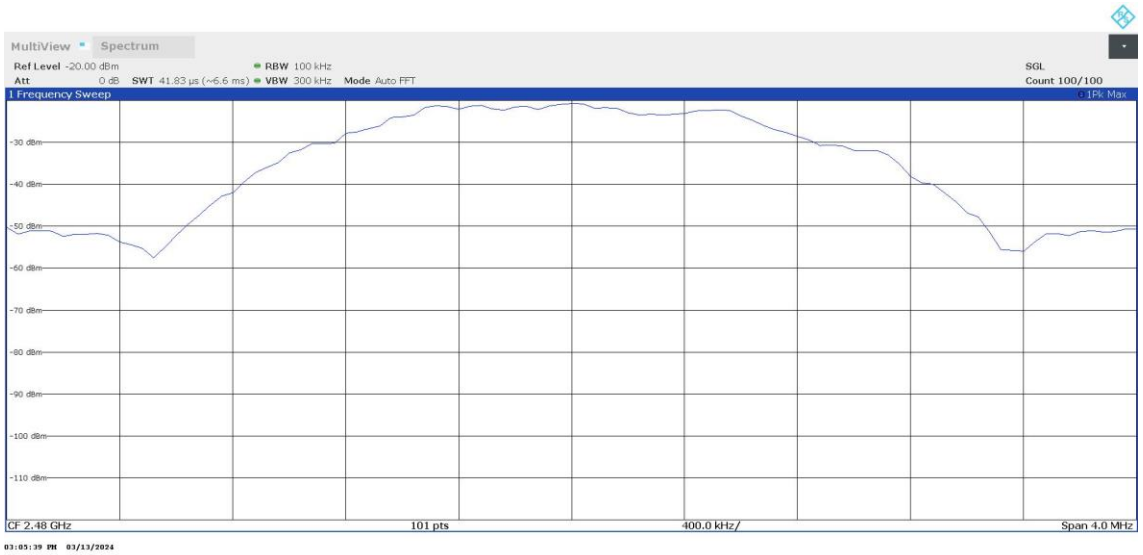
Bandwidth MHz = 2 Modulation = BTLE (GFSK 2 Mbit/s)

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.

Modulation: BTLE (GFSK 1 Mbit/s)

Results

Freq (MHz)	PSD (dBm)
2402.00000	-6.15
2440.00000	-5.82
2480.00000	-6.98

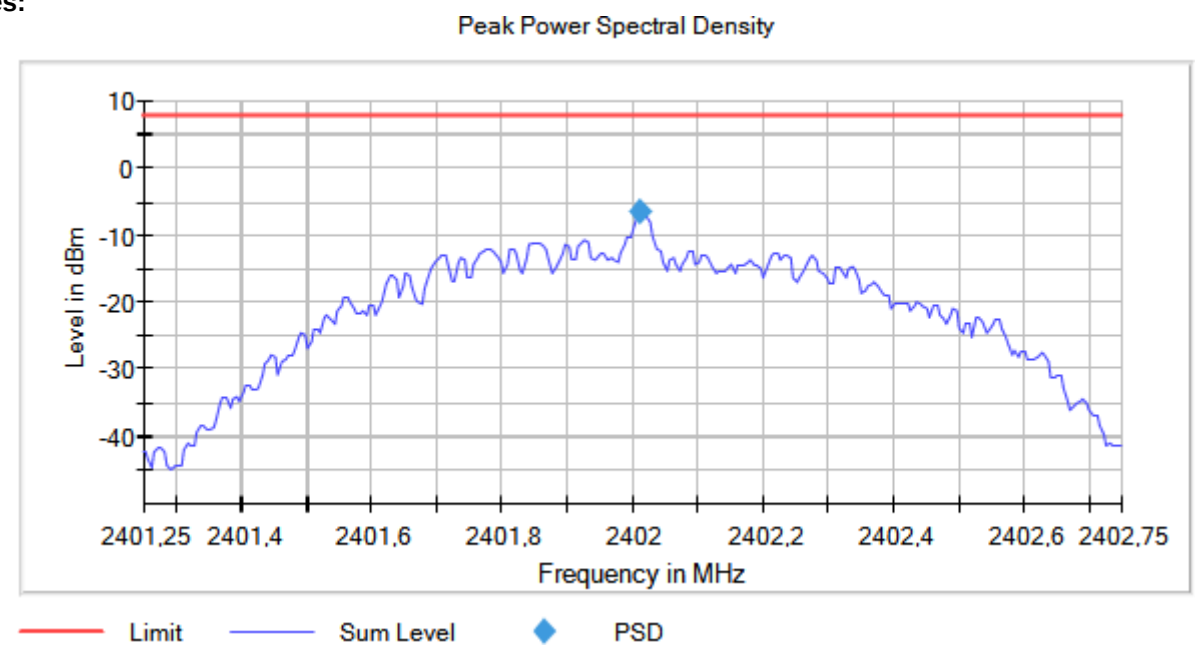
Verdict

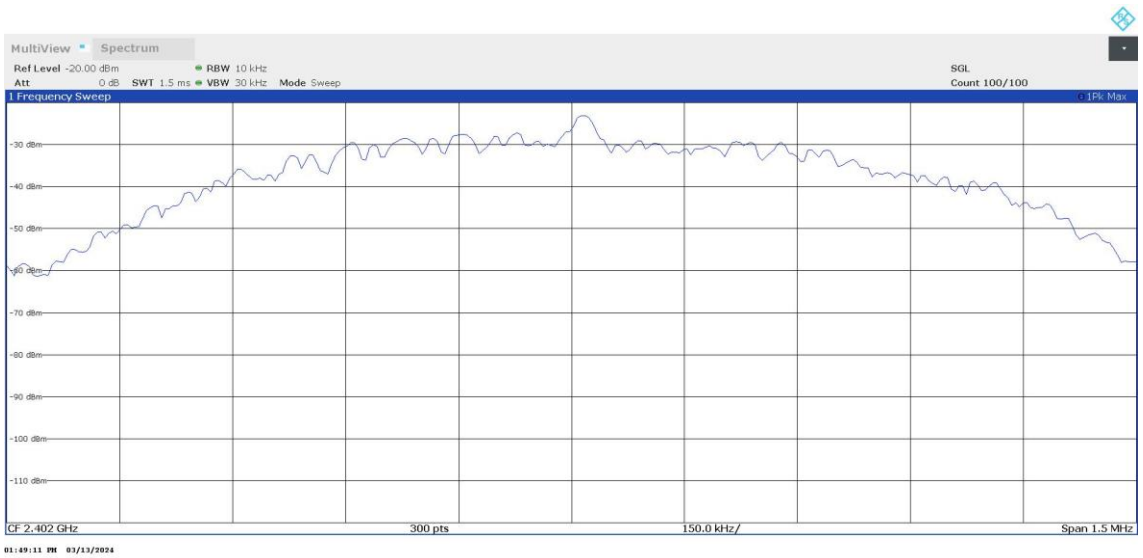
Pass

Attachments

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

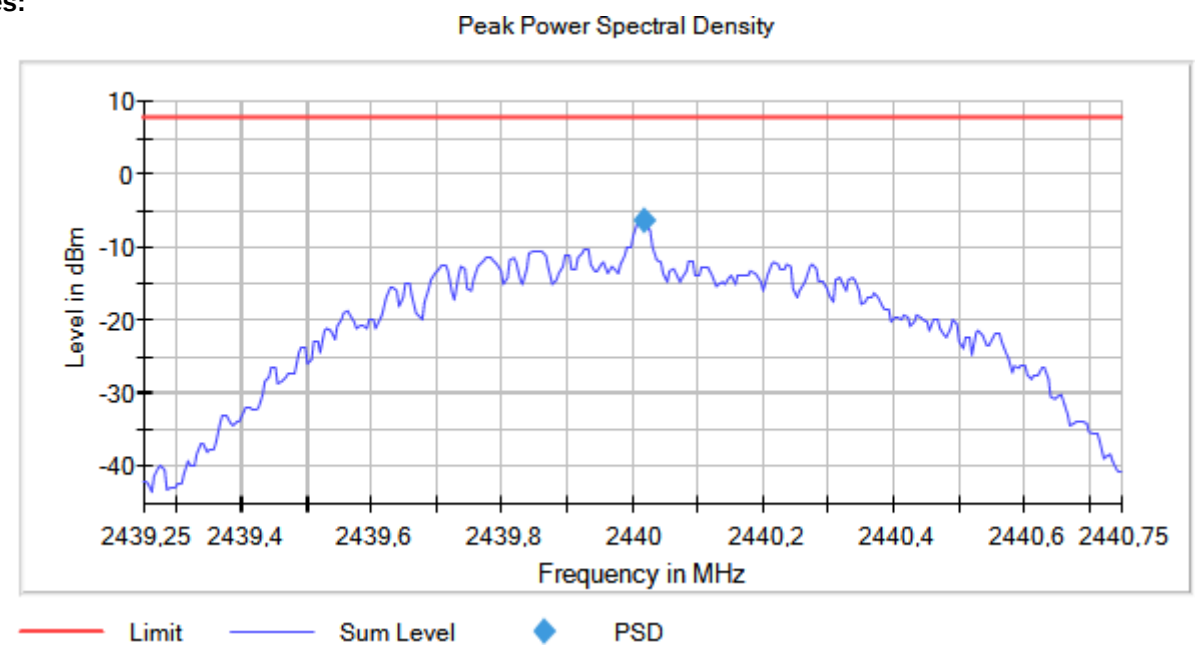
Images:

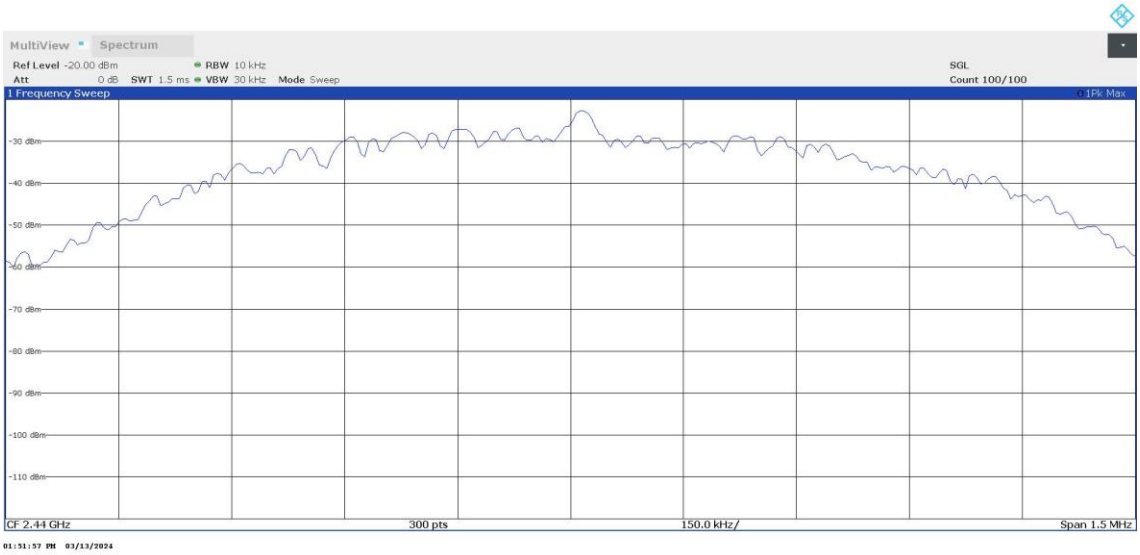




Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 1
Modulation = BTLE (GFSK 1 Mbit/s)
Frequency MHz = 2440.00000
MIMO Mode = SISO
Active Port = 1

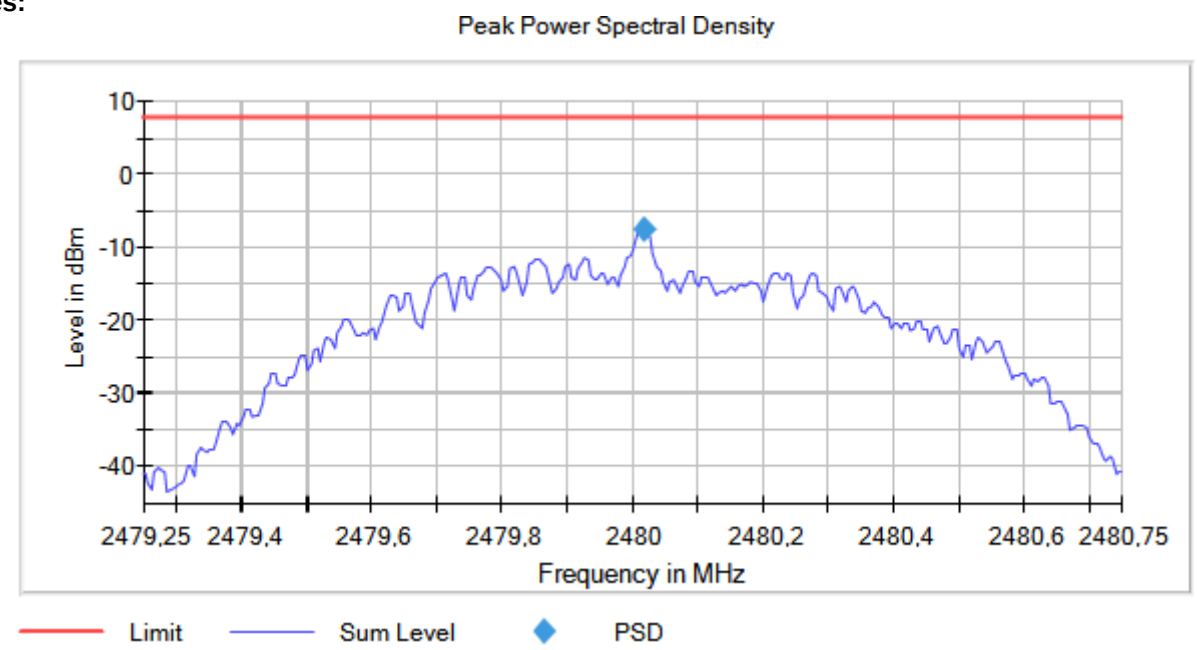
Images:

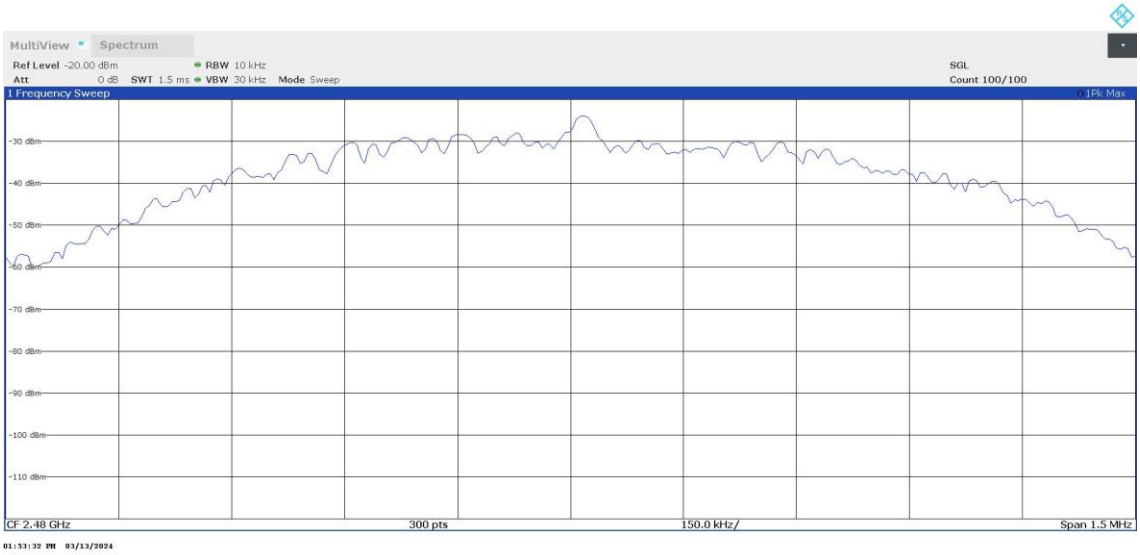




Equipment Type = Digital Transmission System (DTS)	Bandwidth MHz = 1
Modulation = BTLE (GFSK 1 Mbit/s)	Frequency MHz = 2480.00000
MIMO Mode = SISO	Active Port = 1

Images:





Modulation: BTLE (GFSK 2 Mbit/s)

Results

Freq (MHz)	PSD (dBm)
2402.00000	-6.60
2440.00000	-6.31
2480.00000	-7.38

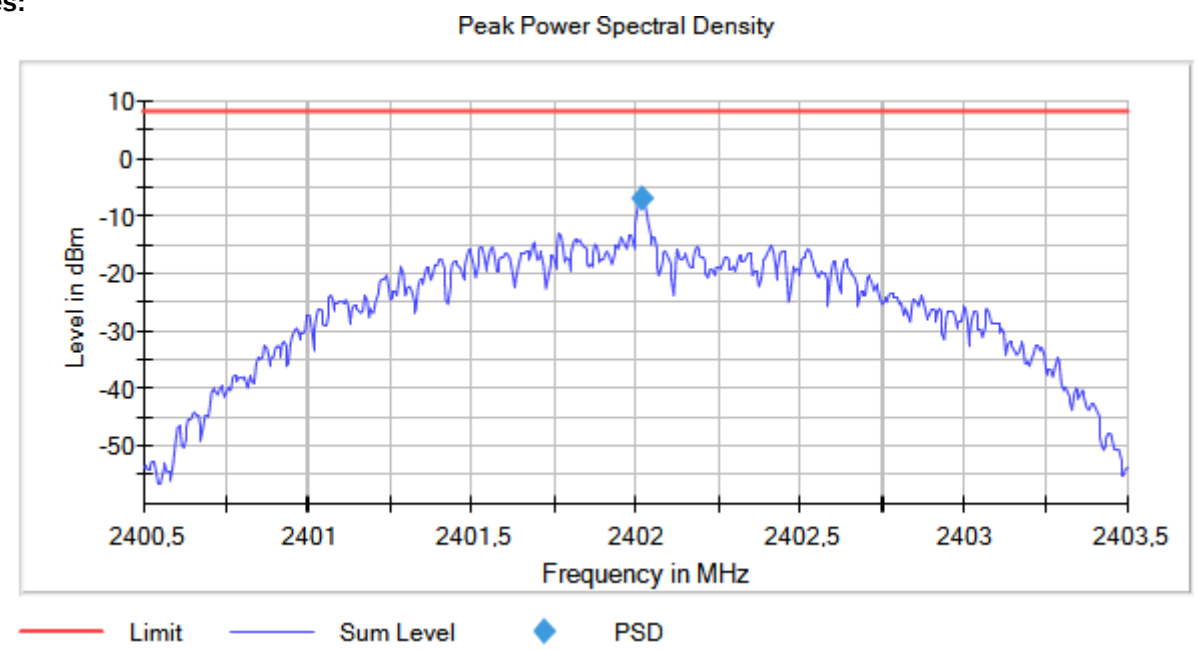
Verdict

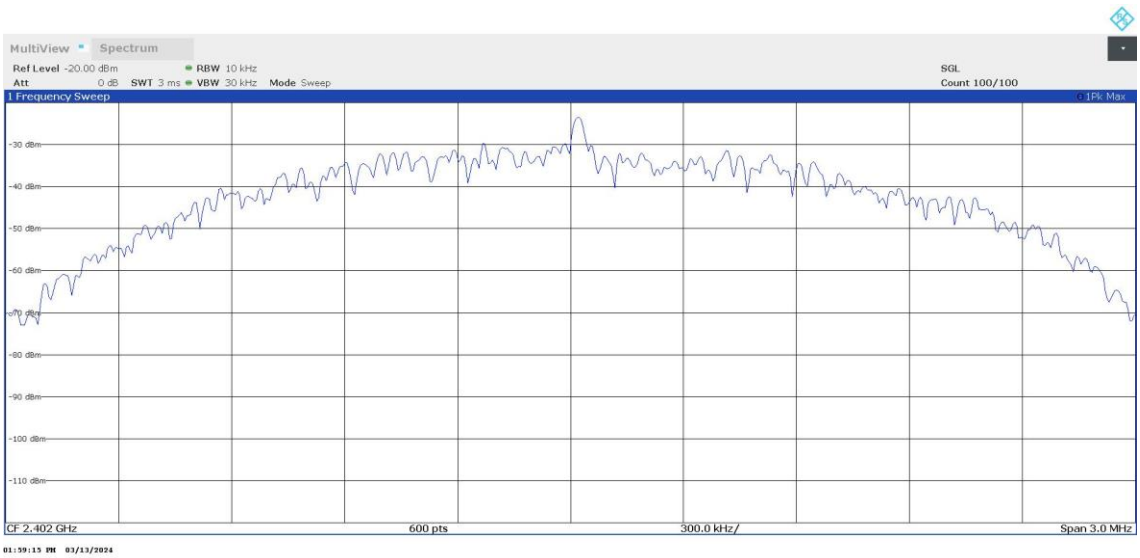
Pass

Attachments

Equipment Type = Digital Transmission System (DTS)	Bandwidth MHz = 2
Modulation = BTLE (GFSK 2 Mbit/s)	Frequency MHz = 2402.00000
MIMO Mode = SISO	Active Port = 1

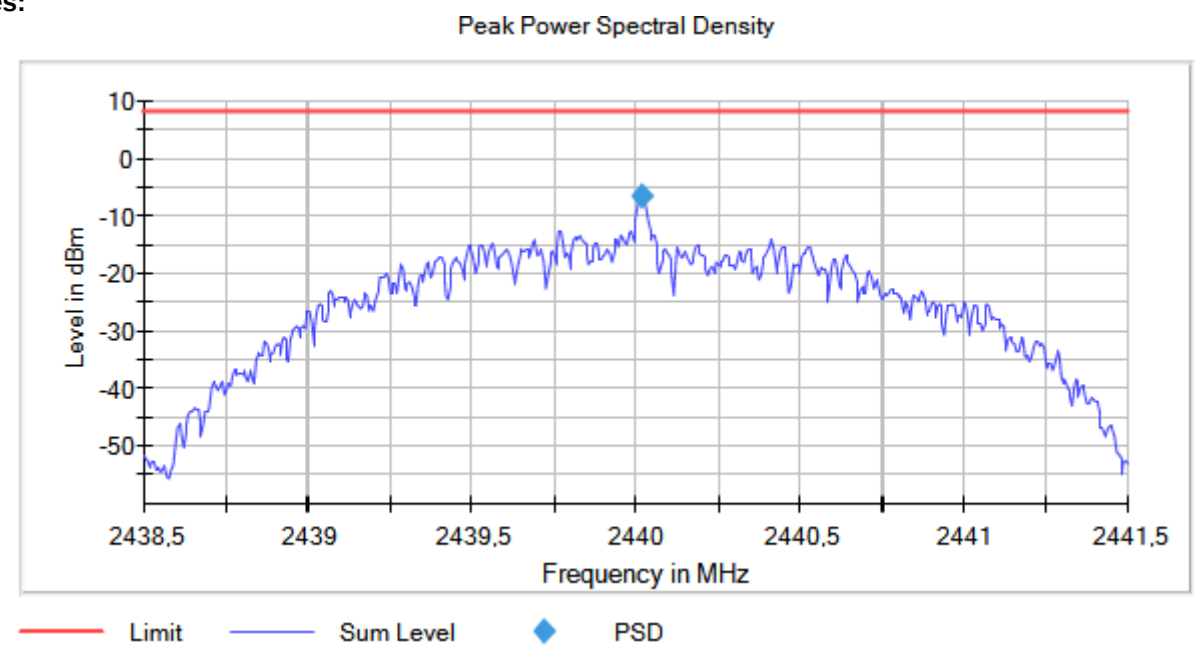
Images:

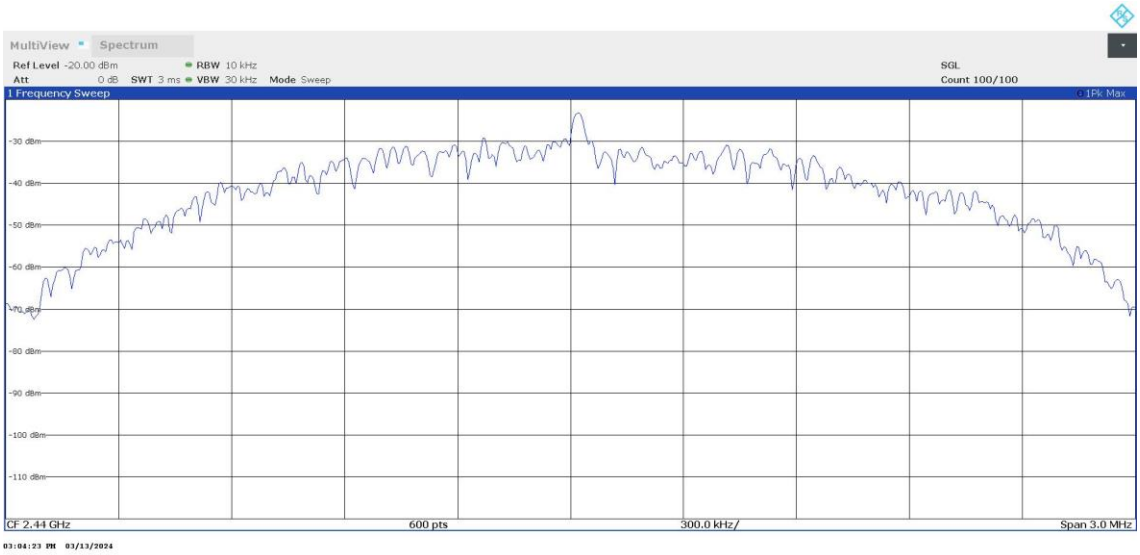




Equipment Type = Digital Transmission System (DTS)	Bandwidth MHz = 2
Modulation = BTLE (GFSK 2 Mbit/s)	Frequency MHz = 2440.00000
MIMO Mode = SISO	Active Port = 1

Images:



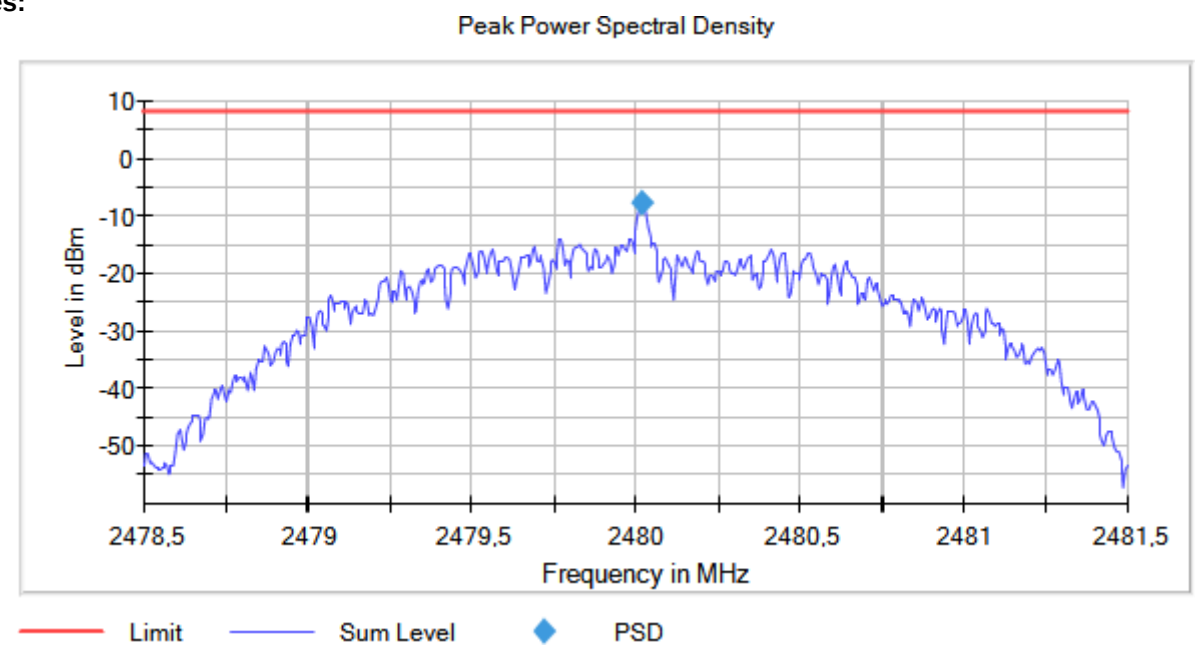


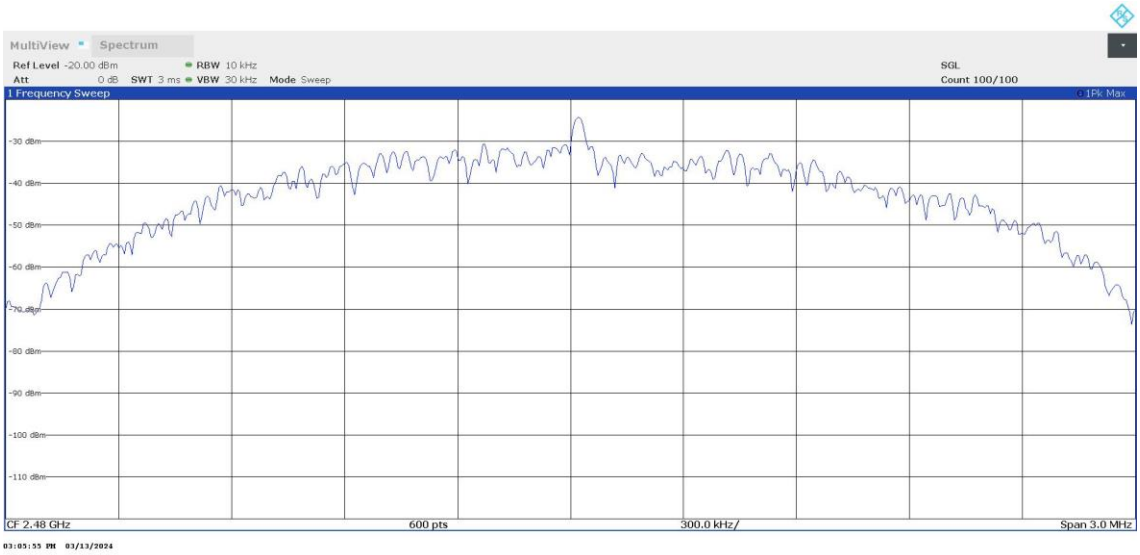
Equipment Type = Digital Transmission System (DTS) Bandwidth MHz = 2

Modulation = BTLE (GFSK 2 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) (Canada).

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.

Modulation: BTLE (GFSK 1 Mbit/s)

Results

Freq (MHz)	Peak Power (dBm)	Peak Power EIRP (dBm)
2402.00000	-0.102	-9.702
2440.00000	0.464	-9.136
2480.00000	-0.792	-10.392

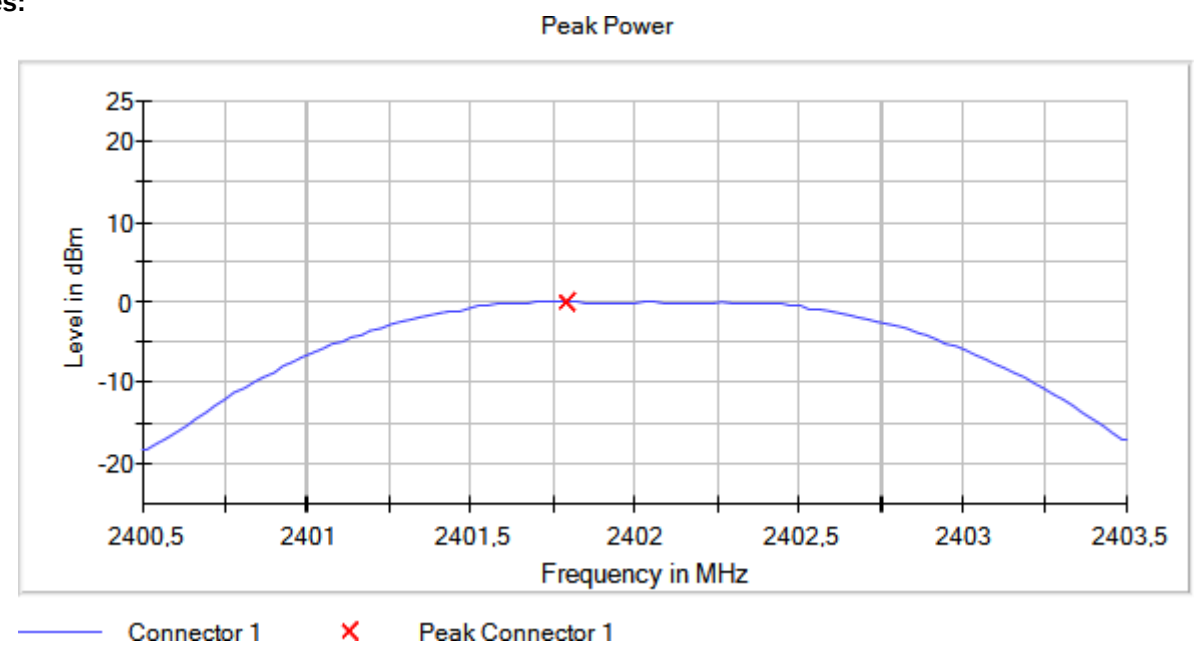
Verdict

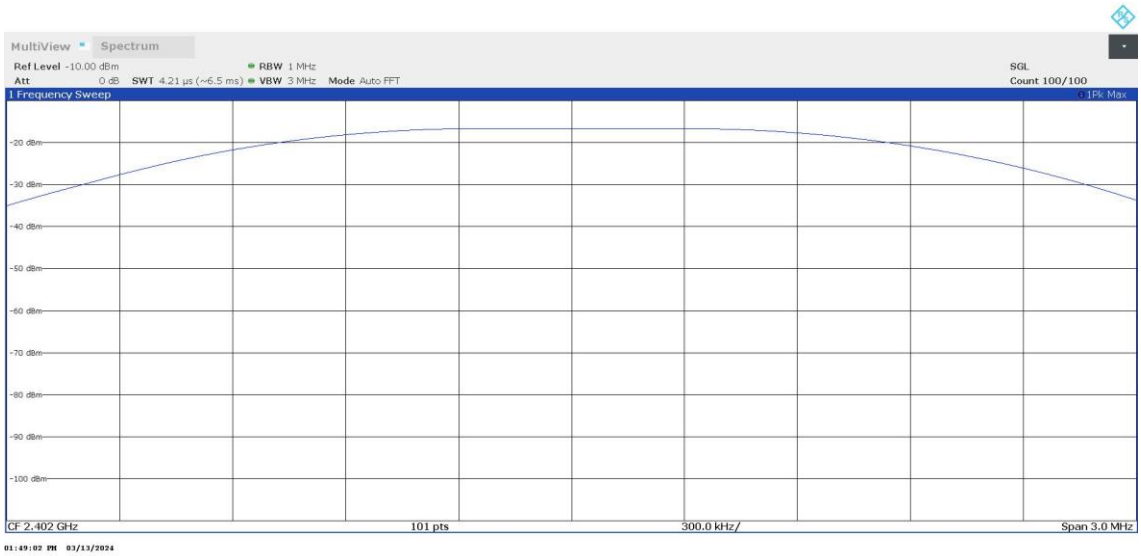
Pass

Attachments

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

Images:



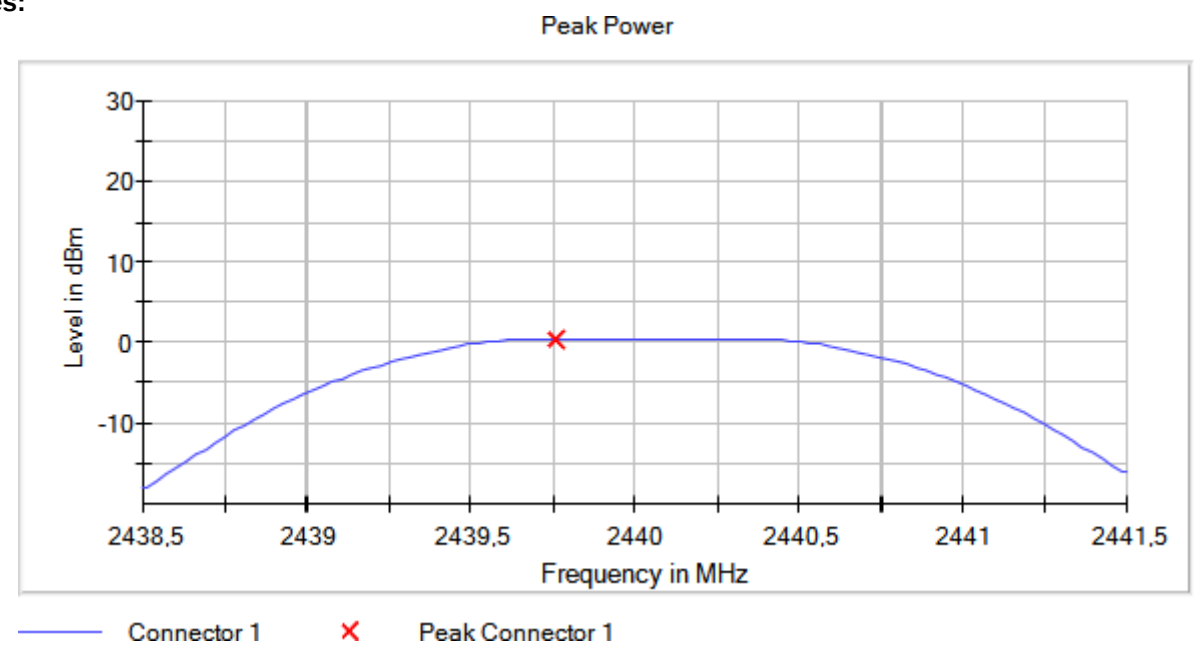


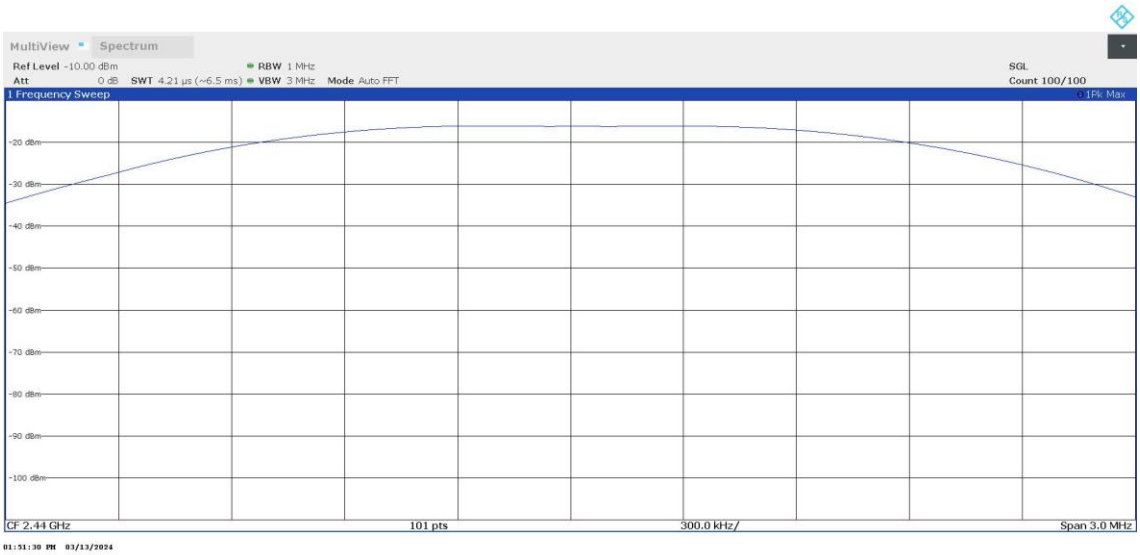
Equipment Type = Digital Transmission System (DTS) Bandwidth MHz = 1

Modulation = BTLE (GFSK 1 Mbit/s) Frequency MHz = 2440.00000

MIMO Mode = SISO Active Port = 1

Images:



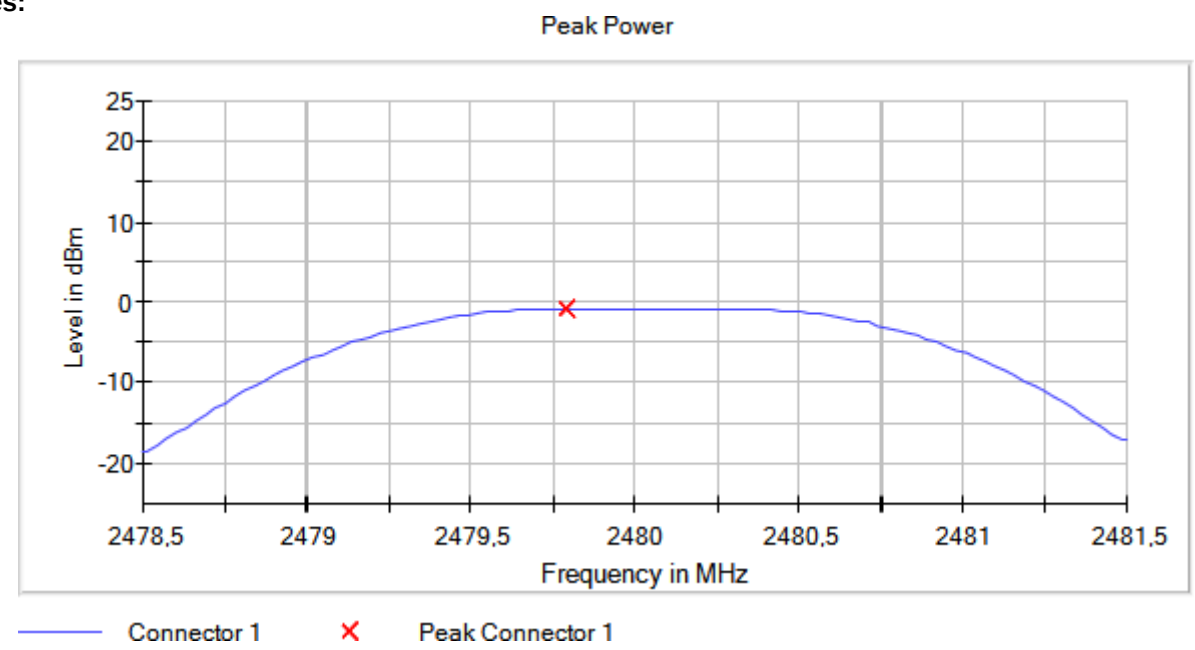


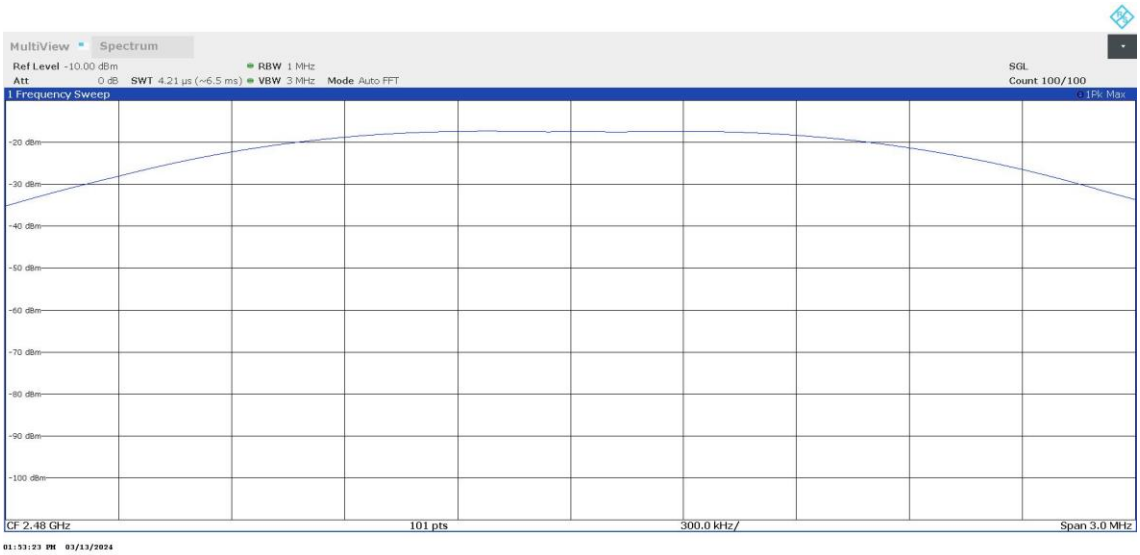
Equipment Type = Digital Transmission System (DTS) Bandwidth MHz = 1

Modulation = BTLE (GFSK 1 Mbit/s) Frequency MHz = 2480.00000

MIMO Mode = SISO Active Port = 1

Images:





Modulation: BTLE (GFSK 2 Mbit/s)

Results

Freq (MHz)	Peak Power (dBm)	Peak Power EIRP (dBm)
2402.00000	-0.050	-9.650
2440.00000	0.581	-9.019
2480.00000	-0.720	-10.32

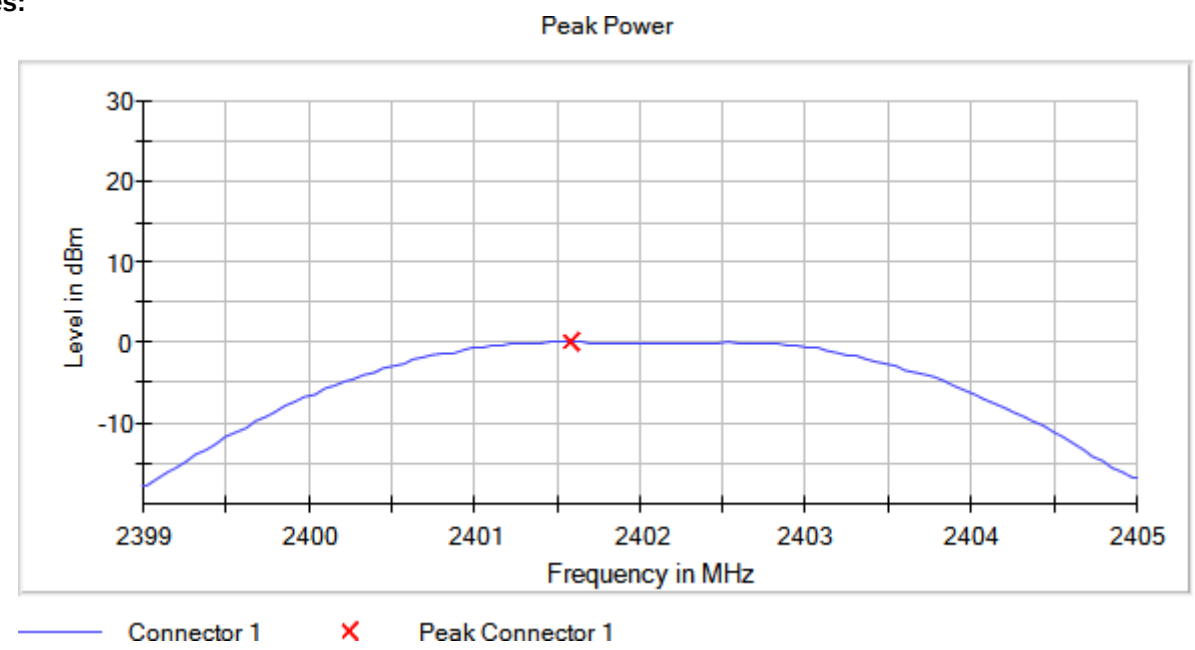
Verdict

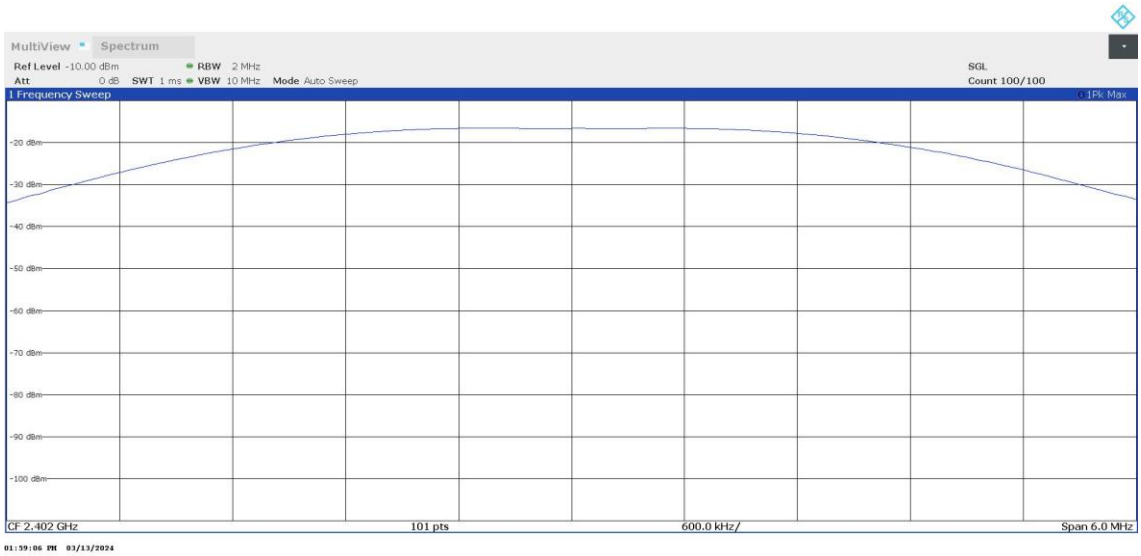
Pass

Attachments

Equipment Type = Digital Transmission System (DTS)	Bandwidth MHz = 2
Modulation = BTLE (GFSK 2 Mbit/s)	Frequency MHz = 2402.00000
MIMO Mode = SISO	Active Port = 1

Images:



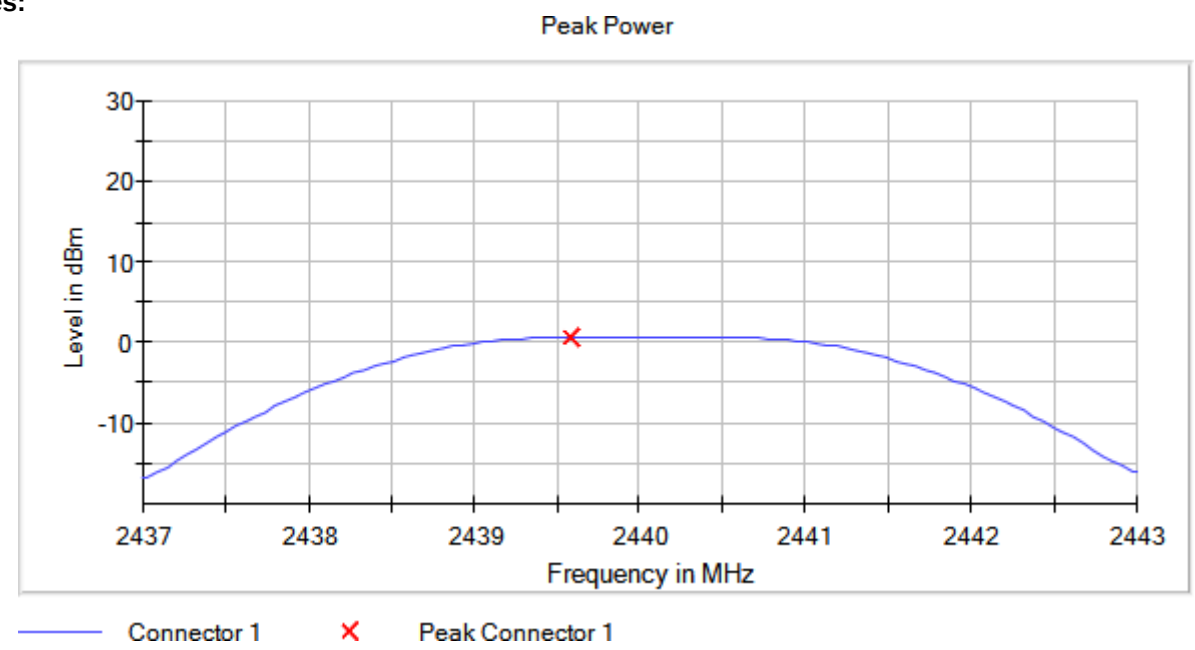


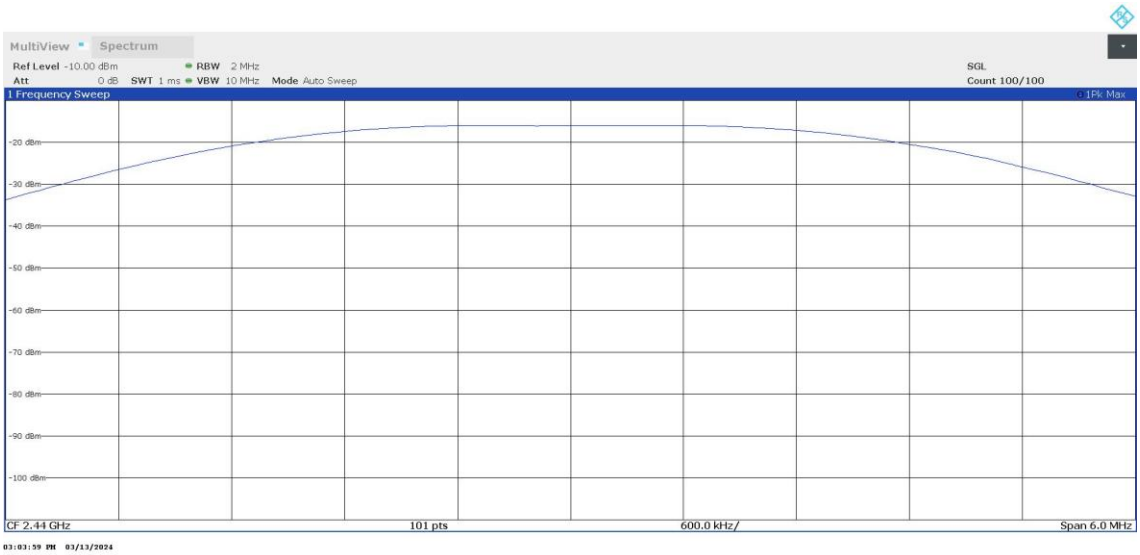
Equipment Type = Digital Transmission System (DTS) Bandwidth MHz = 2

Modulation = BTLE (GFSK 2 Mbit/s) Frequency MHz = 2440.00000

MIMO Mode = SISO Active Port = 1

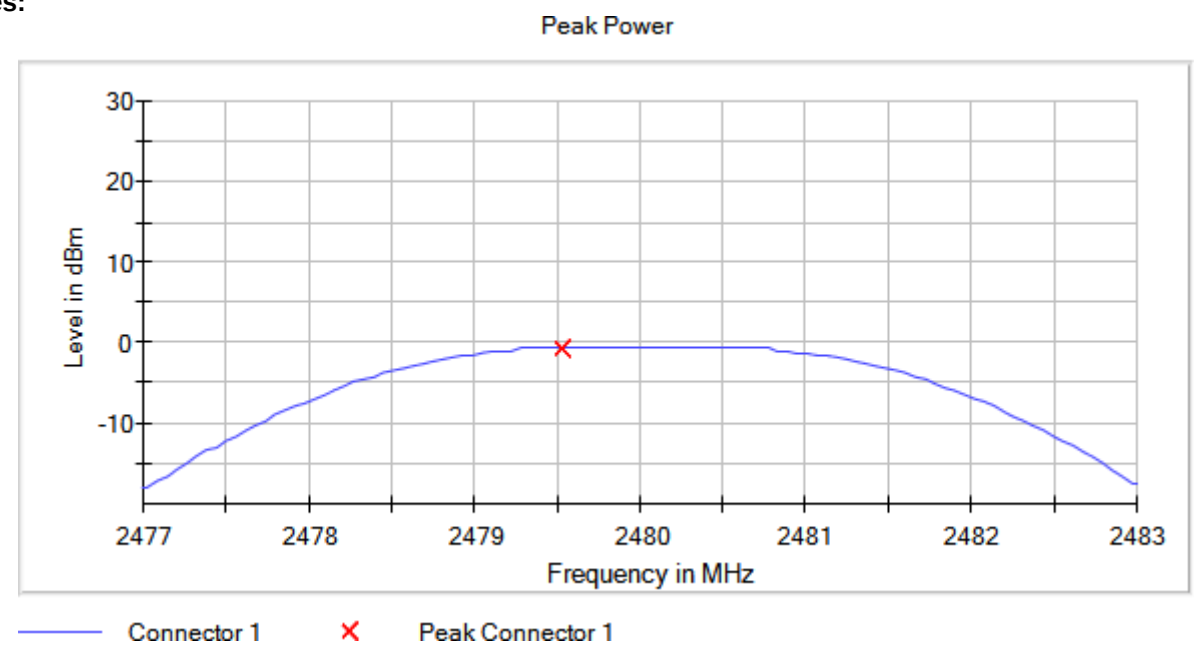
Images:

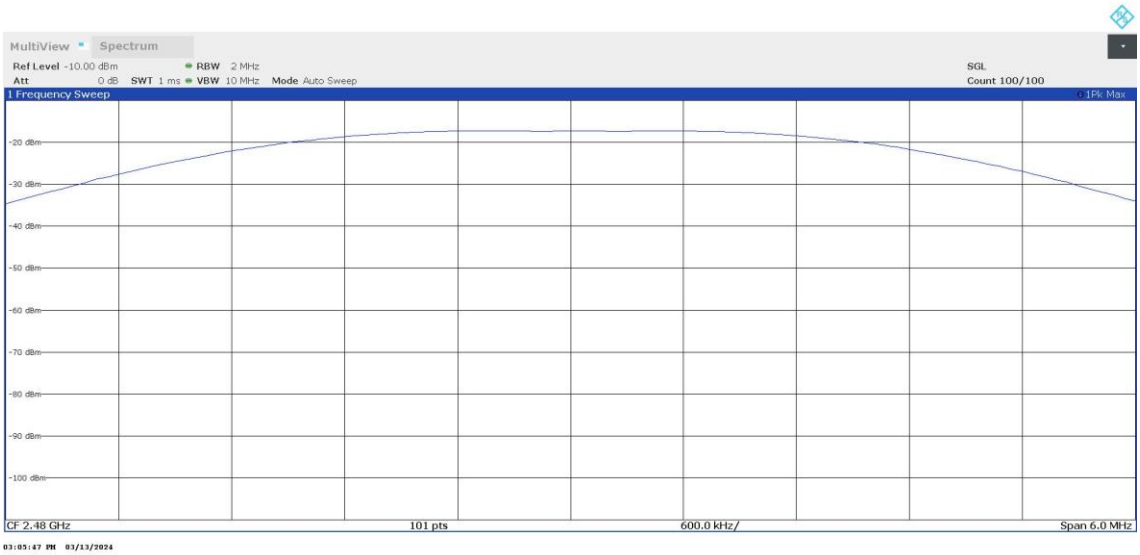




Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 2
Modulation = BTLE (GFSK 2 Mbit/s)
Frequency MHz = 2480.00000
MIMO Mode = SISO
Active Port = 1

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.

Modulation: BTLE (GFSK 1 Mbit/s)

Results

Freq (MHz)	Freq (MHz)	Lvl (dBm)
2402.00000	2399.625000	-57.7
	2399.675000	-57.7
	2399.775000	-57.9
	2399.975000	-57.9
	2399.825000	-58.0
	2399.575000	-58.0
	2399.875000	-58.1
	2399.725000	-58.2
	2399.925000	-58.3
	2399.525000	-59.1
	2399.375000	-59.4
	2399.325000	-59.4
	2399.475000	-59.6
	2399.425000	-59.6
	2399.175000	-60.0

Freq (MHz)	Freq (MHz)	Lvl (dBm)
2480.00000	2483.525000	-62.4
	2483.675000	-63.1
	2483.725000	-63.3
	2483.625000	-63.6
	2483.775000	-63.7
	2483.575000	-63.8
	2483.825000	-63.8
	2483.875000	-64.3
	2484.075000	-64.3
	2483.925000	-64.3
	2484.025000	-64.7
	2484.175000	-65.3
	2483.975000	-65.3
	2484.475000	-65.8
	2484.225000	-66.1

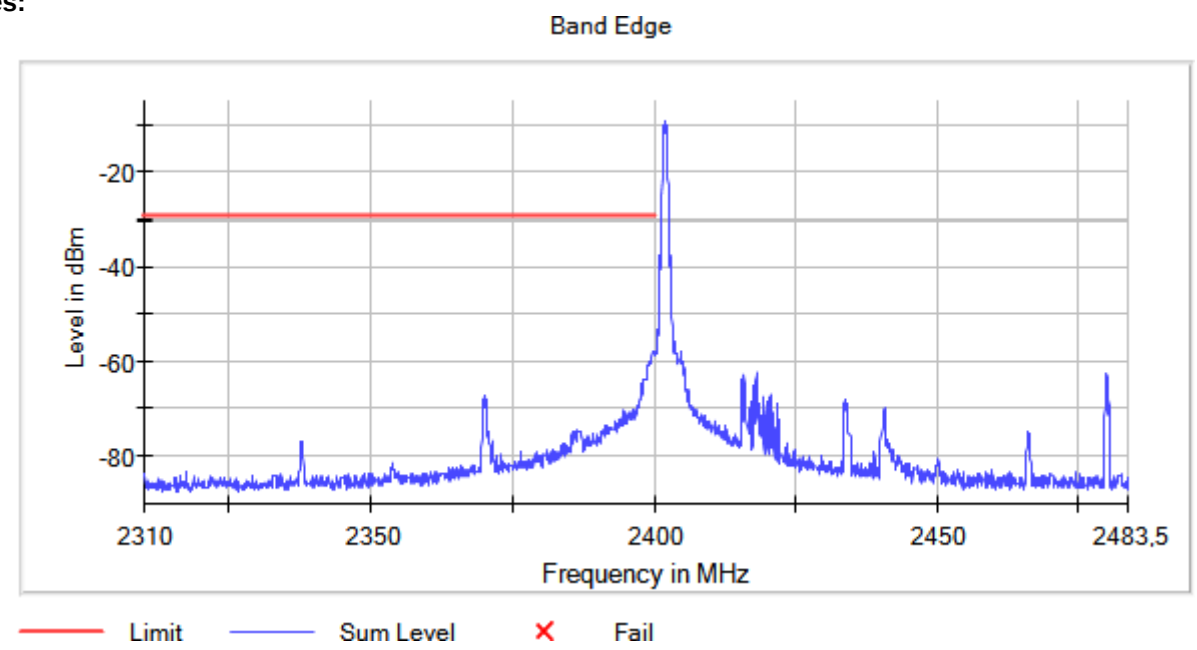
Verdict

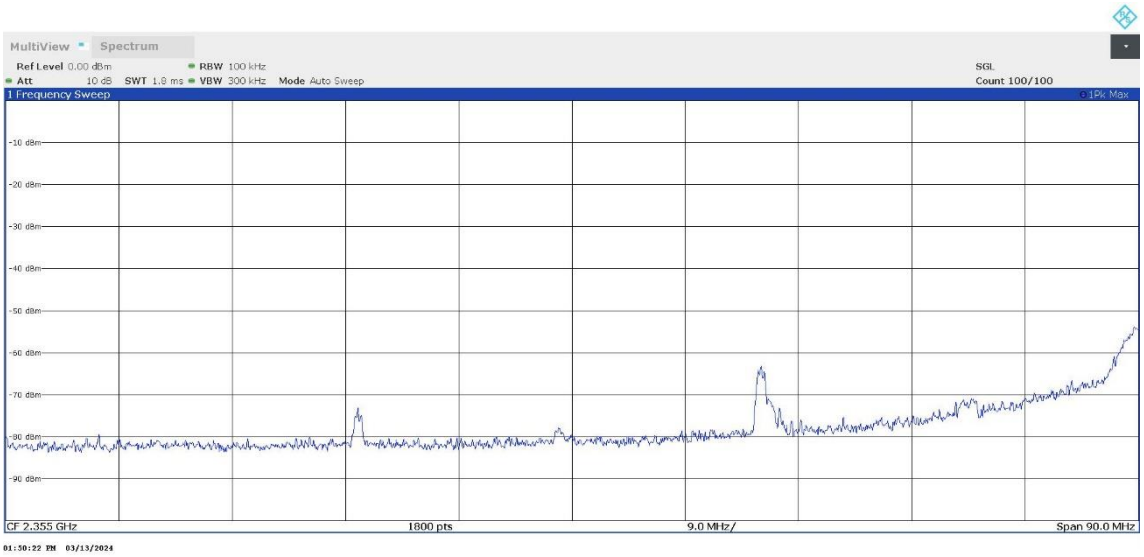
Pass

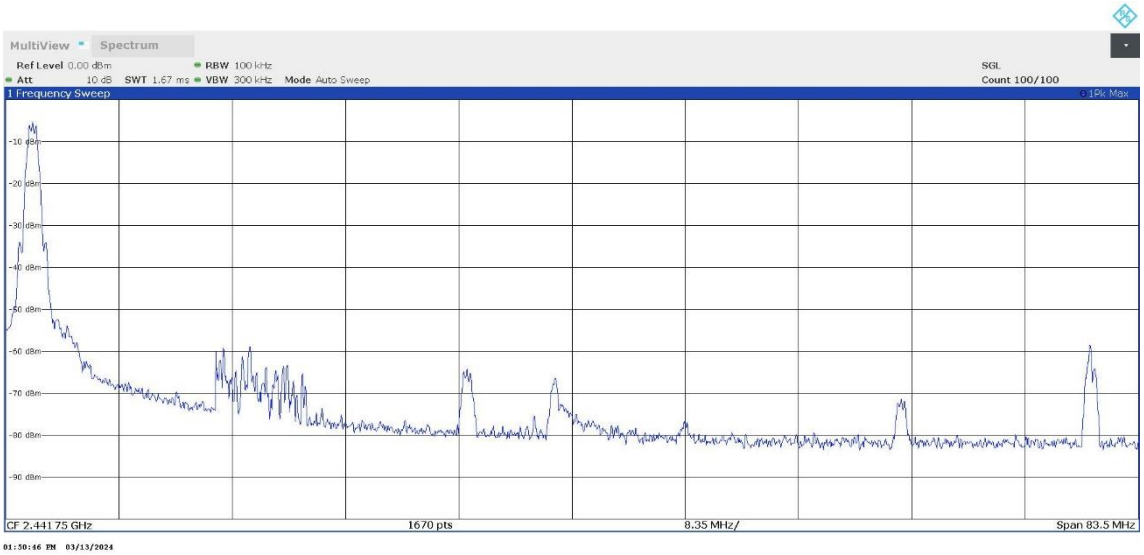
Attachments

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

Images:

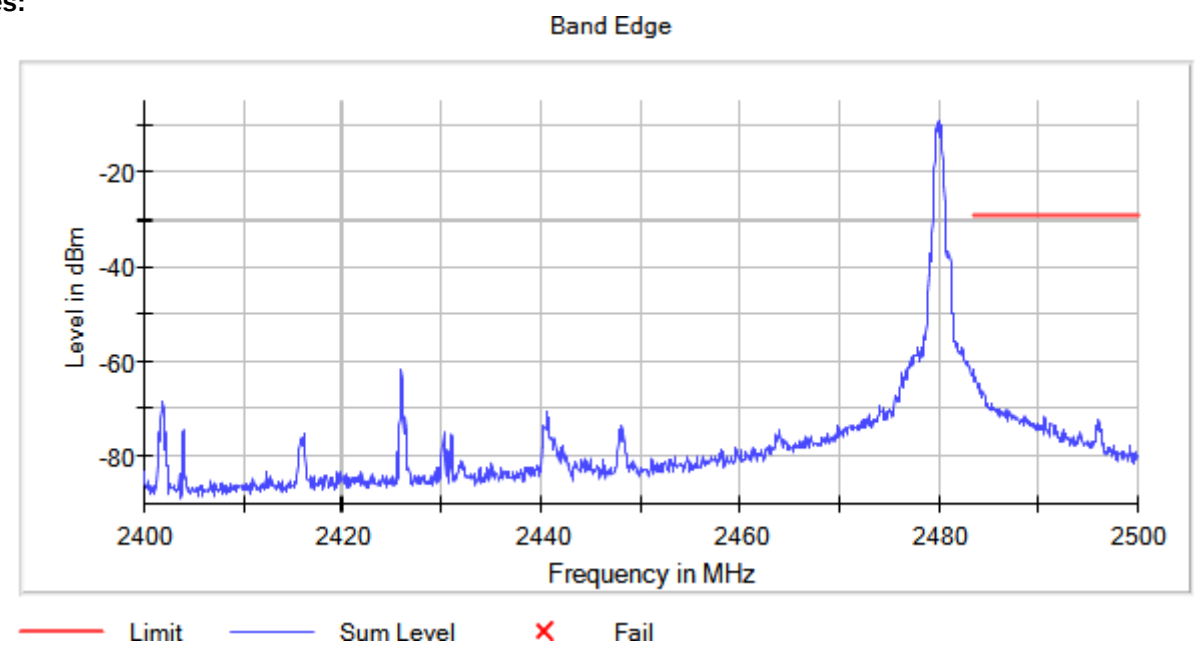


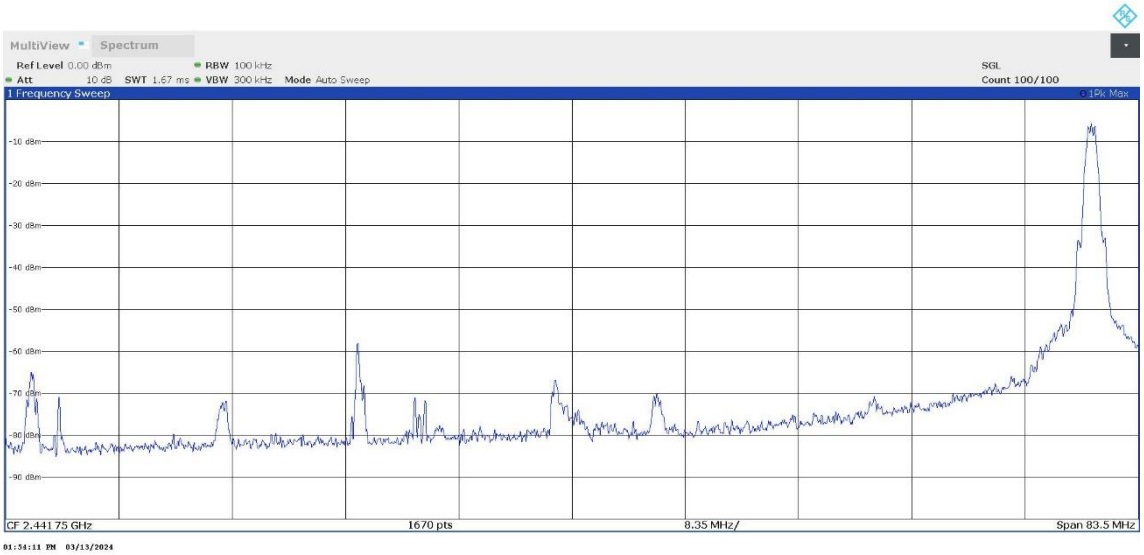


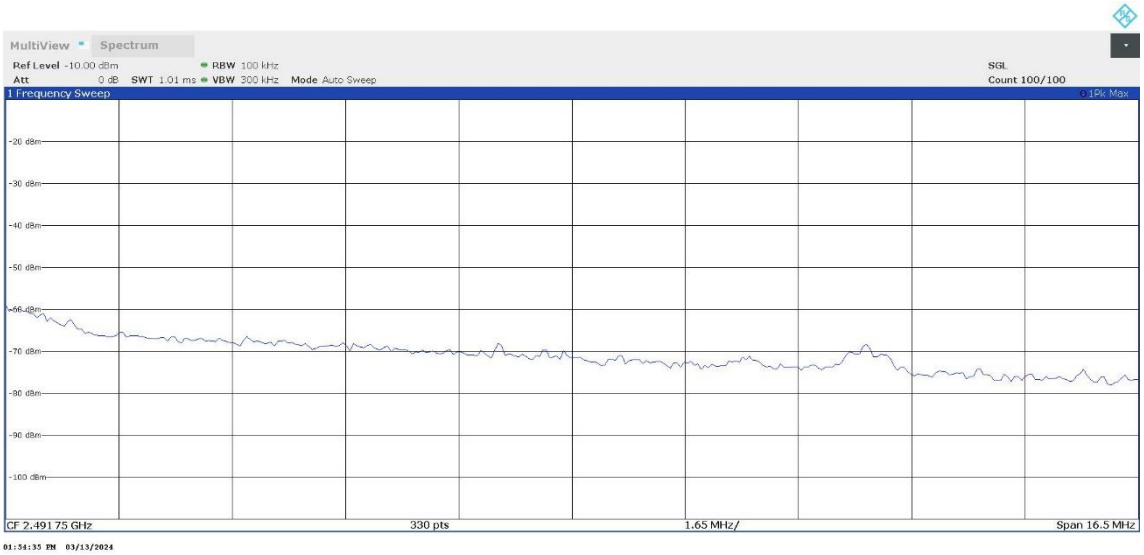

MultiView
Spectrum
Ref Level 0.00 dBm
RBW 100 kHz
SGL
Att 10 dB
SWT 1.67 ms
VBW 300 kHz
Mode Auto Sweep
Count 100/100
1 Frequency Sweep
1Pk Max
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
CF 2.441 75 GHz
1670 pts
8.35 MHz/
Span 83.5 MHz
01:50:46 PM 03/13/2024

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

Images:






MultiView
Spectrum
Ref Level -10.00 dBm
RBW 100 kHz
SGL
Att 0 dB SWT 1.01 ms VBW 300 kHz Mode Auto Sweep
Count 100/100
1 Frequency Sweep
1Pk Max
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
-100 dBm
CF 2.491 75 GHz
330 pts
1.65 MHz/
Span 16.5 MHz
01:54:35 PM 03/13/2024

Modulation: BTLE (GFSK 2 Mbit/s)

Results

Freq (MHz)	Freq (MHz)	Lvl (dBm)
2402.00000	2399.975000	-40.2
	2399.925000	-43.6
	2399.875000	-47.1
	2399.825000	-48.6
	2399.775000	-49.4
	2399.725000	-52.8
	2399.675000	-54.7
	2399.625000	-57.2
	2399.575000	-57.6
	2399.025000	-58.2
	2399.525000	-58.6
	2399.075000	-59.1
	2399.425000	-59.3
	2399.325000	-59.4
	2399.375000	-59.4

Freq (MHz)	Freq (MHz)	Lvl (dBm)
2480.00000	2483.875000	-62.0
	2483.925000	-62.5
	2483.525000	-62.6
	2483.575000	-63.0
	2483.775000	-63.1
	2483.725000	-63.4
	2483.675000	-63.5
	2483.825000	-63.7
	2484.075000	-63.9
	2484.575000	-64.0
	2484.525000	-64.1
	2484.025000	-64.3
	2484.775000	-64.7
	2484.125000	-64.9
	2484.175000	-65.0

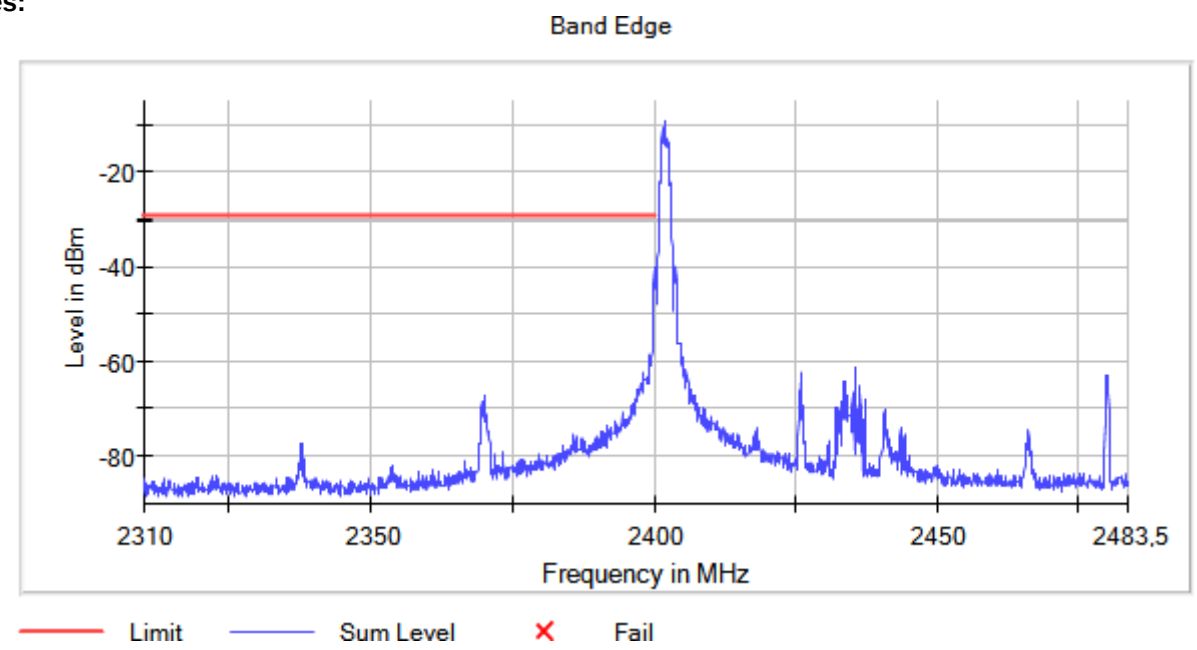
Verdict

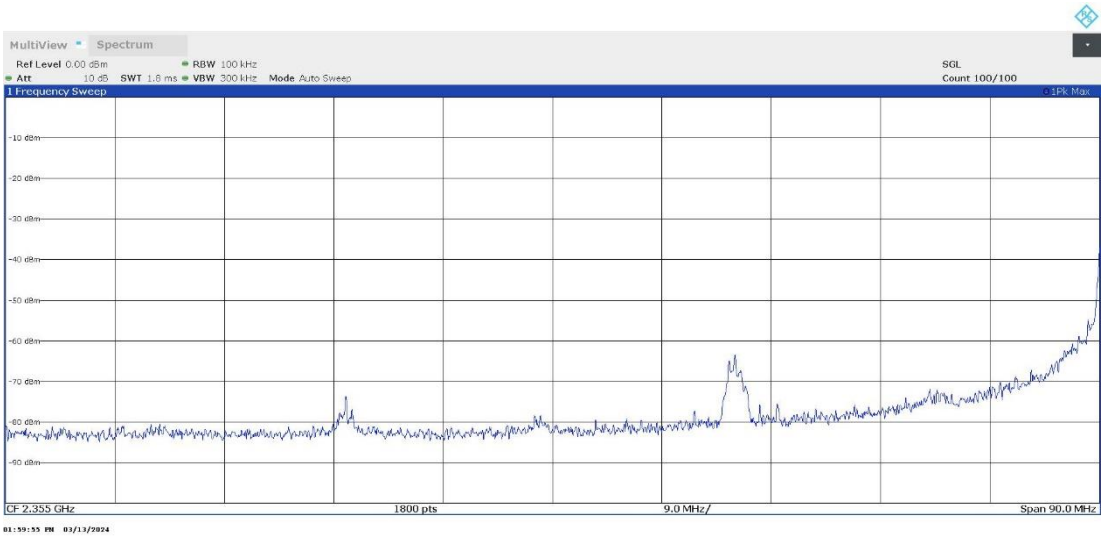
Pass

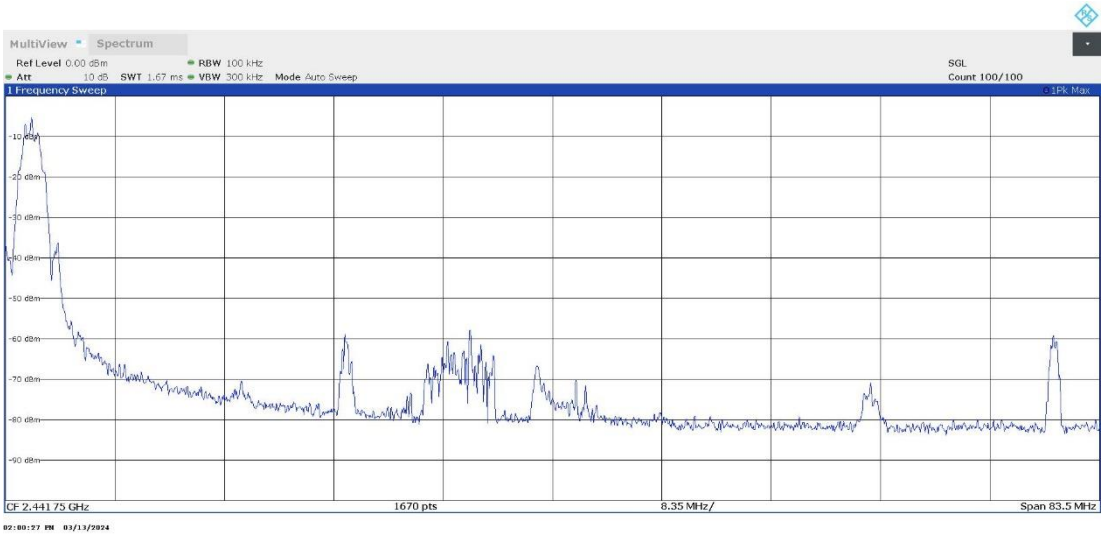
Attachments

Equipment Type = Digital Transmission System (DTS)	Bandwidth MHz = 2
Modulation = BTLE (GFSK 2 Mbit/s)	Frequency MHz = 2402.00000
MIMO Mode = SISO	Active Port = 1

Images:

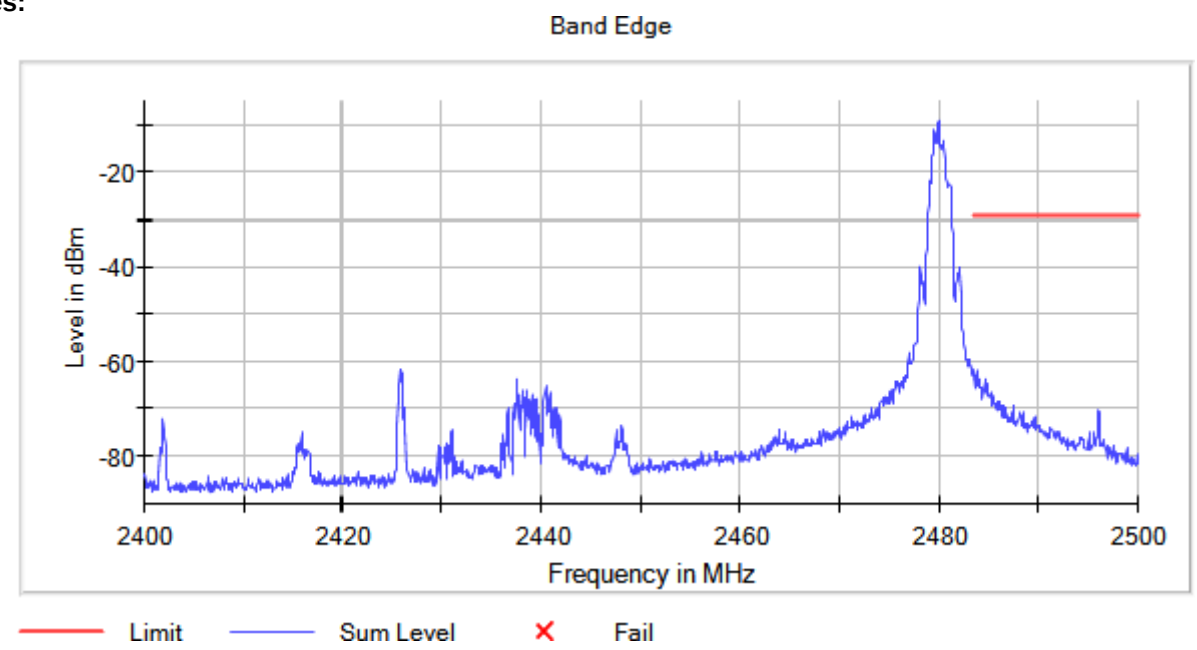


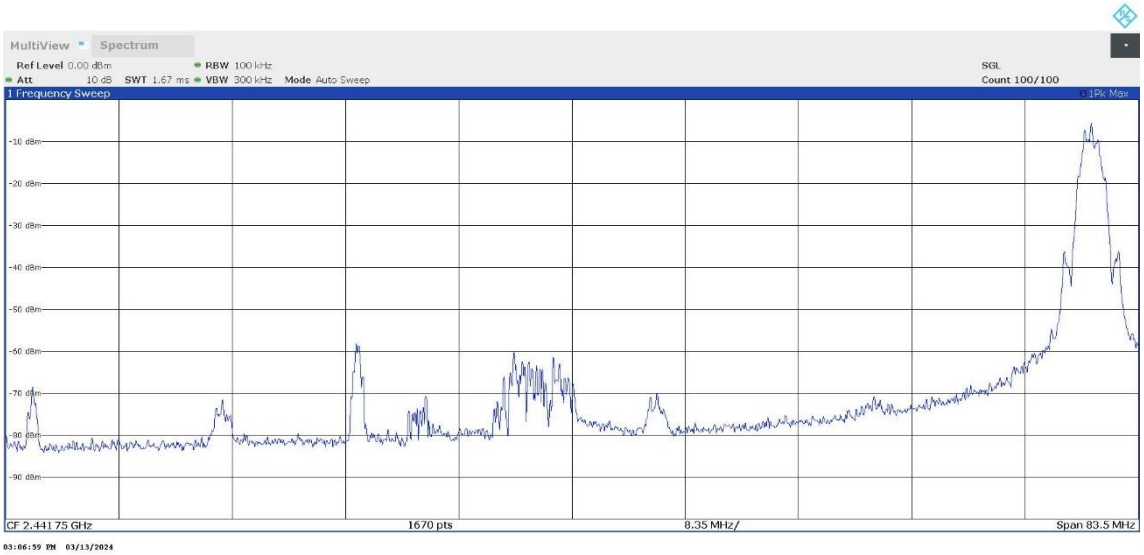


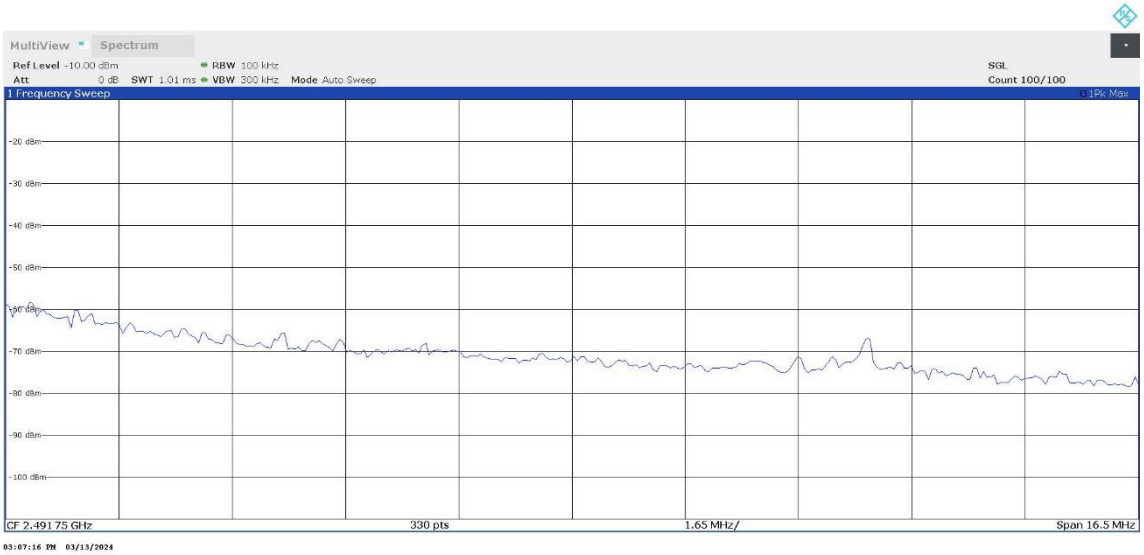

MultiView
Spectrum
Ref Level 0.00 dBm
RBW 100 kHz
SGL
Att 10 dB SWT 1.67 ms VBW 300 kHz Mode Auto Sweep
Count 100/100
1 Frequency Sweep
1Pk Max
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
CF 2.441 75 GHz
1670 pts
8.35 MHz/
Span 83.5 MHz
02:80:27 PM 03/13/2024

Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 2
Modulation = BTLE (GFSK 2 Mbit/s)
Frequency MHz = 2480.00000
MIMO Mode = SISO
Active Port = 1

Images:






MultiView
Spectrum
Ref Level -10.00 dBm
RBW 100 kHz
SGL
Att 0 dB SWT 1.01 ms VBW 300 kHz Mode Auto Sweep
Count 100/100
1 Frequency Sweep
1Pk Max
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
-100 dBm
CF 2.491 75 GHz
330 pts
1.65 MHz/
Span 16.5 MHz
03:07:16 PM 03/13/2024

RSS-247 5.5 / FCC 15.247 (d) [RSE] 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 (µV/m)	Field strength (dBµV/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.

Modulation: BTLE (GFSK 1 Mbit/s)

Results

Range 30MHz-1GHz

No spurious frequencies detected at less than 20dB below the limit.

Range 1GHz-3GHz

No spurious frequencies detected at less than 20dB below the limit.

Range 3GHz-17GHz

Freq Rng (GHz)	Freq (MHz)	Unwanted Freq (MHz)	Unwanted Lvl (dBµV/m)	Pol	Detector
[3, 17]	2402.00000	4804.000	52.44	H	PK
		7205.500	52.45	H	PK
		9607.000	50.64	V	PK
	2440.00000	4879.500	51.49	H	PK
		7321.000	50.38	H	PK
		9759.000 (*)	48.36	V	PK
	2480.00000	4959.500	51.89	H	PK
		7439.500	50.89	H	PK
		9919.000 (**)	49.43	V	PK

(*): 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 84.64 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 levels were measured with a RBW = 100 kHz and the measured radiated carrier level was 81.06 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).

Range 17GHz-26GHz

No spurious frequencies detected at less than 20dB below the limit.

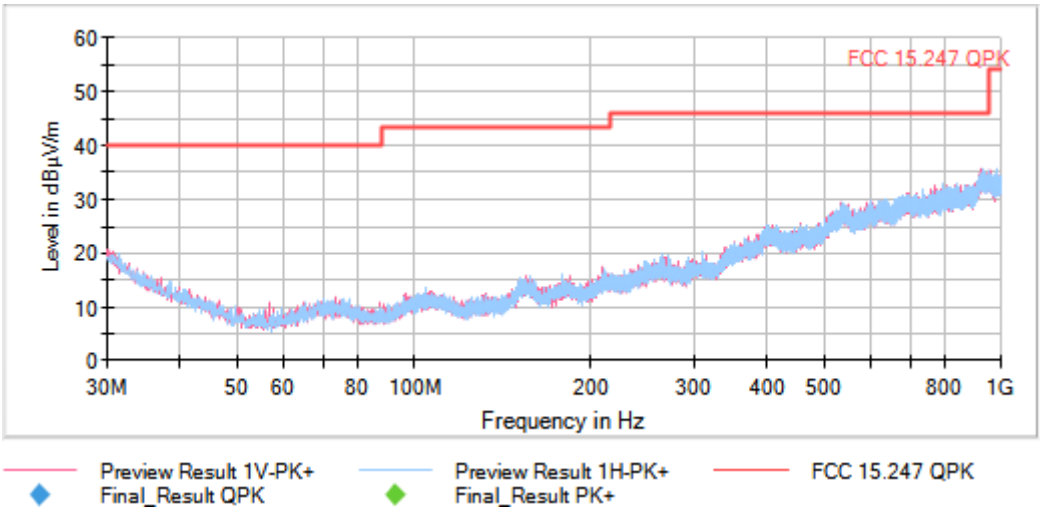
Verdict

Pass

Attachments

Frequency Range GHz = [0.03, 1]	Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE (GFSK 1 Mbit/s)	Frequency MHz = The results obtained in the range 30MHz-1GHz do not depend on transmission channel
MIMO Mode = SISO	Active Port = 1

Images:



This plot is valid for all channels.

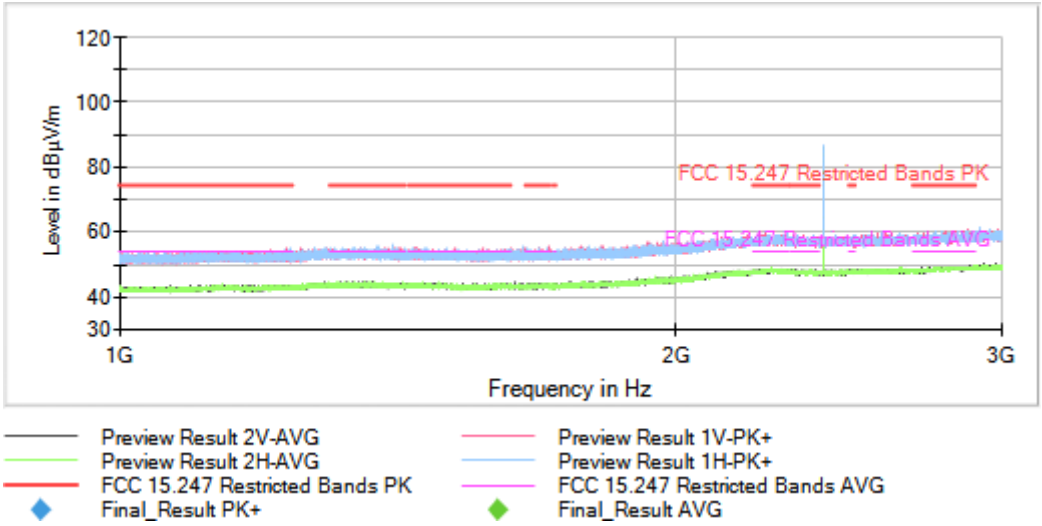
Tables:

Spectrum Analyzer Parameters

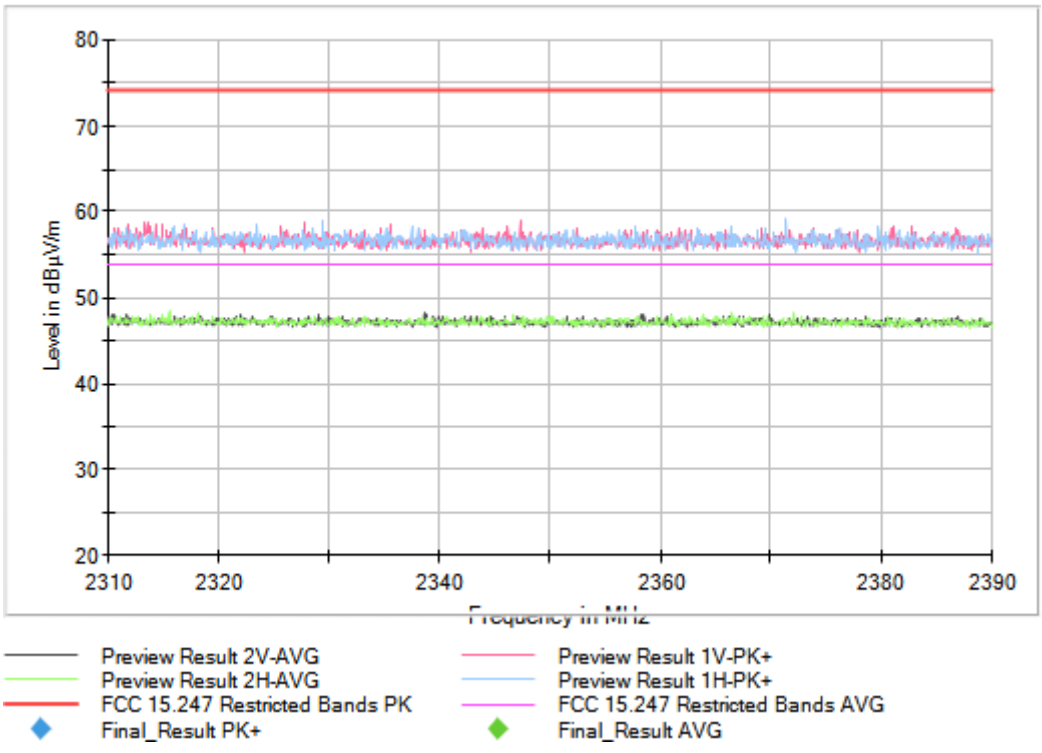
	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	30 MHz - 1 GHz	48,5 kHz	PK+	100 kHz	1 s	20 dB

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

Images:



Full Spectrum



Tables:

Spectrum Analyzer Parameters

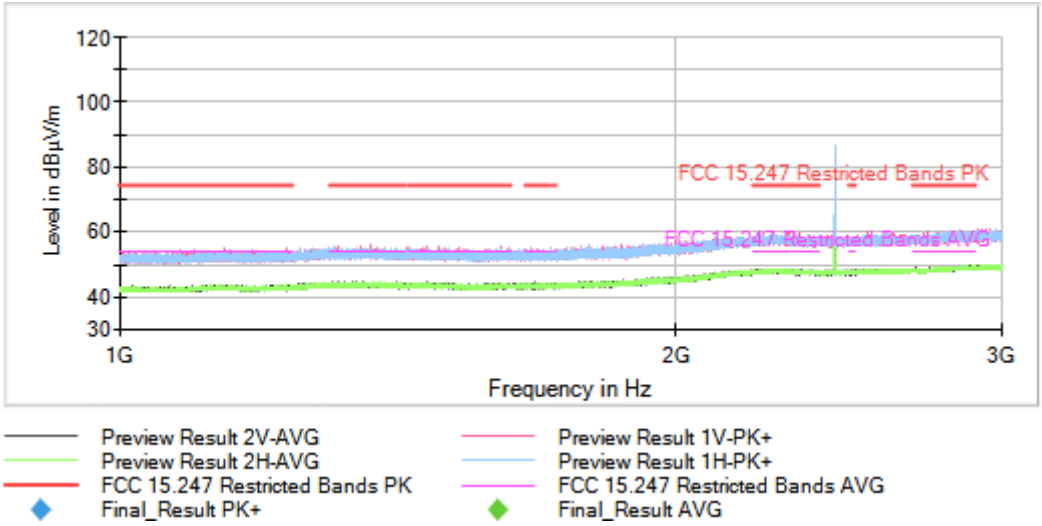
	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	1 GHz - 3 GHz	66,667 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Frequency Range GHz = [1, 3] Equipment Type = Digital Transmission System (DTS)

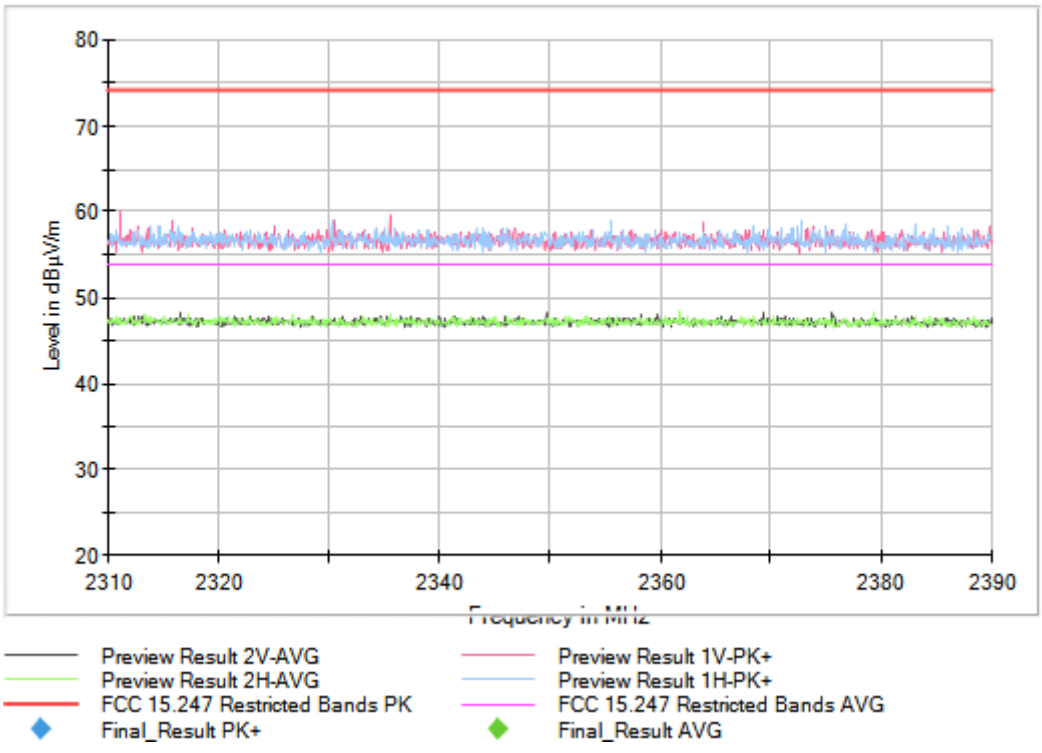
Modulation = BTLE (GFSK 1 Mbit/s) Frequency MHz = 2440.00000

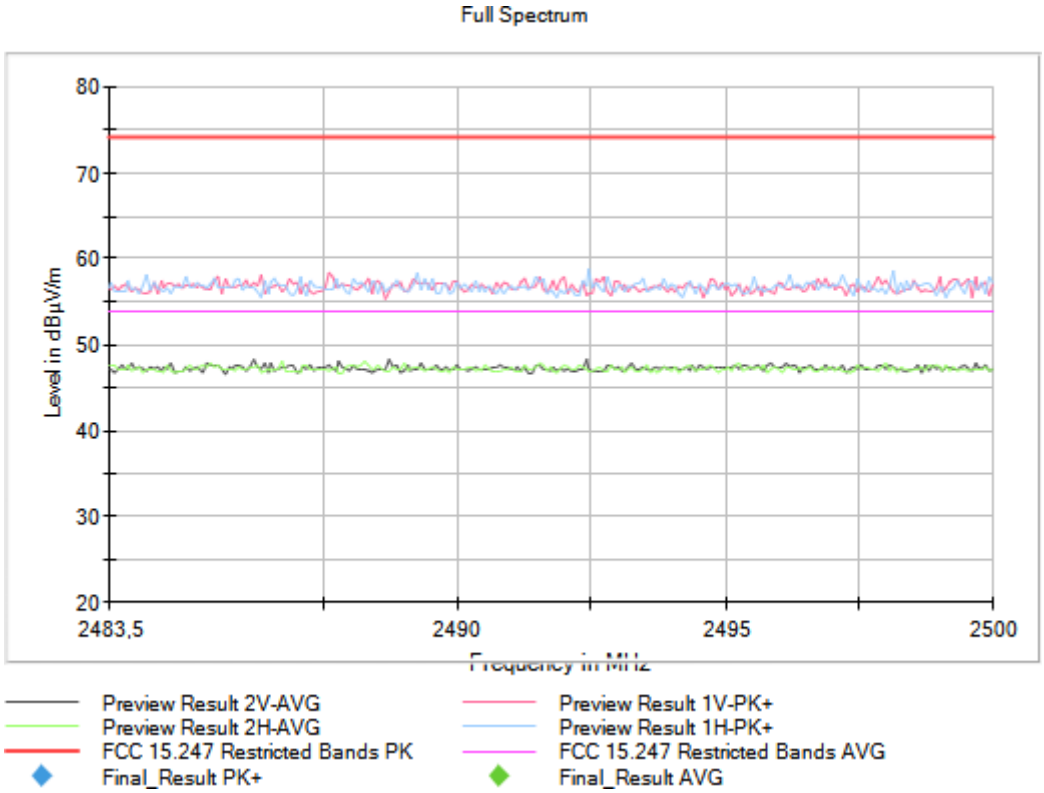
MIMO Mode = SISO Active Port = 1

Images:



Full Spectrum





Tables:

Spectrum Analyzer Parameters

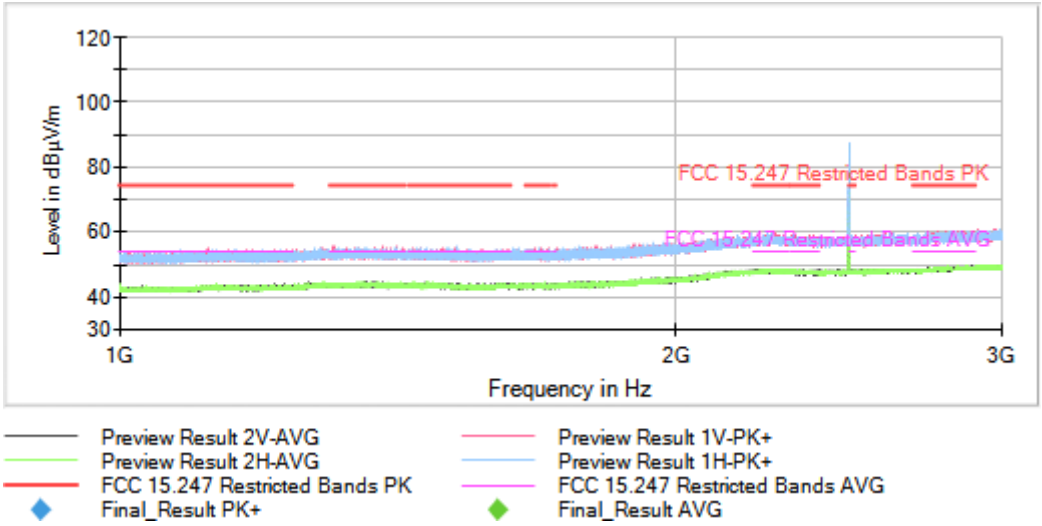
	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	1 GHz - 3 GHz	66,667 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Frequency Range GHz = [1, 3] Equipment Type = Digital Transmission System (DTS)

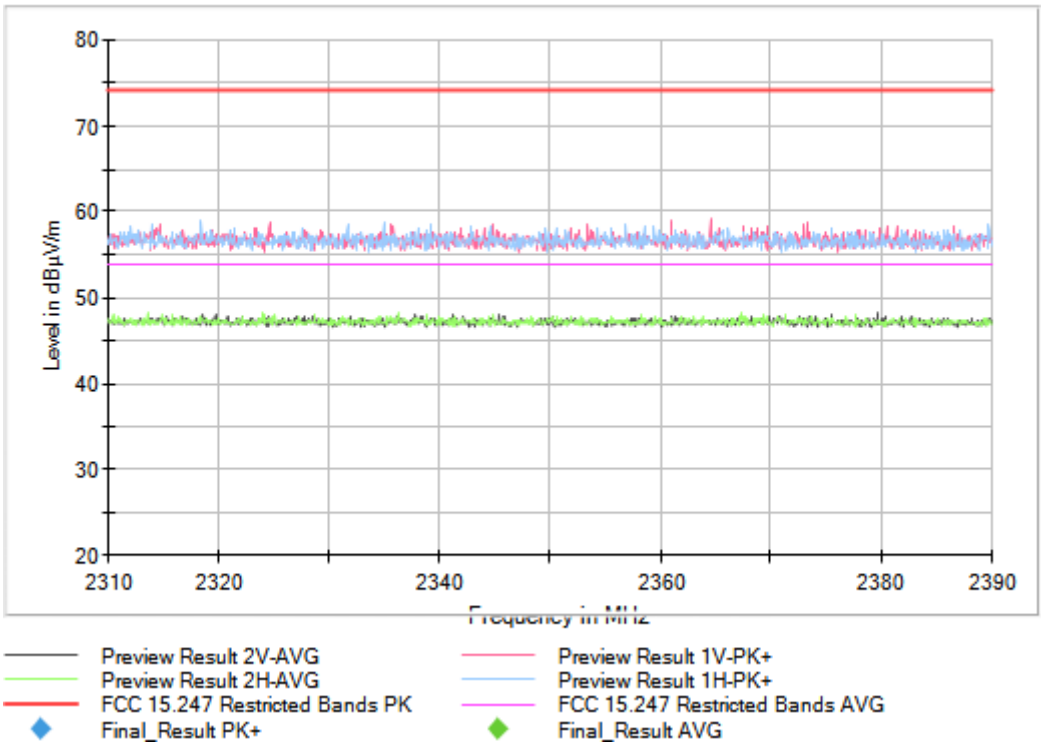
Modulation = BTLE (GFSK 1 Mbit/s) Frequency MHz = 2480.00000

MIMO Mode = SISO Active Port = 1

Images:



Full Spectrum



Tables:

Spectrum Analyzer Parameters

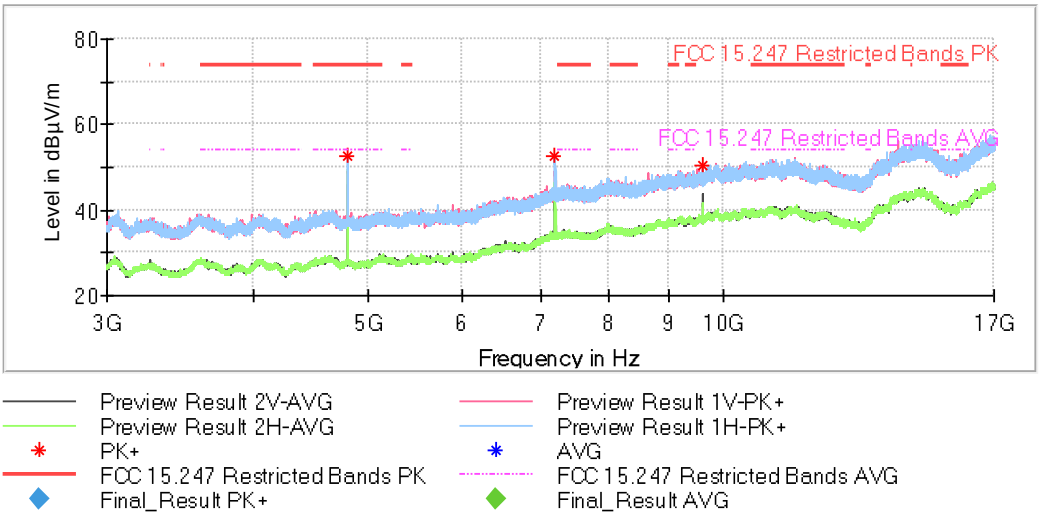
	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	1 GHz - 3 GHz	66,667 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Frequency Range GHz = [3, 17] Equipment Type = Digital Transmission System (DTS)

Modulation = BTLE (GFSK 1 Mbit/s) Frequency MHz = 2402.00000

MIMO Mode = SISO Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

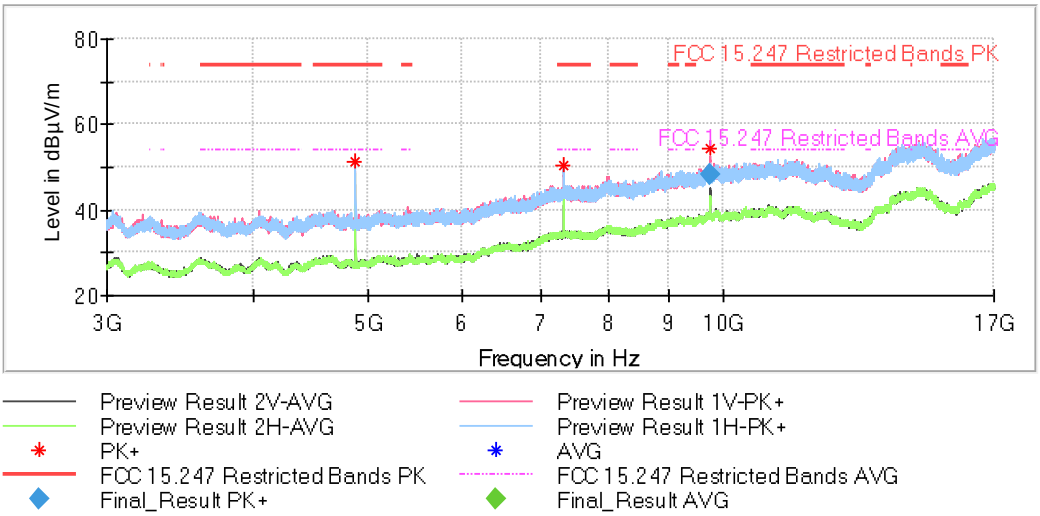
	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	3 GHz - 17 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Frequency Range GHz = [3, 17] Equipment Type = Digital Transmission System (DTS)

Modulation = BTLE (GFSK 1 Mbit/s) Frequency MHz = 2440.00000

MIMO Mode = SISO Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

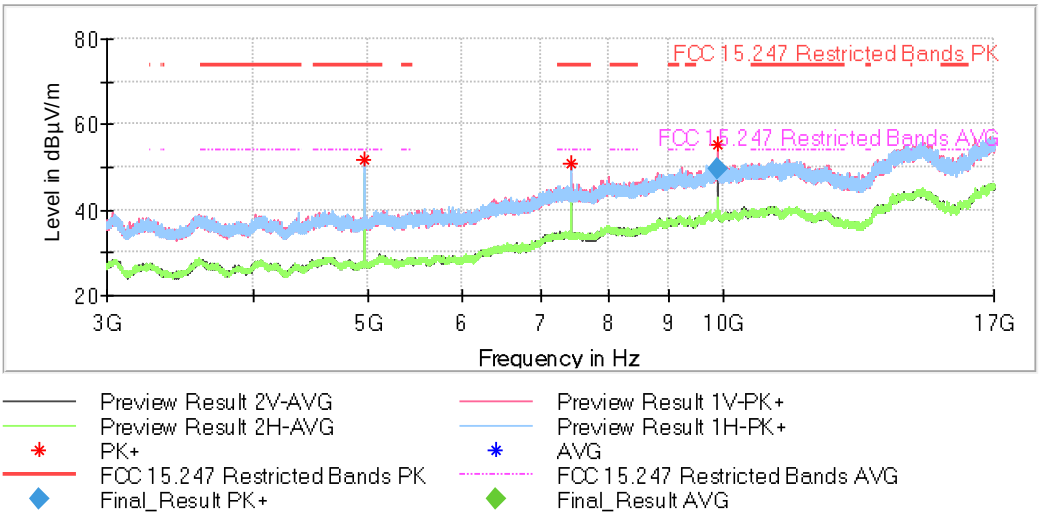
	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	3 GHz - 17 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Frequency Range GHz = [3, 17] Equipment Type = Digital Transmission System (DTS)

Modulation = BTLE (GFSK 1 Mbit/s) Frequency MHz = 2480.00000

MIMO Mode = SISO Active Port = 1

Images:



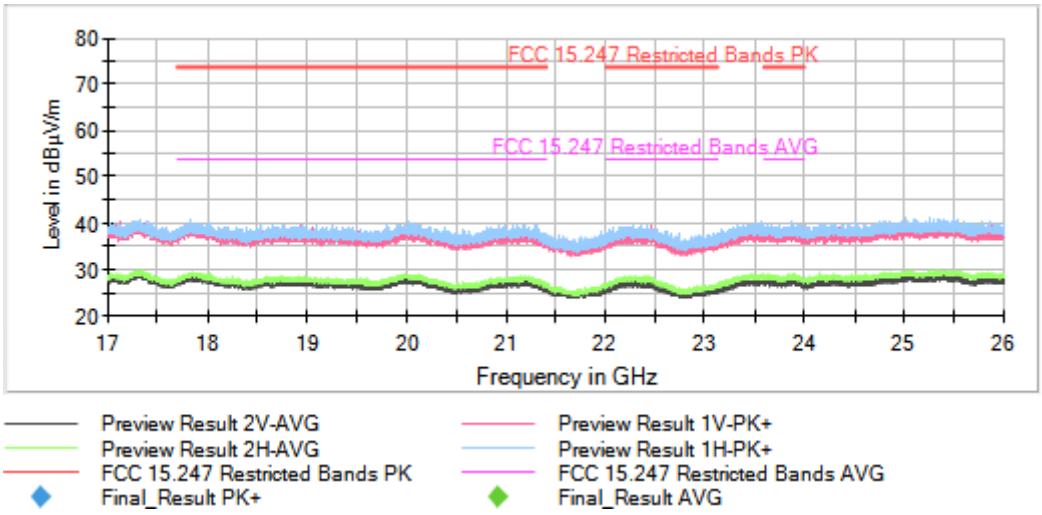
Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	3 GHz - 17 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Frequency Range GHz = [17, 26]	Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE (GFSK 1 Mbit/s)	Frequency MHz = The results obtained in the range 17GHz-26GHz do not depend on transmission channel
MIMO Mode = SISO	Active Port = 1

Images:



This plot is valid for all channels.

Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	17 GHz - 26 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Modulation: BTLE (GFSK 2 Mbit/s)

Results

Range 30MHz-1GHz

No spurious frequencies detected at less than 20dB below the limit.

Range 1GHz-3GHz

No spurious frequencies detected at less than 20dB below the limit.

Range 3GHz-17GHz

Freq Rng (GHz)	Freq (MHz)	Unwanted Freq (MHz)	Unwanted Lvl (dBµV/m)	Pol	Detector
[3, 17]	2402.00000	4805.000	52.38	H	PK
		7204.500 (*)	47.30	H	PK
		9605.500	45.56	V	PK
	2440.00000	4879.000	52.69	H	PK
		7318.500	50.03	H	PK
		9758.000 (**)	46.97	V	PK
	2480.00000	4959.000	51.45	H	PK
		7438.500	49.62	H	PK
		9922.000 (***)	47.99	V	PK

(*): 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 83.62 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 levels were measured with a RBW = 100 kHz and the measured radiated carrier level was 77.65 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 levels were measured with a RBW = 100 kHz and the measured radiated carrier level was 81.12 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).

Range 17GHz-26GHz

No spurious frequencies detected at less than 20dB below the limit.

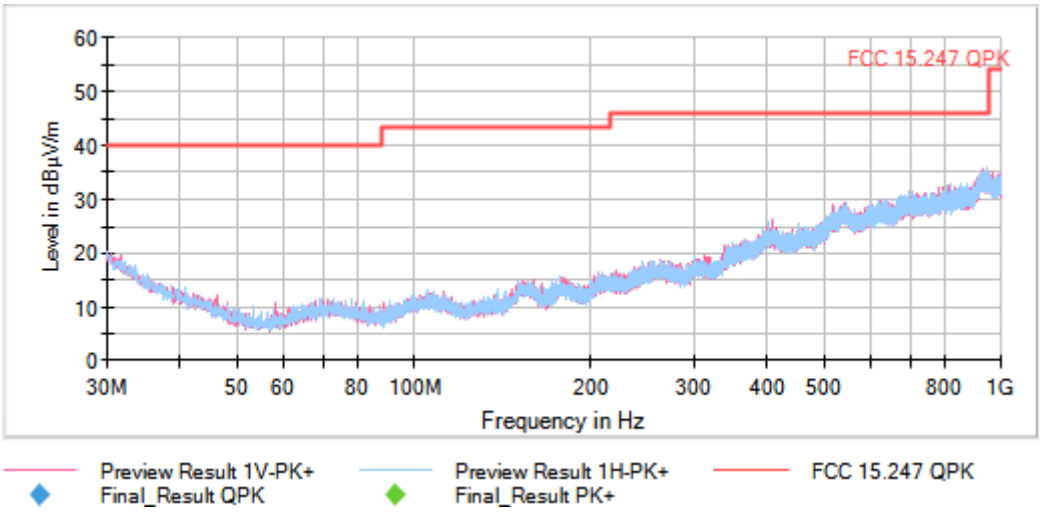
Verdict

Pass

Attachments

Frequency Range GHz = [0.03, 1]	Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE (GFSK 2 Mbit/s)	Frequency MHz = The results obtained in the range 30MHz-1GHz do not depend on transmission channel
MIMO Mode = SISO	Active Port = 1

Images:



This plot is valid for all channels.

Tables:
Spectrum Analyzer Parameters

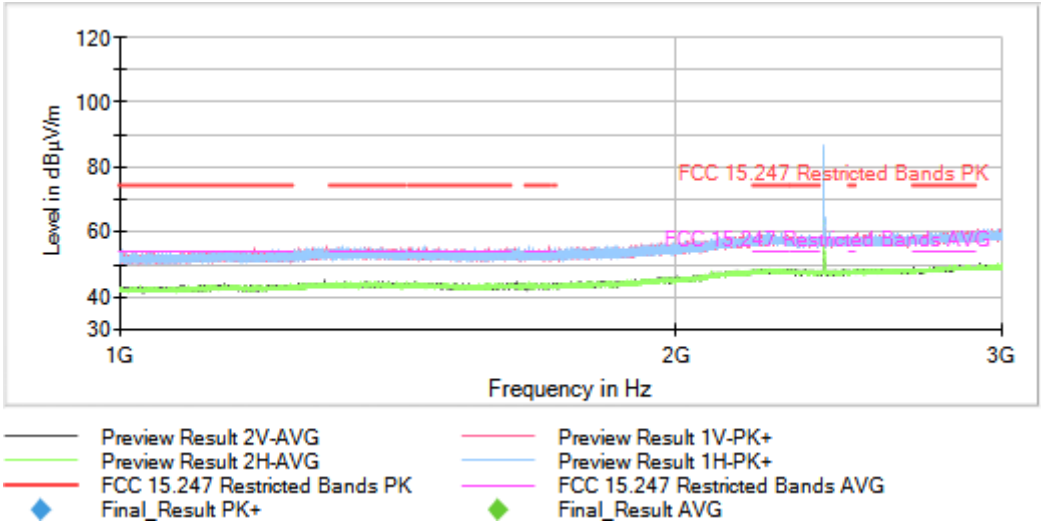
	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	30 MHz - 1 GHz	48,5 kHz	PK+	100 kHz	1 s	20 dB

Frequency Range GHz = [1, 3] Equipment Type = Digital Transmission System (DTS)

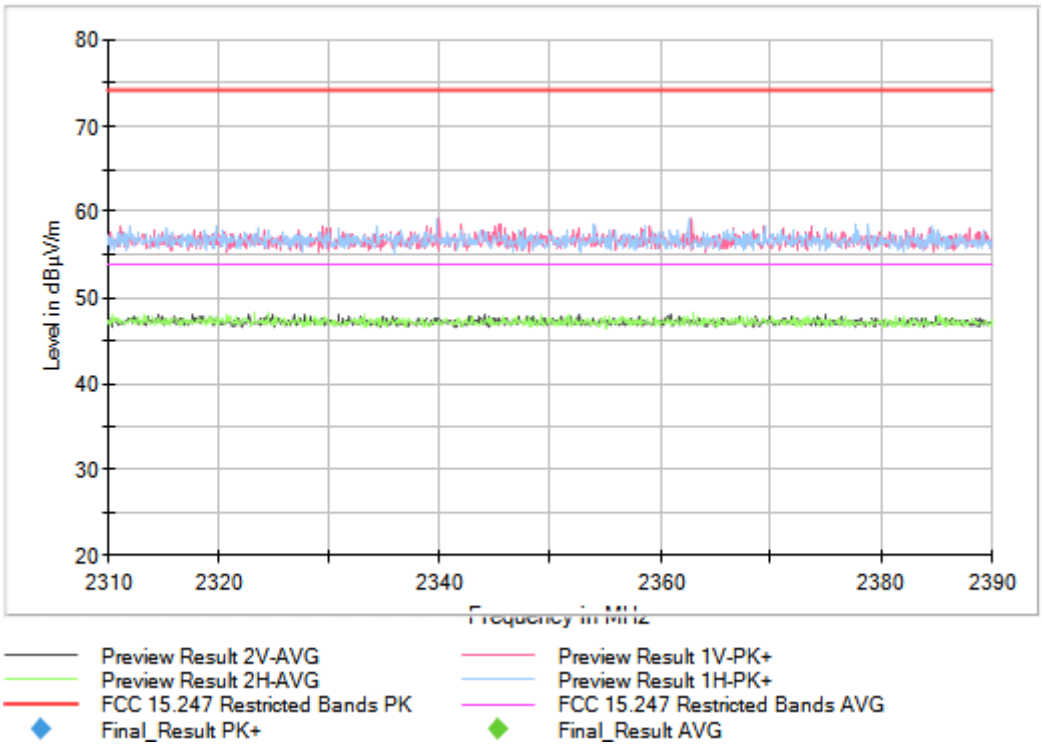
Modulation = BTLE (GFSK 2 Mbit/s) Frequency MHz = 2402.00000

MIMO Mode = SISO Active Port = 1

Images:



Full Spectrum



Tables:

Spectrum Analyzer Parameters

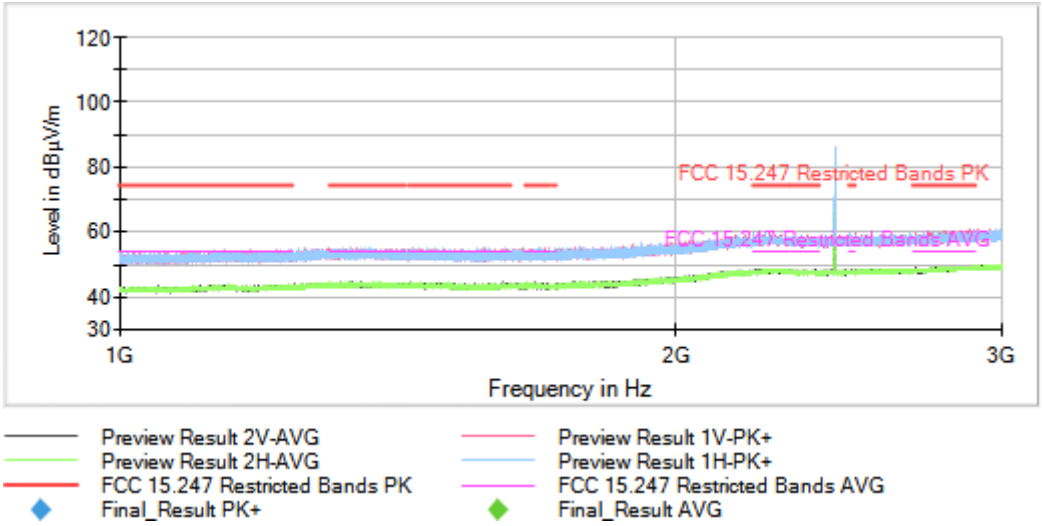
	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	1 GHz - 3 GHz	66,667 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Frequency Range GHz = [1, 3] Equipment Type = Digital Transmission System (DTS)

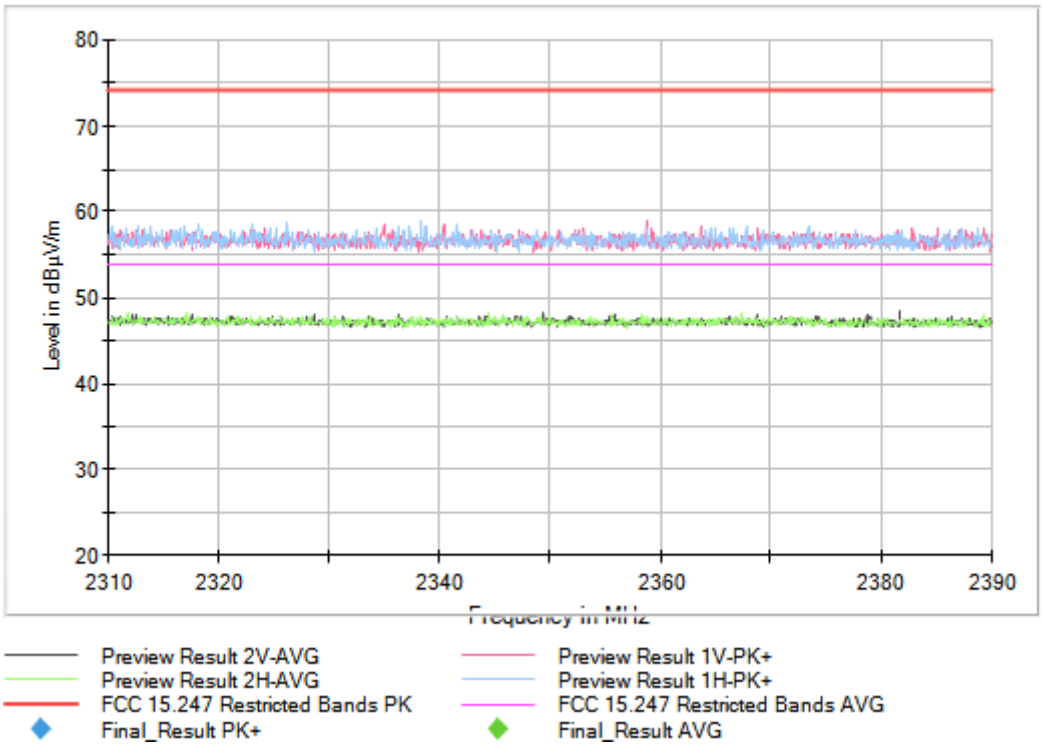
Modulation = BTLE (GFSK 2 Mbit/s) Frequency MHz = 2440.00000

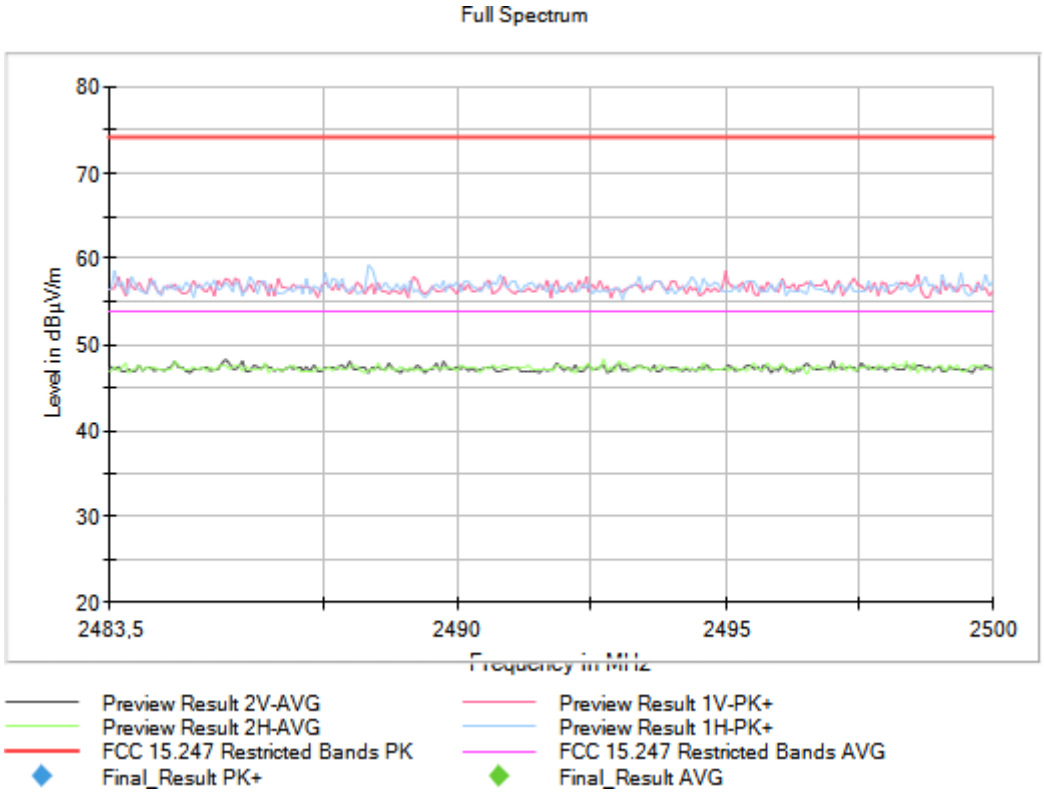
MIMO Mode = SISO Active Port = 1

Images:



Full Spectrum





Tables:

Spectrum Analyzer Parameters

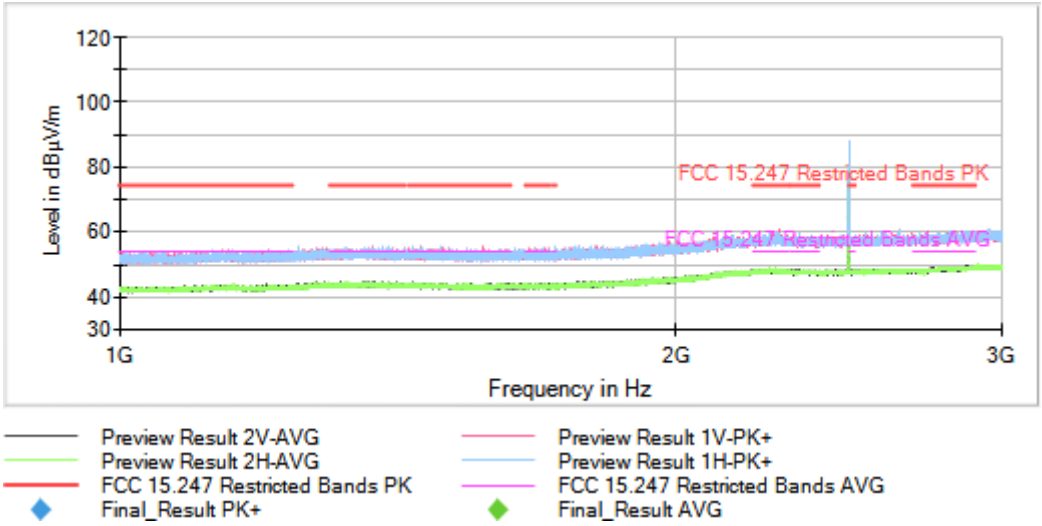
	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	1 GHz - 3 GHz	66,667 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Frequency Range GHz = [1, 3] Equipment Type = Digital Transmission System (DTS)

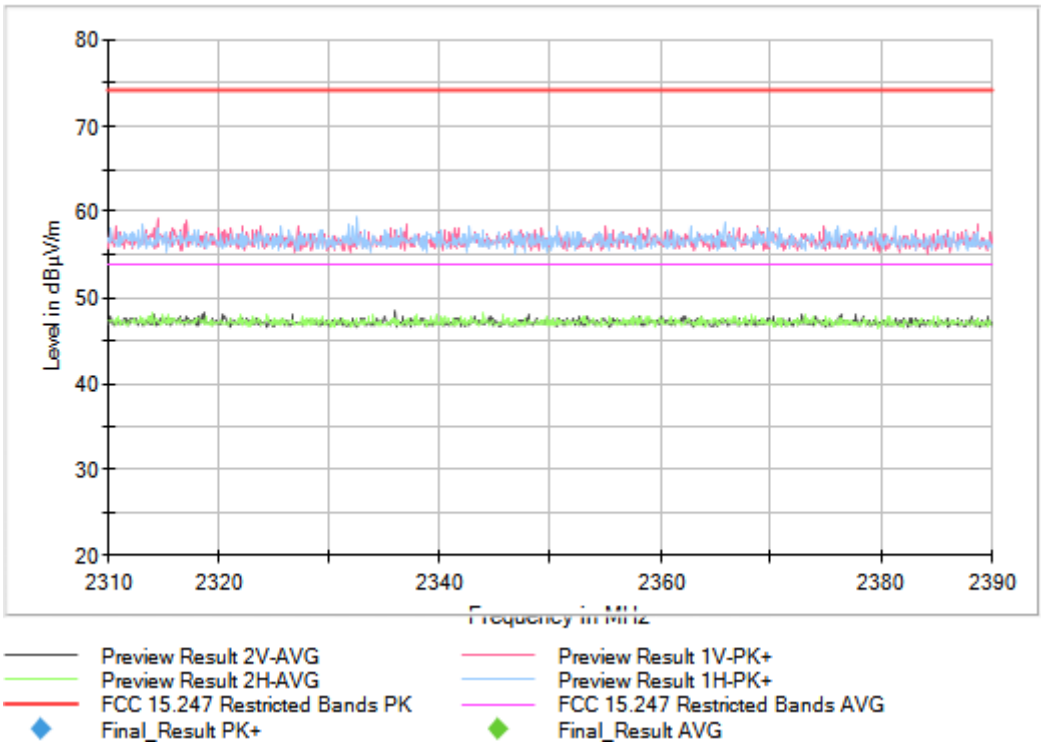
Modulation = BTLE (GFSK 2 Mbit/s) Frequency MHz = 2480.00000

MIMO Mode = SISO Active Port = 1

Images:



Full Spectrum



Tables:

Spectrum Analyzer Parameters

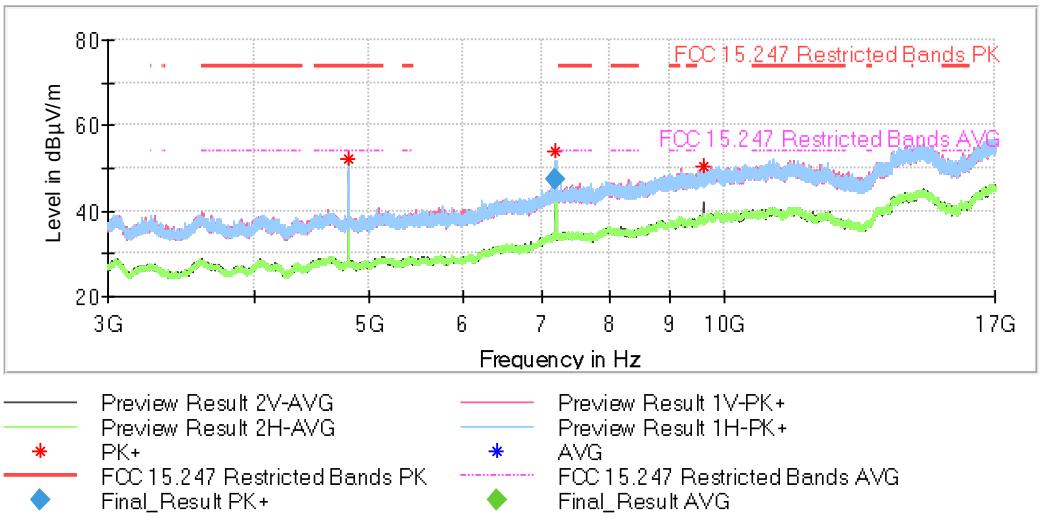
	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	1 GHz - 3 GHz	66,667 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Frequency Range GHz = [3, 17] Equipment Type = Digital Transmission System (DTS)

Modulation = BTLE (GFSK 2 Mbit/s) Frequency MHz = 2402.00000

MIMO Mode = SISO Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

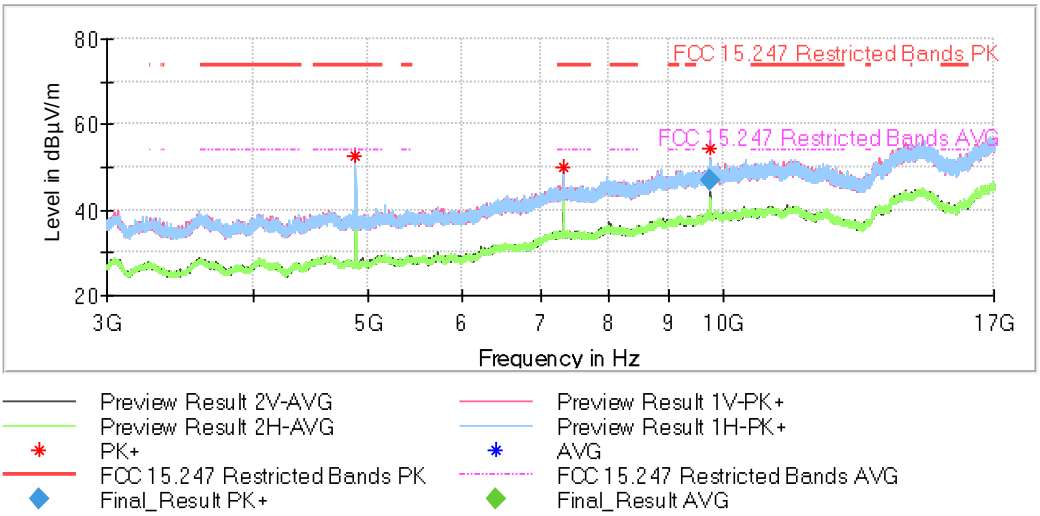
	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	3 GHz - 17 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Frequency Range GHz = [3, 17] Equipment Type = Digital Transmission System (DTS)

Modulation = BTLE (GFSK 2 Mbit/s) Frequency MHz = 2440.00000

MIMO Mode = SISO Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

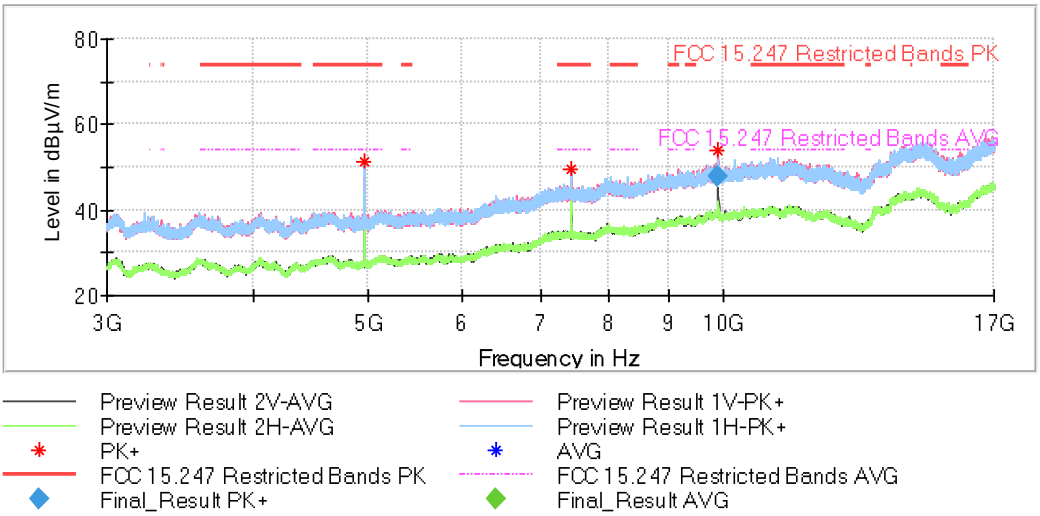
	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	3 GHz - 17 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Frequency Range GHz = [3, 17] Equipment Type = Digital Transmission System (DTS)

Modulation = BTLE (GFSK 2 Mbit/s) Frequency MHz = 2480.00000

MIMO Mode = SISO Active Port = 1

Images:



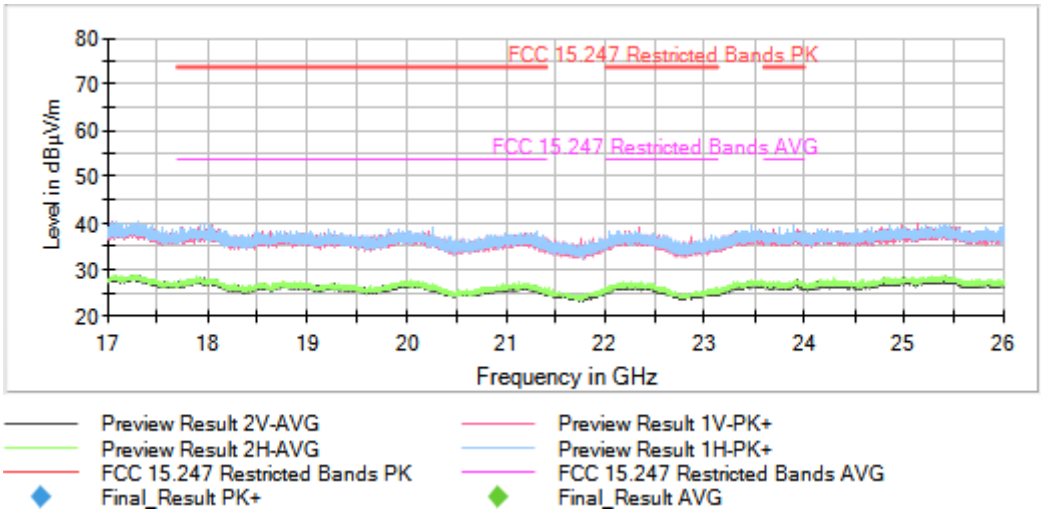
Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	3 GHz - 17 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Frequency Range GHz = [17, 26]	Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE (GFSK 2 Mbit/s)	Frequency MHz = The results obtained in the range 17GHz-26GHz do not depend on transmission channel
MIMO Mode = SISO	Active Port = 1

Images:



This plot is valid for all channels.

Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	17 GHz - 26 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s	0 dB