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

Test Report No:
NIE: 72370RRF.005A2

Test Report
USA FCC Part 15.247, 15.209

(*) Identification of item tested	CIVIC (Central In-Vehicle Infotainment Computer)
(*) Trademark	Bosch
(*) Model and /or type reference	MBCI2LS4PN1
Other identification of the product	FCC ID: 2AUXS-MBCI2LS4PN1 IC: 25847-MBCI2LS4PN1
(*) Features	Features: AM/FM/DAB/SIRIUS, GNSS, 2.4/5GHz WLAN, Bluetooth 5.1, Video/Audio etc HW version: D1.1 SW version: E23.3
Applicant	Robert Bosch GmbH Robert-Bosch-Strasse 200 31139, Hildesheim 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. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager 2022.11.02 17:47:43 +01'00'
Date of issue	2022-11-02
Report template No	FDT08_24 (*) "Data provided by the client"

Index

Acronyms

Acronym ID	Acronym Description
# of Tx Chains	Number of Transmission Chains
Detector	Detector used
Equipment	Equipment Type
Freq	Frequency
Freq Rng	Frequency Range
MP	Measurement Point
Mod	Modulation
Pol	Polarization
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 is an FCC-recognized accredited testing laboratory with 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
Accumulated Dwell Time: Measurement uncertainty ≤ ± 0,16 %
Minimum Frequency Occupation Time: Measurement uncertainty ≤ ± 0,53 %
Hopping Frequency Separation: Measurement uncertainty ≤ ± 1,74 %
Occupied Channel Bandwidth: Measurement uncertainty ≤ ± 1,24 %
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 CIVIC Central In-Vehicle Infotainment Computer, including WLAN/ Bluetooth, GPS, AM/FM/DAB receiver.

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	72370C_26.1	Central In-Vehicle Infotainment Computer)	MBCI2LS4PN1	0006002	2022-05-17	Element Under Test
S/01	72370C_10.1	Harness	--	--	2022-05-17	Element Under Test
S/01	72370C_27.1	BT/WLAN antenna	--	--	2022-05-17	Auxiliary Element
S/01	72370C_28.1	BT/WLAN antenna	--	--	2022-05-17	Auxiliary Element
S/01	72370C_29.1	BT/WLAN antenna	--	--	2022-05-17	Auxiliary Element
S/01	72370C_30.1	BT/WLAN antenna	--	--	2022-05-17	Auxiliary Element
S/01	72370C_31.1	FAKRA 4n1 cable	--	--	2022-05-17	Auxiliary Element
S/01	72370C_32.1	SMA 4n1 cable	--	--	2022-05-17	Auxiliary Element
S/01	72370C_34.1	FAKRA to SMA adapter	--	--	2022-05-17	Auxiliary Element
S/01	72370C_35.1	FAKRA to SMA adapter	--	--	2022-05-17	Auxiliary Element
S/01	72370C_36.1	FAKRA to SMA adapter	--	--	2022-05-17	Auxiliary Element
S/01	72370C_37.1	FAKRA to SMA adapter	--	--	2022-05-17	Auxiliary Element
S/01	72370C_38.1	DC Block	--	--	2022-05-17	Auxiliary Element
S/01	72370C_39.1	DC Block	--	--	2022-05-17	Auxiliary Element
S/01	72370C_42.1	DC Block	--	--	2022-05-17	Auxiliary Element
S/01	72370C_43.1	FAKRA to SMA cable	--	--	2022-05-17	Auxiliary Element
S/01	72370C_9.1	Connecting cable	--	--	2022-05-17	Auxiliary Element
S/01	72370C_7.1	USB Cable	--	--	2022-05-17	Auxiliary Element
S/01	72370C_8.1	USB adapter	--	--	2022-05-17	Auxiliary Element

Id	Control Number	Description	Model	Serial No.	Date of Reception	Application
S/02	72370C_26.1	Central In-Vehicle Infotainment Computer)	MBCI2LS4PN1	0006002	2022-05-17	Element Under Test
S/02	72370C_10.1	Harness	--	--	2022-05-17	Element Under Test
S/02	72370C_31.1	FAKRA 4n1 cable	--	--	2022-05-17	Auxiliary Element
S/02	72370C_32.1	SMA 4n1 cable	--	--	2022-05-17	Auxiliary Element
S/02	72370C_34.1	FAKRA to SMA adapter	--	--	2022-05-17	Auxiliary Element
S/02	72370C_35.1	FAKRA to SMA adapter	--	--	2022-05-17	Auxiliary Element
S/02	72370C_36.1	FAKRA to SMA adapter	--	--	2022-05-17	Auxiliary Element
S/02	72370C_37.1	FAKRA to SMA adapter	--	--	2022-05-17	Auxiliary Element
S/02	72370C_38.1	DC Block	--	--	2022-05-17	Auxiliary Element
S/02	72370C_39.1	DC Block	--	--	2022-05-17	Auxiliary Element
S/02	72370C_42.1	DC Block	--	--	2022-05-17	Auxiliary Element
S/02	72370C_43.1	FAKRA to SMA cable	--	--	2022-05-17	Auxiliary Element
S/02	72370C_9.1	Connecting cable	--	--	2022-05-17	Auxiliary Element
S/02	72370C_7.1	USB Cable	--	--	2022-05-17	Auxiliary Element
S/02	72370C_8.1	USB adapter	--	--	2022-05-17	Auxiliary Element

Notes referenced to samples during the project:

Id	Type
S/01	Sample used for radiated test
S/02	Sample used for conducted test

Test sample description

Ports…… :	Port name and description	Cable					
		Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)		
	Main Connector	2m	[X]	[ ]	[ ]		
	Most Connector	2m	[X]	[ ]	[ ]		
	Fakra Quad Connector AM/FM/DAB Fakra Single Connector GPS	.....	[X]	[X]	[ ]		
	Fakra Quad Connector WLAN/BT	.....	[X]	[X]	[ ]		
	.....	.....	[X]	[X]	[ ]		
Supplementary information to the ports…… :	.....						
Rated power supply .....:	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	[ ]	AC:	[ ]	[ ]	[ ]	[ ]	[ ]
	[X]	DC: 9-16V nomimal 12 VDC by vehicle battery					
Rated Power .....:	.....						
Clock frequencies.....:	.....						
Other parameters.....:	.....						
Software version .....:	E23.3						
Hardware version.....:	D1.1						
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: Cluster in the car					
Modules/parts.....:	Module/parts of test item		Type	Manufacturer			
	.....		.....	.....			

Accessories (not part of the test item) .....:	Description	Type	Manufacturer
	Antennas	.....	.....
	HUD	.....	.....
	SA2 Panel	.....	.....
	Cameras	.....	.....
	.....	.....	.....
Documents as provided by the applicant .....:	Description	File name	Issue date
	.....	.....	.....

(3) Only for Medical Equipment

Identification of the client

Robert Bosch GmbH
Robert-Bosch-Strasse 200
31139, Hildesheim, Germany

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2022-06-20
Date (finish)	2022-08-24

Document history

Report number	Date	Description
72370RRF.005	2022-10-18	First release.
72370RRF.005A1	2022-10-20	Second release. Modification of Hardware Version of sample tested and correction of minor typos. This modification of test report cancels and replaces the test report 72370RRF.005.
72370RRF.005A2	2022-11-02	Third release. Correction of typo in index of Appendix D. This modification of test report cancels and replaces the test report 72370RRF.005A1.

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: Nicolas Salguero Camarena, Alfonso Gutiérrez Martínez, Jose Manuel Jimenez Gonzalez, Miguel Manuel López Guzmán and Rafael Fernandez Martin.

Used instrumentation:

Control No.	Equipment	Model	Manufacturer	Next Calibration
6791	SEMIANECHOIC ABSORBER LINED CHAMBER IV	FACT 3 200 STP	ETS LINDGREN	N/A
6792	SHIELDED ROOM	S101	ETS LINDGREN	N/A
7445	DC POWER SUPPLY 30V/5A	U8002A	KEYSIGHT TECHNOLOGIES	---
7760	DIGITAL MULTIMETER	175	FLUKE	2022-11-04
7817	EMI TEST RECEIVER 2Hz-44GHz	ESW44	ROHDE AND SCHWARZ	2023-12-30
6496	HORN ANTENNA 1-18GHz	BBHA 9120 D	SCHWARZBECK	2023-08-24
4657	HORN ANTENNA 18-40GHz	BBHA 9170	SCHWARZBECK	2023-05-05
6143	HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	ETS LINDGREN	2023-10-29
8856	PRE-AMPLIFIER G>30dB 18-40GHz	BLMA 1840-4A	BONN ELEKTRONIK	2022-09-08
3783	PRE-AMPLIFIER G>30dB 1GHz-18GHz	BLMA 0118-3A	BONN ELEKTRONIK	2022-12-01
6144	PRE-AMPLIFIER G>40dB 10MHz-6GHz	BLNA 0160-01N	BONN ELEKTRONIK	2023-03-17
2942	EMI TEST RECEIVER 20Hz-40GHz	ESU40	ROHDE AND SCHWARZ	2023-11-22
6158	SIGNAL AND SPECTRUM ANALYZER 10Hz-40GHz	FSV40	ROHDE AND SCHWARZ	2023-10-22
4848	SOFTWARE FOR EMC/RF TESTING	EMC32	ROHDE AND SCHWARZ	N/A
7794	SIGNAL AND SPECTRUM ANALYZER 10Hz-40GHz	FSV40	ROHDE AND SCHWARZ	2023-02-26
8848	OPEN SWITCH UNIT UP TO 7.5 GHz	OSP-B157W8 PLUS	ROHDE & SCHWARZ	2023-08-20
0922	POWER SUPPLY DC 40 V / 40 A	NGPE 40/40	ROHDE AND SCHWARZ	---
7798	EMC/RF MEASUREMENT SOFTWARE	WMS32	ROHDE AND SCHWARZ	N/A

Testing verdicts

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

Summary

1. Bluetooth EDR. Appendixes A and B

Requirement – Test case	FCC PART 15 PARAGRAPH	Verdict	Remark
FCC 15.247 (a) (1) 20 dB Bandwidth and Carrier frequency separation		P	--
FCC 15.247 (a) (1) (iii) Time of Occupancy (Dwell Time)		P	--
FCC 15.247 (b) Maximum peak output power and antenna gain		P	--
FCC 15.247 (a) (1) (iii) Number of hopping channels		P	--
FCC 15.247 (d) Band-edge emissions compliance (Transmitter)		P	--
FCC 15.247 (d) Emission limitations radiated (Transmitter)		P	--
Supplementary information and remarks: None.			

2. Bluetooth Low Energy 5.1 (1M, 2M). Appendixes C and D

Requirement – Test case FCC PART 15	Verdict	Remark
FCC 15.247 (a) (2) 6 dB Bandwidth	P	--
FCC 15.247 (e) Power spectral density	P	--
FCC 15.247 (b) Maximum output power and antenna gain	P	--
FCC 15.247 (d) Band-edge emissions compliance (Transmitter)	P	--
FCC 15.247 (d) Emission limitations radiated (Transmitter)	P	--
Supplementary information and remarks: None		

3. 802.11 b/g/n20/ax20. Appendix E

Requirement – Test case FCC PART 15	Verdict	Remark
FCC 15.247 (a) (2) 6 dB Bandwidth	P	--
FCC 15.247 (e) Power spectral density	P	--
FCC 15.247 (b) Maximum output power and antenna gain	P	--
FCC 15.247 (d) Band-edge emissions compliance (Transmitter)	P	--
FCC 15.247 (d) Emission limitations radiated (Transmitter)	P	--
Supplementary information and remarks: None		

Appendix A: Test results. Bluetooth EDR. Chipset 1

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TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal:	12Vdc
Type of Power Supply:	Battery

ANTENNA (*):

Type of Antenna:	External antenna
Maximum Declared Antenna Gain:	2 dBi

TEST FREQUENCIES (*):

Low Channel:	2402 MHz
Middle Channel:	2441 MHz
High Channel:	2480 MHz

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).

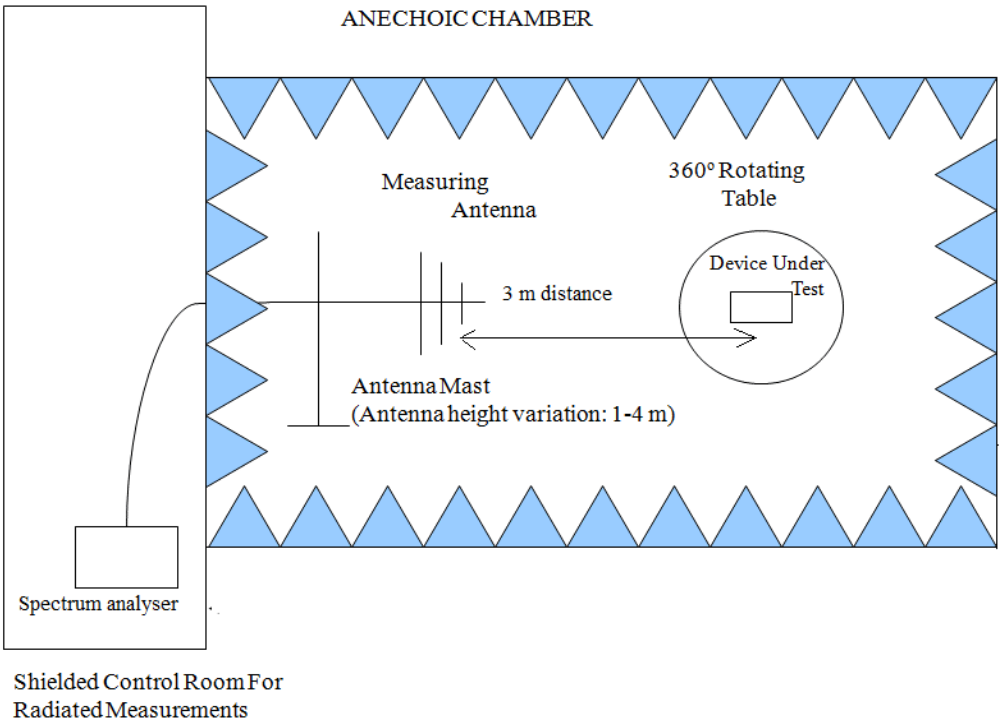
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

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

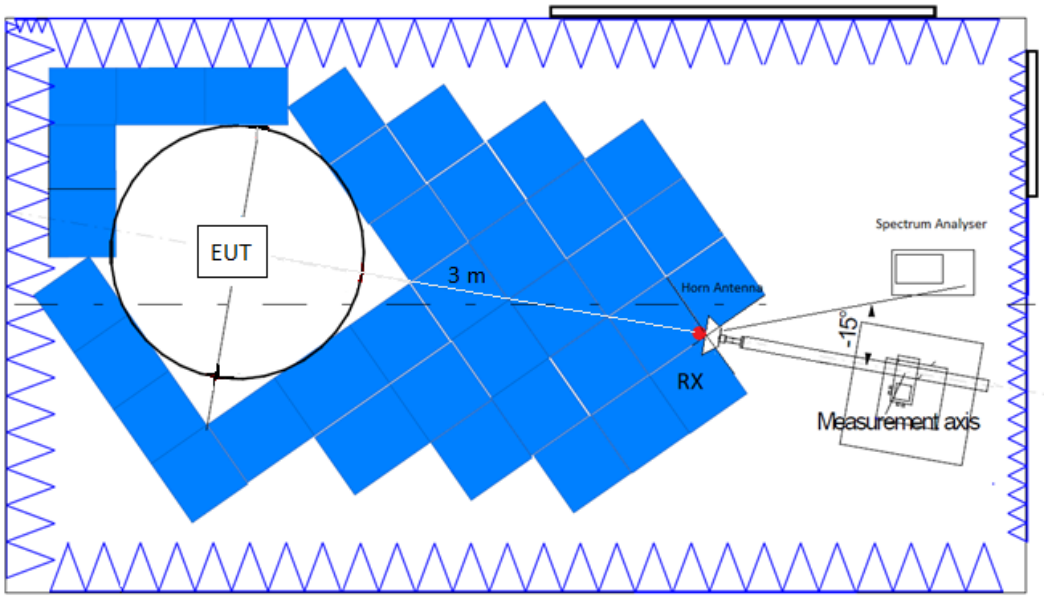
Measurements were made in both horizontal and vertical planes of polarization.

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

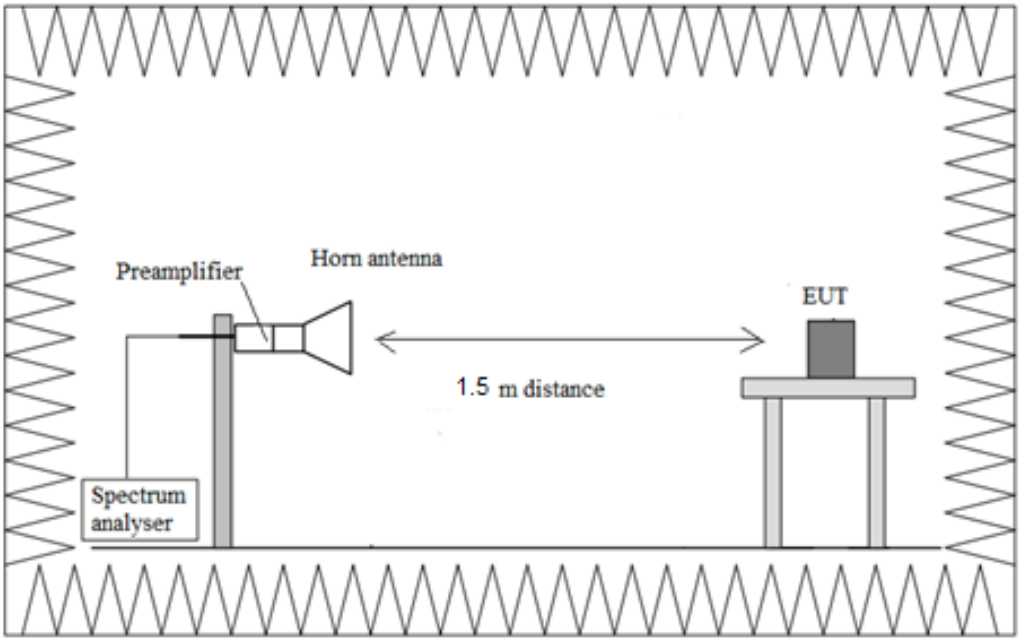
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup f > 17 GHz:



TEST CASES DETAILS

Occupied Channel Bandwidth 99%

Results

Modulation: BT (GFSK 1-DH5)

Freq (MHz)	Occ Ch BW (MHz)
2402.00	0.835000
2441.00	0.835000
2480.00	0.835000

Modulation: BT (Pi/4 DQPSK 2-DH5)

Freq (MHz)	Occ Ch BW (MHz)
2402.00	1.170000
2441.00	1.170000
2480.00	1.165000

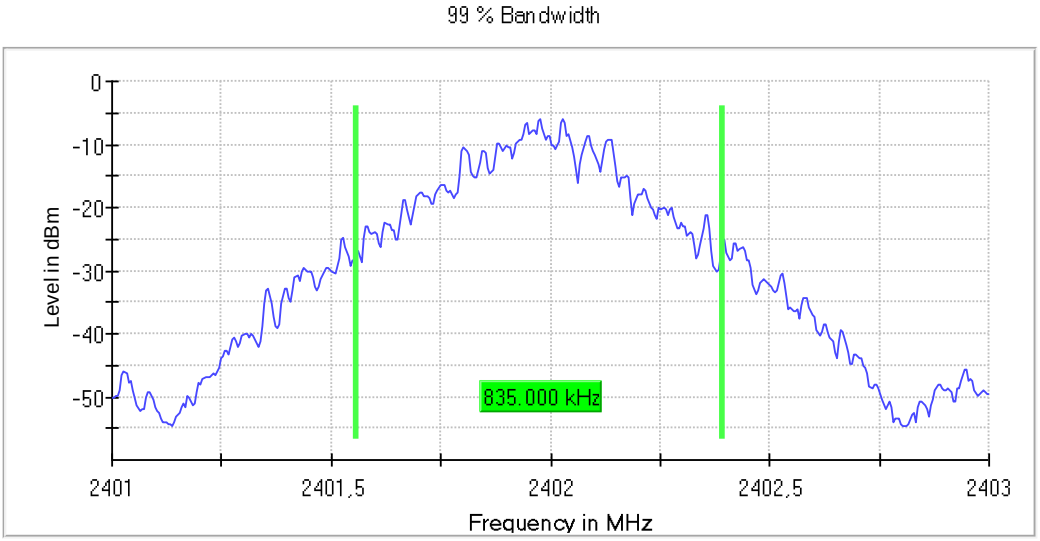
Modulation: BT (8DPSK 3-DH5)

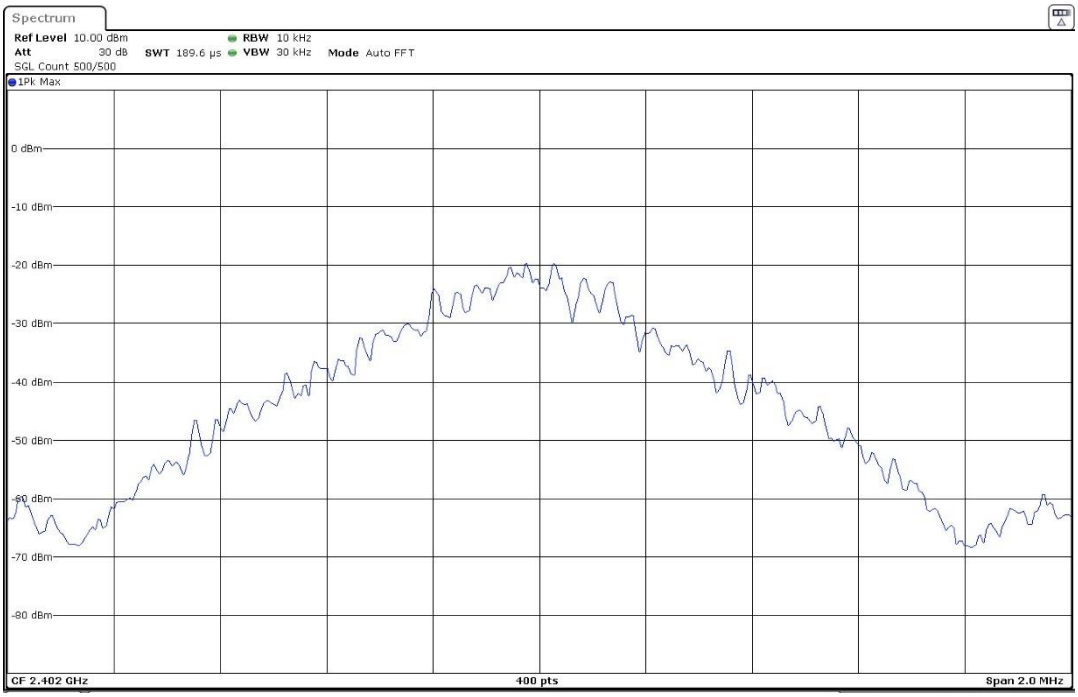
Freq (MHz)	Occ Ch BW (MHz)
2402.00	1.185000
2441.00	1.185000
2480.00	1.185000

Attachments

Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

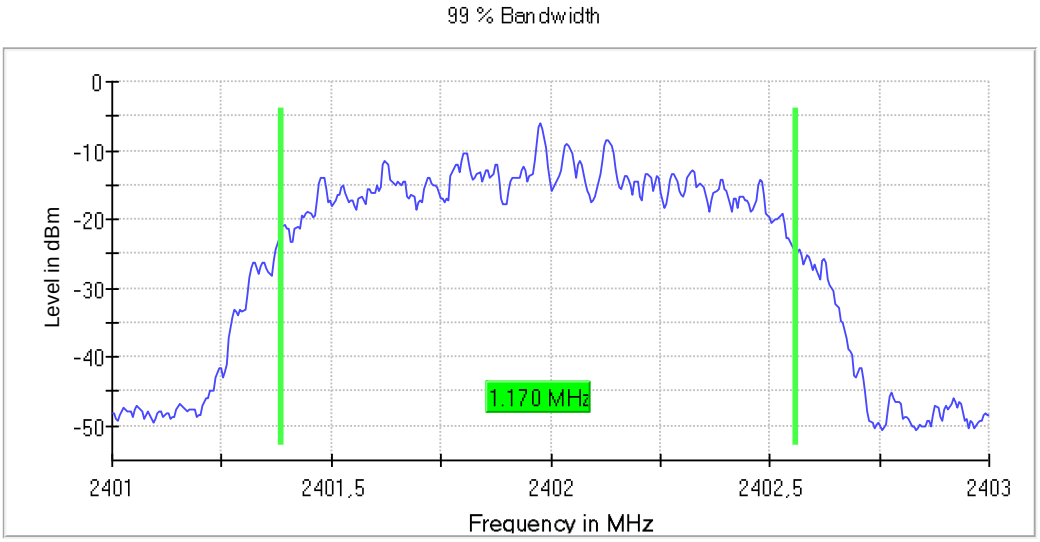
Plots:

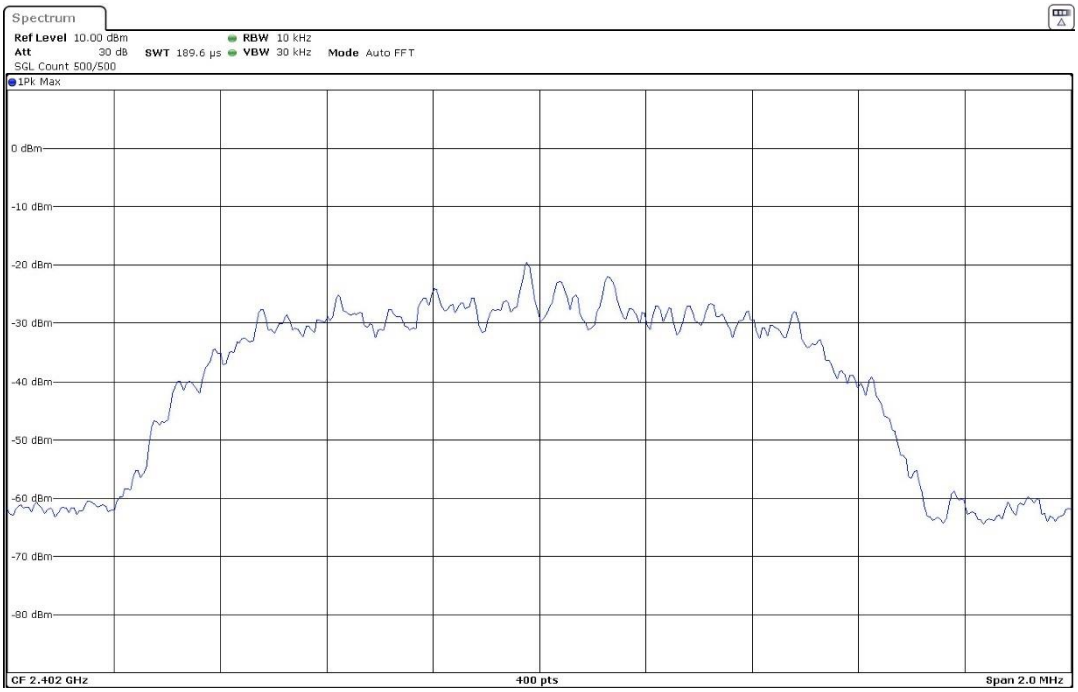




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

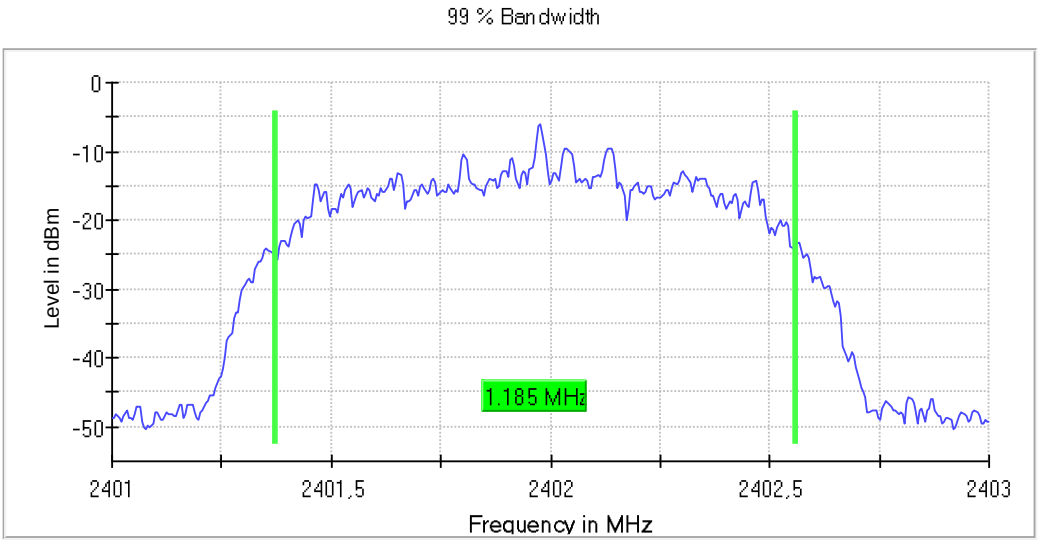
Plots:

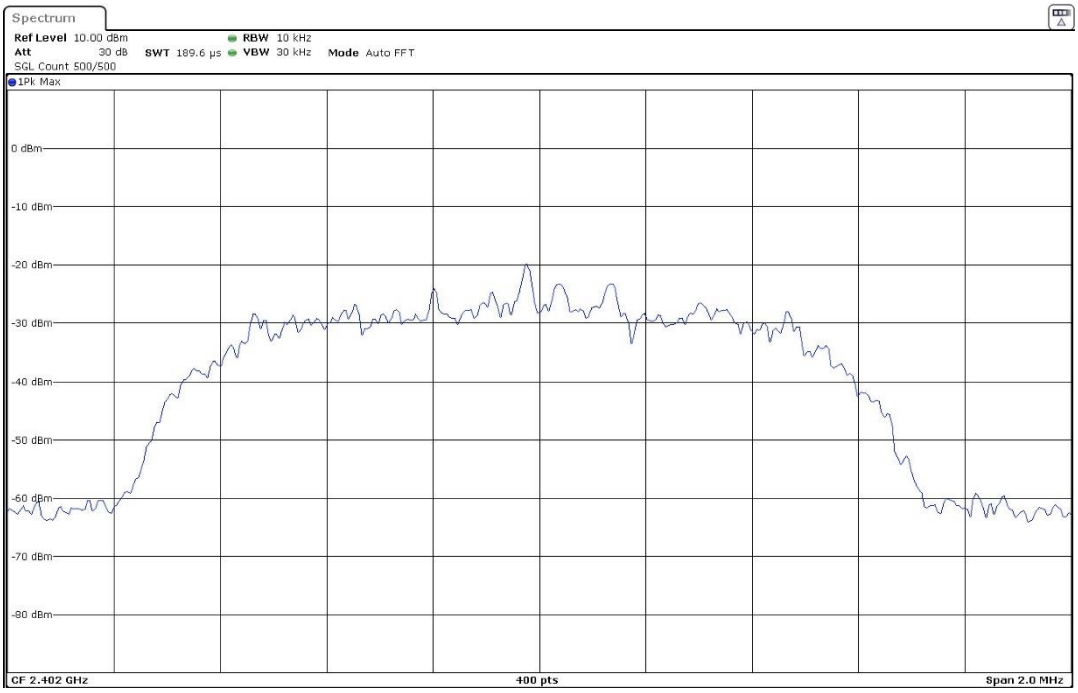




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

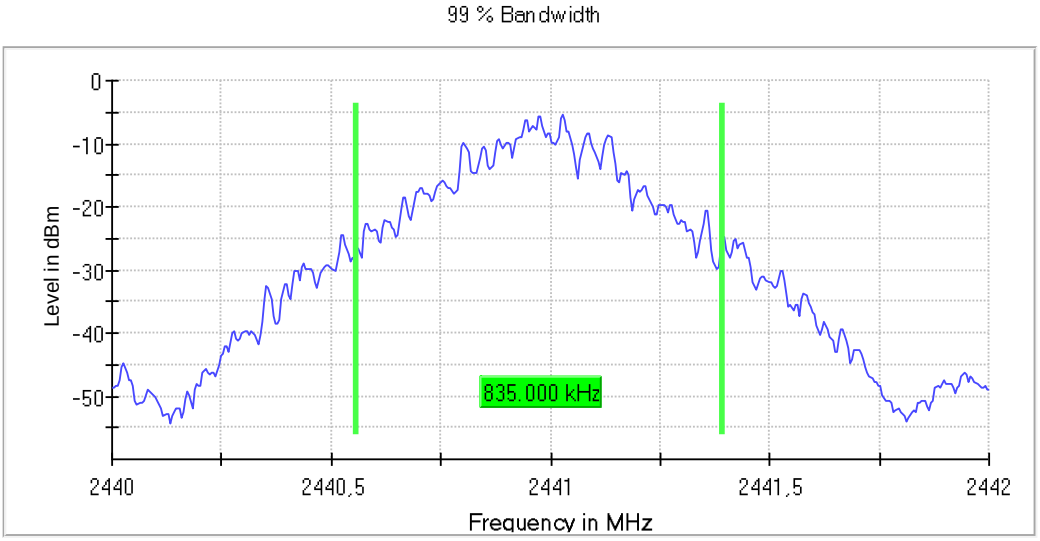
Plots:

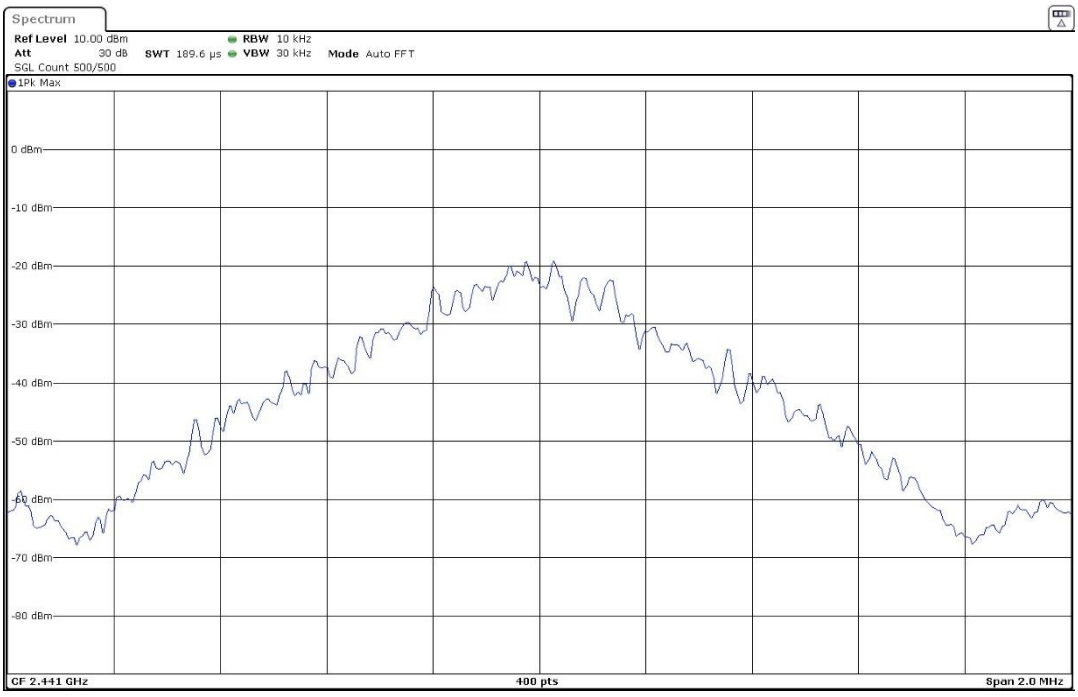




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2441.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

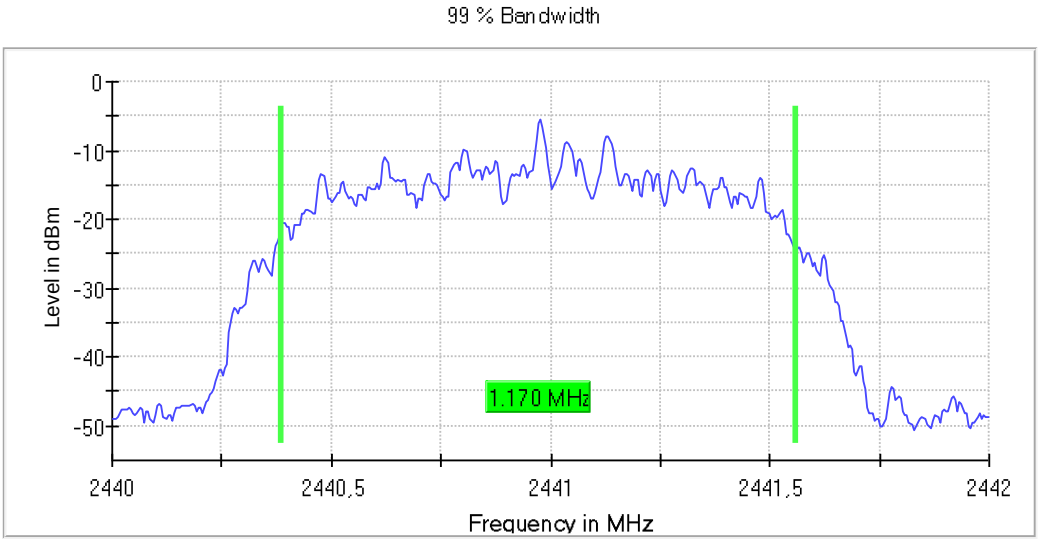
Plots:

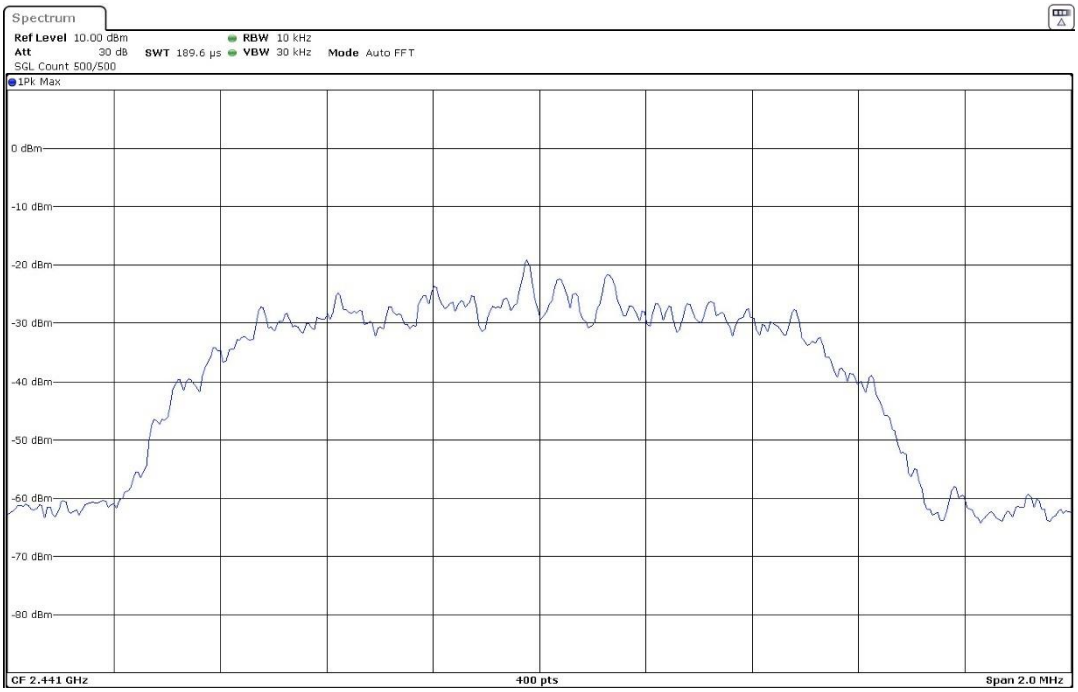




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2441.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

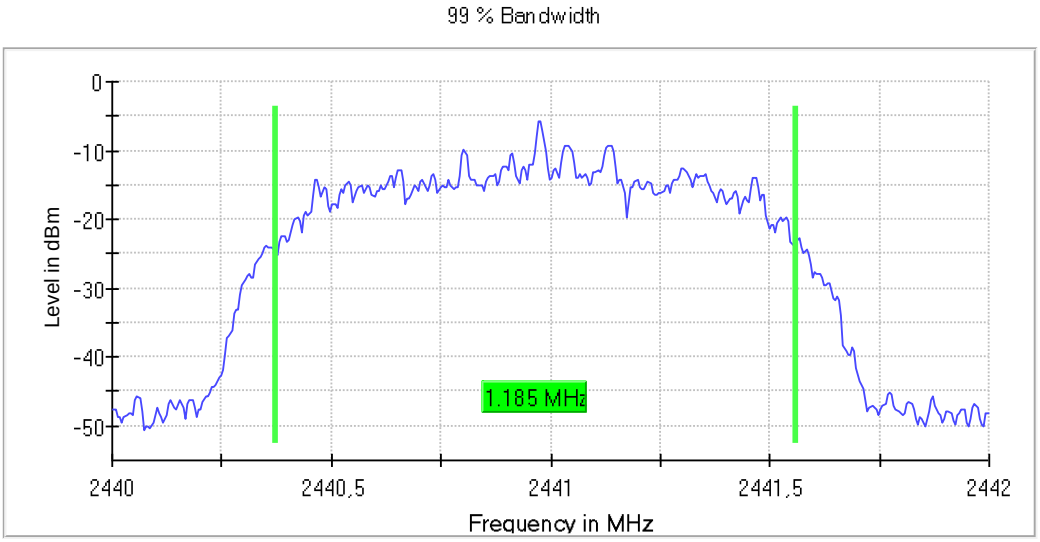
Plots:

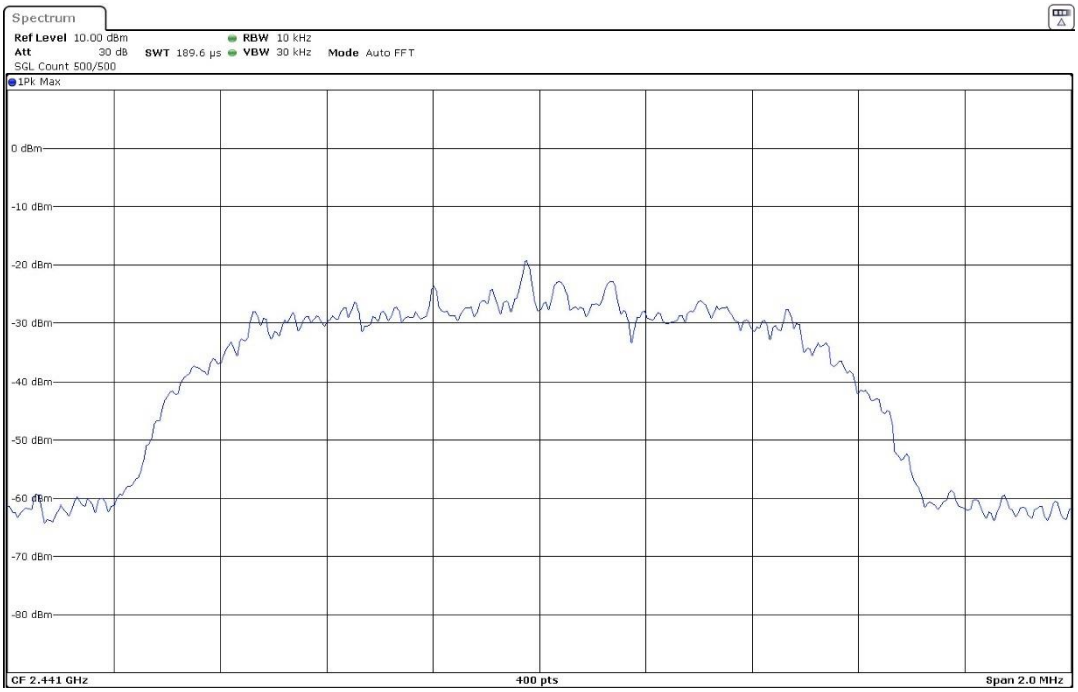




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2441.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

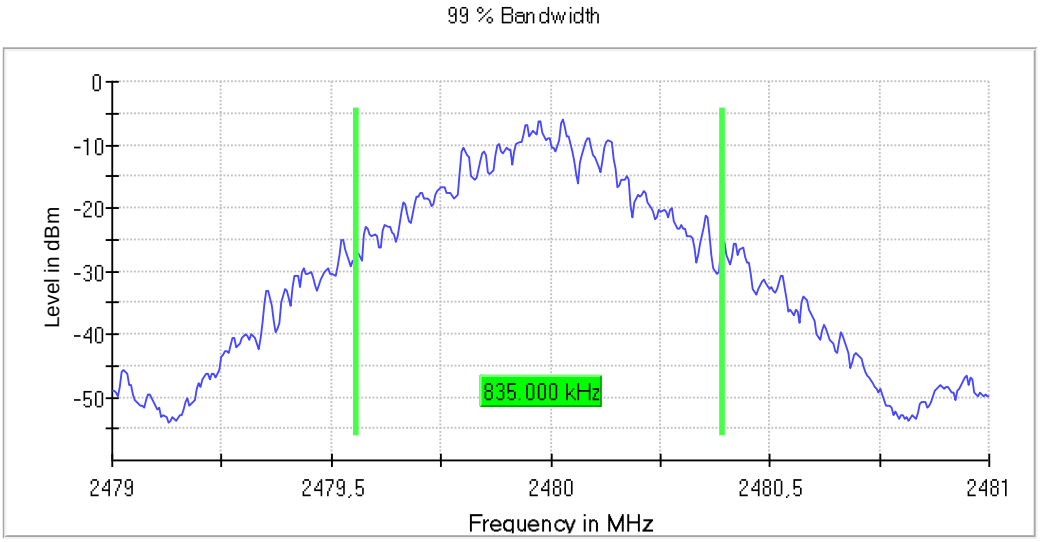
Plots:

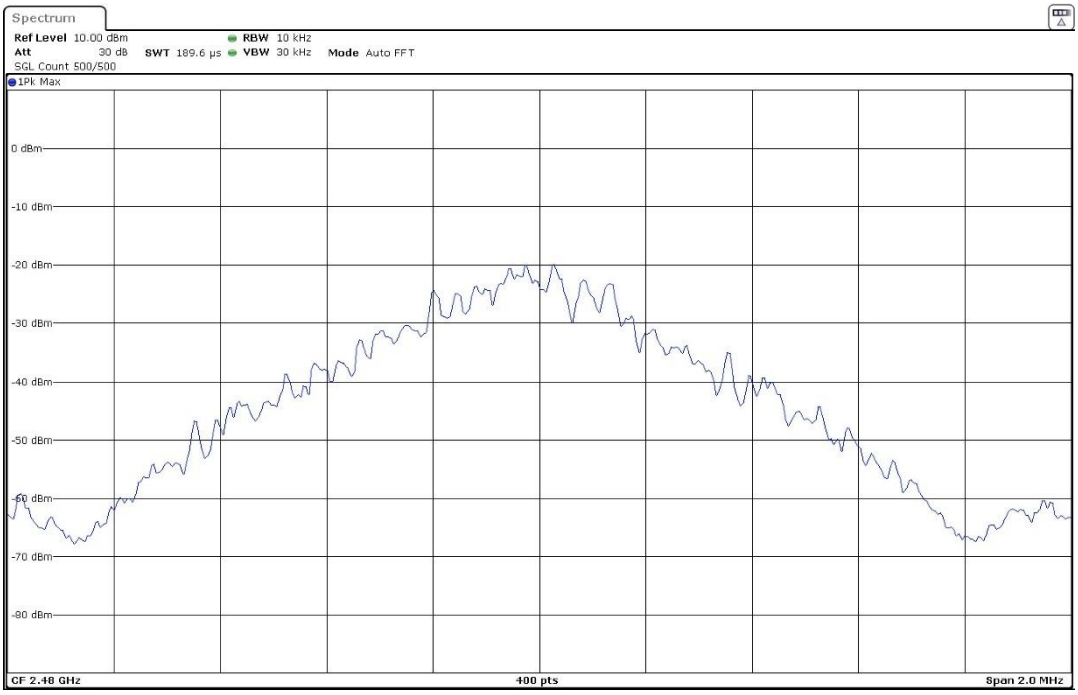




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

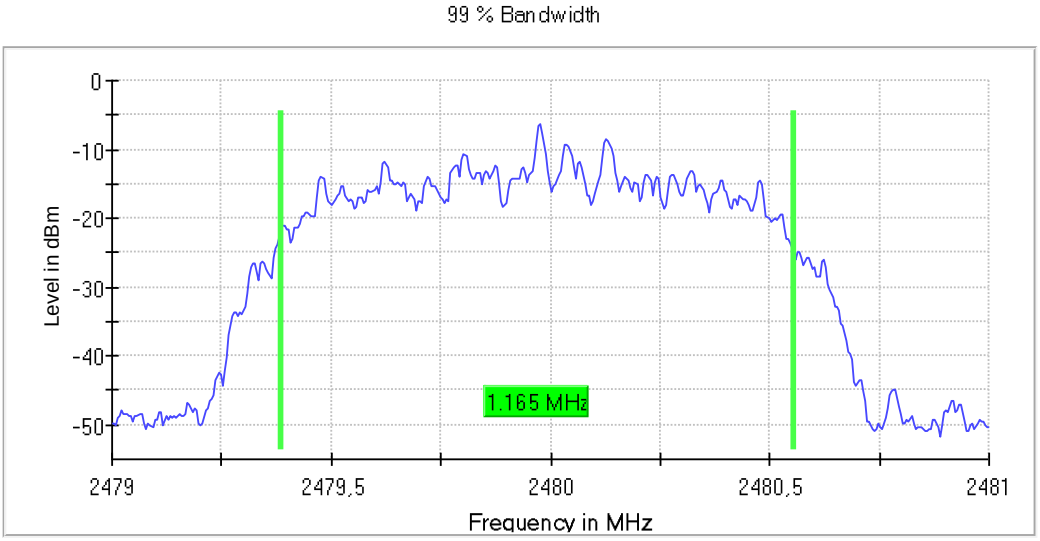
Plots:

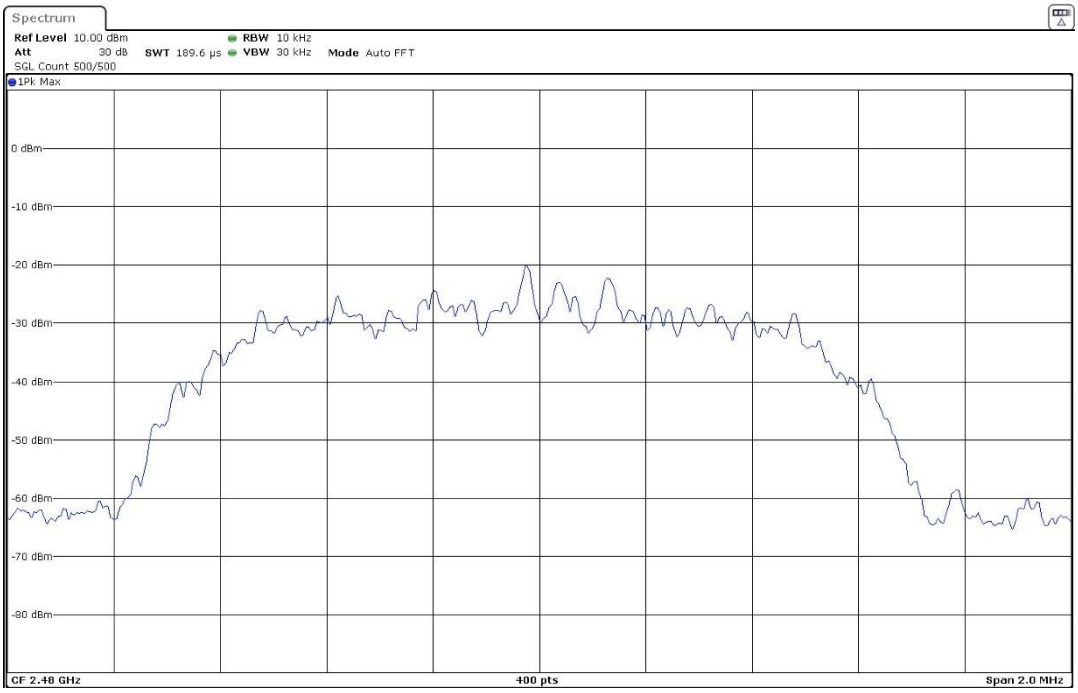




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

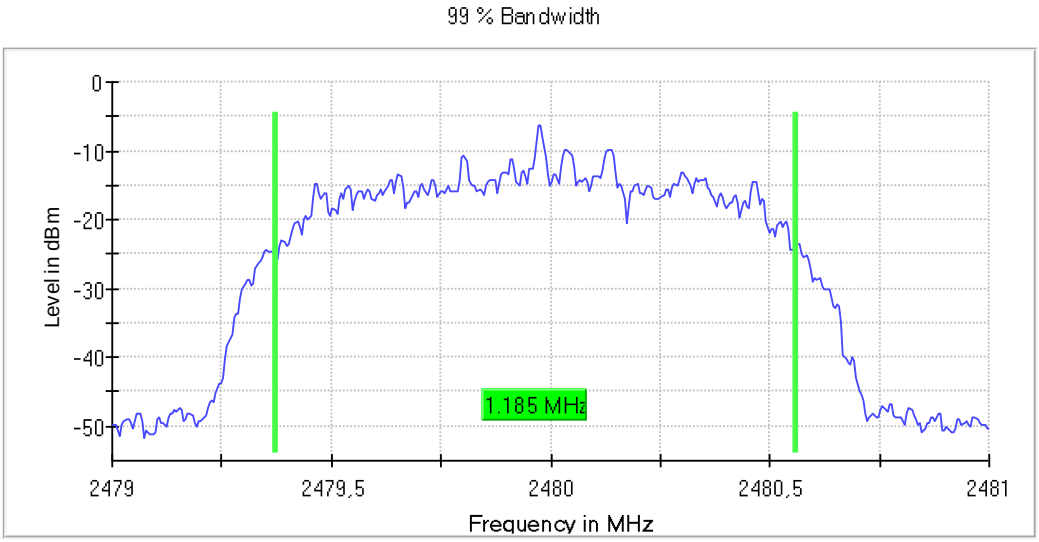
Plots:

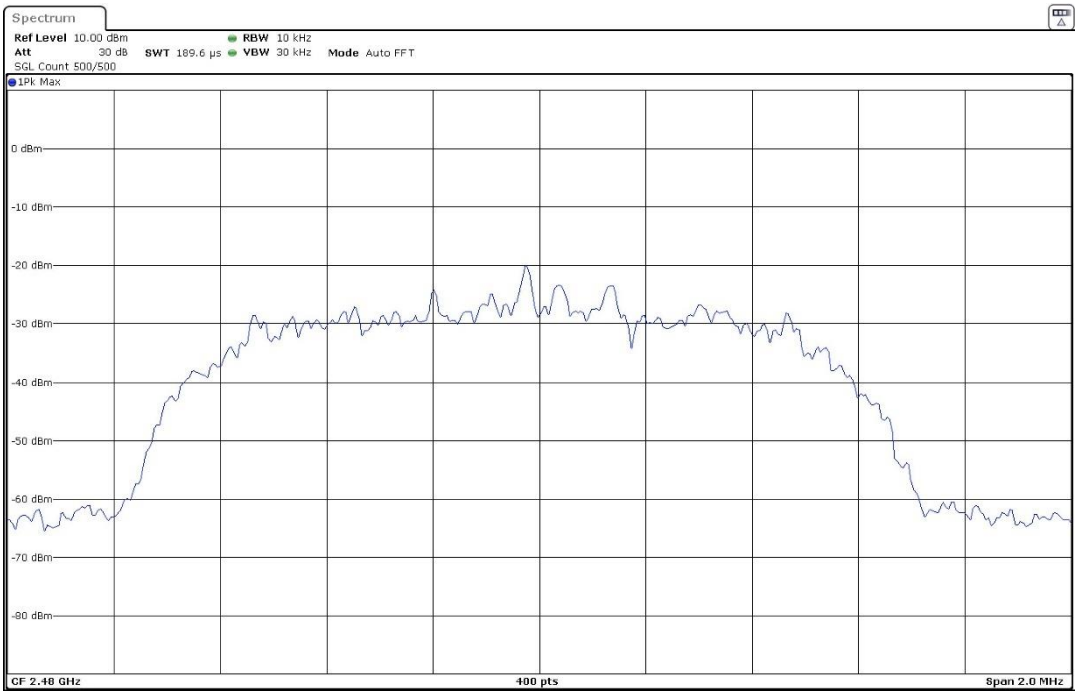




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Plots:





FCC 15.247 (a)(1) 20 dB Bandwidth

Limits

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Results

Modulation: BT (GFSK 1-DH5)

Freq (MHz)	20dBw (MHz)
2402.00	0.910000
2441.00	0.910000
2480.00	0.910000

Modulation: BT (Pi/4 DQPSK 2-DH5)

Freq (MHz)	20dBw (MHz)
2402.00	1.260000
2441.00	1.265000
2480.00	1.265000

Modulation: BT (8DPSK 3-DH5)

Freq (MHz)	20dBw (MHz)
2402.00	1.265000
2441.00	1.260000
2480.00	1.260000

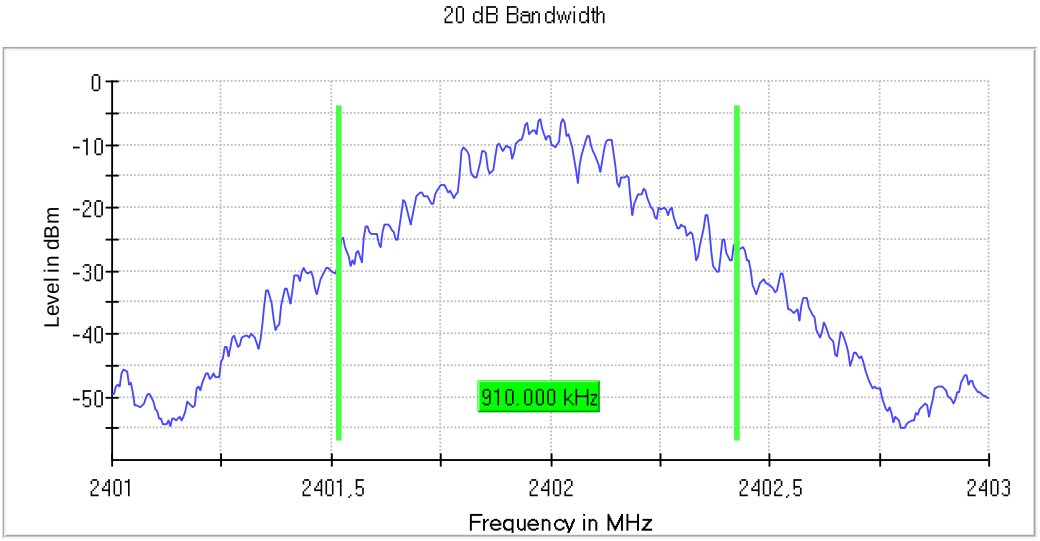
Verdict

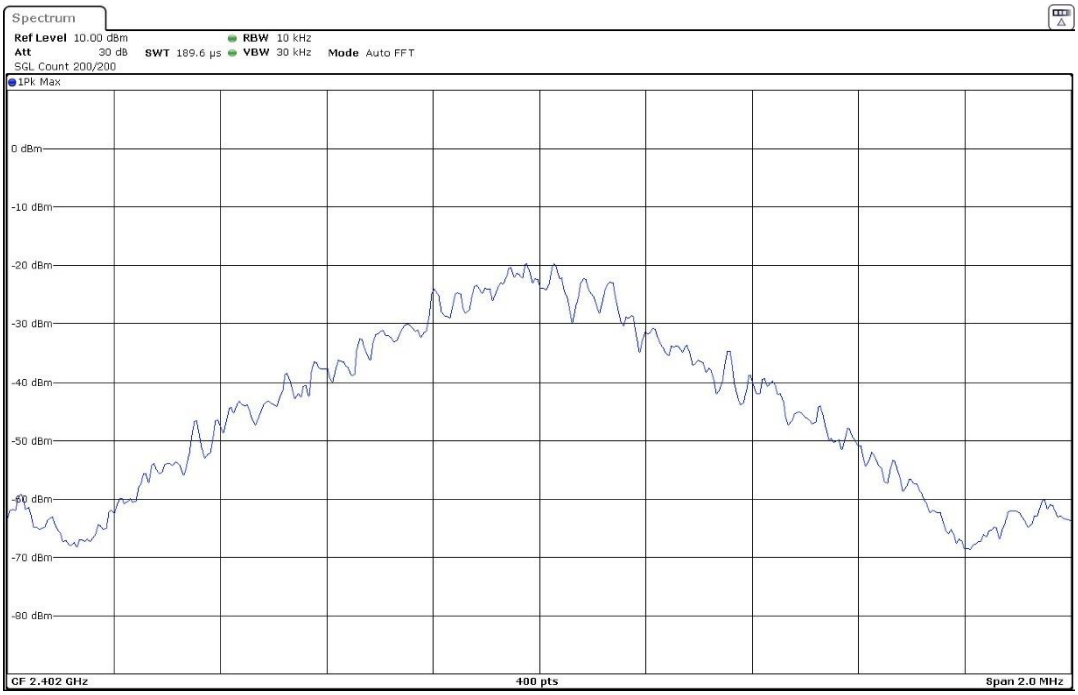
Pass

Attachments

Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

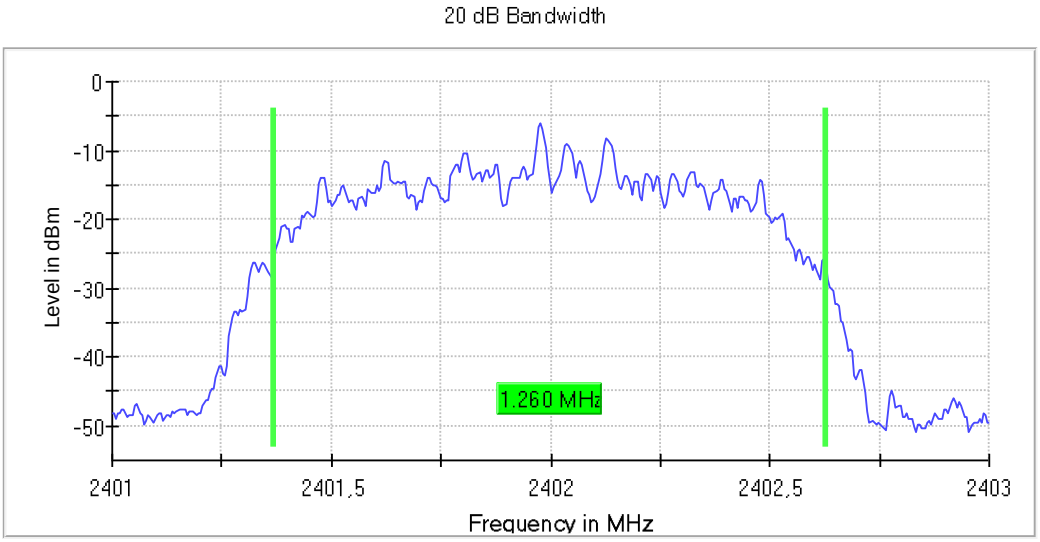
Plots:

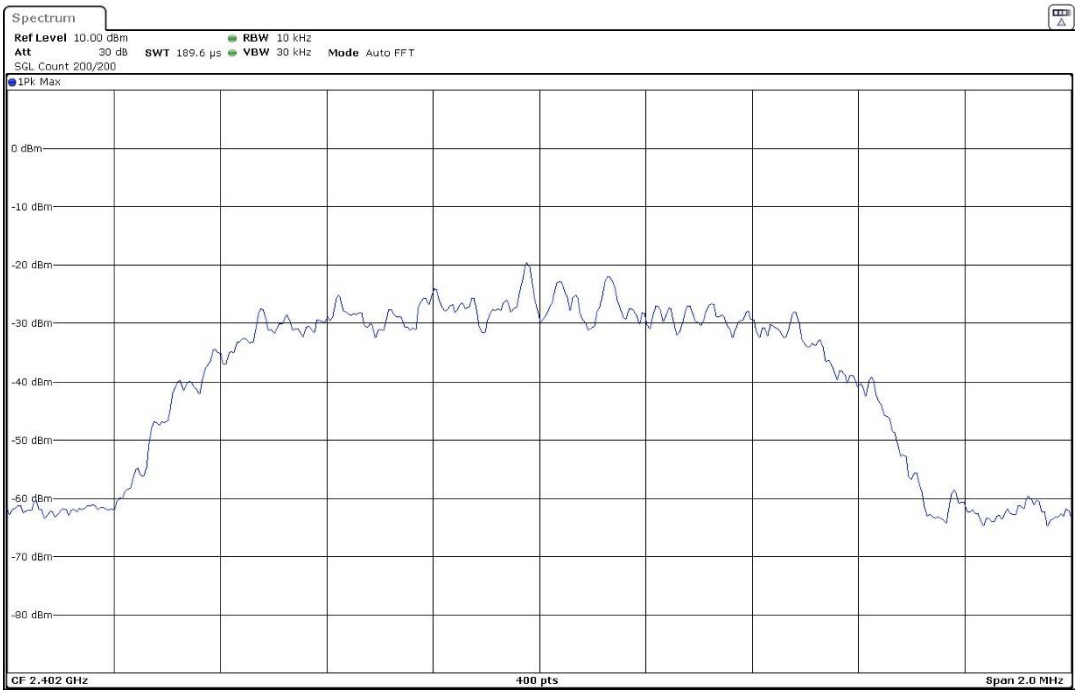




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

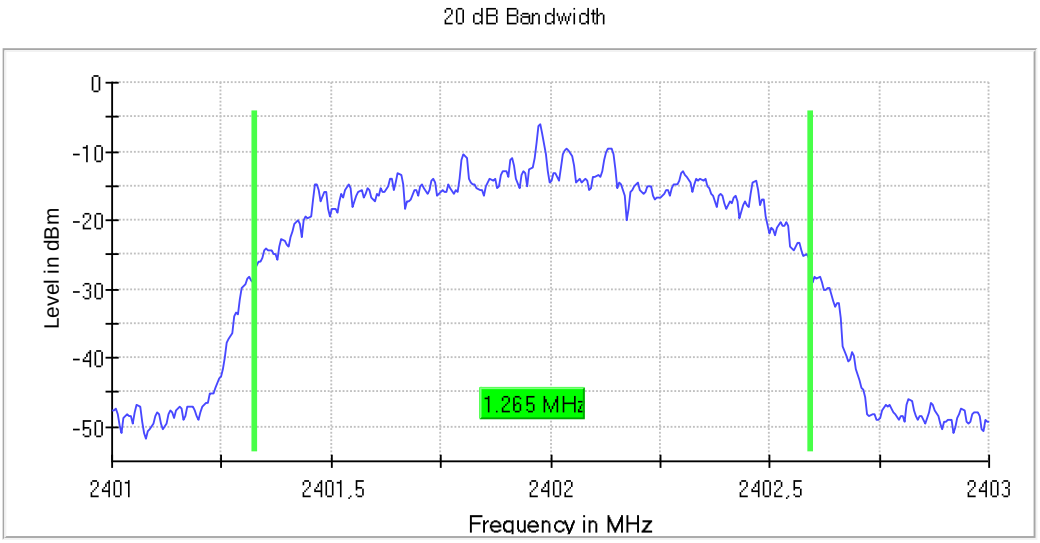
Plots:

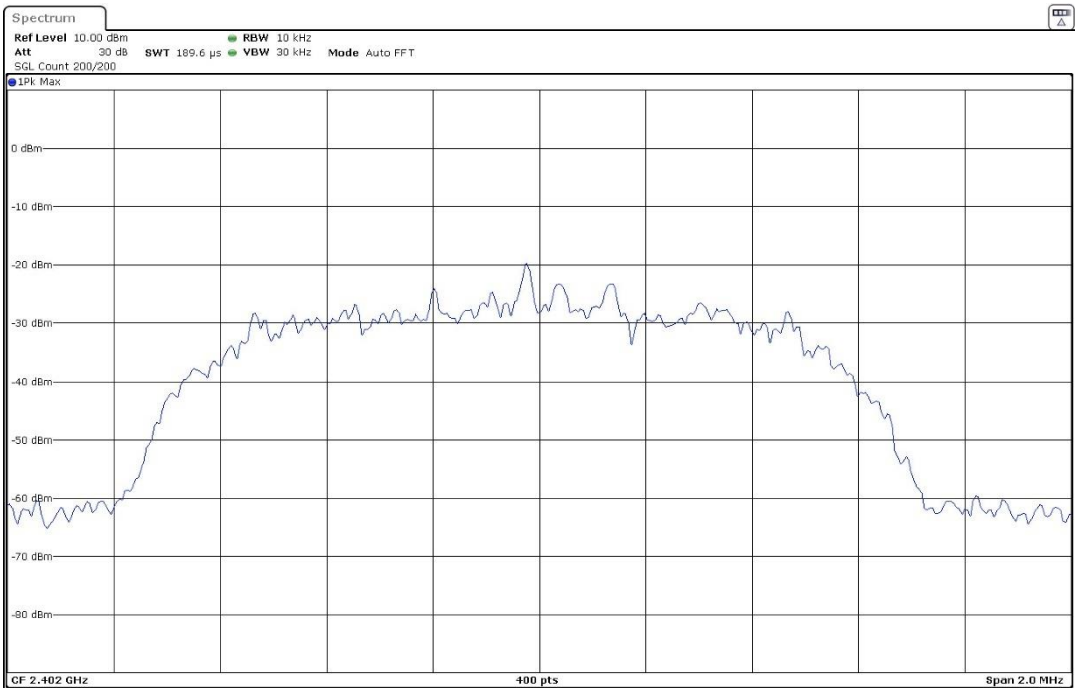




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

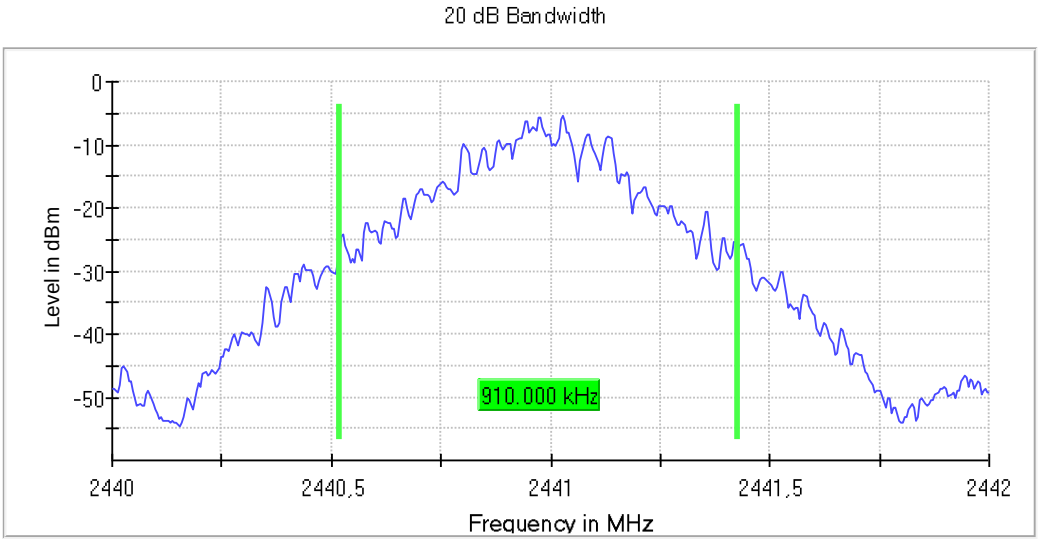
Plots:

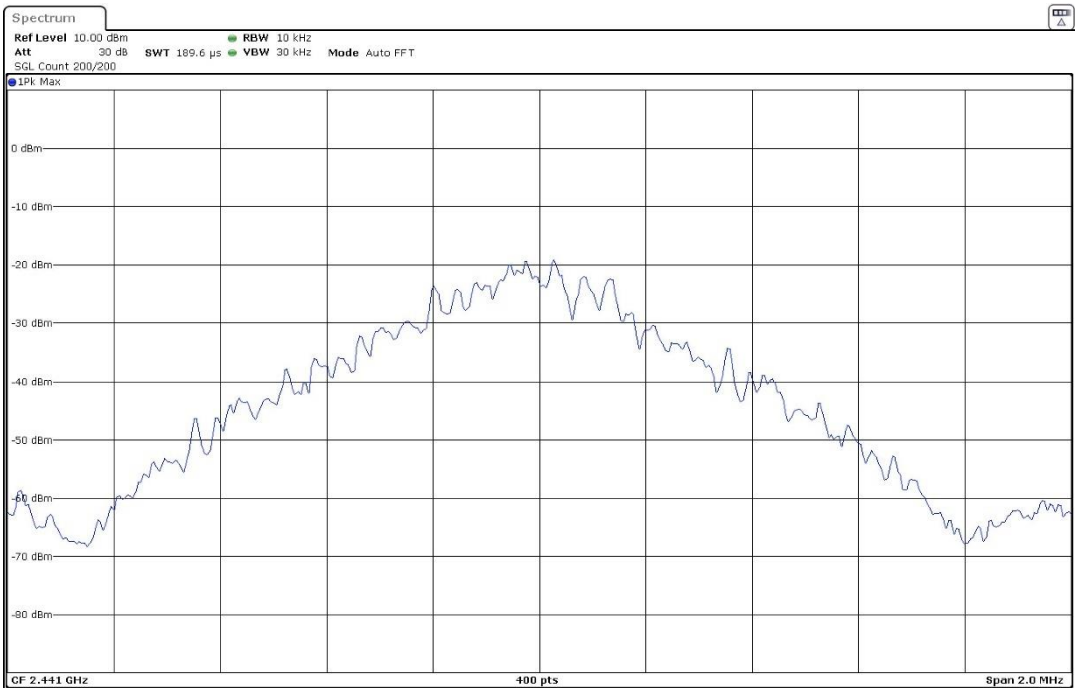




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2441.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

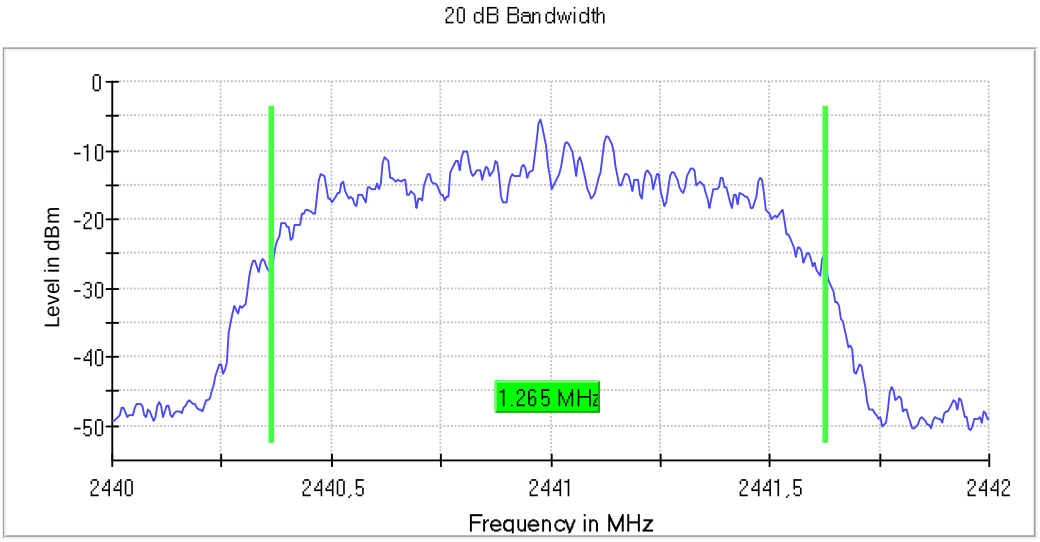
Plots:

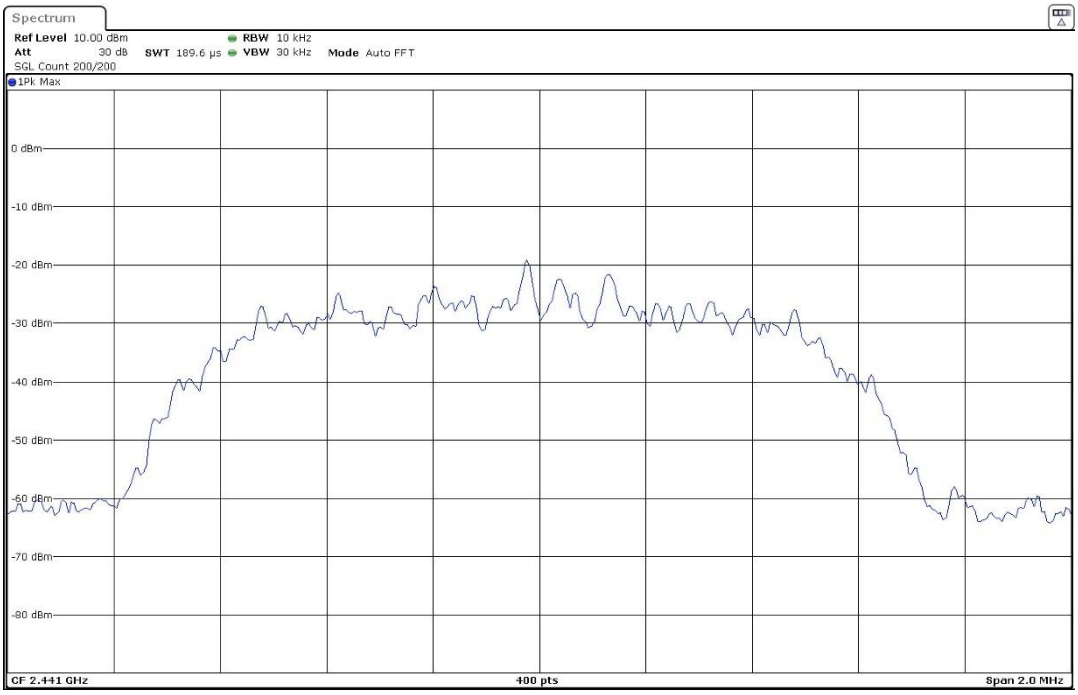




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2441.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

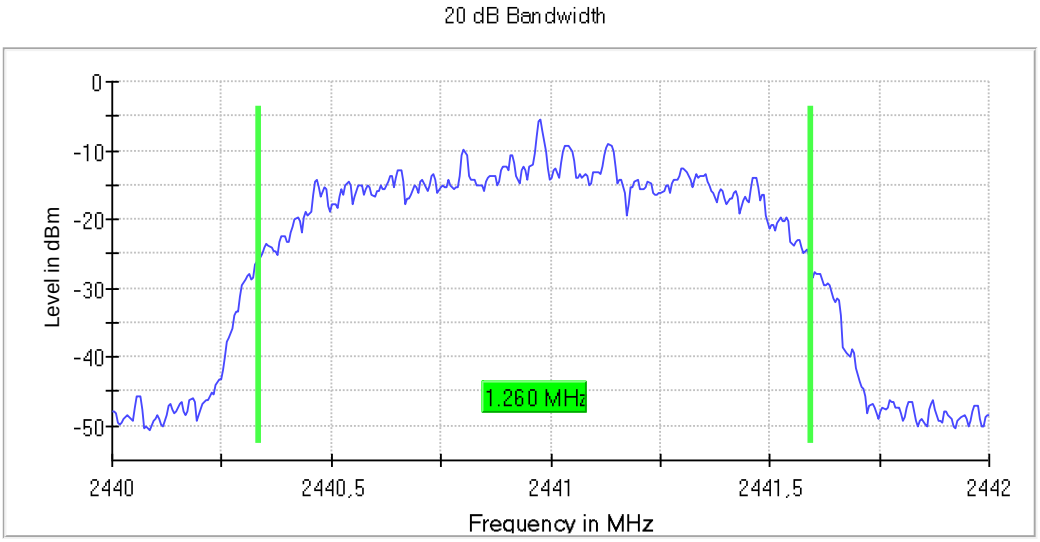
Plots:

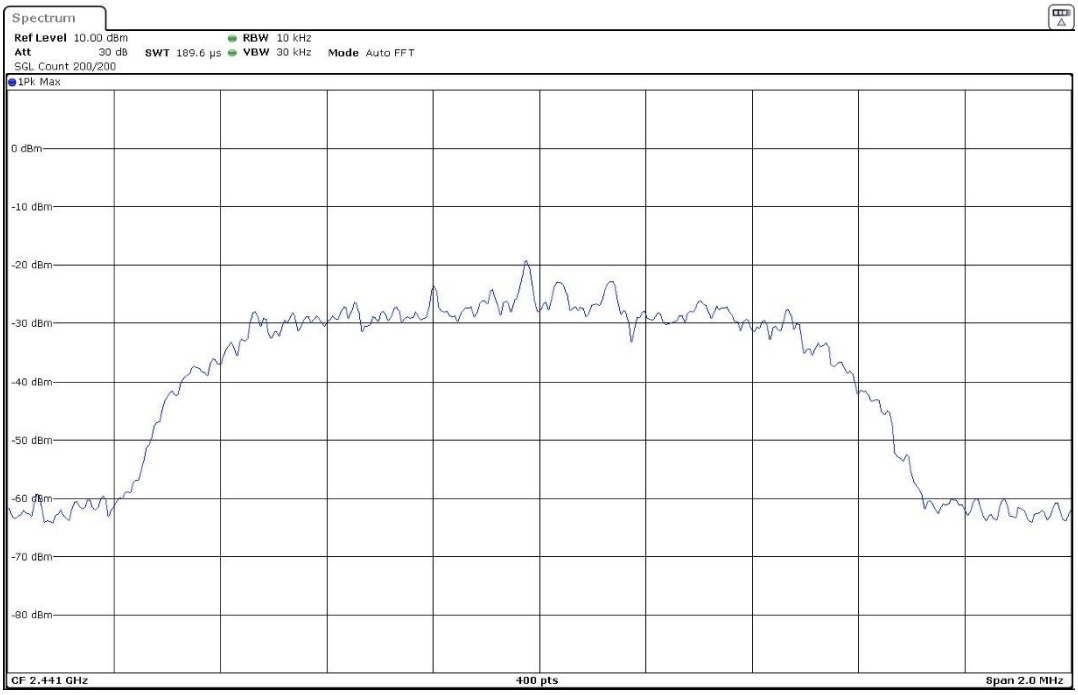




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2441.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

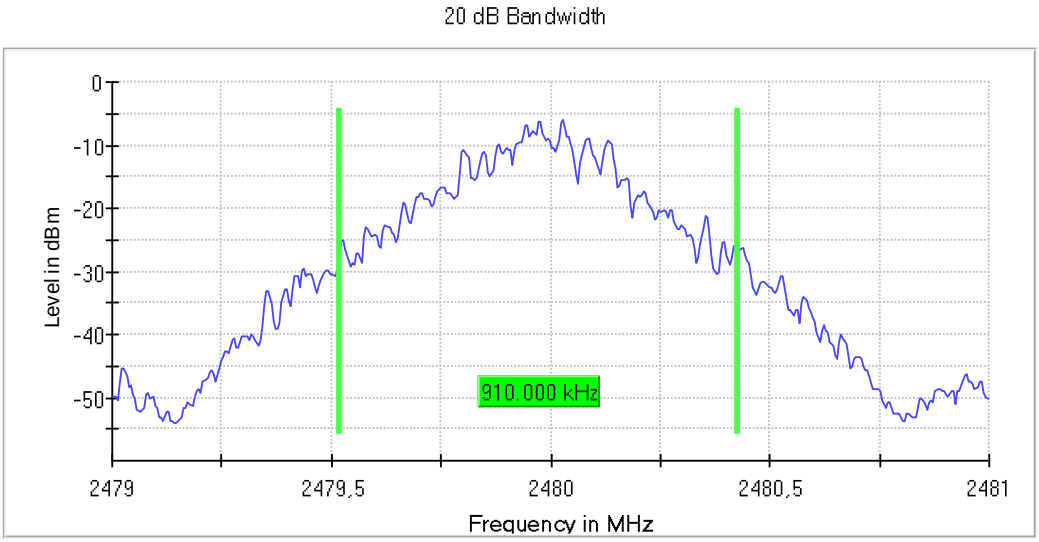
Plots:

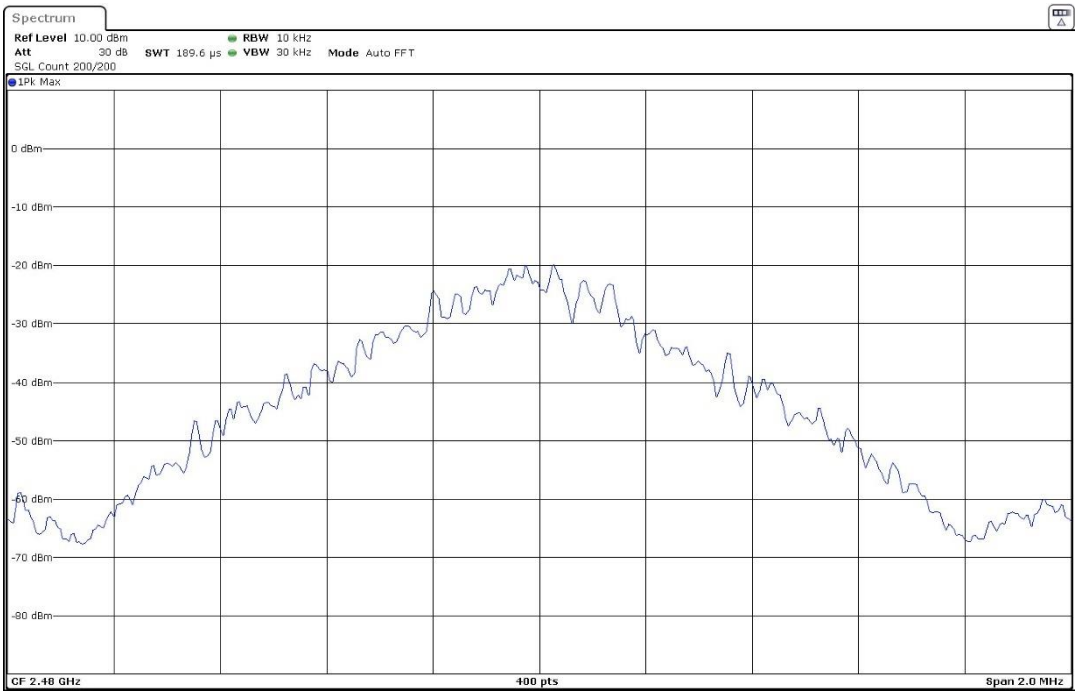




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

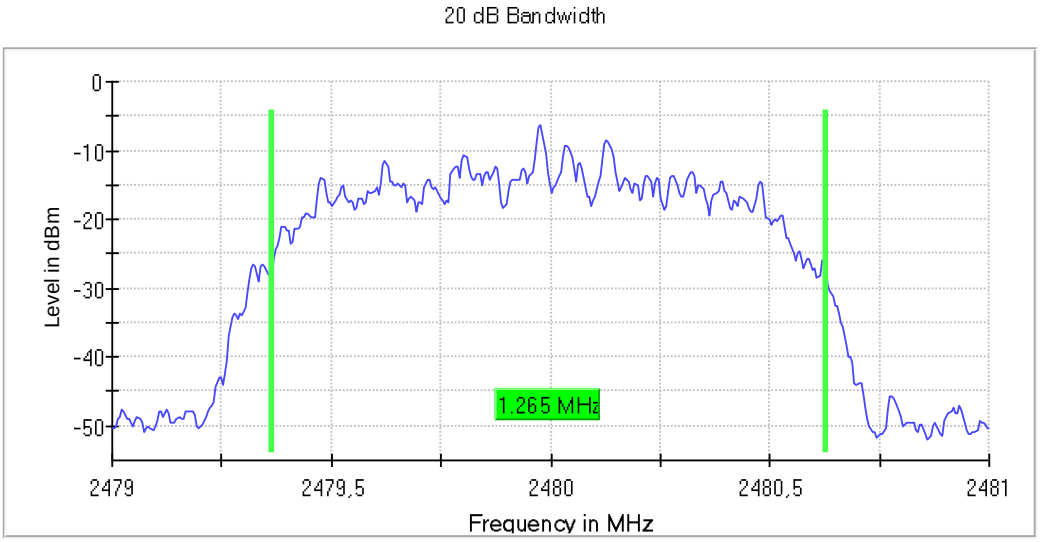
Plots:

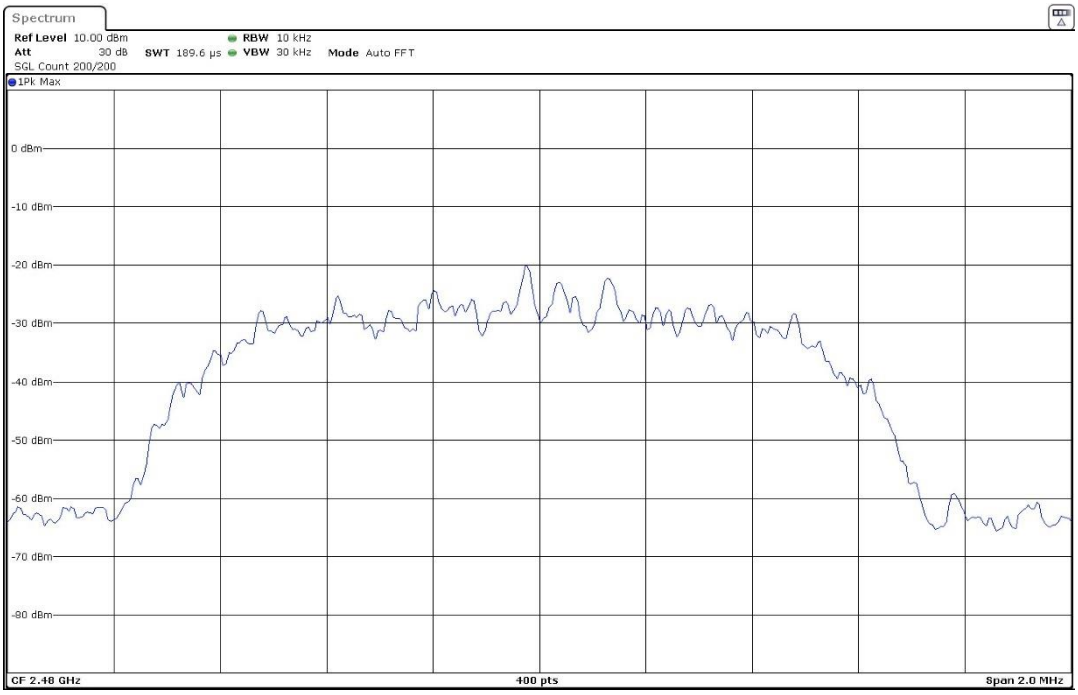




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

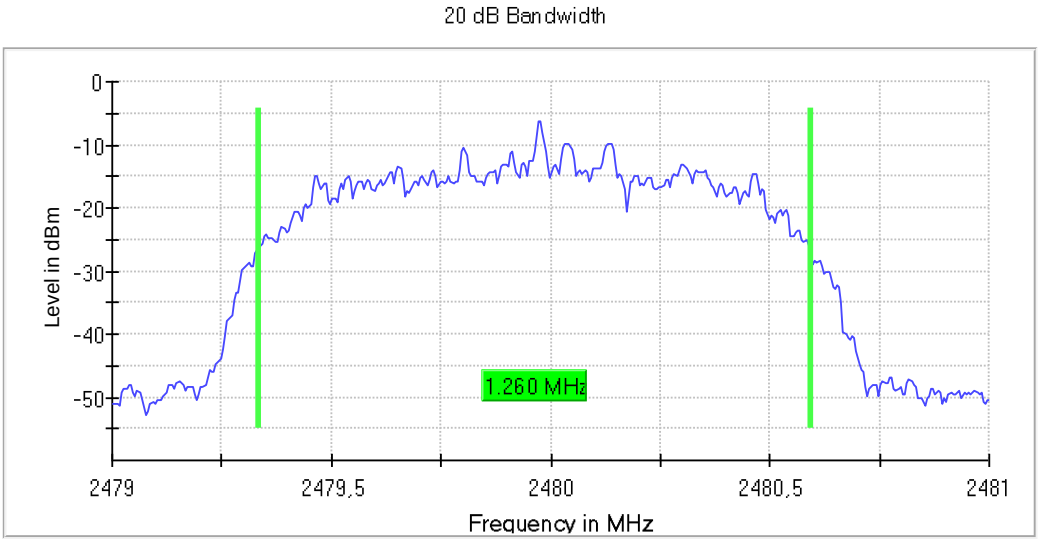
Plots:

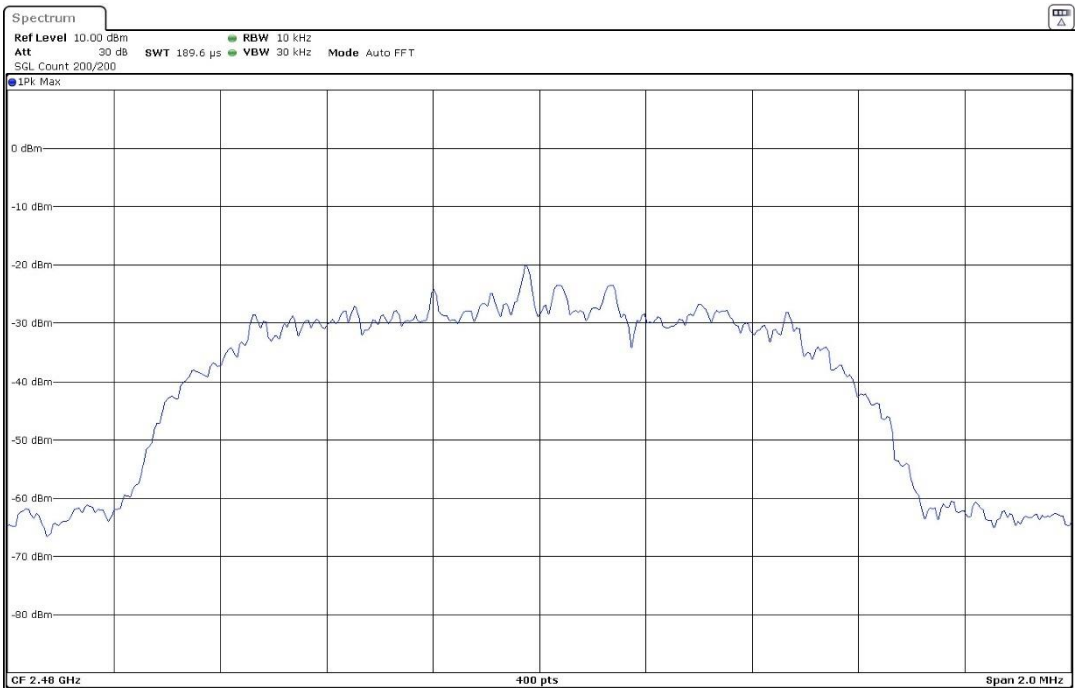




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Plots:





FCC 15.247 (a)(1) Carrier Frequency Separation

Results

Modulation: BT (GFSK 1-DH5)

Operation Band (MHz)	Equipment	Freq Sep (MHz)
[2400, 2483.5]	Frequency Hopping Spread Spectrum systems (DSS)	1.009901

Modulation: BT (Pi/4 DQPSK 2-DH5)

Operation Band (MHz)	Equipment	Freq Sep (MHz)
[2400, 2483.5]	Frequency Hopping Spread Spectrum systems (DSS)	1.000000

Modulation: BT (8DPSK 3-DH5)

Operation Band (MHz)	Equipment	Freq Sep (MHz)
[2400, 2483.5]	Frequency Hopping Spread Spectrum systems (DSS)	1.000000

The hopping channel carrier frequencies are separated by a minimum of two-thirds of the 20 dB bandwidth of the hopping channel.

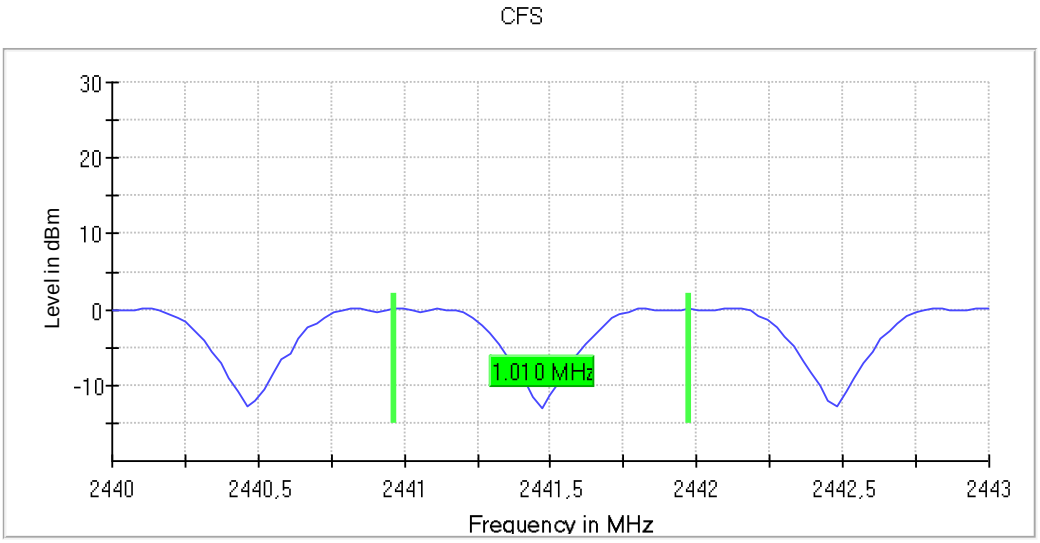
Verdict

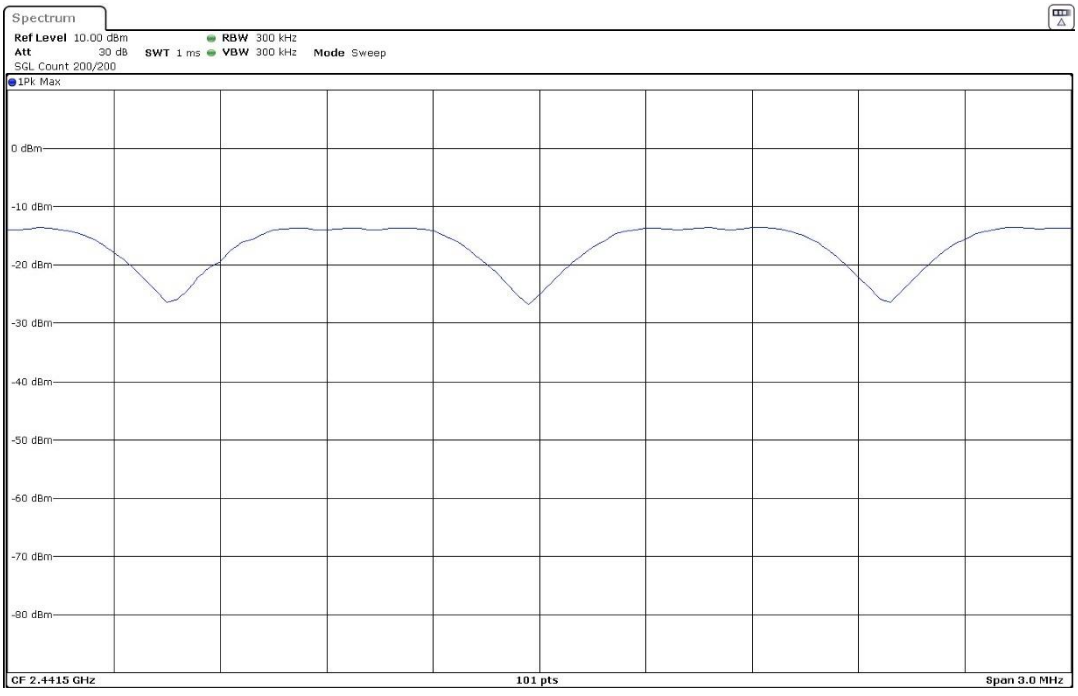
Pass

Attachments

Operation Band (MHz) = [2400, 2483.5], Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

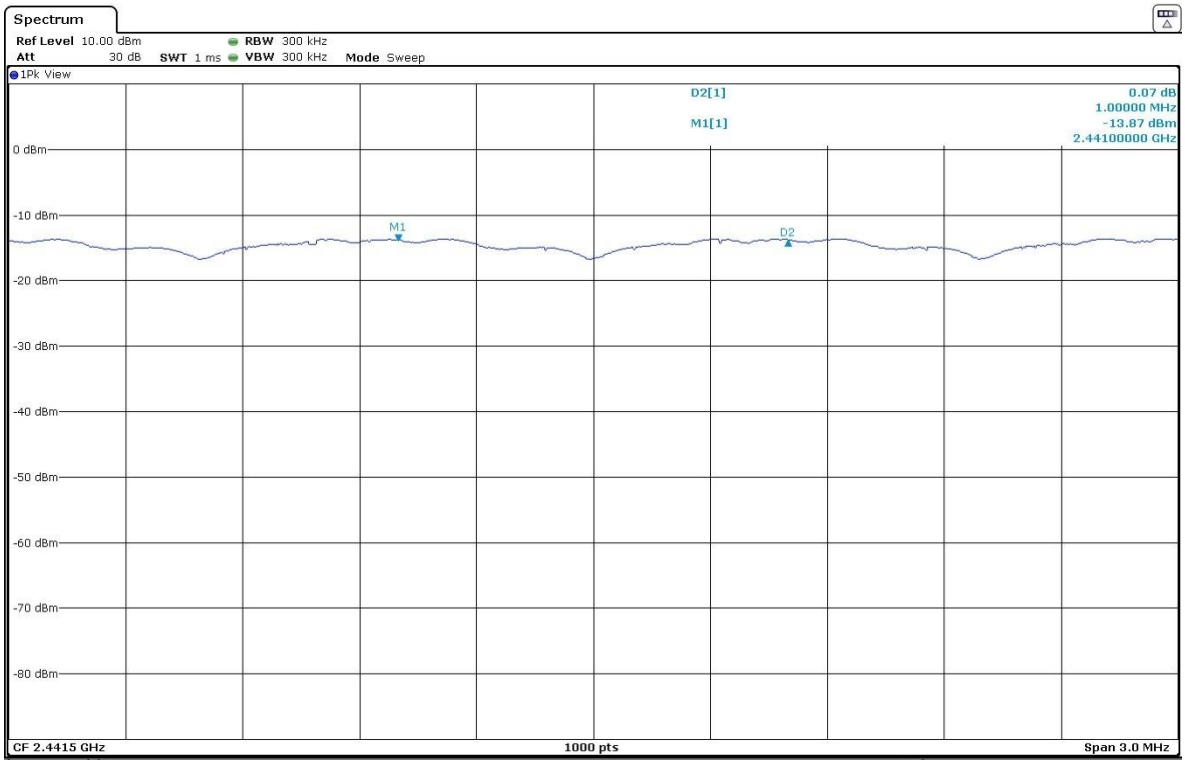
Plots:





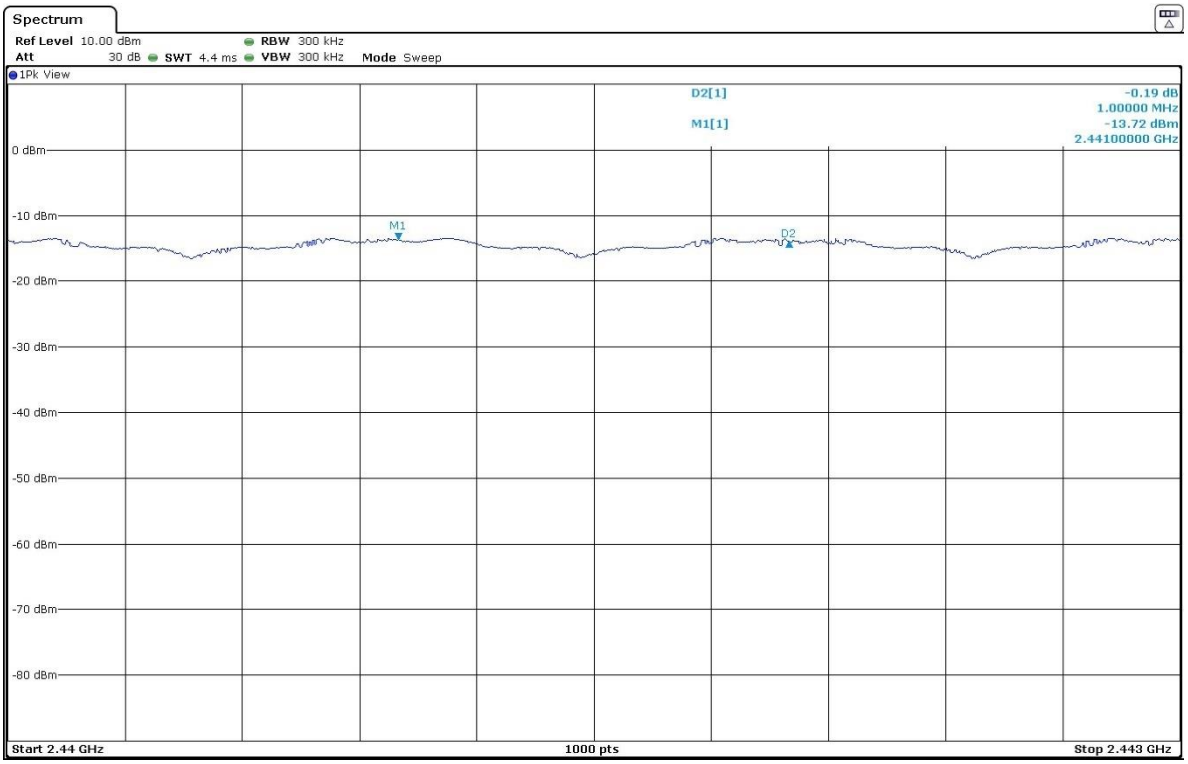
Operation Band (MHz) = [2400, 2483.5], Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

Plots:



Operation Band (MHz) = [2400, 2483.5], Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Plots:



FCC 15.247 (a)(1)(iii) Time of Occupancy (Dwell Time)

Limits

The average time of occupancy on any channel shall not be greater than 0.4 seconds (400 ms) within a period of 0.4 seconds multiplied by the number of hopping channels employed = 0.4 x 79= 31.6 seconds.

Results

The average time of occupancy was measured on low, middle and high channels for each modulation and worst case (highest Avg COT) is reported.

Modulation: BT (GFSK 1-DH5)

Operation Band (MHz)	Equipment	NHp	Avg COT (ms)
[2400, 2483.5]	Frequency Hopping Spread Spectrum systems (DSS)	120	349.940

Modulation: BT (Pi/4 DQPSK 2-DH5)

Operation Band (MHz)	Equipment	NHp	Avg COT (ms)
[2400, 2483.5]	Frequency Hopping Spread Spectrum systems (DSS)	125	300.060

Modulation: BT (8DPSK 3-DH5)

Operation Band (MHz)	Equipment	NHp	Avg COT (ms)
[2400, 2483.5]	Frequency Hopping Spread Spectrum systems (DSS)	106	265.270

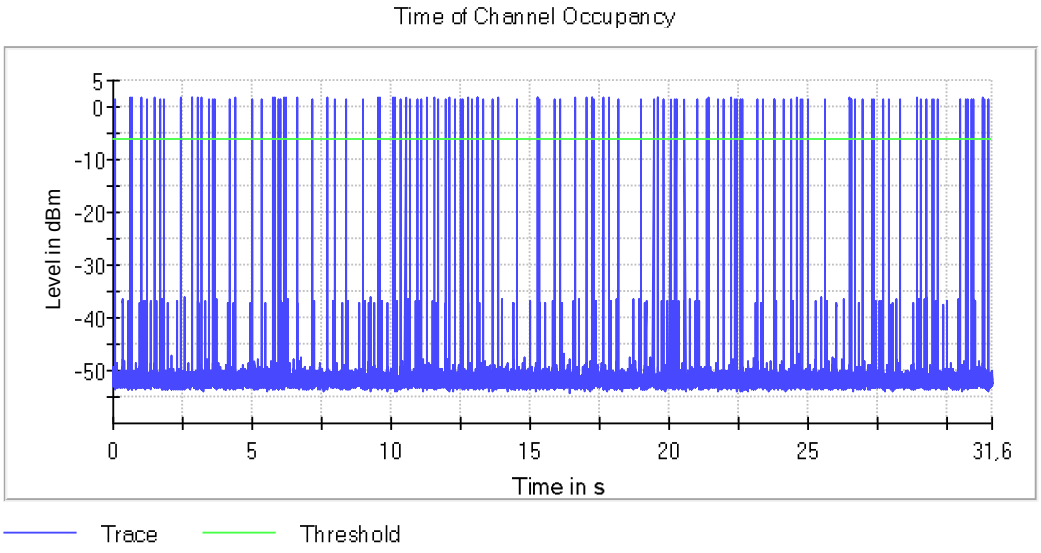
Verdict

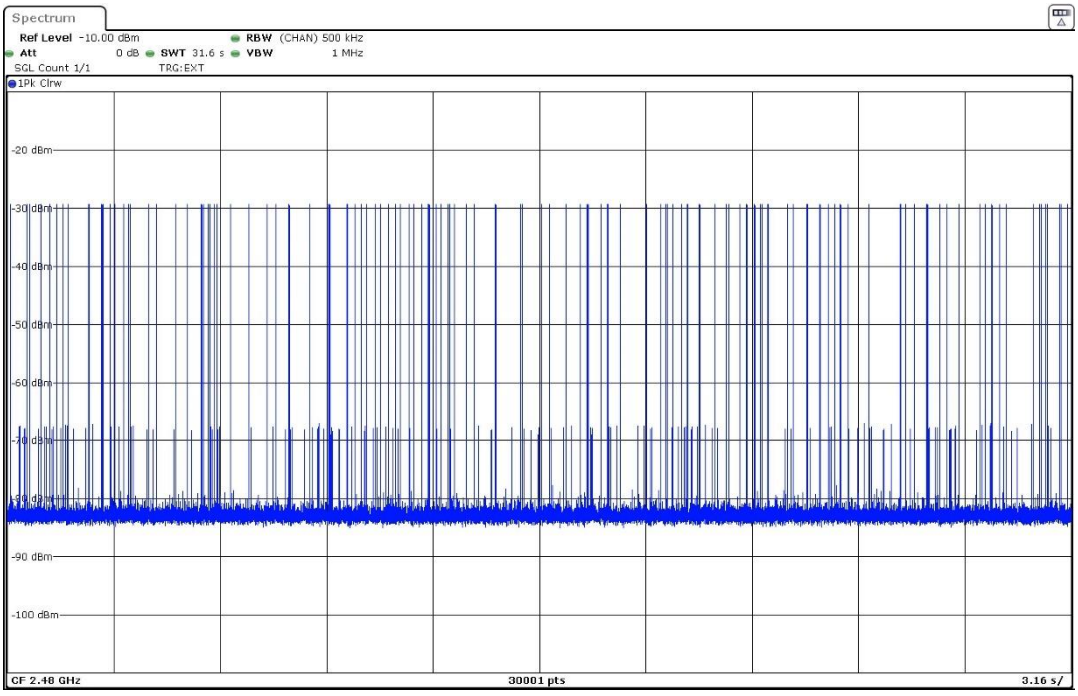
Pass

Attachments

Operation Band (MHz) = [2400, 2483.5], Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

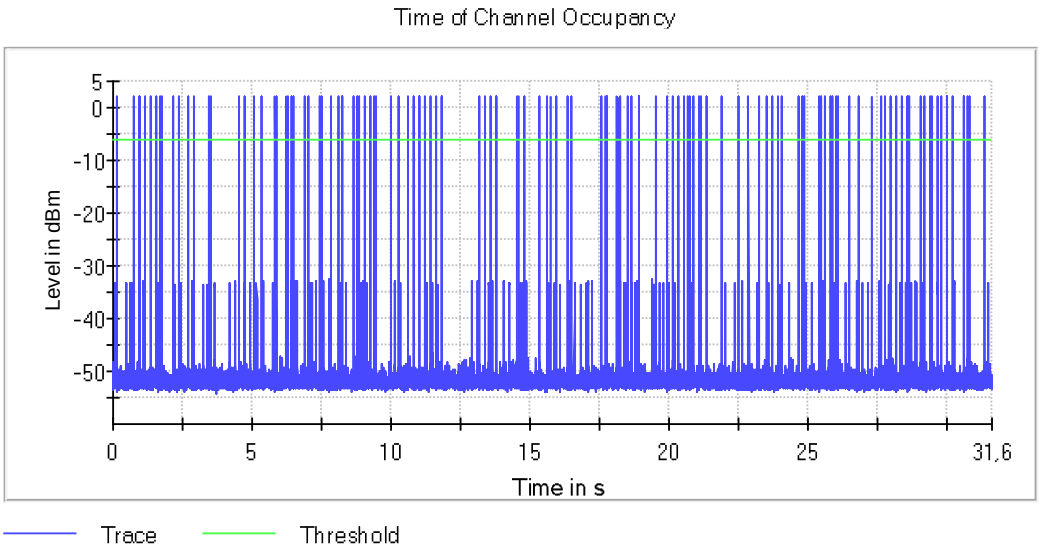
Plots:

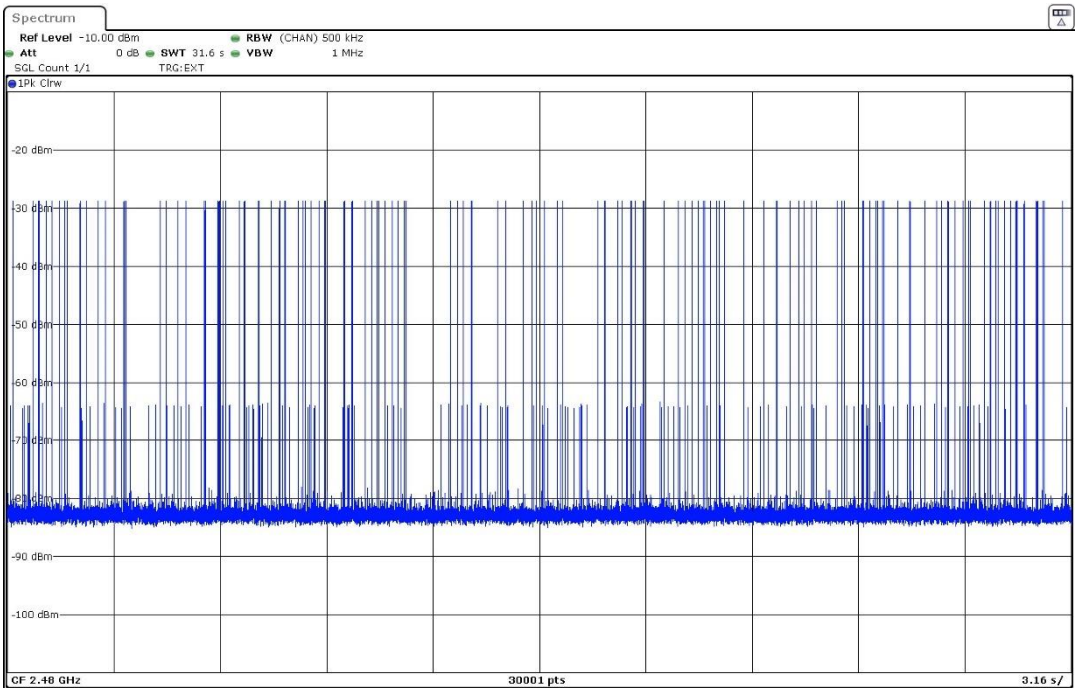




Operation Band (MHz) = [2400, 2483.5], Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

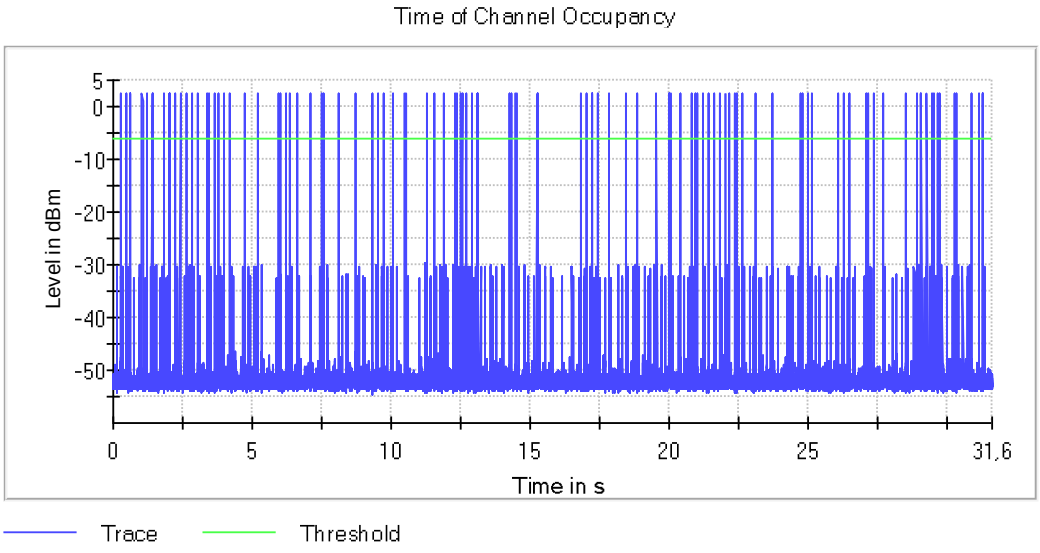
Plots:

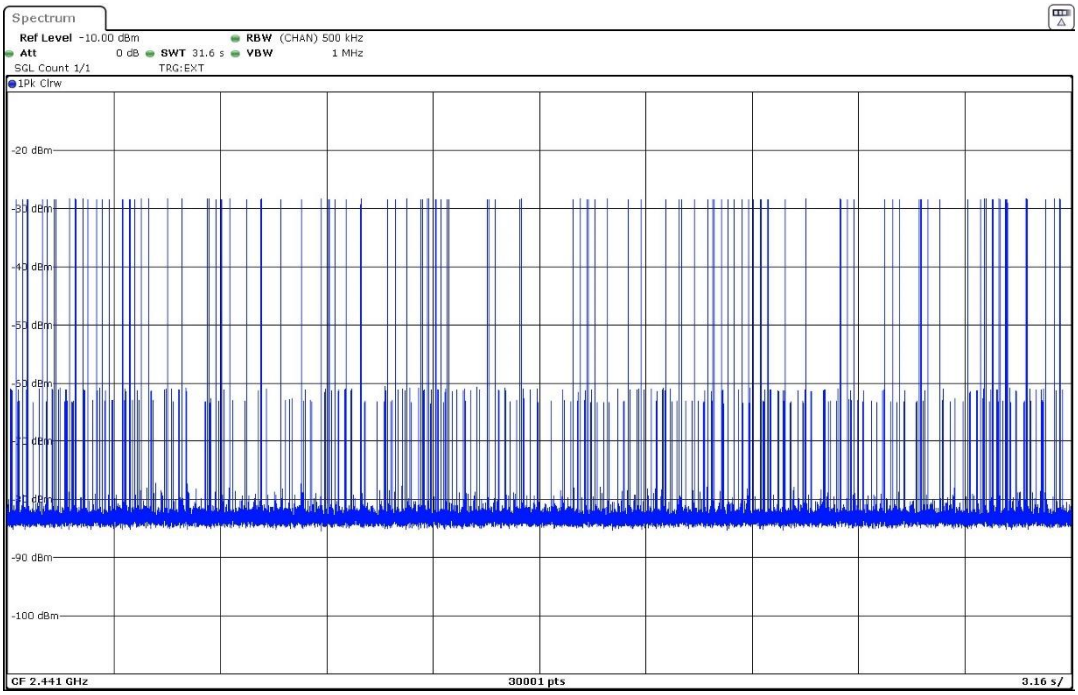




Operation Band (MHz) = [2400, 2483.5], Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Plots:





FCC 15.247 (a)(1)(iii) Number of hopping channels

Limits

Frequency hopping system in the 2400-2483.5 MHz band shall use at least 15 channels.

Results

Modulation: BT (GFSK 1-DH5)

Operation Band (MHz)	Equipment	NHC
[2400, 2483.5]	Frequency Hopping Spread Spectrum systems (DSS)	79

Modulation: BT (Pi/4 DQPSK 2-DH5)

Operation Band (MHz)	Equipment	NHC
[2400, 2483.5]	Frequency Hopping Spread Spectrum systems (DSS)	79

Modulation: BT (8DPSK 3-DH5)

Operation Band (MHz)	Equipment	NHC
[2400, 2483.5]	Frequency Hopping Spread Spectrum systems (DSS)	79

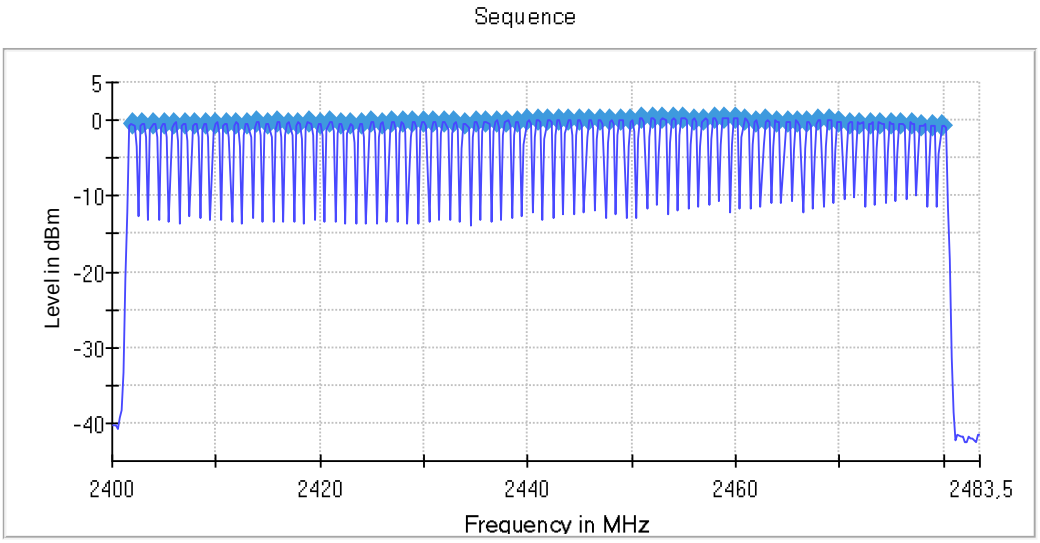
Verdict

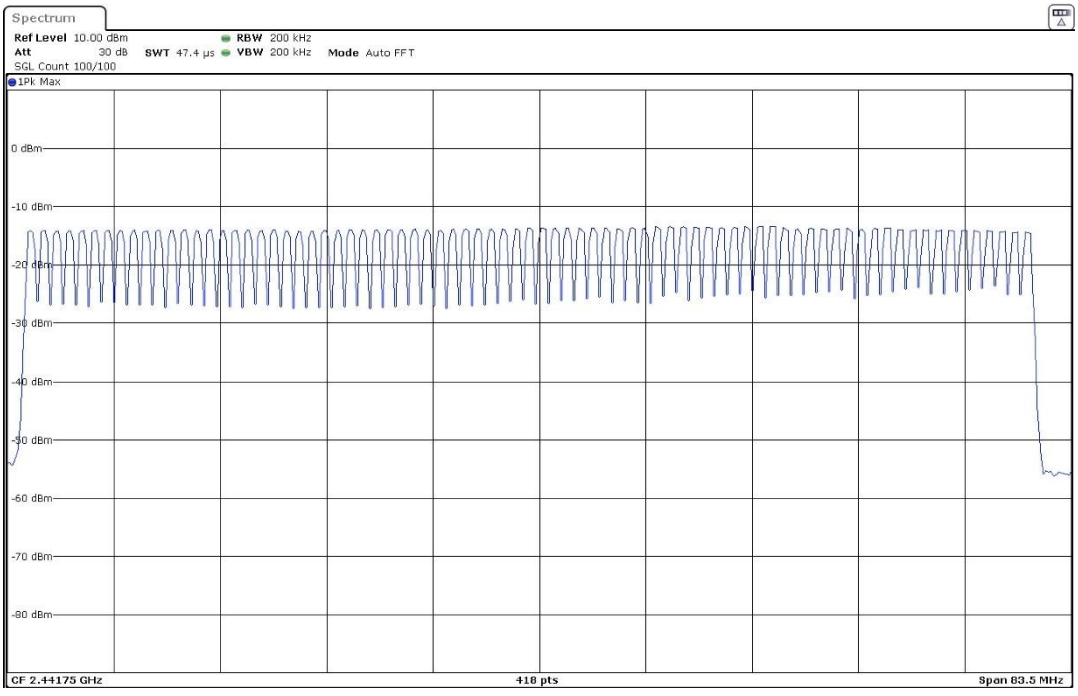
Pass

Attachments

Operation Band (MHz) = [2400, 2483.5], Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

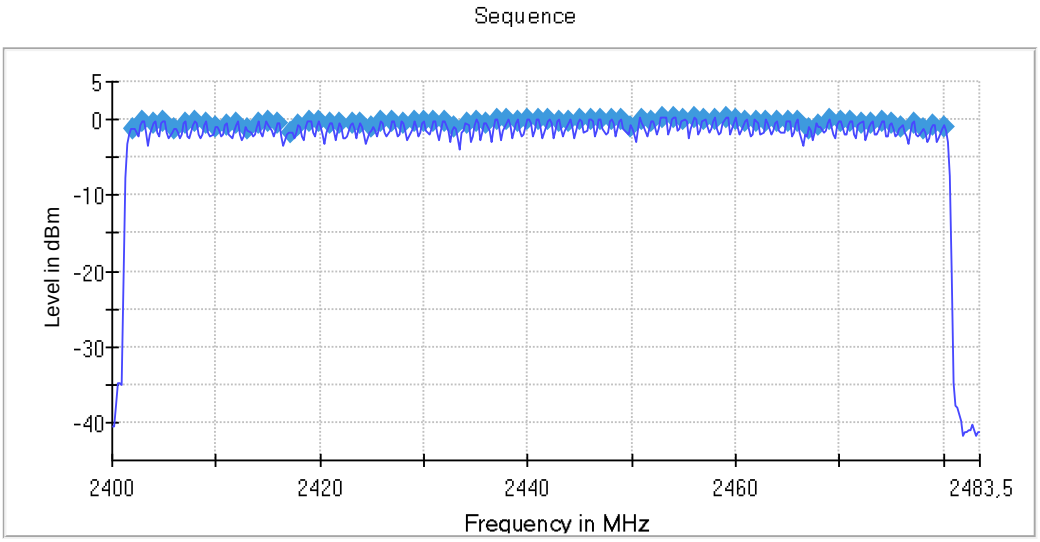
Plots:

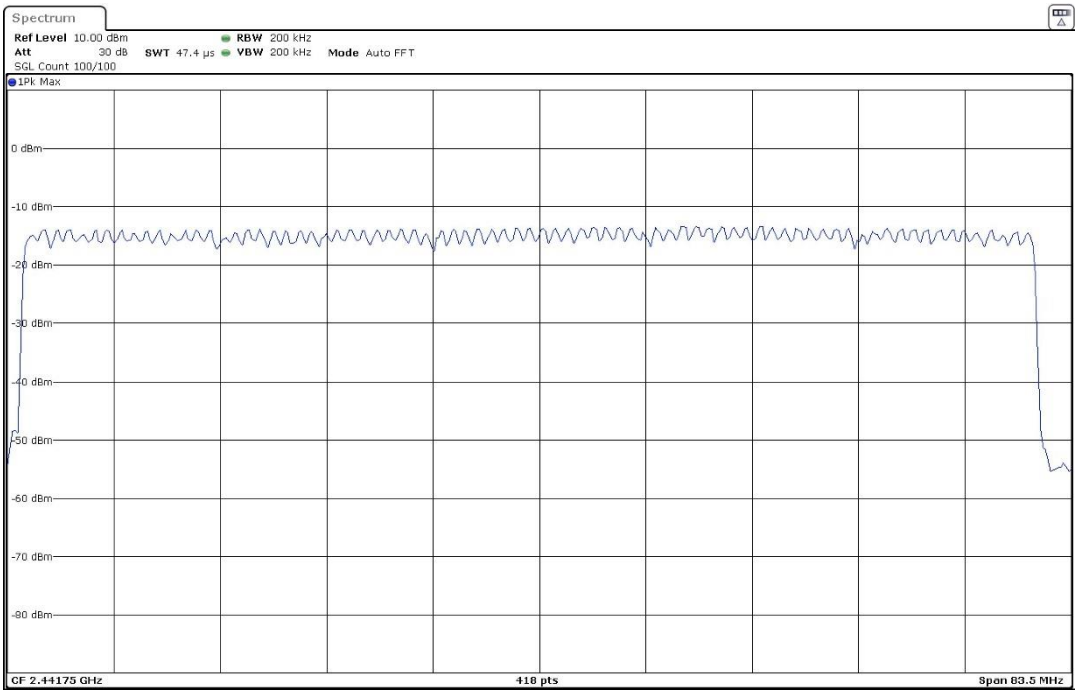




Operation Band (MHz) = [2400, 2483.5], Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

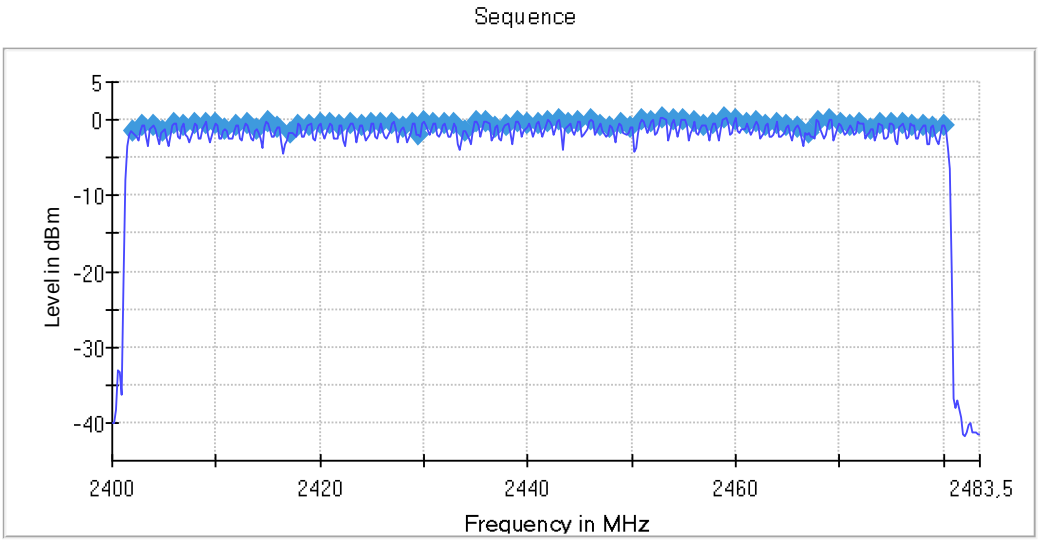
Plots:

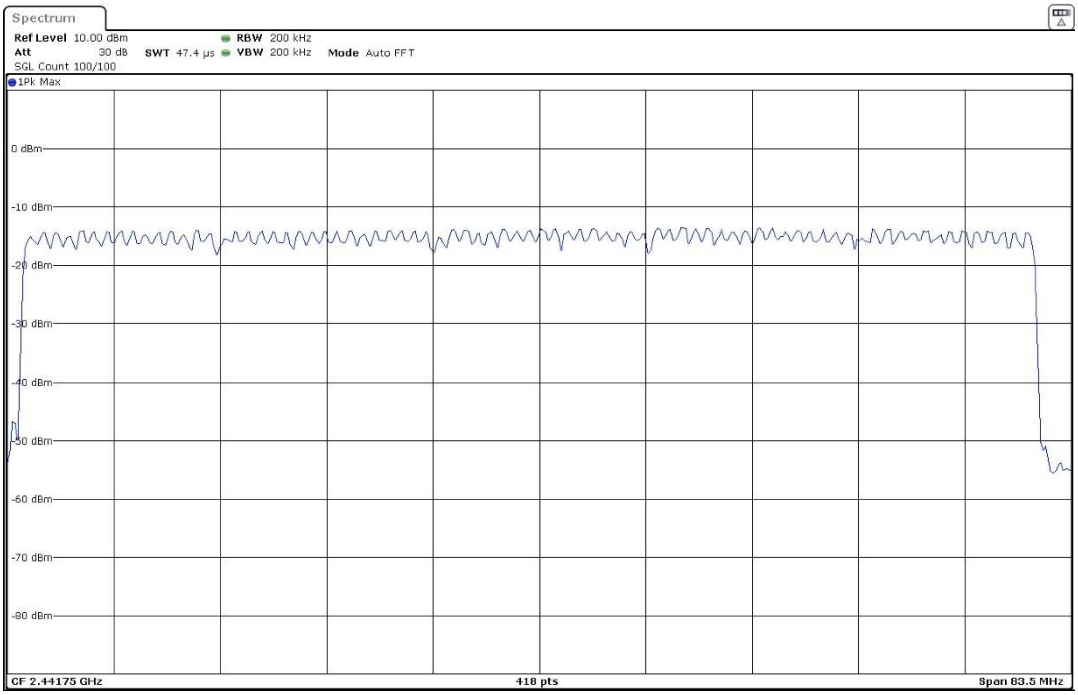




Operation Band (MHz) = [2400, 2483.5], Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Plots:





FCC 15.247 (b) Maximum peak output power and antenna gain

Limits

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels: 1 watt (30 dBm).

Results

The maximum peak conducted output power level of the fundamental emission was measured according to clause 7.8.5 “Output power test procedure for frequency-hopping spread-spectrum (FHSS) devices” of ANSI C63.10-2013.

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

Maximum Declared Antenna Gain: 2 dBi

The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

Modulation: BT (GFSK 1-DH5)

Peak Conducted Output Power	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
Maximum Conducted Power (dBm)	-0.030	0.364	-0.197
Maximum EIRP (dBm)	1.970	2.364	1.803

Modulation: BT (Pi/4 DQPSK 2-DH5)

Peak Conducted Output Power	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
Maximum Conducted Power (dBm)	1.459	1.790	1.016
Maximum EIRP (dBm)	3.459	3.790	3.016

Modulation: BT (8DPSK 3-DH5)

Peak Conducted Output Power	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
Maximum Conducted Power (dBm)	1.089	1.972	1.166
Maximum EIRP (dBm)	3.089	3.972	3.166

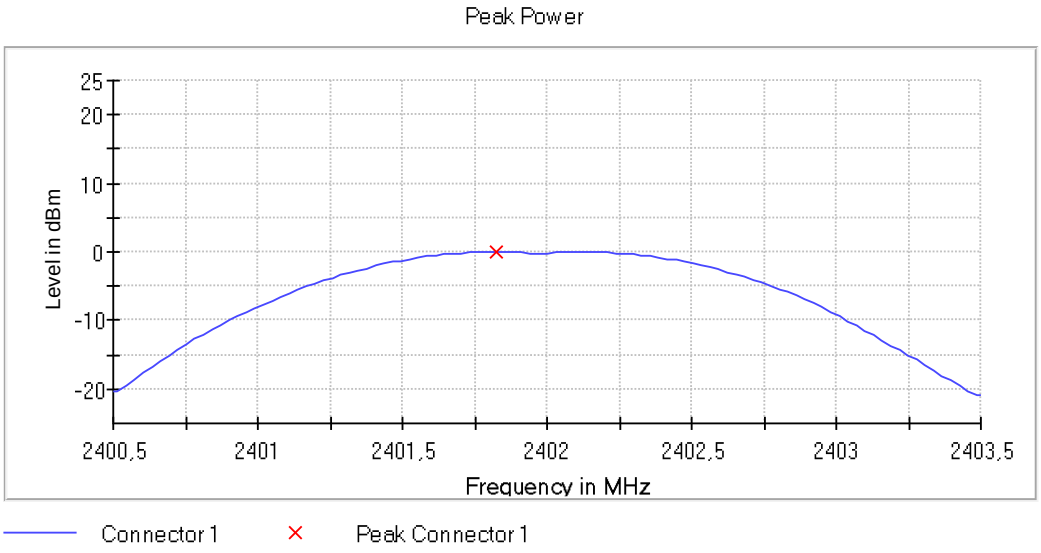
Verdict

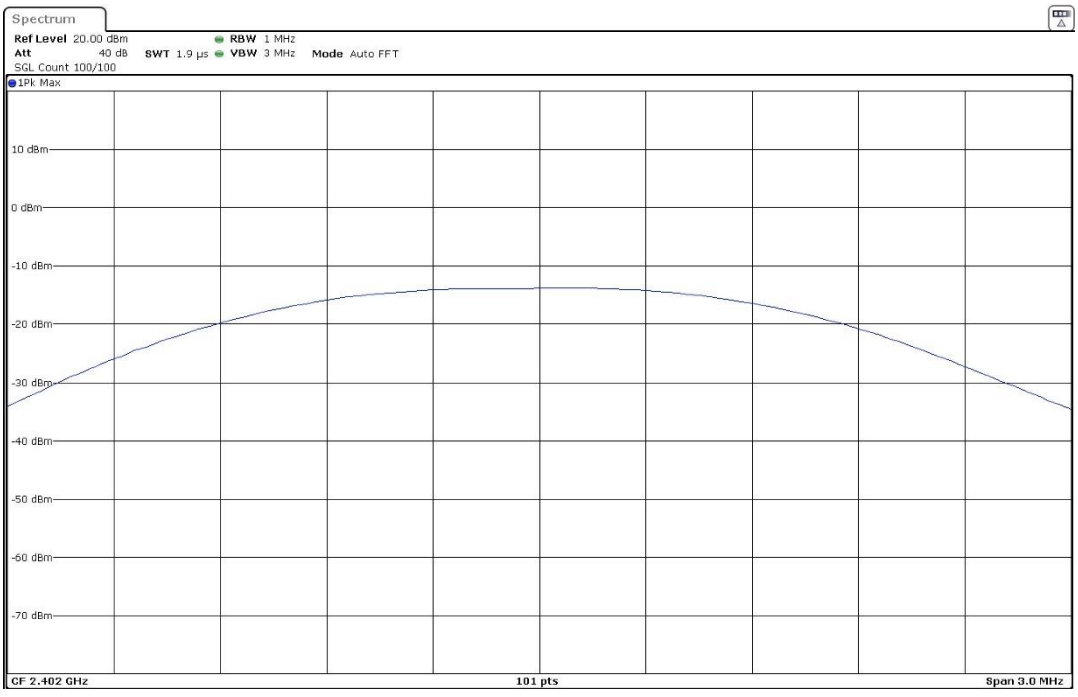
Pass

Attachments

Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

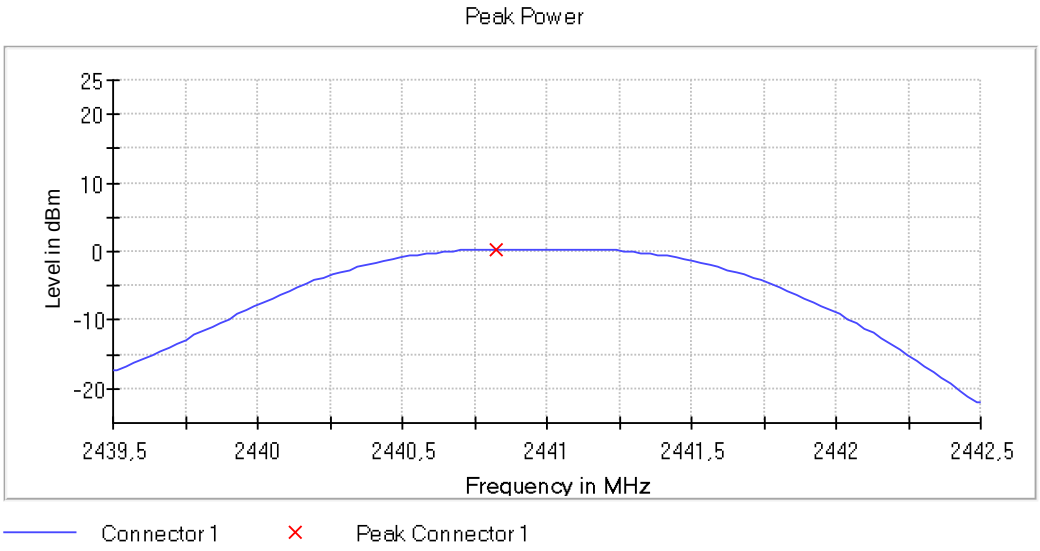
Plots:

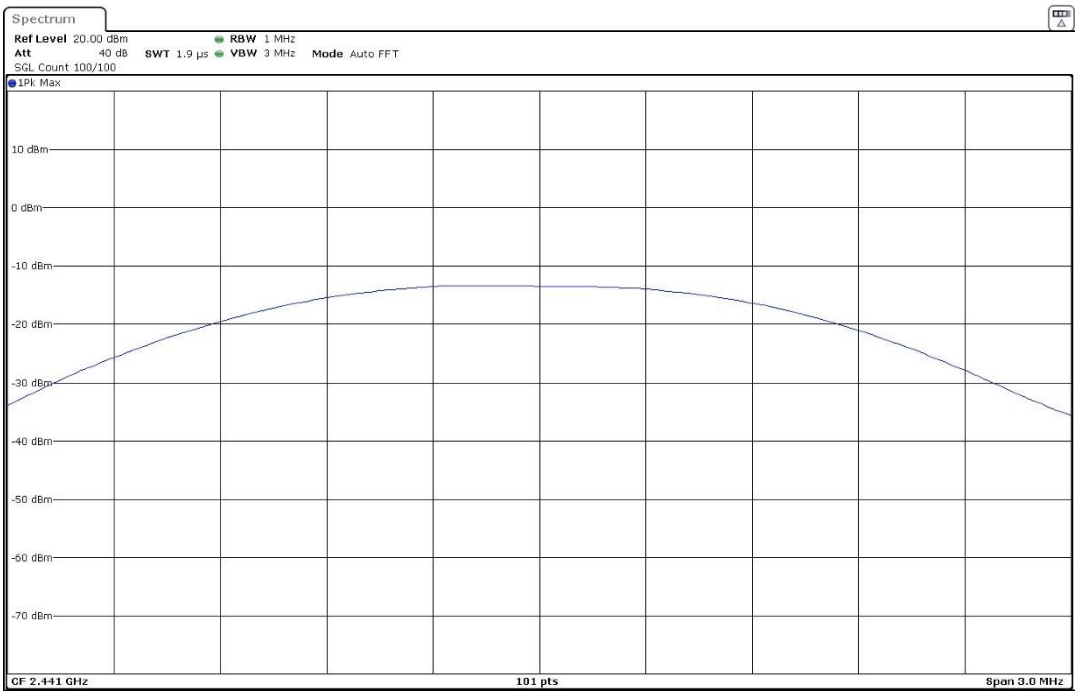




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2441.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

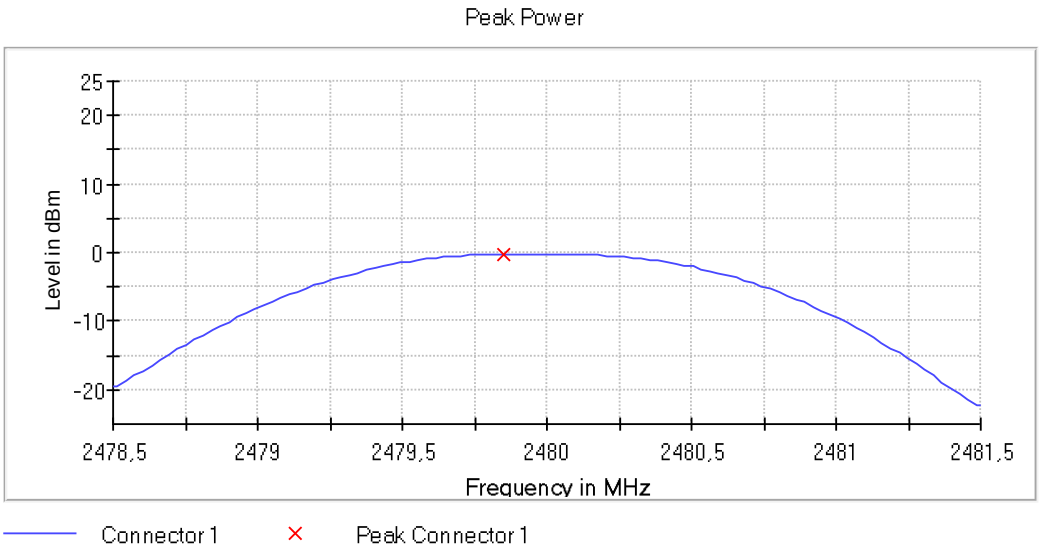
Plots:

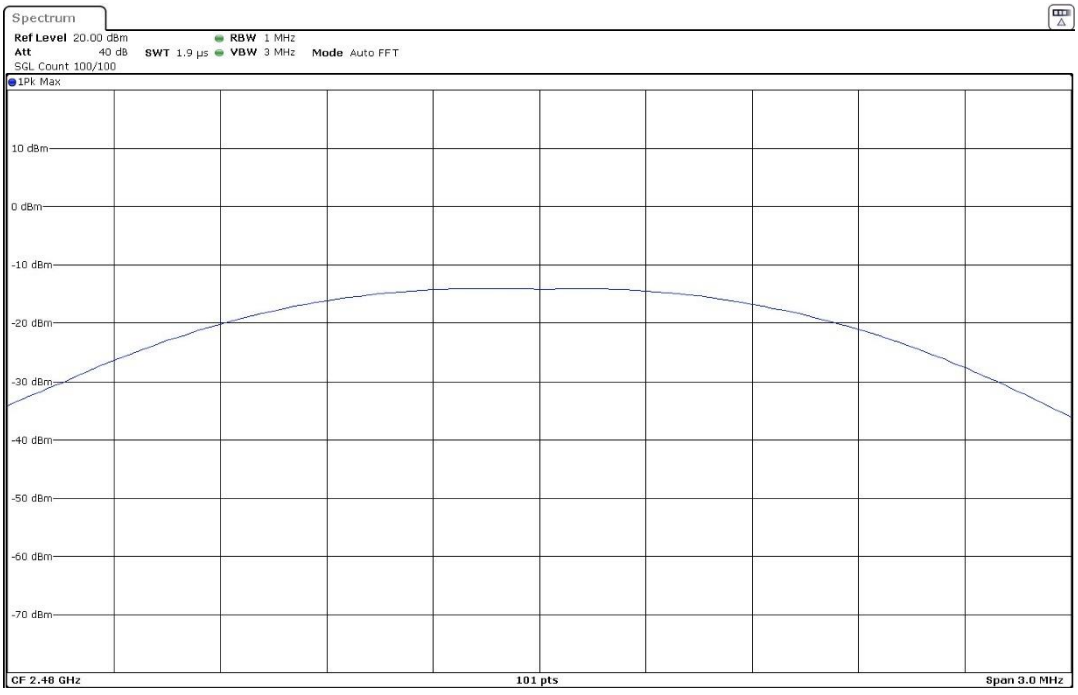




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

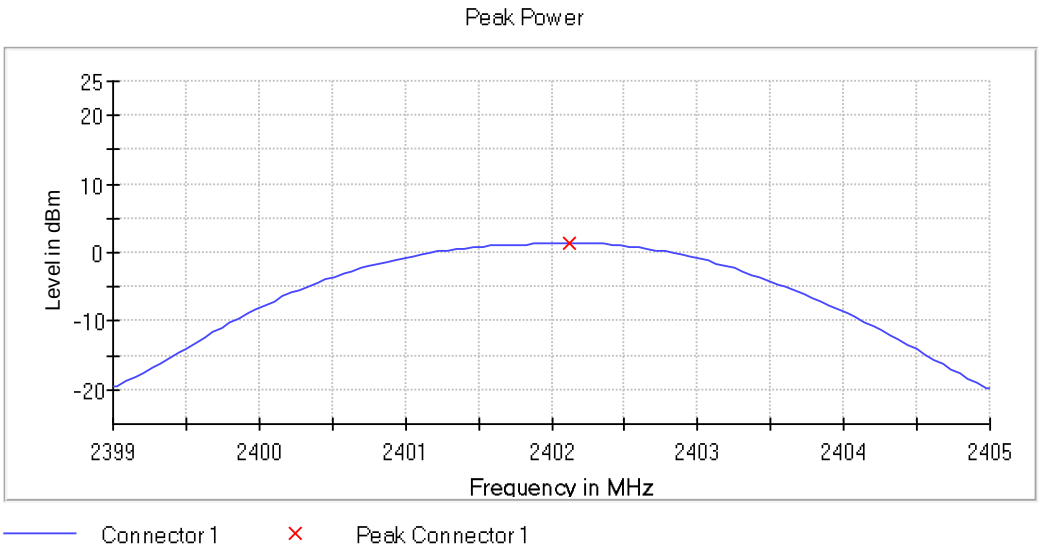
Plots:

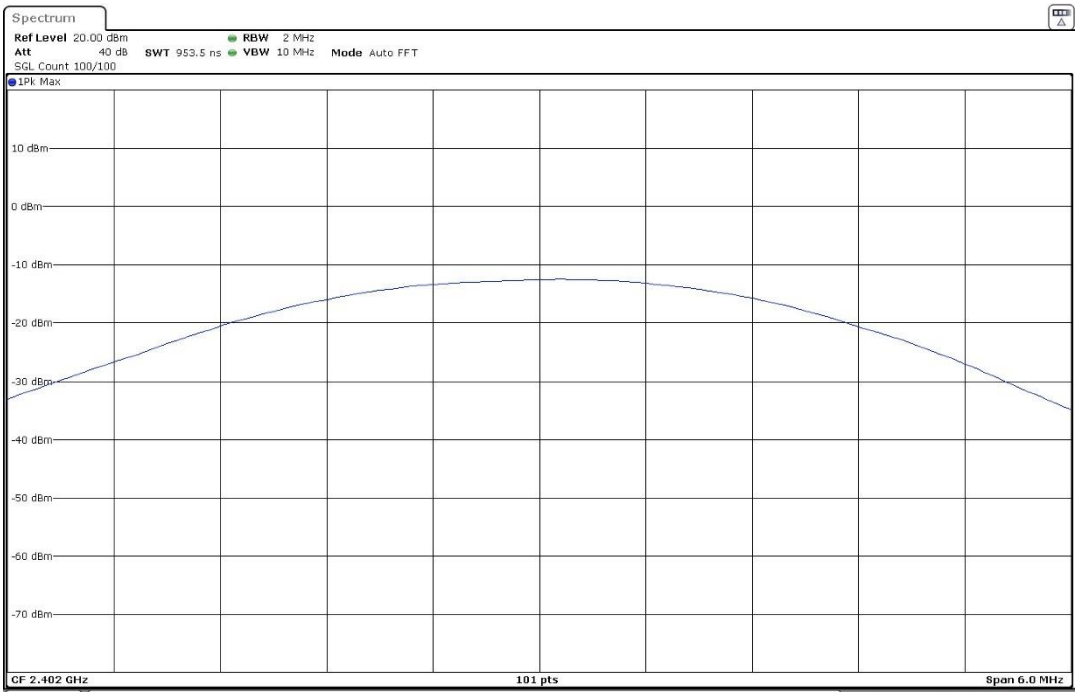




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

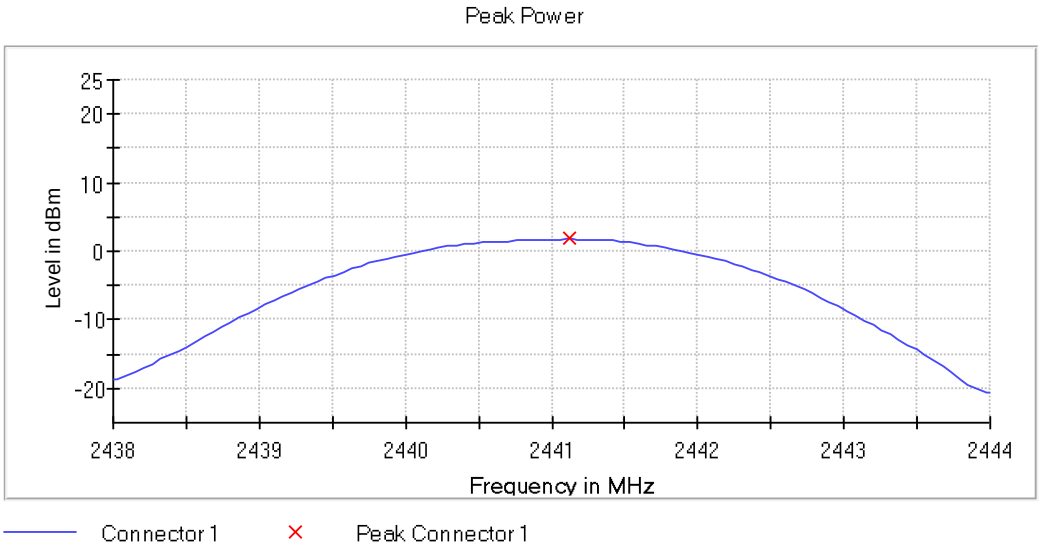
Plots:

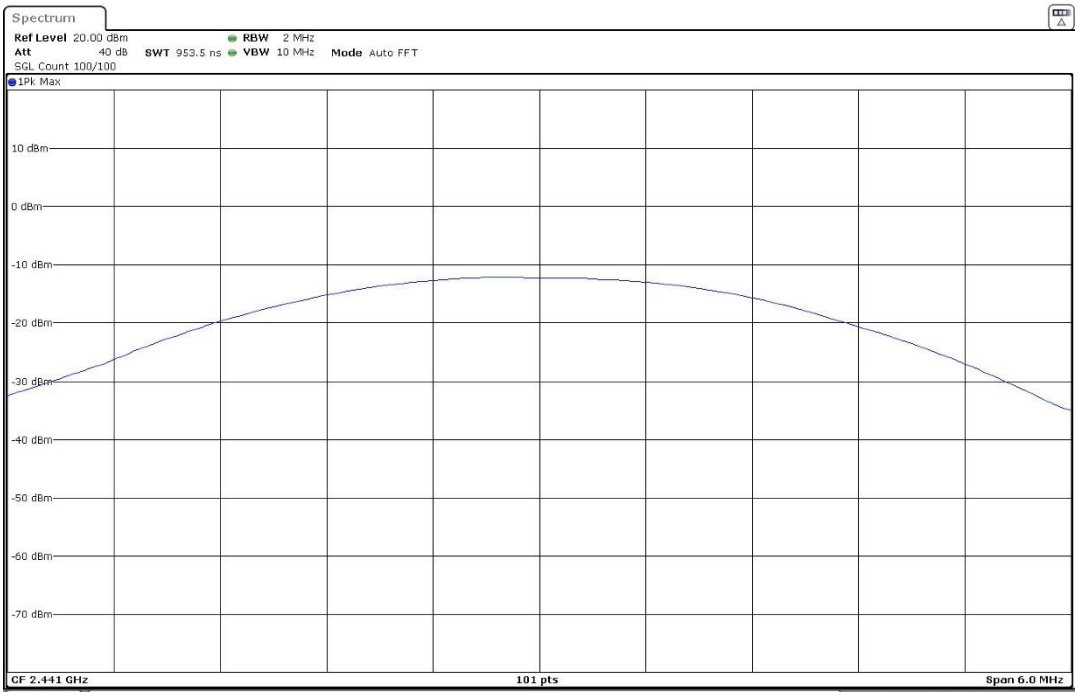




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2441.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

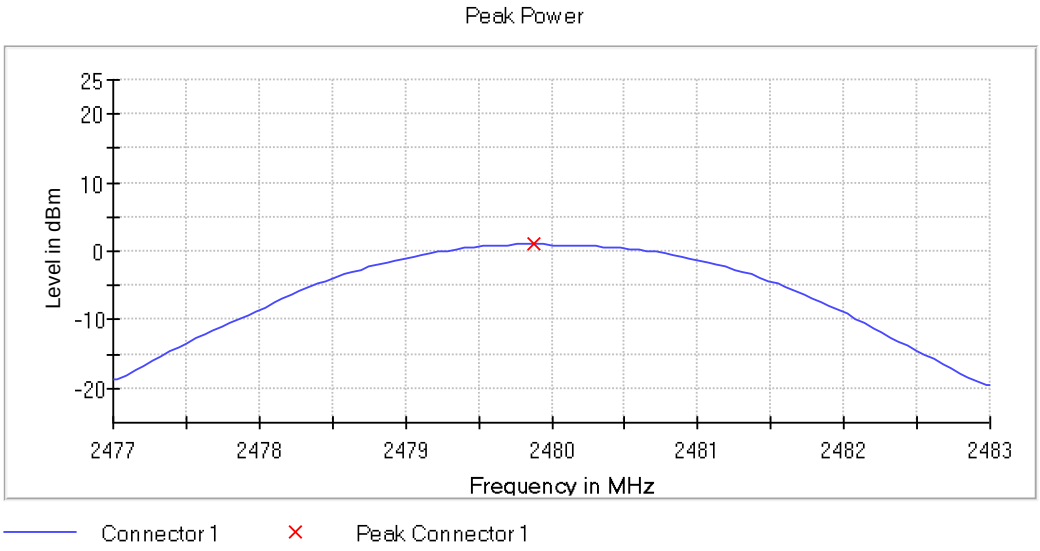
Plots:

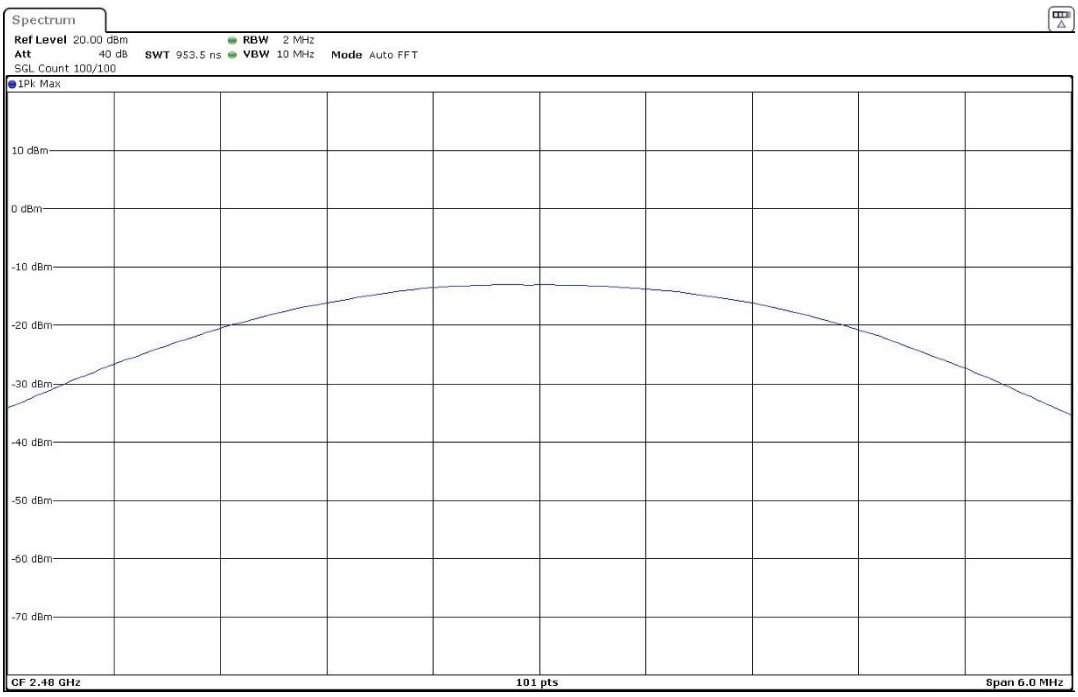




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

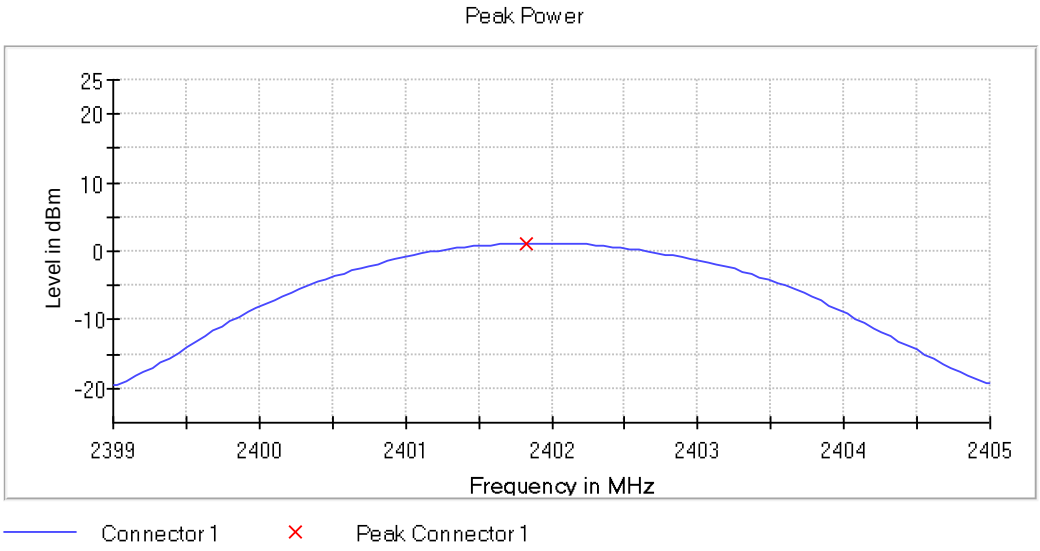
Plots:

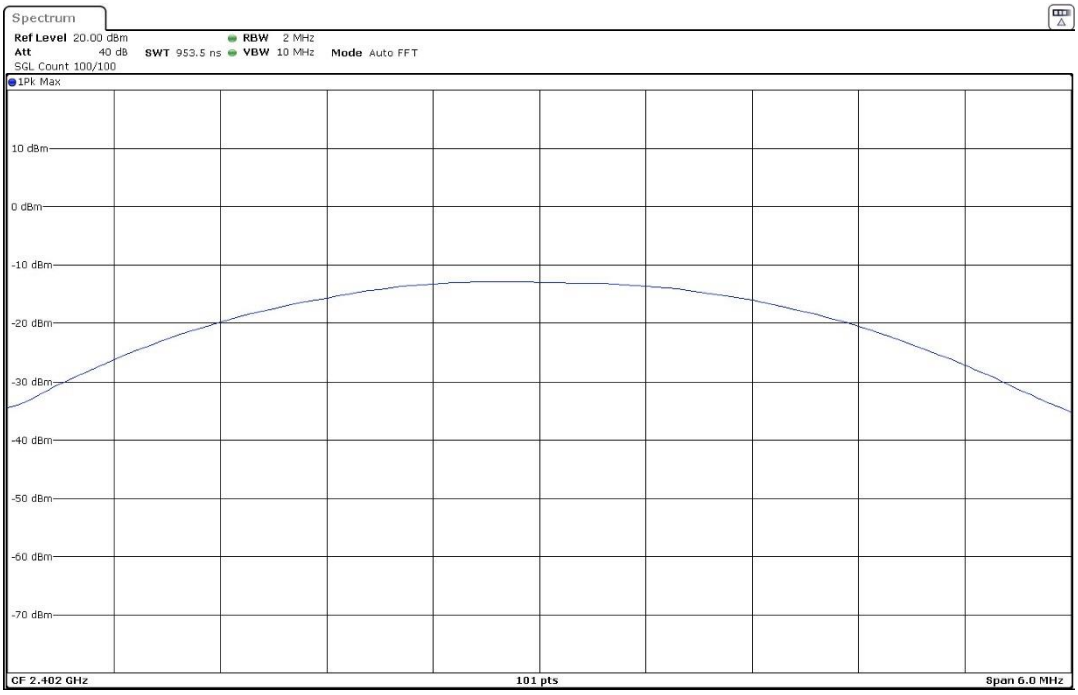




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

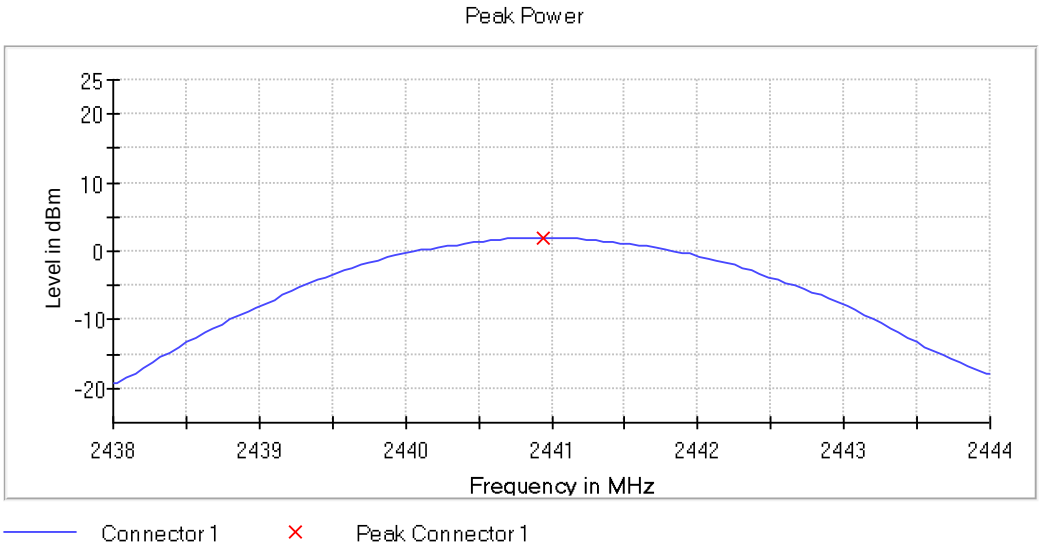
Plots:

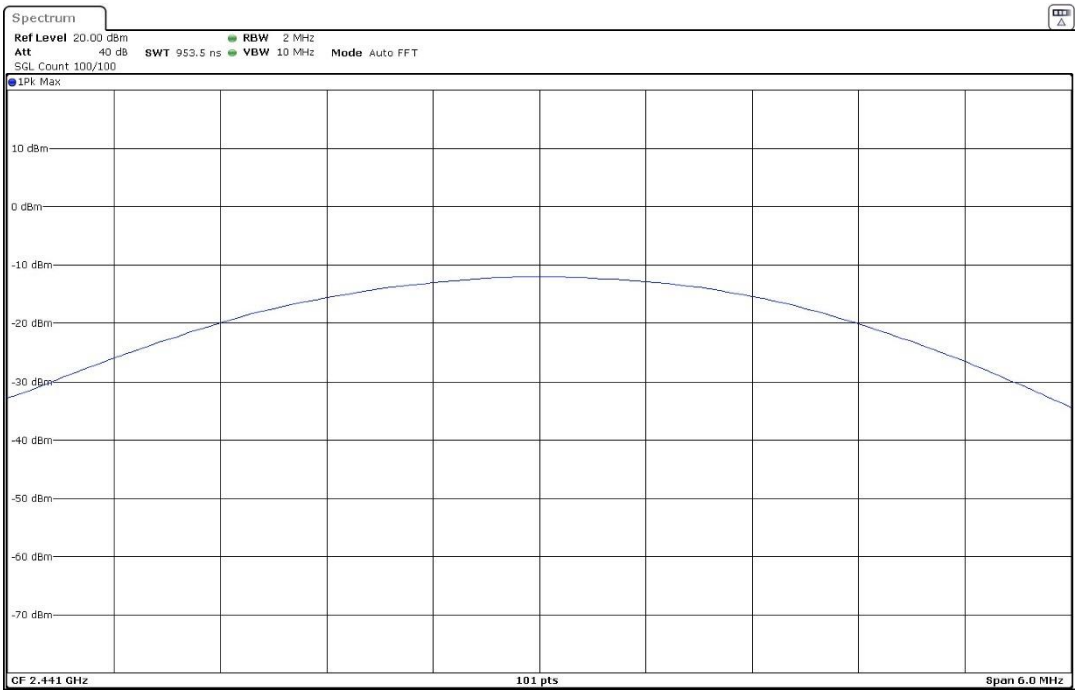




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2441.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

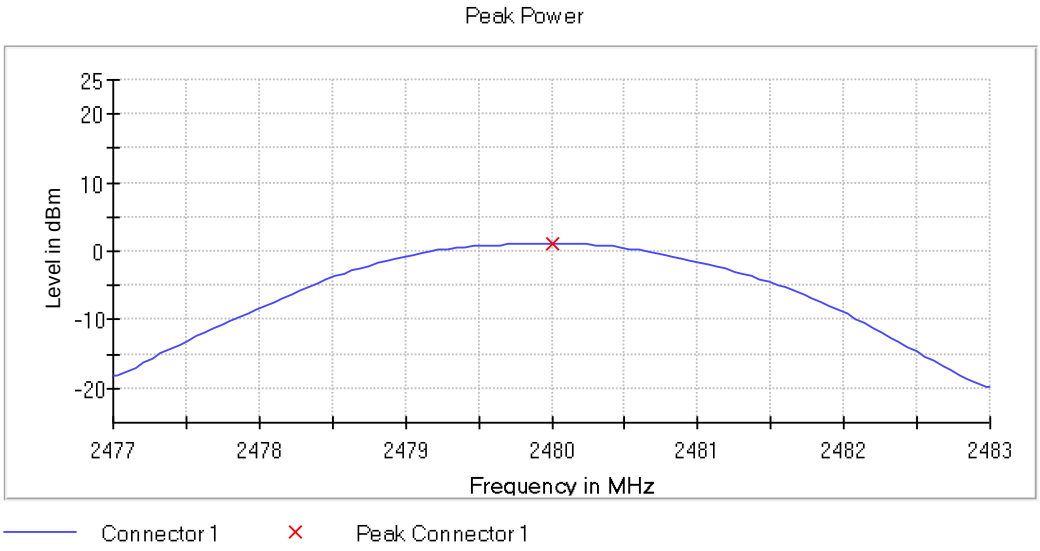
Plots:

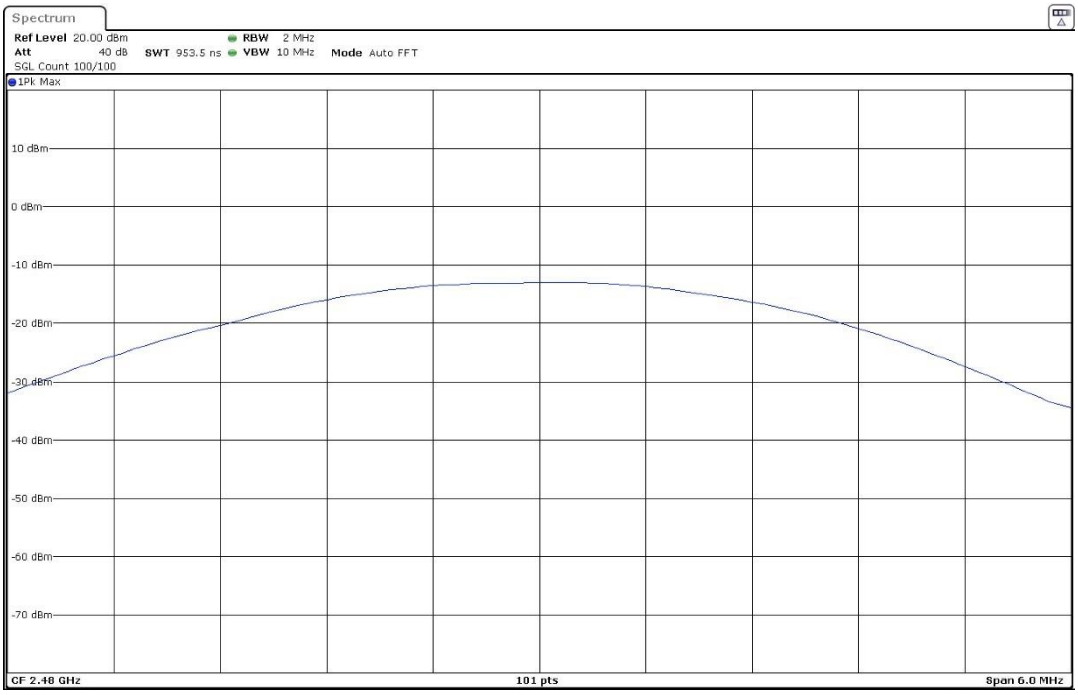




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Plots:





FCC 15.247 (d) Band-edge emissions compliance (Transmitter)

Limits

In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Results

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.

Modulation: BT (GFSK 1-DH5)

Verdict

Pass

Modulation: BT (Pi/4 DQPSK 2-DH5)

Verdict

Pass

Modulation: BT (8DPSK 3-DH5)

Verdict

Pass