

ISED CABid: ES1909

Test Report No:
NIE: 69536RRF.008A1

Test Report

USA FCC Part 15.247, 15.209

CANADA RSS-247, RSS-Gen

(*) Identification of item tested	Automotive infotainment System
(*) Trademark	BMW
(*) Model and /or type reference	MGU FQ
Other identification of the product	HW version: 3.2 SW version: K18_21w43.1-1 FCC ID: T8GMGUFQ IC:6434A-MGUFQ
(*) Features	USB 2.0 (including support for Apple Devices), Bluetooth, WLAN Modul 2.4 / 5 GHz, GNSS, Video-out APIX2, CAN and 100Base-T1.
Manufacturer	HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH Becker-Goering-Str. 16 76307, Karlsbad, GERMANY
Test method requested, standard	USA FCC Part 15.247 (10-1-20 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-20 Edition): Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 amendment 1 (March 2019). Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid Systems Devices Operating Under Section 15.247 of the FCC Rules. 558074 D01 Meas Guidance v05r02 dated April 2, 2019. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager
Date of issue	2022-01-25
Report template No	FDT08_23 (*) "Data provided by the client"

Index

INDEX	2
ACRONYMS	3
COMPETENCES AND GUARANTEES	3
GENERAL CONDITIONS	4
UNCERTAINTY	4
DATA PROVIDED BY THE CLIENT	4
USAGE OF SAMPLES	5
TEST SAMPLE DESCRIPTION	6
IDENTIFICATION OF THE CLIENT	8
TESTING PERIOD AND PLACE	8
DOCUMENT HISTORY	8
ENVIRONMENTAL CONDITIONS	8
REMARKS AND COMMENTS	9
TESTING VERDICTS	9
SUMMARY	10
APPENDIX A: TEST RESULTS. BLUETOOTH EDR	11

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
Detector	Detector used
Equipment	Equipment Type
Freq	Frequency
Freq Rng	Frequency Range
Freq Sep	Frequency Separation
Inband Peak Lvl	Inband Peak Level
Lvl	Level
MP	Measurement Point
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
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 a 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.

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

General conditions

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

Uncertainty

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

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 MGU Head-Unit. The main functionalities are: Navigation, USB, voice recognition and several interfaces to the vehicle and Bluetooth / WLAN. The Head-unit provides different interfaces like: Video-out APIX2 (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.

- Sample S/01 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
69536B/036	Automotive infotainment System	MGU FQ	B49299M278000021	2021/11/11

Auxiliary elements used with the Sample S/01:

Control N°	Description	Model	Serial N°	Date of reception
69536B/040	OABR Converter Board	--	--	2021/11/11
69536B/037	OABR Converter Cable	--	--	2021/11/11
69536B/039	Power Cable DC	--	--	2021/11/11
69536B/042	Power Harness	--	--	2021/11/11
69536B/041	Ethernet to USB Adapter	EU-4306	--	2021/11/11

Sample S/01 has undergone the following test(s): Conducted test indicated in the Appendix A

- Sample S/02 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
69536B/025	Automotive infotainment System	MGU FQ	B49219M277000002	2021/11/11

Auxiliary elements used with the Sample S/02:

Control N°	Description	Model	Serial N°	Date of reception
69536B/026	OABR Converter Board	--	--	2021/11/11
69536B/027	OABR Converter Cable	--	--	2021/11/11
69536B/028	Power Cable DC	--	--	2021/11/11
69536B/029	Ethernet Cable	--	--	2021/11/11
69536B/030	Ethernet to USB Adapter	EU-4306	--	2021/11/11
69536B/031	Power Harness	--	--	2021/11/11

Sample S/02 has undergone the following test(s): Radiated test indicated in the Appendix A.

Test sample description

Test Sample description (compulsory information for EMC and RF testing services)

Ports..... :	Port name and description	Cable					
		Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾		
	2xFakra		[X]	[X]	[]		
	USB1 connector – CONM-SM 4POL ROS D4S20Y-40MA5-B		[]	[X]	[]		
	USB2 connector – CONM-SM 4POL ROS D4S20Y-40MA5-C		[]	[X]	[]		
	USB3 connector – CONM-SM 4POL ROS D4S20Y-40MA5-E		[]	[X]	[]		
	APIX2 connector – CONM-SM 4+2POL ROS 99S22A-40MA5-D		[X]	[]	[]		
	Car Main-connector – CONM 16POL TYC 2300483-s		[X]	[]	[]		
	Ethernet BroadR-Reach, 100 BASE-T1		[X]	[]	[]		
	GNSS connector		[X]	[X]	[]		
Supplementary information to the ports..... :							
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
		AC:					
		AC:					
	X	DC: 12Vdc					
		DC:					
Rated Power							
Clock frequencies.....							
Other parameters							
Software version	K18_21w43.1-1						

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	
	X	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)	2021-11-17
Date (finish)	2021-12-16

Document history

Report number	Date	Description
69536RRF.008	2022-01-12	First release
69536RRF.008A1	2022-01-25	First modification due to typos. This modification test report cancels and replaces the test report 69536RRF.008

Environmental conditions

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

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

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

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

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

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

Remarks and comments

The tests have been performed by the technical personnel: Antonio Ruiz Sánchez, Francisco Javier Fernández Aragón, José Gabriel Pendón.

Used instrumentation:

Equipment	Model	Vendor	Latest Calibration	Next Calibration
DIGITAL MULTIMETER	179	FLUKE	2021-10-19	2022-10-19
EMI TEST RECEIVER 2Hz-44GHz	ESW44	ROHDE AND SCHWARZ	2021-09-21	2023-09-21
HORN ANTENNA 1-18GHz	BBHA 9120 D	SCHWARZBECK MESS-ELEKTRONIK	2021-07-13	2024-07-13
PREAMPLIFIER 30dB 500MHz-18GHz	BBV 9718 C	SCHWARZBECK	2021-06-07	2022-06-07
HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	EST LINDGREN	2021-09-15	2024-09-15
PRE-AMPLIFIER G>40dB 10MHz-6GHz	BLNA 0160-01N	BONN ELEKTRONIK	2021-10-27	2022-10-27
HORN ANTENNA 18-40GHz	BBHA 9170	SCHWARZBECK	2021-09-29	2024-09-29
PRE-AMPLIFIER G>30dB 17-40GHz	BLMA 1840-4A	BONN ELEKTRONIK	2021-09-08	2022-09-08
OPEN SWITCH UNIT UP TO 7.5 GHz	OSP-B157W8 PLUS	ROHDE & SCHWARZ	2021-08-20	2023-08-20
POWER SUPPLY DC 40 V / 40 A	NGPE 40/40	ROHDE AND SCHWARZ	--	--
SIGNAL AND SPECTRUM ANALYZER 10Hz-40GHz	FSV 40	ROHDE AND SCHWARZ	2021-02-26	2023-02-26
SIGNAL GENERATOR 8kHz-6GHz	SMB100B	ROHDE AND SCHWARZ	2021-11-03	2023-11-03
VECTOR SIGNAL GENERATOR 100kHz-7.5GHz	SMW200A	ROHDE AND SCHWARZ	2021-08-20	2023-08-20
WIRELESS CONNECTIVITY TESTER BW 160 MHz	CMW270	ROHDE AND SCHWARZ	2021-11-30	2022-11-30

Testing verdicts

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

Summary

Bluetooth EDR

Requirement – Test case	FCC PART 15 PARAGRAPH / RSS-247	Verdict	Remark
RSS-247 5.1 (b) / FCC 15.247 (a) (1) [20dBW] 20 dB Bandwidth		Pass	
RSS-247 5.1 (d) / FCC 15.247 (a) (1) (iii) [DwT] Time of Occupancy (Dwell Time)		Pass	
RSS-247 5.4. (b) / FCC 15.247 (b) [Pkcp] Maximum peak output power and antenna gain		Pass	
RSS-247 5.1 (d) / FCC 15.247 (a) (1) (iii) [NHC] Number of hopping channels		Pass	
RSS-247 5.5 / FCC 15.247 (d) [Bndedge] Band-edge emissions compliance (Transmitter)		Pass	
RSS-247 5.5 / FCC 15.247 (d) [RSE] Emission limitations radiated (Transmitter)		Pass	
<u>Supplementary information and remarks:</u>			
None			

Appendix A: Test results. Bluetooth EDR

INDEX

TEST CONDITIONS	13
TEST CASES DETAILS	16
<i>RSS-247 5.1 (b) / FCC 15.247 (a) (1) [20dBW] 20 dB Bandwidth</i>	<i>16</i>
<i>99dBw Occupied Channel Bandwidth 99%</i>	<i>23</i>
<i>RSS-247 5.1 (b) / FCC 15.247 (a) (1) [CFS] Carrier Frequency Separation.....</i>	<i>30</i>
<i>RSS-247 5.1 (d) / FCC 15.247 (a) (1) (iii) [DwT] Time of Occupancy (Dwell Time).....</i>	<i>33</i>
<i>RSS-247 5.1 (d) / FCC 15.247 (a) (1) (iii) [NHC] Number of hopping channels</i>	<i>36</i>
<i>FCC 15.247 (b) / RSS-247 5.4 (b) Maximum peak output power and antenna gain</i>	<i>39</i>
<i>RSS-247 5.5 / FCC 15.247 (d) [Bndedge] Band-edge emissions compliance (Transmitter)</i>	<i>45</i>
<i>RSS-247 5.5 / FCC 15.247 (d) [RSE] Emission limitations radiated</i>	<i>53</i>

TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal:	12 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 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 m for the frequency range 17 GHz-26 GHz (antenna and 18 GHz-40 GHz horn antenna).

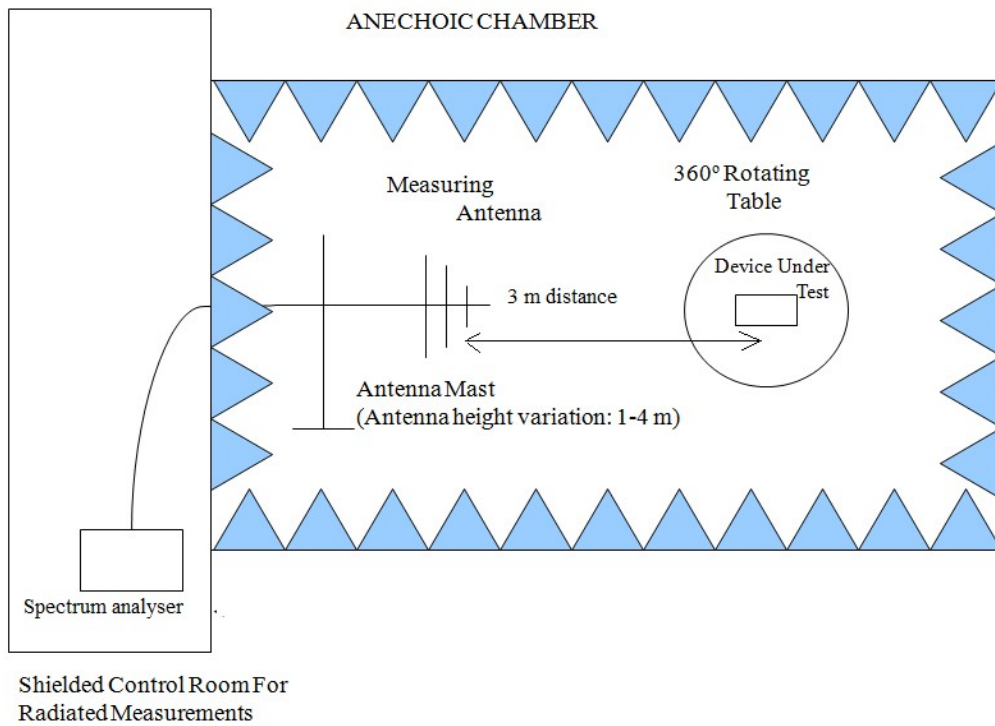
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

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

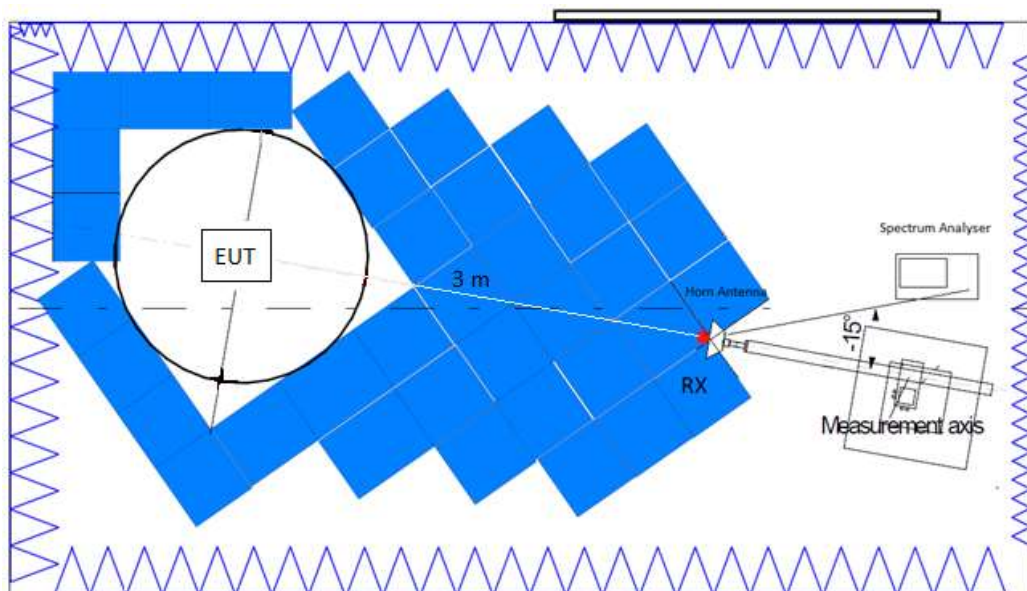
Measurements were made in both horizontal and vertical planes of polarization.

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

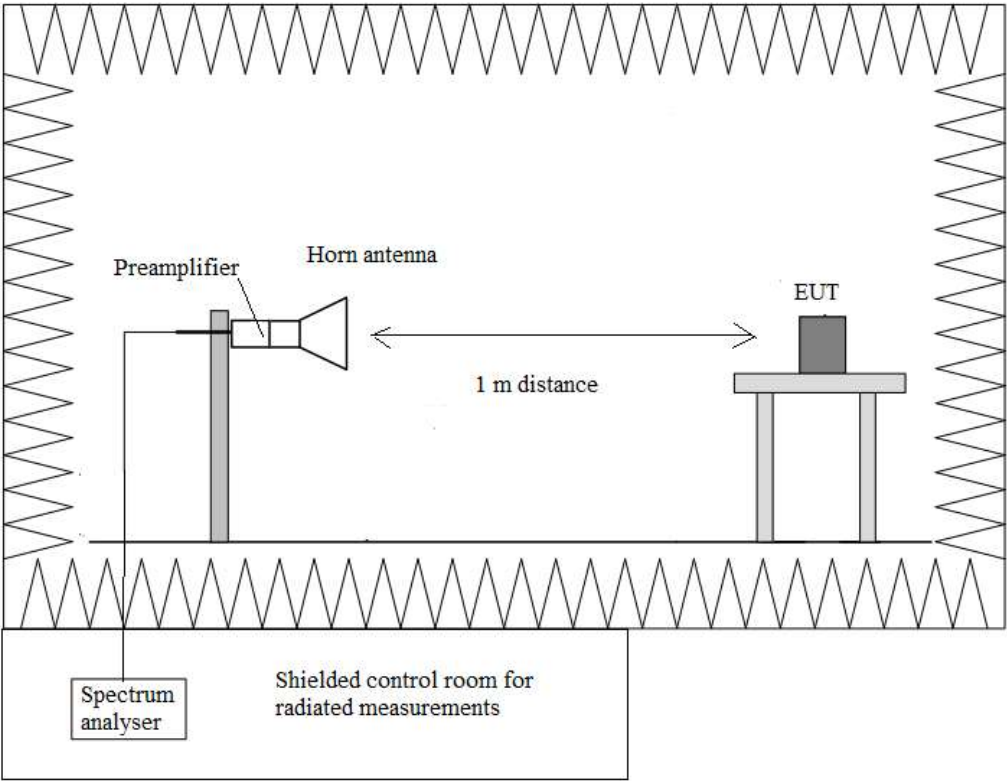
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup $f > 17\text{ GHz}$:



TEST CASES DETAILS

RSS-247 5.1 (b) / FCC 15.247 (a) (1) [20dBW] 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	0.930000
2441.00	0.930000
2480.00	0.930000

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

Freq (MHz)	20dBw (MHz)
2402.00	1.325000
2441.00	1.325000
2480.00	1.320000

Modulation: BT (8DPSK 3-DH5)

Freq (MHz)	20dBw (MHz)
2402.00	1.290000
2441.00	1.290000
2480.00	1.295000

Verdict

Pass

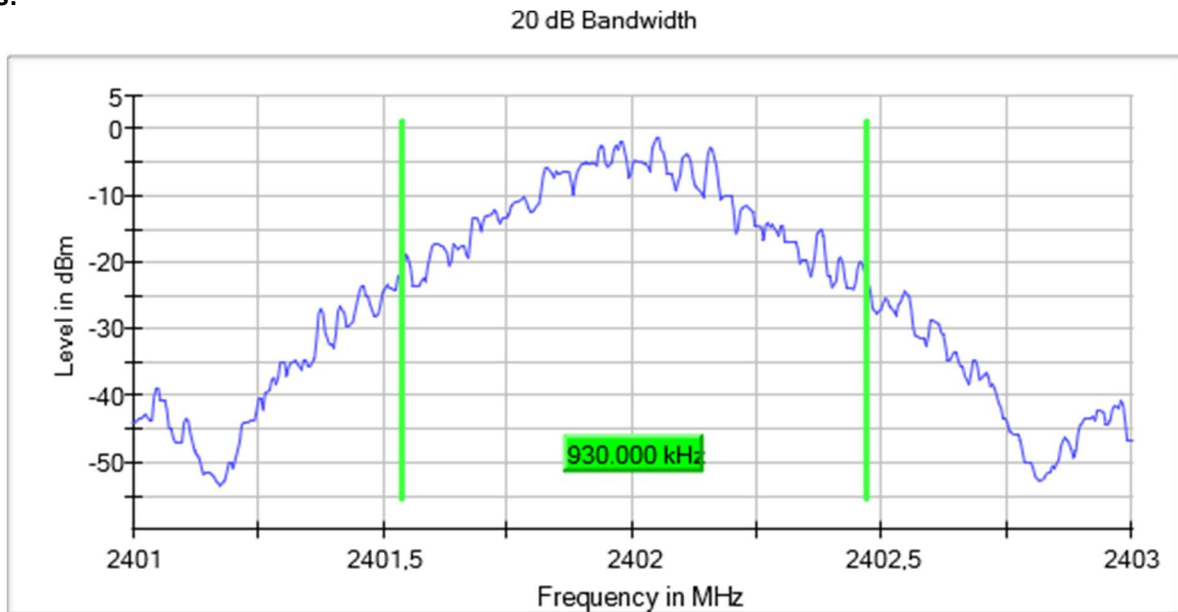
Uncertainty

Measurement uncertainty (%) $\leq \pm 1.24$

Attachments

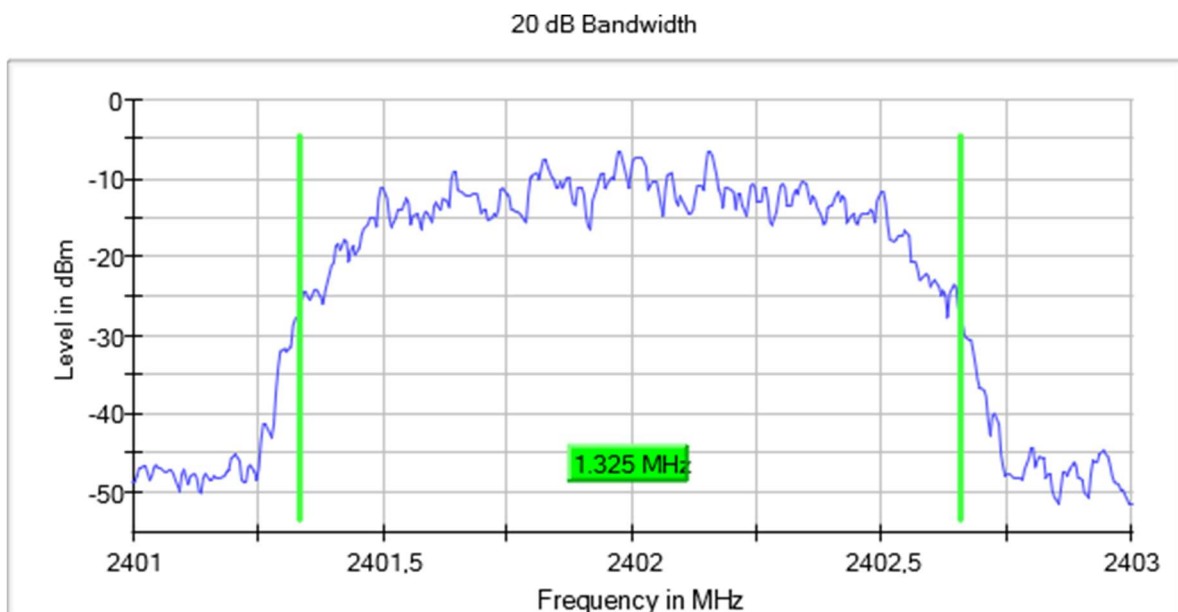
Operation Band MHz = [2400, 2483.5], Frequency MHz = 2402.00, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



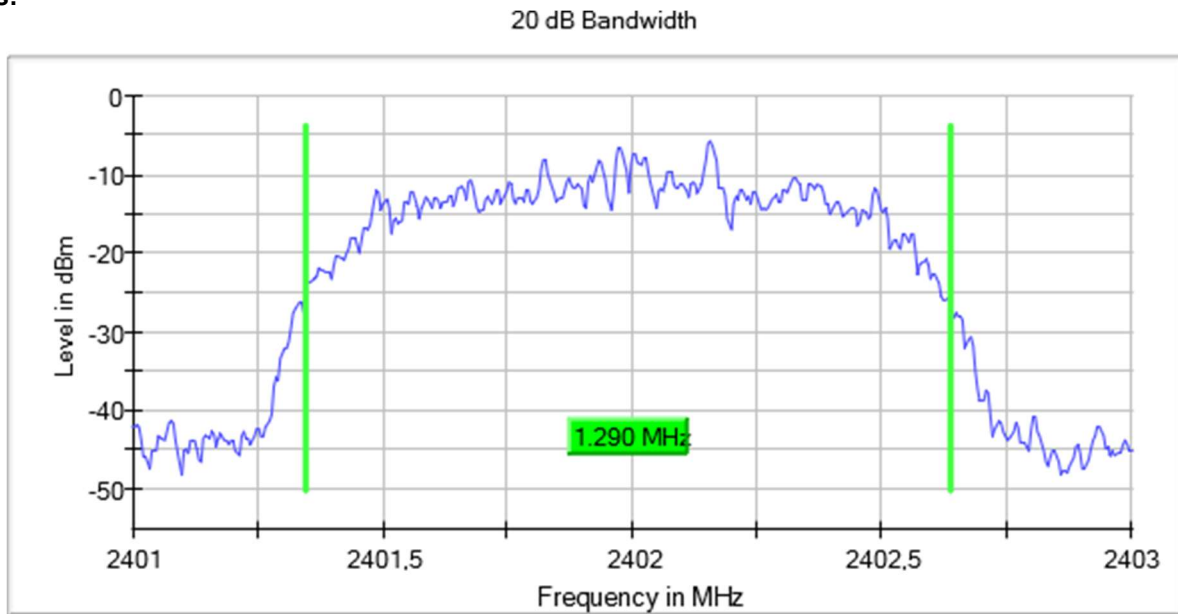
Operation Band MHz = [2400, 2483.5], Frequency MHz = 2402.00, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



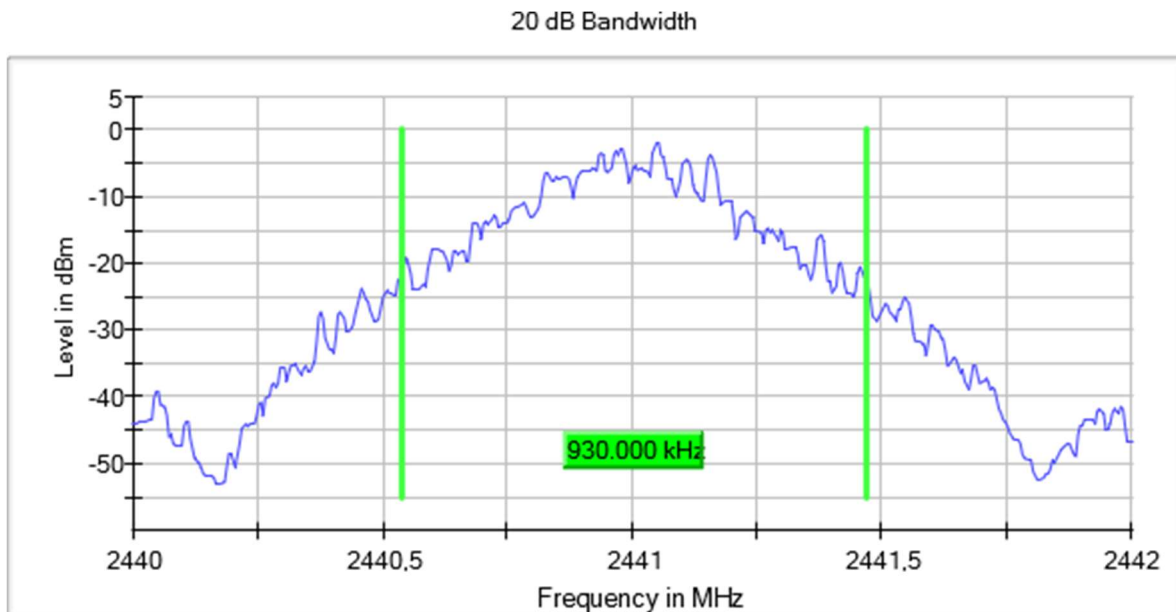
Operation Band MHz = [2400, 2483.5], Frequency MHz = 2402.00, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (8DPSK 3-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



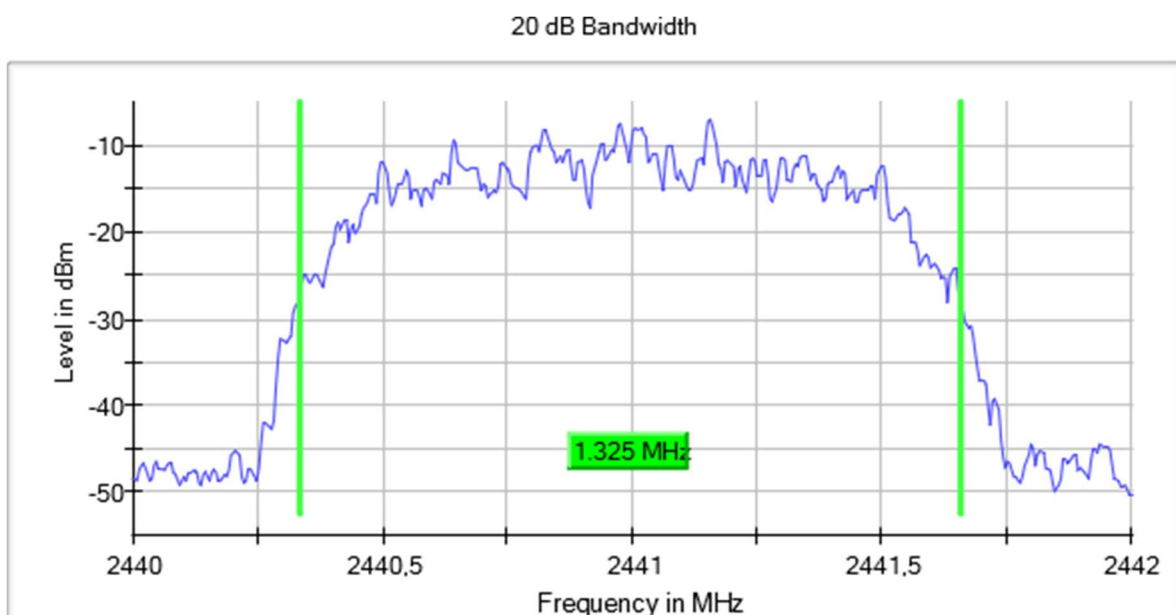
Operation Band MHz = [2400, 2483.5], Frequency MHz = 2441.00, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



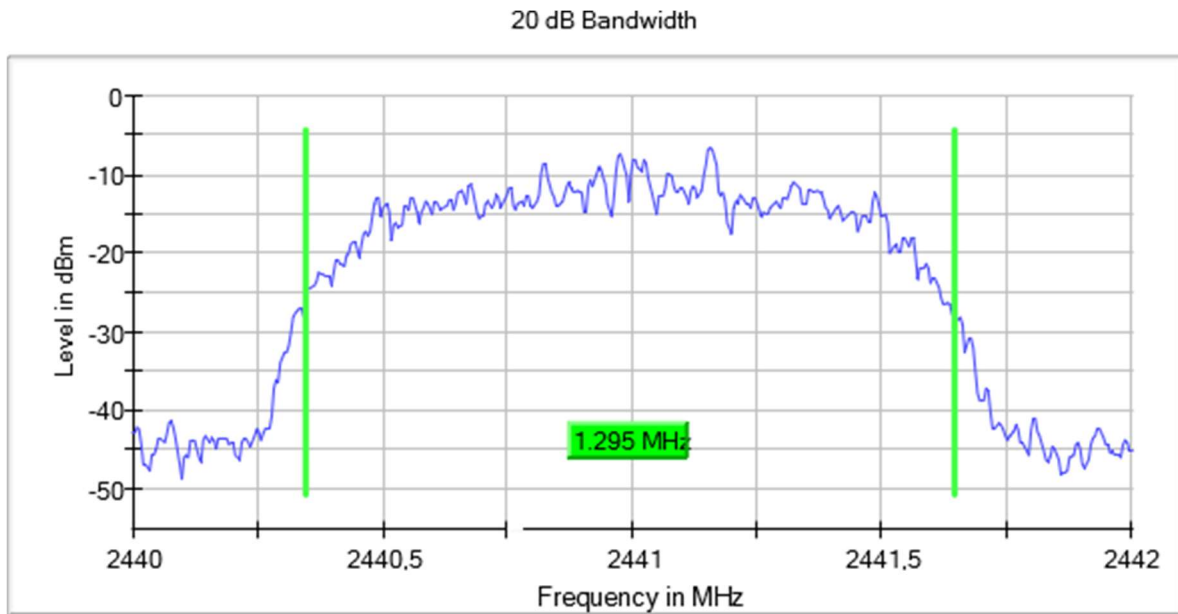
Operation Band MHz = [2400, 2483.5], Frequency MHz = 2441.00, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



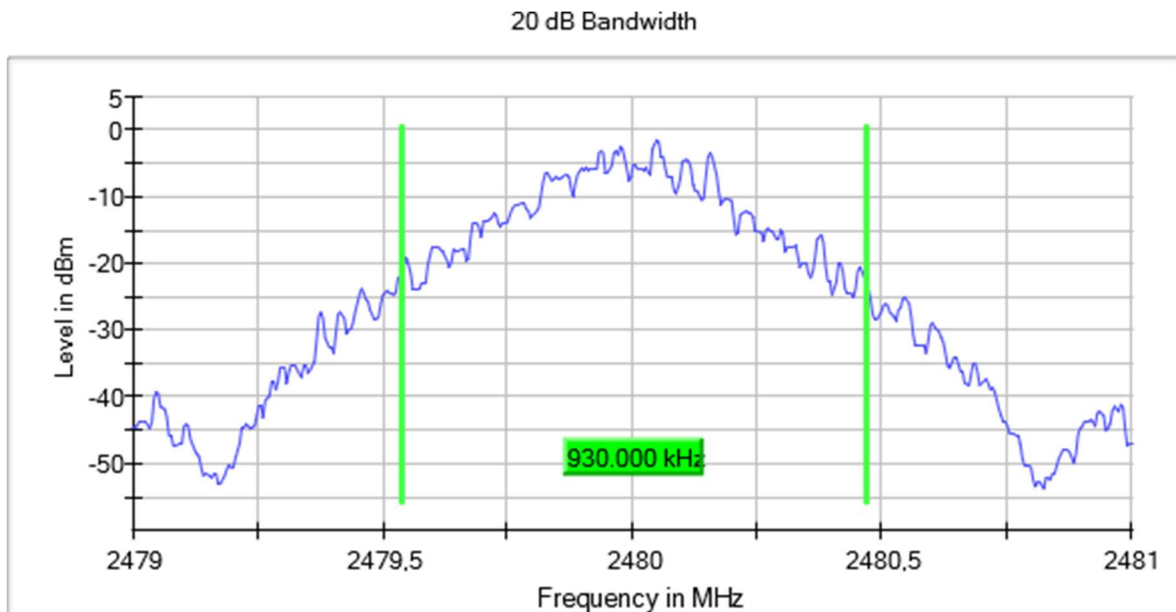
Operation Band MHz = [2400, 2483.5], Frequency MHz = 2441.00, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (8DPSK 3-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



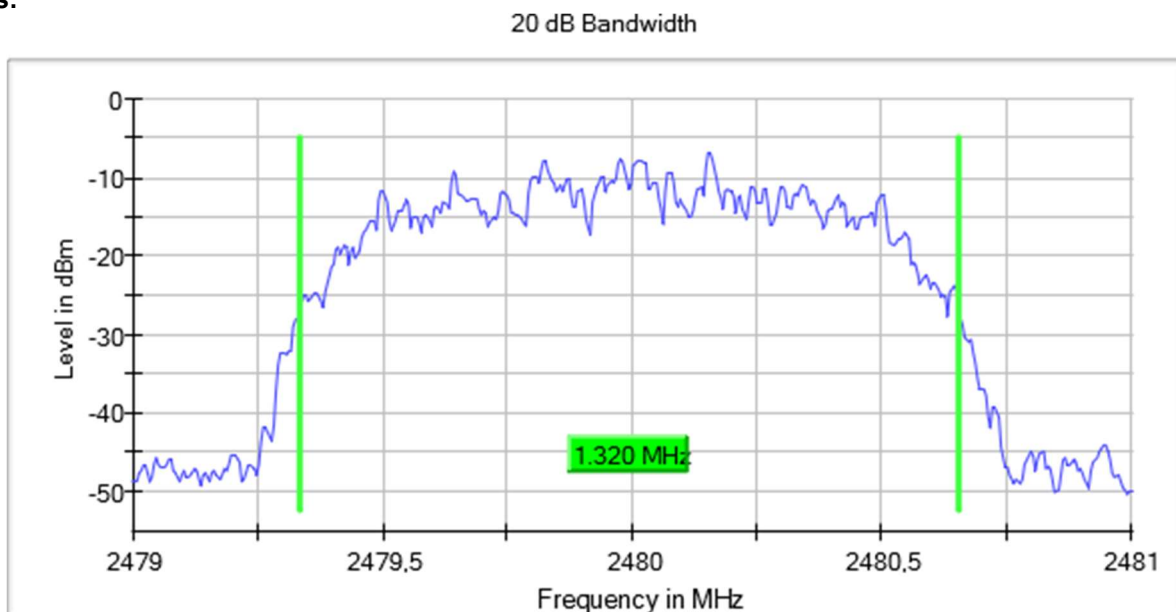
Operation Band MHz = [2400, 2483.5], Frequency MHz = 2480.00, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



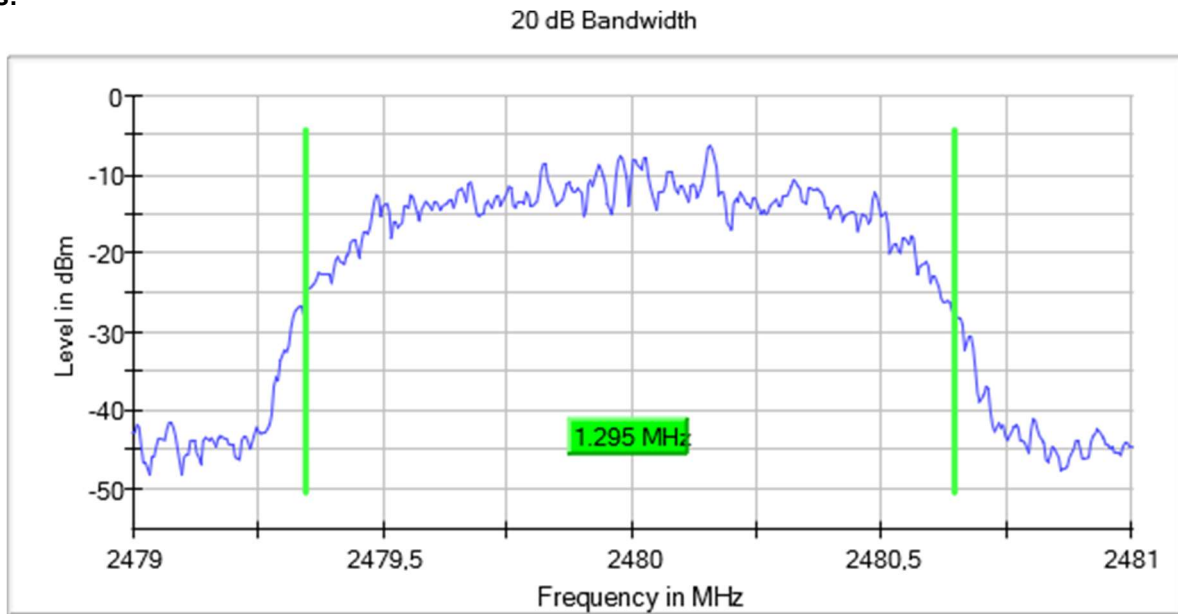
Operation Band MHz = [2400, 2483.5], Frequency MHz = 2480.00, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



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, Available Number of Channels = 1

Images:



99dBw 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	0.865000

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

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

Modulation: BT (8DPSK 3-DH5)

Freq (MHz)	Occ Ch BW (MHz)
2402.00	1.175000
2441.00	1.175000
2480.00	1.185000

Verdict

Pass

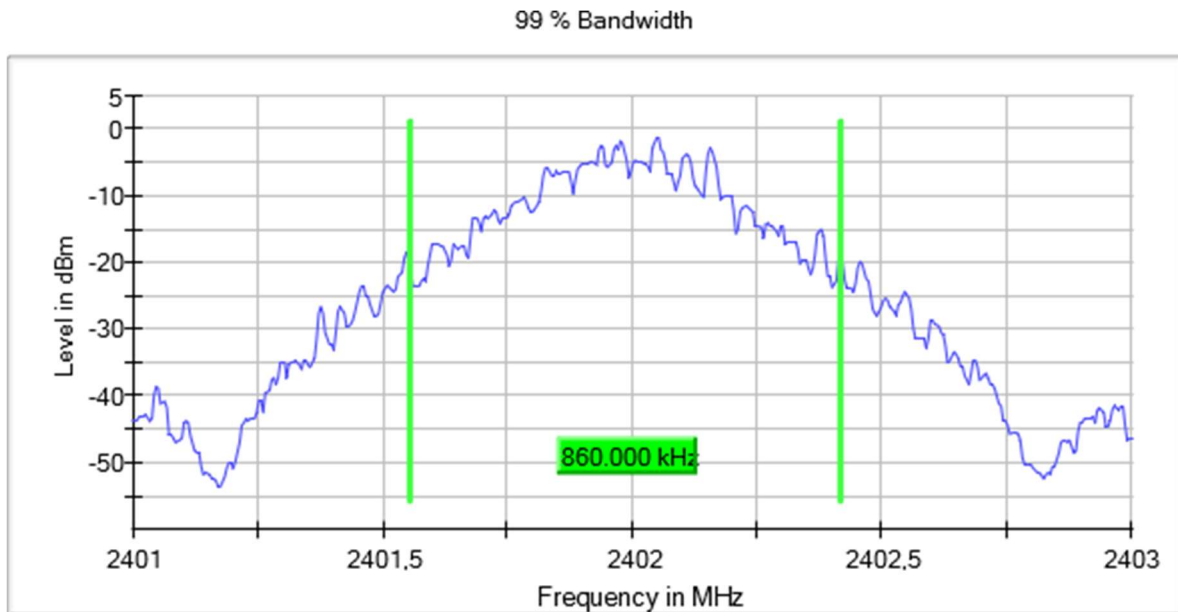
Uncertainty

Measurement uncertainty (%) $\leq \pm 1.24$

Attachments

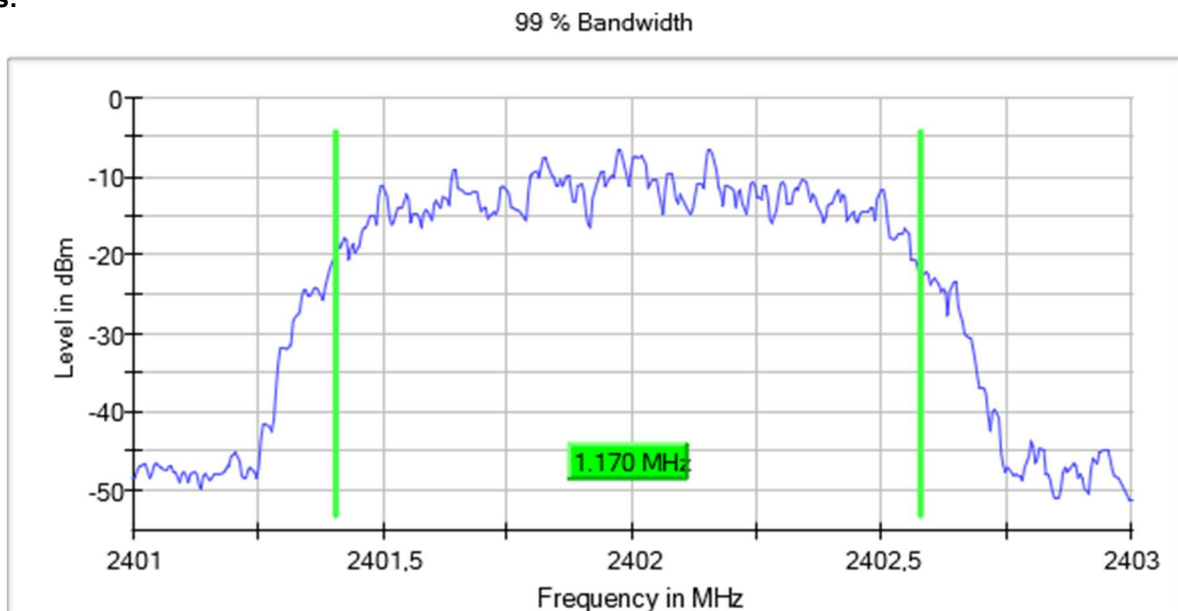
Operation Band MHz = [2400, 2483.5], Frequency MHz = 2402.00, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



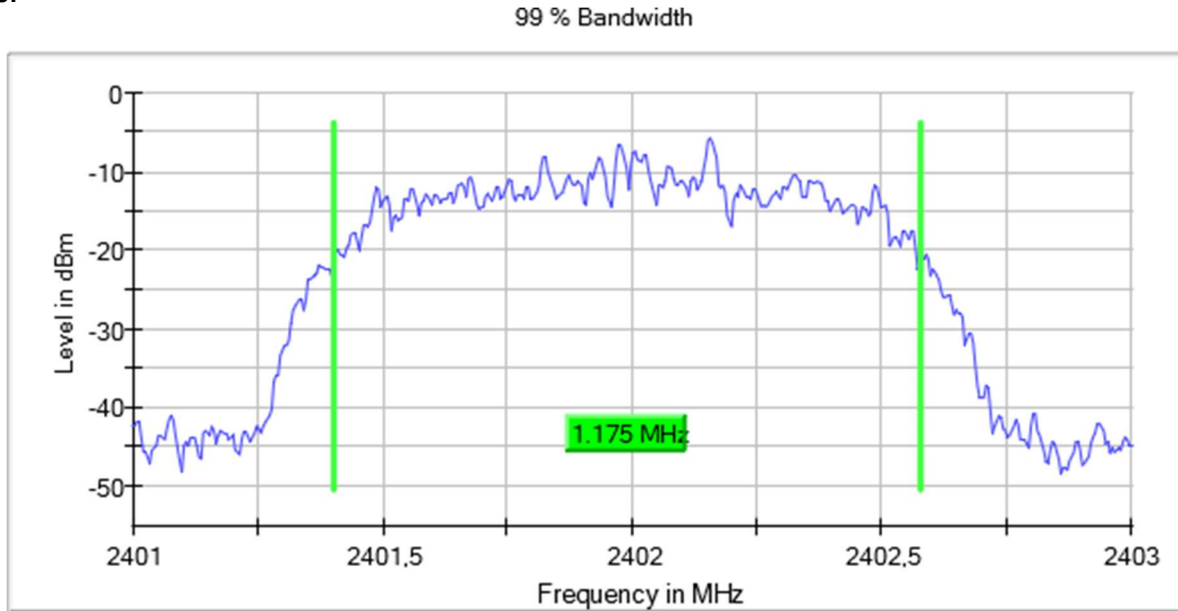
Operation Band MHz = [2400, 2483.5], Frequency MHz = 2402.00, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



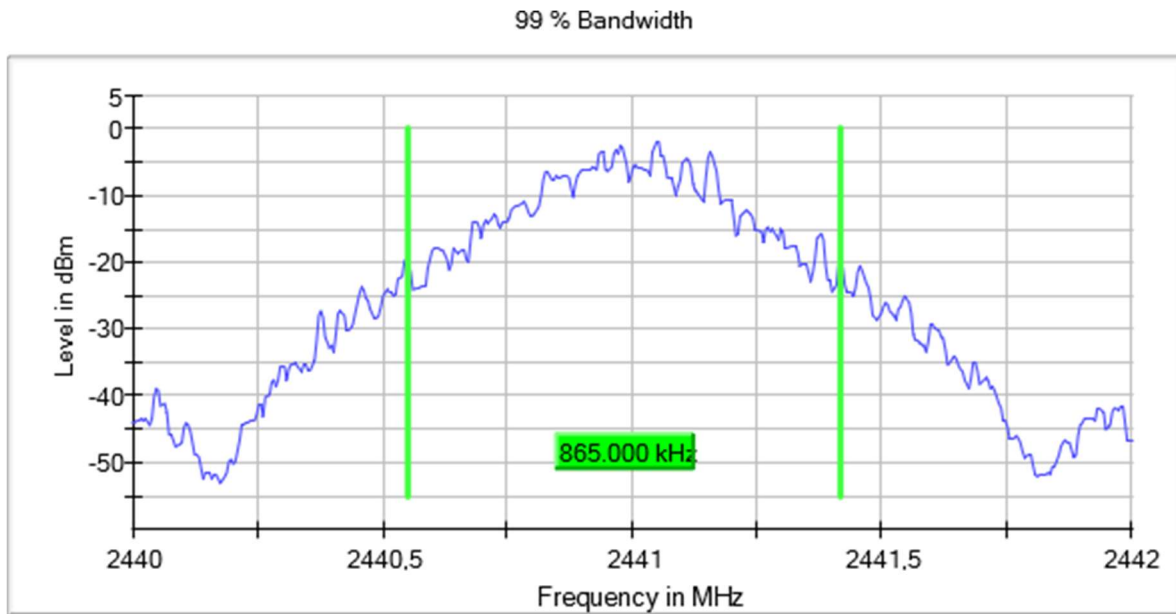
Operation Band MHz = [2400, 2483.5], Frequency MHz = 2402.00, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (8DPSK 3-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



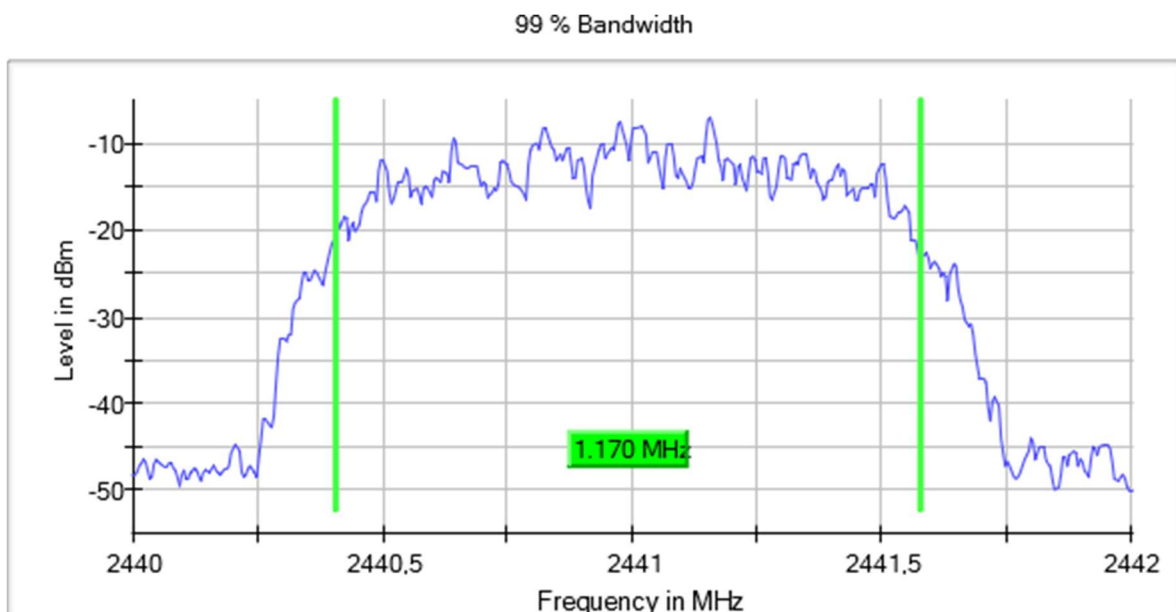
Operation Band MHz = [2400, 2483.5], Frequency MHz = 2441.00, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



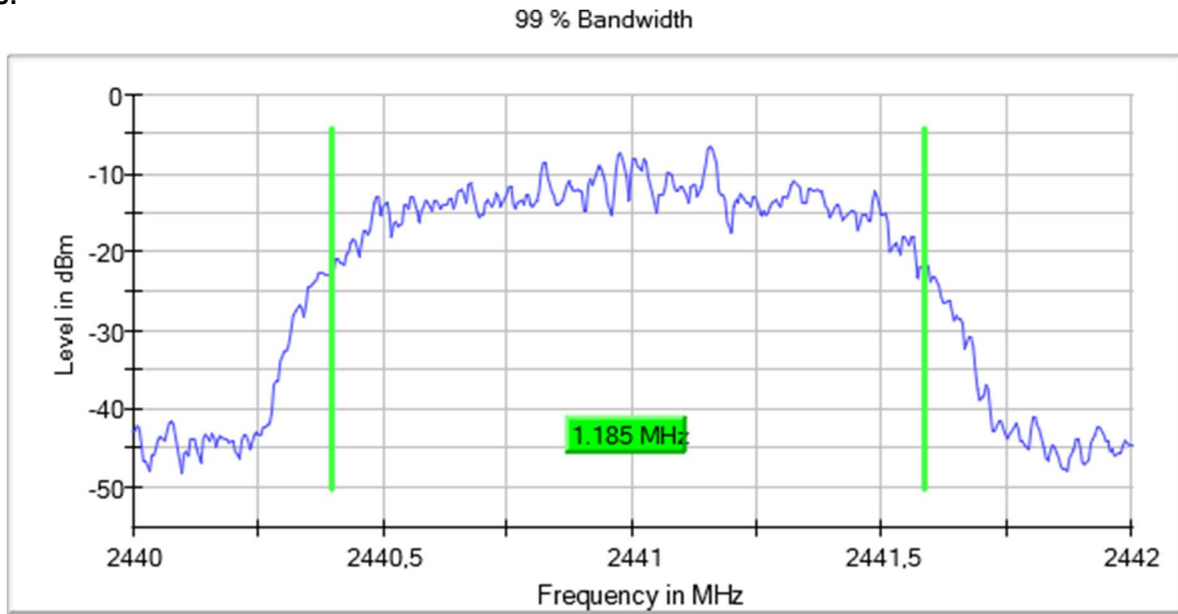
Operation Band MHz = [2400, 2483.5], Frequency MHz = 2441.00, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



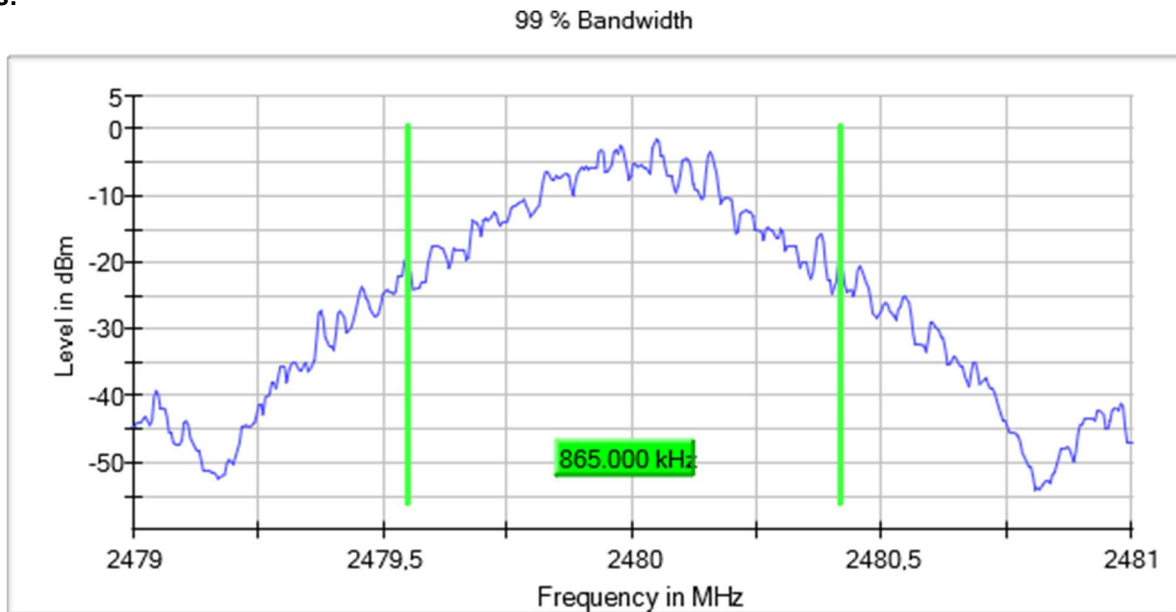
Operation Band MHz = [2400, 2483.5], Frequency MHz = 2441.00, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (8DPSK 3-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



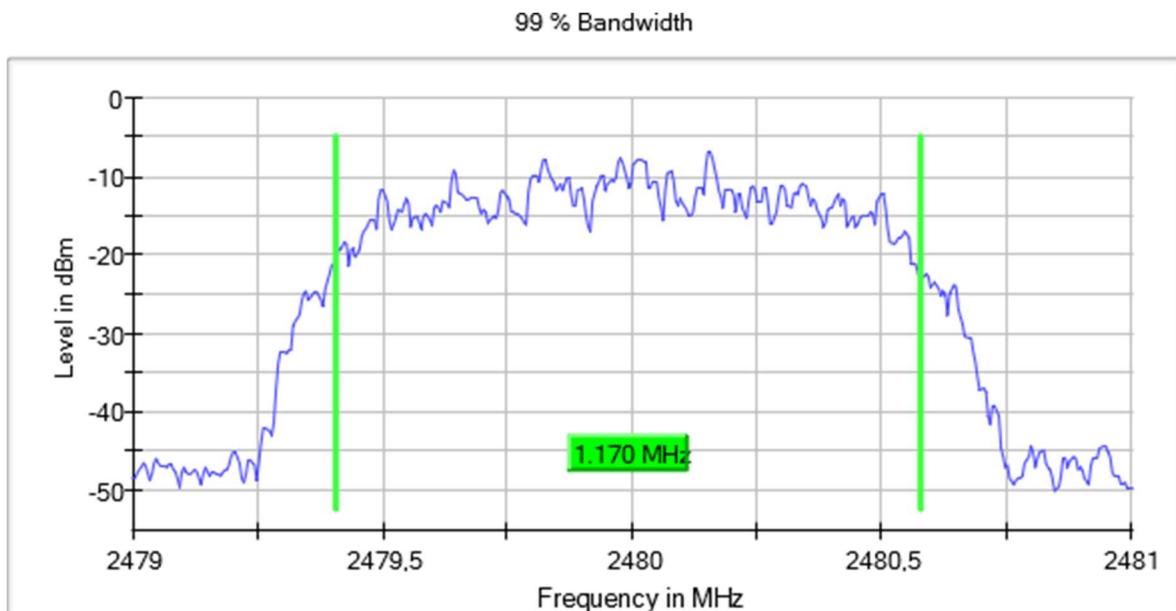
Operation Band MHz = [2400, 2483.5], Frequency MHz = 2480.00, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



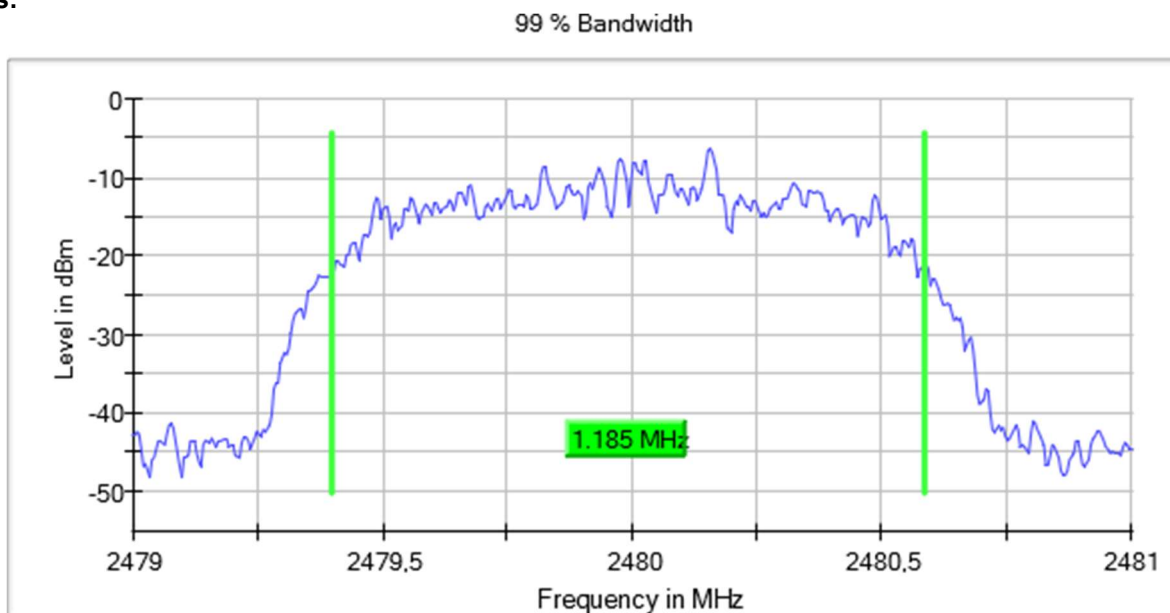
Operation Band MHz = [2400, 2483.5], Frequency MHz = 2480.00, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



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, Available Number of Channels = 1

Images:



RSS-247 5.1 (b) / FCC 15.247 (a) (1) [CFS] 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)	0.97733

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

Operation Band (MHz)	Equipment	Freq Sep (MHz)
[2400, 2483.5]	Frequency Hopping Spread Spectrum systems (DSS)	0.9833

Modulation: BT (8DPSK 3-DH5)

Operation Band (MHz)	Equipment	Freq Sep (MHz)
[2400, 2483.5]	Frequency Hopping Spread Spectrum systems (DSS)	0.97430

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

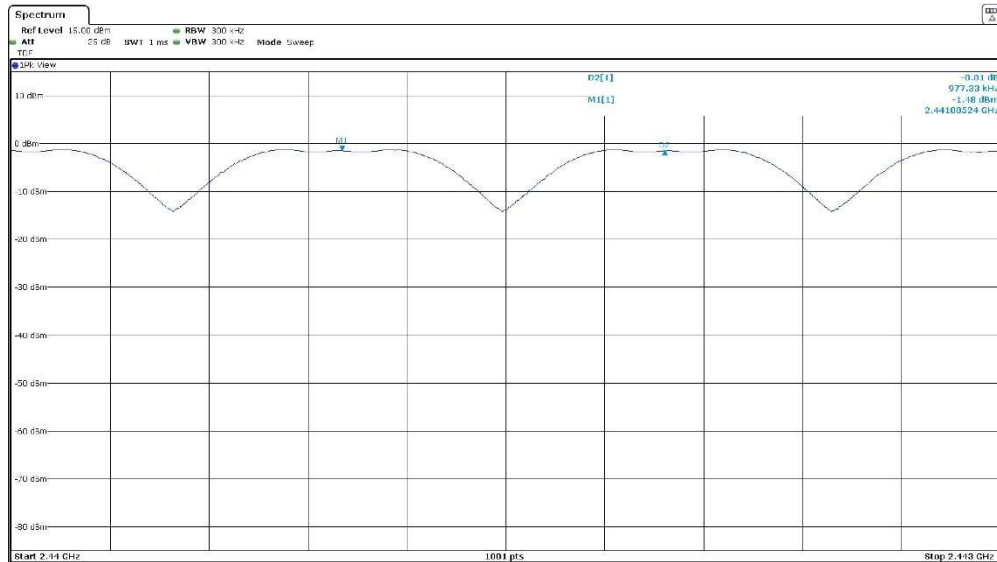
Verdict

Pass

Attachments

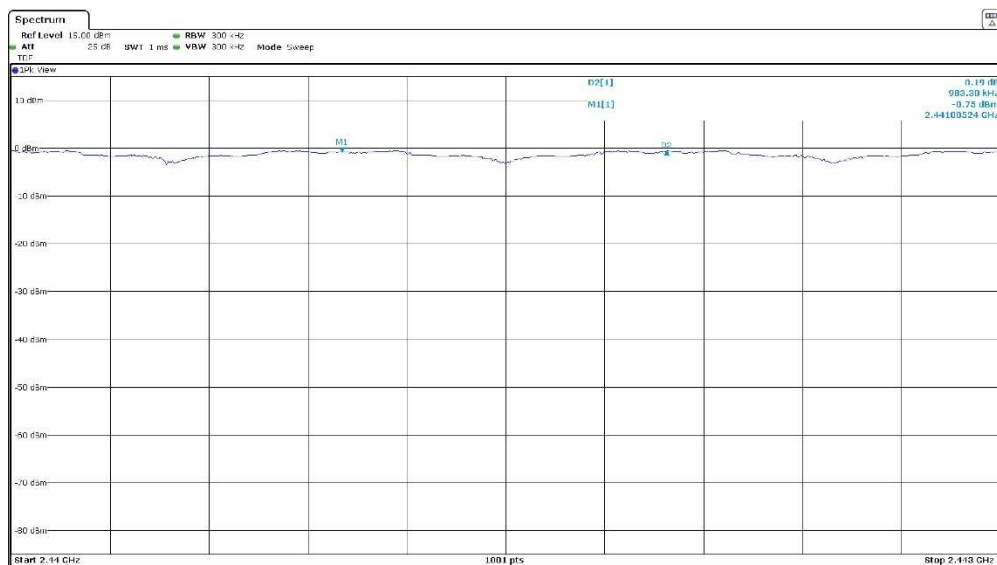
Operation Band MHz = [2400, 2483.5], Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



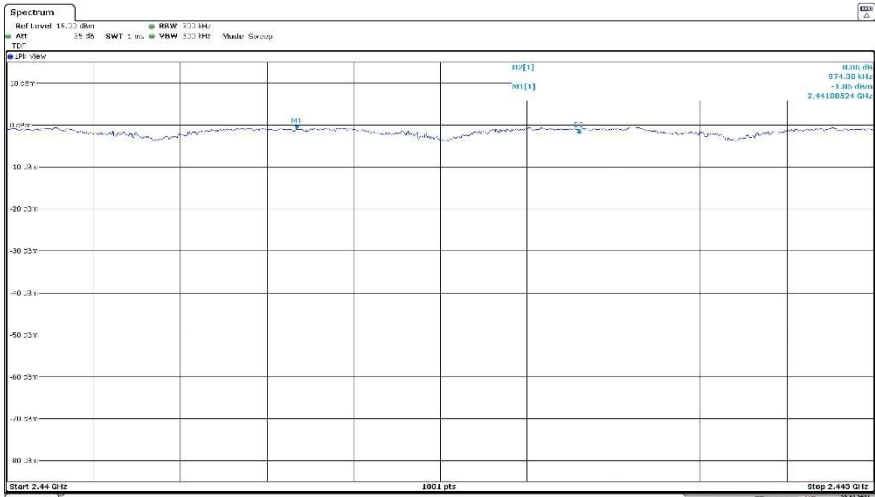
Operation Band MHz = [2400, 2483.5], Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



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

Images:



RSS-247 5.1 (d) / FCC 15.247 (a) (1) (iii) [DwT] 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 = $0.4 \times 79 = 31.6$ seconds.

Results

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)	112	317.560

Modulation: BT (8DPSK 3-DH5)

Operation Band (MHz)	Equipment	NHp	Avg COT (ms)
[2400, 2483.5]	Frequency Hopping Spread Spectrum systems (DSS)	114	323.350

Verdict

Pass

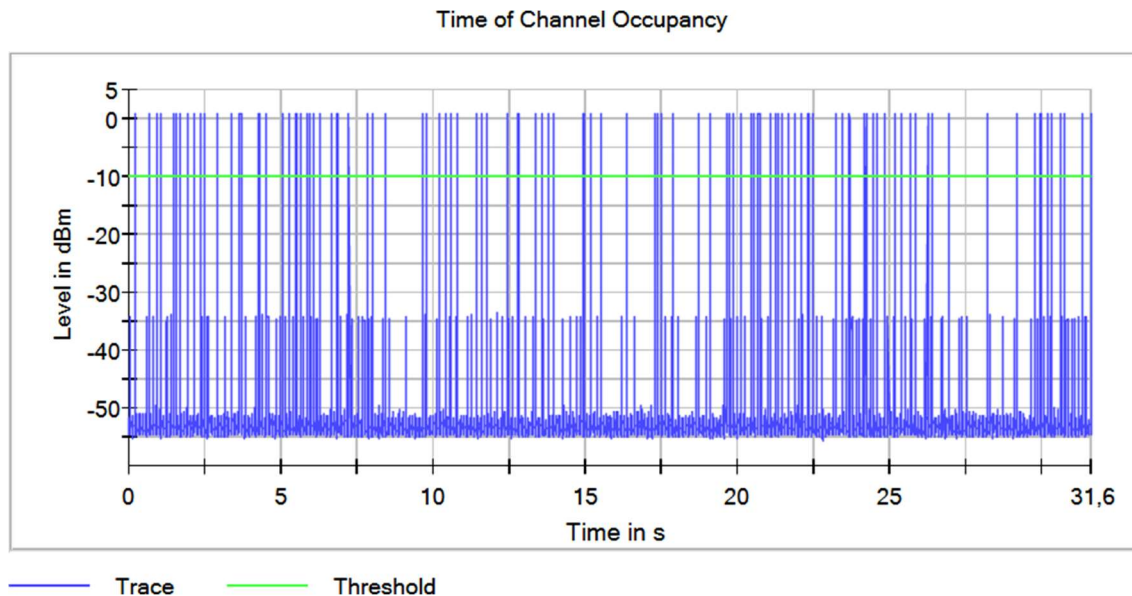
Uncertainty

Measurement uncertainty (%) $\leq \pm 0.53$

Attachments

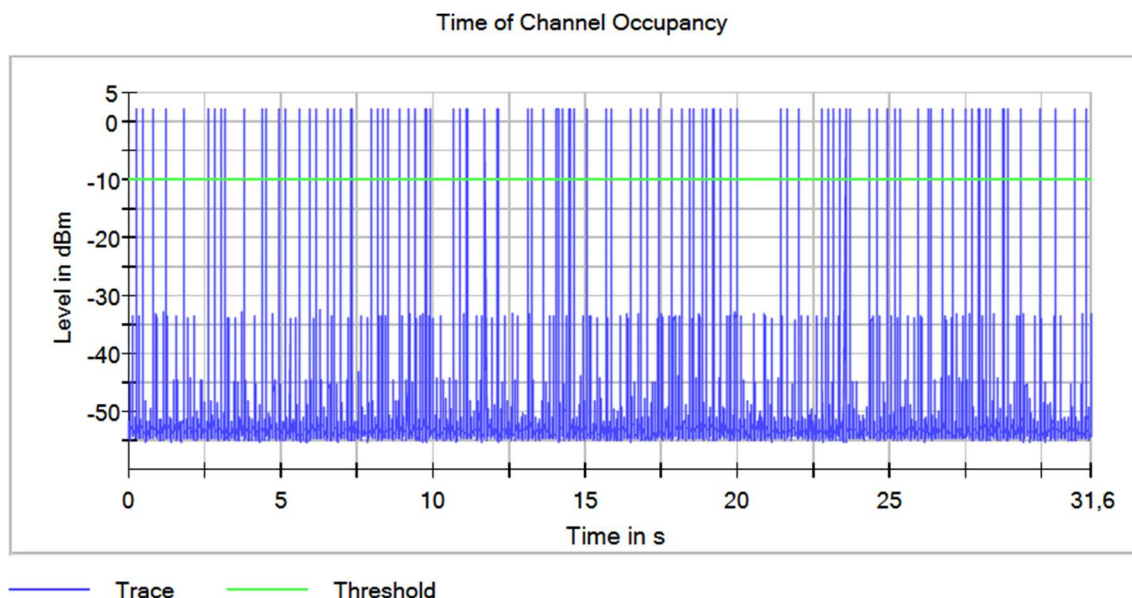
Operation Band MHz = [2400, 2483.5], Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



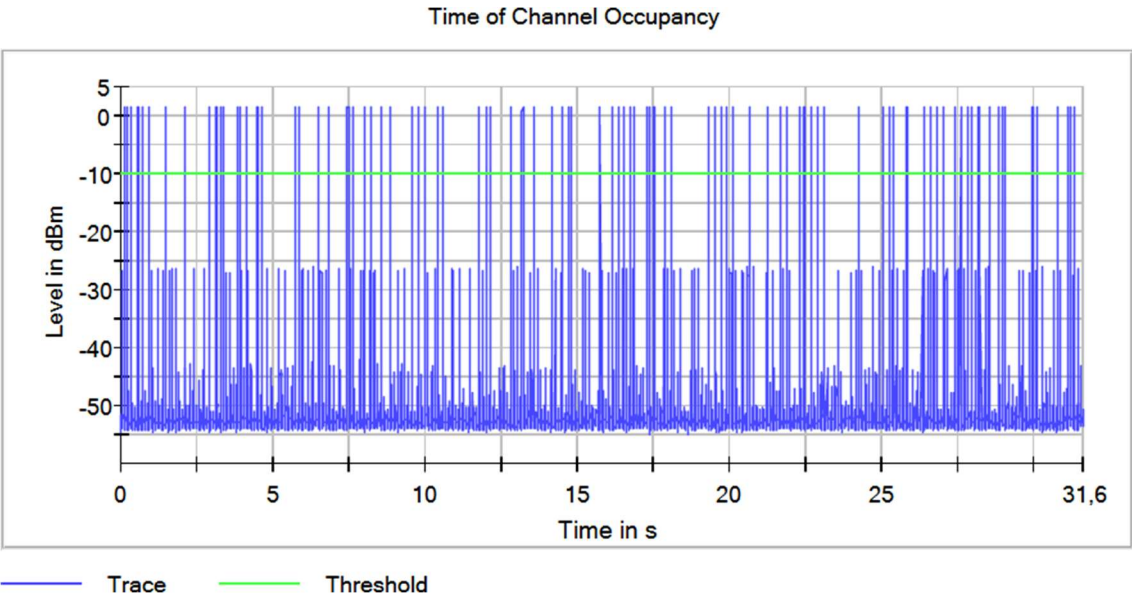
Operation Band MHz = [2400, 2483.5], Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



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

Images:



RSS-247 5.1 (d) / FCC 15.247 (a) (1) (iii) [NHC] 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
[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

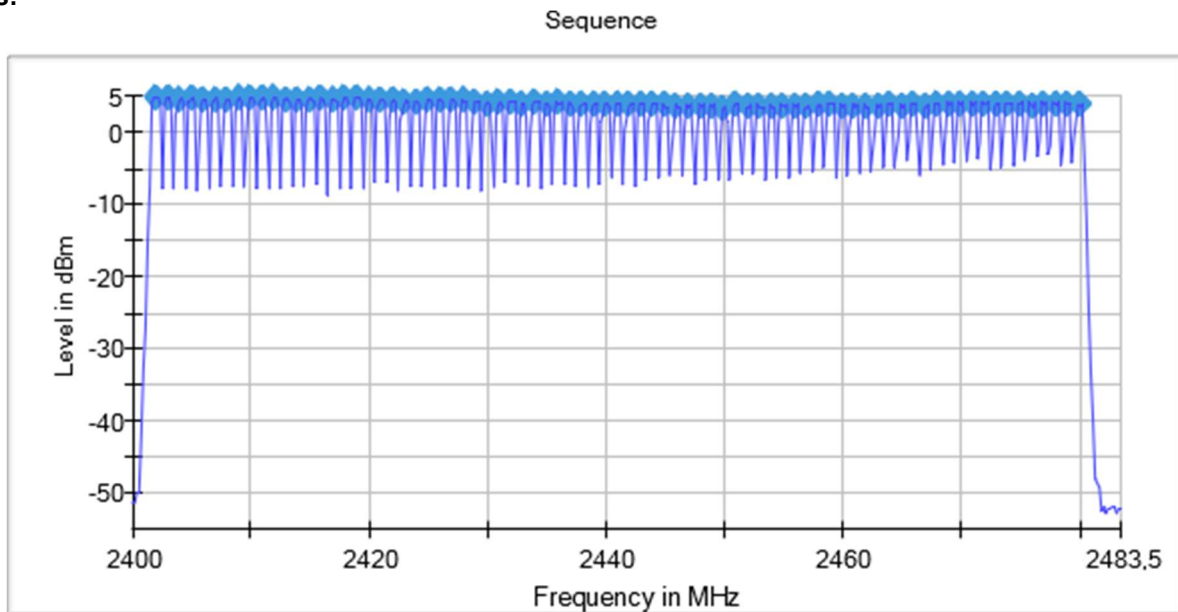
Verdict

Pass

Attachments

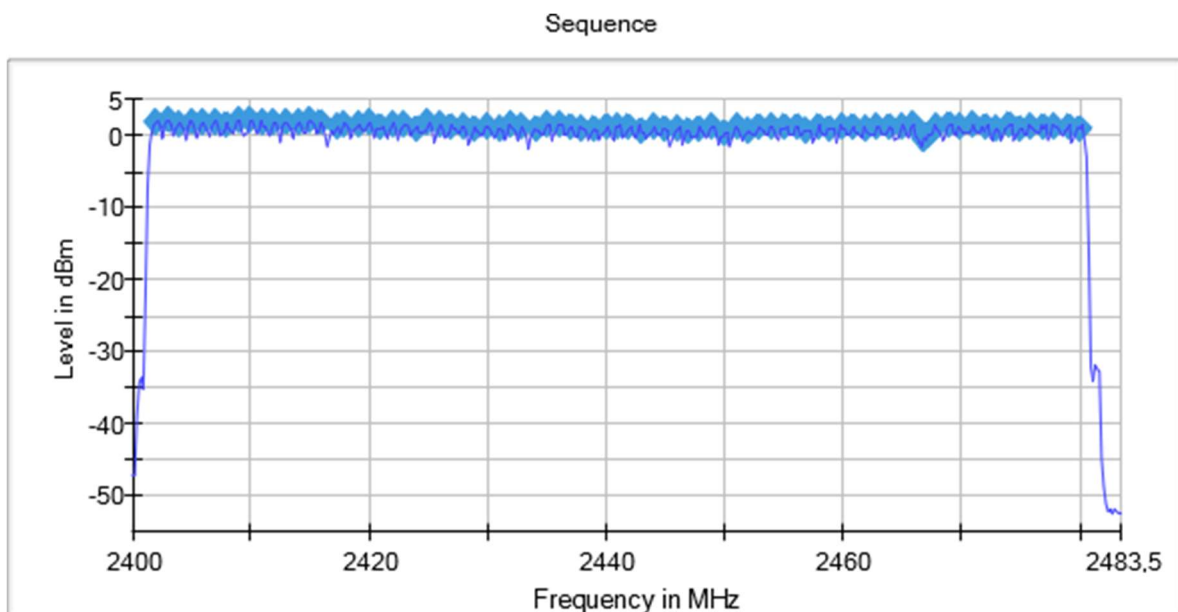
Operation Band MHz = [2400, 2483.5], Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



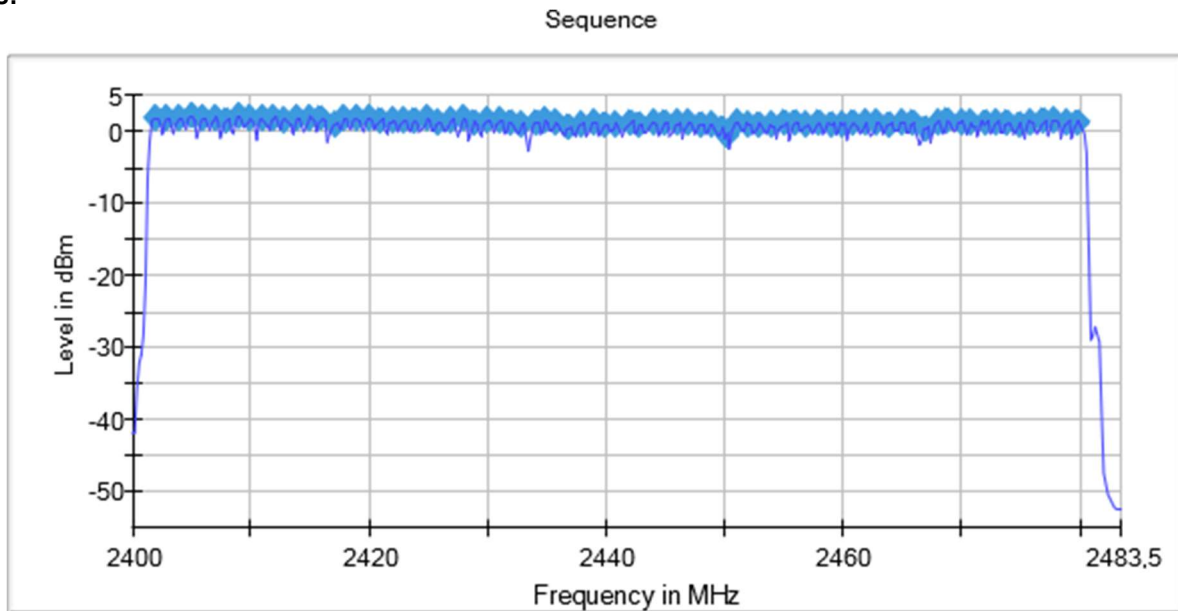
Operation Band MHz = [2400, 2483.5], Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BT (Pi/4 DQPSK 2-DH5), Number of Transmission Chains = 1, Available Number of Channels = 1

Images:



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

Images:



FCC 15.247 (b) / RSS-247 5.4 (b) Maximum peak output power and antenna gain

SPECIFICATION:

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 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.

- GFSK**

Peak Conducted Output Power	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
Maximum Conducted Power (dBm)	4.70	4.00	4.10
Maximum EIRP Power (dBm)	2.20	1.50	1.60
Measurement uncertainty (dB)	<±0.80		

- Pi/4 DQPSK**

Peak Conducted Output Power	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
Maximum Conducted Power (dBm)	3.80	3.20	3.30
Maximum EIRP Power (dBm)	1.30	0.70	0.80
Measurement uncertainty (dB)	<±0.80		

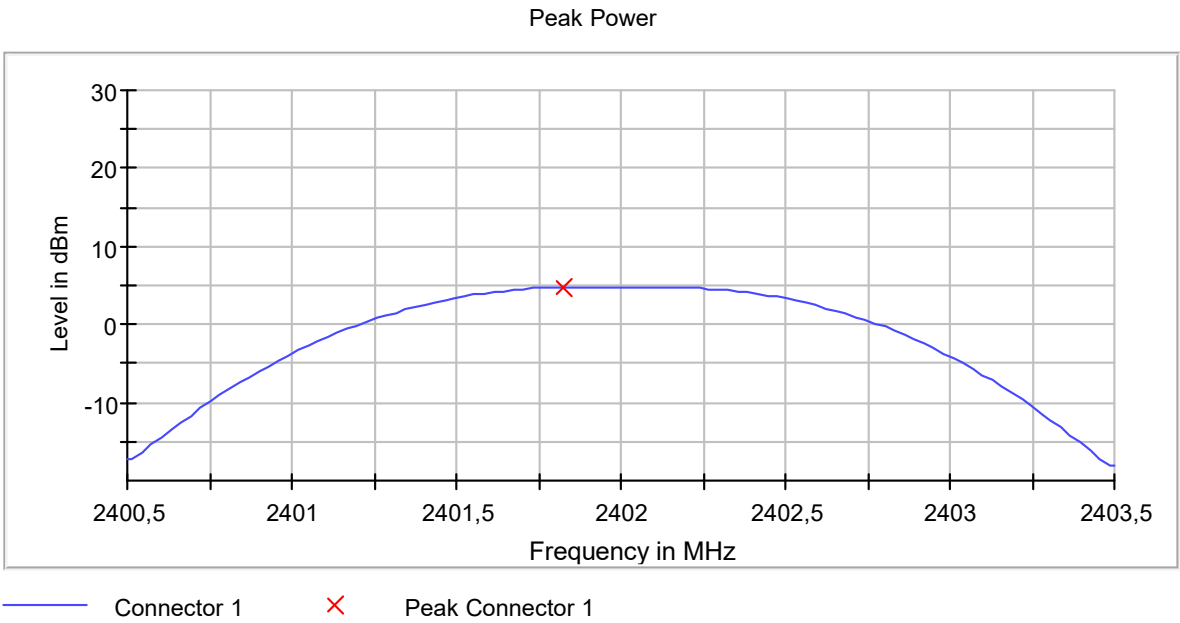
- 8DPSK**

Peak Conducted Output Power	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
Maximum Conducted Power (dBm)	4.30	3.60	3.70
Maximum EIRP Power (dBm)	1.80	1.10	1.20
Measurement uncertainty (dB)	<±0.80		

Verdict: PASS

• GFSK – Peak Output Power

- Low Channel:



- Middle Channel:

