Index

Acronyms

Acronym ID	Acronym Description
# of Ch	Available Number of Channels
# of Tx Chains	Number of Transmission Chains
20dBw	Emission Bandwidth
Avg COT	Average Channel Occupancy Time
Avg Power	Maximum Average Conducted Output Power
Detector	Detector used
Equipment	Equipment Type
EUT	Equipment Under Test
Freq	Frequency
Freq Rng	Frequency Range
Freq Sep	Frequency Separation
Lvl	Level
Mod	Modulation
NHC	Number of Hopping Channels
NHp	Number of hops over the period
Occ Ch BW	Occupied Channel Bandwidth
Operation Band	Operation Band
Pol	Polarization
PSD	Power Spectrum Density
Unwanted Freq	Unwanted Emissions Frequency

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.

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

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

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

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

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

General conditions

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

Uncertainty

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

The total uncertainty of the measurement system for the radiated emissions of EUT from 30 MHz to 1 GHz is: Measurement uncertainty ≤ ±5.35 dB (with factor k = 2).

The total uncertainty of the measurement system for the radiated emissions of EUT from 1 GHz to 17 GHz is: Measurement uncertainty ≤ ±4.32 dB (with factor k = 2).

The total uncertainty of the measurement system for the radiated emissions of EUT from 17 GHz to 26 GHz is: Measurement uncertainty ≤ ±5.51 dB (with factor k = 2).

The total uncertainty of the measurement system for the conducted testing of EUT is:
RF Peak Output Power: Measurement uncertainty ≤ ±0.80 dB
Power Spectral Density: Measurement uncertainty ≤ ±0.99 dB
Accumulated Dwell Time: Measurement uncertainty ≤ ±0.16 %
Minimum Frequency Occupation Time: Measurement uncertainty ≤ ±0.53 %
Hopping Frequency Separation: Measurement uncertainty ≤ ±1.74 %
6dB Bandwidth: Measurement uncertainty ≤ ±1.14 %
Occupied Channel Bandwidth: Measurement uncertainty ≤ ±1.24 % (BTEDR)
Occupied Channel Bandwidth: Measurement uncertainty ≤ ±1.40 % (WLAN)
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 an automotive infotainment System. The main functionalities are: Navigation, DVD/CD, HDD, USB, voice recognition, different interfaces to the car, Bluetooth and WLAN.

   The Head-unit provides different interfaces like: Auxiliary input, Video In, Video Out APIX3 (for the connection of an external Display), 3 USB interfaces (including support for Apple devices), CAN and 100Base-T1.

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	71290C_37.1	Automotive infotainment System	MGU FQ	B49289N055000036	2022-04-11	Equipment Under Test
S/01	71290C_29.1	Power harness	--	--	2022-04-11	Equipment Under Test
S/01	71290C_31.1	BT/WLAN Antenna	--	--	2022-04-11	Equipment Under Test
S/01	71290C_32.1	BT/WLAN Antenna	--	--	2022-04-11	Equipment Under Test
S/01	71290C_26.1	Power cable DC	--	--	2022-04-11	Auxiliary Equipment
S/01	71290C_27.1	Ethernet Cable	--	--	2022-04-11	Auxiliary Equipment
S/01	71290C_28.1	OABR_converter board	--	--	2022-04-11	Auxiliary Equipment
S/01	71290C_30.1	OABR_converter cable	--	--	2022-04-11	Auxiliary Equipment
S/01	71290C_33.1	Adapter Fakra Z jack-SMA Plug	--	--	2022-04-11	Auxiliary Equipment
S/01	71290C_34.1	Adapter Fakra Z jack-SMA Plug	--	--	2022-04-11	Auxiliary Equipment
S/01	71290C_35.1	SMA Adapter	--	--	2022-04-11	Auxiliary Equipment
S/01	71290C_36.1	SMA Adapter	--	--	2022-04-11	Auxiliary Equipment
S/02	71290C_37.1	Automotive infotainment System	MGU FQ	B49289N055000036	2022-04-11	Equipment Under Test
S/02	71290C_29.1	Power harness	--	--	2022-04-11	Equipment Under Test
S/02	71290C_26.1	Power cable DC	--	--	2022-04-11	Auxiliary Equipment
S/02	71290C_27.1	Ethernet Cable	--	--	2022-04-11	Auxiliary Equipment
S/02	71290C_30.1	OABR_converter cable	--	--	2022-04-11	Auxiliary Equipment
S/02	71290C_33.1	Adapter Fakra Z jack-SMA Plug	--	--	2022-04-11	Auxiliary Equipment
S/02	71290C_34.1	Adapter Fakra Z jack-SMA Plug	--	--	2022-04-11	Auxiliary Equipment
S/02	71290C_40.1	OABR_converter board	--	--	2022-04-11	Auxiliary Equipment

Notes referenced to samples during the project:

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

Test sample description

Ports..... :	Port name and description	Cable			
		Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)
	BT/WIFI connector – 2X 1 POL ROS 59S2BT-40MA5-1		☒	☒	☐
	USB1 connector – CONM-SM 4POL ROS D4S20Y-40MA5-B		☐	☒	☐
	USB2 connector – CONM-SM 4POL ROS D4S20Y-40MA5-C		☐	☒	☐
	USB3 connector – CONM-SM 4POL ROS D4S20Y-40MA5-E		☐	☒	☐
	APIX3 connector – CONM-SM 4+2POL ROS 99S22A-40MA5-D		☒	☐	☐
	Car Main-connector – CONM 16POL TYC 2300483-s		☒	☐	☐
	AR-CAM connector – CONM 1POL ROS 59S2FT-40MA5-K		☐	☐	☐
	Ethernet BroadR-Reach, 100 BASE-T1		☒	☐	☐
	Ethernet, 1000 BASE-T1		☐	☐	☐
	GNSS connector 1 POL ROS 59S2BT-40MA5-C		☒	☒	☐
	--				

Supplementary information to the ports..... :							
Rated power supply .....:	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
		AC:	☐	☐	☐	☐	☐
	☒	DC: 13.2 Vdc					
Rated Power .....:	-						
Clock frequencies.....:	-						
Other parameters .....:	-						
Software version .....:	490S_22w09.4-1						

Hardware version .....:	3.2			
Dimensions in cm (W x H x D) ....:	-			
Mounting position .....:	☐	Table top equipment		
	☐	Wall/Ceiling mounted equipment		
	☐	Floor standing equipment		
	☐	Hand-held equipment		
	☒	Other: Automotive dashboard		
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

HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH
Becker-Goering-Str. 16
76307, Karlsbad, GERMANY

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2022-04-22
Date (finish)	2022-06-15

Document history

Report number	Date	Description
71290RRF.009	2022-10-14	First release

Environmental conditions

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

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

In the semi-anechoic 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: Javier Miguel Nadales, Rafael Fernandez and Jose Manuel Jimenez.

Used instrumentation:

Equipment	Model	Manufacturer	Next Calibration
SHIELDED ROOM	S101	ETS LINDGREN	N.A.
SIGNAL AND SPECTRUM ANALYZER 10Hz-40GHz	FSV40	ROHDE AND SCHWARZ	2023-02-26
OPEN SWITCH UNIT UP TO 7.5 GHz	OSP-B157W8 PLUS	ROHDE & SCHWARZ	2023-08-20
POWER SUPPLY DC 40 V / 40 A	NGPE 40/40	ROHDE AND SCHWARZ	N.A.
DIGITAL MULTIMETER	179	FLUKE	2022-10-19
EMC/RF MEASUREMENT SOFTWARE	WMS32	ROHDE AND SCHWARZ	N.A.
SEMIANECHOIC ABSORBER LINED CHAMBER II	FACT 3 200 STP	ETS LINDGREN	2023-08-28
SHIELDED ROOM	S101	ETS LINDGREN	N.A.
SIGNAL AND SPECTRUM ANALYZER 2Hz-50GHz	FSW50	ROHDE AND SCHWARZ	2022-07-06
EMI TEST RECEIVER 9kHz-7GHz	ESR7	ROHDE AND SCHWARZ	2022-12-12
HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	ETS LINDGREN	2023-04-30
HORN ANTENNA 1-18GHz	BBHA 9120 D	SCHWARZBECK MESS-ELEKTRONIK	2022-11-18
HORN ANTENNA 17-40GHz	BBHA 9170	SCHWARZBECK	2023-05-05
PRE-AMPLIFIER G>40dB 10MHz-6GHz	BLNA 0160-01N	BONN ELEKTRONIK	2023-03-17
PRE-AMPLIFIER G>40dB 1-18 GHz	BLMA 0118-1M	BONN ELEKTRONIK	2022-06-07 (*)
PRE-AMPLIFIER G>30dB 17-40GHz	BLMA 1840-4A	BONN ELEKTRONIK	2022-09-08
DC POWER SUPPLY 30V/5A	U8002A	KEYSIGHT TECHNOLOGIES	N.A.
EMC/RF MEASUREMENT SOFTWARE	EMC32	ROHDE AND SCHWARZ	N.A.

(*) Used for radiated tests before expiration of the calibration period.

Testing verdicts

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

Summary

Bluetooth EDR

Requirement – Test case	FCC PART 15 / RSS-247	Verdict	Remark
RSS-247 5.1 (b) / FCC 15.247 (a)(1)	20 dB Bandwidth	P	--
RSS-247 5.1 (b) / FCC 15.247 (a)(1)	Carrier Frequency Separation	P	--
RSS-247 5.1 (d) / FCC 15.247 (a)(1)(iii)	Time of Occupancy (Dwell Time)	P	--
RSS-247 5.1 (d) / FCC 15.247 (a)(1)(iii)	Number of hopping channels	P	--
RSS-247 5.4 (b) / FCC 15.247 (b)	Maximum peak output power and antenna gain	P	--
RSS-247 5.5 / FCC 15.247 (d)	Band-edge emissions compliance (Transmitter)	P	--
RSS-247 5.5 / FCC 15.247 (d)	Emission limitations radiated (Transmitter)	P	--
Supplementary information and remarks: None.			

802.11 b/g/n20 MHz 1x1

FCC PART 15 / 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 (e) / RSS-247 5.2 (b)	Power spectral density	P	--
FCC 15.247 (d) / RSS-247 5.5	Band-edge emissions compliance (Transmitter)	P	--
FCC 15.247 (d) / RSS-247 5.5	Emission limitations radiated (Transmitter)	P	--
Supplementary information and remarks: None.			

Appendix A: Test results. Bluetooth EDR

INDEX

TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal:	13.2 Vdc
Type of Power Supply:	DC External (Car Battery).

ANTENNA (*):

Type of Antenna:	External Antenna
Maximum Declared Antenna Gain:	-2.5 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 from 30 MHz to 1000 MHz and 1 – 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).

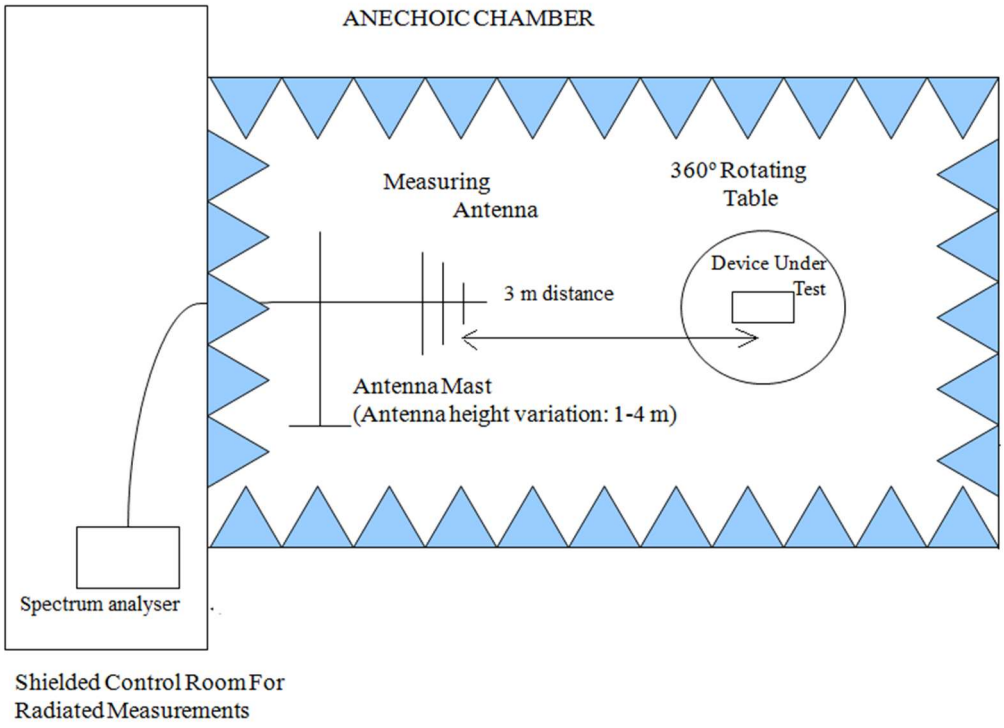
For radiated emissions in the range 17 GHz – 26 GHz performed at a distance closer than the distance specified in standard, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and its 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 (up to 17GHz) to find the maximum radiated emission.

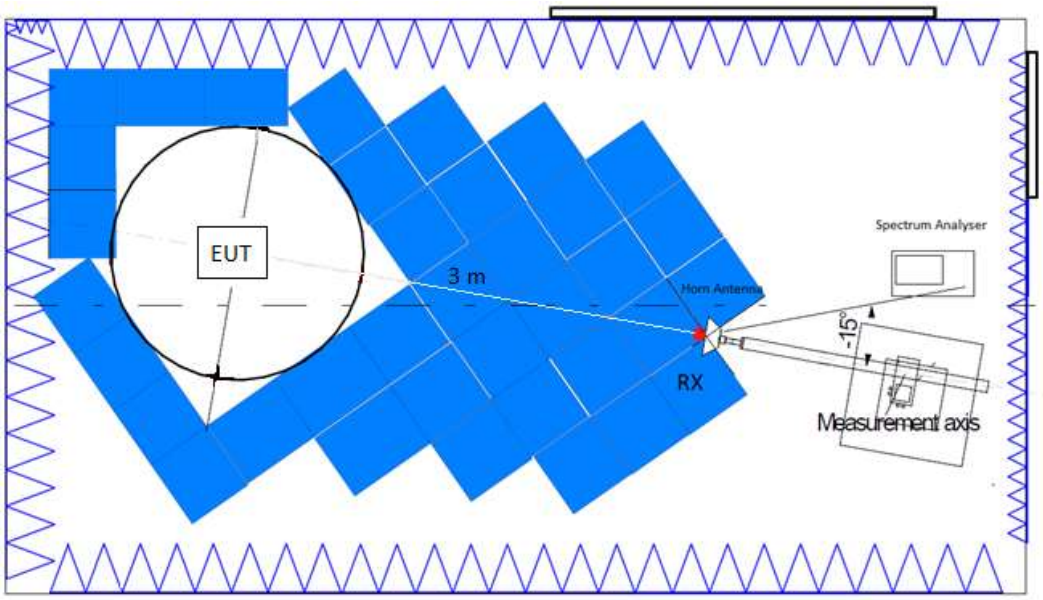
Measurements were made in both horizontal and vertical planes of polarization.

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.

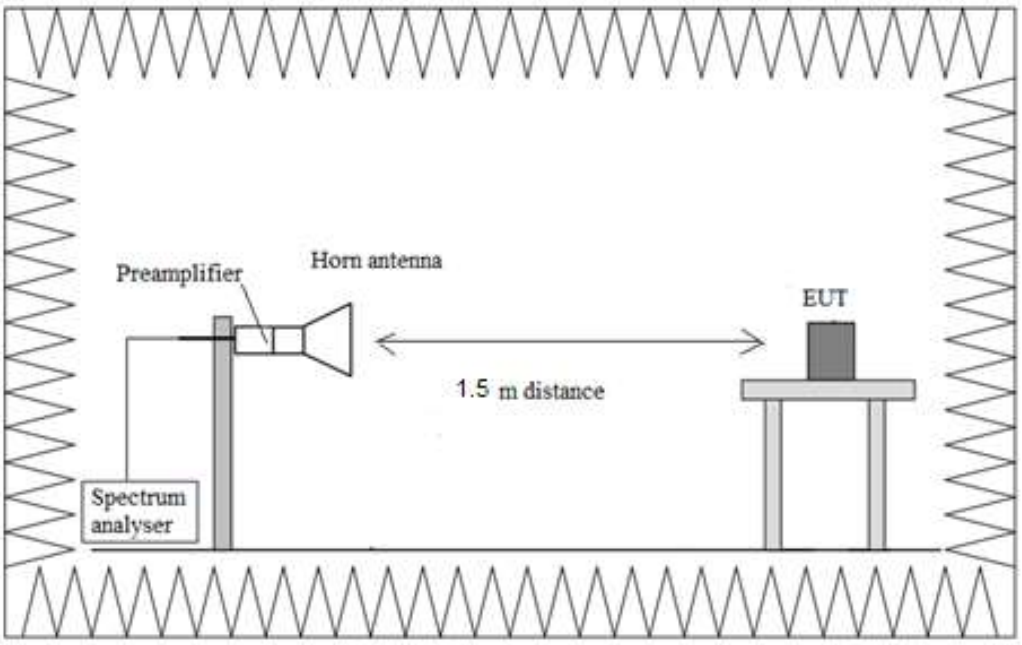
Radiated measurements setup from 30 MHz to 1 GHz:



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	0.860000
2441.00	0.860000
2480.00	0.860000

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

Freq (MHz)	Occ Ch BW (MHz)
2402.00	1.175000
2441.00	1.175000
2480.00	1.175000

Modulation: BT (8DPSK 3-DH5)

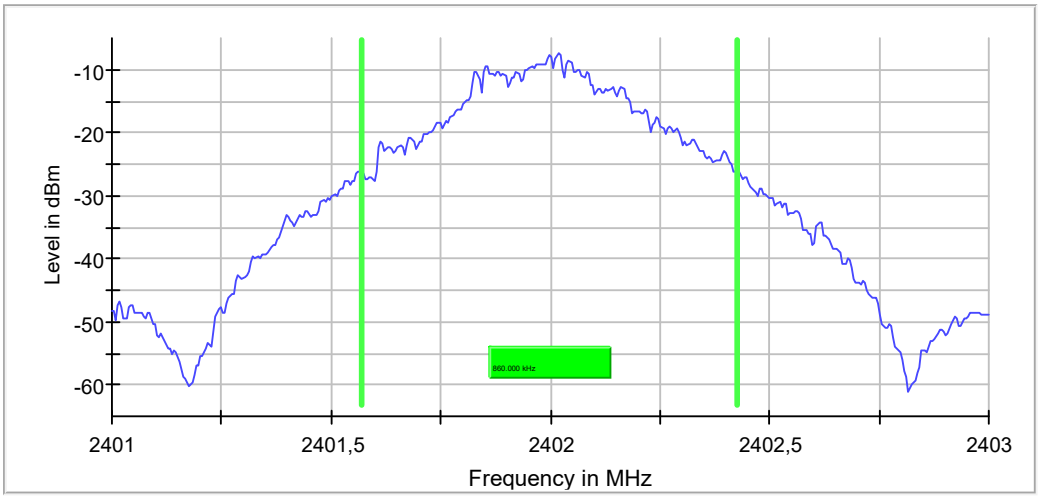
Freq (MHz)	Occ Ch BW (MHz)
2402.00	1.180000
2441.00	1.180000
2480.00	1.180000

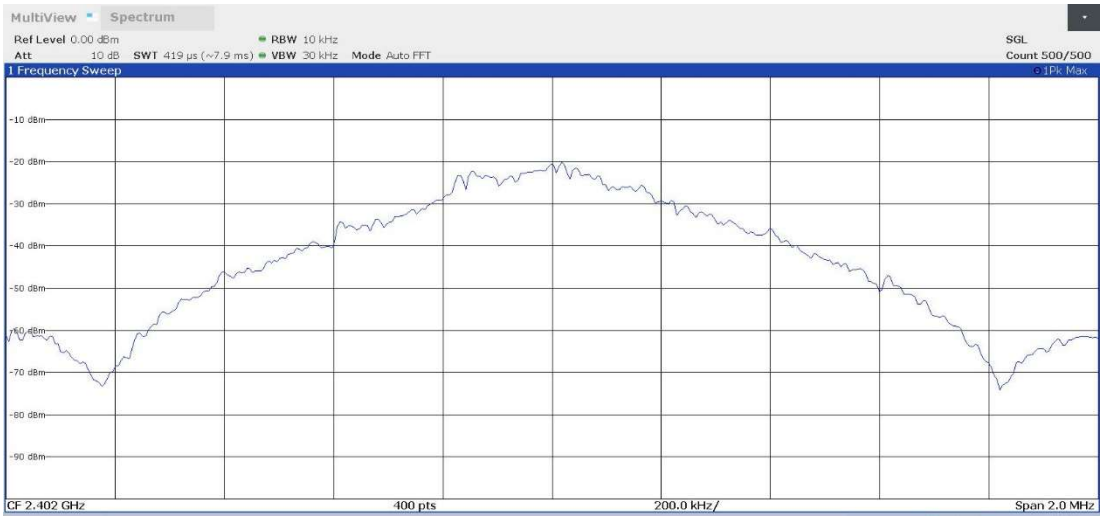
Attachments

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:

99 % Bandwidth

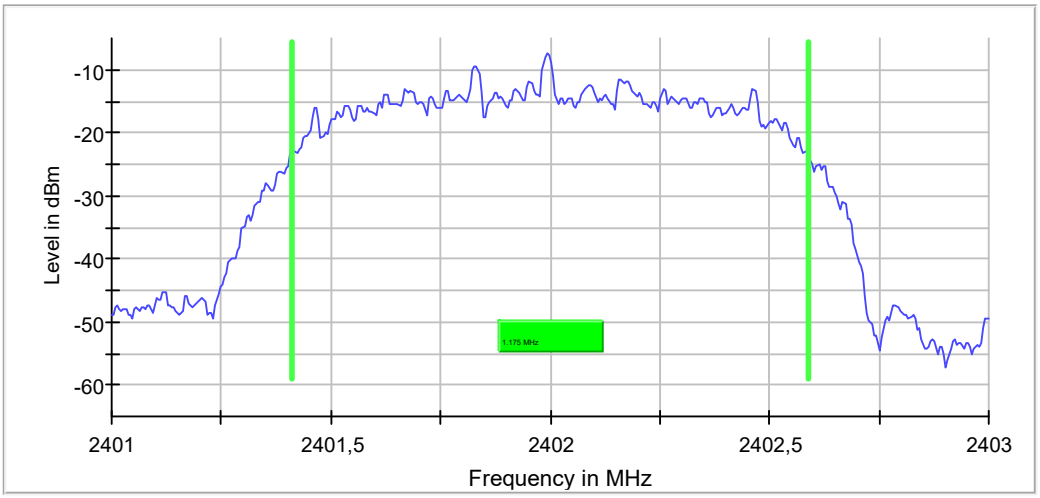


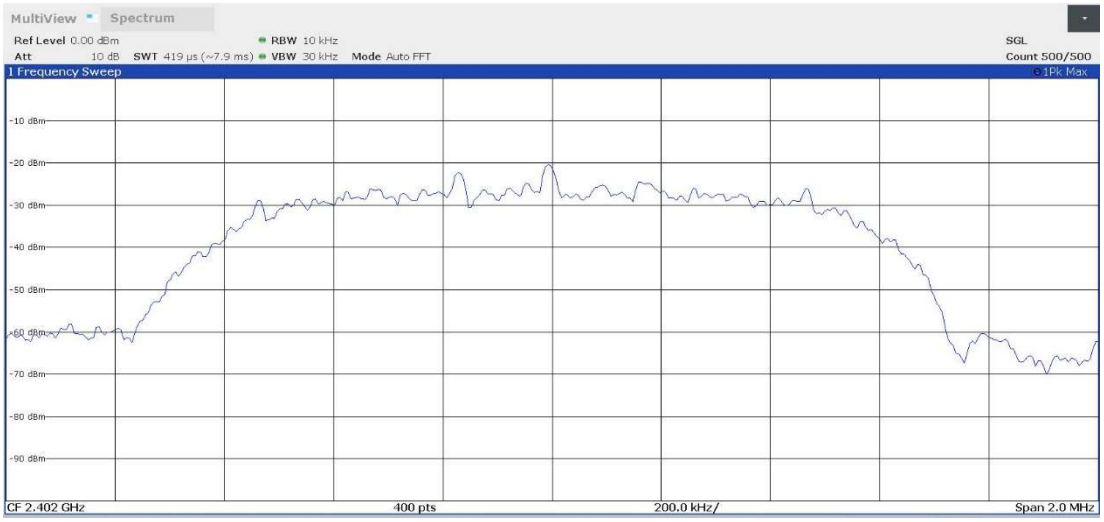


Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

Plots:

99 % Bandwidth

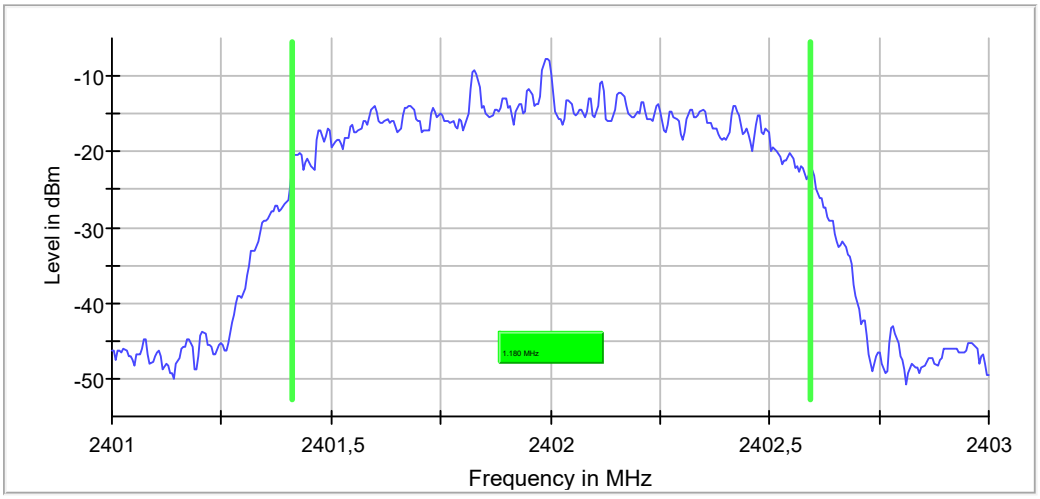


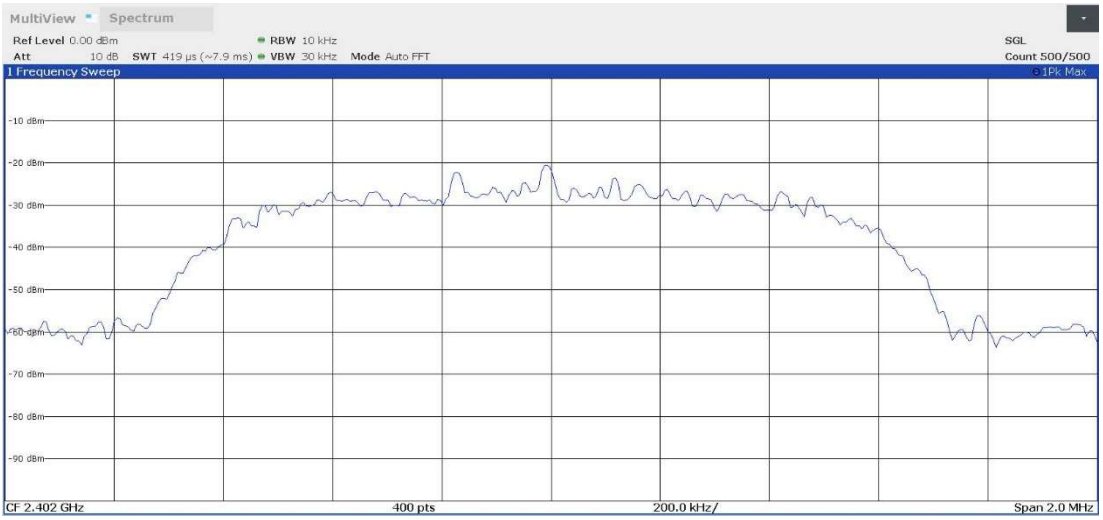


Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Plots:

99 % Bandwidth

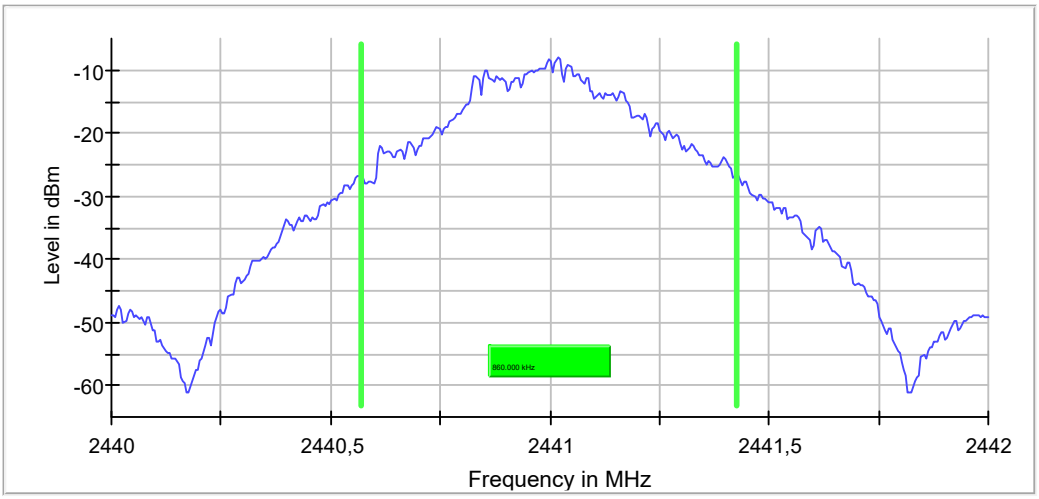


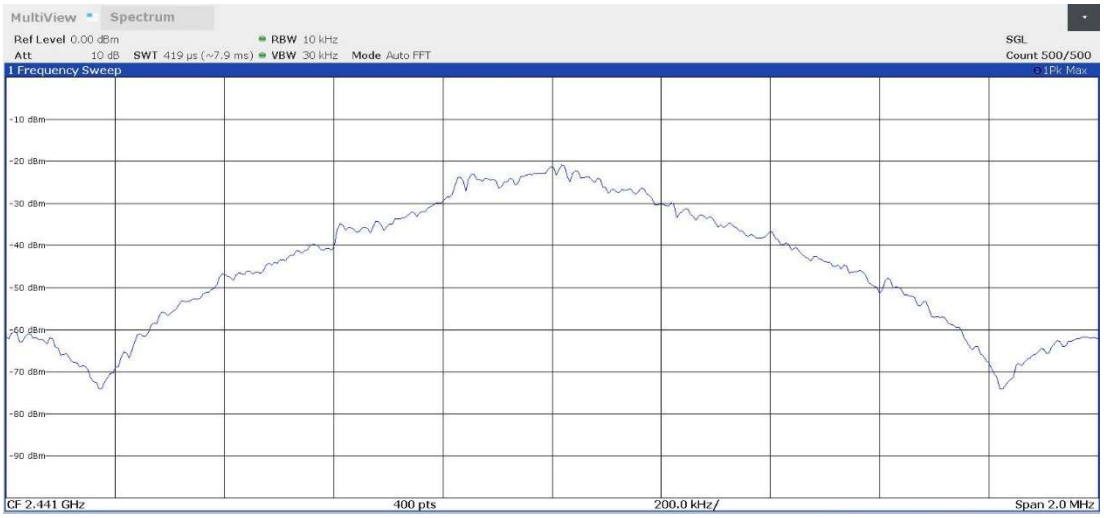


Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2441.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

Plots:

99 % Bandwidth

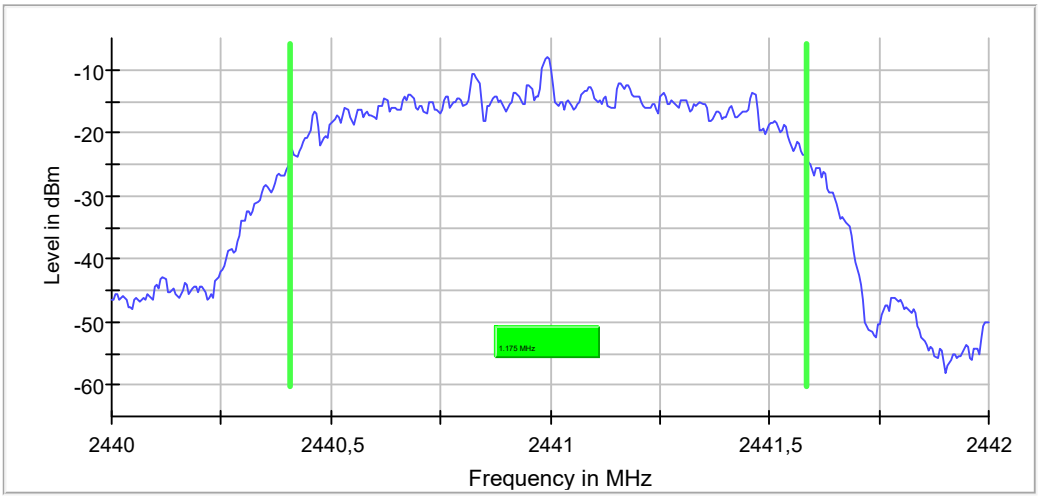


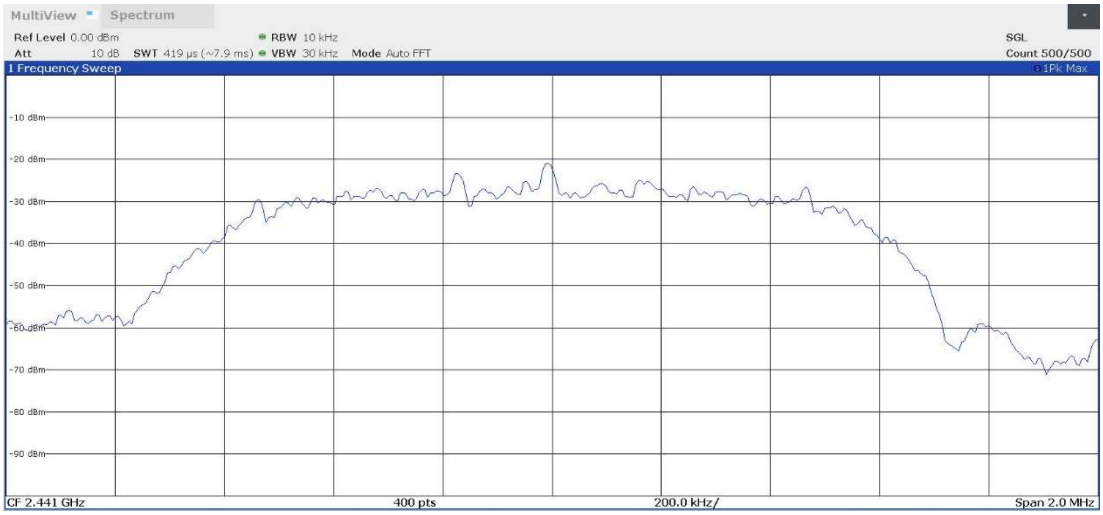


Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2441.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

Plots:

99 % Bandwidth

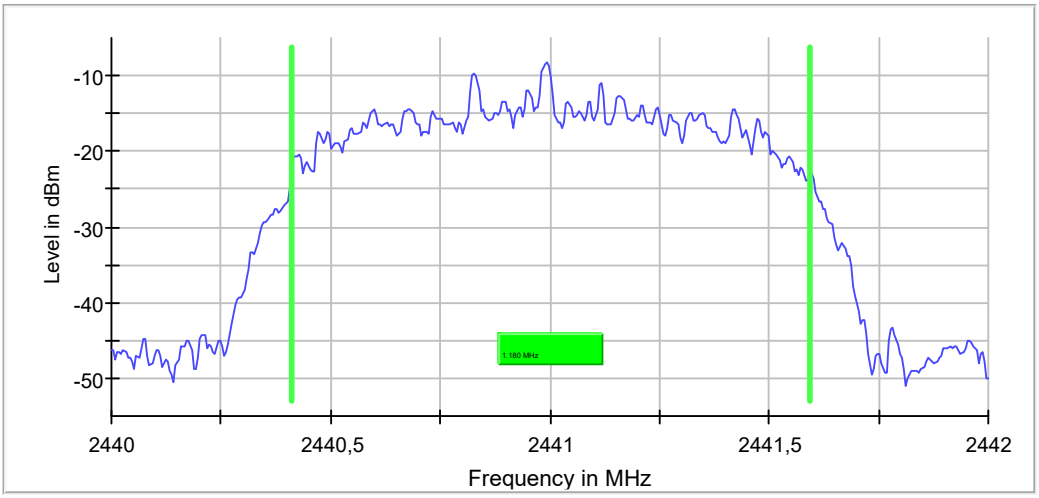


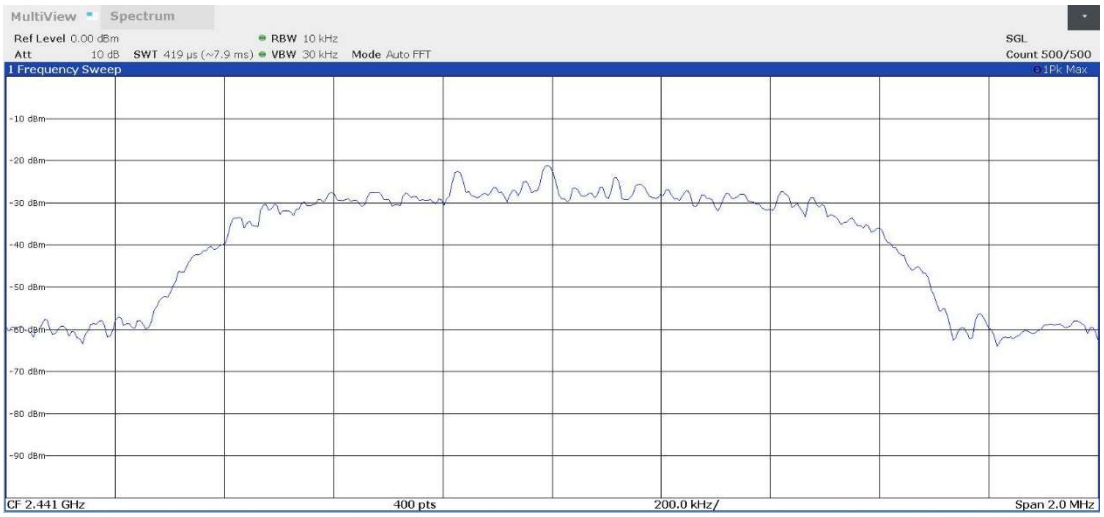


Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2441.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Plots:

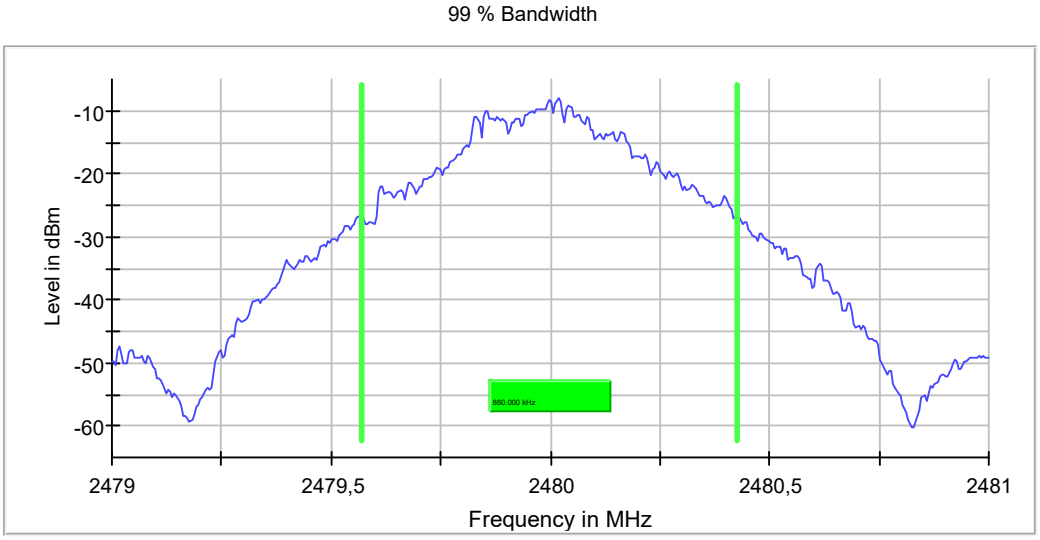
99 % Bandwidth

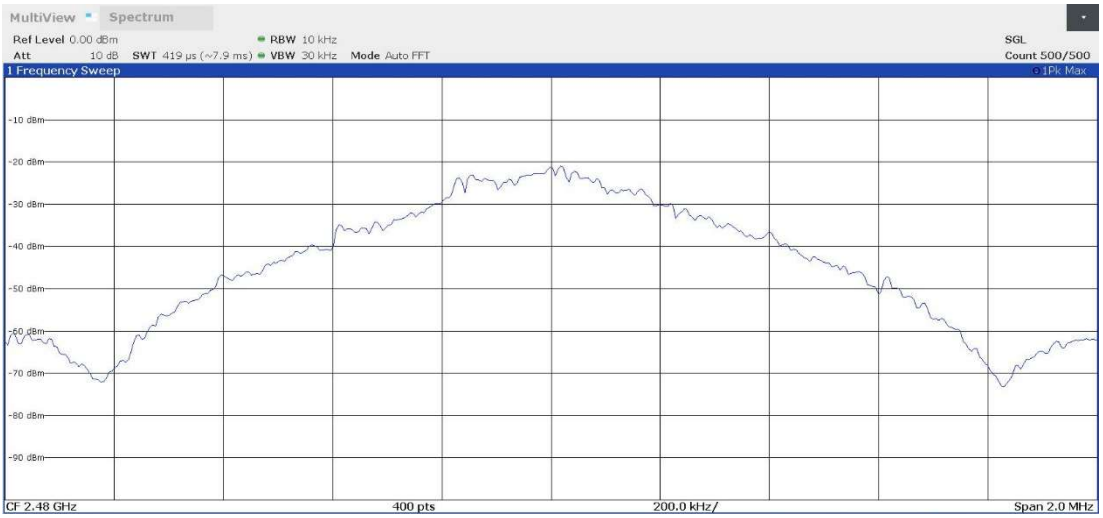




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

Plots:

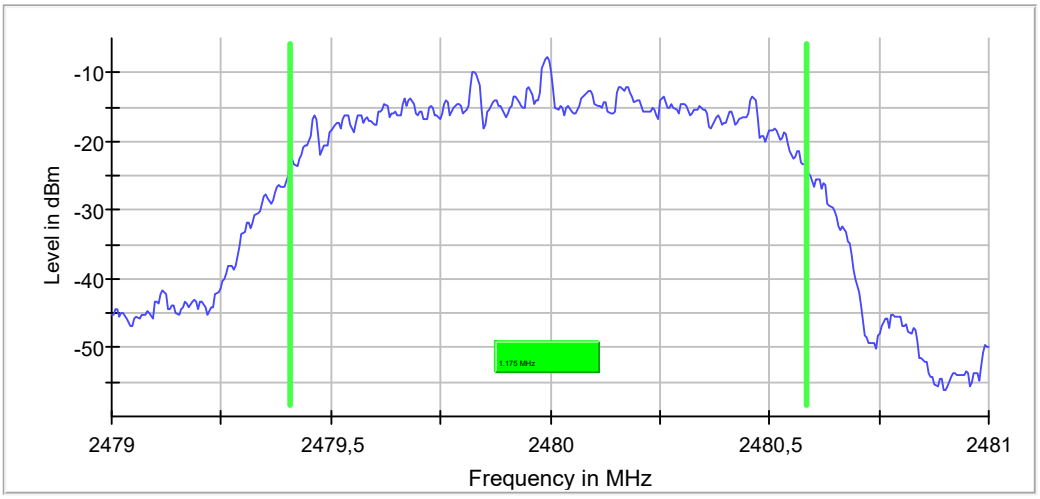


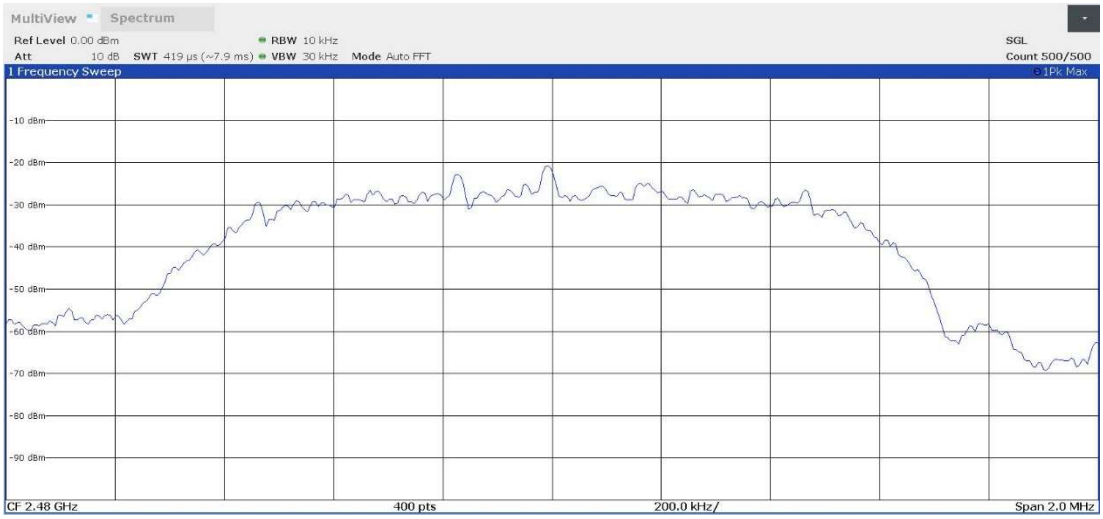


Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

Plots:

99 % Bandwidth

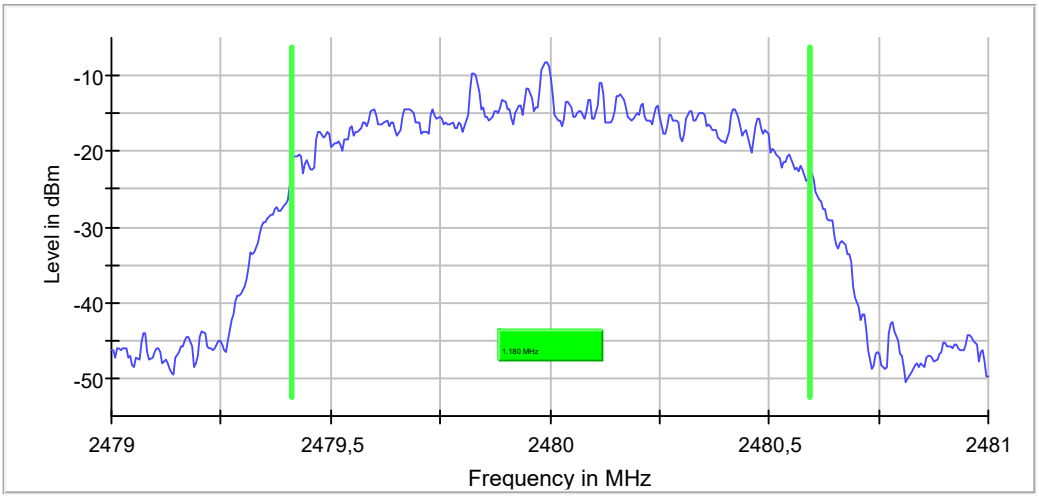


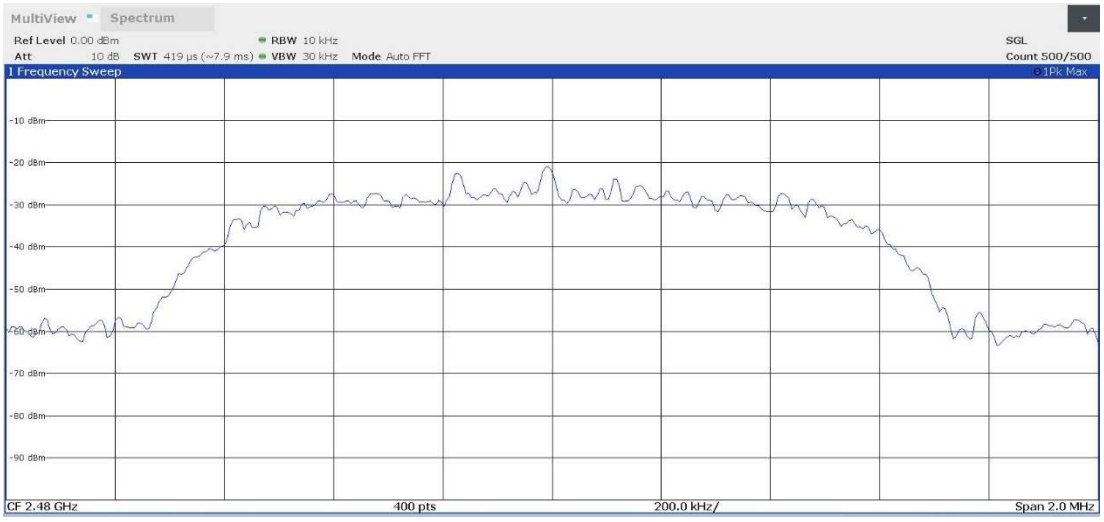


Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Plots:

99 % Bandwidth





RSS-247 5.1 (b) / 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	0.900000
2441.00	0.900000
2480.00	0.900000

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

Freq (MHz)	20dBw (MHz)
2402.00	1.260000
2441.00	1.260000
2480.00	1.285000

Modulation: BT (8DPSK 3-DH5)

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

Verdict

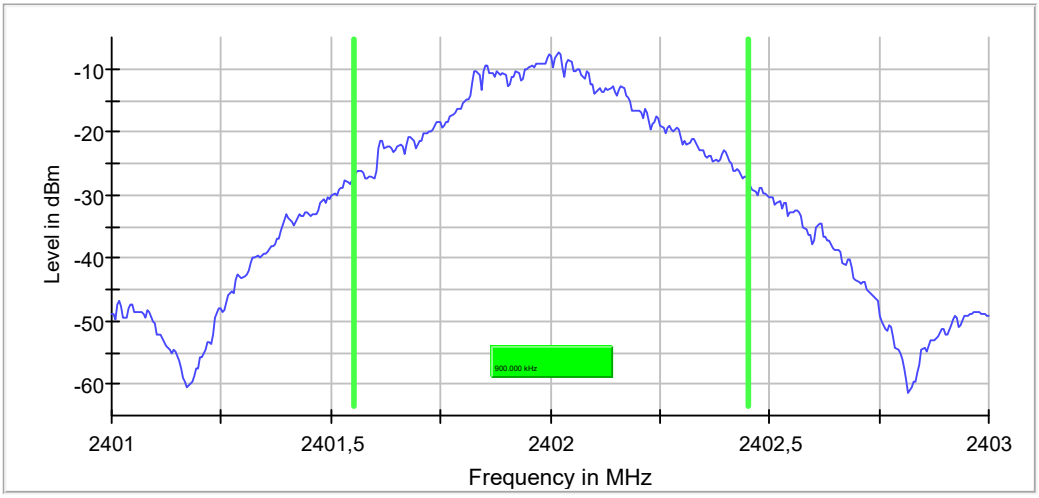
Pass

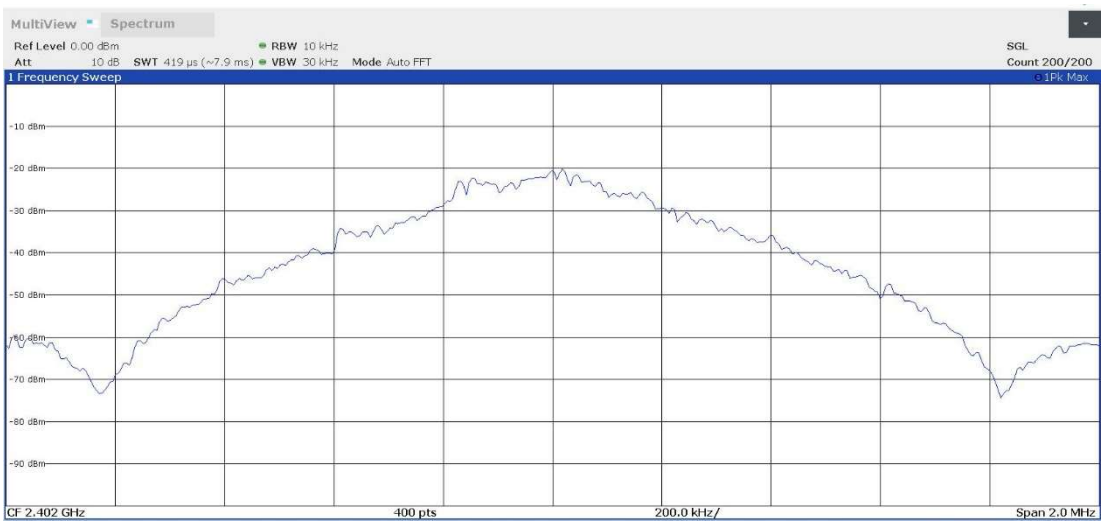
Attachments

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:

20 dB Bandwidth

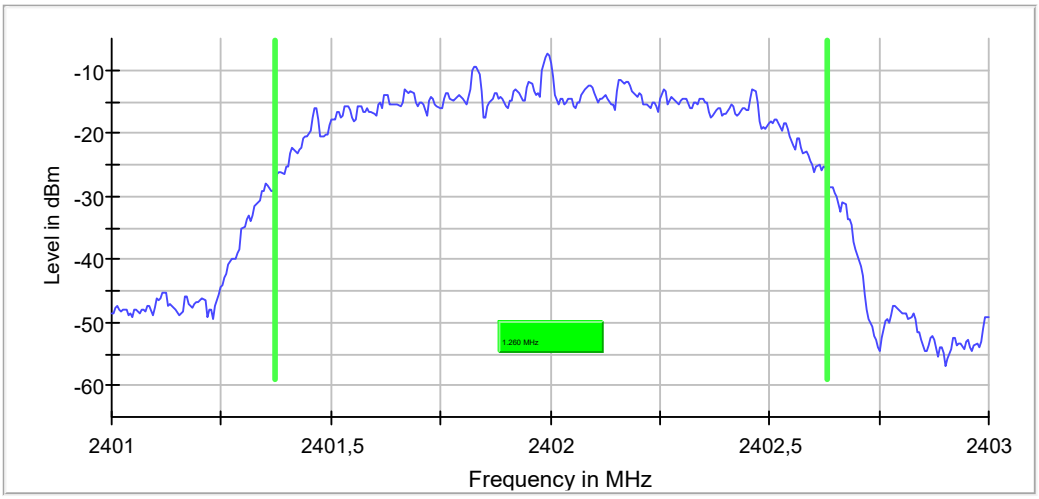


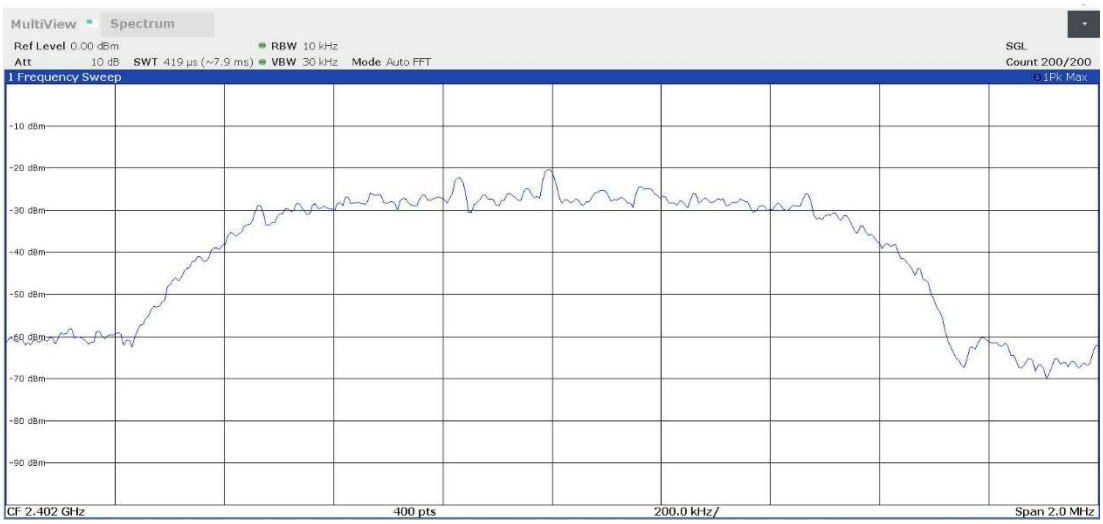


Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

Plots:

20 dB Bandwidth

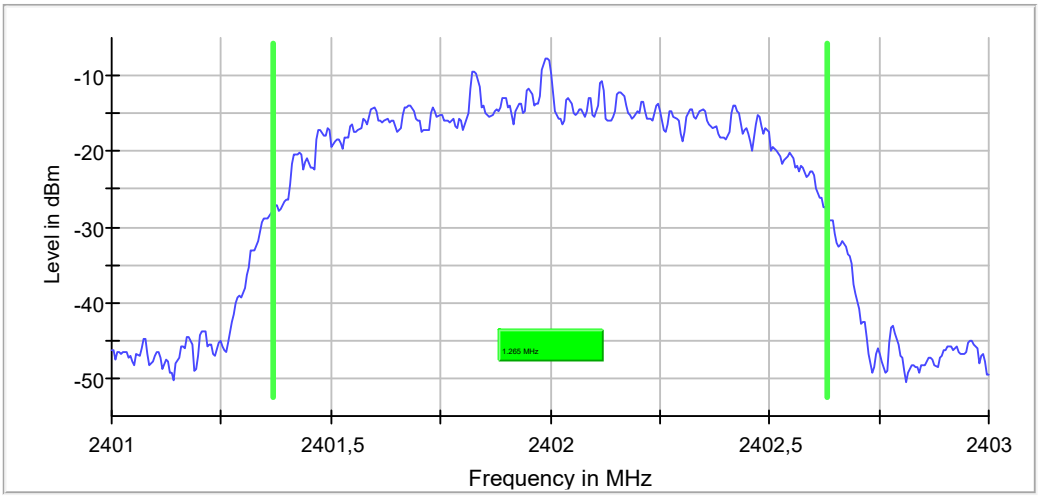


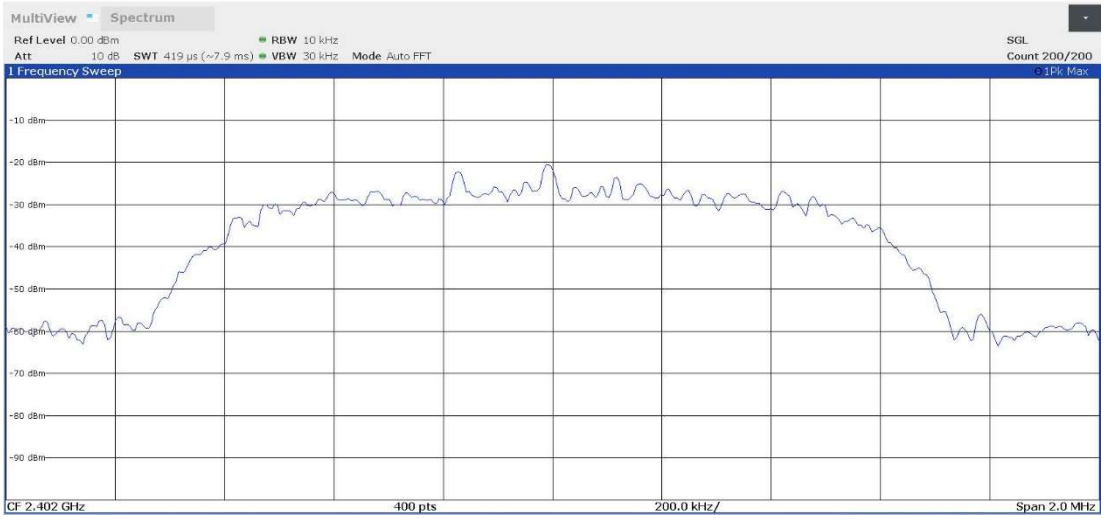


Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Plots:

20 dB Bandwidth

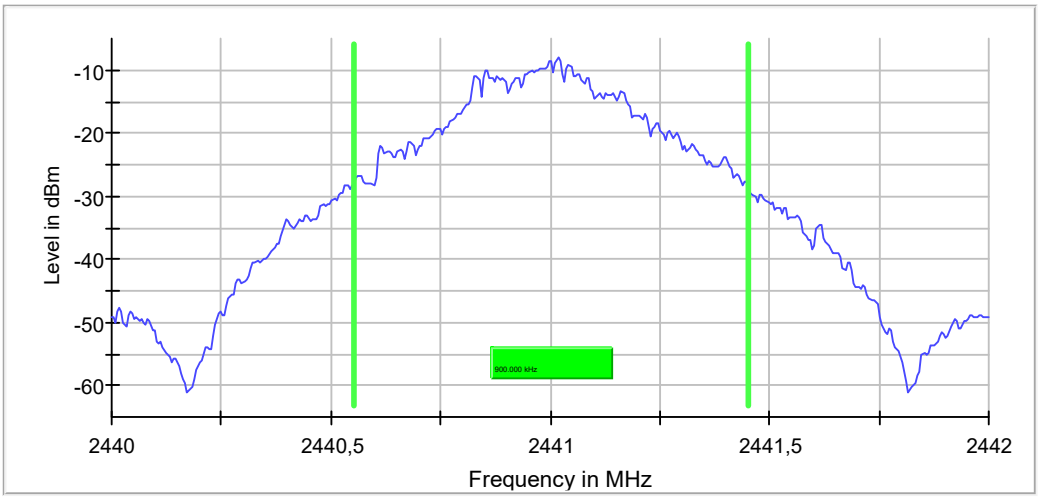


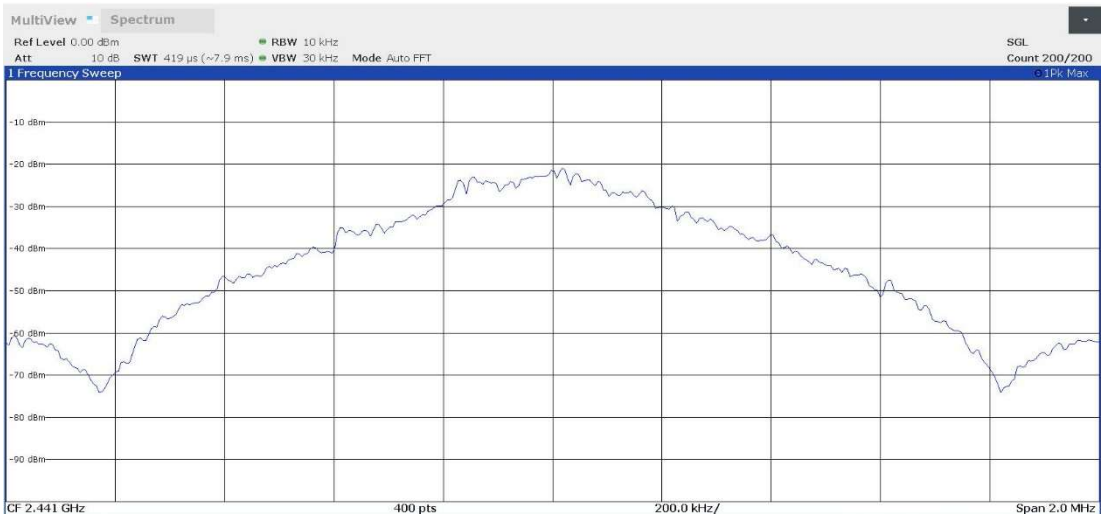


Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2441.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

Plots:

20 dB Bandwidth

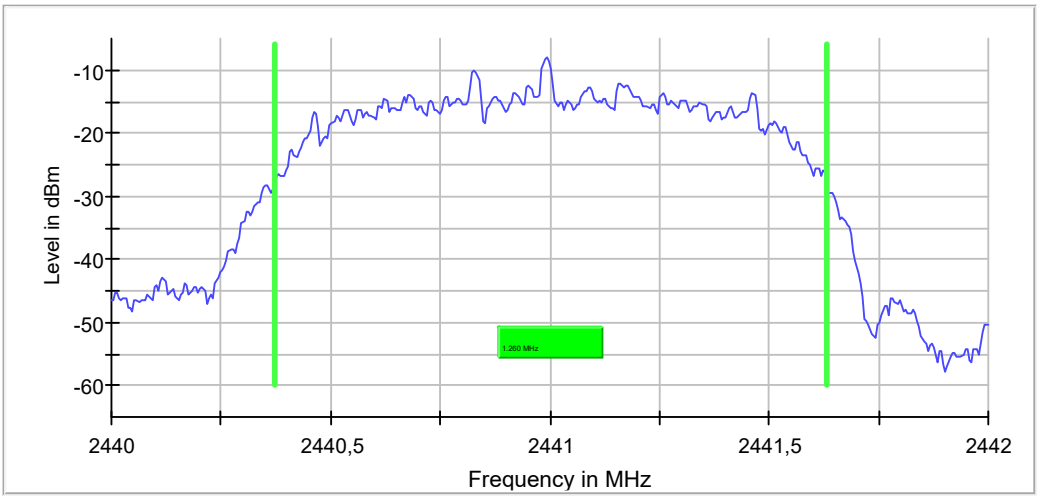


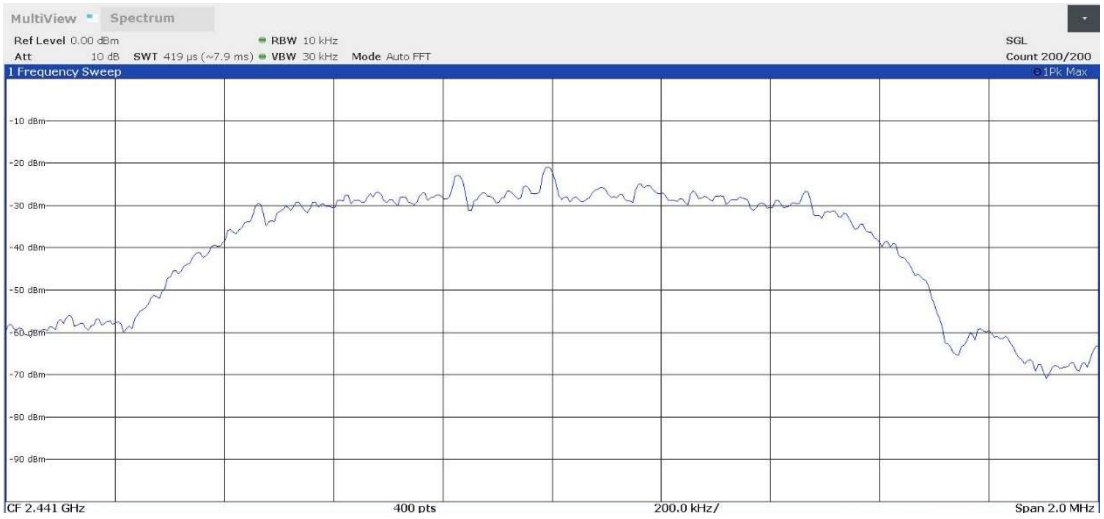


Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2441.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

Plots:

20 dB Bandwidth

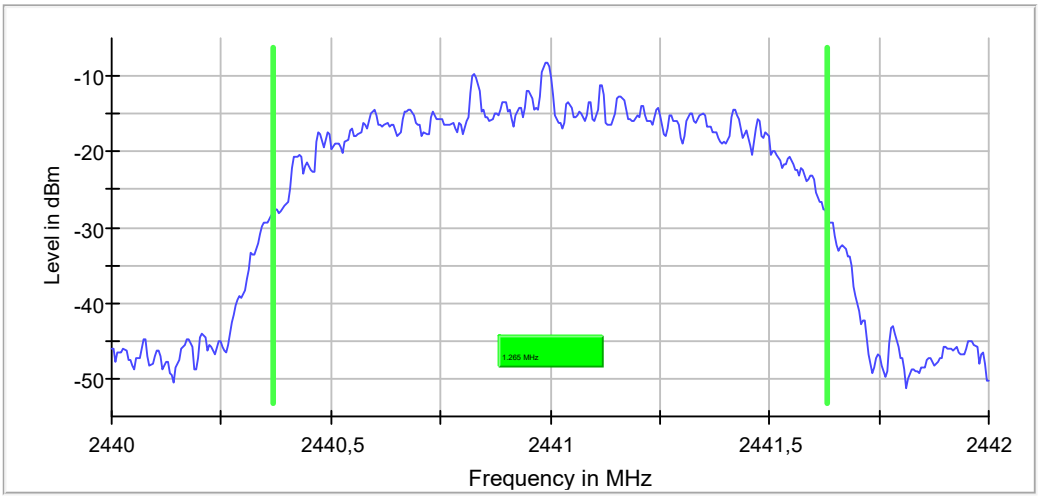


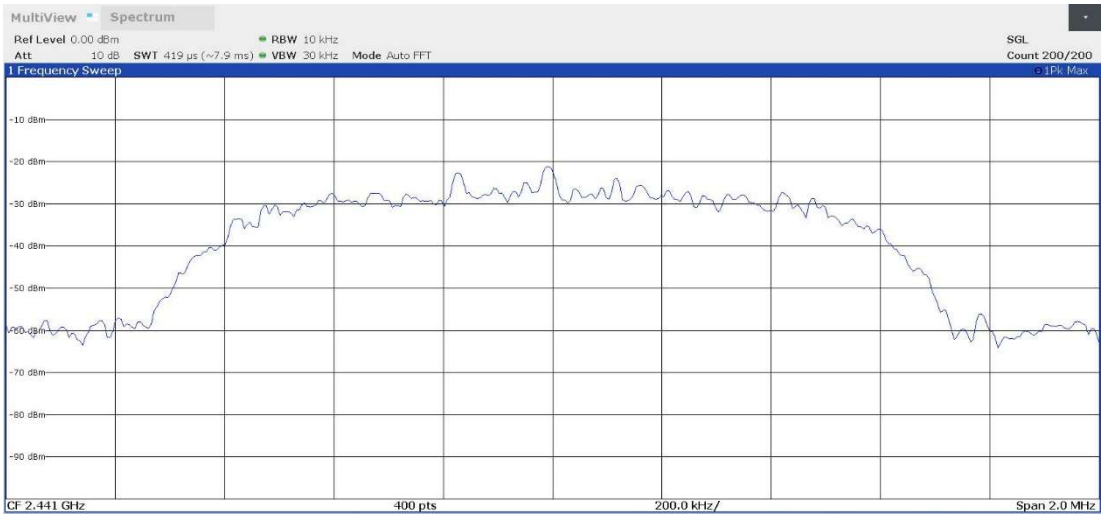


Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2441.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Plots:

20 dB Bandwidth

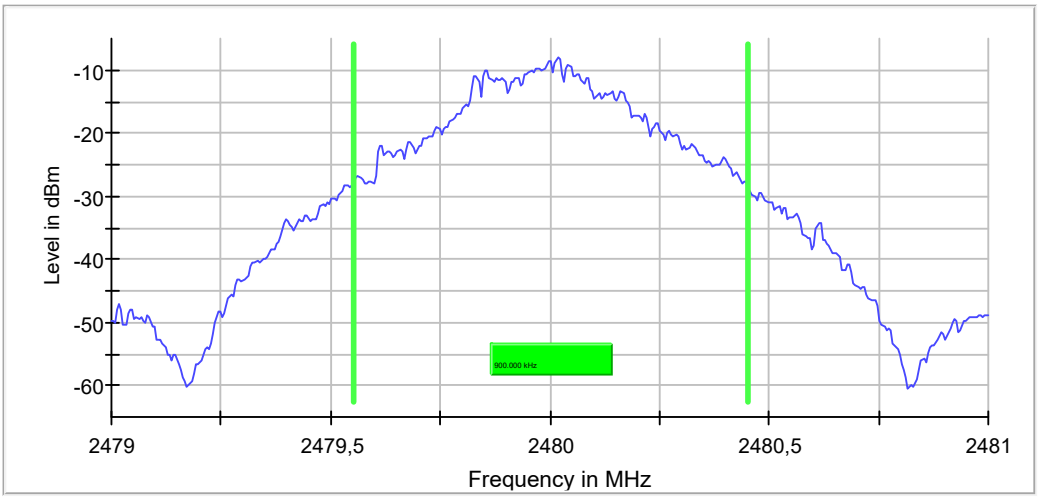


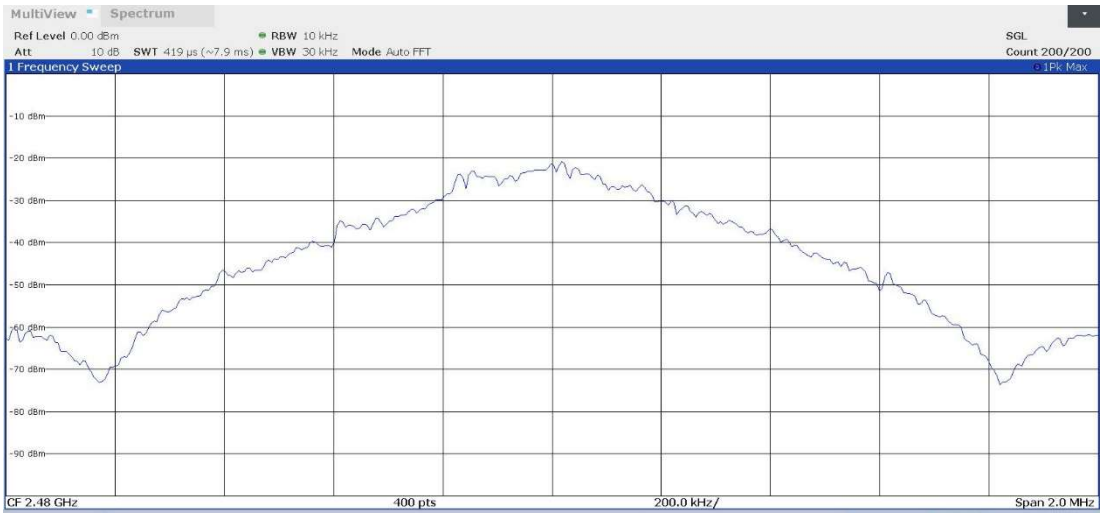


Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

Plots:

20 dB Bandwidth

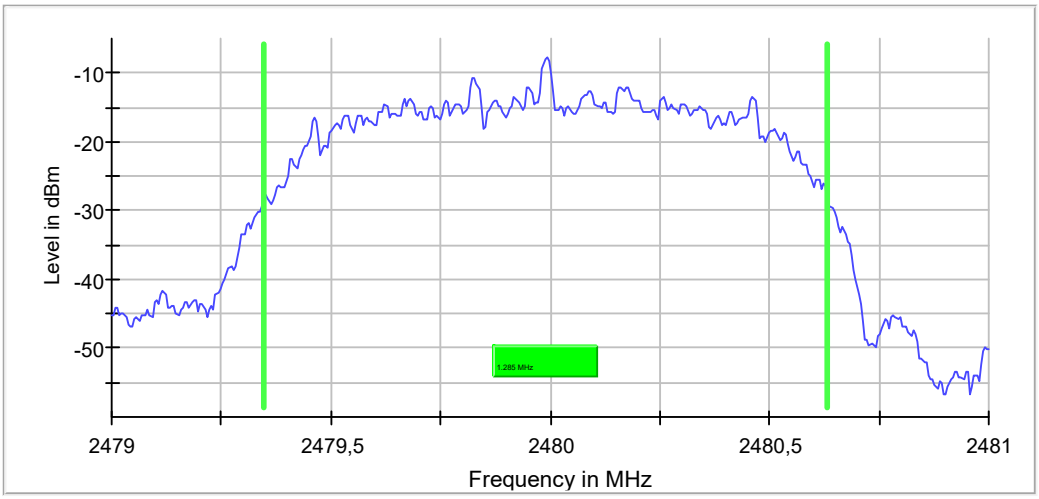


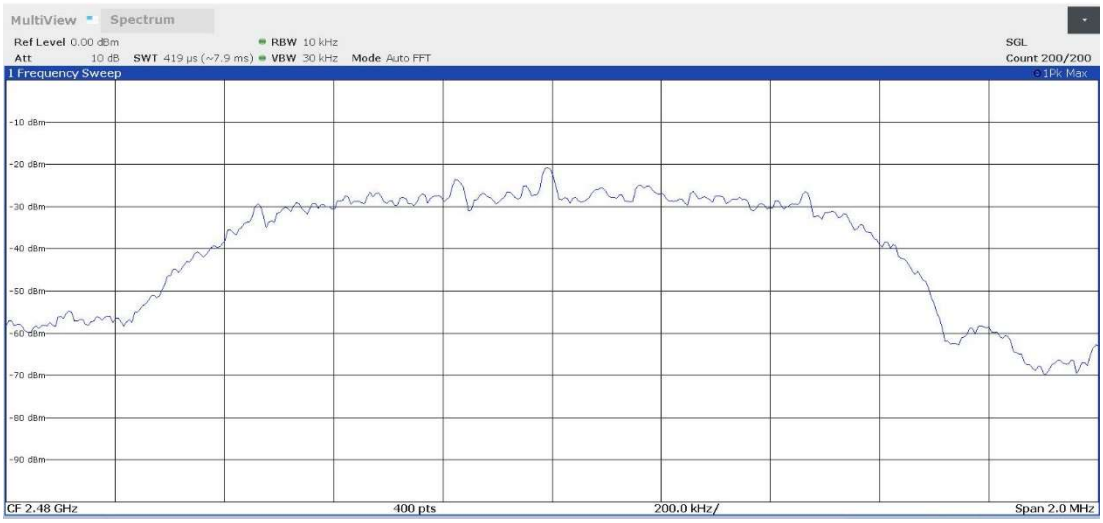


Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

Plots:

20 dB Bandwidth

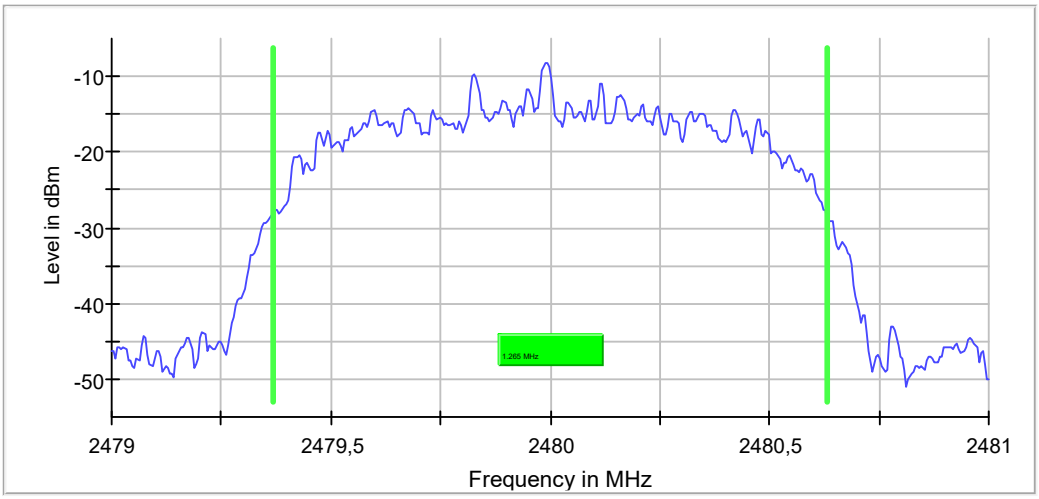


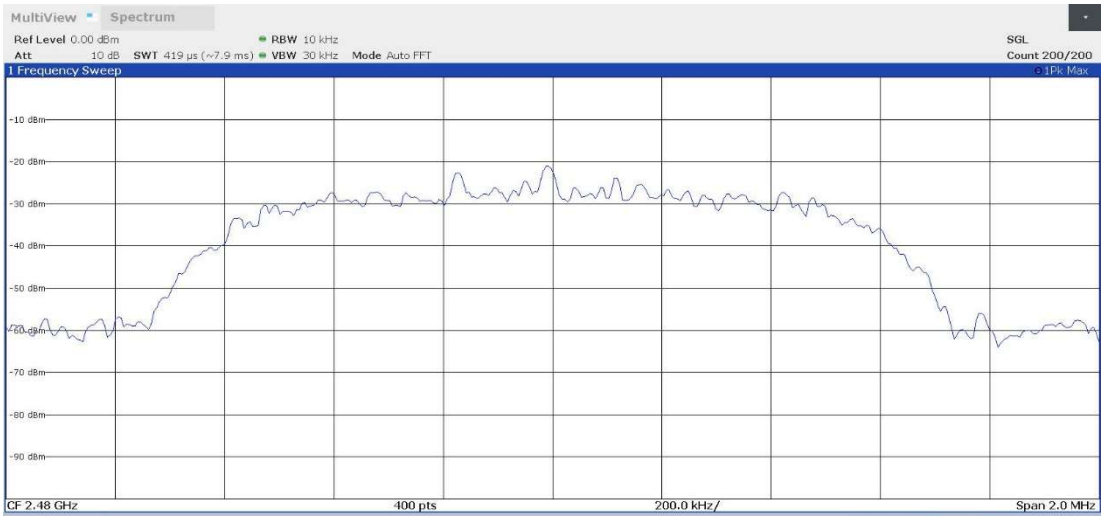


Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Plots:

20 dB Bandwidth





RSS-247 5.1 (b) / 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)	1.009900

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

Operation Band (MHz)	Equipment	Freq Sep (MHz)
[2400, 2483.5]	Frequency Hopping Spread Spectrum systems (DSS)	0.980198

Modulation: BT (8DPSK 3-DH5)

Operation Band (MHz)	Equipment	Freq Sep (MHz)
[2400, 2483.5]	Frequency Hopping Spread Spectrum systems (DSS)	0.980198

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

Verdict

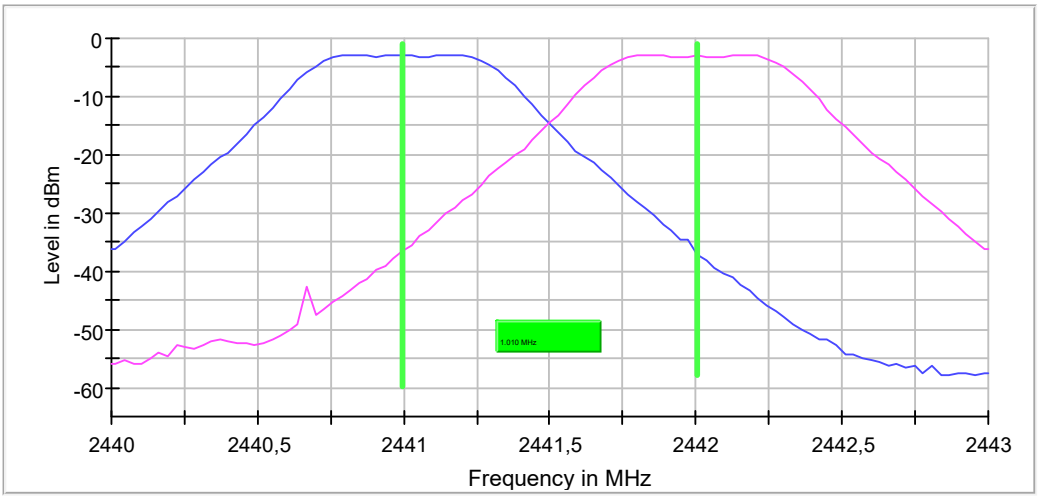
Pass

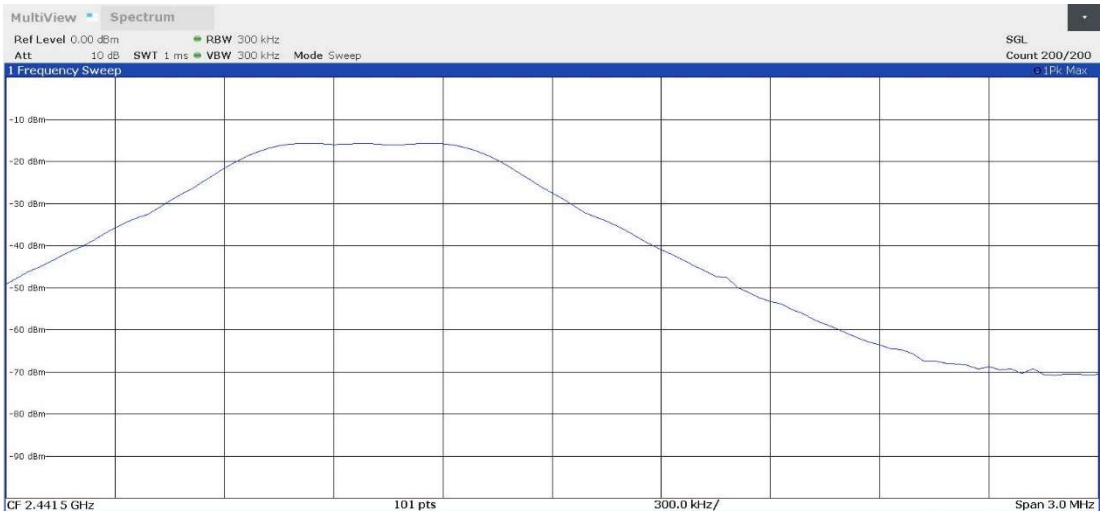
Attachments

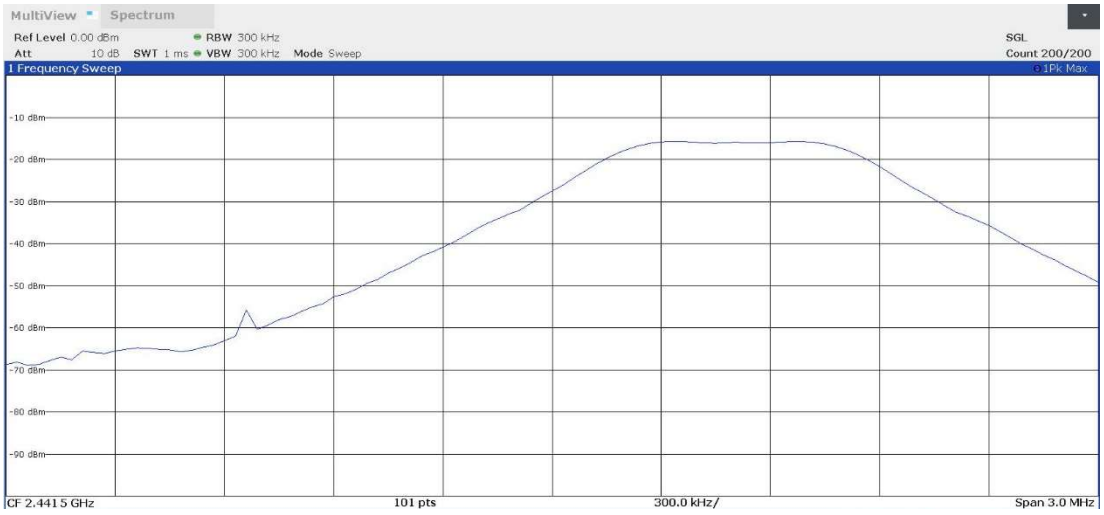
Operation Band (MHz) = [2400, 2483.5], Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

Plots:

CFS



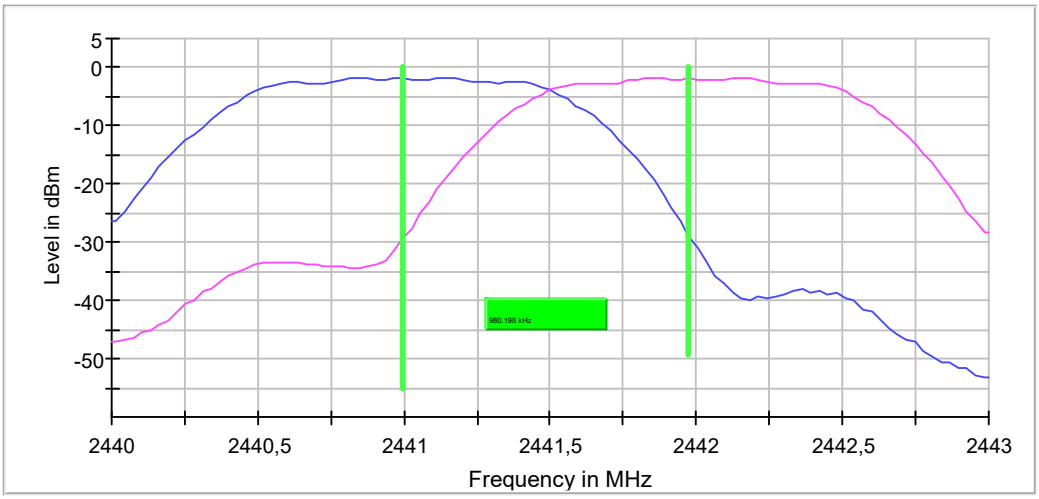


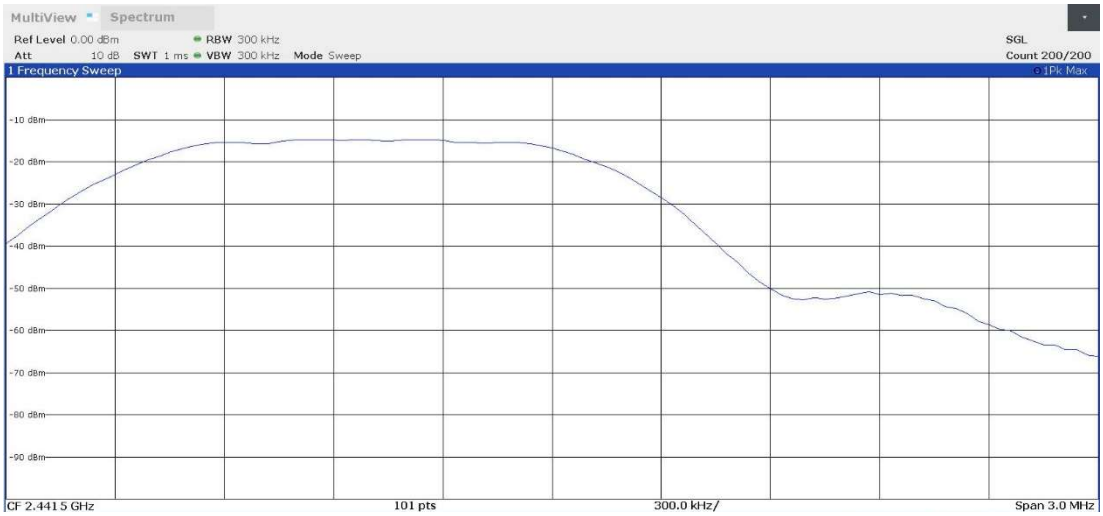


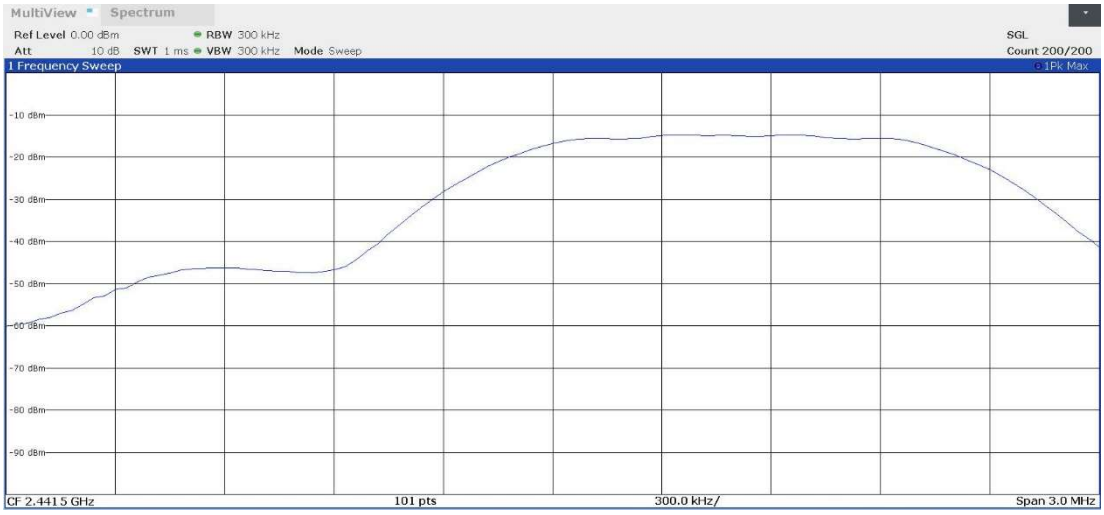
Operation Band (MHz) = [2400, 2483.5], Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

Plots:

CFS



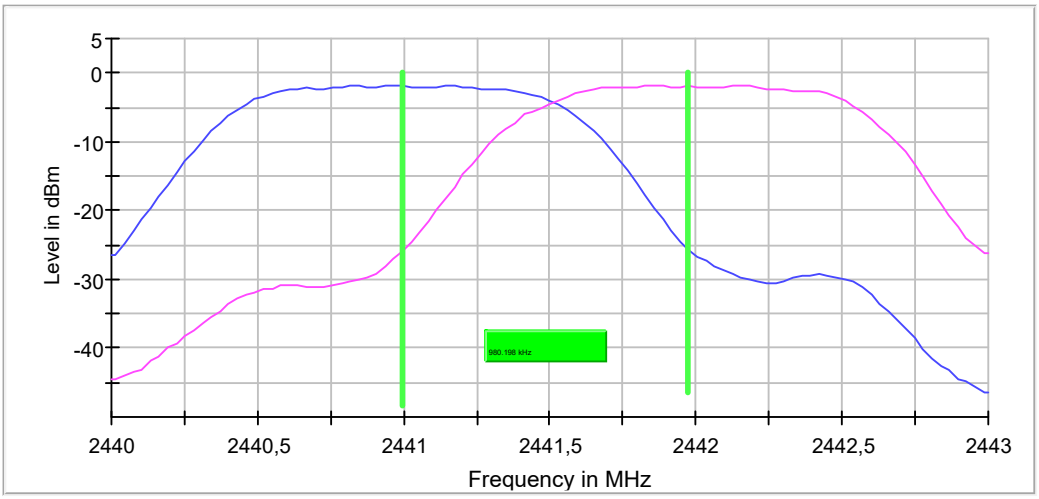


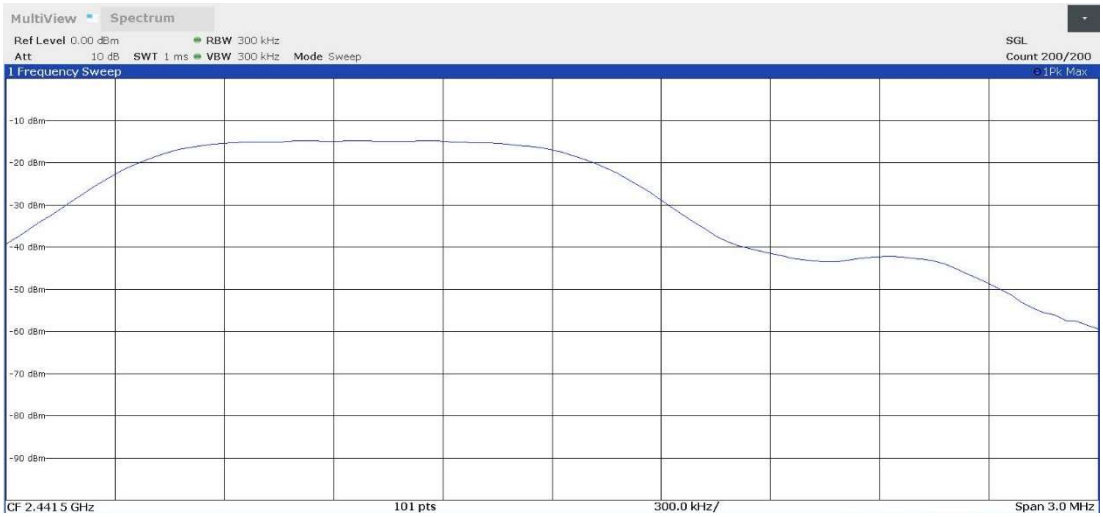


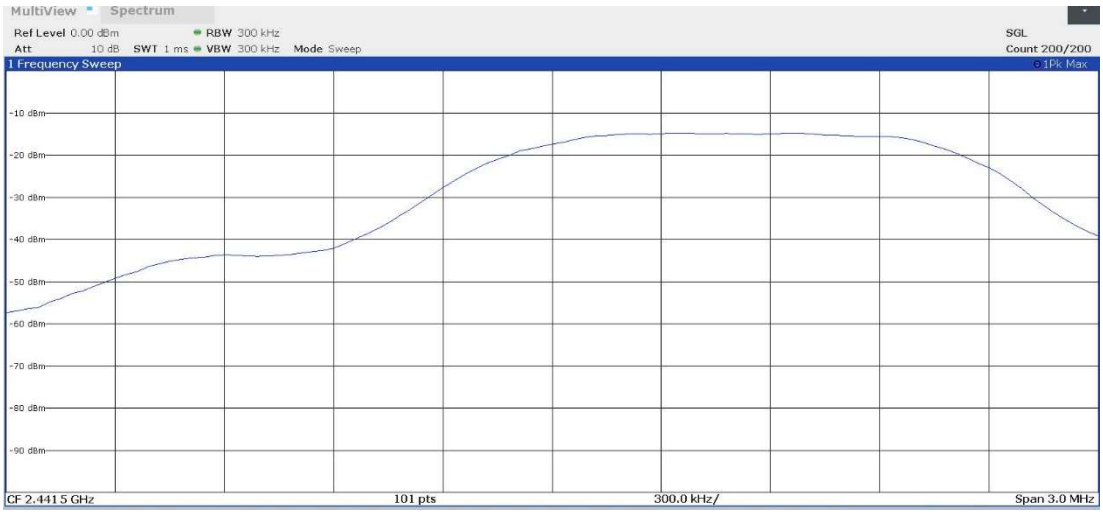
Operation Band (MHz) = [2400, 2483.5], Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Plots:

CFS







RSS-247 5.1 (d) / 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)	110	321.770

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

Operation Band (MHz)	Equipment	NHp	Avg COT (ms)
[2400, 2483.5]	Frequency Hopping Spread Spectrum systems (DSS)	119	337.110

Modulation: BT (8DPSK 3-DH5)

Operation Band (MHz)	Equipment	NHp	Avg COT (ms)
[2400, 2483.5]	Frequency Hopping Spread Spectrum systems (DSS)	113	315.200

Verdict

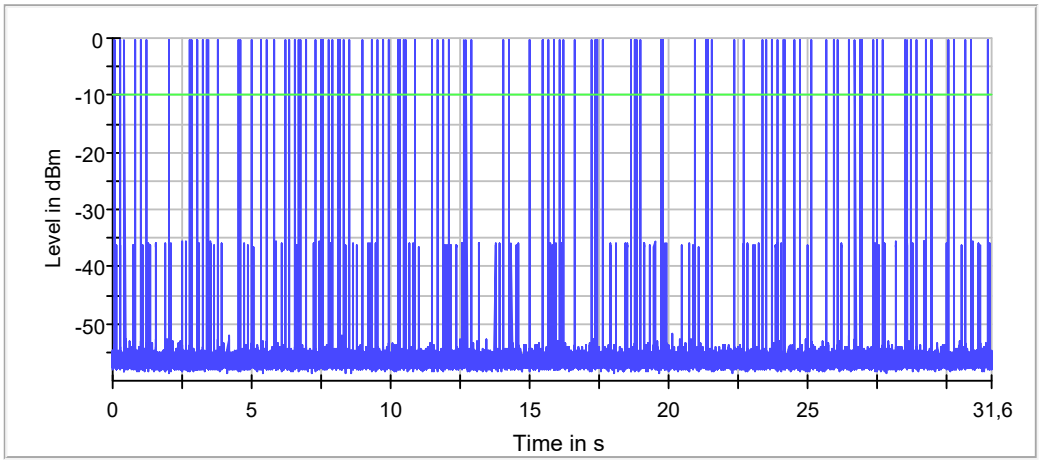
Pass

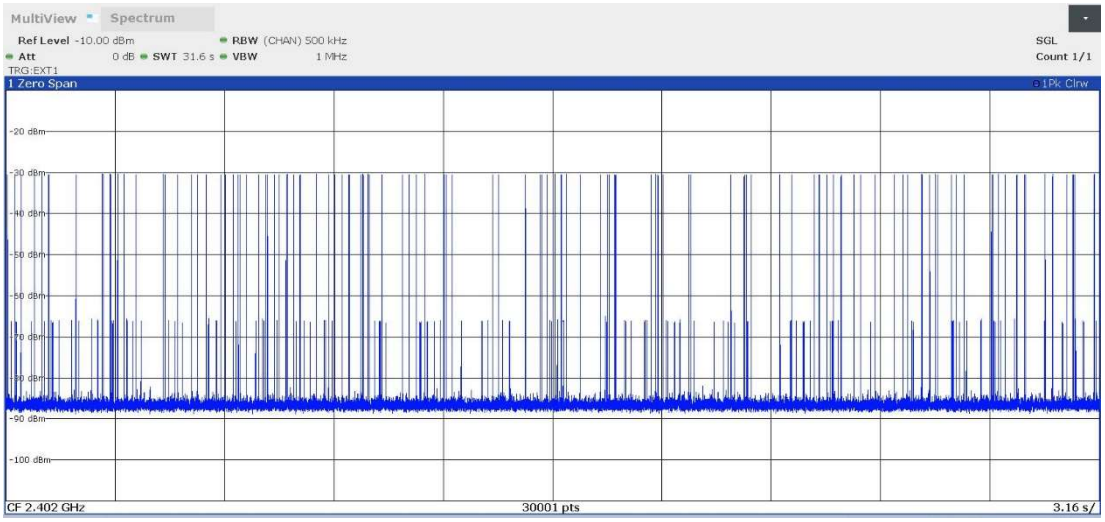
Attachments

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:

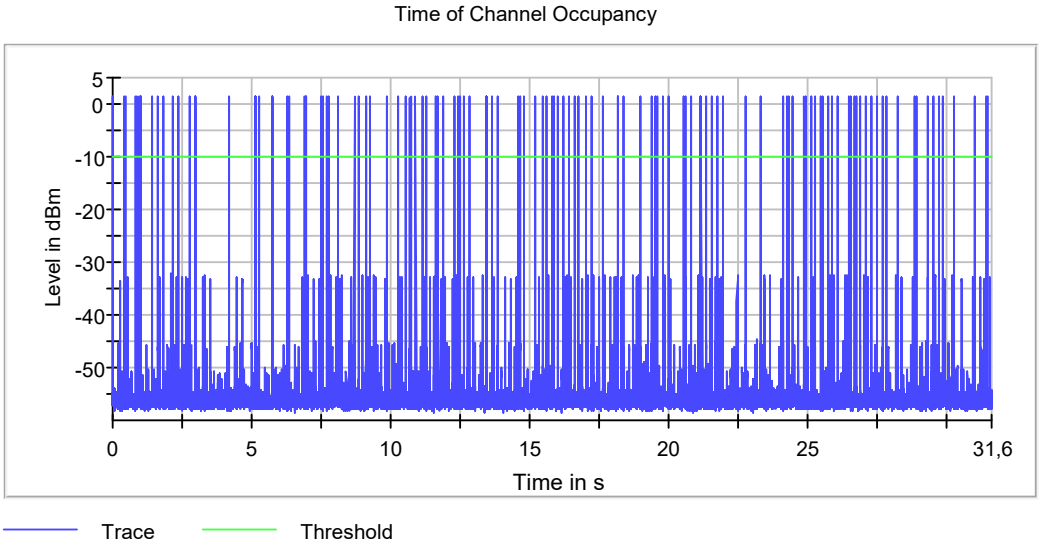
Time of Channel Occupancy

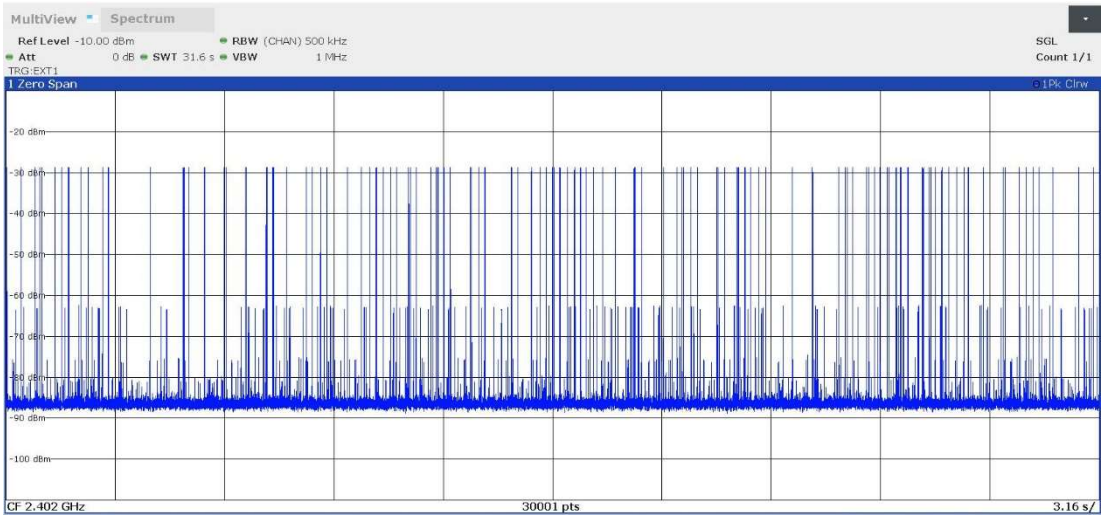




Operation Band (MHz) = [2400, 2483.5], Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

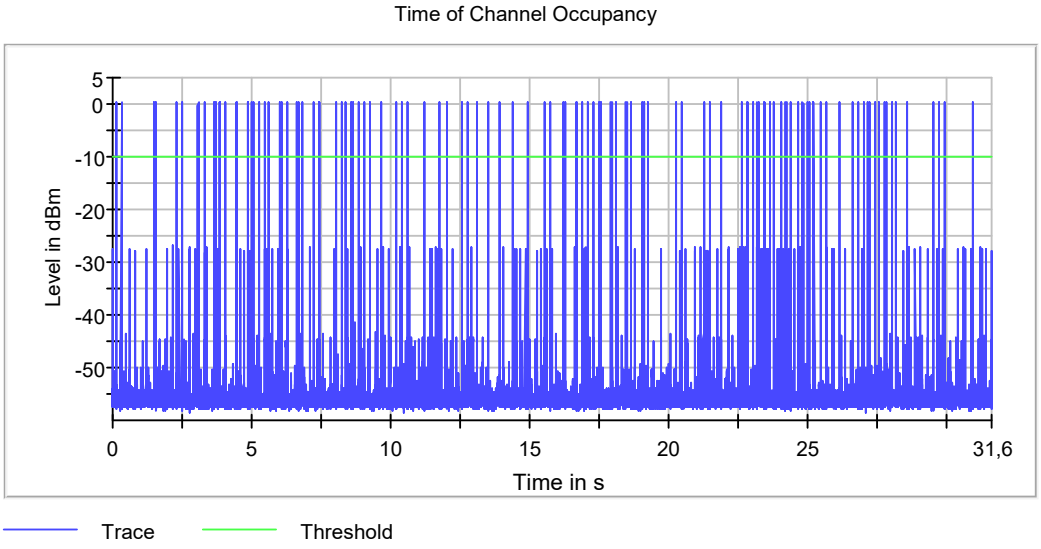
Plots:

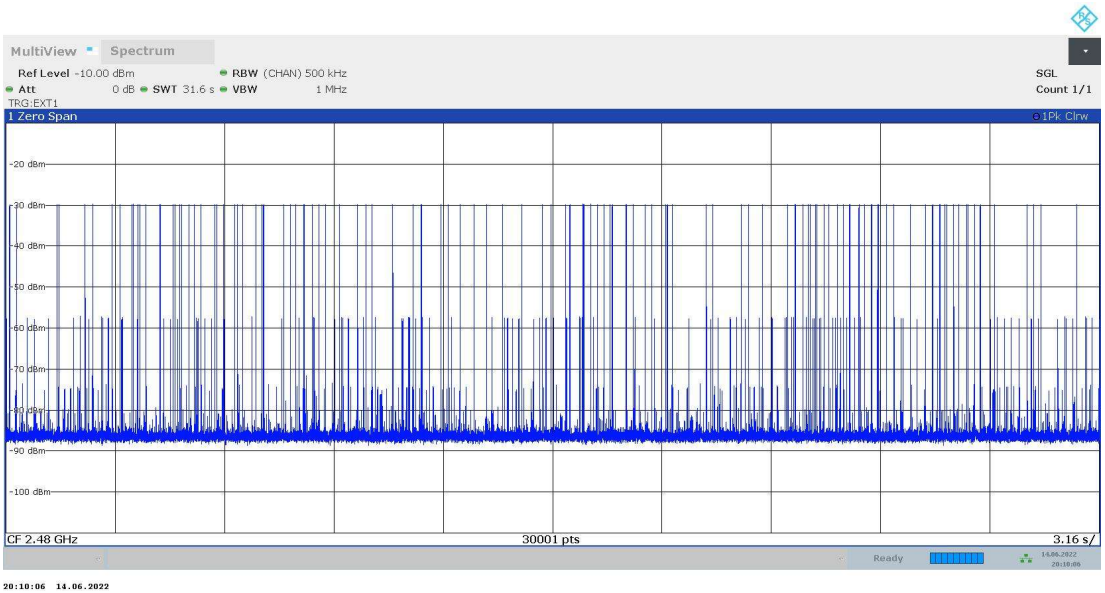




Operation Band (MHz) = [2400, 2483.5], Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Plots:





RSS-247 5.1 (d) / 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

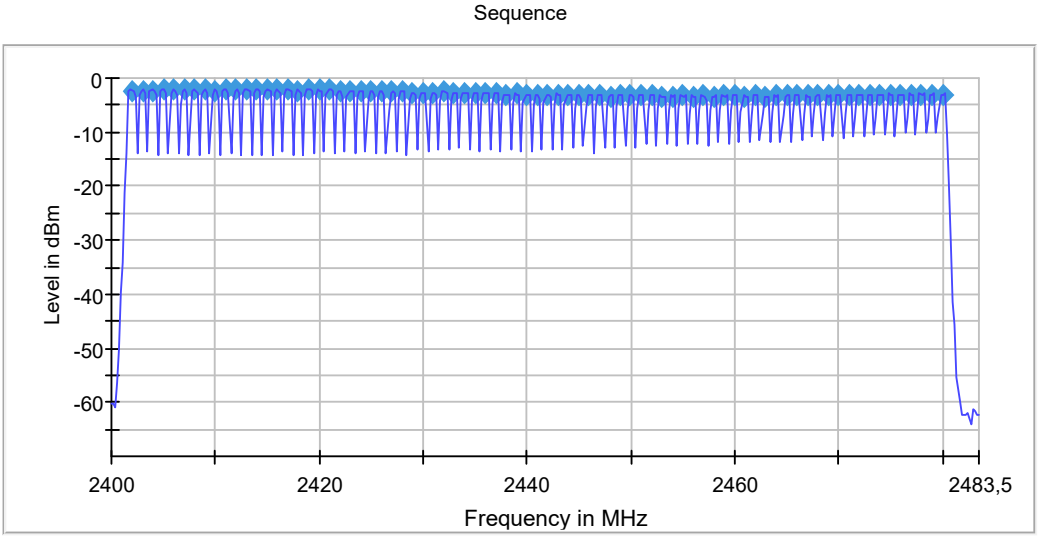
Verdict

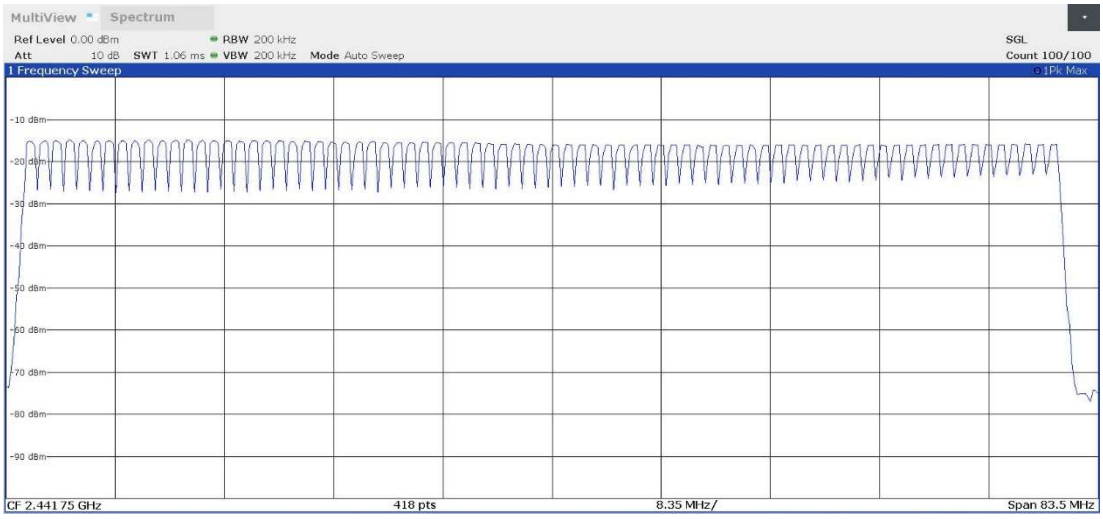
Pass

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

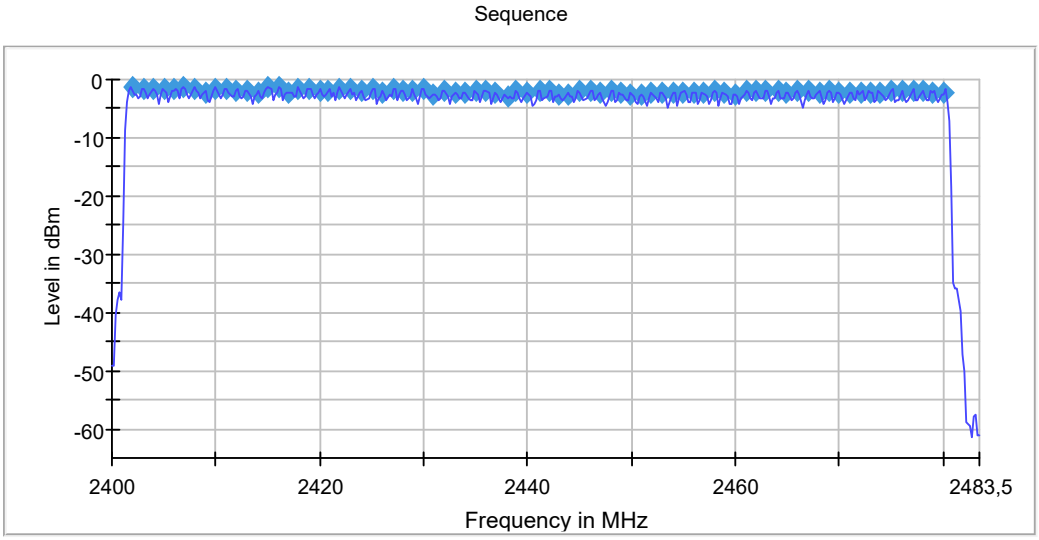
Plots:

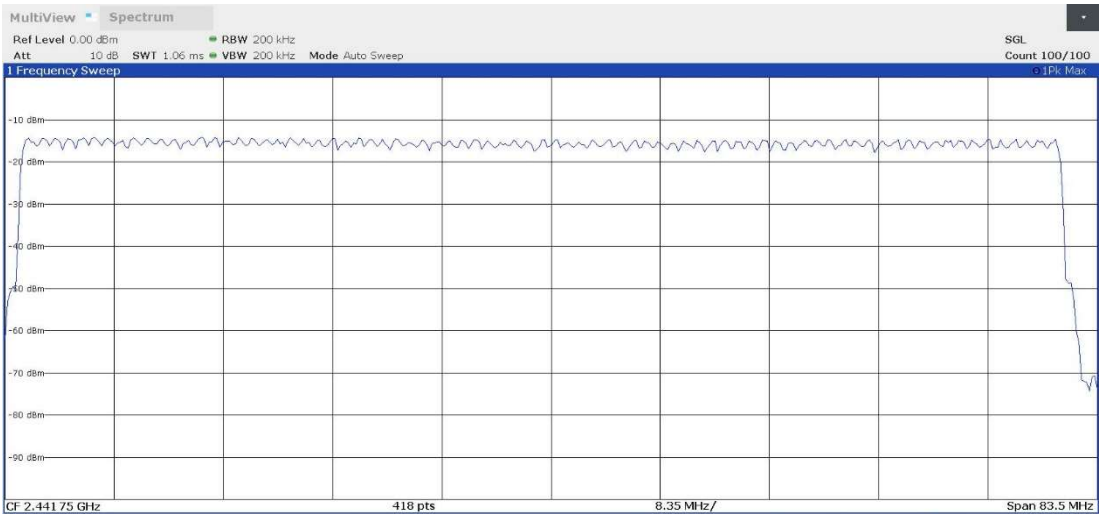




Operation Band (MHz) = [2400, 2483.5], Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

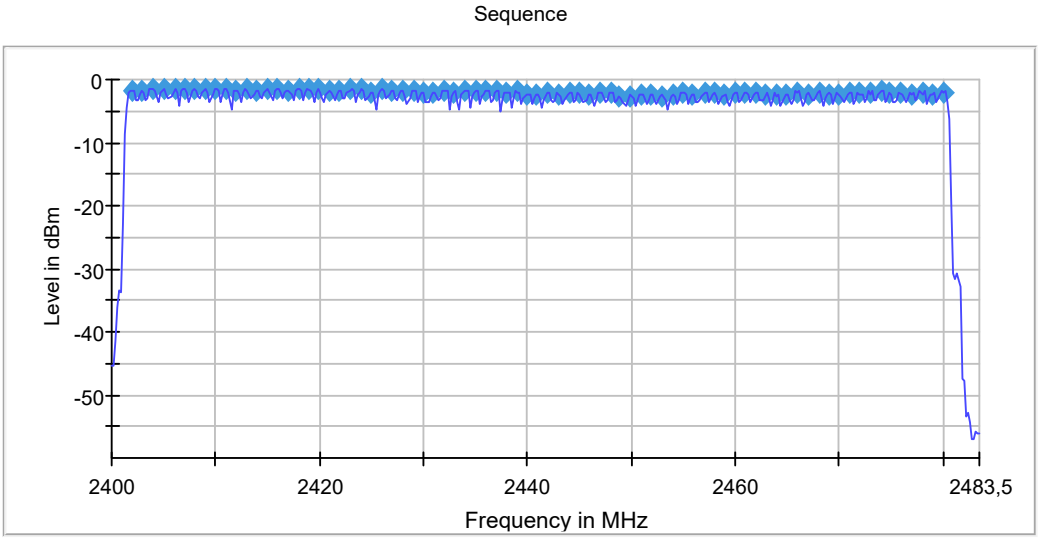
Plots:

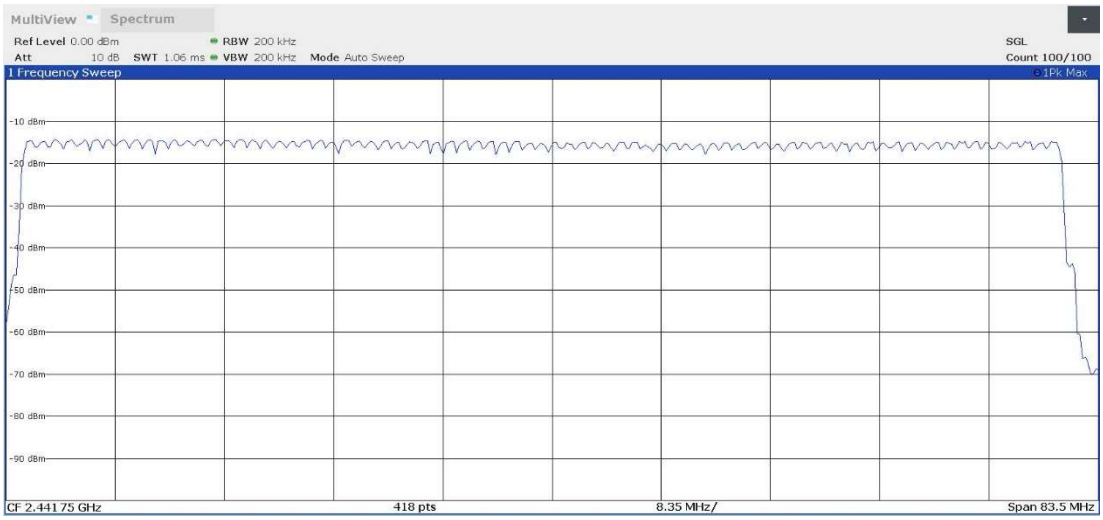




Operation Band (MHz) = [2400, 2483.5], Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Plots:





FCC 15.247 (b) / RSS-247 5.4 (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). The e.i.r.p. shall not exceed 4 W (RSS-247).

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: -2.5 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)	-2.048	-2.800	-2.775
Maximum EIRP (dBm)	-4.548	-5.300	-5.275

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)	0.634	0.068	0.139
Maximum EIRP (dBm)	-1.866	-2.432	-2.361

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)	0.850	0.297	0.397
Maximum EIRP (dBm)	-1.650	-2.203	-2.103

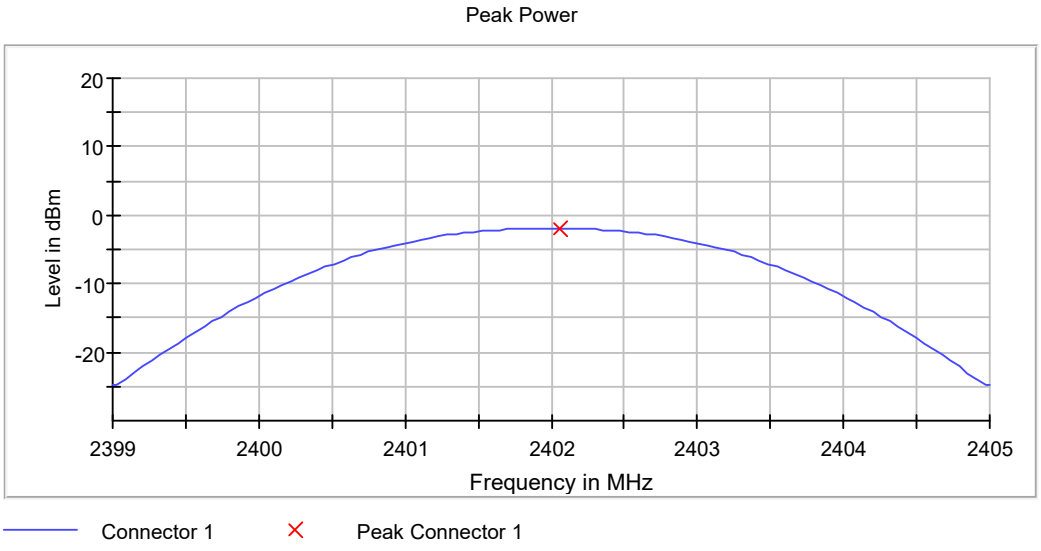
Verdict

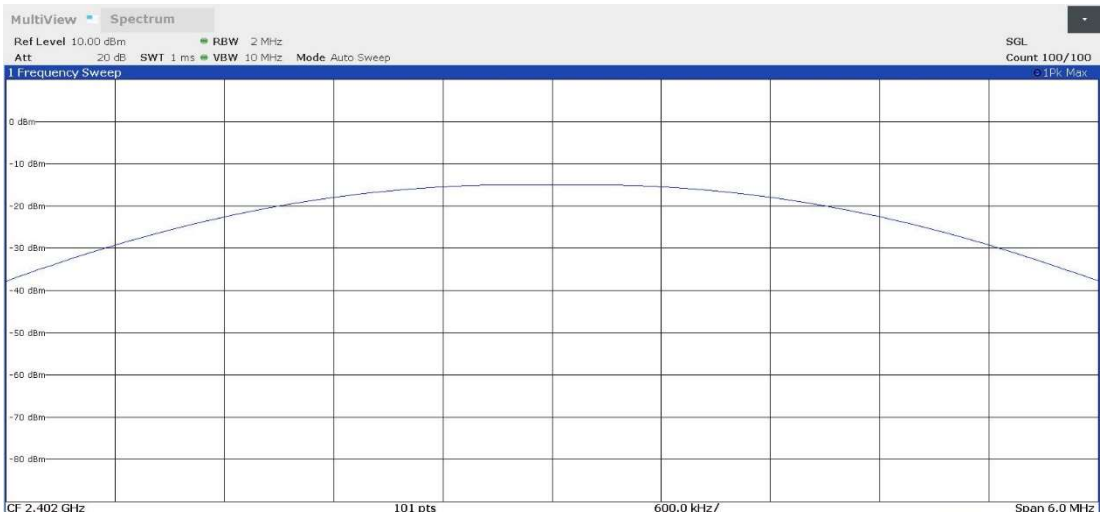
Pass

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

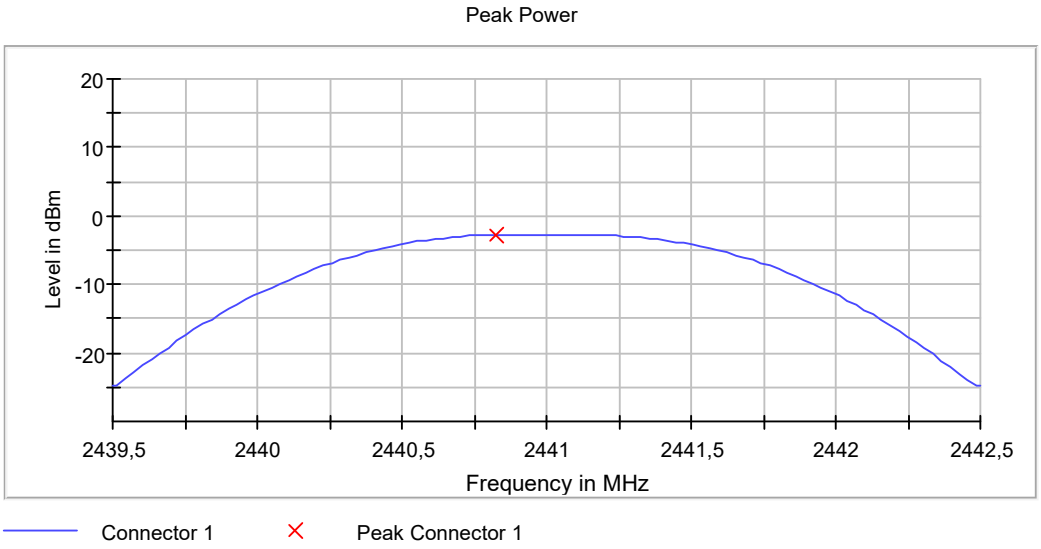
Plots:

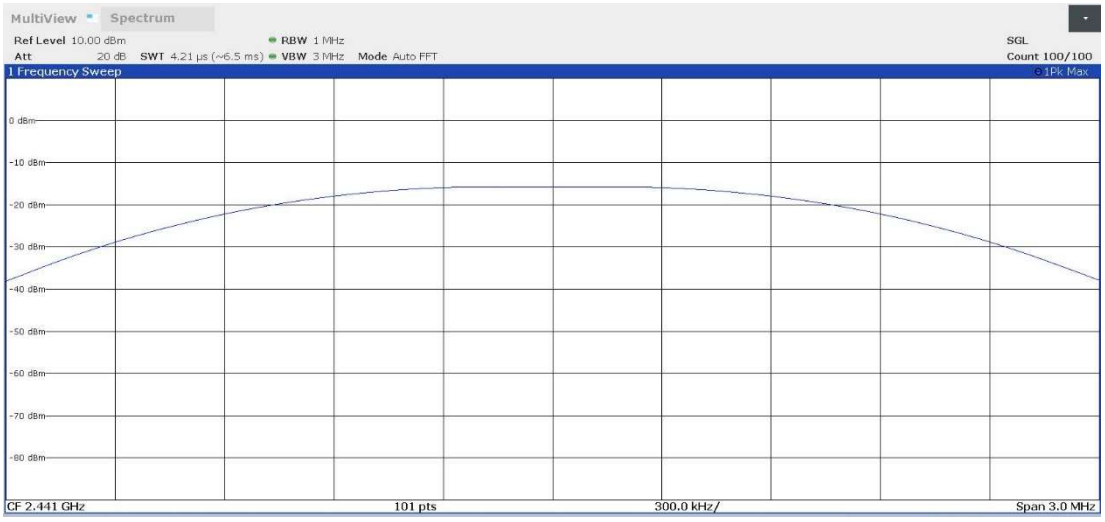




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2441.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

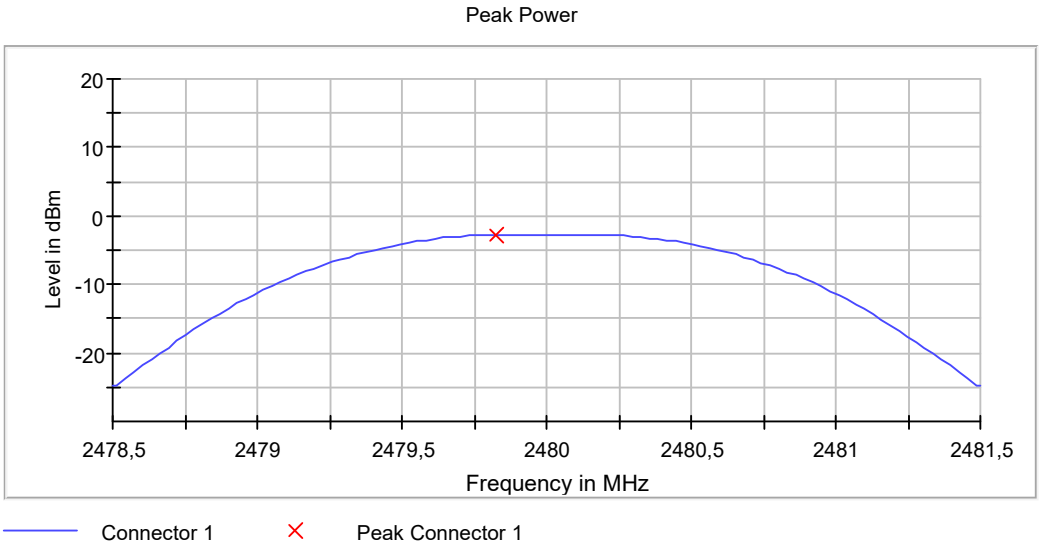
Plots:

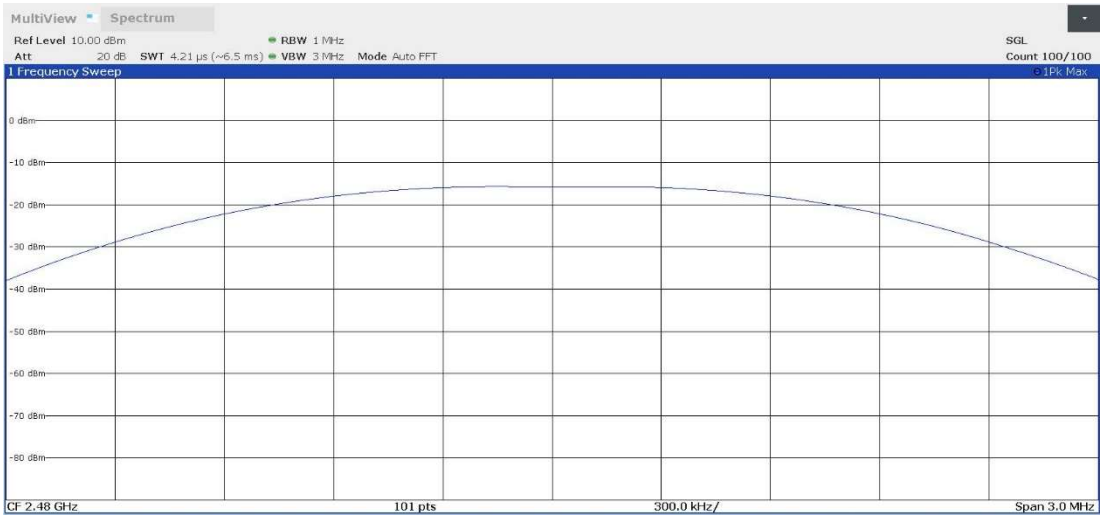




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

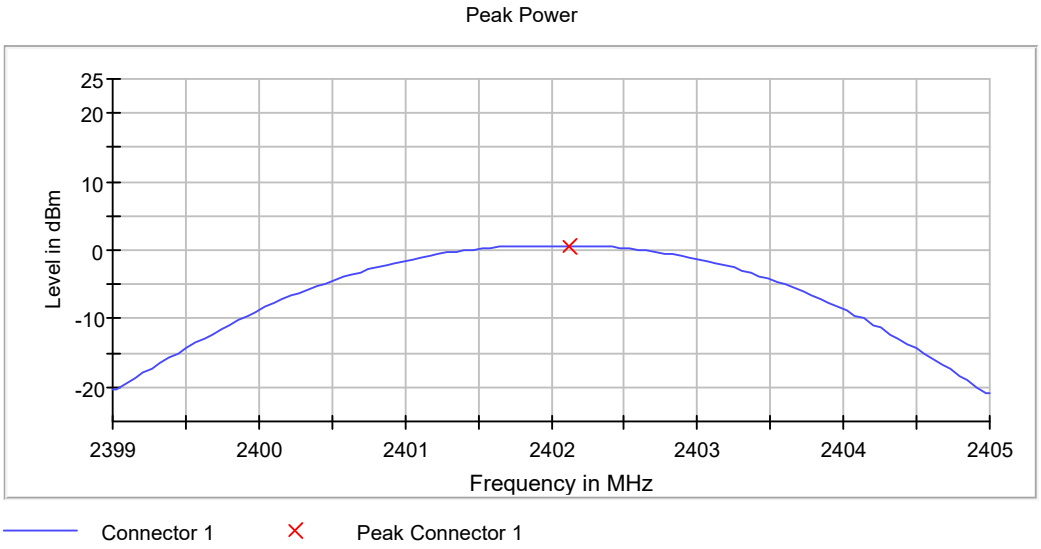
Plots:

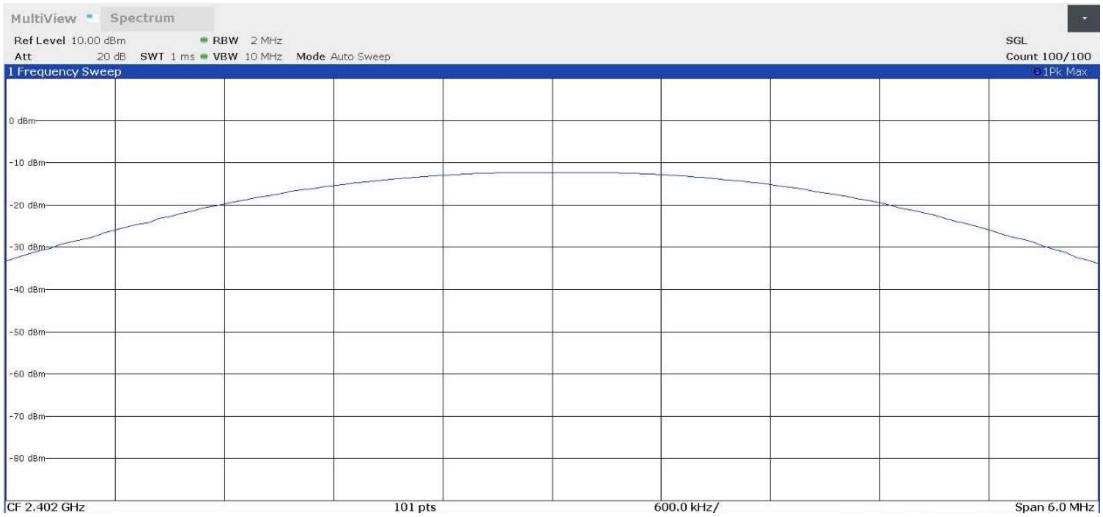




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

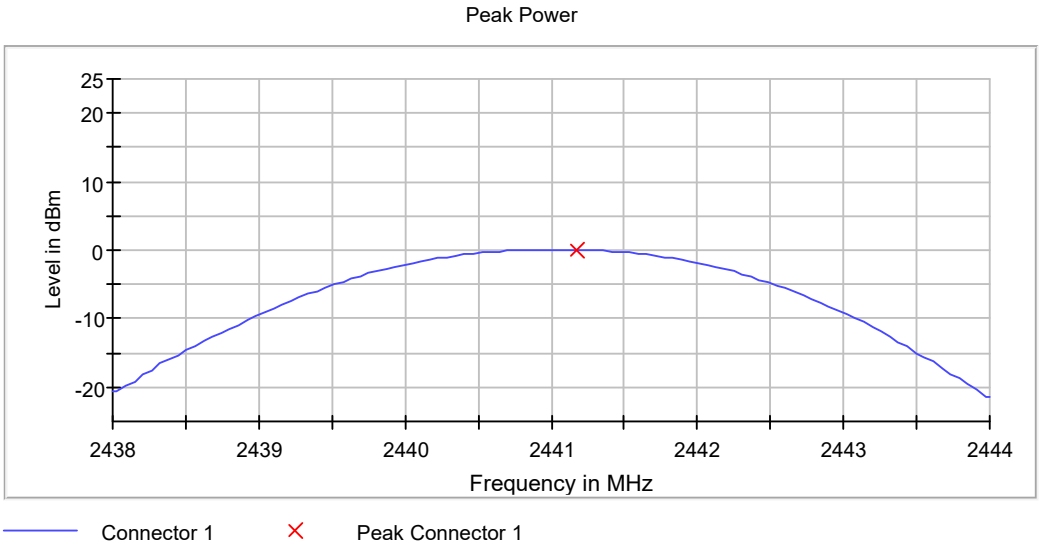
Plots:

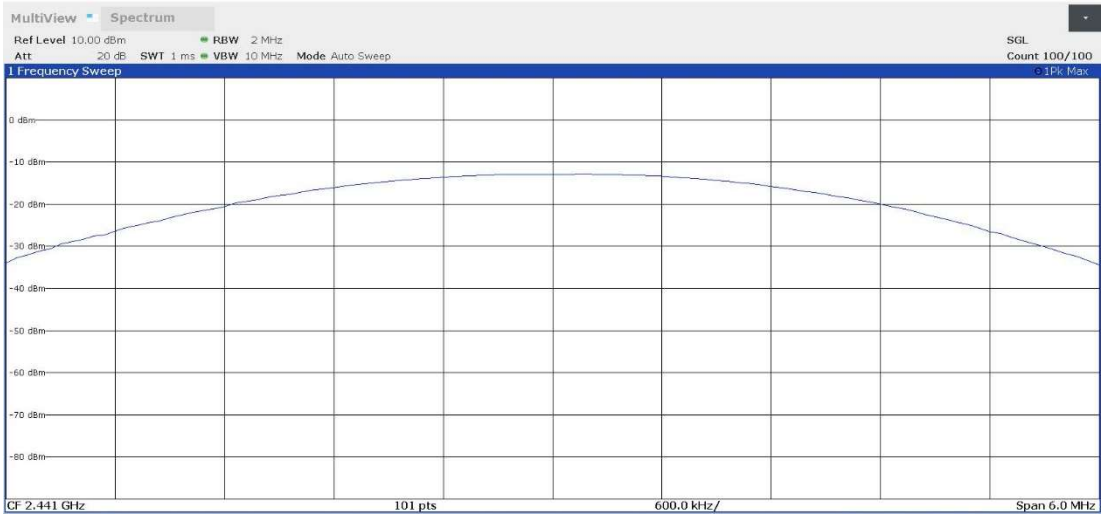




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2441.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

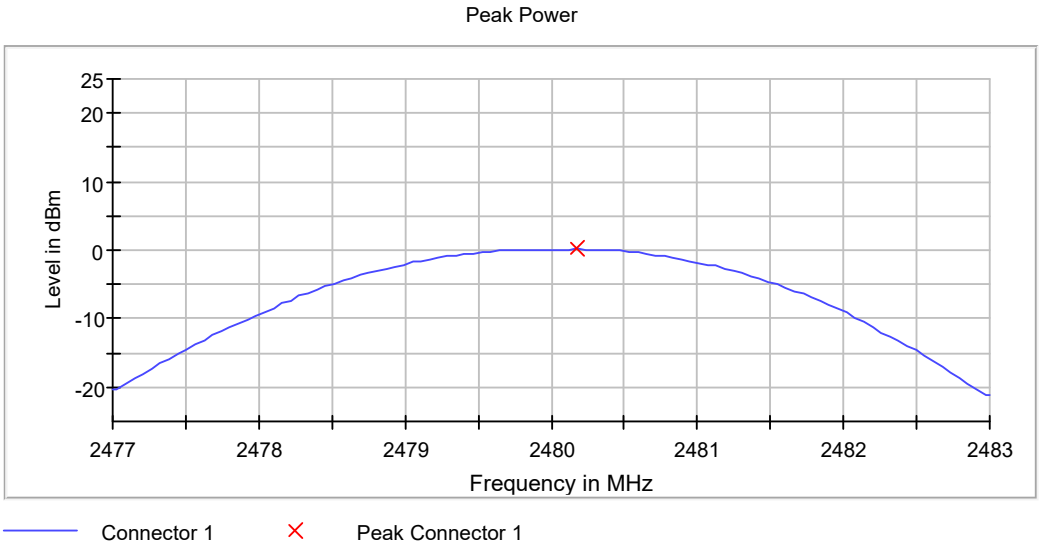
Plots:

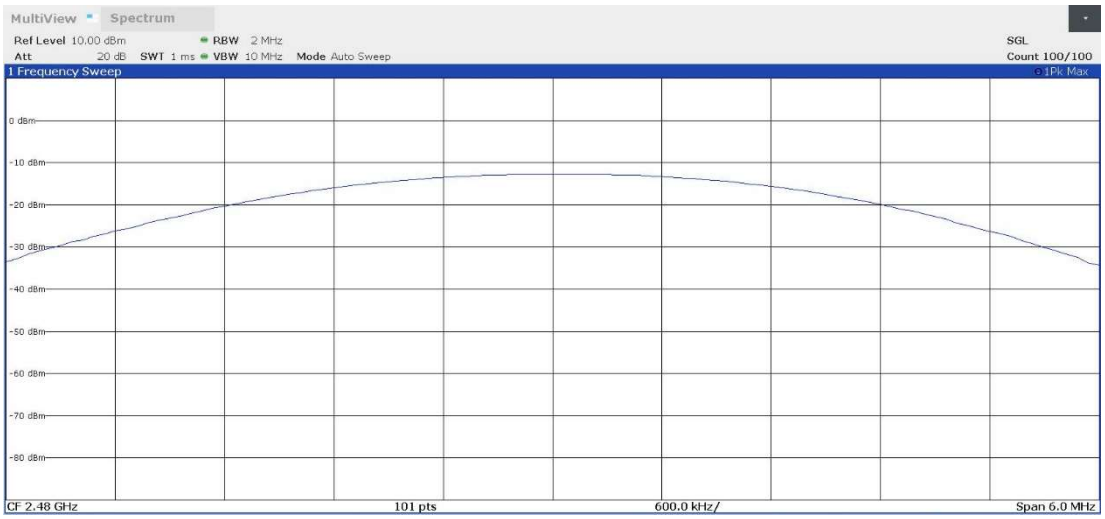




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

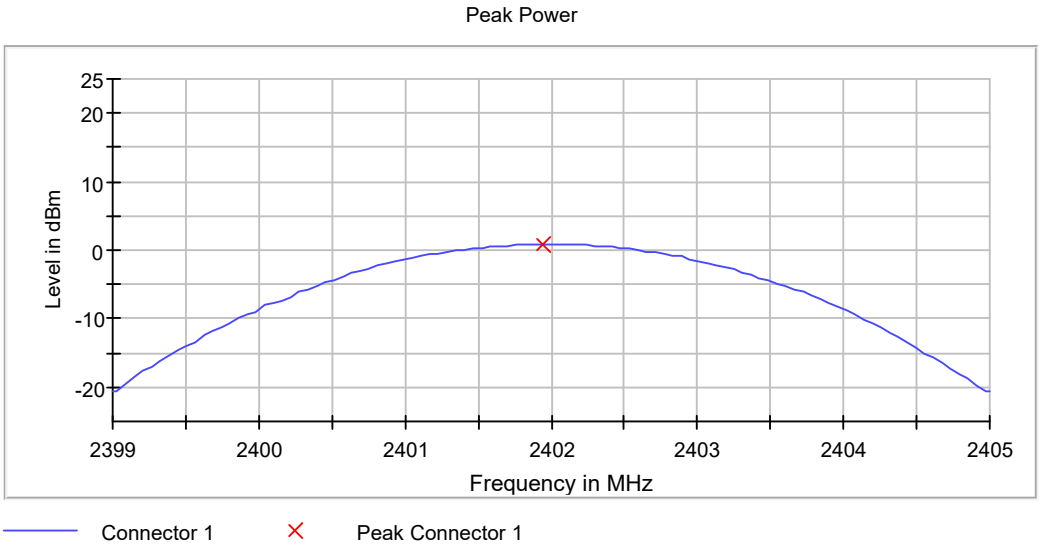
Plots:

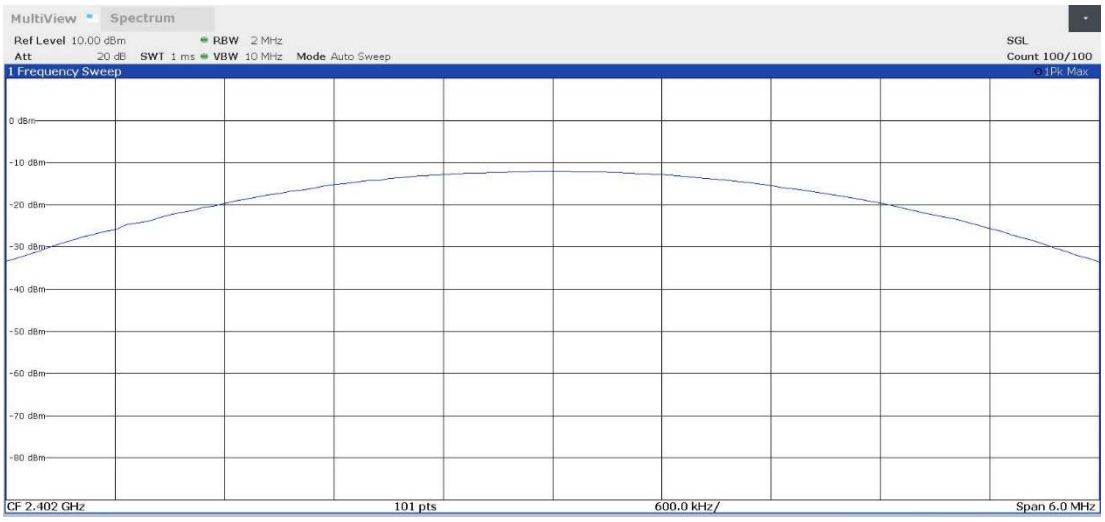




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

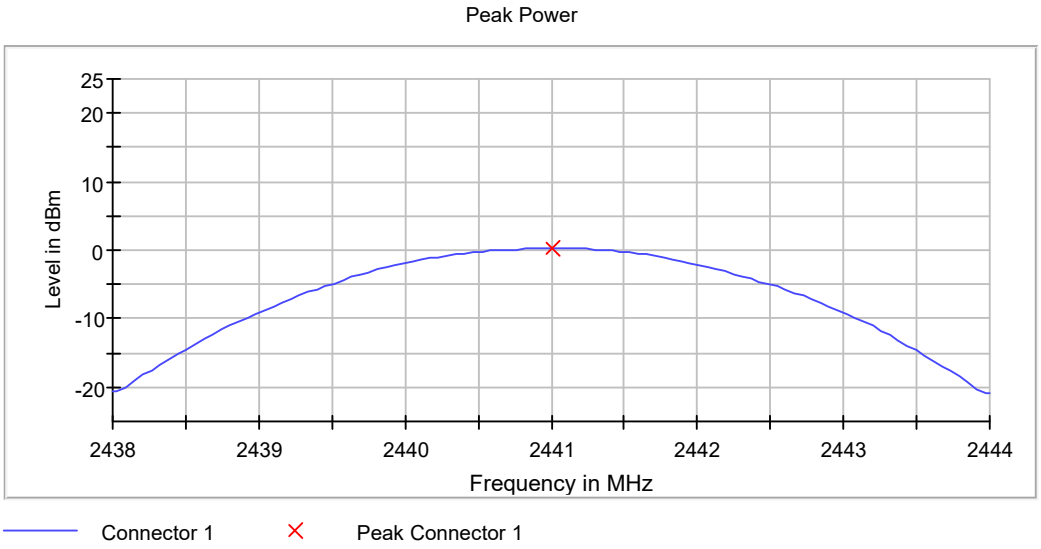
Plots:

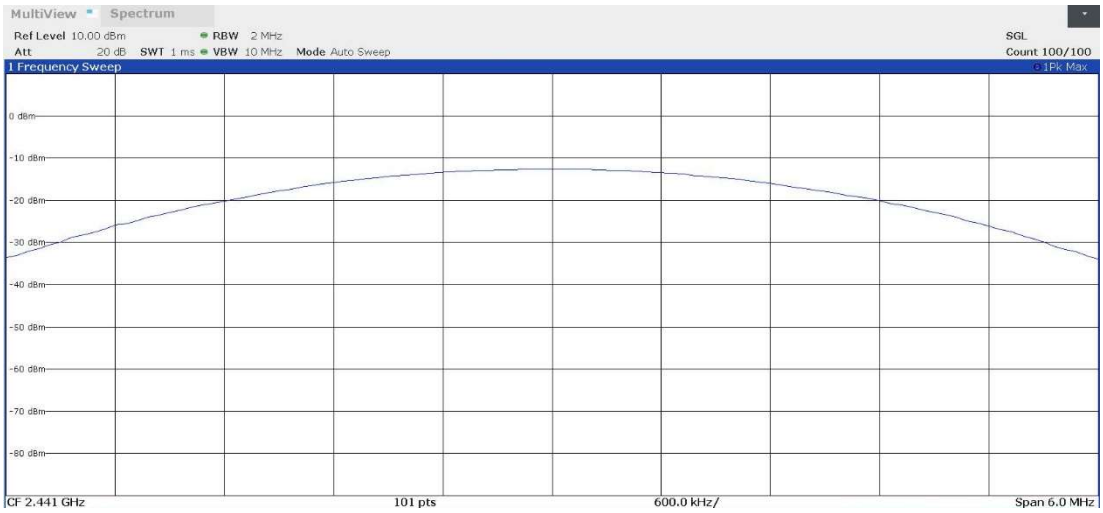




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2441.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

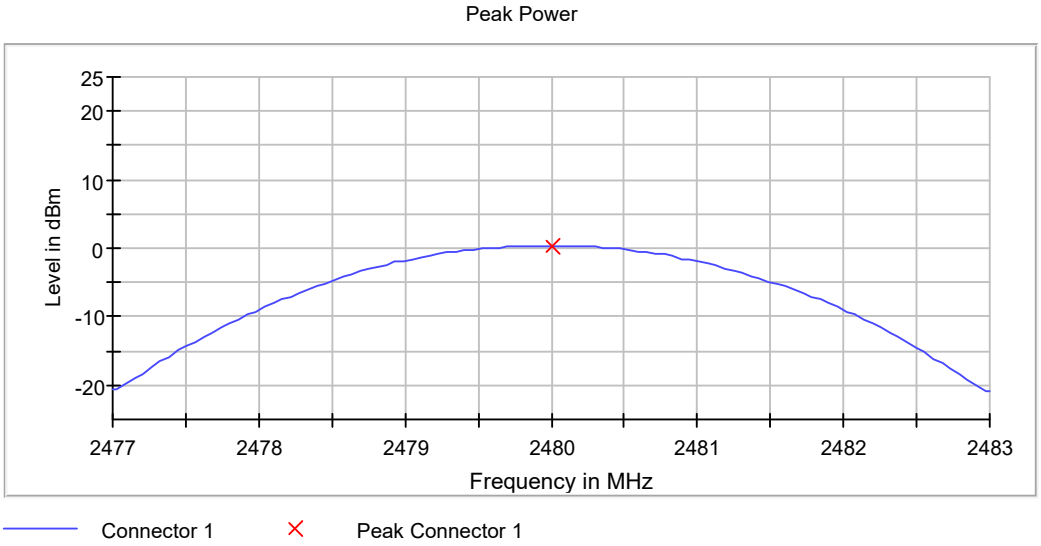
Plots:

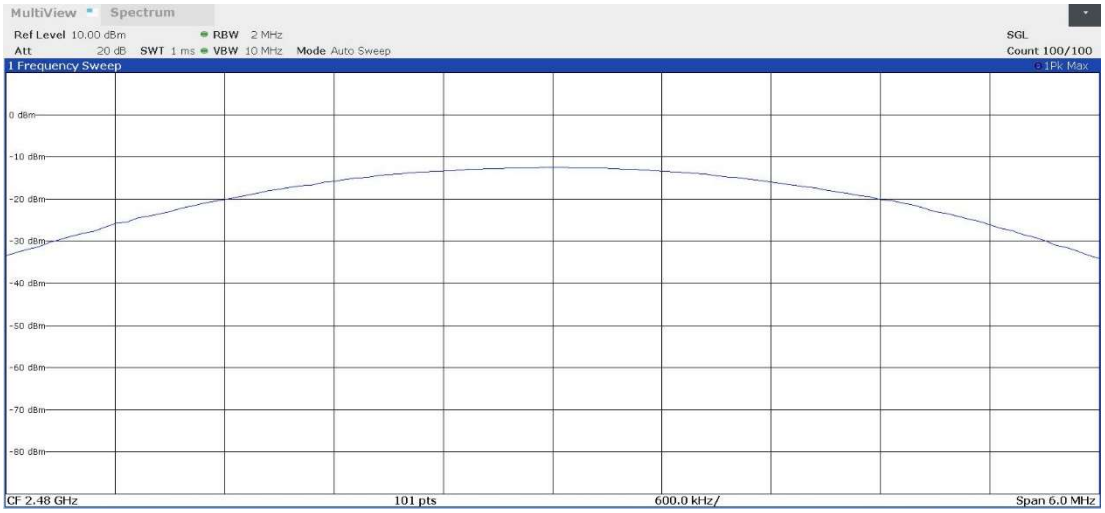




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Equipment Type: Frequency Hopping Spread Spectrum systems (DSS), Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Plots:





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

Limits

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

Results

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

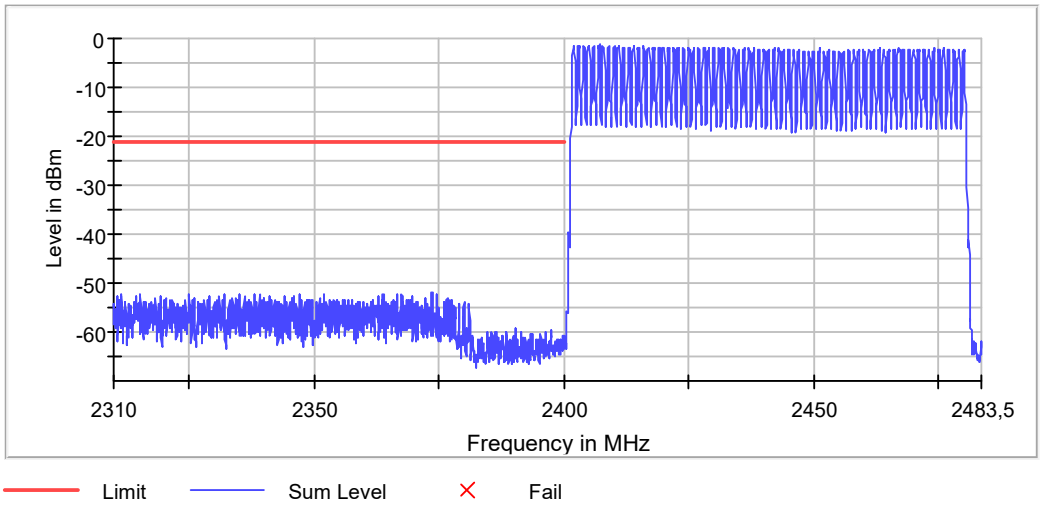
Pass

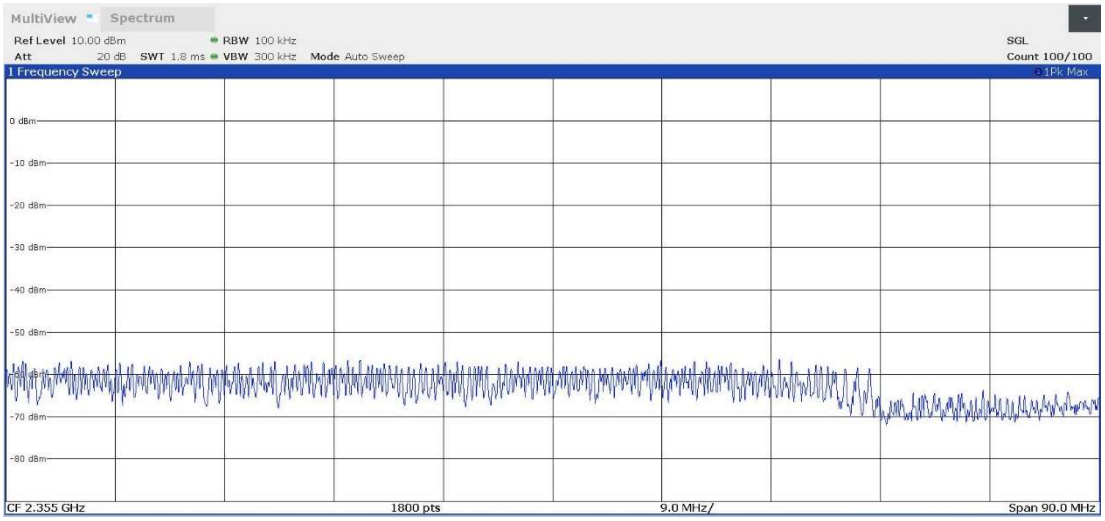
Attachments

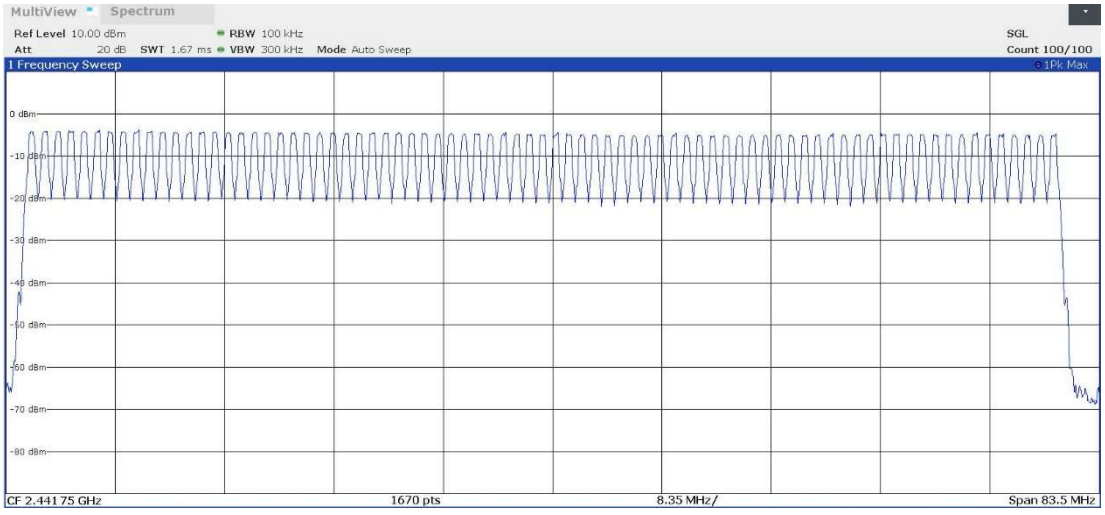
Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Hopping Mode: ON, Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

Plots:

Band Edge



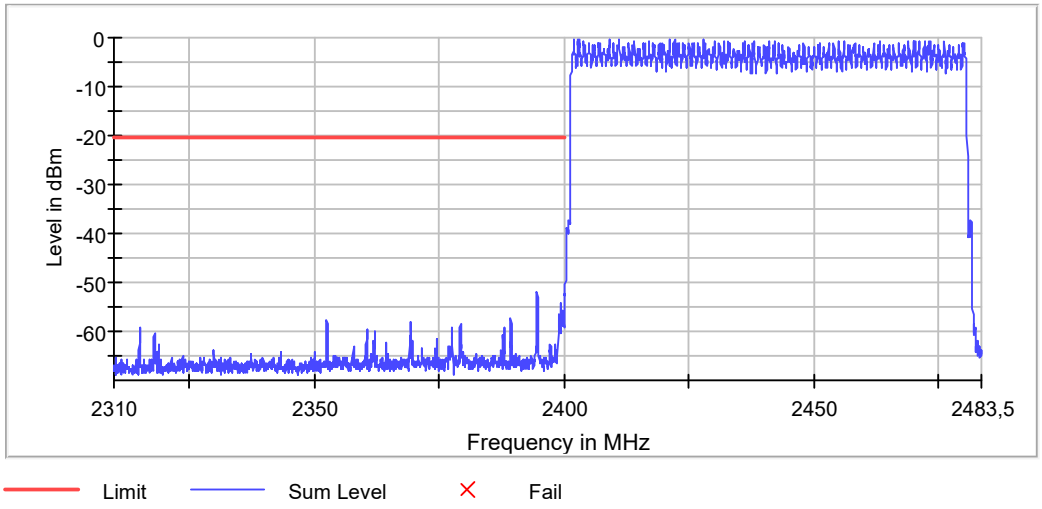


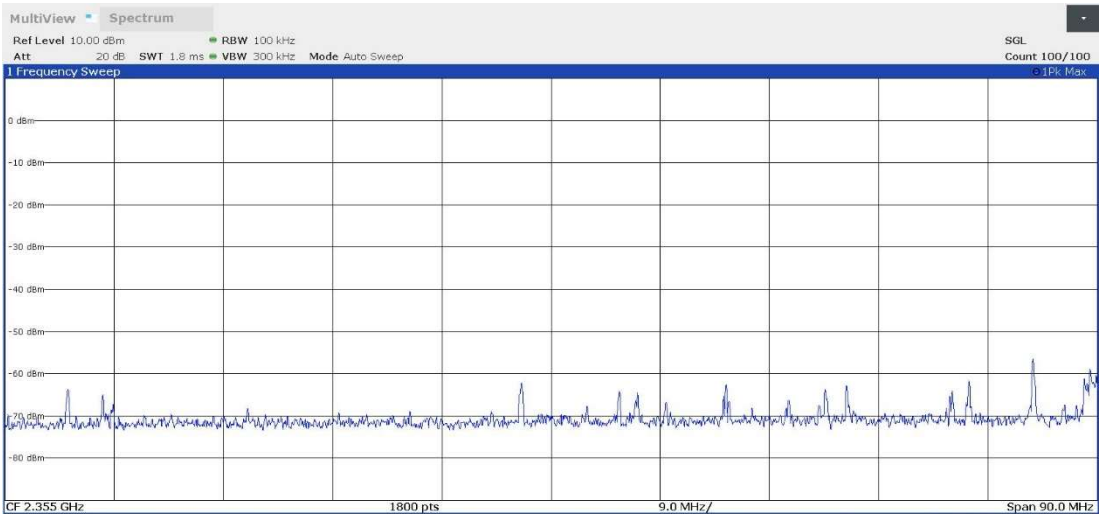


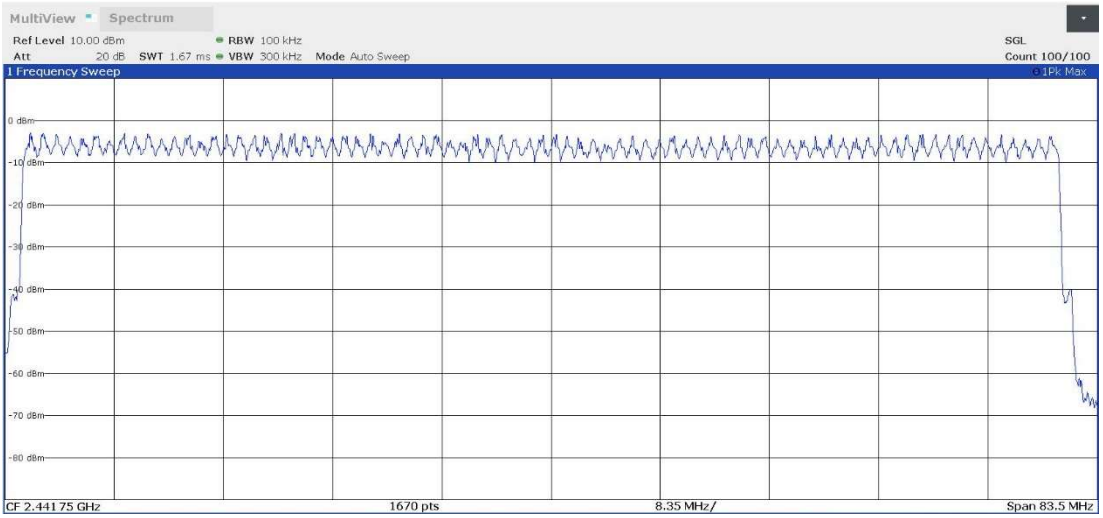
Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Hopping Mode: ON, Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

Plots:

Band Edge



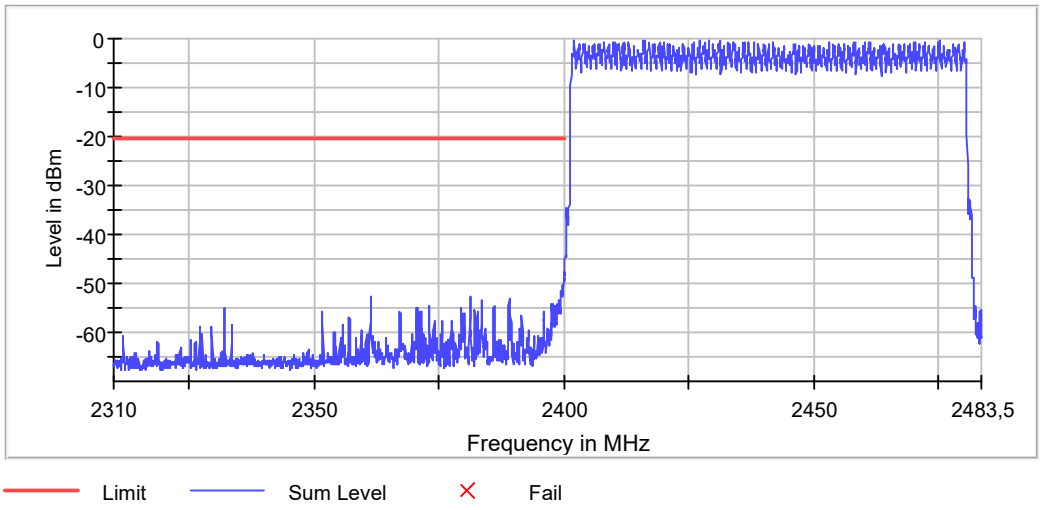


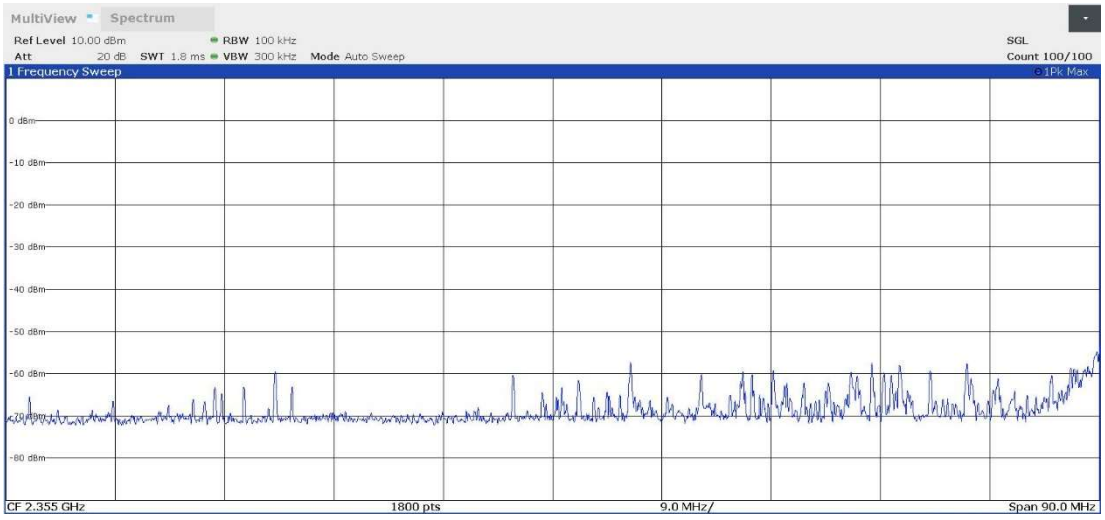


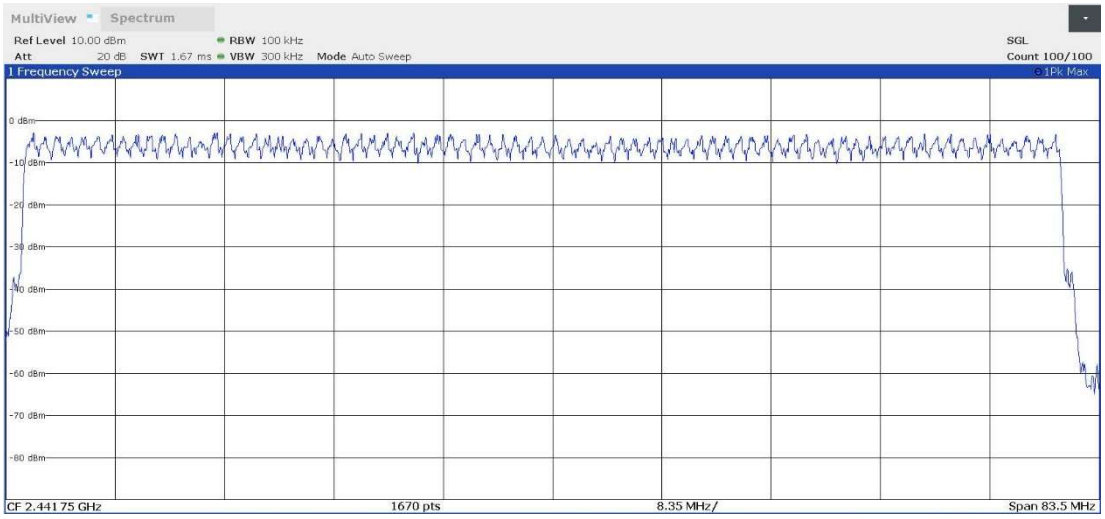
Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Hopping Mode: ON, Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Plots:

Band Edge

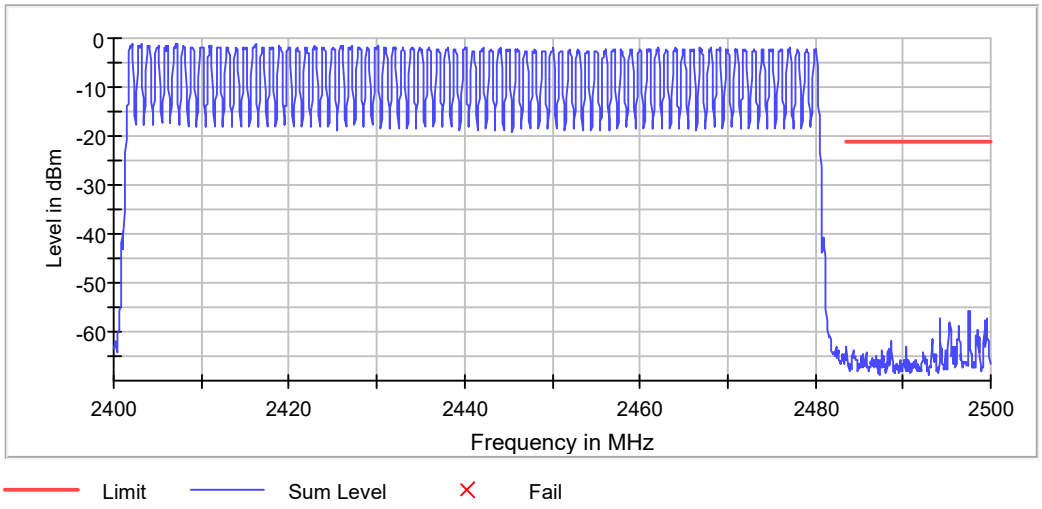


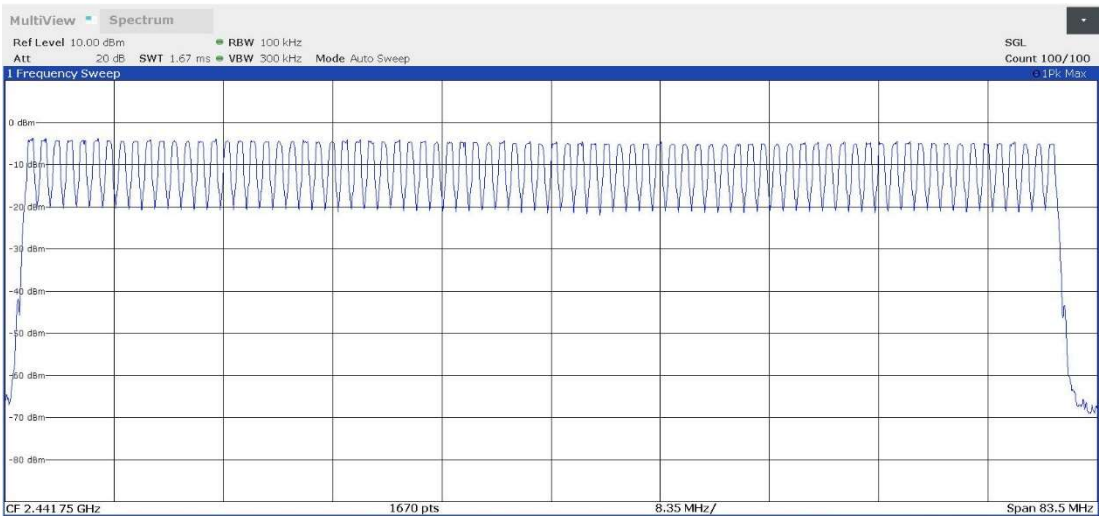


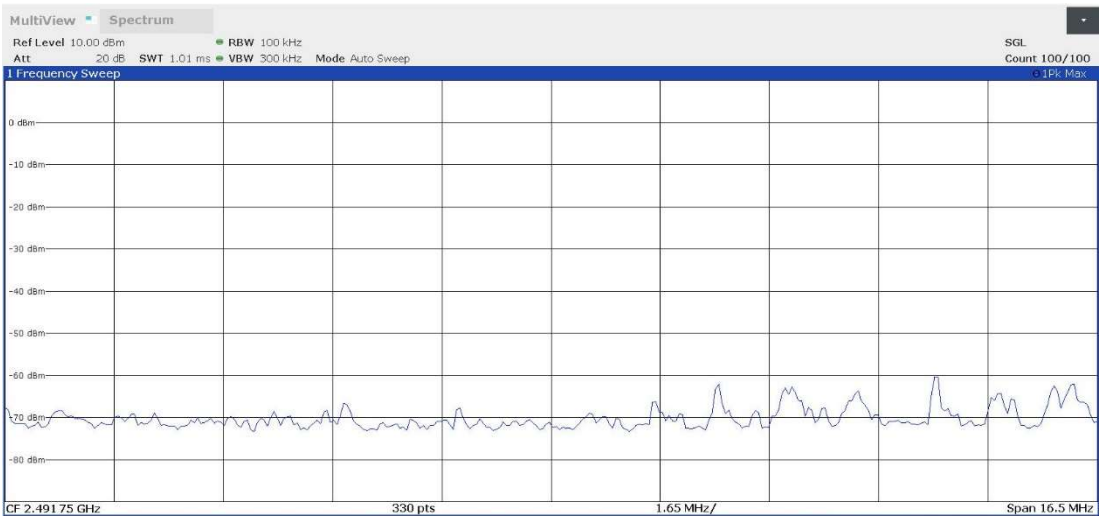


Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Hopping Mode: ON, Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

Band Edge

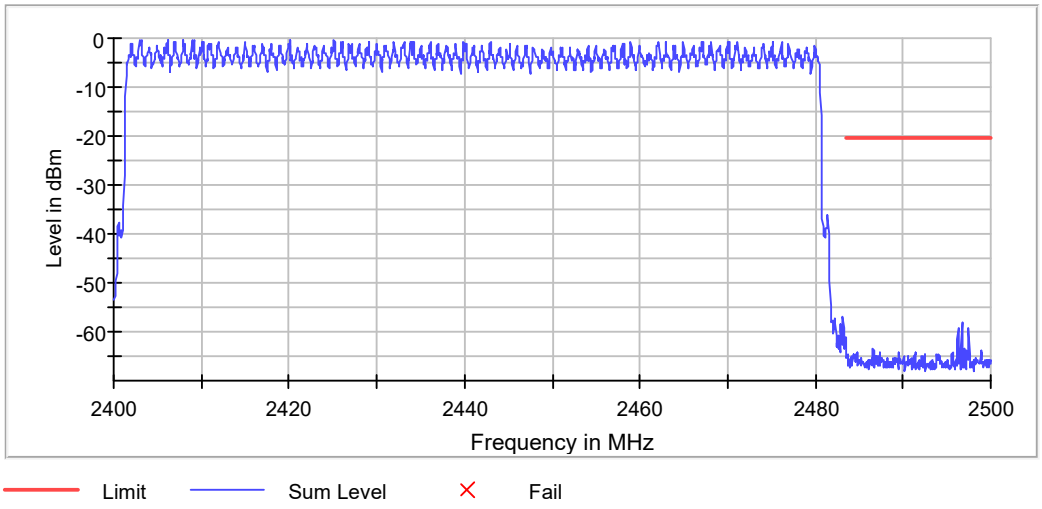


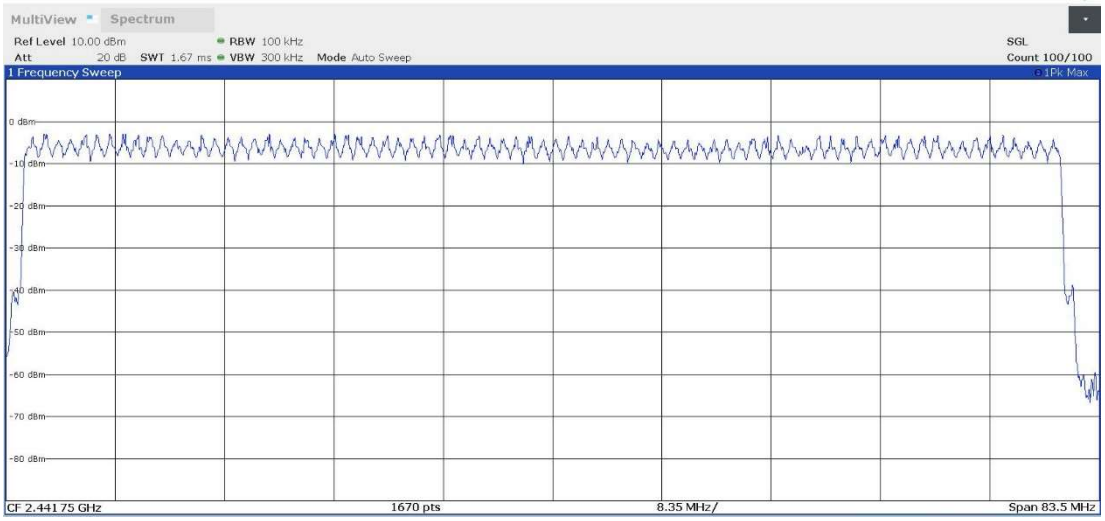


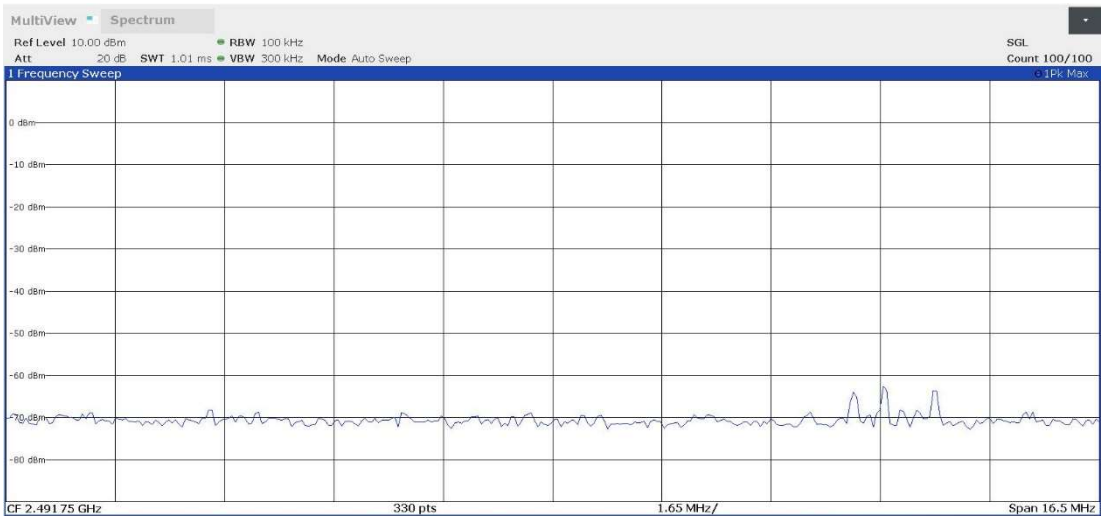


Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Hopping Mode: ON, Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

Band Edge

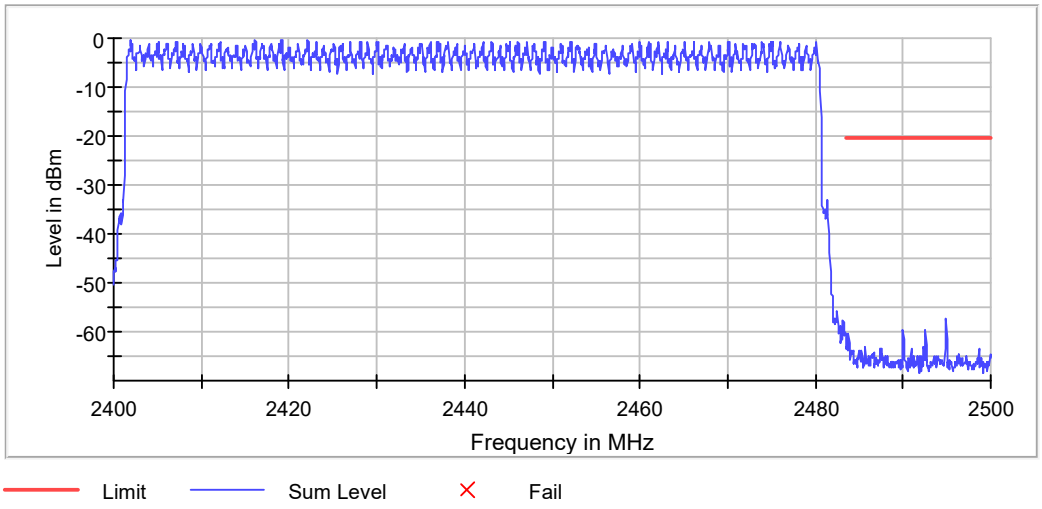


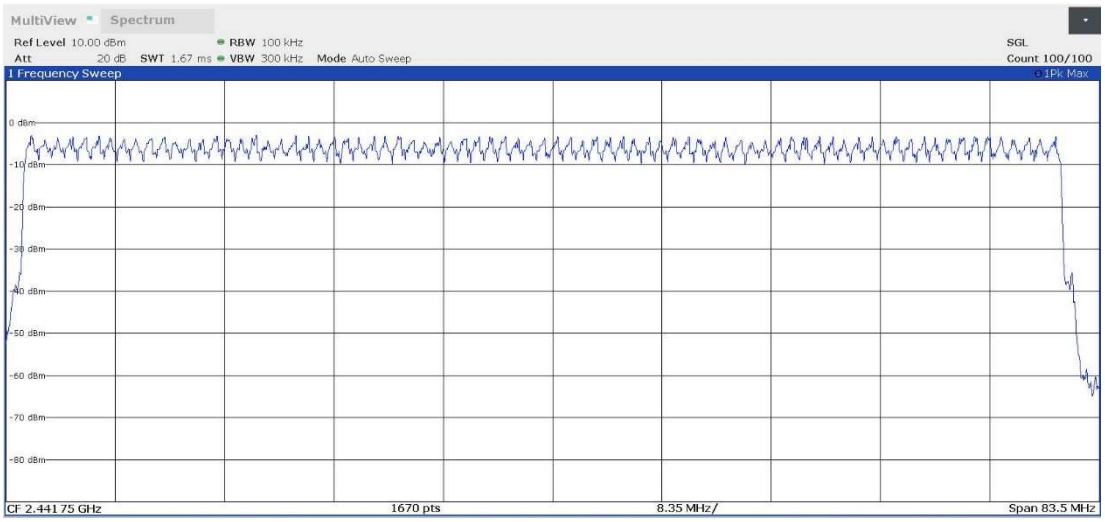


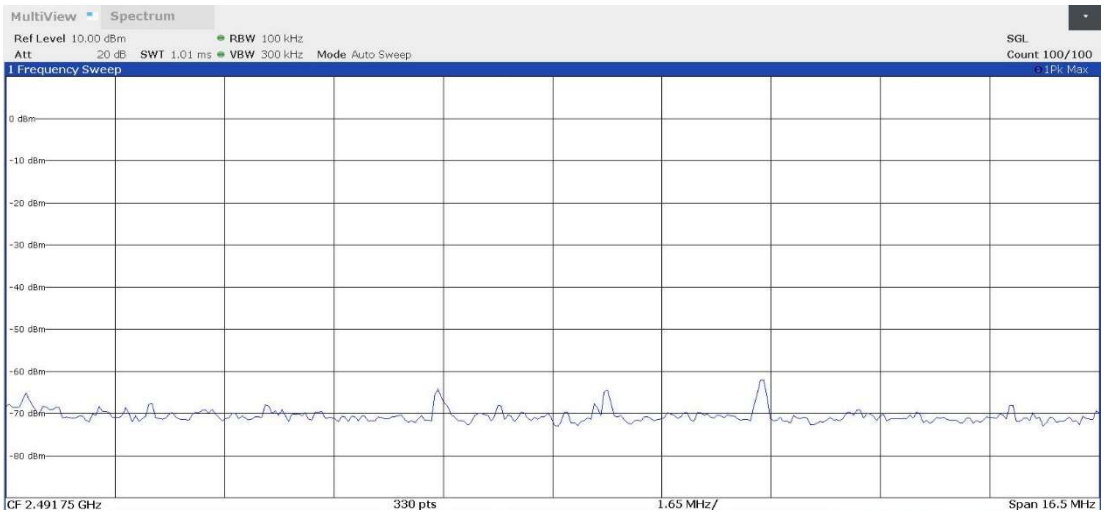


Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2480.00, Hopping Mode: ON, Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Band Edge



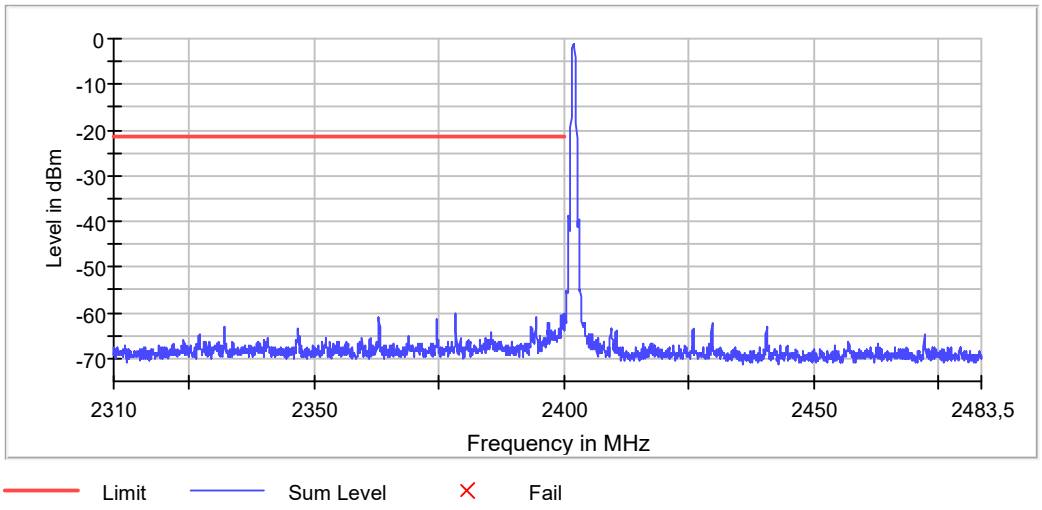


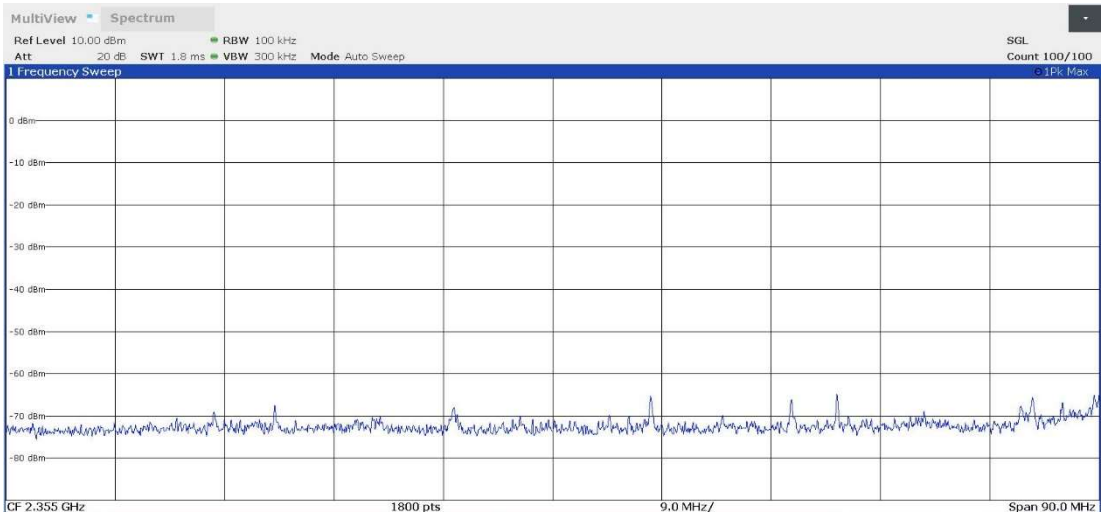


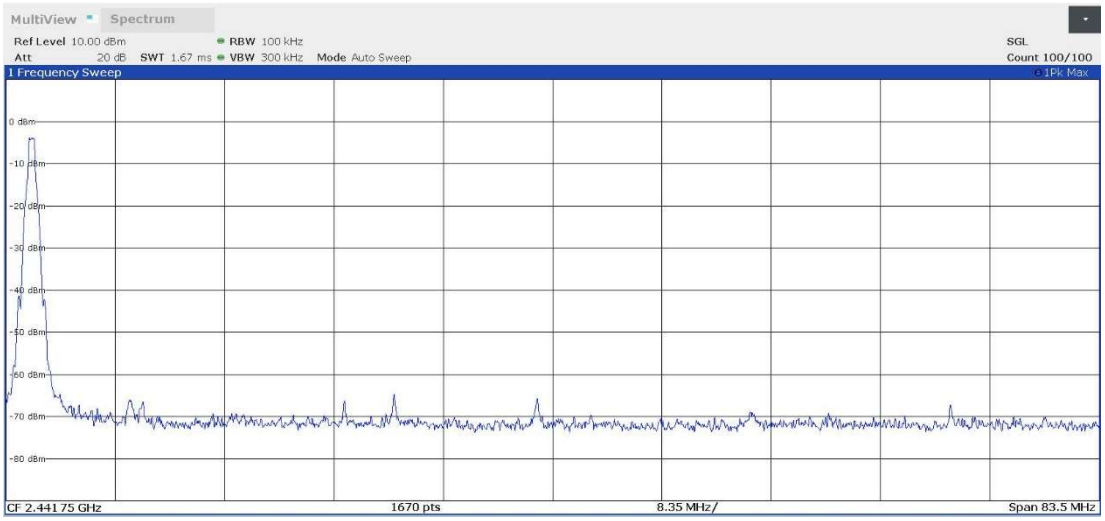
Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Hopping Mode: OFF, Modulation: BT (GFSK 1-DH5), Number of Transmission Chains = 1

Plots:

Band Edge



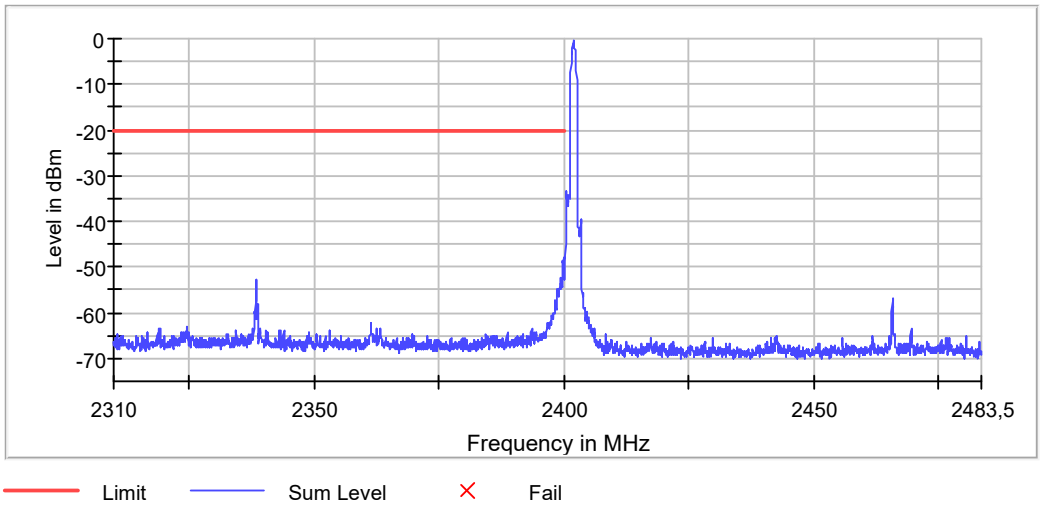


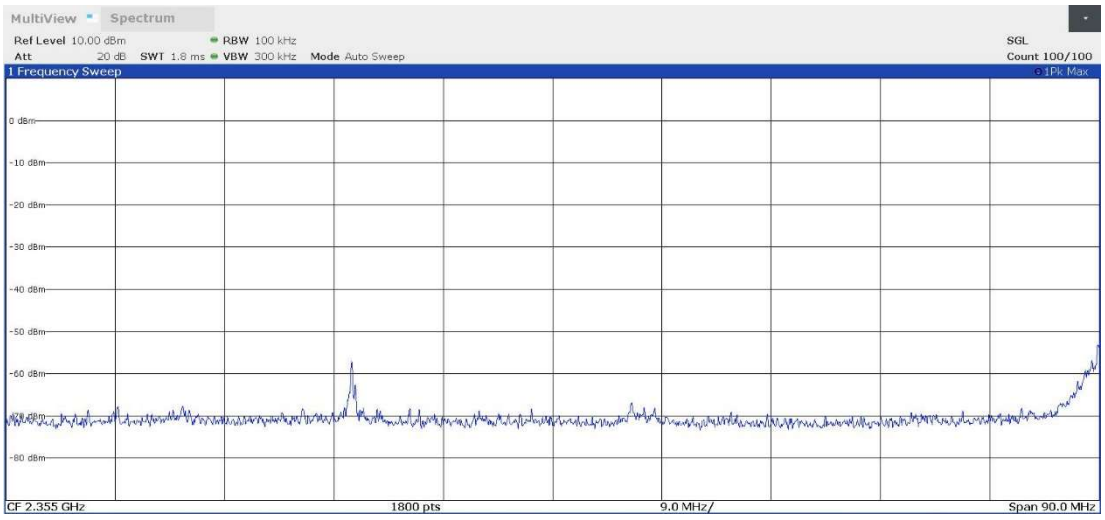


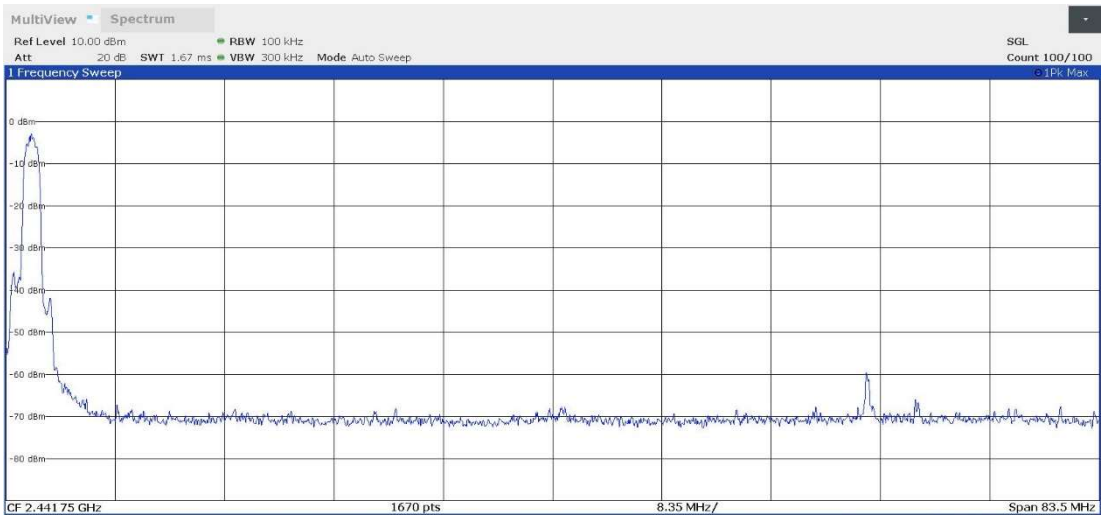
Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Hopping Mode: OFF, Modulation: BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1

Plots:

Band Edge



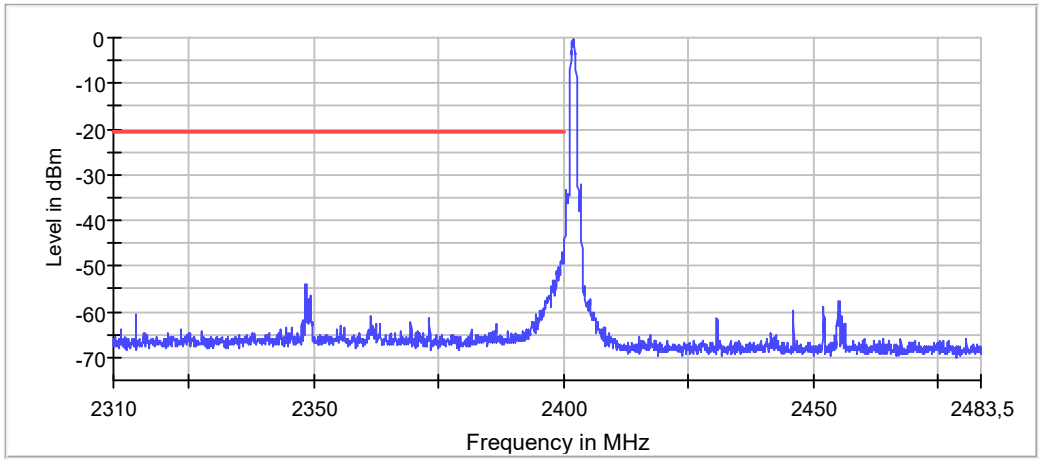




Operation Band (MHz) = [2400, 2483.5], Frequency (MHz) = 2402.00, Hopping Mode: OFF, Modulation: BT (8DPSK 3-DH5), Number of Transmission Chains = 1

Plots:

Band Edge



Limit Sum Level Fail