DEKRA Testing and Certification, S.A.U.
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C.I.F. A29507456

ISED CABid: ES1909
Lab. Company Number: 4621A

Test Report No:
75154RRF.002A1

Test Report

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

(*) Identification of item tested	BLE supporting sensor node in the form of a wearable design
(*) Trademark	Bosch
(*) Model and /or type reference	SCS Wearable Design
Other identification of the product	FCC ID: 2AO4I-SCS1 IC: 26413-SCS1
(*) Features	Bluetooth LE 5.3, no version specific features used HW version: 1.0 SW version: 1.0
Applicant	Bosch Sensortec GmbH Gerhard-Kindler-Straße 9, 72127 Reutlingen, Germany
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 2 (February 2017). 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)	Antonio José Jurado Industrial & Automotive Lab. Manager 80157242B ANTONIO JOSE JURADO (C:A29507456) Firmado digitalmente por 80157242B ANTONIO JOSE JURADO (C:A29507456) Fecha: 2023.12.26 14:29:45 +01'00'
Date of issue	2023-12-26
Report template No	FDT08_24 (*) "Data provided by the client"

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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	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.

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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 BLE supporting sensor node in the form of a wearable design. The product is used as one of multiple sensor nodes in a sensor network used for activity recognition and providing sensor data to customers of consumer electronics. The node consists of a PCB with the following functional components: A microcontroller with RF functionality + antenna for Bluetooth low energy communication, 1x BHI380 (Smart sensor IMU), 1x BMP581 (pressure sensor),1 x BMM350 (magnetometer), 1x external Flash memory for storing sensor and algorithm data, 1x Power management IC for controlling voltage domains and charging the LiPo battery and a USB C port for charging and data transfer. The node communicates with other nodes and to a host device via BLE.

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	75154B/001	BLE supporting sensor node in the form of a wearable design (radiated)	SCS Wearable Design	-	2023-09-20	Element Under Test
S/02	75154B/004	BLE supporting sensor node in the form of a wearable design (conducted)	SCS Wearable Design	-	2023-09-20	Element Under Test
S/01, S/02	75154B/005	Converter FTDI Chip USB RS485	-	-	2023-09-20	Auxiliary Element

Notes referenced to samples during the project:

Id	Type
S/01	Samples used for radiated testing.
S/02	Samples used for conducted testing.

Test sample description

Ports…… :	Port name and description	Cable			
		Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)
	.....	.....	[ ]	[ ]	[ ]
Supplementary information to the ports…… :	.....				

Rated power supply .....:	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	[ ]	AC:	[ ]	[ ]	[ ]	[ ]	[ ]
	[X]	DC: 3.7V battery					
	[X]	DC: 5V USB VBus					

Rated Power .....:	< 1W	
Clock frequencies.....:	32 MHz (64 MHz), 32.678 kHz	
Other parameters .....:	.....	
Software version .....:	1.0	
Hardware version .....:	1.0	
Dimensions in cm (W x H x D) ....:	.....	
Mounting position .....:	[ ]	Table top equipment
	[ ]	Wall/Ceiling mounted equipment
	[ ]	Floor standing equipment
	[ ]	Hand-held equipment
	[X]	Other: Wearable

Modules/parts.....:	Module/parts of test item	Type	Manufacturer
	.....	.....	.....
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

deveritec GmbH
Bamberger Straße 1 01187 Dresden / Germany

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2023-09-26
Date (finish)	2023-10-18

Document history

Report number	Date	Description
75154RRF.002	2023-11-07	First release.
75154RRF.002A1	2023-12-26	Second release. Modification due to missing information. This modification test report cancels and replaces the test report with NIE: 75154RRF.002

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: Fernando Chito Solis, Ireneo Bibang Bacale and Pablo Redondo Reyes.

Used instrumentation:

Control No.	Equipment	Model	Manufacturer	Next Calibration
6791	SEMIANECHOIC ABSORBER LINED CHAMBER IV	FACT 3 200 STP	ETS LINDGREN	--
6792	SHIELDED ROOM	S101	ETS LINDGREN	--
6143	HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	ETS LINDGREN	2023-10-29
6144	PRE-AMPLIFIER G>40dB 10MHz-6GHz	BLNA 0160-01N	BONN ELEKTRONIK	2024-07-25
4611	HORN ANTENNA 1-18GHz	BBHA 9120 D	SCHWARZBECK	2026-01-16
3783	PRE-AMPLIFIER G>30dB 1GHz-18GHz	BLMA 0118-3A	BONN ELEKTRONIK	2023-12-29
7817	EMI TEST RECEIVER 2Hz-44GHz	ESW44	ROHDE AND SCHWARZ	2023-12-30
7760	DIGITAL MULTIMETER	175	FLUKE	2023-11-14
4848	SOFTWARE FOR EMC/RF TESTING	EMC32	ROHDE AND SCHWARZ	--
6793	SHIELDED ROOM	S101	ETS LINDGREN	--
7796	EXTENSION FOR OPEN SWITCH UNIT UP TO 40GHz	OSP-B157Wx	ROHDE AND SCHWARZ	2024-03-16
8848	OPEN SWITCH UNIT UP TO 7.5 GHz	OSP-B157W8 PLUS	ROHDE & SCHWARZ	2024-12-21
0922	POWER SUPPLY DC 40 V / 40 A	NGPE 40/40	ROHDE AND SCHWARZ	--
5850	DIGITAL MULTIMETER	179	FLUKE	2023-11-02
7794	SIGNAL AND SPECTRUM ANALYZER 10Hz-40GHz	FSV40	ROHDE AND SCHWARZ	2025-04-21
6668	SIGNAL AND SPECTRUM ANALYZER 10Hz-40GHz	FSV40	ROHDE AND SCHWARZ	2024-12-14
7798	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 5.3 (2M, 1M).

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 5.3 (2M, 1M)

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TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal:	3.7 Vdc
Type of Power Supply:	Battery

ANTENNA (*):

Type of Antenna:	Integral Antenna (SMD)
Maximum Declared Antenna Gain:	+1.7 dBi

TEST FREQUENCIES (*):

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

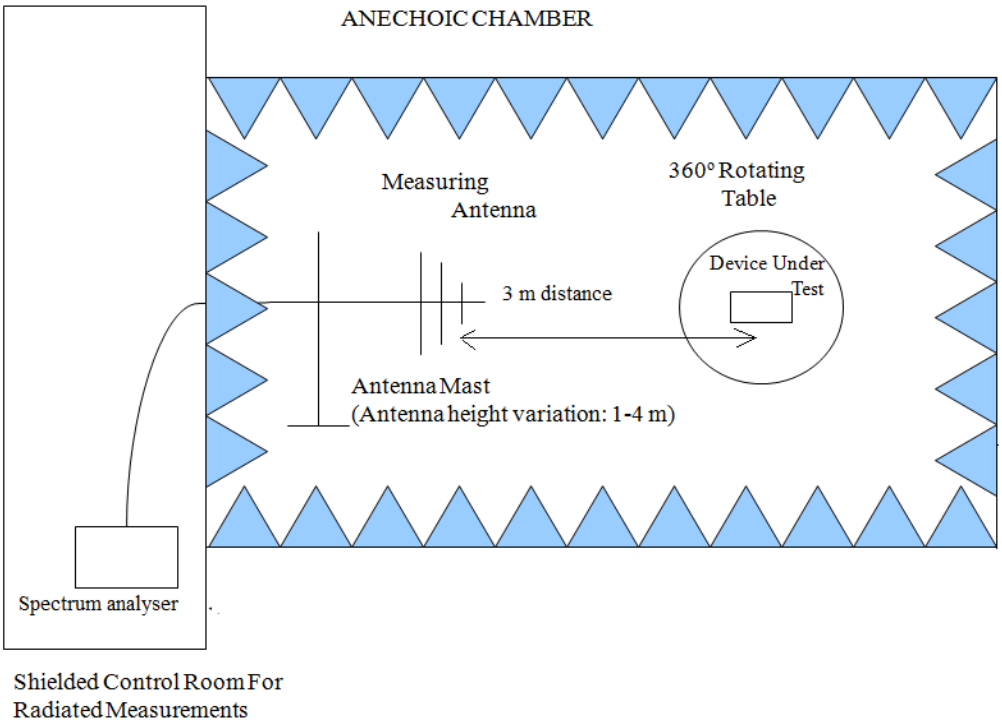
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

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.

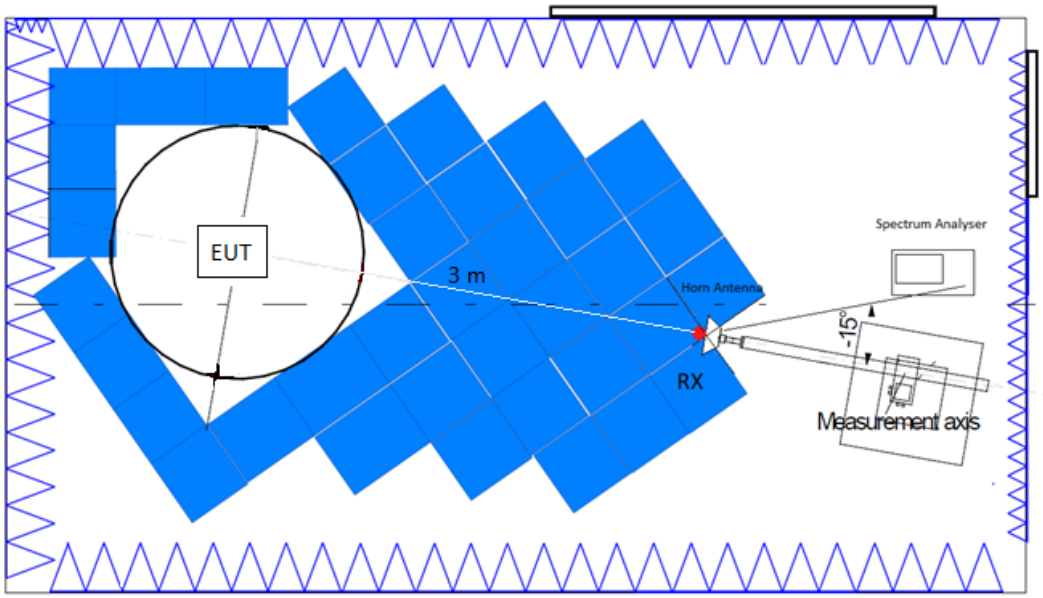
Measurements were made in both horizontal and vertical planes of polarization.

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.

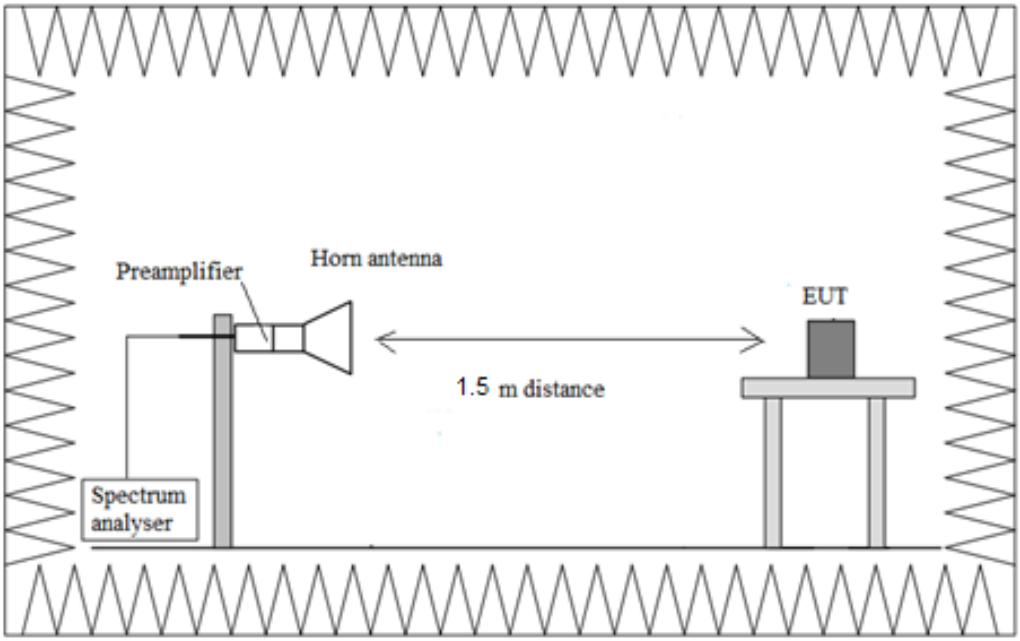
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup f > 17 GHz:



TEST CASES DETAILS

Occupied Channel Bandwidth 99%

Modulation: BTLE 5.3 (GFSK 1 Mbit/s)

Mode: SISO

Results

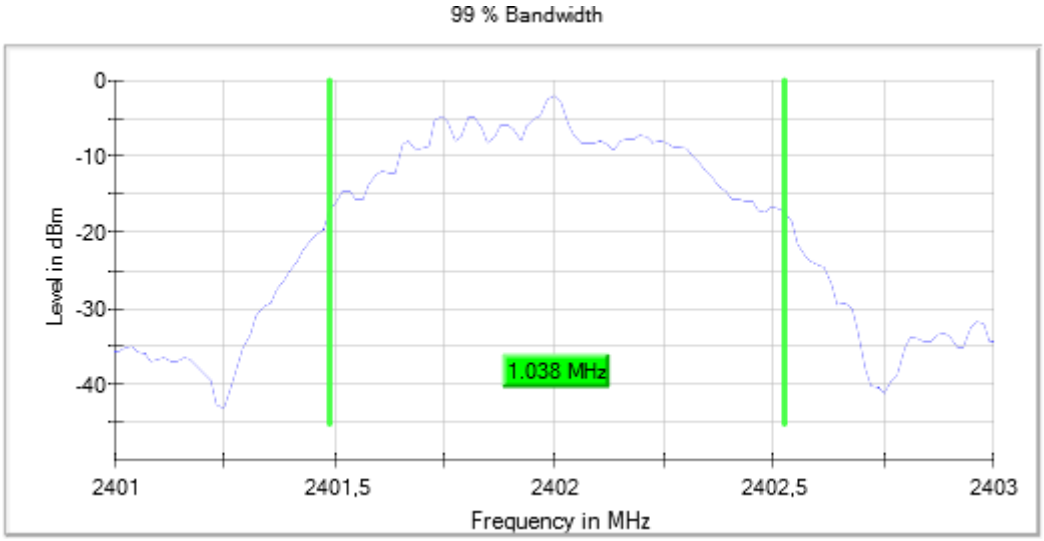
Equipment	BW (MHz)	Freq (MHz)	Port	Occ Ch BW (MHz)
Digital Transmission System (DTS)	1	2402.00	1	1.038
		2440.00		1.053
		2480.00		1.038

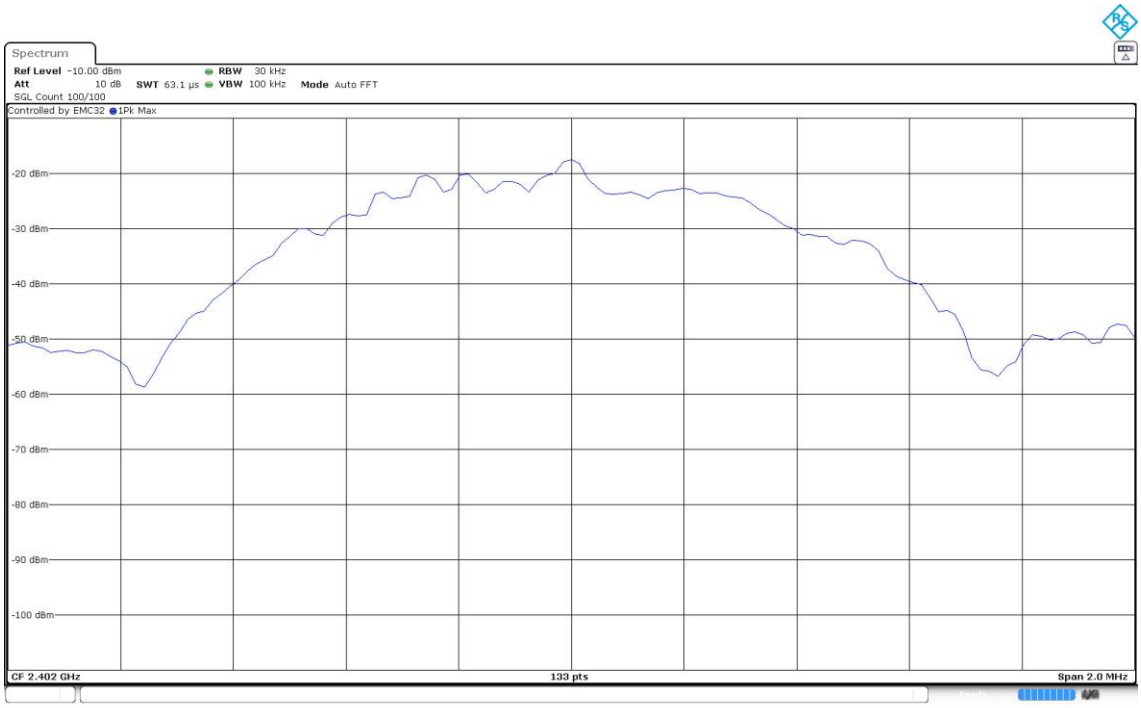
Attachments

Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Mode = SISO

Bandwidth MHz = 1
Frequency MHz = 2402.00000
Active Port = 1

Images:

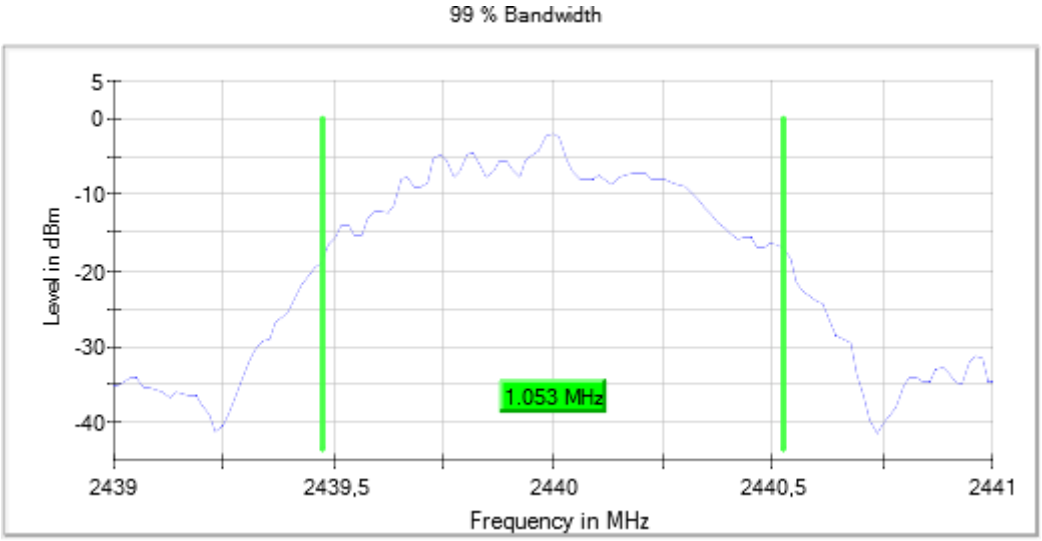


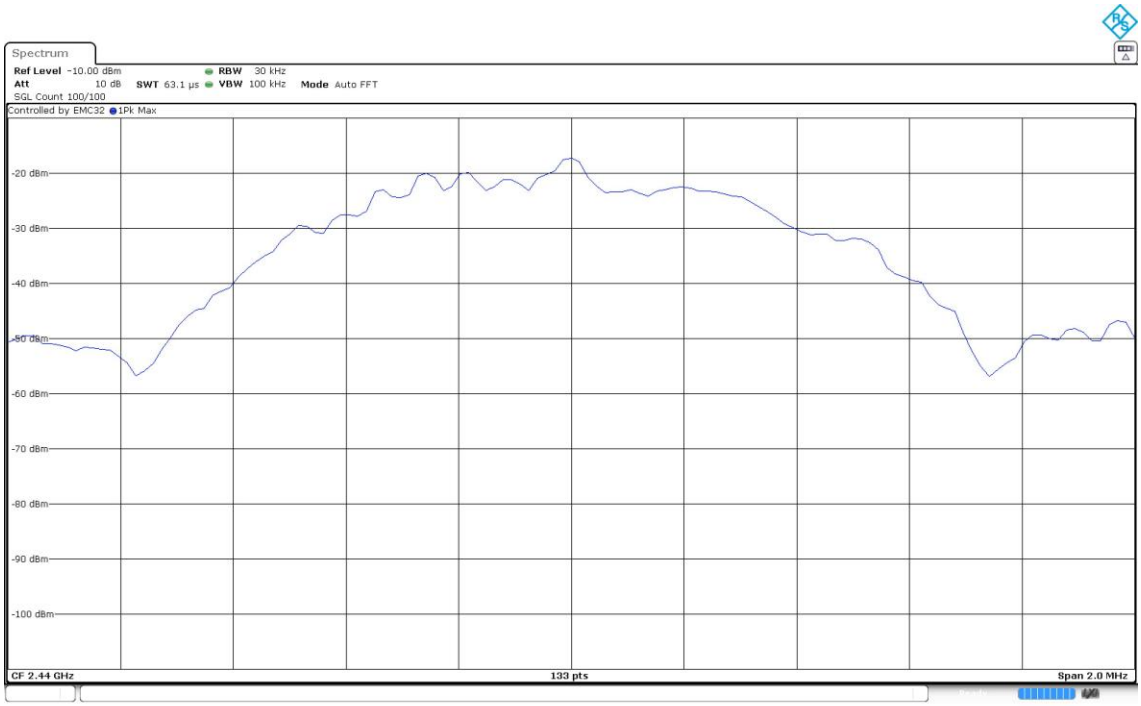


Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Mode = SISO

Bandwidth MHz = 1
Frequency MHz = 2440.00000
Active Port = 1

Images:

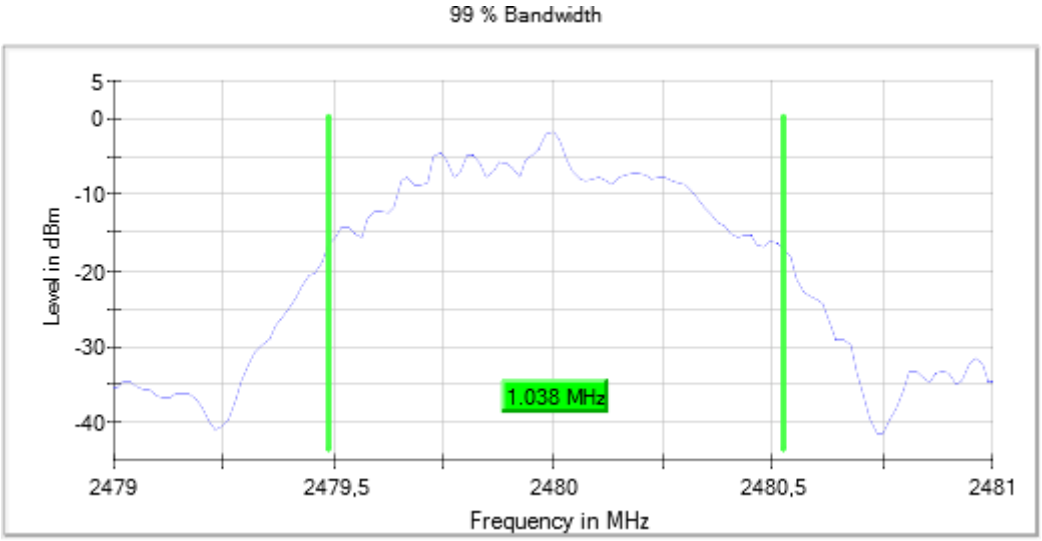


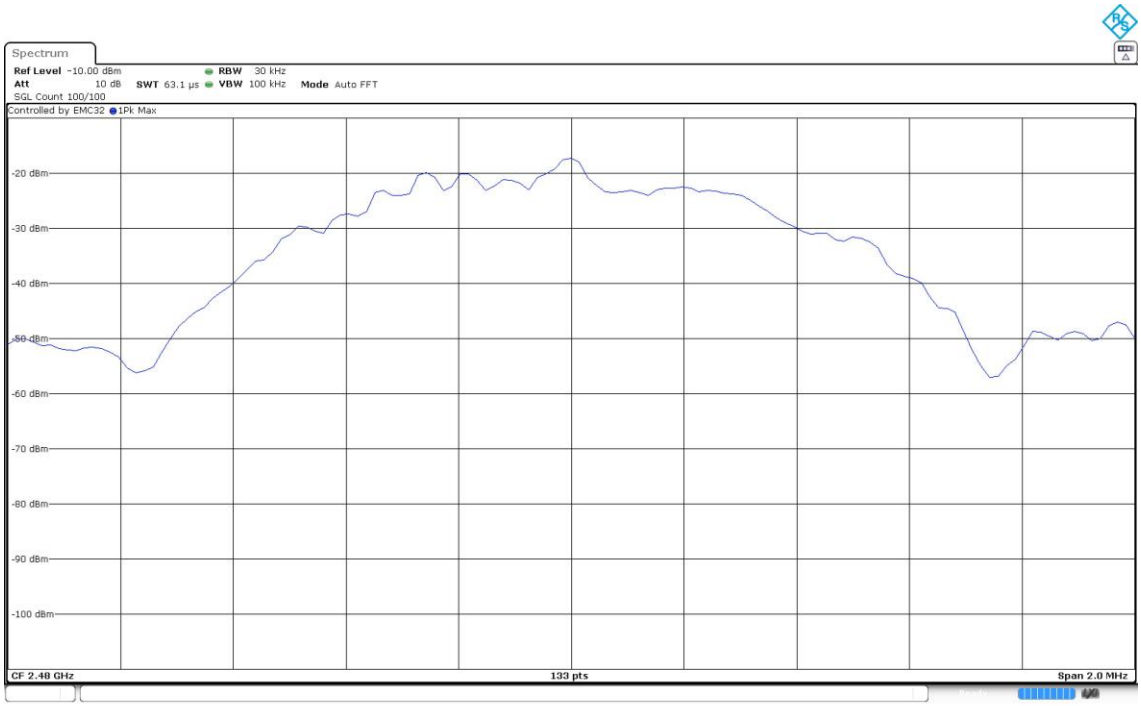


Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Mode = SISO

Bandwidth MHz = 1
Frequency MHz = 2480.00000
Active Port = 1

Images:





Modulation: BTLE 5.3 (GFSK 2 Mbit/s)

Mode: SISO

Results

Equipment	BW (MHz)	Freq (MHz)	Port	Occ Ch BW (MHz)
Digital Transmission System (DTS)	2	2402.00	1	2.139
		2440.00		2.139
		2480.00		2.139

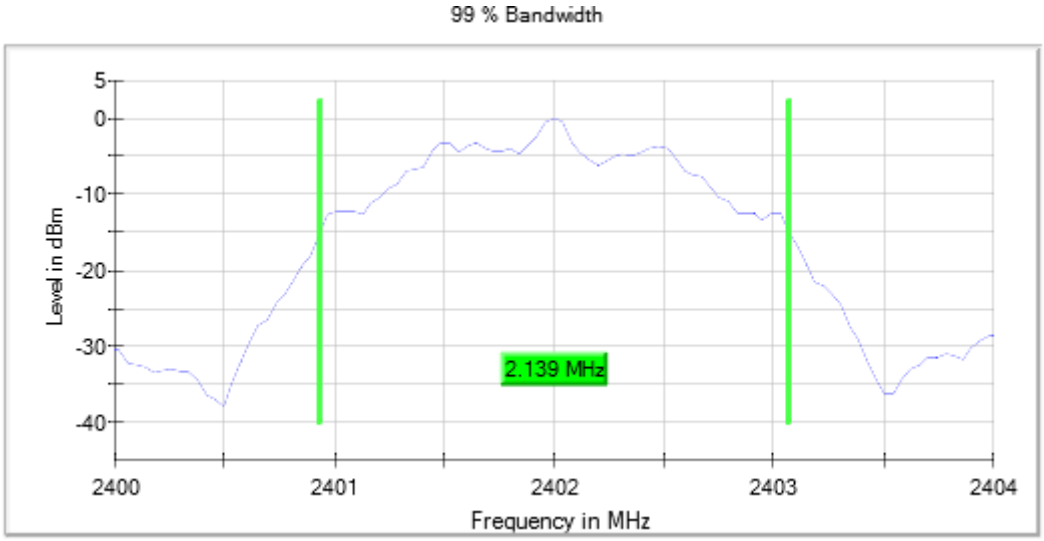
Attachments

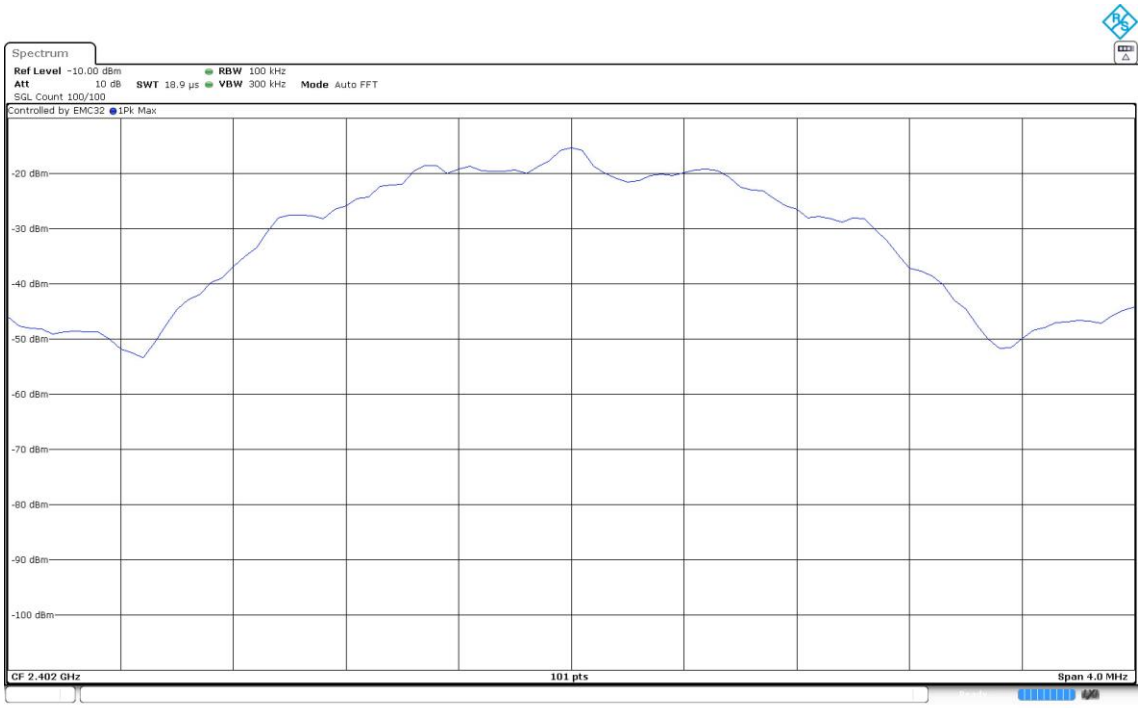
Equipment Type = Digital Transmission System (DTS) Bandwidth MHz = 2

Modulation = BTLE 5.3 (GFSK 2 Mbit/s) Frequency MHz = 2402.00000

Mode = SISO Active Port = 1

Images:

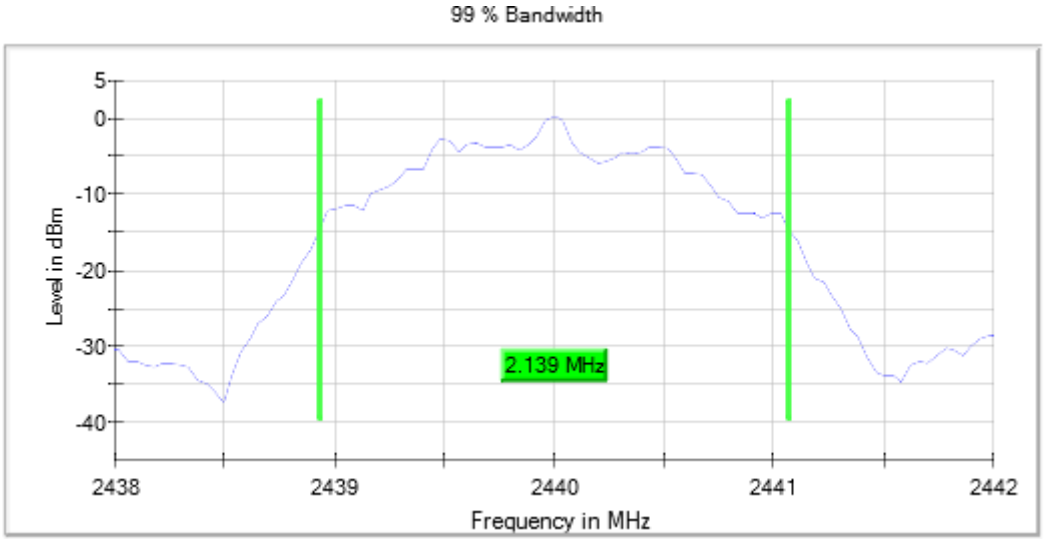


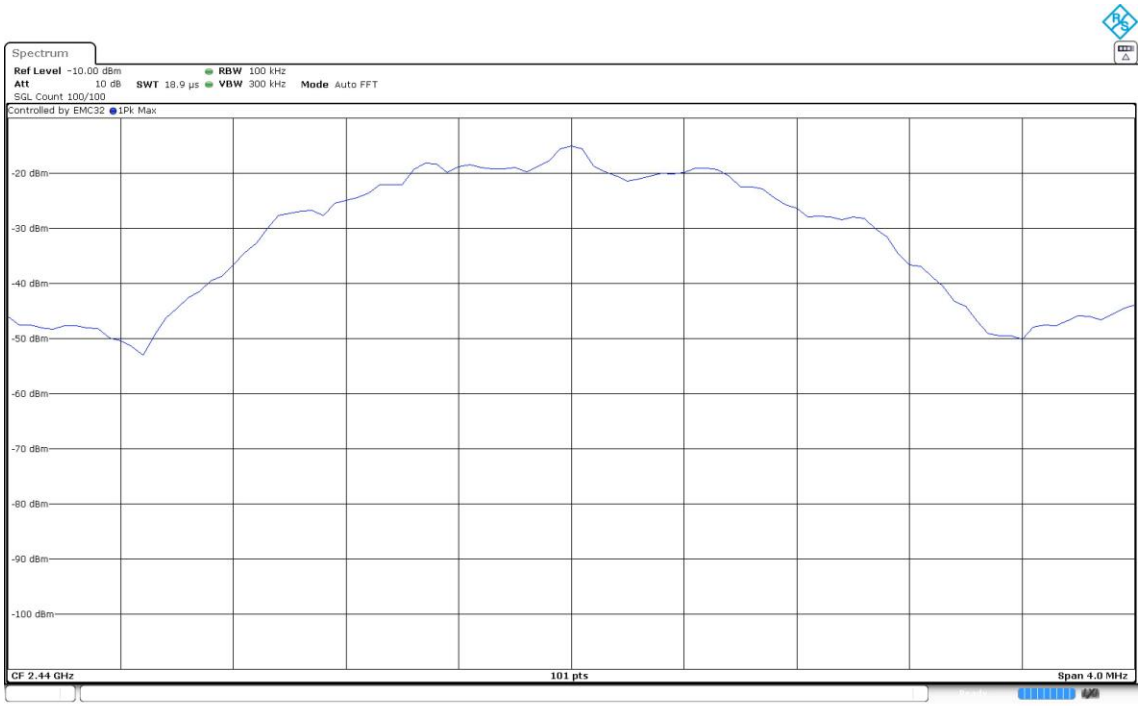


Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 2 Mbit/s)
Mode = SISO

Bandwidth MHz = 2
Frequency MHz = 2440.00000
Active Port = 1

Images:

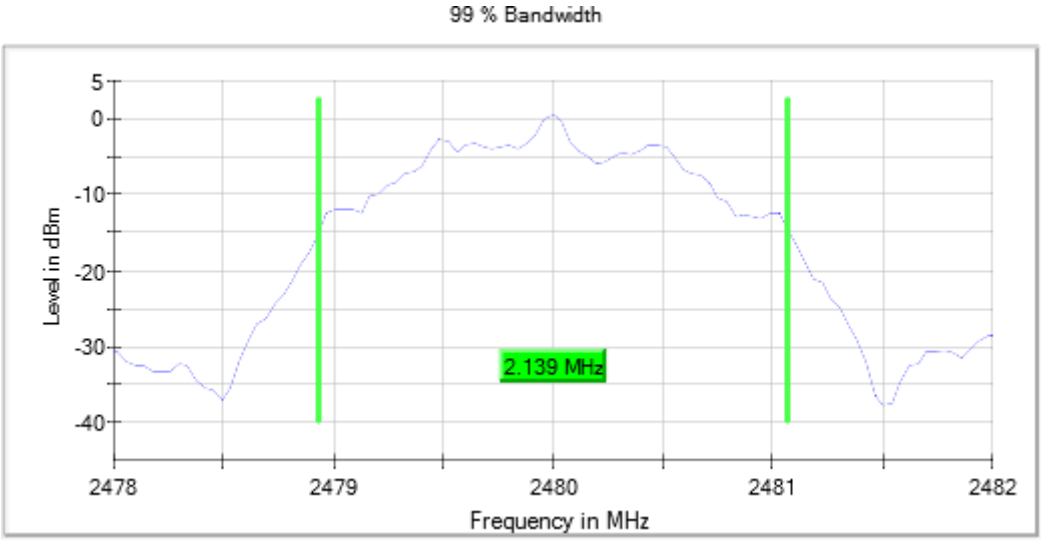


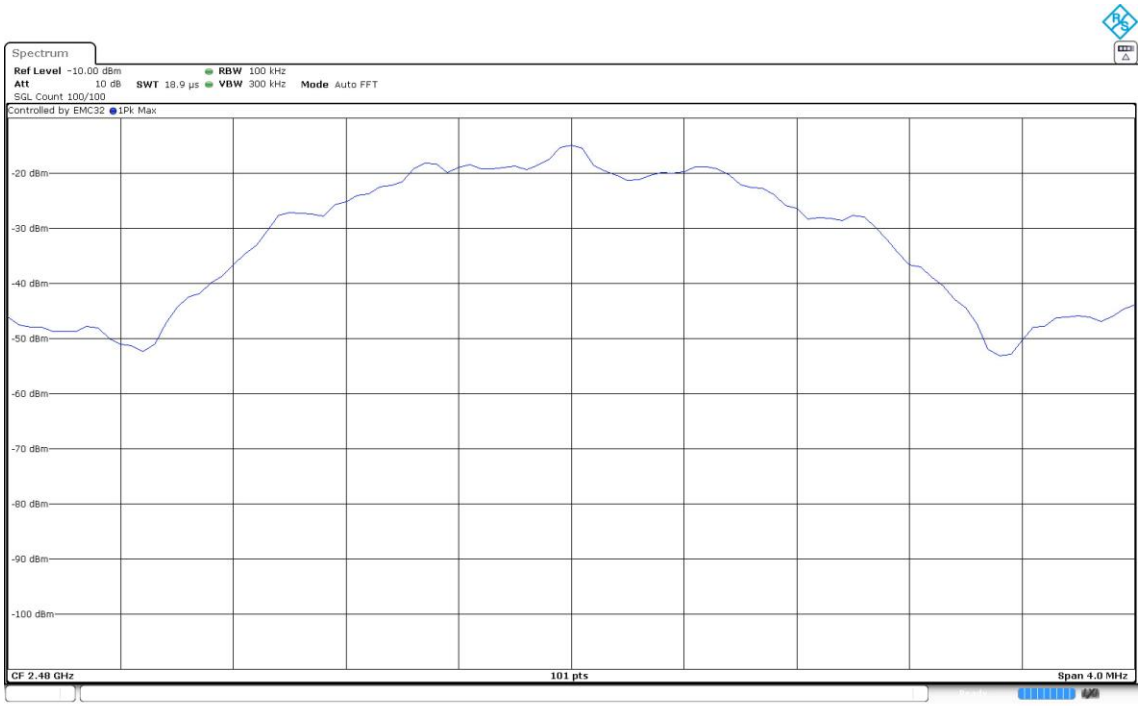


Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 2 Mbit/s)
Mode = SISO

Bandwidth MHz = 2
Frequency MHz = 2480.00000
Active Port = 1

Images:





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

Limits

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

Modulation: BTLE 5.3 (GFSK 1 Mbit/s)

Mode: SISO

Results

BW (MHz)	Freq (MHz)	Port	Ebw (MHz)
1	2402.00	1	0.693
	2440.00		0.713
	2480.00		0.693

Verdict

Pass

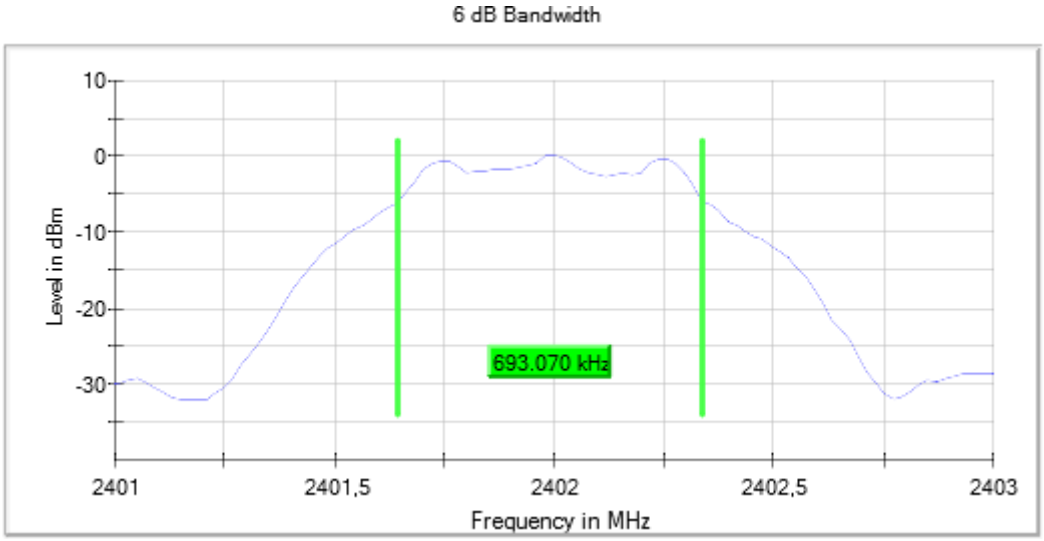
Attachments

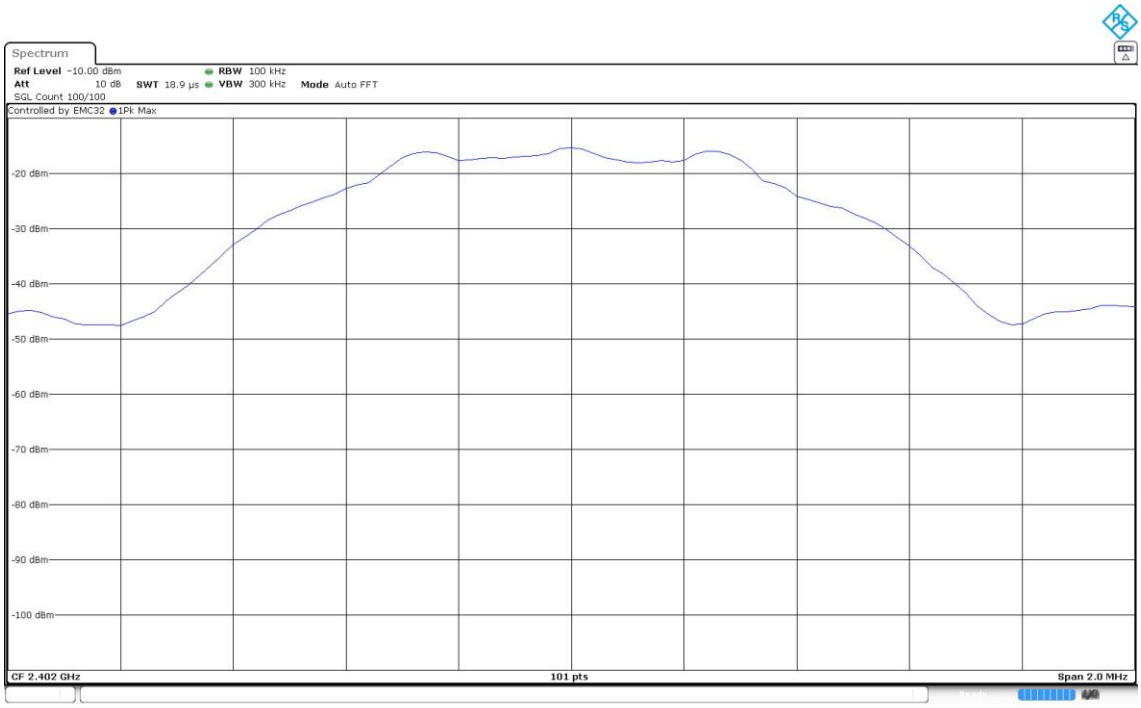
Bandwidth MHz = 1 Modulation = BTLE 5.3 (GFSK 1 Mbit/s)

Frequency MHz = 2402.00000 Mode = SISO

Active Port = 1

Images:



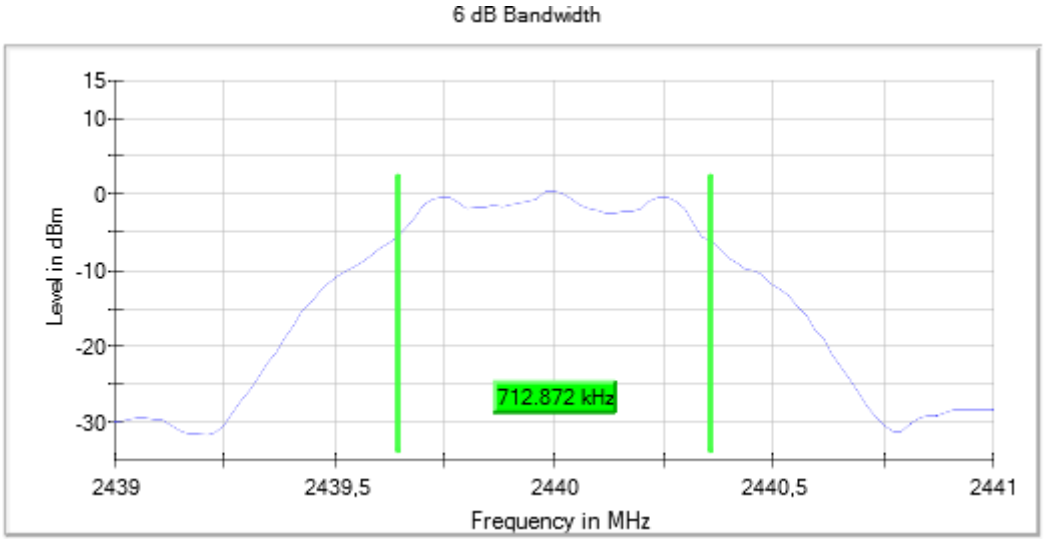


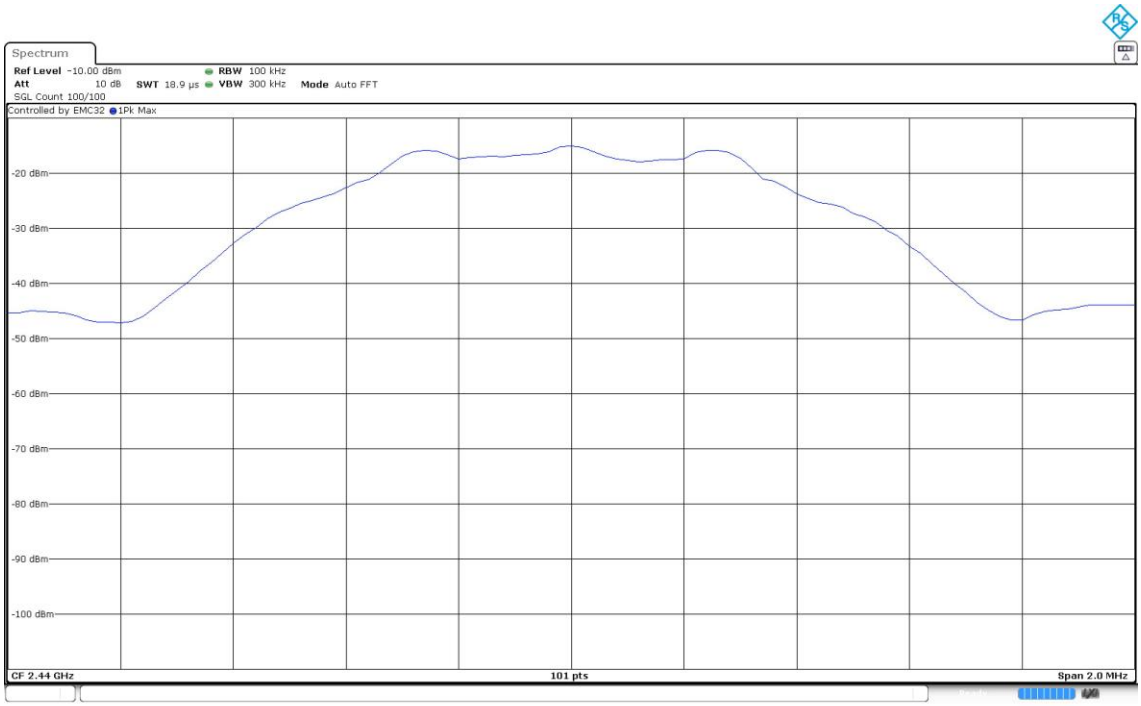
Bandwidth MHz = 1 Modulation = BTLE 5.3 (GFSK 1 Mbit/s)

Frequency MHz = 2440.00000 Mode = SISO

Active Port = 1

Images:



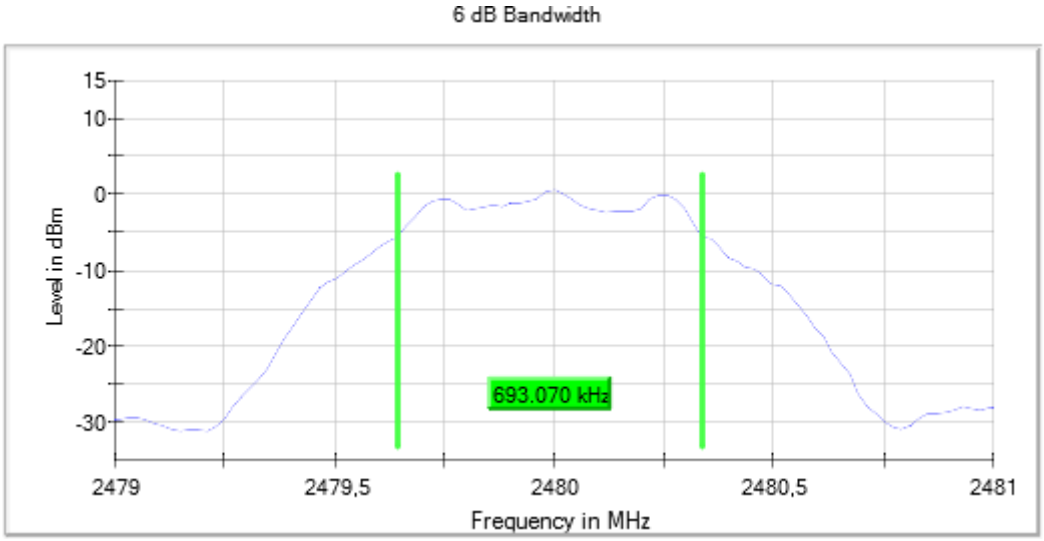


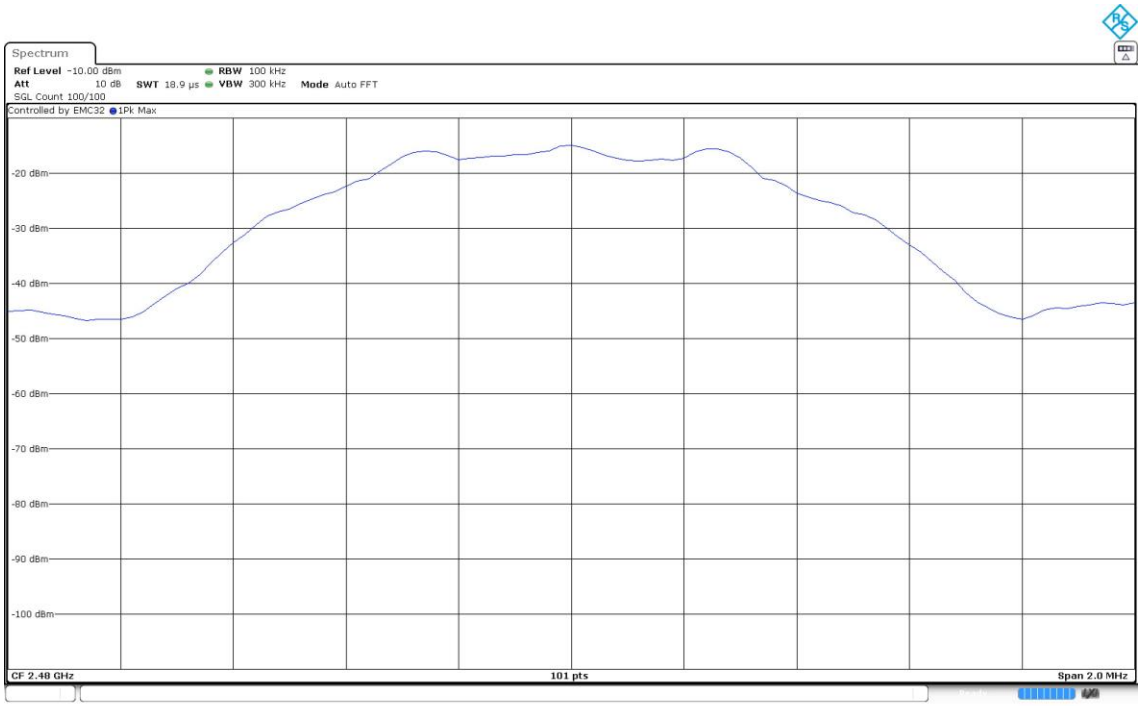
Bandwidth MHz = 1 Modulation = BTLE 5.3 (GFSK 1 Mbit/s)

Frequency MHz = 2480.00000 Mode = SISO

Active Port = 1

Images:





Modulation: BTLE 5.3 (GFSK 2 Mbit/s)

Mode: SISO

Results

BW (MHz)	Freq (MHz)	Port	Ebw (MHz)
2	2402.00	1	1.188
	2440.00		1.188
	2480.00		1.188

Verdict

Pass

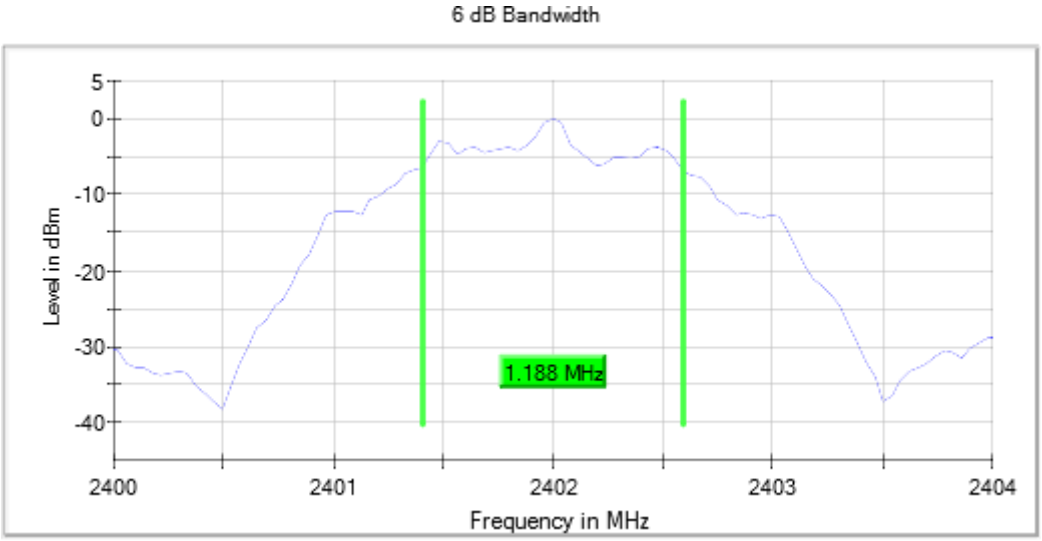
Attachments

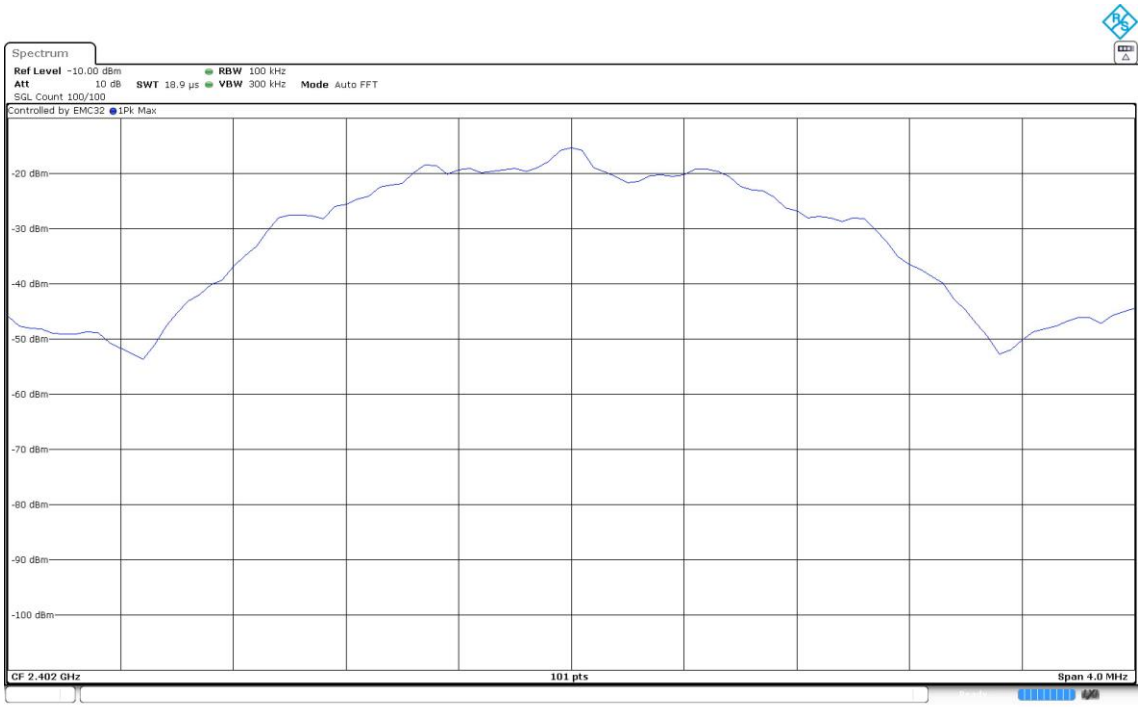
Bandwidth MHz = 2 Modulation = BTLE 5.3 (GFSK 2 Mbit/s)

Frequency MHz = 2402.00000 Mode = SISO

Active Port = 1

Images:



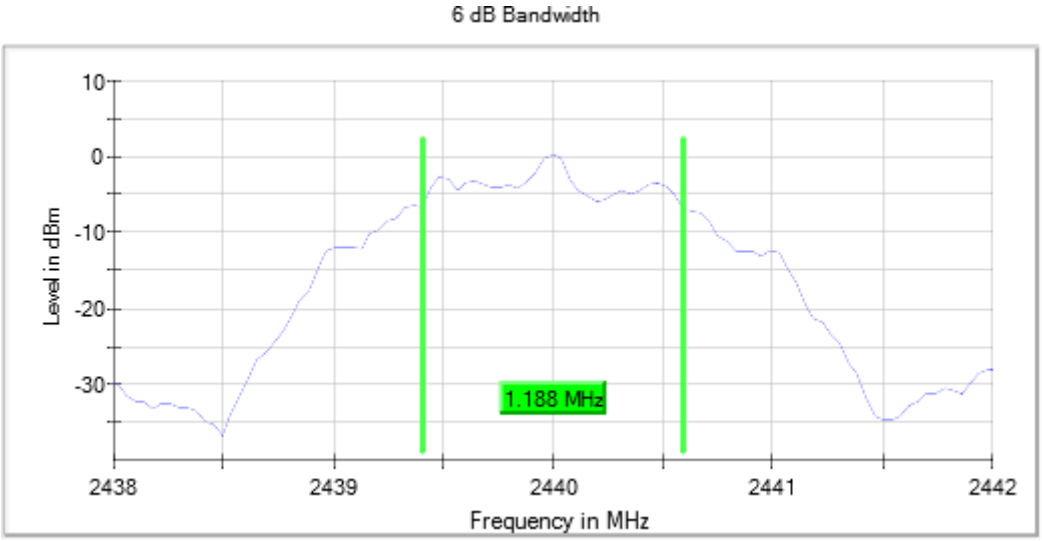


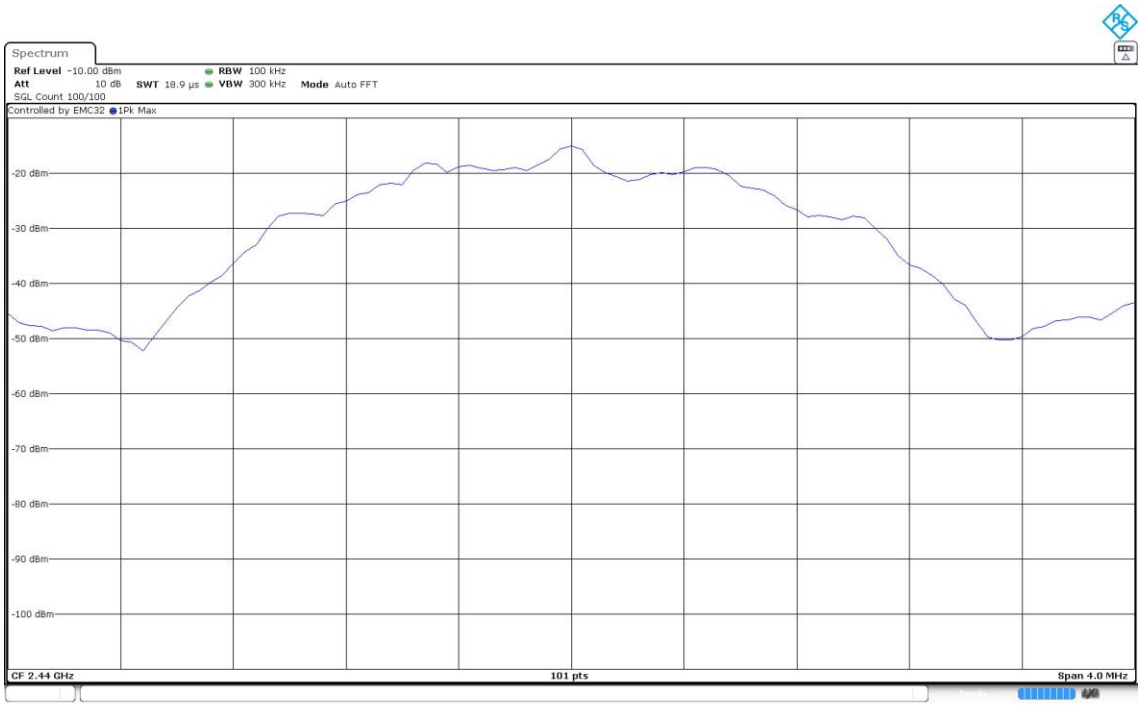
Bandwidth MHz = 2 Modulation = BTLE 5.3 (GFSK 2 Mbit/s)

Frequency MHz = 2440.00000 Mode = SISO

Active Port = 1

Images:



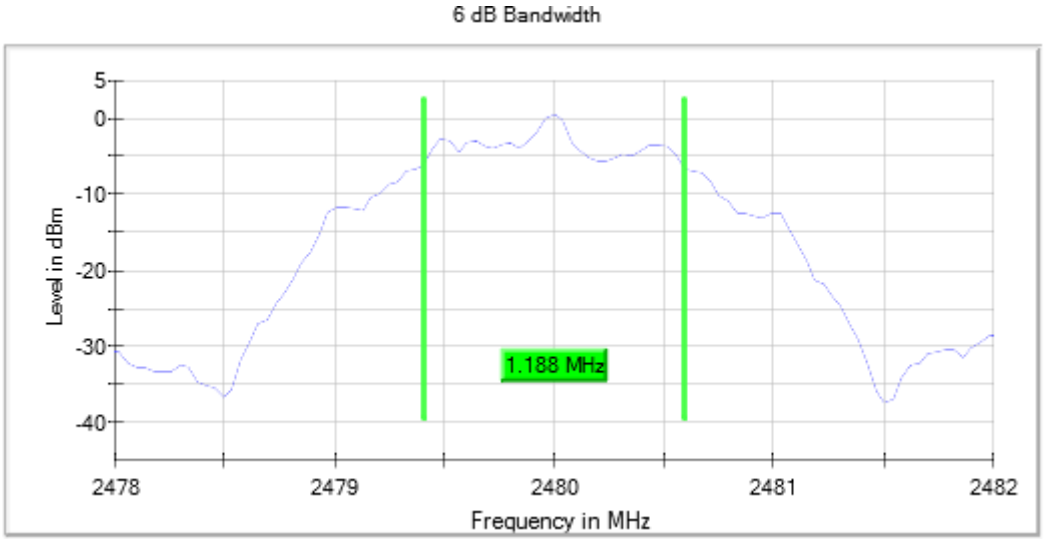


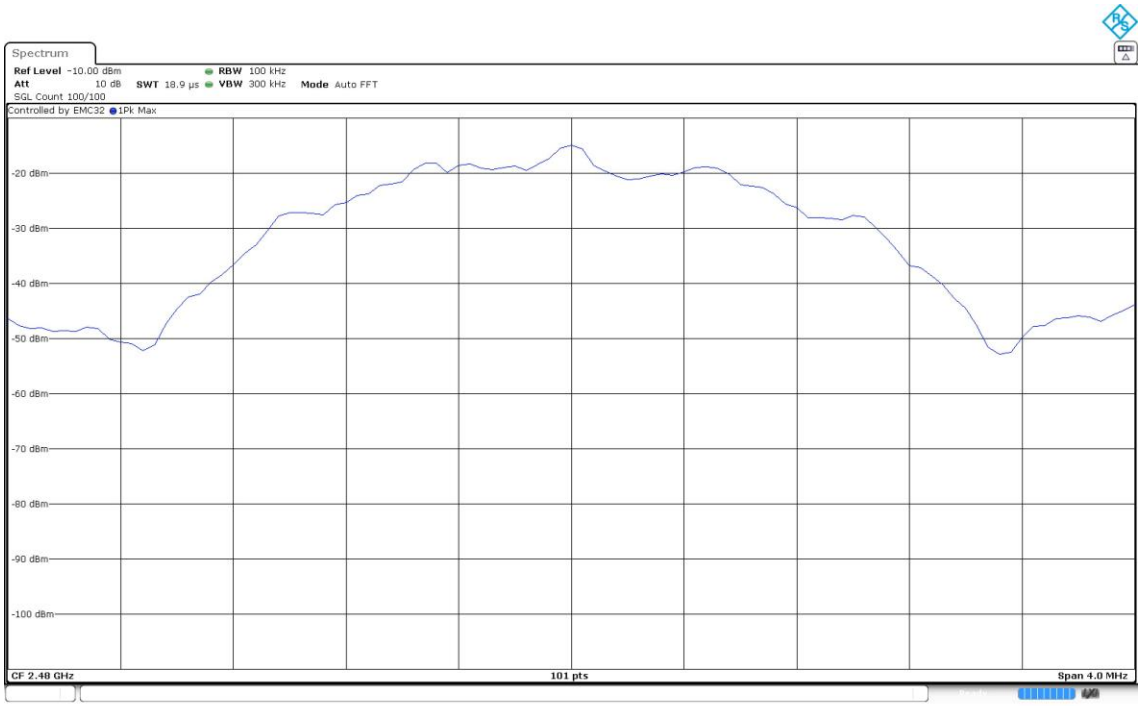
Bandwidth MHz = 2 Modulation = BTLE 5.3 (GFSK 2 Mbit/s)

Frequency MHz = 2480.00000 Mode = SISO

Active Port = 1

Images:





RSS-247 5.2 (b) / FCC 15.247 (e) [Psd] 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 5.3 (GFSK 1 Mbit/s)

Mode: SISO

Results

Equipment	BW (MHz)	Freq (MHz)	Port	PSD (dBm)
Digital Transmission System (DTS)	1	2402.00	1	-9.43
		2440.00		-9.16
		2480.00		-9.10

Verdict

Pass

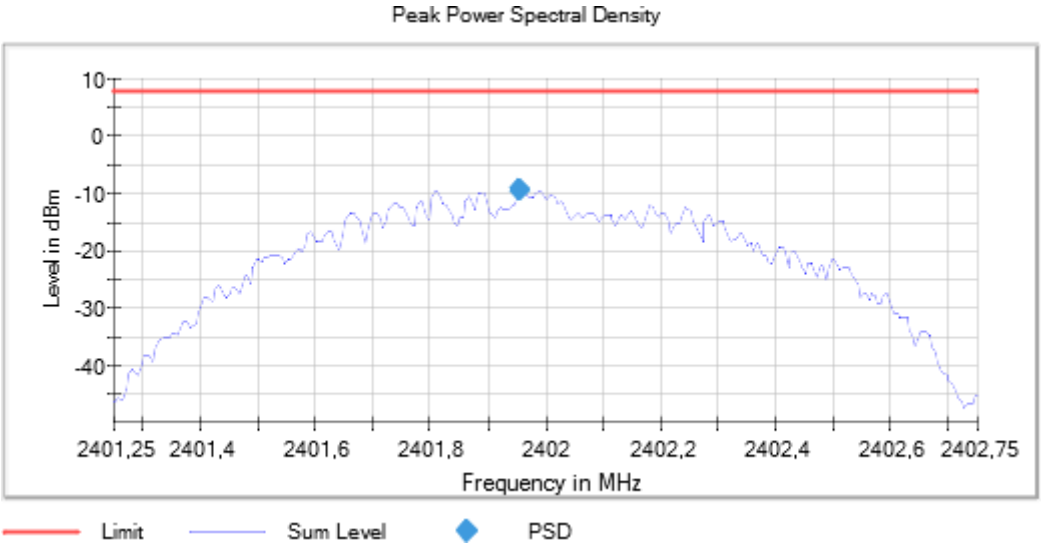
Attachments

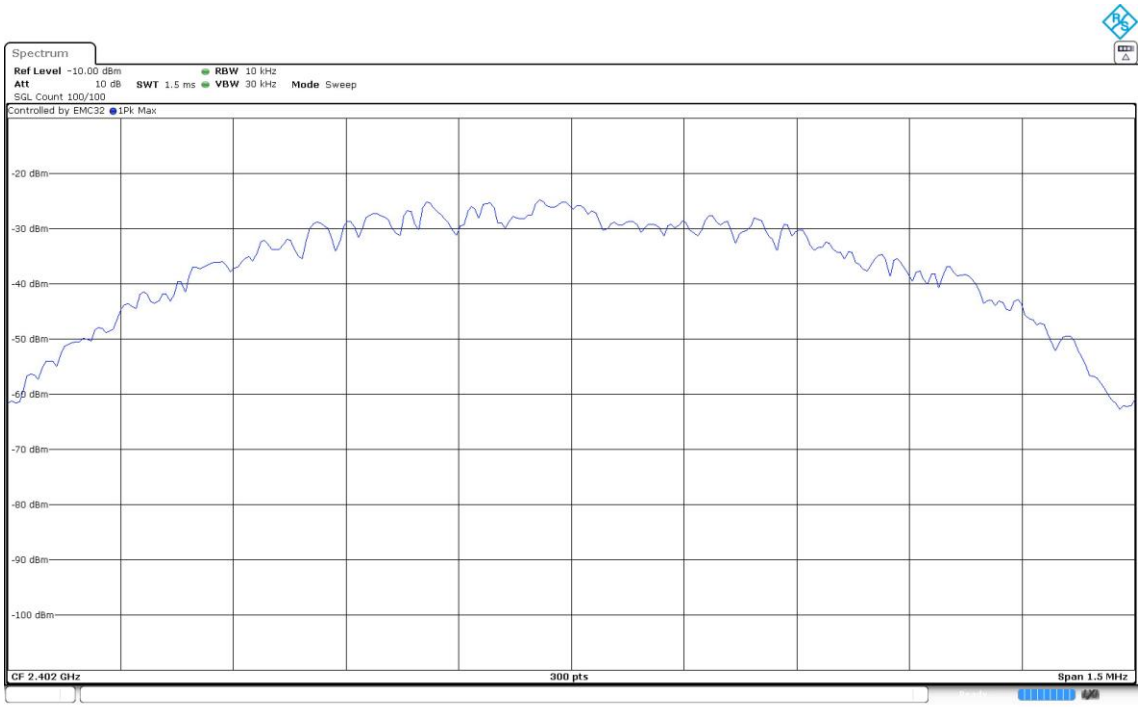
Equipment Type = Digital Transmission System (DTS) Bandwidth MHz = 1

Modulation = BTLE 5.3 (GFSK 1 Mbit/s) Frequency MHz = 2402.00000

Mode = SISO Active Port = 1

Images:

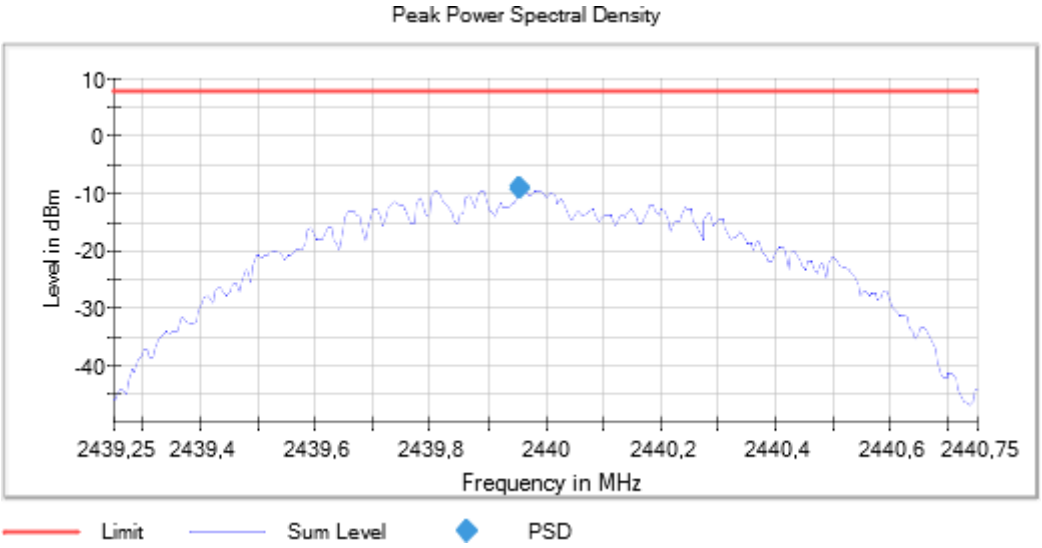


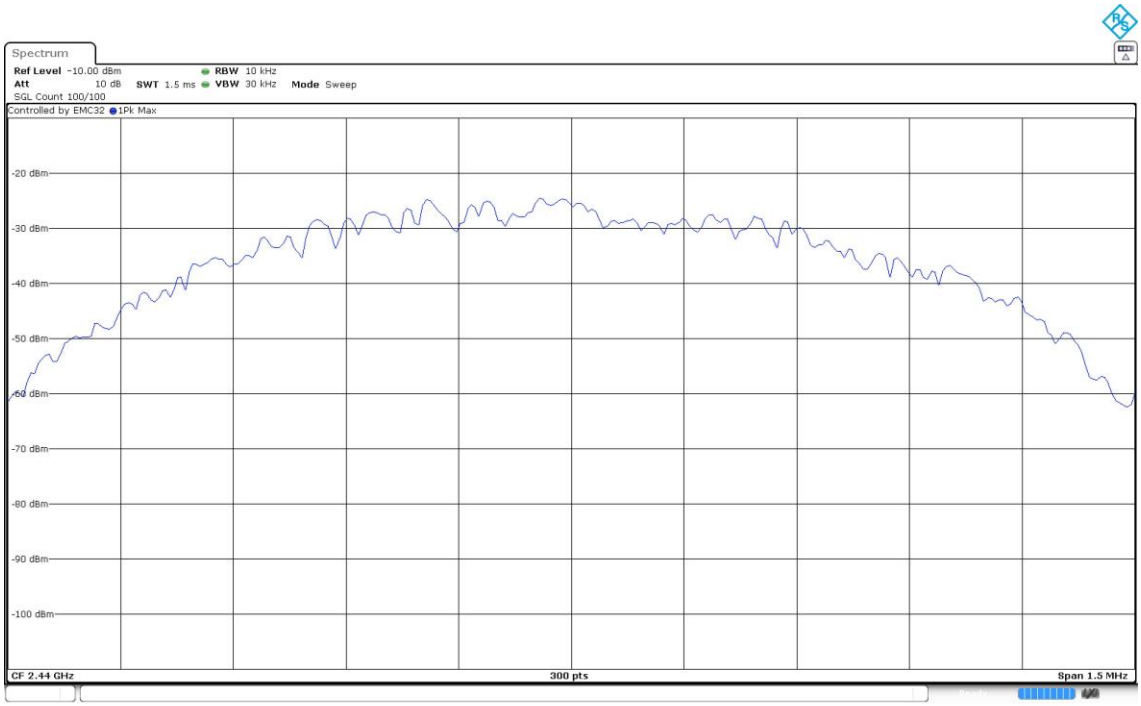


Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Mode = SISO

Bandwidth MHz = 1
Frequency MHz = 2440.00000
Active Port = 1

Images:



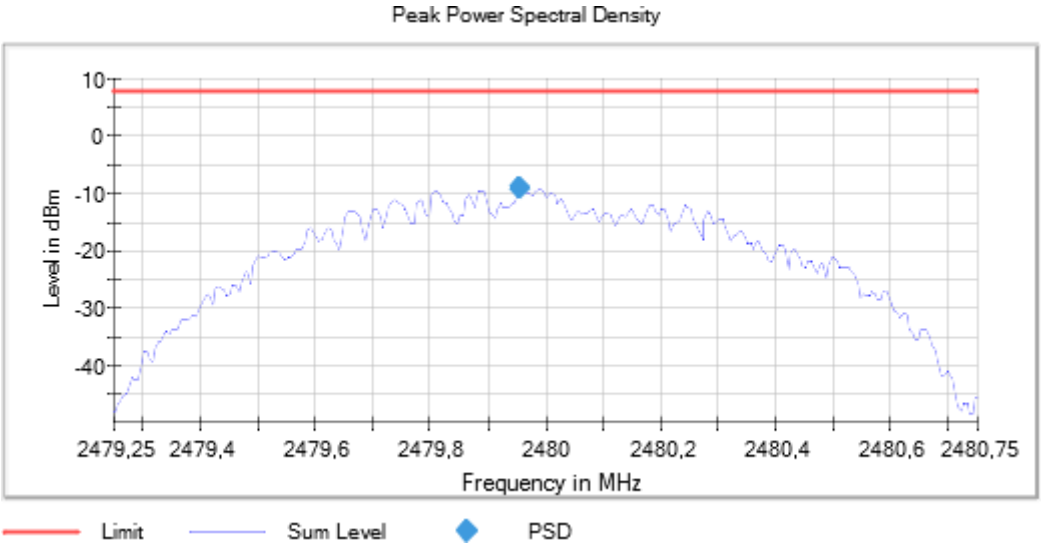


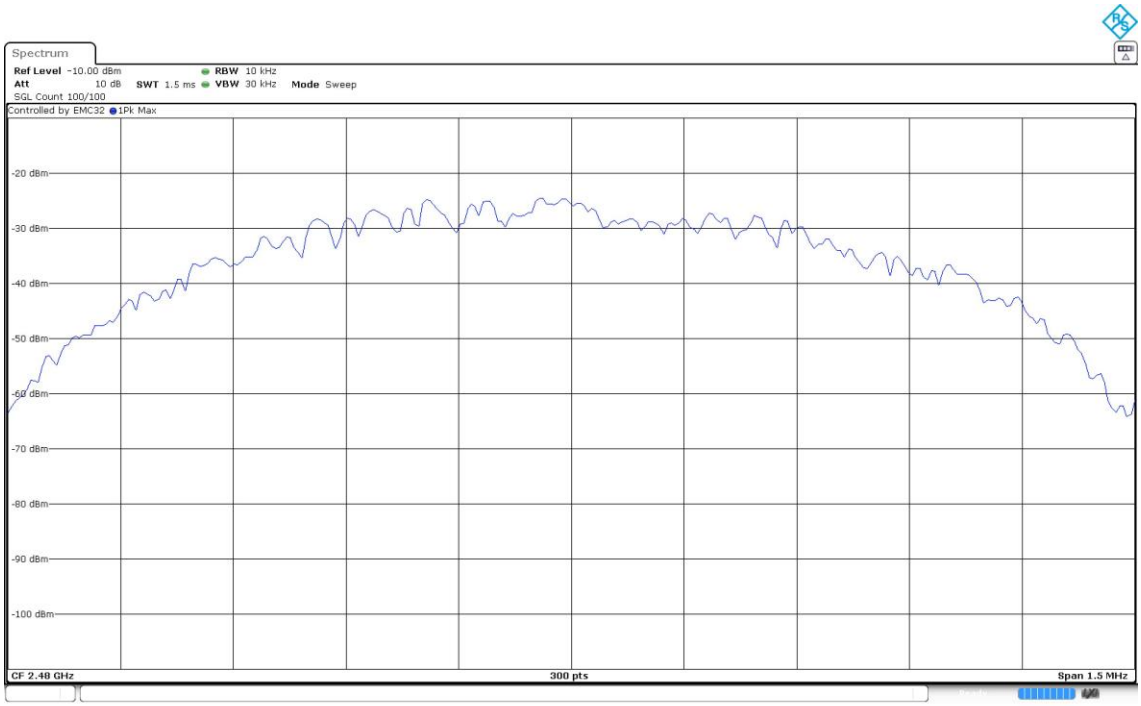
Equipment Type = Digital Transmission System (DTS) Bandwidth MHz = 1

Modulation = BTLE 5.3 (GFSK 1 Mbit/s) Frequency MHz = 2480.00000

Mode = SISO Active Port = 1

Images:





Modulation: BTLE 5.3 (GFSK 2 Mbit/s)

Mode: SISO

Results

Equipment	BW (MHz)	Freq (MHz)	Port	PSD (dBm)
Digital Transmission System (DTS)	2	2402.00	1	-9.70
		2440.00		-9.45
		2480.00		-9.57

Verdict

Pass

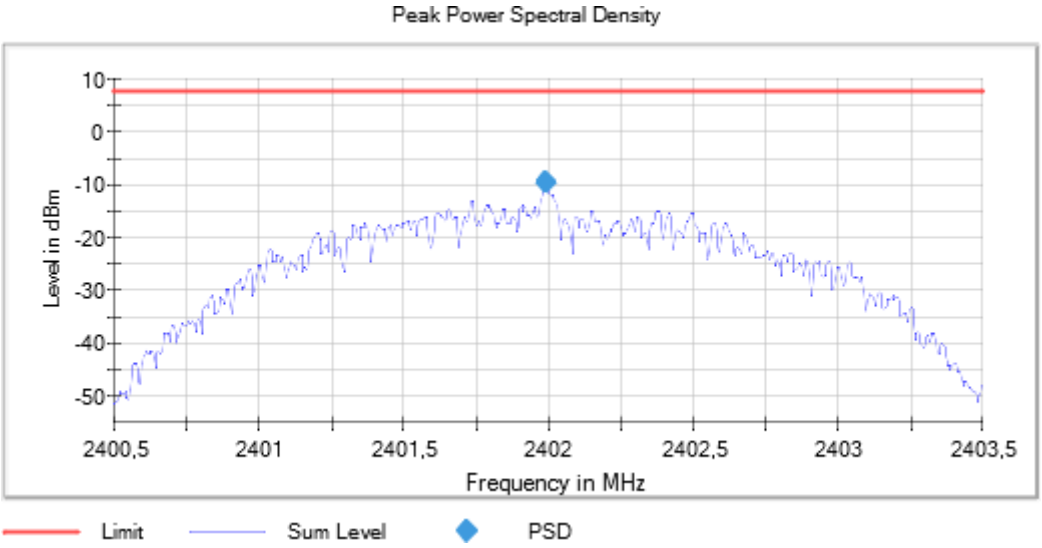
Attachments

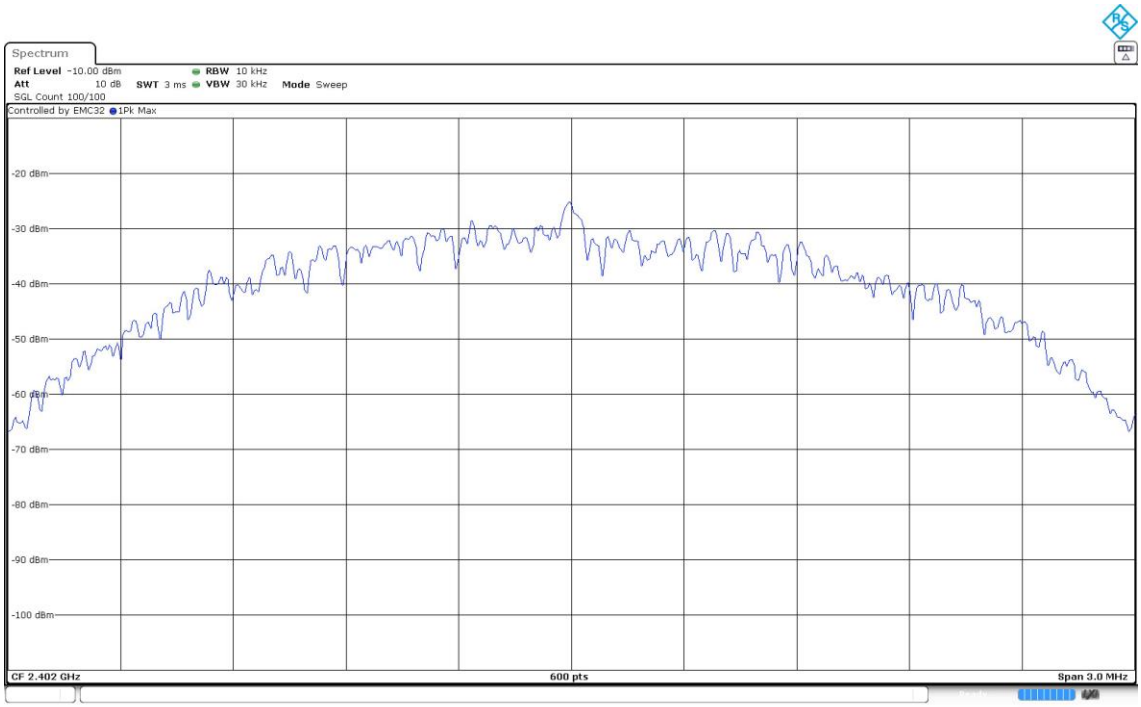
Equipment Type = Digital Transmission System (DTS) Bandwidth MHz = 2

Modulation = BTLE 5.3 (GFSK 2 Mbit/s) Frequency MHz = 2402.00000

Mode = SISO Active Port = 1

Images:



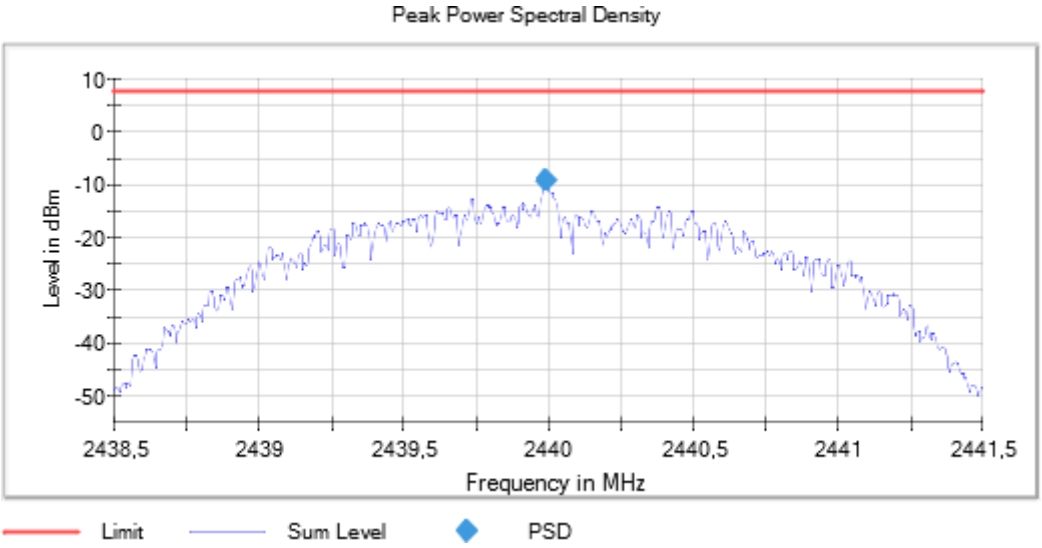


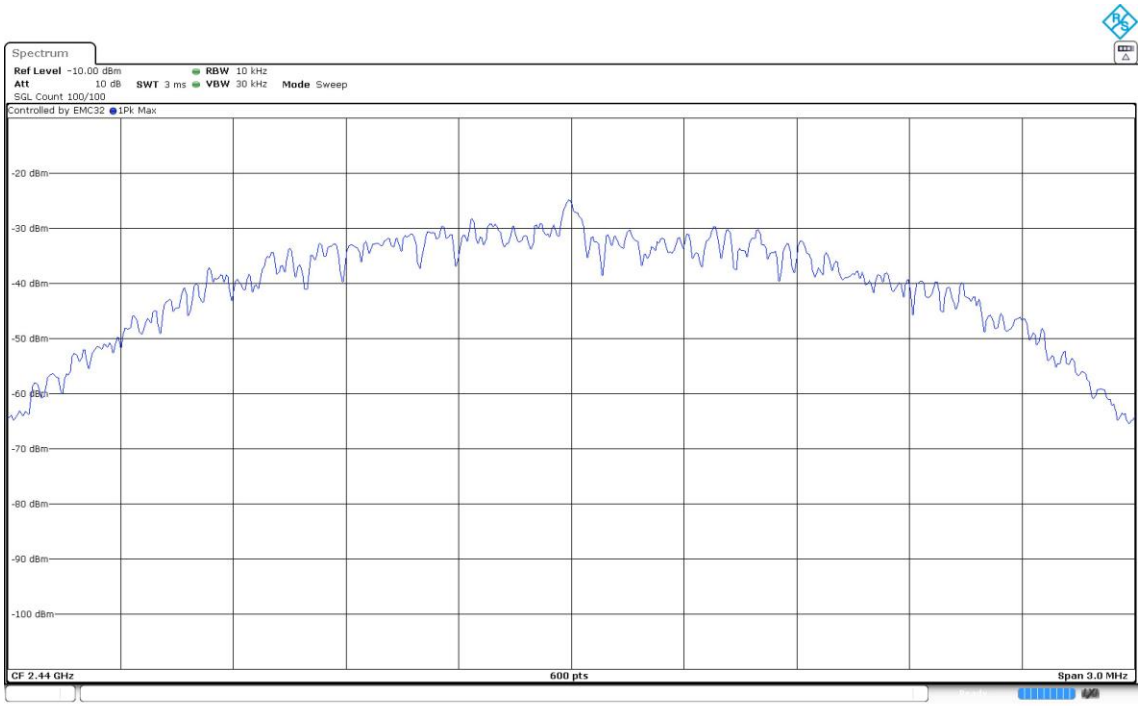
Equipment Type = Digital Transmission System (DTS) Bandwidth MHz = 2

Modulation = BTLE 5.3 (GFSK 2 Mbit/s) Frequency MHz = 2440.00000

Mode = SISO Active Port = 1

Images:



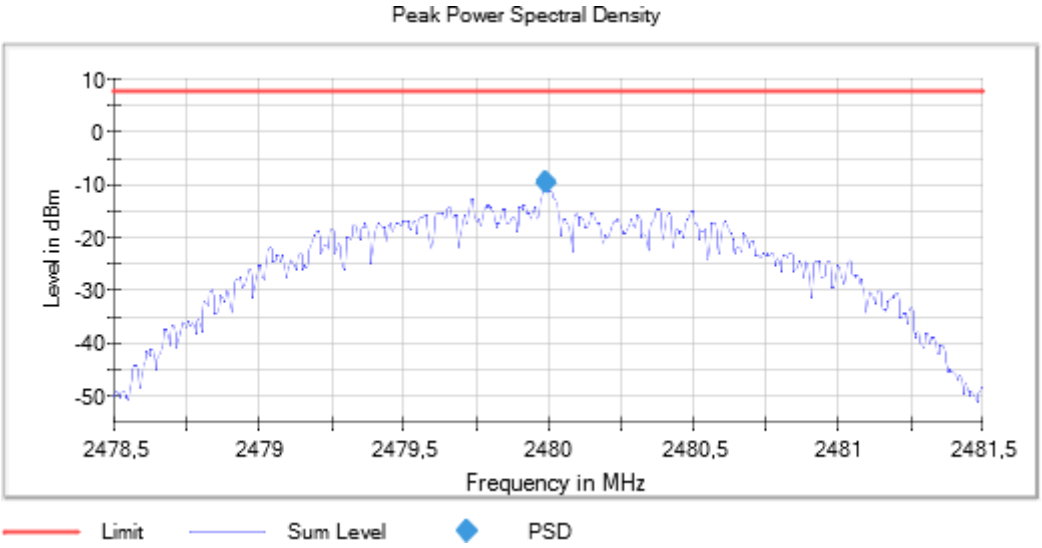


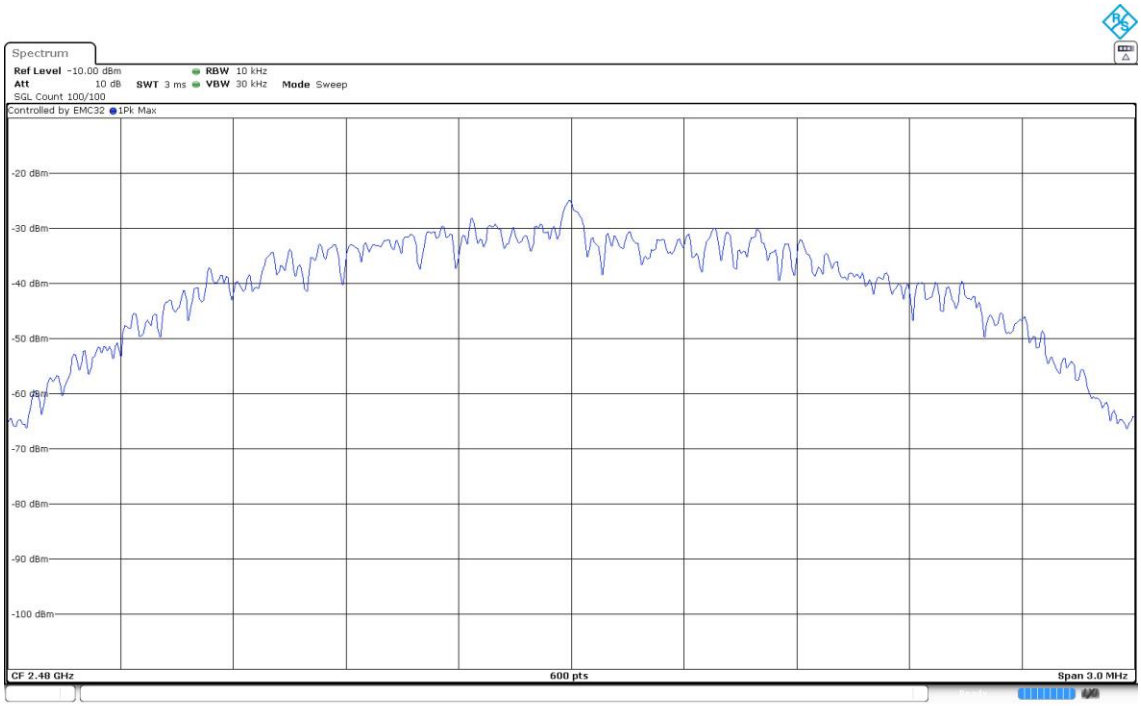
Equipment Type = Digital Transmission System (DTS) Bandwidth MHz = 2

Modulation = BTLE 5.3 (GFSK 2 Mbit/s) Frequency MHz = 2480.00000

Mode = SISO Active Port = 1

Images:





RSS-247 5.4 (d) / FCC 15.247 (b) (3) [Pkcp] 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 5.3 (GFSK 1 Mbit/s)

Mode: SISO

Maximum Declared Antenna Gain: +1.7 dBi

Results

Equipment	BW (MHz)	Freq (MHz)	Port	PeakPower (dBm)	E.I.R.P. (dBm)
Digital Transmission System (DTS)	1	2402.00	1	0.2140	1.9140
		2440.00		0.3520	2.0520
		2480.00		0.4590	2.1590

Verdict

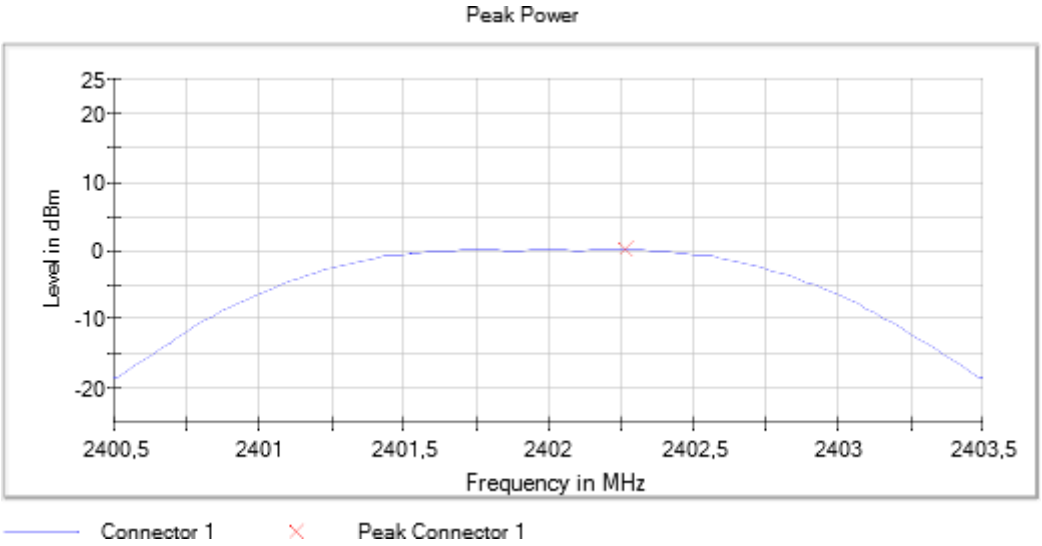
Pass

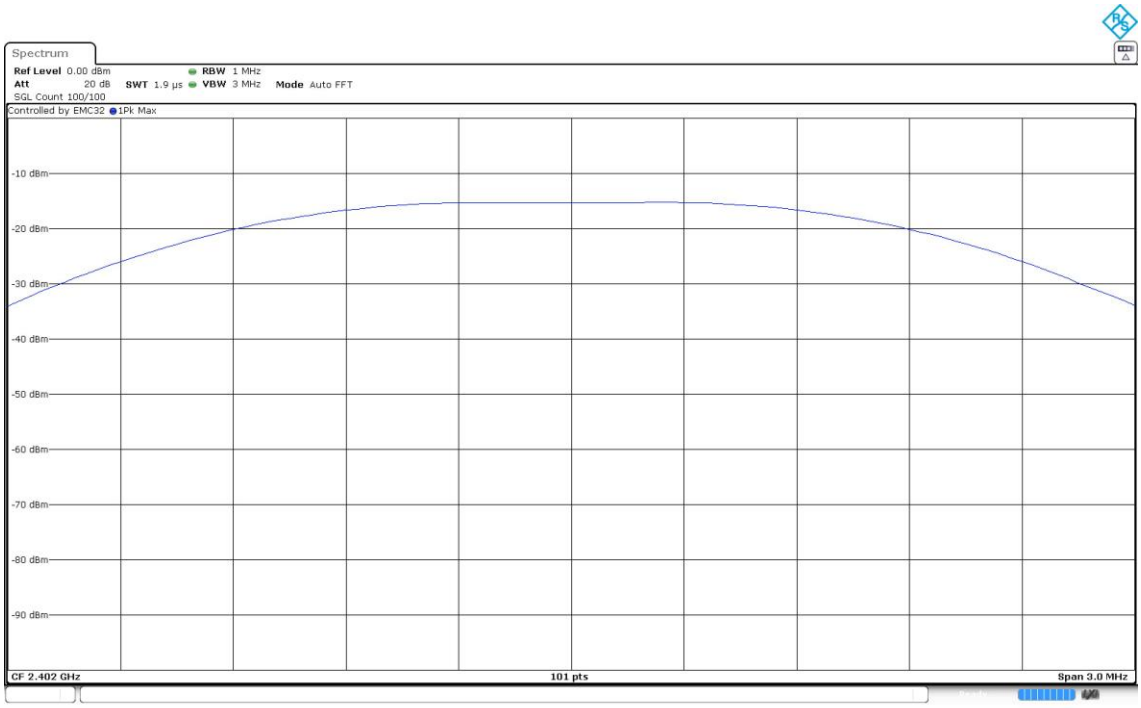
Attachments

Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Mode = SISO

Bandwidth MHz = 1
Frequency MHz = 2402.00000
Active Port = 1

Images:

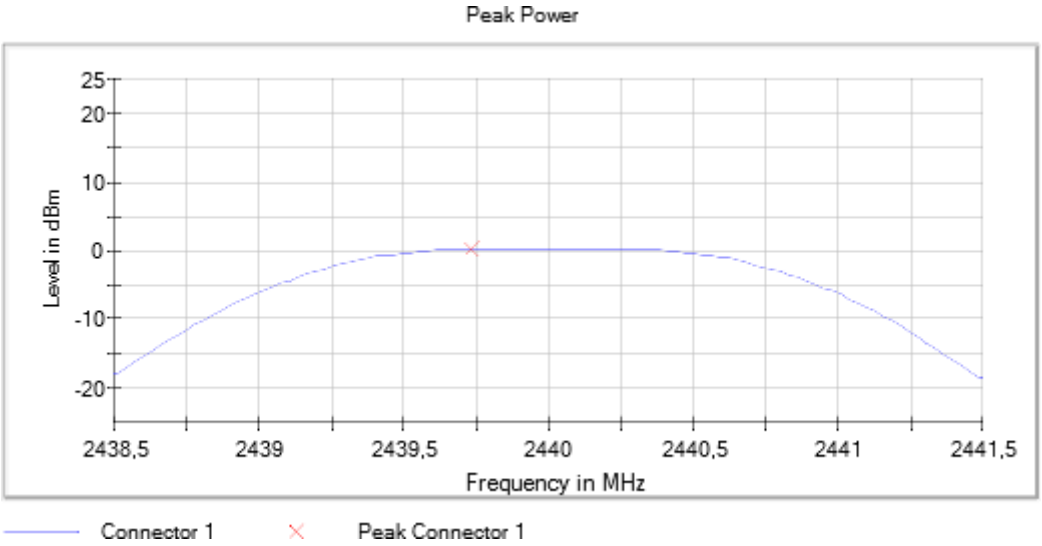


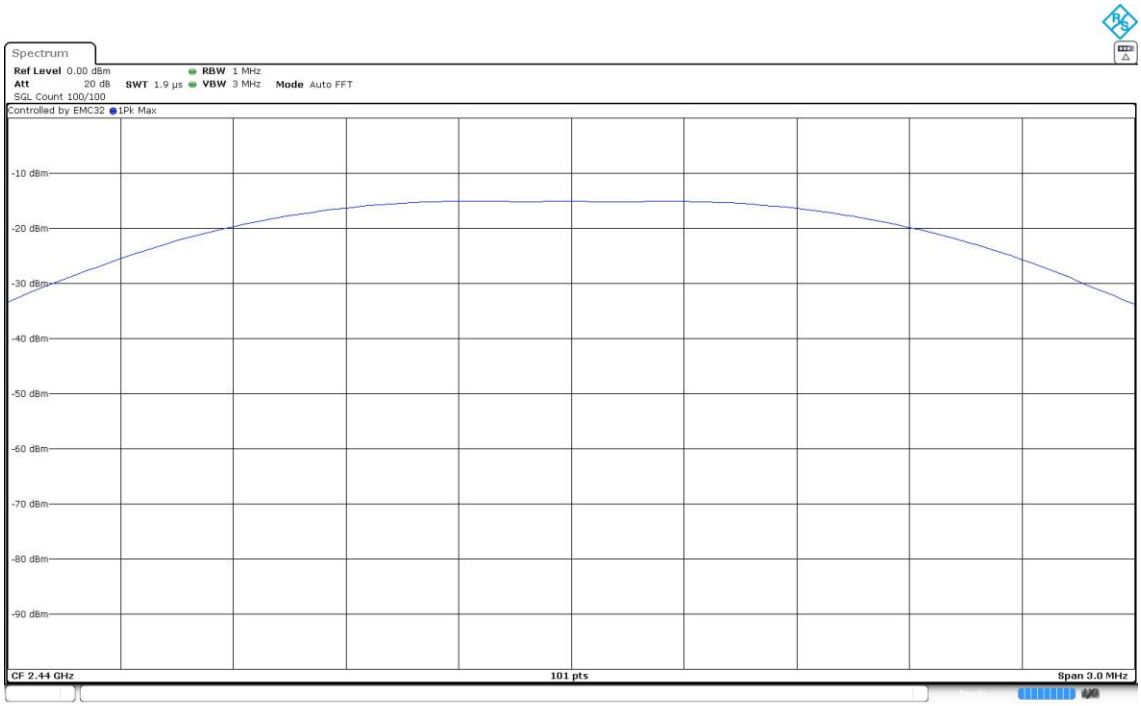


Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Mode = SISO

Bandwidth MHz = 1
Frequency MHz = 2440.00000
Active Port = 1

Images:

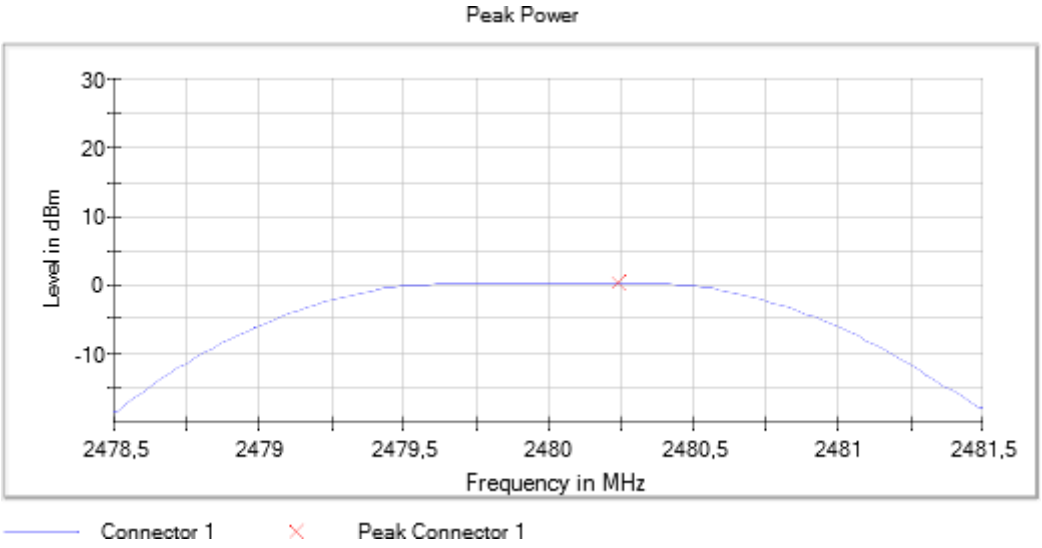


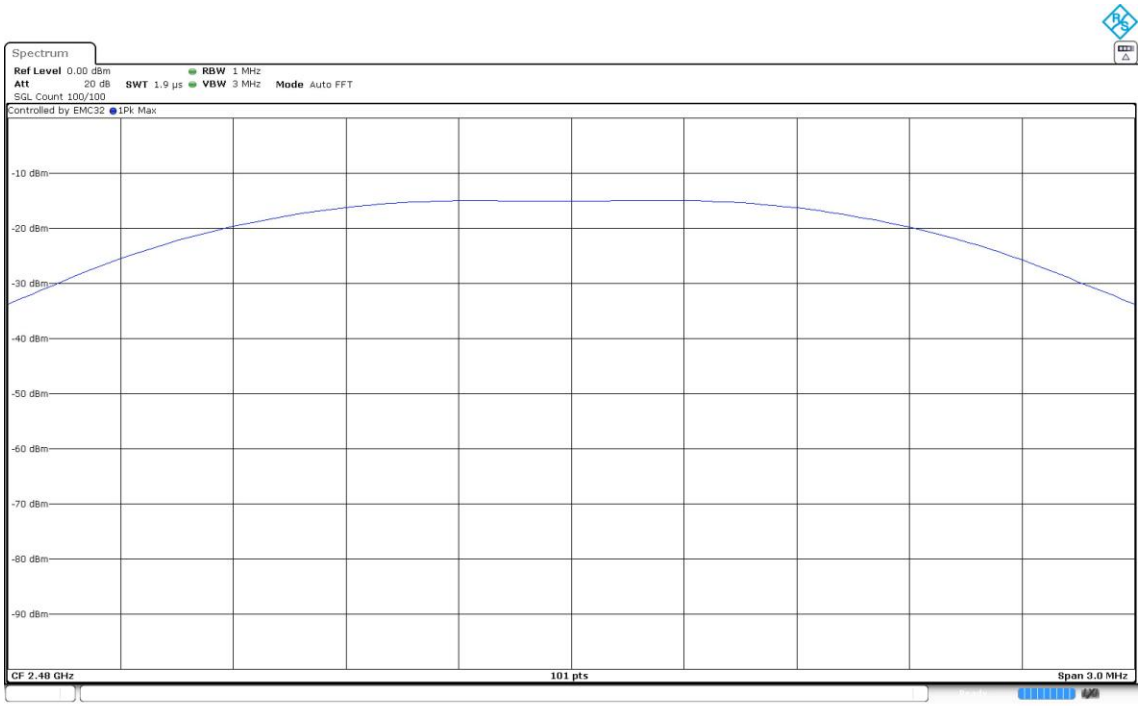


Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Mode = SISO

Bandwidth MHz = 1
Frequency MHz = 2480.00000
Active Port = 1

Images:





Modulation: BTLE 5.3 (GFSK 2 Mbit/s)

Mode: SISO

Maximum Declared Antenna Gain: +1.7 dBi

Results

Equipment	BW (MHz)	Freq (MHz)	Port	PeakPower (dBm)	E.I.R.P. (dBm)
Digital Transmission System (DTS)	2	2402.00	1	0.2280	1.9280
		2440.00		0.3650	2.0650
		2480.00		0.4870	2.1870

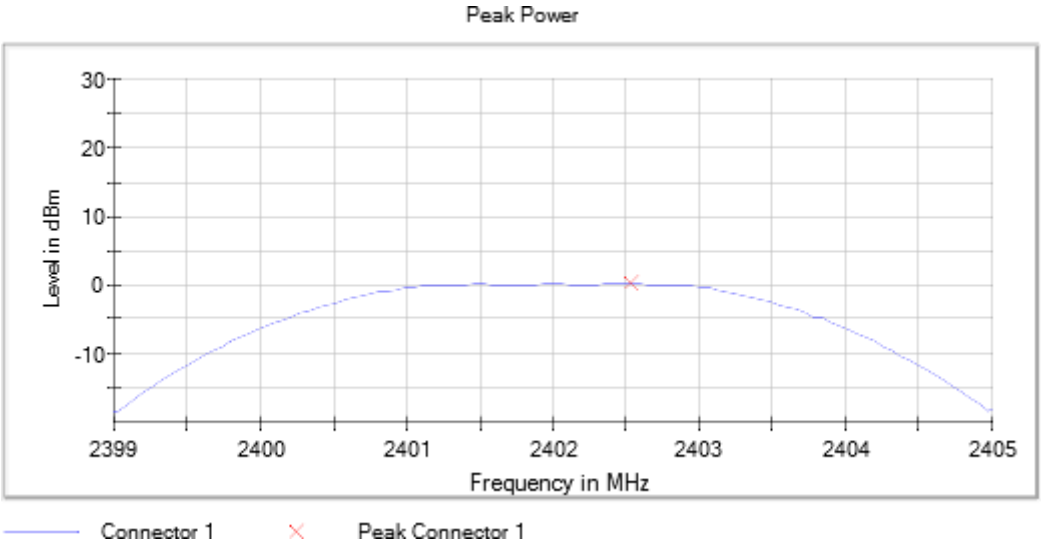
Verdict

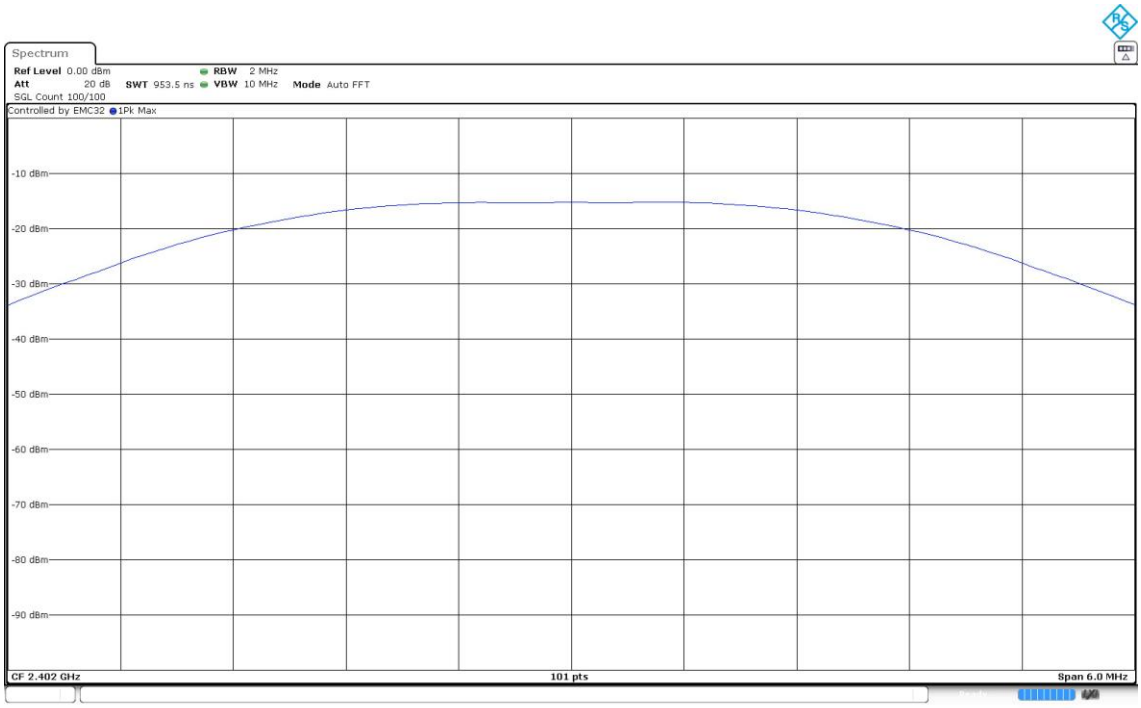
Pass

Attachments

Equipment Type = Digital Transmission System (DTS)	Bandwidth MHz = 2
Modulation = BTLE 5.3 (GFSK 2 Mbit/s)	Frequency MHz = 2402.00000
Mode = SISO	Active Port = 1

Images:

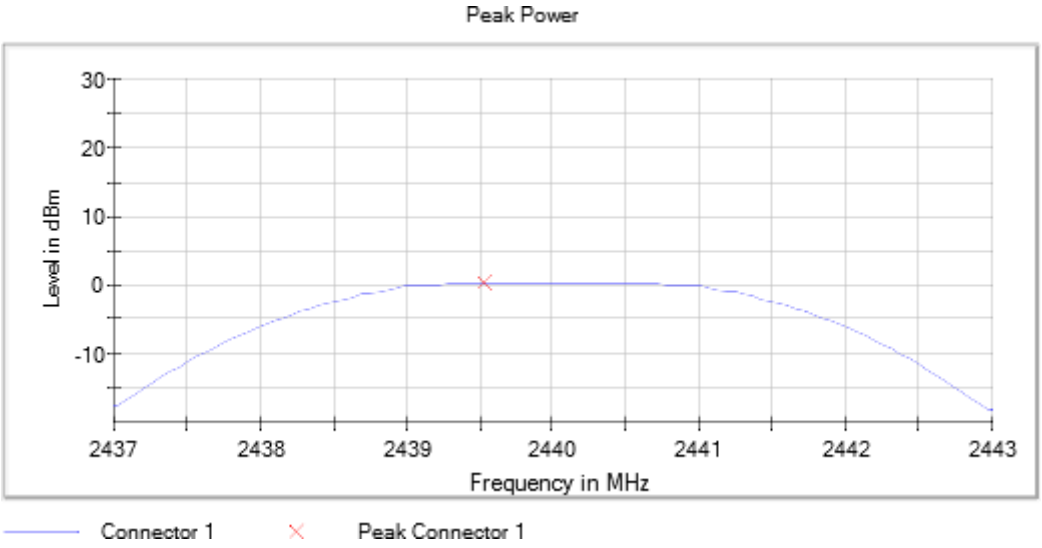


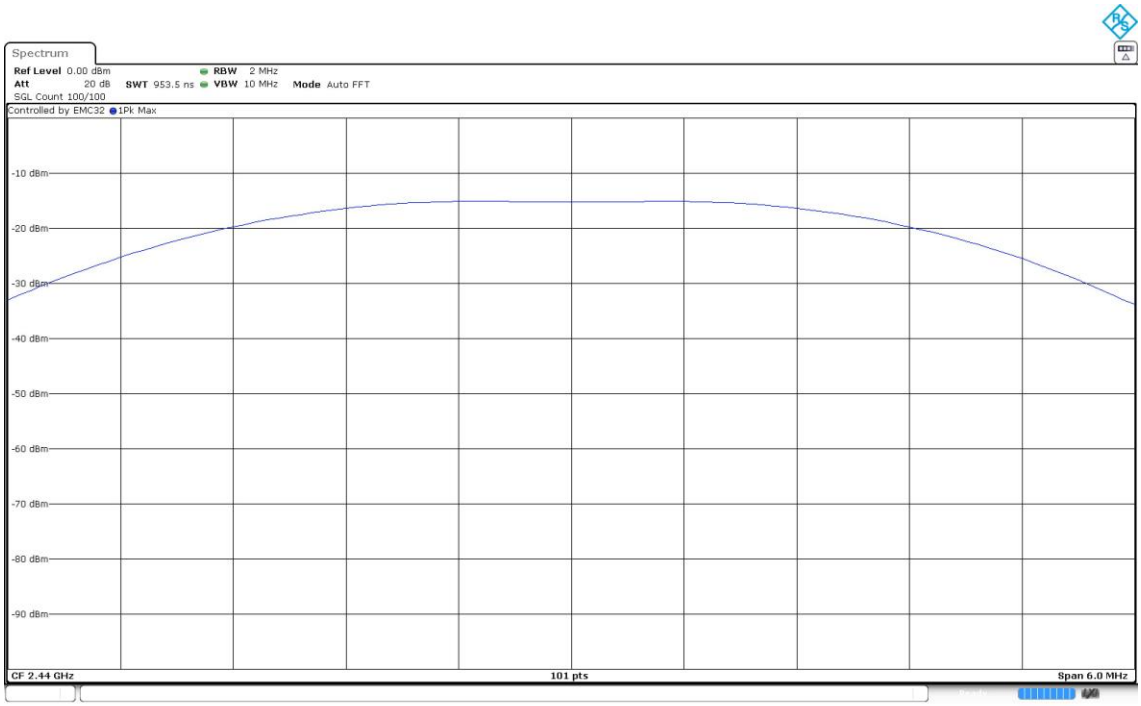


Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 2 Mbit/s)
Mode = SISO

Bandwidth MHz = 2
Frequency MHz = 2440.00000
Active Port = 1

Images:

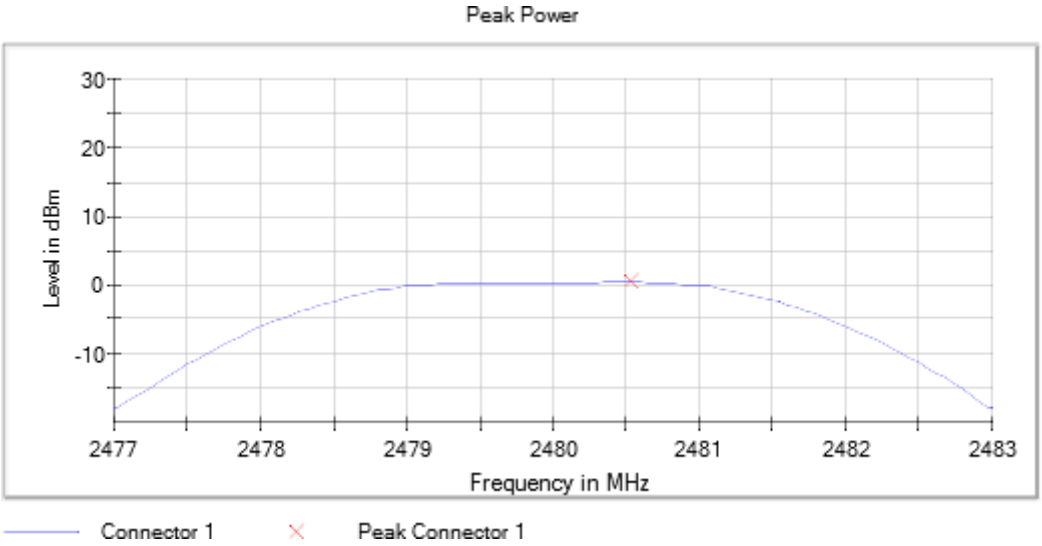


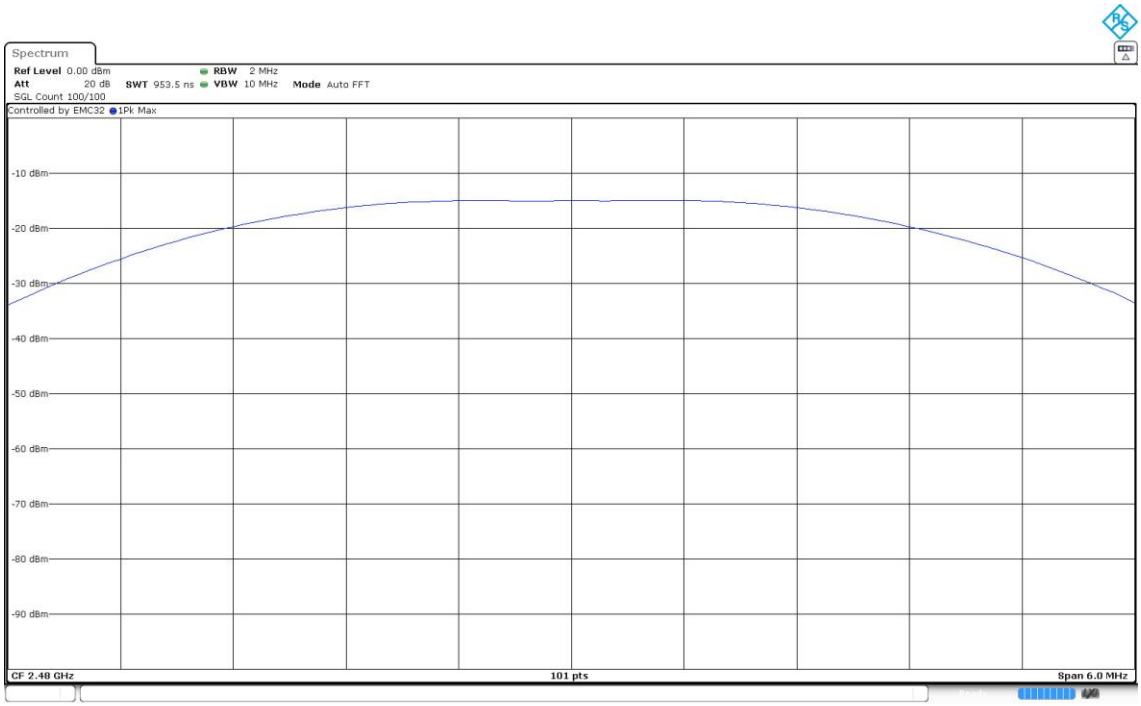


Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 2 Mbit/s)
Mode = SISO

Bandwidth MHz = 2
Frequency MHz = 2480.00000
Active Port = 1

Images:





RSS-247 5.5 / FCC 15.247 (d) [Bndedge] 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 5.3 (GFSK 1 Mbit/s)

Mode: SISO

Results

Radiated measurements were used to show compliance with the limits in the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

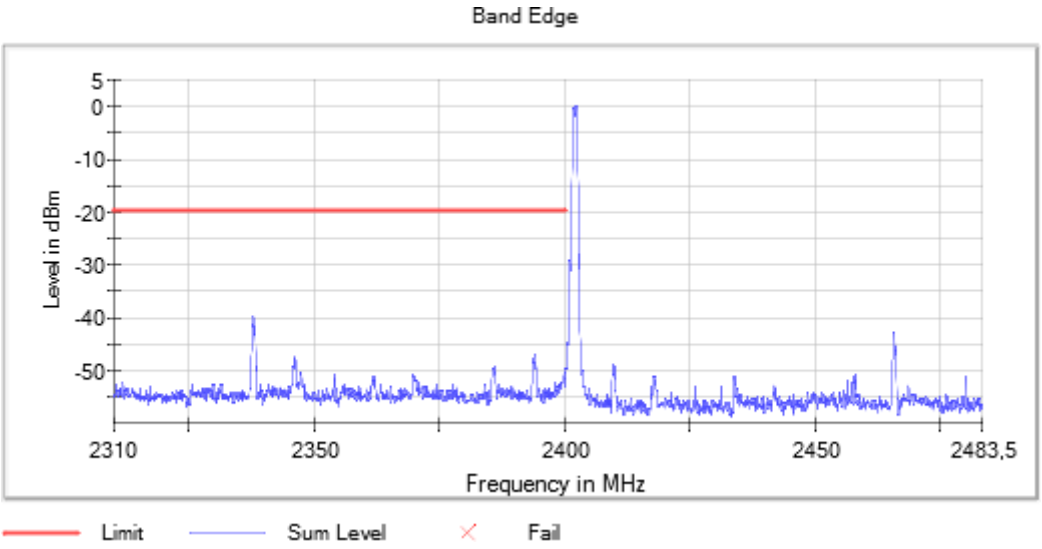
Verdict

Pass

Attachments

Equipment Type = Digital Transmission System (DTS)	Bandwidth MHz = 1
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)	Frequency MHz = 2402.00000
Mode = SISO	Measurement Point = 1
Active Port = 1	

Images:



Tables:

Spectrum Analyzer Parameters 1

Setting	Instrument Value	Target Value
Start Frequency	2.31000 GHz	2.31000 GHz
Stop Frequency	2.40000 GHz	2.40000 GHz
Span	90.000 MHz	90.000 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	1800	~ 1800
Sweeptime	113.672 µs	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	8 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

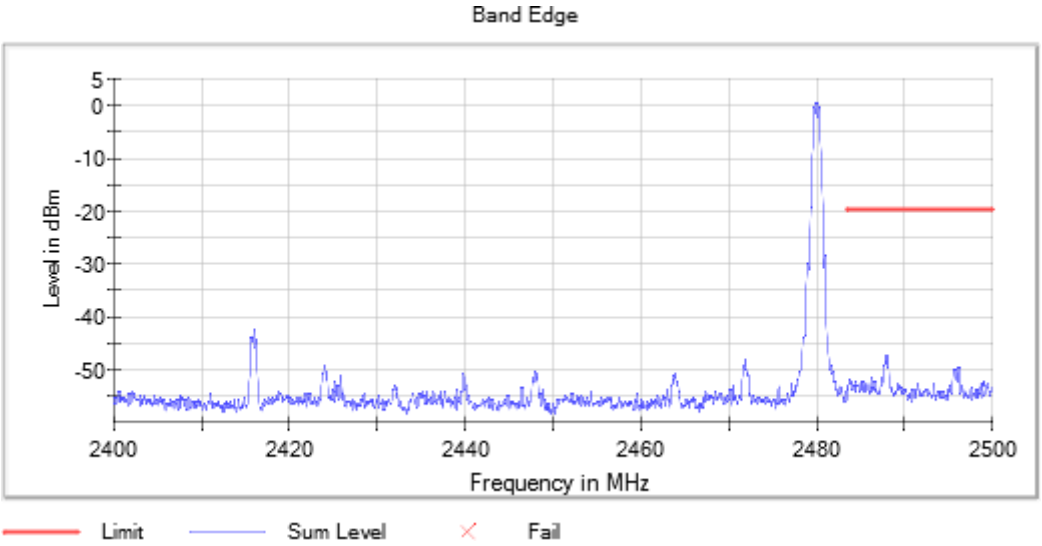
Spectrum Analyzer Parameters 2

Setting	Instrument Value	Target Value
Start Frequency	2.40000 GHz	2.40000 GHz
Stop Frequency	2.48350 GHz	2.48350 GHz
Span	83.500 MHz	83.500 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	1670	~ 1670
Sweeptime	94.727 µs	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	6 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.36 dB	0.50 dB

Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Mode = SISO
Active Port = 1

Bandwidth MHz = 1
Frequency MHz = 2480.00000
Measurement Point = 1

Images:



Tables:

Spectrum Analyzer Parameters 1

Setting	Instrument Value	Target Value
Start Frequency	2.31000 GHz	2.31000 GHz
Stop Frequency	2.40000 GHz	2.40000 GHz
Span	90.000 MHz	90.000 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	1800	~ 1800
Sweeptime	113.672 µs	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	8 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

Spectrum Analyzer Parameters 2

Setting	Instrument Value	Target Value
Start Frequency	2.40000 GHz	2.40000 GHz
Stop Frequency	2.48350 GHz	2.48350 GHz
Span	83.500 MHz	83.500 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	1670	~ 1670
Sweeptime	94.727 µs	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	6 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.36 dB	0.50 dB

Modulation: BTLE 5.3 (GFSK 2 Mbit/s)

Mode: SISO

Results

Radiated measurements were used to show compliance with the limits in the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

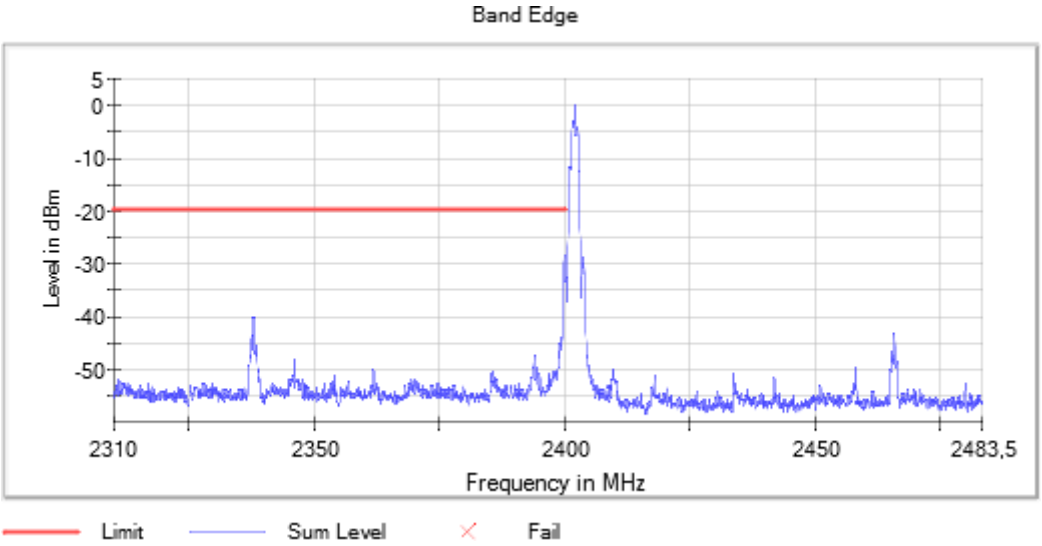
Verdict

Pass

Attachments

Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 2
Modulation = BTLE 5.3 (GFSK 2 Mbit/s)
Frequency MHz = 2402.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters 1

Setting	Instrument Value	Target Value
Start Frequency	2.31000 GHz	2.31000 GHz
Stop Frequency	2.40000 GHz	2.40000 GHz
Span	90.000 MHz	90.000 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	1800	~ 1800
Sweeptime	113.672 µs	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	8 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.26 dB	0.50 dB

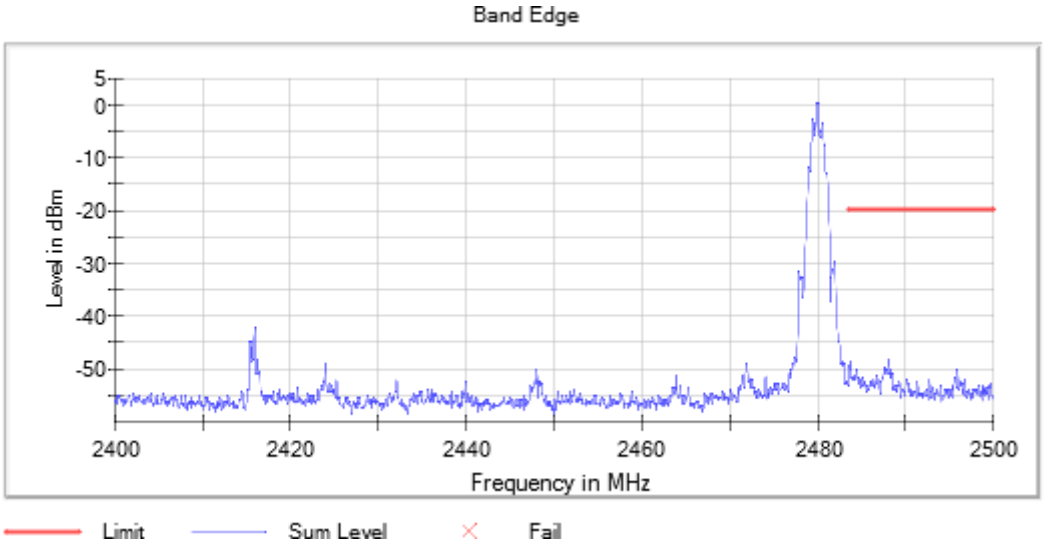
Spectrum Analyzer Parameters 2

Setting	Instrument Value	Target Value
Start Frequency	2.40000 GHz	2.40000 GHz
Stop Frequency	2.48350 GHz	2.48350 GHz
Span	83.500 MHz	83.500 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	1670	~ 1670
Sweeptime	94.727 µs	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	7 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.07 dB	0.50 dB

Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 2 Mbit/s)
Mode = SISO
Active Port = 1

Bandwidth MHz = 2
Frequency MHz = 2480.00000
Measurement Point = 1

Images:



Tables:

Spectrum Analyzer Parameters 1

Setting	Instrument Value	Target Value
Start Frequency	2.31000 GHz	2.31000 GHz
Stop Frequency	2.40000 GHz	2.40000 GHz
Span	90.000 MHz	90.000 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	1800	~ 1800
Sweeptime	113.672 µs	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	8 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.26 dB	0.50 dB

Spectrum Analyzer Parameters 2

Setting	Instrument Value	Target Value
Start Frequency	2.40000 GHz	2.40000 GHz
Stop Frequency	2.48350 GHz	2.48350 GHz
Span	83.500 MHz	83.500 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	1670	~ 1670
Sweeptime	94.727 µs	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	7 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.07 dB	0.50 dB

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 5.3 (GFSK 1 Mbit/s)

Mode: SISO

Results

Freq Rng (GHz)	Equipment	Freq (MHz)	Port	Unwanted Freq (MHz)	Unwanted Lvl (dBµV/m)	Pol	Detector
[0.03, 1]	Digital Transmission System (DTS)	2402.00	1	48.006	31.81	V	PK
					30.87		QP
				71.983	32.07	V	PK
					30.76		QP
				119.937	26.34	V	PK
					23.68		QP
				143.854	25.49	V	PK
					23.65		QP
				167.952	29.26	V	PK
					27.09		QP
				192.020	29.08	V	PK
					27.76		QP
		2440.00		48.006	33.16	V	PK
					32.28		QP
				71.983	31.82	V	PK
					30.57		QP
				96.021	27.80	V	PK
					26.38		QP
				119.937	26.07	V	PK
					23.09		QP
				144.248	24.75	V	PK
					22.33		QP
				168.013	30.90	V	PK
					29.57		QP
				192.051	28.65	V	PK
					27.17		QP
		2480.00		48.036	29.12	V	PK
					27.51		QP
				72.013	34.25	V	PK
					33.11		QP
				95.808	30.44	V	PK
					28.95		QP
				168.013	26.88	V	PK
					25.23		QP
				191.990	25.37	H	PK
					23.43		QP

Freq Rng (GHz)	Equipment	Freq (MHz)	Port	Unwanted Freq (MHz)	Unwanted Lvl (dBµV/m)	Pol	Detector
[1, 3]		2402.00		2337.815	54.91	H	PK
					46.25		AVG
				2345.692	55.45	H	PK
					46.87		AVG
		2440.00		2376.308	54.32	H	PK
					49.49		AVG
				2384.000	56.08	H	PK
					49.39		AVG
				2495.907	55.80	H	PK
					48.10		AVG

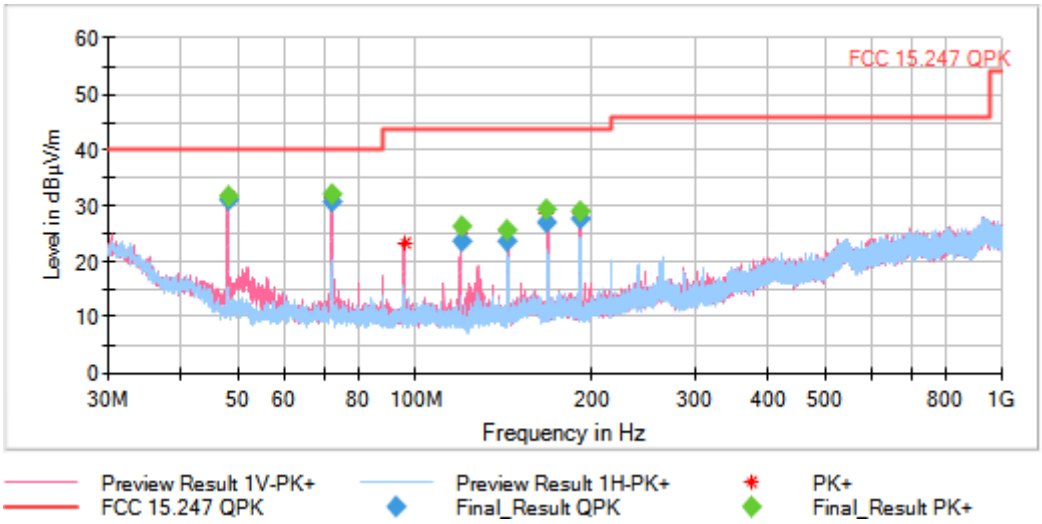
Verdict

Pass

Attachments

Frequency Range GHz = [0.03, 1]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Frequency MHz = 2402.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



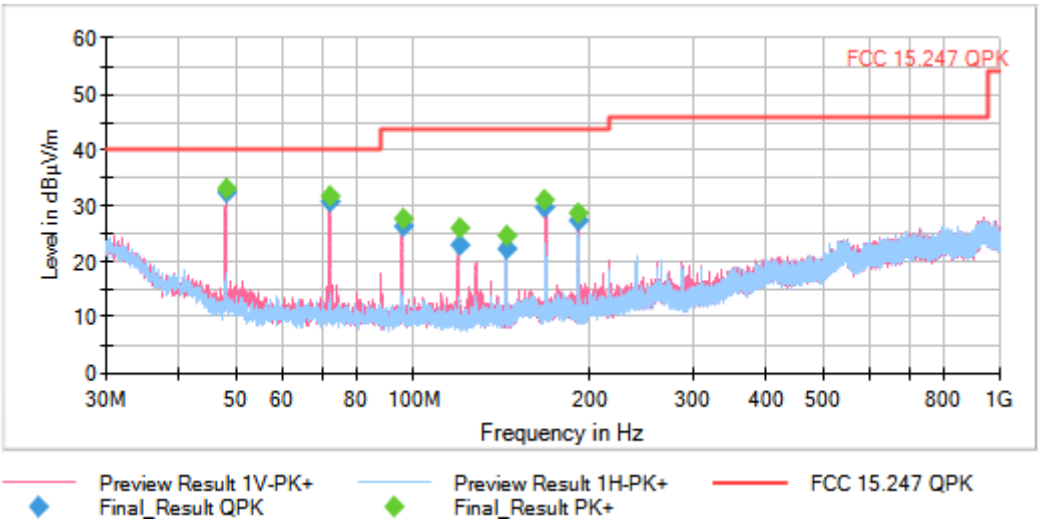
Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	30 MHz - 1 GHz	30,312 kHz	PK+	100 kHz	1 s	0 dB

Frequency Range GHz = [0.03, 1]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Frequency MHz = 2440.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



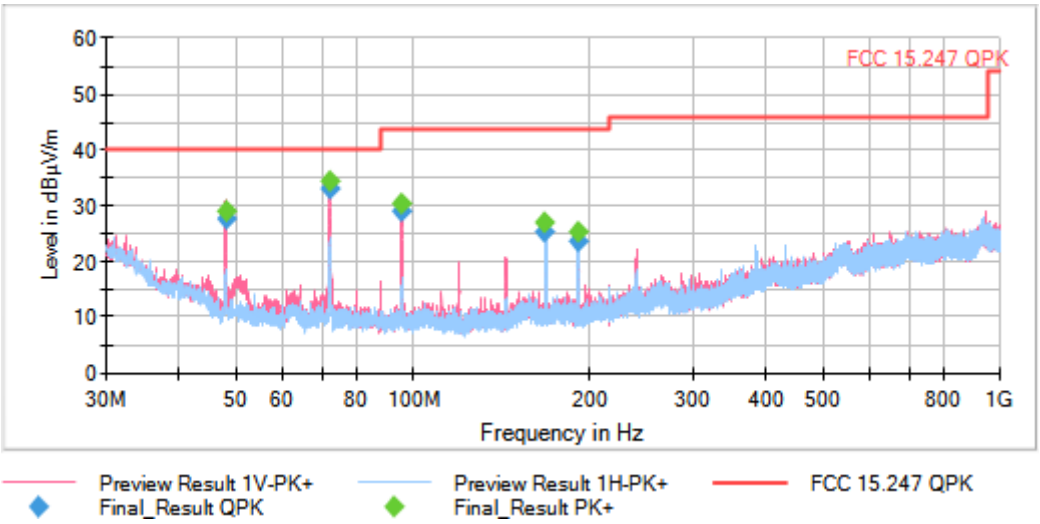
Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	30 MHz - 1 GHz	30,312 kHz	PK+	100 kHz	1 s	0 dB

Frequency Range GHz = [0.03, 1]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Frequency MHz = 2480.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



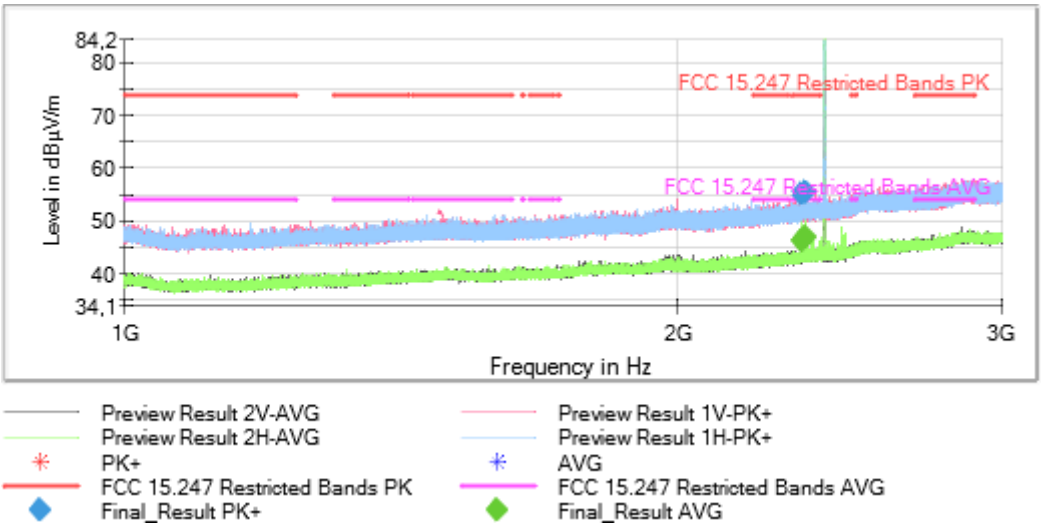
Tables:

Spectrum Analyzer Parameters

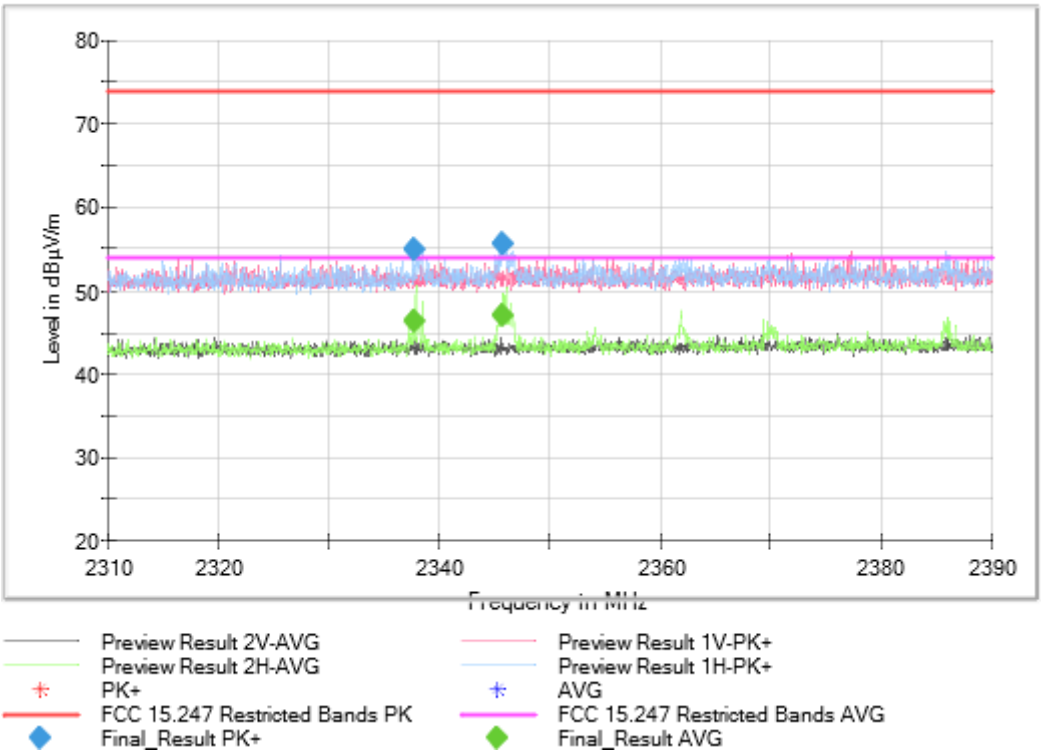
	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	30 MHz - 1 GHz	30,312 kHz	PK+	100 kHz	1 s	0 dB

Frequency Range GHz = [1, 3]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Frequency MHz = 2402.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



Full Spectrum



Frequency Range GHz = [1, 3]

Modulation = BTLE 5.3 (GFSK 1 Mbit/s)

Mode = SISO

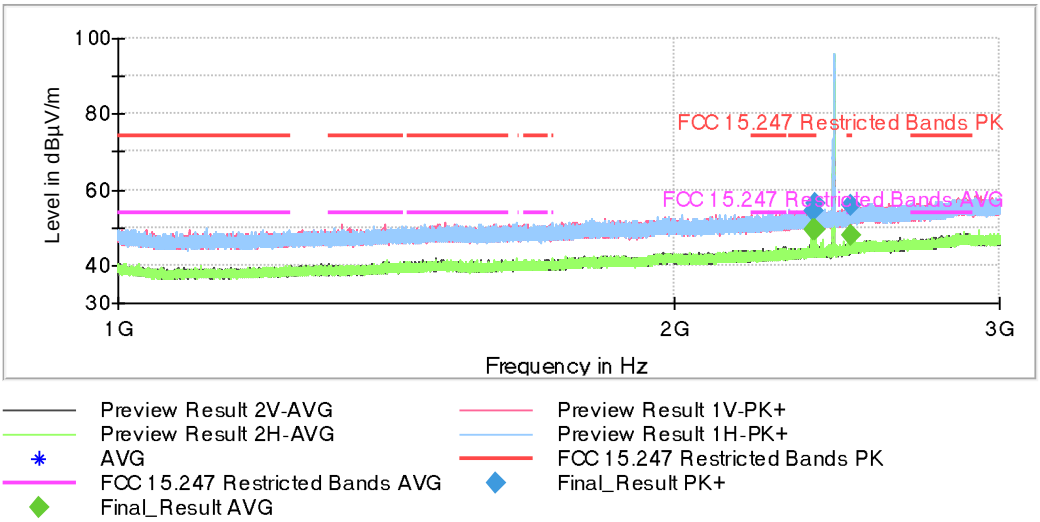
Active Port = 1

Equipment Type = Digital Transmission System (DTS)

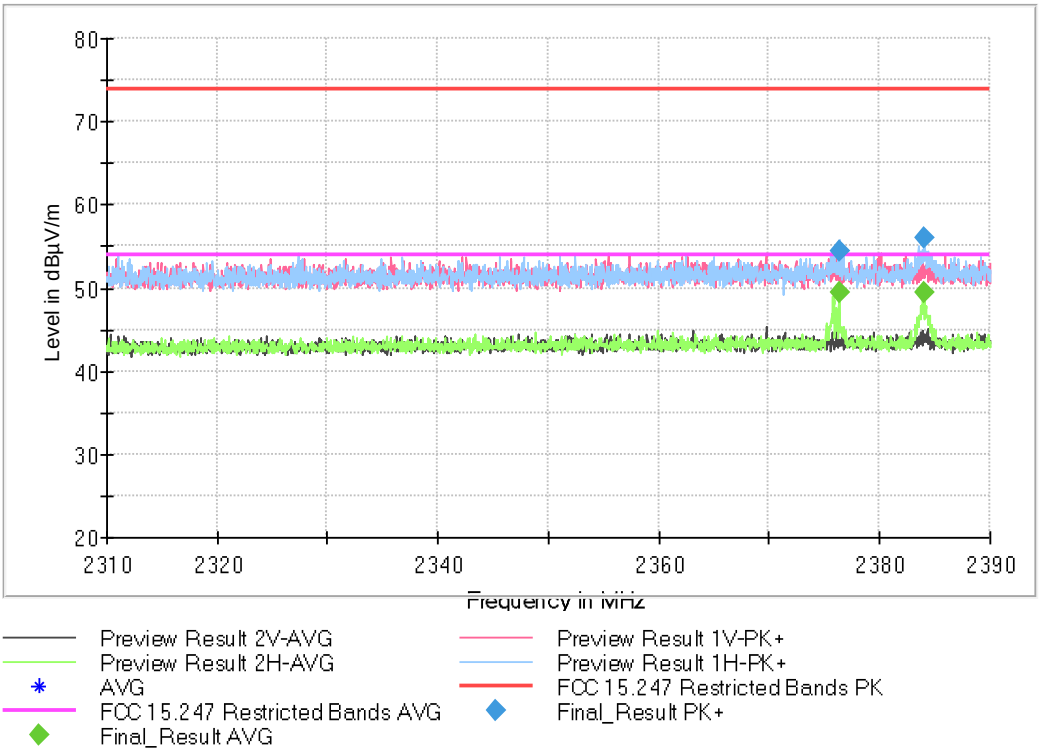
Frequency MHz = 2440.00000

Measurement Point = 1

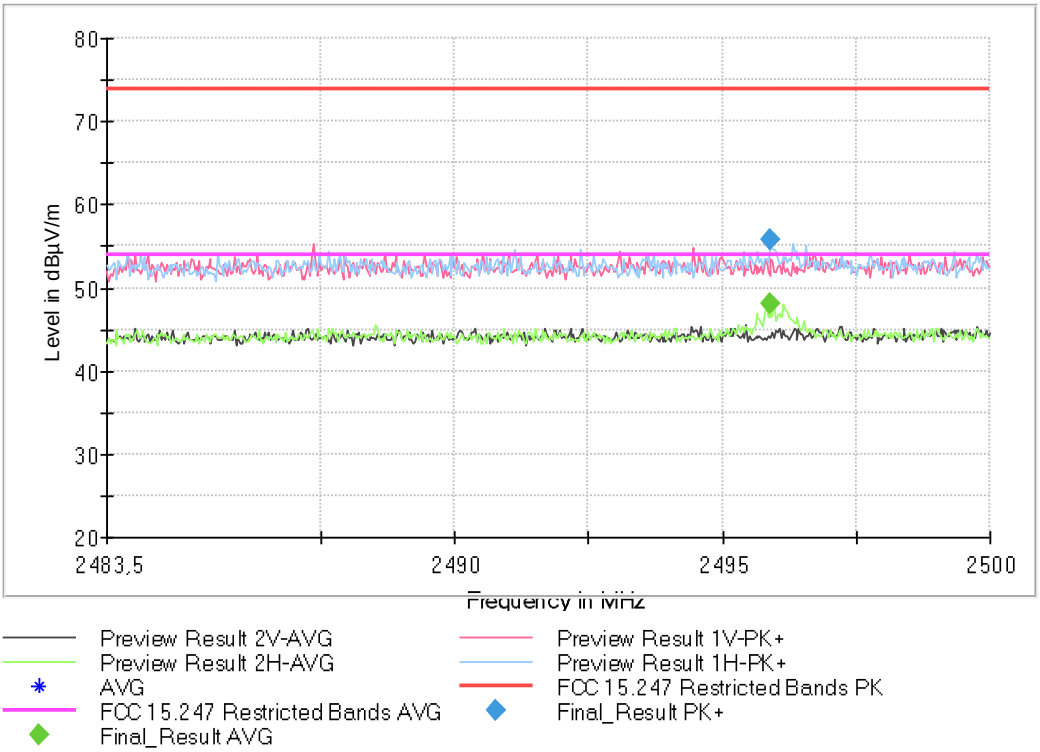
Images:



Full Spectrum

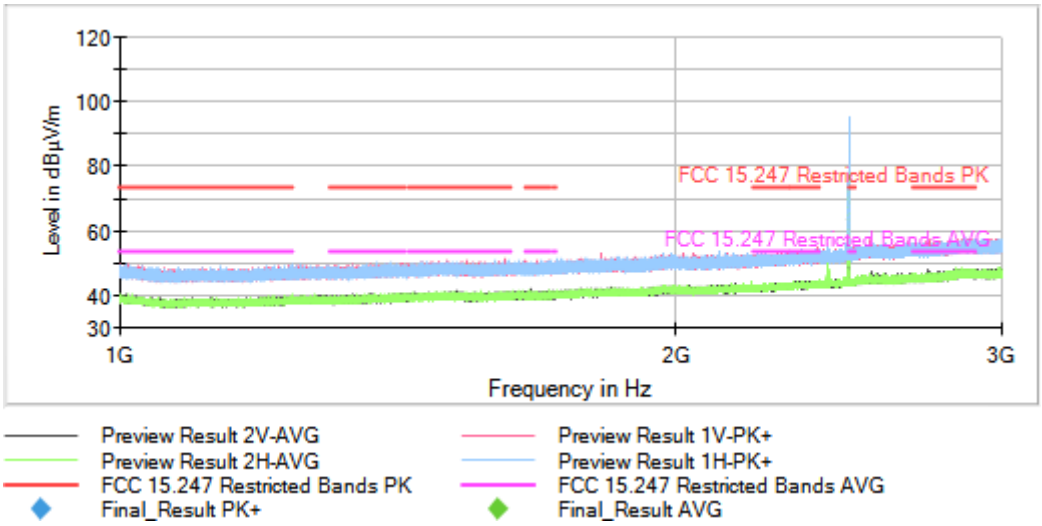


Full Spectrum

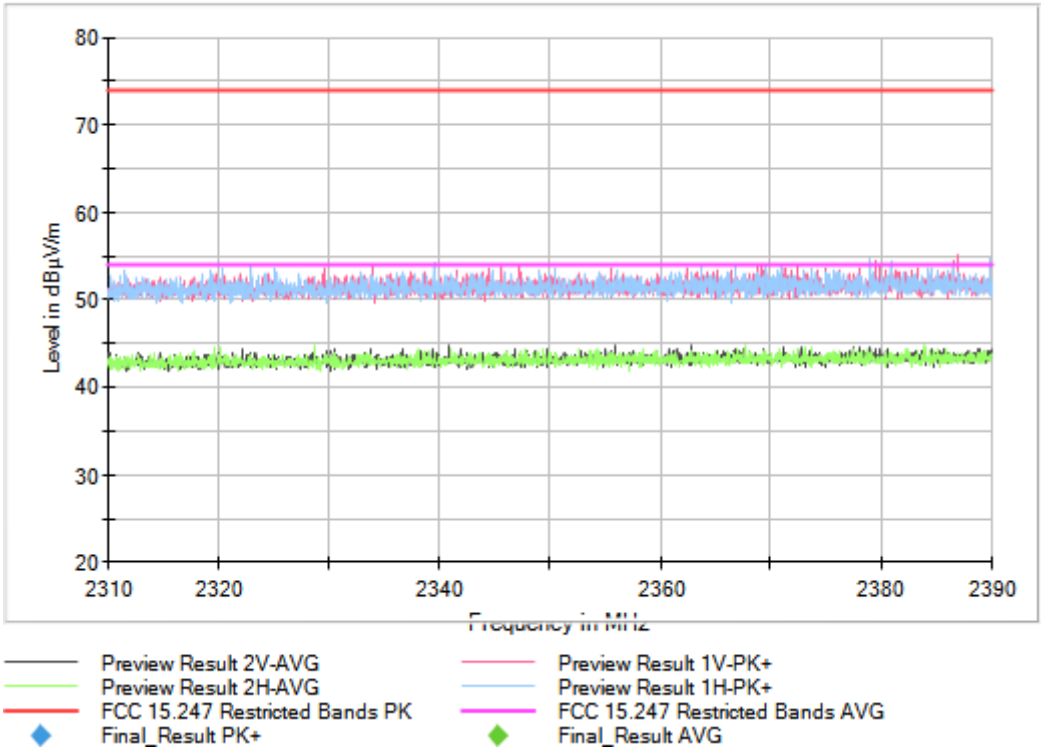


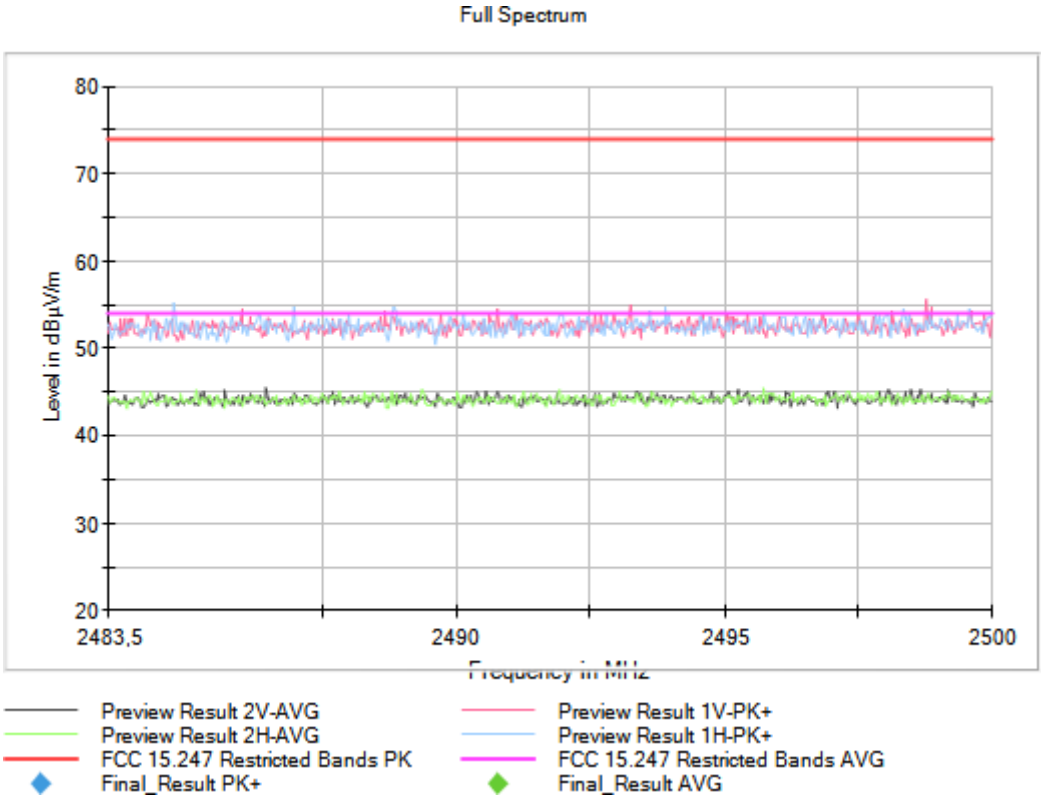
Frequency Range GHz = [1, 3]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Frequency MHz = 2480.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



Full Spectrum





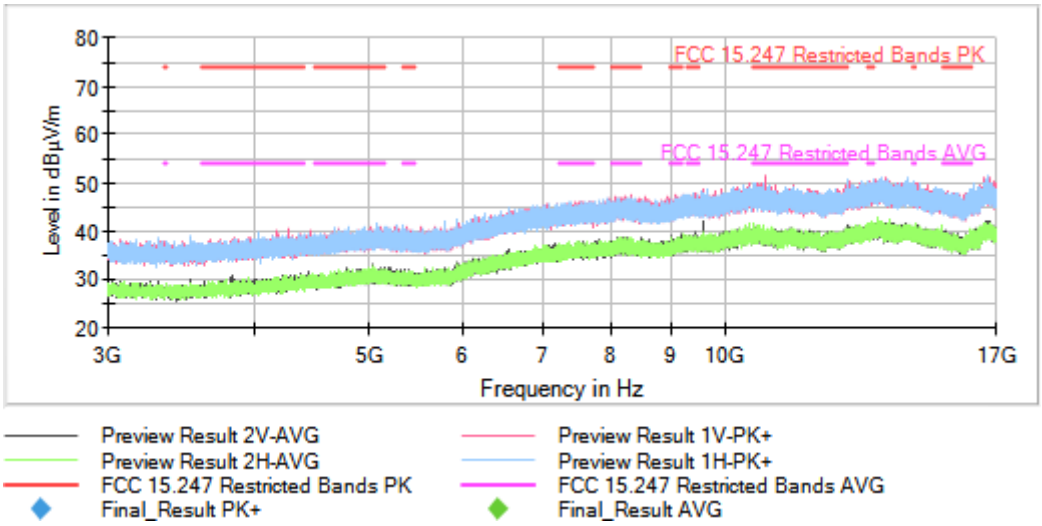
Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	1 GHz - 3 GHz	30,769 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

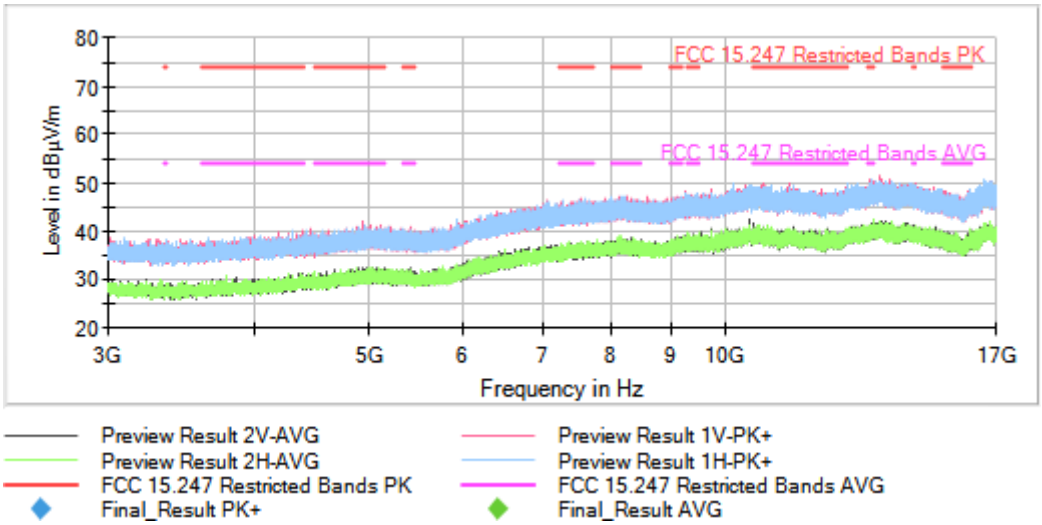
Frequency Range GHz = [3, 17]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Frequency MHz = 2402.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



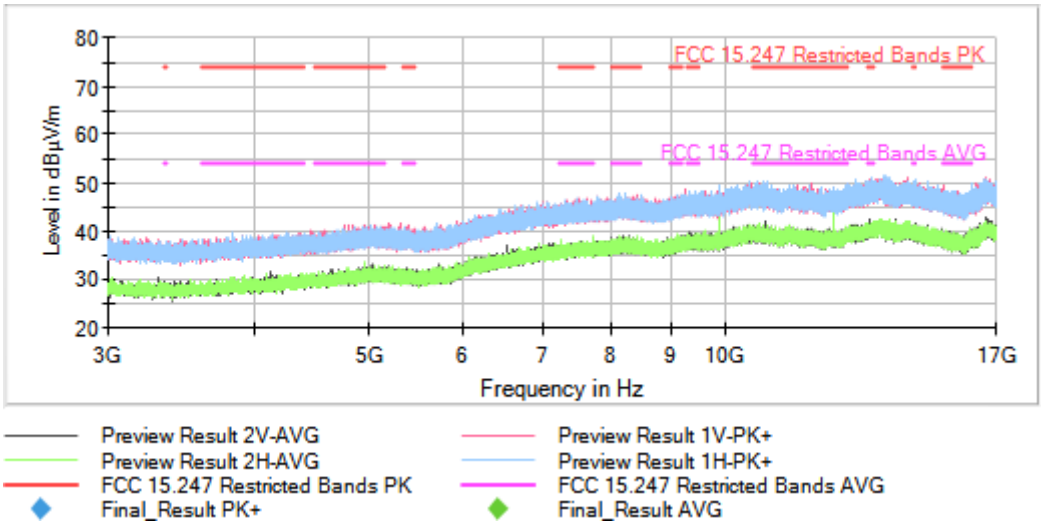
Frequency Range GHz = [3, 17]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Frequency MHz = 2440.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



Frequency Range GHz = [3, 17]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Frequency MHz = 2480.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



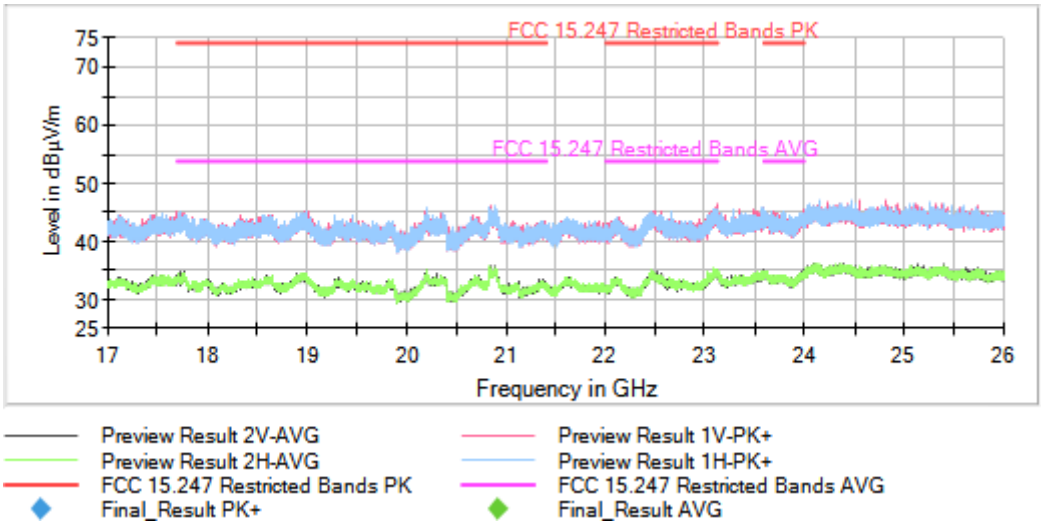
Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	30 dB

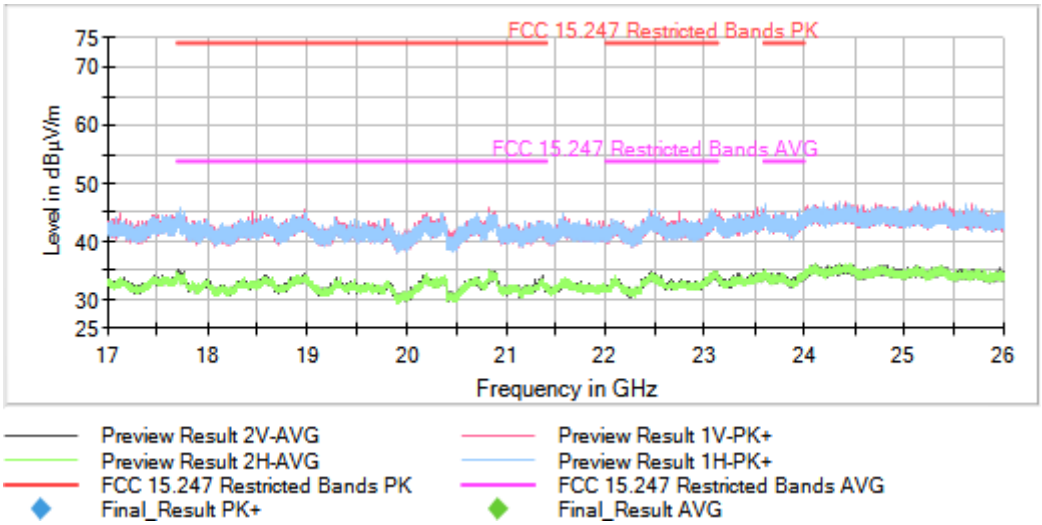
Frequency Range GHz = [17, 26]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Frequency MHz = 2402.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



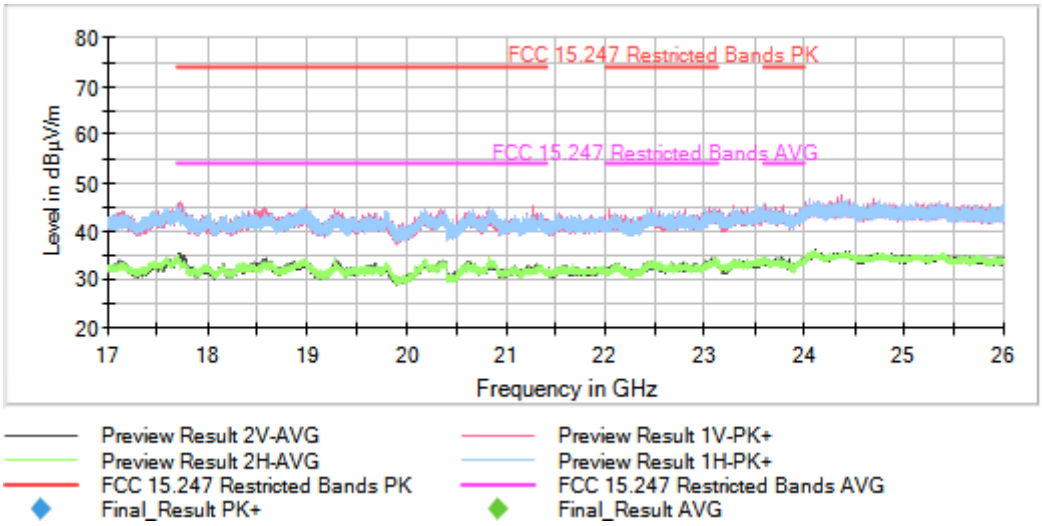
Frequency Range GHz = [17, 26]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Frequency MHz = 2440.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



Frequency Range GHz = [17, 26]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 1 Mbit/s)
Frequency MHz = 2480.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSV 40]					
	17 GHz - 26 GHz	300 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Modulation: BTLE 5.3 (GFSK 2 Mbit/s)

Results

Freq Rng (GHz)	Equipment	Freq (MHz)	Port	Unwanted Freq (MHz)	Unwanted Lvl (dBµV/m)	Pol	Detector
[0.03, 1]	Digital Transmission System (DTS)	2402.00	1	47.975	13.61	V	PK
					7.68		QP
				71.983	33.62	V	PK
					32.28		QP
				95.960	11.69	V	PK
					6.18		QP
				167.982	25.18	V	PK
					23.23		QP
				191.929	27.54	V	PK
					25.59		QP
		2440.00		47.975	31.59	V	PK
					30.12		QP
				71.983	32.64	V	PK
					31.21		QP
				95.869	30.10	V	PK
					28.83		QP
				119.968	25.88	V	PK
					23.38		QP
				143.793	23.99	V	PK
					21.87		QP
				167.892	27.91	V	PK
					25.66		QP
		2480.00		48.006	27.90	V	PK
					26.51		QP
				71.983	33.63	V	PK
					32.31		QP
				95.990	30.13	V	PK
					28.73		QP
				167.982	30.31	H	PK
					29.00		QP
				192.020	27.17	H	PK
					25.76		QP
[1, 3]		2402.00		2344.276	60.46	V	PK
					47.57		QP
		2440.00		2376.615	54.59	H	PK
					50.36		QP
				2384.246	54.86	H	PK
					49.90		QP

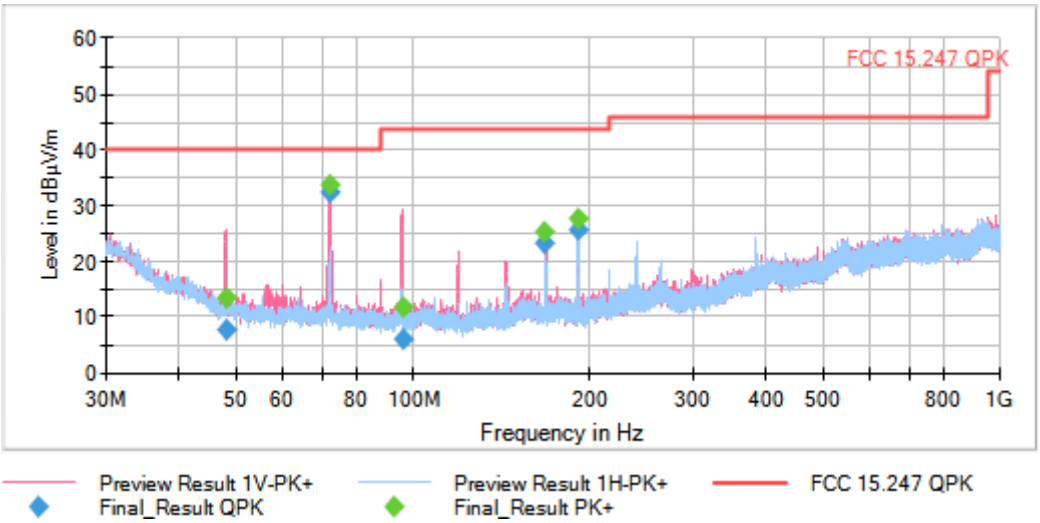
Verdict

Pass

Attachments

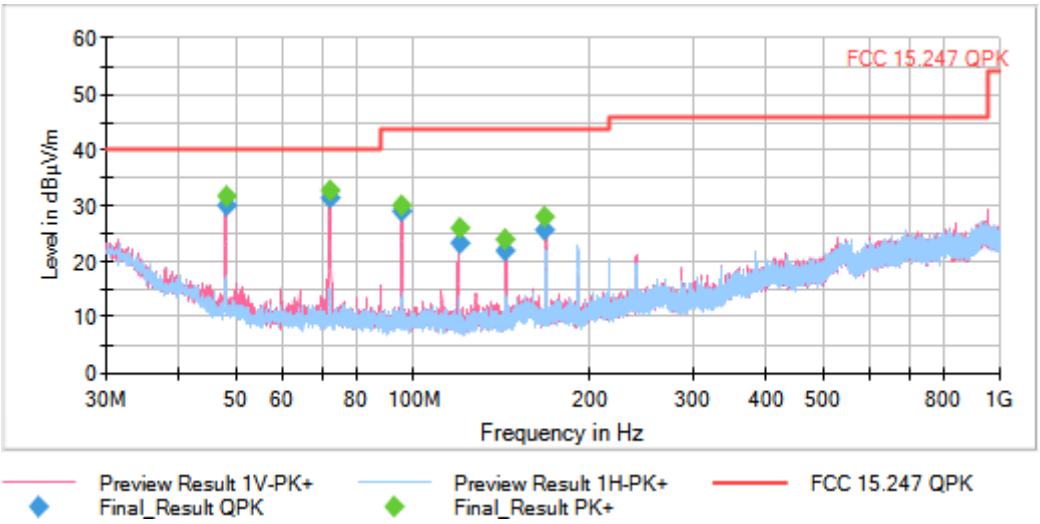
Frequency Range GHz = [0.03, 1]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 2 Mbit/s)
Frequency MHz = 2402.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



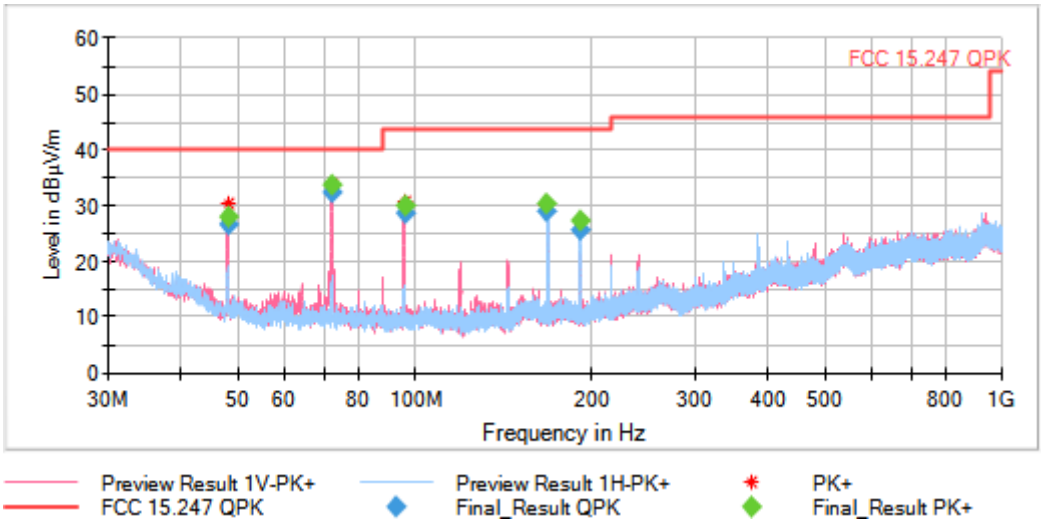
Frequency Range GHz = [0.03, 1]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 2 Mbit/s)
Frequency MHz = 2440.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



Frequency Range GHz = [0.03, 1]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 2 Mbit/s)
Frequency MHz = 2480.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



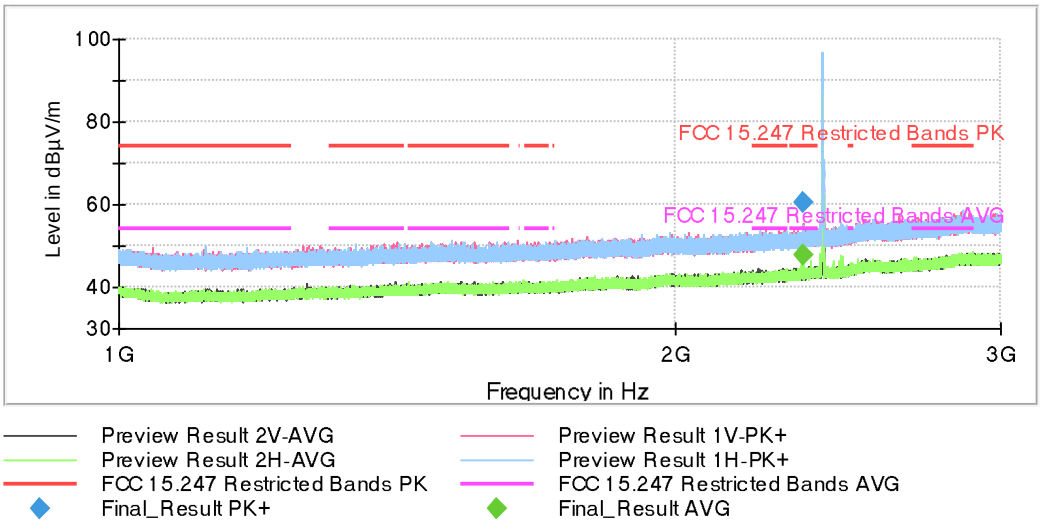
Tables:

Spectrum Analyzer Parameters

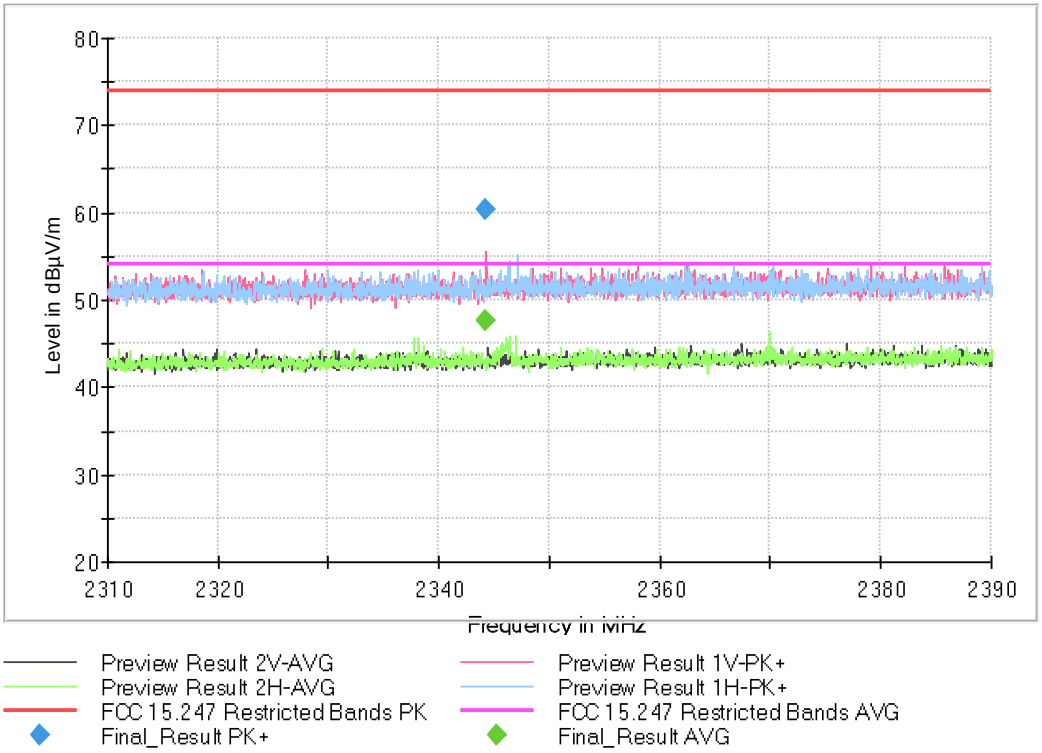
	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	30 MHz - 1 GHz	30,312 kHz	PK+	100 kHz	1 s	0 dB

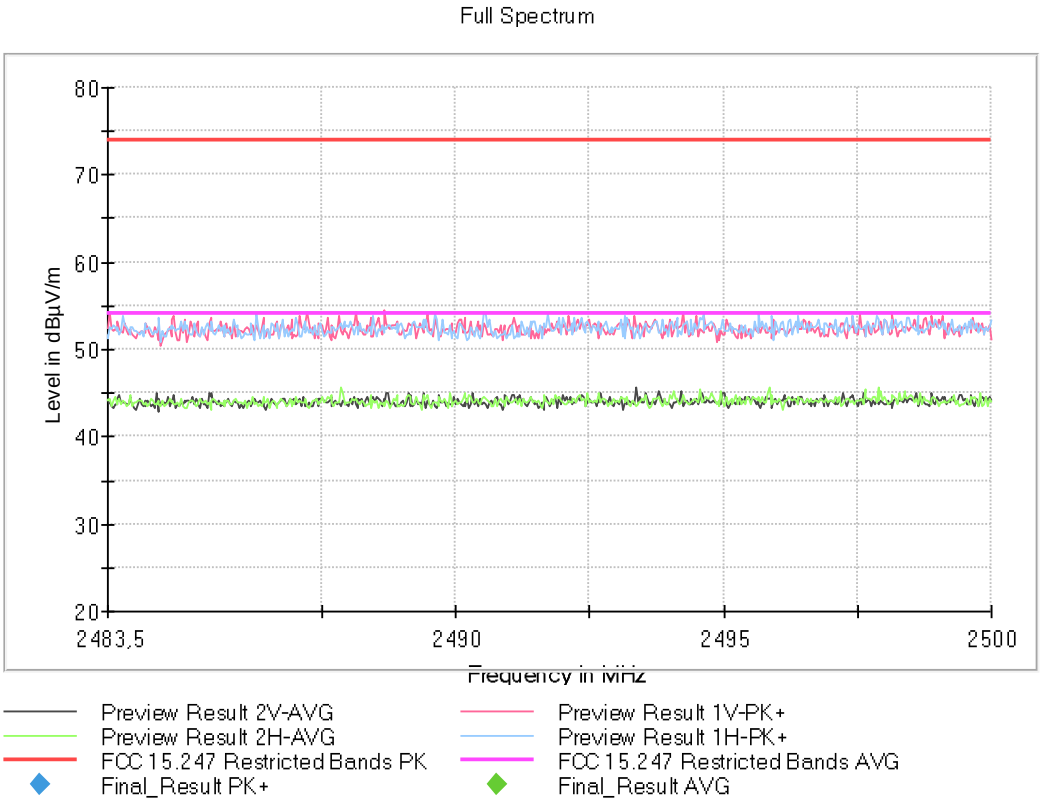
Frequency Range GHz = [1, 3]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 2 Mbit/s)
Frequency MHz = 2402.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



Full Spectrum





Frequency Range GHz = [1, 3]

Equipment Type = Digital Transmission System (DTS)

Modulation = BTLE 5.3 (GFSK 2 Mbit/s)

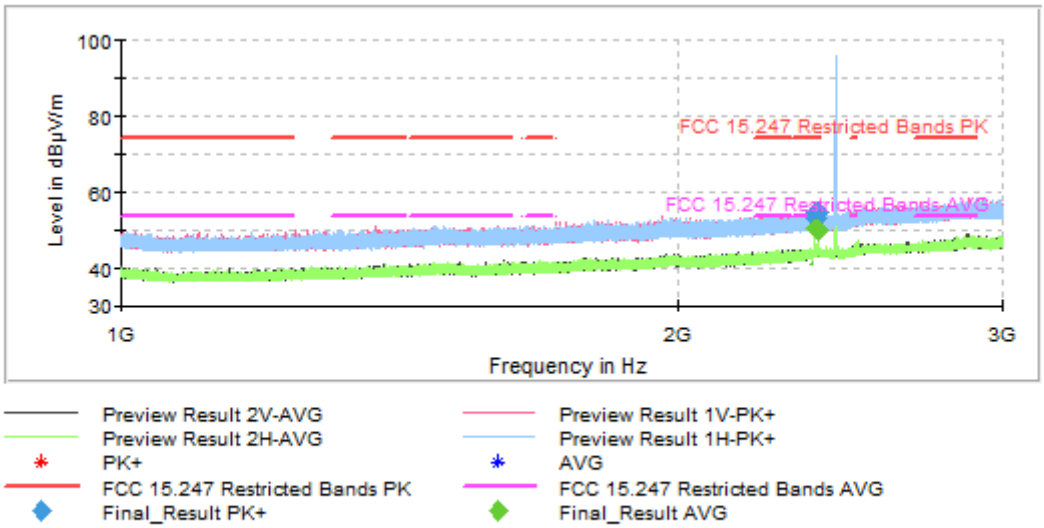
Frequency MHz = 2440.00000

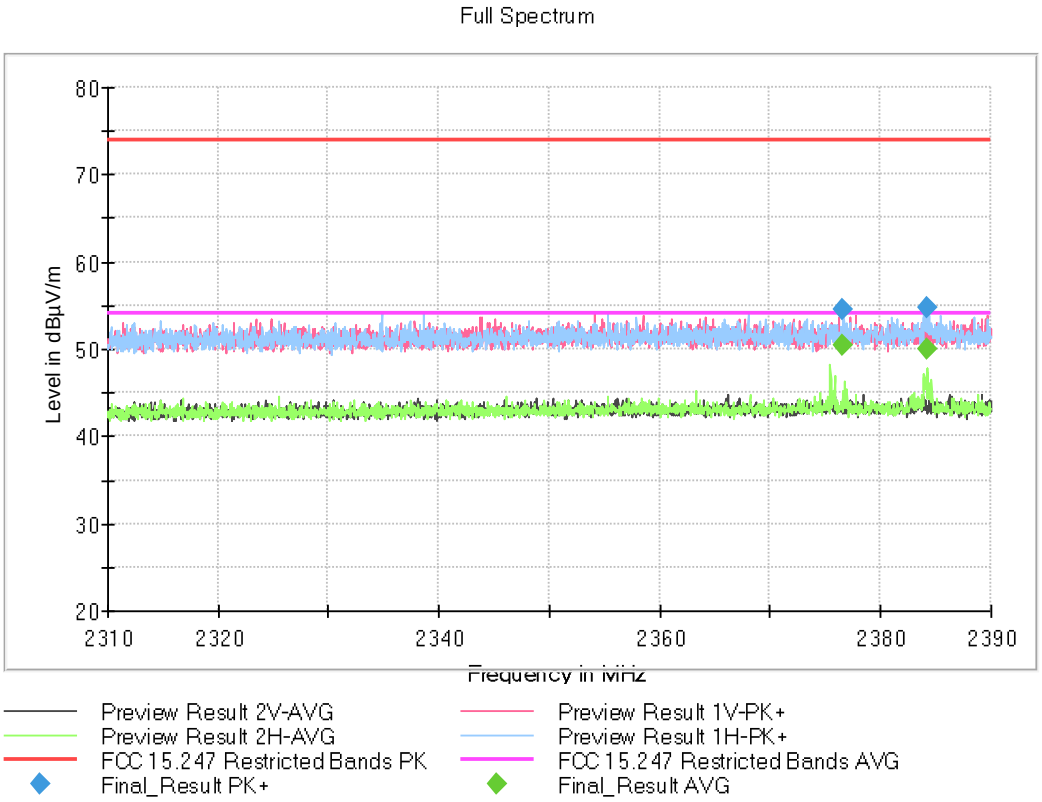
Mode = SISO

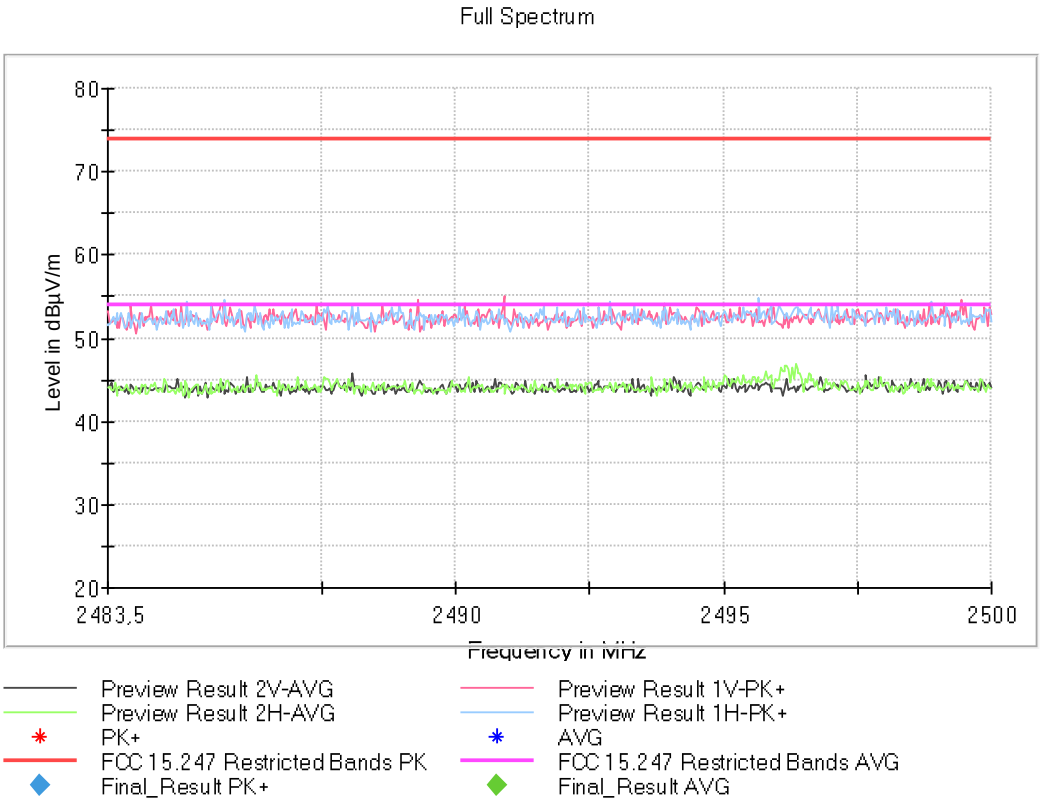
Measurement Point = 1

Active Port = 1

Images:



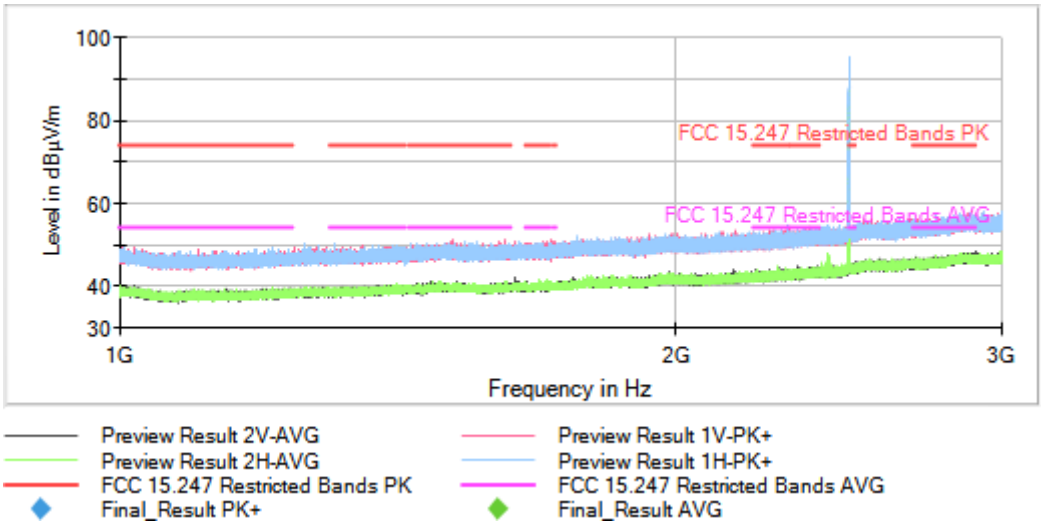

Full Spectrum
Level in dBµV/m
80
70
60
50
40
30
20
2310
2320
2340
2360
2380
2390
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 Restricted Bands PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG


Full Spectrum
Level in dBµV/m
80
70
60
50
40
30
20
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
PK+
FCC 15.247 Restricted Bands PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
AVG
FCC 15.247 Restricted Bands AVG
Final_Result AVG

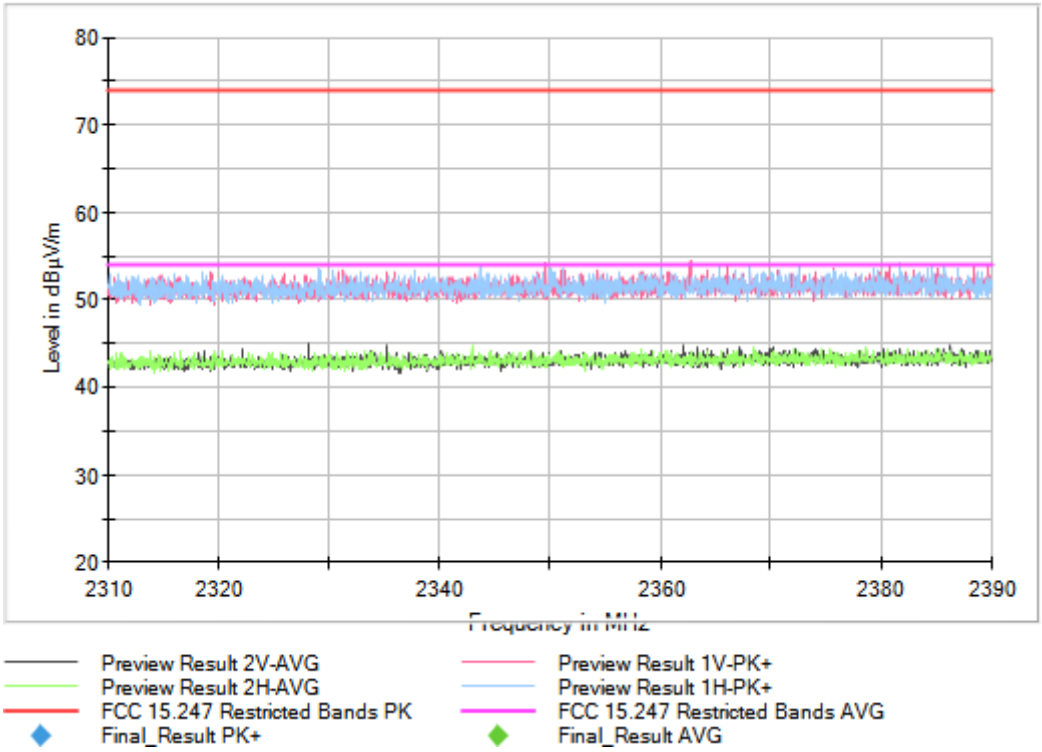
Tables

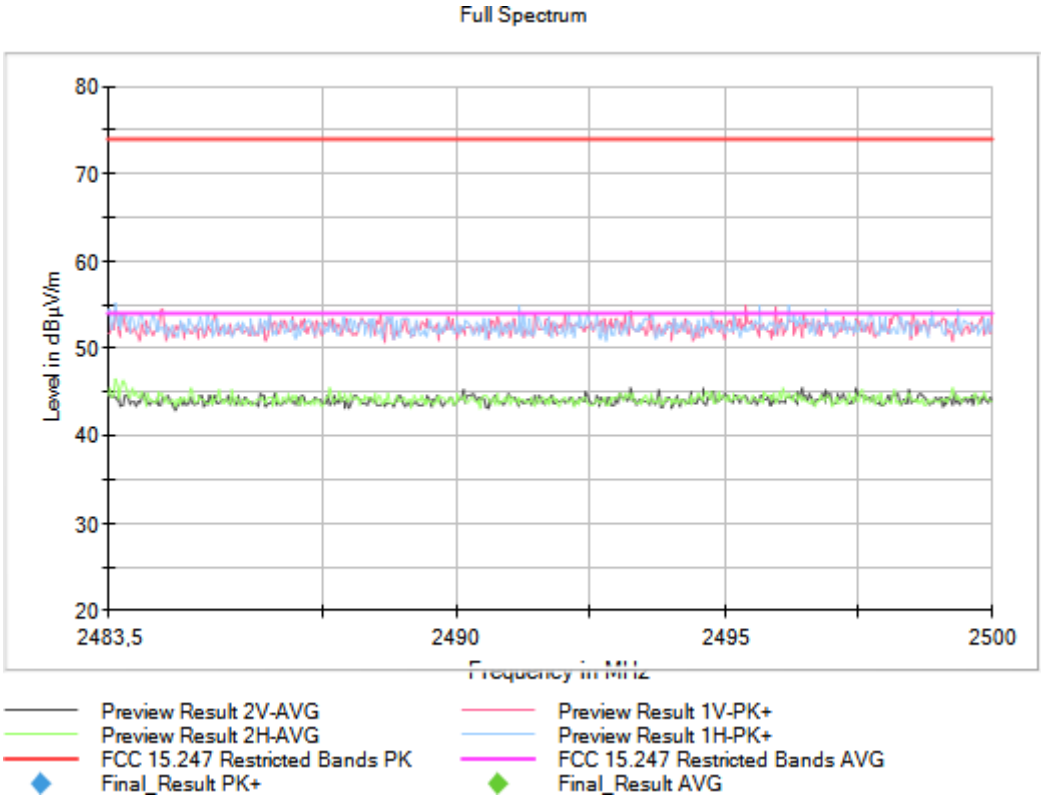
Frequency Range GHz = [1, 3]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 2 Mbit/s)
Frequency MHz = 2480.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



Full Spectrum





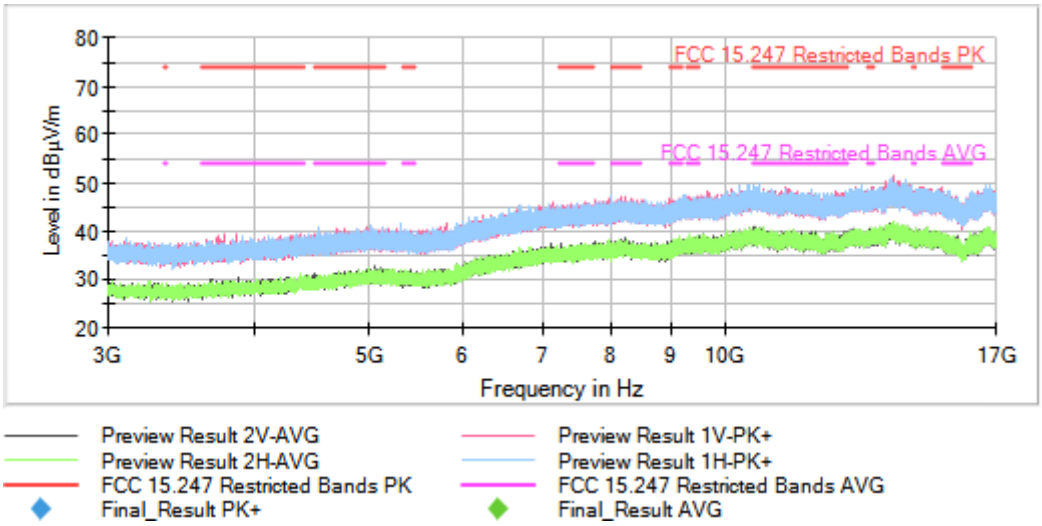
Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	1 GHz - 3 GHz	30,769 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

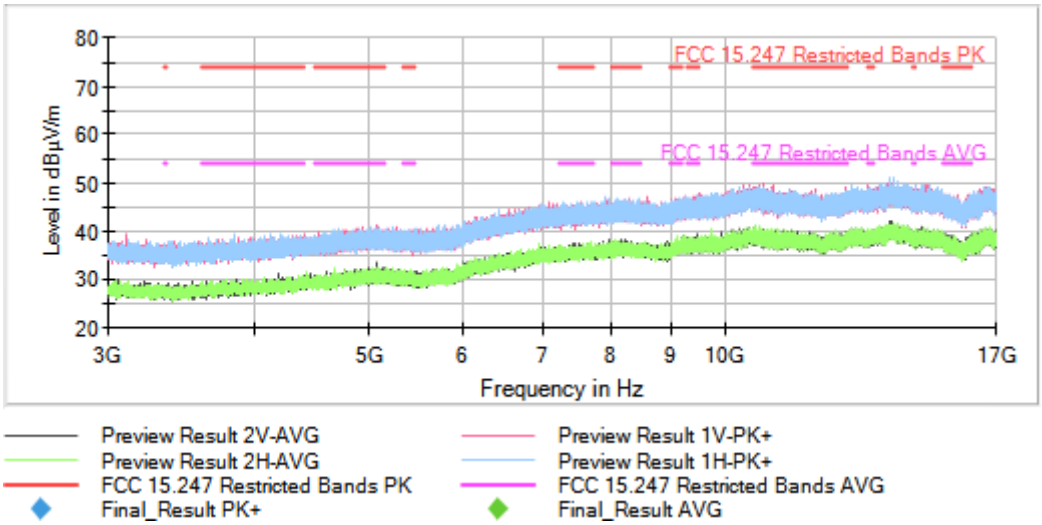
Frequency Range GHz = [3, 17]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 2 Mbit/s)
Frequency MHz = 2402.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



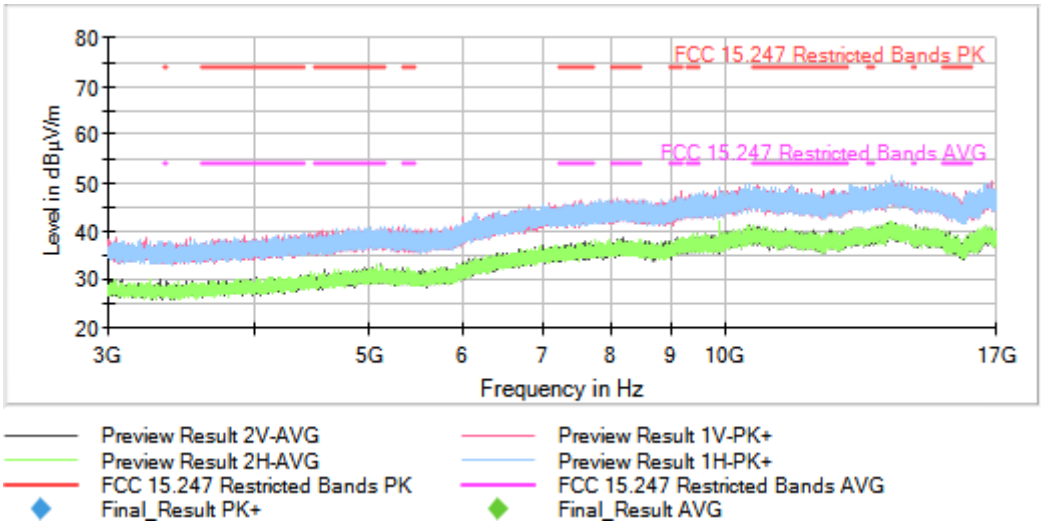
Frequency Range GHz = [3, 17]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 2 Mbit/s)
Frequency MHz = 2440.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



Frequency Range GHz = [3, 17]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 2 Mbit/s)
Frequency MHz = 2480.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



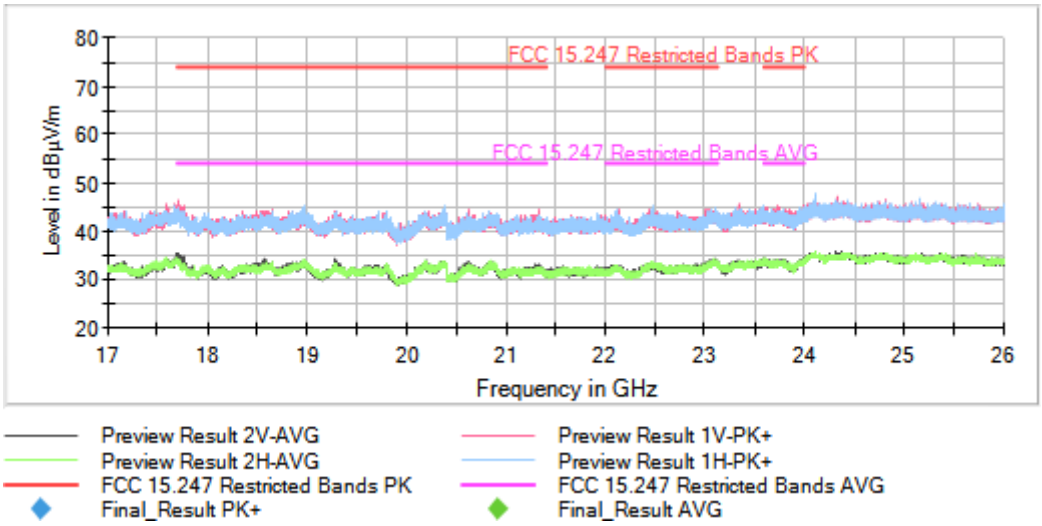
Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESW 44]					
	3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	30 dB

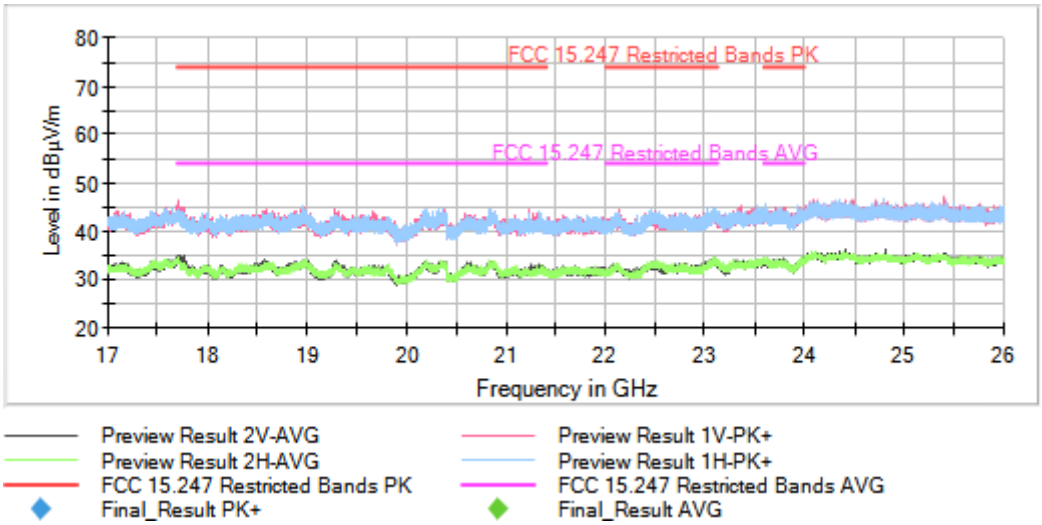
Frequency Range GHz = [17, 26]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 2 Mbit/s)
Frequency MHz = 2402.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



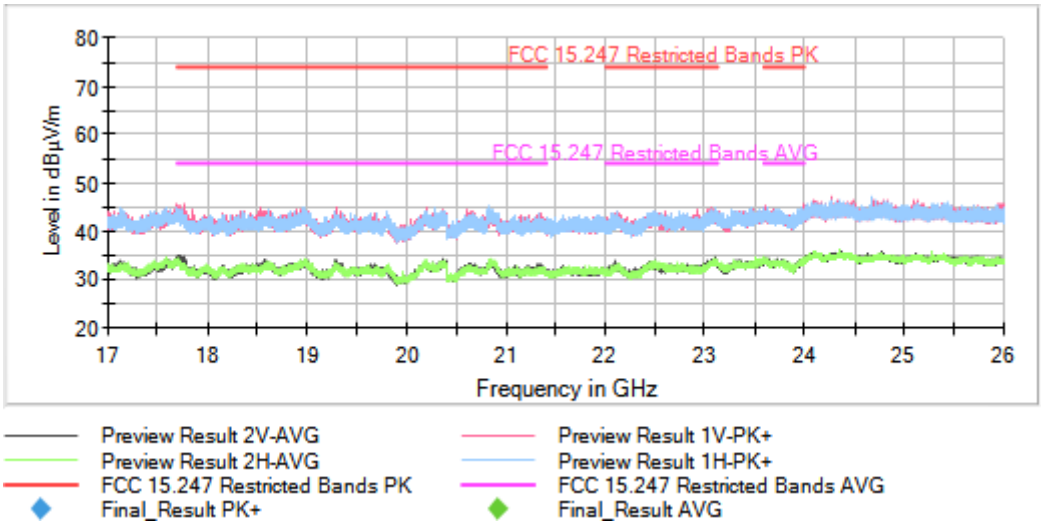
Frequency Range GHz = [17, 26]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 2 Mbit/s)
Frequency MHz = 2440.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



Frequency Range GHz = [17, 26]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.3 (GFSK 2 Mbit/s)
Frequency MHz = 2480.00000
Mode = SISO
Measurement Point = 1
Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSV 40]					
	17 GHz - 26 GHz	300 kHz	PK+ ; AVG	1 MHz	1 s	0 dB