N° 1-6736
Scope available
on www.cofrac.fr

CERTIFICATE #3478.01

TEST REPORT

EUT Description	**WLAN and BT, 2x2 PCIe M.2 1216 SD adapter card**
Brand Name	**Intel® Wi-Fi 6E AX211**
Model Name	**AX211D2WH**
FCC/IC ID	**FCCID: PD9AX211D2H/ IC 1000M-AX211D2H**
Date of Test Start/End	**2022-02-15 /2022-02-27**
Features	**802.11ax, Tri Band, 2x2 Wi-Fi 6E + Bluetooth® 5.2** (see section 5)

Applicant	**Intel Mobile Communications**
Address	**100 Center Point Circle, Suite 200** **Columbia, South Carolina 29210** **USA**
Contact Person	**Steven Hackett**
Telephone/Fax/ Email	**steven.c.hackett@intel.com**

Reference Standards	**FCC CFR Title 47 Part 15 C** **RSS-247 issue 2, RSS-Gen issue 5 A1** (see section 1)

Test Report identification	**220117-04.TR05**
Revision Control	**Rev. 01** **This test report revision replaces any previous test report revision** (see section 8)

The test results relate only to the samples tested.
Reference to accreditation shall be used only by full reproduction of test report.

Issued by	Reviewed by
Digitally signed by Khodor RIDA Date: 2022.05.10 11:57:43 +02'00'	Digitally signed by Ines KHARRAT Date: 2022.05.10 14:25:26 +02'00'
Khodor RIDA (Test Engineer Lead)	Ines KHARRAT (Technical Officer)

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Table of Contents

1. Standards, reference documents and applicable test methods

FCC	1. FCC Title 47 CFR part 15 - Subpart C – §15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz. 2019-10-01 Edition 2. FCC Title 47 CFR part 15 - Subpart C – §15.209 Radiated emission limits; general requirements. 2019-10-01 Edition 3. FCC OET KDB 558074 D01 v05r02 - Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules. 4. FCC OET KDB 662911 D01 v02r01 - Emissions Testing of Transmitters with Multiple Outputs in the Same Band. 5. ANSI C63.10-2013 - American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
ISED	1. RSS-247 Issue 2 - Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices. 2. RSS-Gen Issue 5 A1- General Requirements for Compliance of Radio Apparatus. 3. FCC OET KDB 558074 D01 v05r02 - Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules. 4. FCC OET KDB 662911 D01 v02r01 - Emissions Testing of Transmitters with Multiple Outputs in the Same Band. 5. ANSI C63.10-2013 - American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

2. General conditions, competences and guarantees

- ✓ Tests performed under FCC standards identified in section 1 are covered by A2LA accreditation.
- ✓ Tests performed under ISED standards identified in section 1 are covered by Cofrac accreditation.
- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is an ISO/IEC 17025:2017 laboratory accredited by the American Association for Laboratory Accreditation (A2LA) with the certificate number 3478.01.
- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is an Accredited Test Firm recognized by the FCC, with Designation Number FR0011.
- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is an ISO/IEC 17025:2017 testing laboratory accredited by the French Committee for Accreditation (Cofrac) with the certificate number 1-6736.
- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is a Registered Test Site listed by ISED, with ISED #1000Y.
- ✓ Intel WRF Lab declines any responsibility with respect to the identified information provided by the customer and that may affect the validity of results.
- ✓ Intel WRF Lab only provides testing services and is committed to providing reliable, unbiased test results and interpretations.
- ✓ Intel WRF Lab 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.
- ✓ Intel WRF Lab has developed calibration and proficiency programs for its measurement equipment to ensure correlated and reliable results to its customers.
- ✓ This report is only referred to the item that has undergone the test.
- ✓ This report does not imply an approval of the product by the Certification Bodies or competent Authorities.

3. Environmental Conditions

- ✓ At the site where the measurements were performed the following limits were not exceeded during the tests:

Temperature	22.8ºC ± 4.5ºC
Humidity	35.4% ± 12.7%

4. Test samples

Sample	Control #	Description	Model	Serial #	Date of receipt	Note
#01	220117-04.S05	WiFi 6E Module	AX211D2WH	2C0DA7F5B9B4	2022-01-19	RF Conducted
	180000-01.S01	Adapter 1216SD to M.2	Adapter M2	N/A	2017-08-09	
	170000-01.S02	Laptop	Latitude E5450	21HTPF2	2017-03-28	
	200611-01.S12	Extender	XVT EXTENDER SNJ A4	-	2020-11-30	
#02	220117-04.S01	WiFi 6E Module	AX211D2WH	7C0DA7F5B6AD	2022-01-19	Used for 30 MHz-1 GHz Radiated Spurious Emissions tests
	180001-01.S21	Socket	Socket WsP/ThP /GfP/HrP	-	2021-06-07	
	200611-01.S09	Adapter	PowerBy SNJ A4	-	2020-11-30	
	200602-03.S06	Absorber	-	-	2020-07-03	
	200803-01.S01	Extender	Adexelec	139245	2020-08-31	
	220117-04.S16	Laptop	Latitude 5401	7GJLK13	2022-02-11	
	220117-04.S10	Antenna 2.4GHz	WRF-6dBi-PIFA-2.4G	-	2022-02-09	
	220117-04.S13	Antenna 2.4GHz	WRF-6dBi-PIFA-2.4G	-	2022-02-09	
#03	220117-04.S01	WiFi 6E Module	AX211D2WH	7C0DA7F5B6AD	2022-01-19	Used for 1 GHz-26 GHz Radiated Spurious Emissions tests
	180001-01.S21	Socket	Socket WsP/ThP /GfP/HrP	-	2021-06-07	
	200611-01.S09	Adapter	PowerBy SNJ A4	-	2020-11-30	
	200602-03.S06	Absorber	-	-	2020-07-03	
	200611-03.S31	Extender	ADEXELEC	-	2020-08-19	
	200615-05.S09	Laptop	Latitude 5401	GVGLK13	2020-06-12	
	220117-04.S10	Antenna 2.4GHz	WRF-6dBi-PIFA-2.4G	-	2022-02-09	
	220117-04.S13	Antenna 2.4GHz	WRF-6dBi-PIFA-2.4G	-	2022-02-09	

5. EUT Features

The herein information is provided by the customer

<table>
<tr><td>Brand Name</td><td>Intel® Wi-Fi 6E AX211</td></tr>
<tr><td>Model Name</td><td>AX211D2WH</td></tr>
<tr><td>Software Version</td><td>DRTU_00699_99.0.69C (RSE tests only) / DRTU_11195_99_2100_51G</td></tr>
<tr><td>Driver Version</td><td>99.0.69.5</td></tr>
<tr><td>Prototype / Production</td><td>Production</td></tr>
<tr><td>Supported Radios</td><td>802.11b/g/n — 2.4GHz (2400.0 – 2483.5 MHz)
802.11a/n/ac/ax — 5.2GHz (5150.0 – 5350.0 MHz)
5.6GHz (5470.0 – 5725.0 MHz)
5.8GHz (5725.0 – 5825.0 MHz)
802.11ax — 6.0GHz (5925.0 - 7125.0MHz)
Bluetooth 5.2 — 2.4GHz (2400.0 – 2483.5 MHz)</td></tr>
<tr><td>Antenna Information</td><td>
<table>
<tr><th>Transmitter</th><th>Aux – port 1 (chain A)</th><th>Main – port 2 (chain B)</th></tr>
<tr><td>Manufacturer</td><td>Intel</td><td>Intel</td></tr>
<tr><td>Antenna type</td><td>PIFA antenna</td><td>PIFA antenna</td></tr>
<tr><td>Part number</td><td>WRF-6dBi-PIFA-2.4G</td><td>WRF-6dBi-PIFA-2.4G</td></tr>
<tr><td>Declared antenna gain (dBi) 2.4GHz</td><td>+6.40 dBi</td><td>+6.40 dBi</td></tr>
</table>
</td></tr>
</table>

6. Remarks and comments

1. No deviations were made from the test methods listed in section 1 of this report

7. Test Verdicts summary

The statement of conformity to applicable standards in the table below are based on the measured values, without taking into account the measurement uncertainties.

7.1. BT Basic Rate / Enhanced Data Rate

FCC part	RSS part	Test name	Verdict
15.247 (a) (1)	RSS-247 Clause 5.1 (a) and (b)	20dB Bandwidth and Carrier frequency separation	P
15.247 (a) (1) (iii)	RSS-247 Clause 5.1 (d)	Number of hopping channels	P
15.247 (a) (1) (iii)	RSS-247 Clause 5.1 (d)	Time of Occupancy (Dwell Time)	P
15.247 (b) (1)	RSS-247 Clause 5.4 (b)	Maximum Peak Output Power and antenna gain	P
15.247 (d)	RSS-247 Clause 5.5	Out-of-band Emissions (conducted)	P
15.247 (d) 15.209	RSS-247 Clause 5.5 RSS-GEN A1 Clause 8.9	Out-of-band Emissions (radiated)	P

P: Pass
F: Fail
NM: Not Measured
NA: Not Applicable

8. Document Revision History

Revision #	Modified by	Revision Details
Rev. 00	N. Bui, V. Kaculini	First Issue
Rev. 01	C. REQUIN	Antenna reference of the 2.4 GHz updated

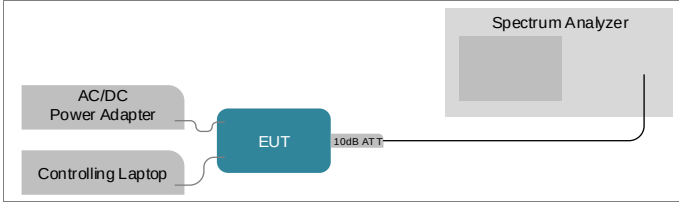
Annex A. Test & System Description

A.1 Measurement System

Measurements were performed using the following setups.

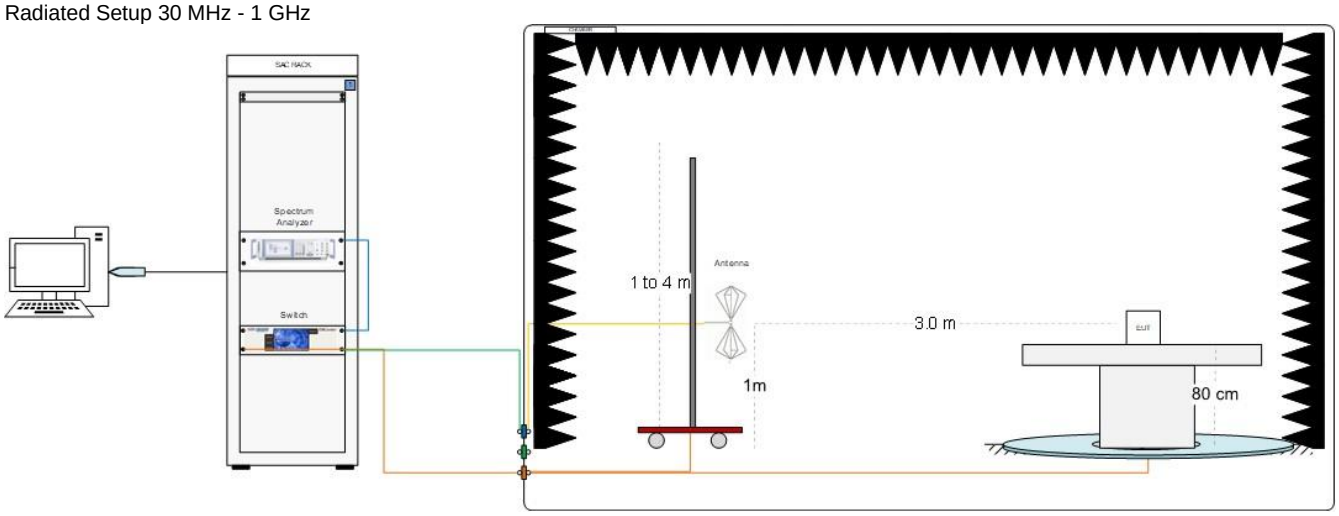
The DUT was installed in a test fixture and this test fixture is connected to a laptop computer and AC/DC power adapter. The laptop computer was used to configure the EUT to continuously transmit at a specified output power using all different modes and modulation schemes.

Conducted test setup

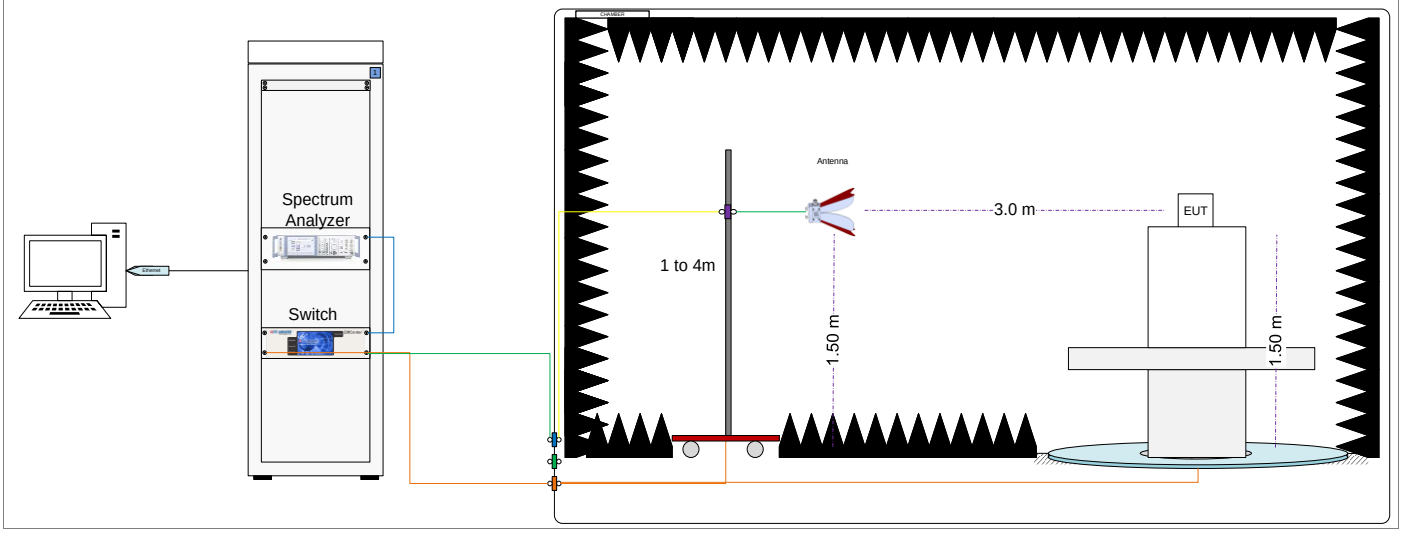


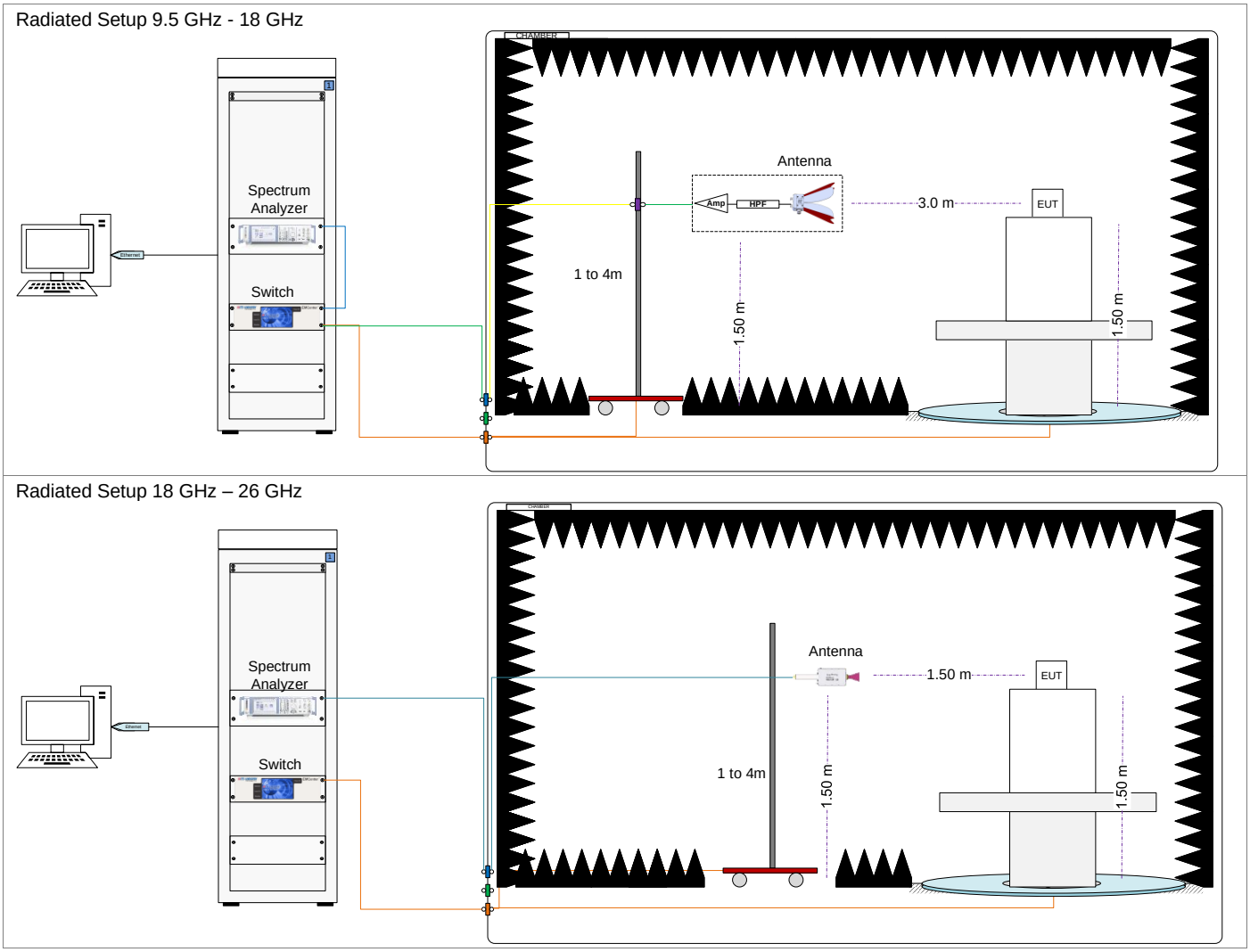
Radiated test setup

Radiated Setup 30 MHz - 1 GHz



Radiated Setup 1 GHz – 9.5 GHz





Sample Calculation

The spurious received voltage V(dBuV) in the spectrum Analyzer is converted to Electric field strength using the transducer factor F corresponding to the Rx path Loss:

F (dB/m)= Rx Antenna Factor (dB/m) + Cable losses (dB) – Amplifiers Gain (dBi)

E (dBuV/m) = V(dBuV) + F (dB/m)

For field strength measurements made at other than the distance at which the applicable limit is specified, the field strength of the emission at the distance specified by the limit is deduced as follows:

$$E_{SpecLimit} = E_{Meas} + 20*\log(D_{Meas}/D_{SpecLimit})$$

where

$E_{SpecLimit}$ is the field strength of the emission at the distance specified by the limit, in dBµV/m
E_{meas} is the field strength of the emission at the measurement distance, in dBµV/m
D_{meas} is the measurement distance, in m
$D_{specLimit}$ is the distance specified by the limit, in m

A.2 Test Equipment List

Conducted setup

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
265-000	Spectrum Analyzer	FSV30	101318	Rohde & Schwarz	2020-05-28	2022-05-28
019-000	RF cable 100cm	PE360-100CM	N/A	PASTERNACK	2022-02-04	2022-08-04
019-002	10dB Attenuator + MH4	N/A	N/A	N/A	2022-02-04	2022-08-04
322-000	Temp & Humidity Logger	RA12E-TH1-RAS	RA12-B89702	AVTECH	2021-09-02	2023-09-02
413-000	Measurement SW v1.5.4.2	Octopi	N/A	Step AT	N/A	N/A

Radiated Setup #1

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
006-000	Anechoic chamber	FACT 3	5720	ETS Lindgren	2022-01-12	2024-01-12
006-001	Turntable	-	-	ETS Lindgren	NA	NA
006-008	Measurement Software v11.30.00	EMC32	100623	Rohde & Schwarz	N/A	N/A
147-000	Spectrum analyzer	FSW43	101847	Rohde & Schwarz	2020-11-02	2022-11-02
006-002	Switch & Positioning	EMC center	00159757	ETS Lindgren	N/A	N/A
006-011	Boresight antenna mast	BAM4.0-P	P/278/2890.01	Maturo	N/A	N/A
006-019	Biconical antenna 30 MHz – 1 GHz	UBAA9115 + BBVU9135 + DGA9552N	0286 + CH 9044	Schwarzbeck	2022-02-01	2024-02-01
006-020	Double Ridged Horn Antenna 1 GHz – 18 GHz	3117	00157734	ETS Lindgren	2021-08-05	2023-08-05
057-000	Horn Antenna 3117 + Amplifier + HPF9.5	3117	00167062+00169546	ETS-Lindgren	2020-06-15	2022-06-15
007-008	Double Horn Ridged antenna	3116C-PA	00169308bis + 00196308	ETS-Lindgren	2021-08-05	2023-08-05
006-058	RF Cable 7.5m	TestPro5	20 50 162	Radiall	2022-02-08	2022-08-08
006-051	RF Cable 1.0m	CBL-1.5M-SMSM+	202879	Mini-Circuits	2022-02-02	2022-08-02
006-030	RF Cable 1.2m	UFA147A-0-0480-200200	MFR 64639223720-003	Micro-coax	2022-02-02	2022-08-02
006-034	RF Cable 1.0m	UFA147A	-	Utilflex	2022-02-02	2022-08-02
006-036	RF Cable 1.0m	UFB311A-0-0590-50U50U	MFR 64639 223230-001	Micro-coax	2022-02-02	2022-08-02
006-038	RF Cable 7.0m	R286304009	-	Radiall	2022-02-02	2022-08-02
006-039	RF Cable 2.5m	0500990992500KE	19.23.395	Radiall	2022-02-02	2022-08-02
365-000	Temperature & Humidity logger	RA12E-TH1-RAS	00-80-A3-E1-6E-55	Avtech	2021-03-08	2023-03-08

N/A: Not Applicable

Radiated Setup #2

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
007-000	Anechoic chamber	RFD-FA-100	5996	ETS Lindgren	2021-09-14	2023-09-14
007-002	Turntable	-	-	ETS Lindgren	N/A	N/A
007-003	Antenna Tower	2171B-3.0M	00150123	ETS Lindgren	N/A	N/A
007-006	Switch & Positioner	EMCenter	00151232	ETS Lindgren	N/A	N/A
007-005	Measurement SW, V11.20.00	EMC32	100401	Rohde & Schwarz	N/A	N/A
127-000	Spectrum Analyzer	FSV40	101358	Rohde & Schwarz	2021-01-15	2023-01-15
007-007	Double Ridge Horn (1-18GHz)	3117	00152266	ETS Lindgren	2020-03-18	2022-03-18
057-000	Horn Antenna 3117 + Amplifier + HPF9.5	3117	00167062+00169546	ETS-Lindgren	2020-06-15	2022-06-15
007-008	Double Horn Ridged antenna	3116C-PA	00169308bis + 00196308	ETS-Lindgren	2021-08-05	2023-08-05
007-022	RF Cable 1-18GHz, 1.5m	0501050991200GX	19.23.493	Radiall	2022-02-03	2022-08-03
007-020	RF Cable 1-18GHz, 1.2 m	2301761761200PJ	12.22.1104	Radiall	2022-02-03	2022-08-03
007-011	RF Cable 1-18GHz – 6.5m	140-8500-11-51	001	Spectrum	2022-02-03	2022-08-03
007-015	RF Cable 1GHz-18GHz 1.5m	-	-	Spirent	2022-02-03	2022-08-03
007-014	RF Cable 18-40 GHz 6m	R286304009	1747364	Radiall	2022-02-03	2022-08-03
007-023	RF Cable 1m DC-40GHz	PE360-100CM	-	Pasternack	2022-02-03	2022-08-03
007-018	RF Cable 1-9.5GHz 1.2m	0500990991200KE	-	Radiall	2022-02-03	2022-08-03
325-000	Temp & Humidity Logger	RA12E-TH1-RAS	RA12-B9B7C6	Avtech	2022-01-17	2024-01-17

N/A: Not Applicable

Shared Radiated Equipment

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
412-000	DRTU Power finder V2.0	-	-	Intel	NA	NA
139-000	Power Sensor	NRP-Z81	104383	Rohde & Schwarz	2021-04-07	2023-04-07
140-000	Power Sensor	NRP-Z81	104382	Rohde & Schwarz	2020-04-08	2022-04-08

A.3 Measurement Uncertainty Evaluation

The system uncertainty evaluation is shown in the table below with a coverage factor of k = 2 to indicate a 95% level of confidence:

Measurement type	Uncertainty	Unit
Timing	±0.12	%
Power Spectral density	±1.47	dB
Occupied bandwidth	±2.07	%
Conducted Power	±1.03	dB
Conducted Out of band Emission <7 GHz	±1.67	dB
Radiated tests <1GHz	±6.07	dB
Radiated tests 1GHz – 26.5 GHz	±5.92	dB

Annex B. Test Results

The herein test results were performed by:

Test case measurement	Test Personnel
20dB Bandwidth and Carrier frequency separation	C.Requin, V.Kaculini
Number of hopping channels	C.Requin, V.Kaculini
Time of Occupancy (Dwell Time)	C.Requin, V.Kaculini
Maximum Peak Output Power and antenna gain	C.Requin, V.Kaculini
Out-of-band Emissions (conducted)	C.Requin, V.Kaculini
Out-of-band Emissions (radiated)	K.Khatib, R.Simonini, N.Bui

B.1 20dB Bandwidth and carrier frequency separation

B.1.1 Test limits

FCC part	RSS part	Limits
15.247 (a) (1)	RSS-247 Clause 5.1 (a) and (b)	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.

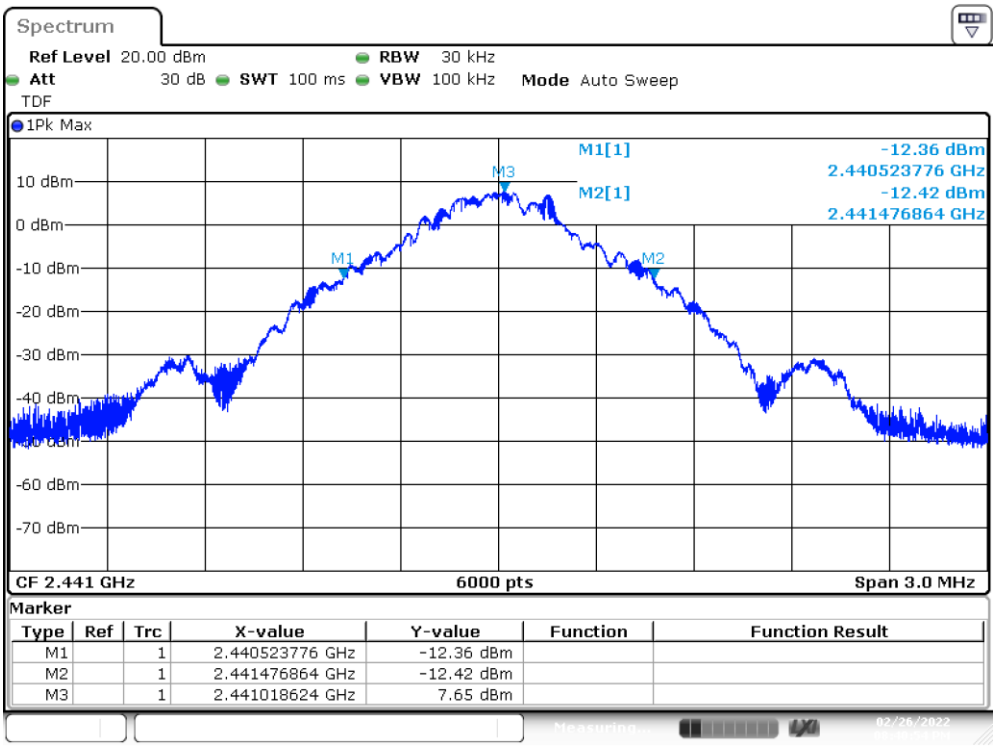
B.1.2 Results tables

Mode	Packet Type	Channel Number	Frequency [MHz]	20dB BW [MHz]	Freq. Separation [kHz]
Basic Rate GFSK	DH5	0	2402	0.947	1000.25
		39	2441	0.953	
		78	2480	0.945	
EDR π/4-DQPSK	2DH5	0	2402	1.407	1000.25
		39	2441	1.409	
		78	2480	1.399	
EDR 8-DPSK	3DH5	0	2402	1.419	1000.25
		39	2441	1.423	
		78	2480	1.418	

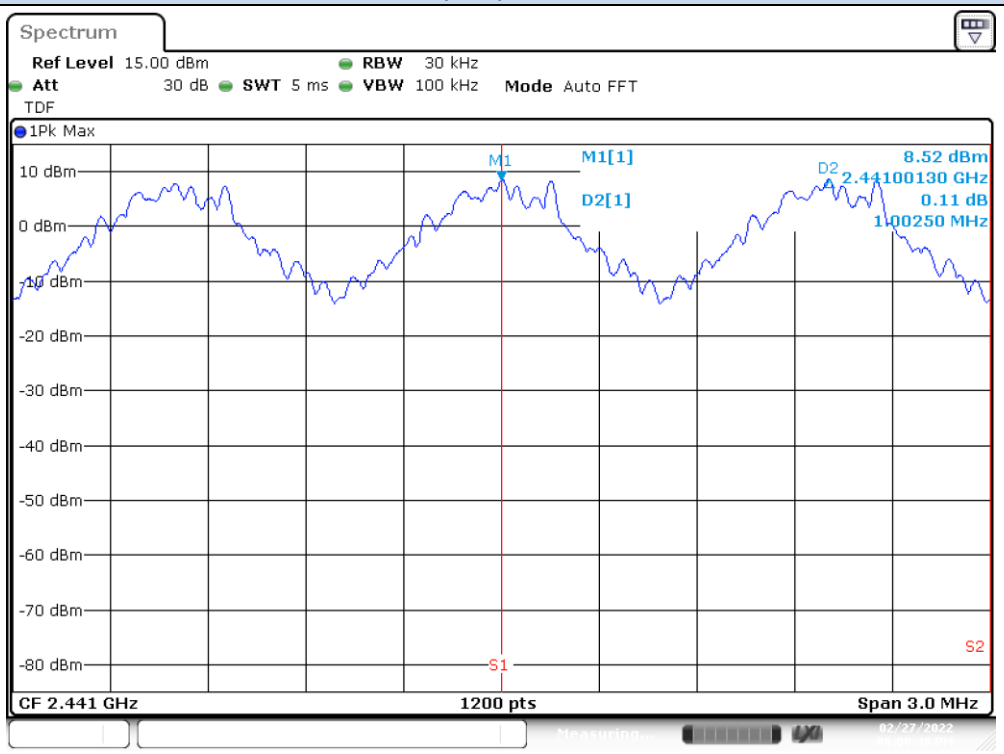
B.1.3 Results screenshot

Basic Rate - GFSK

20dB BW – CH39

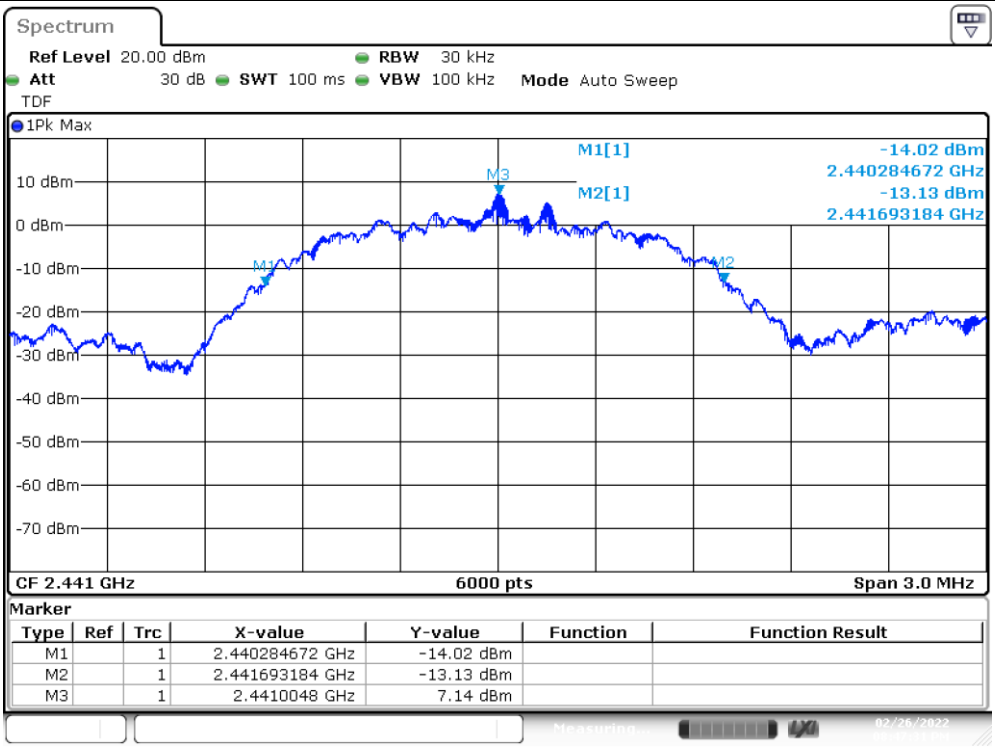


Freq. Separation

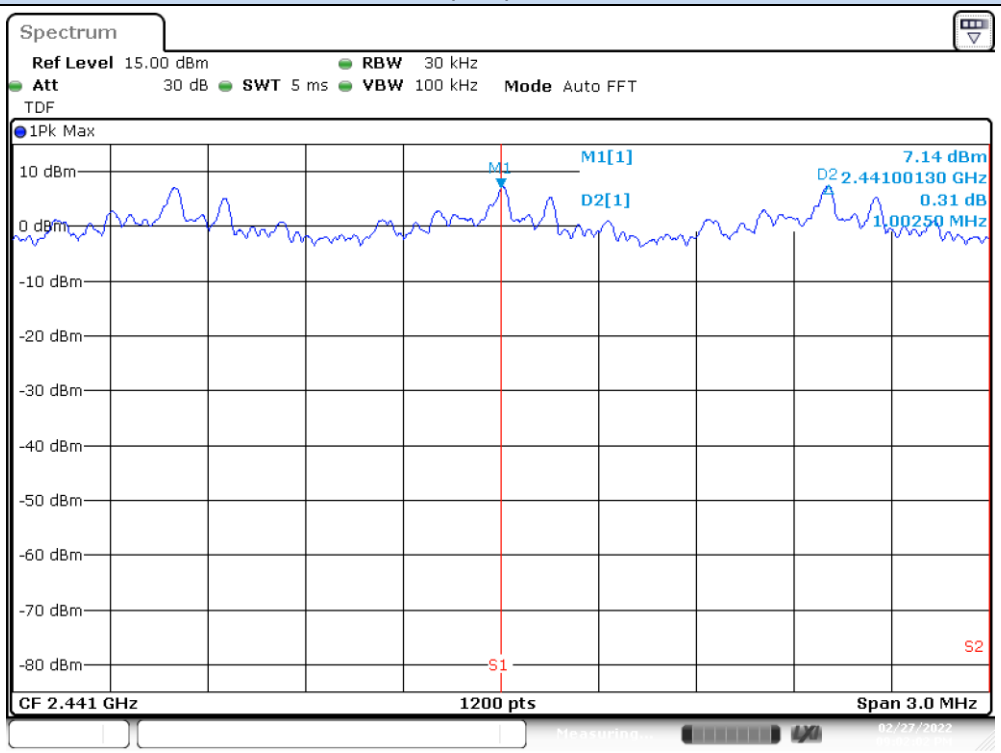


EDR – π/4-DQPSK

20dB BW – CH39

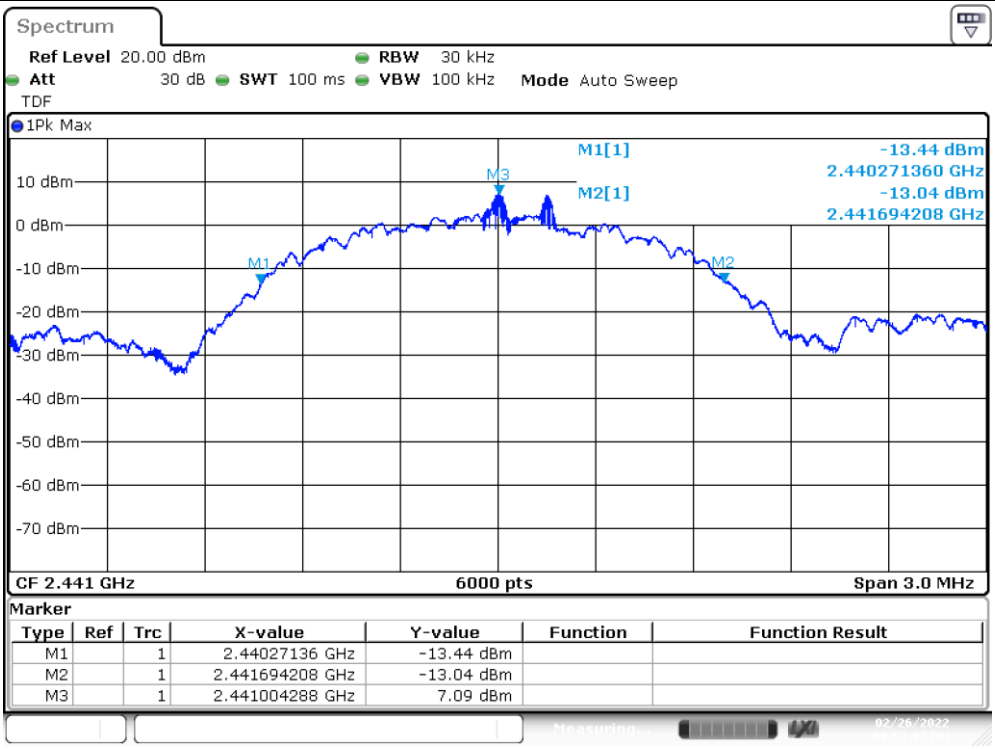


Freq. Separation

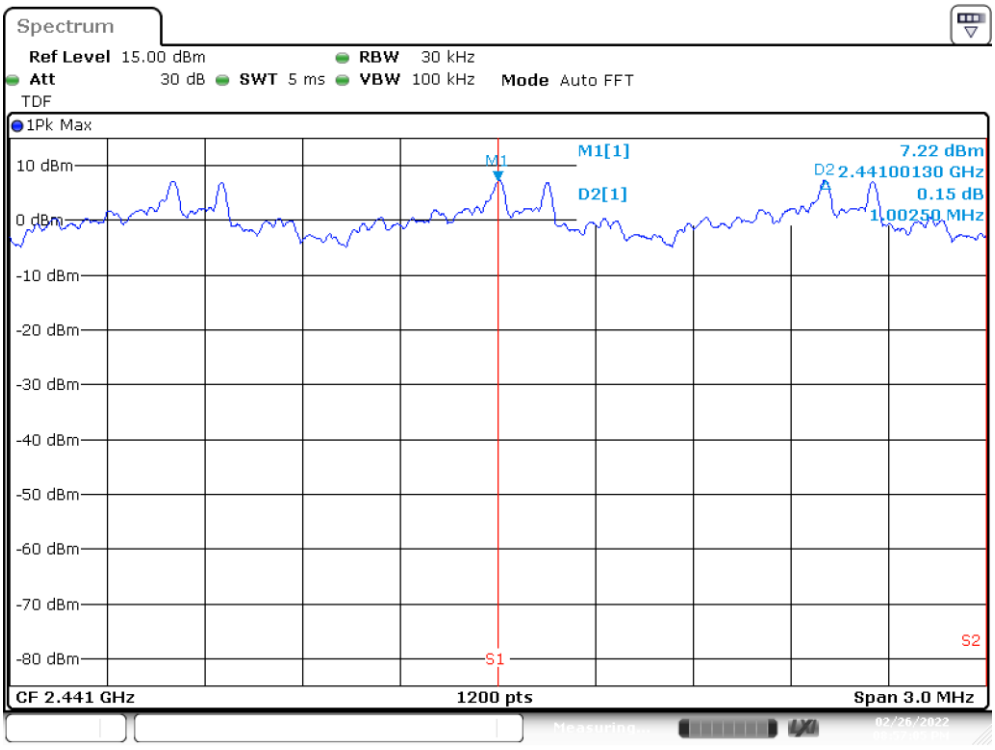


EDR – 8-DPSK

20dB BW – CH39



Freq. Separation



B.2 Number of hopping channels

B.2.1 Test limits

FCC part	RSS part	Limits
15.247 (a) (1) (iii)	RSS-247 Clause 5.1 (d)	Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

B.2.2 Test procedure

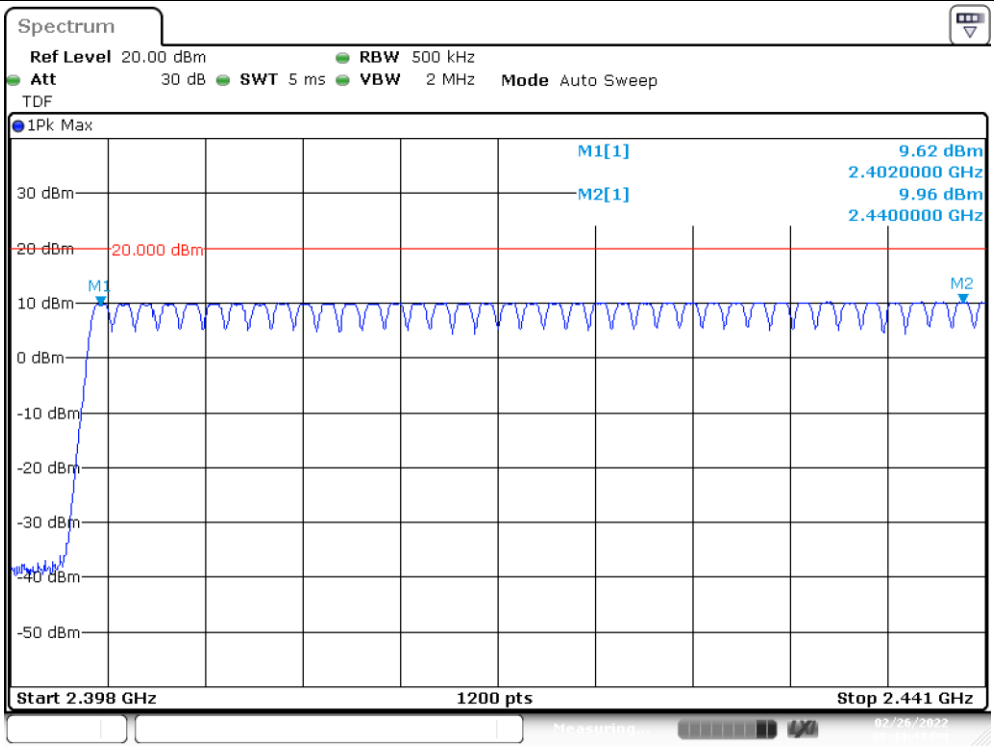
The conducted setup shown in section *Test & System Description* was used to measure the number of hopping channels. The antenna terminal of the EUT is connected to the spectrum through an attenuator, and the spectrum analyzer reading is compensated to include the RF path loss.

B.2.3 Results tables

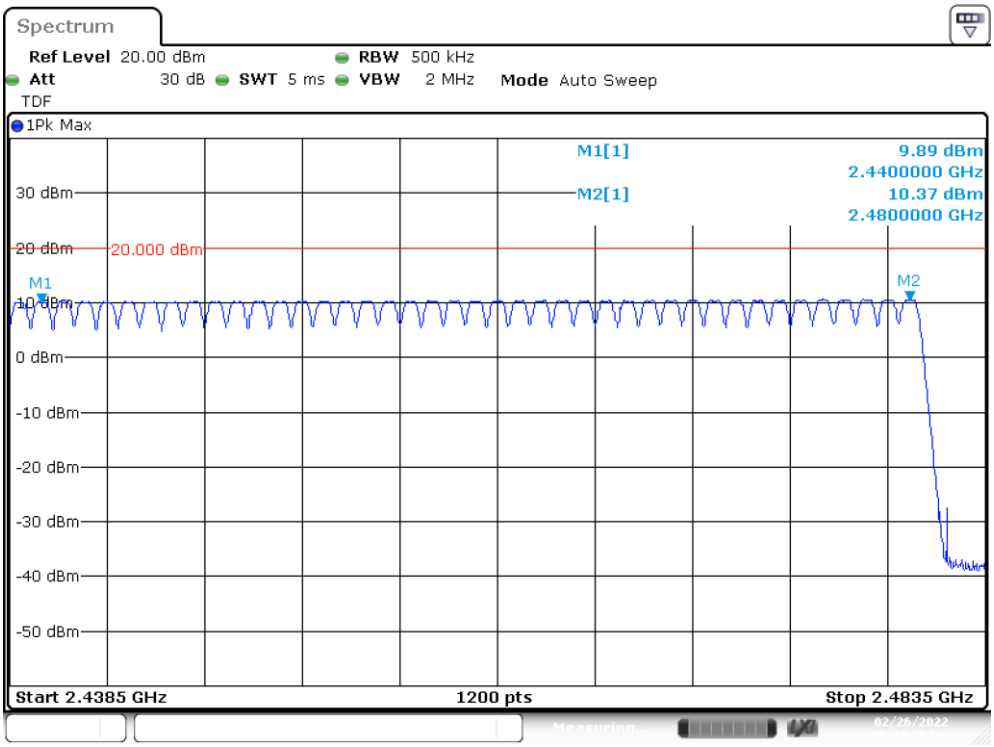
Mode	Packet Type	Number of hopping channels
Basic Rate GFSK	DH5	79
EDR π/4-DQPSK	2DH5	79
EDR 8-DPSK	3DH5	79

Number of hopping channels

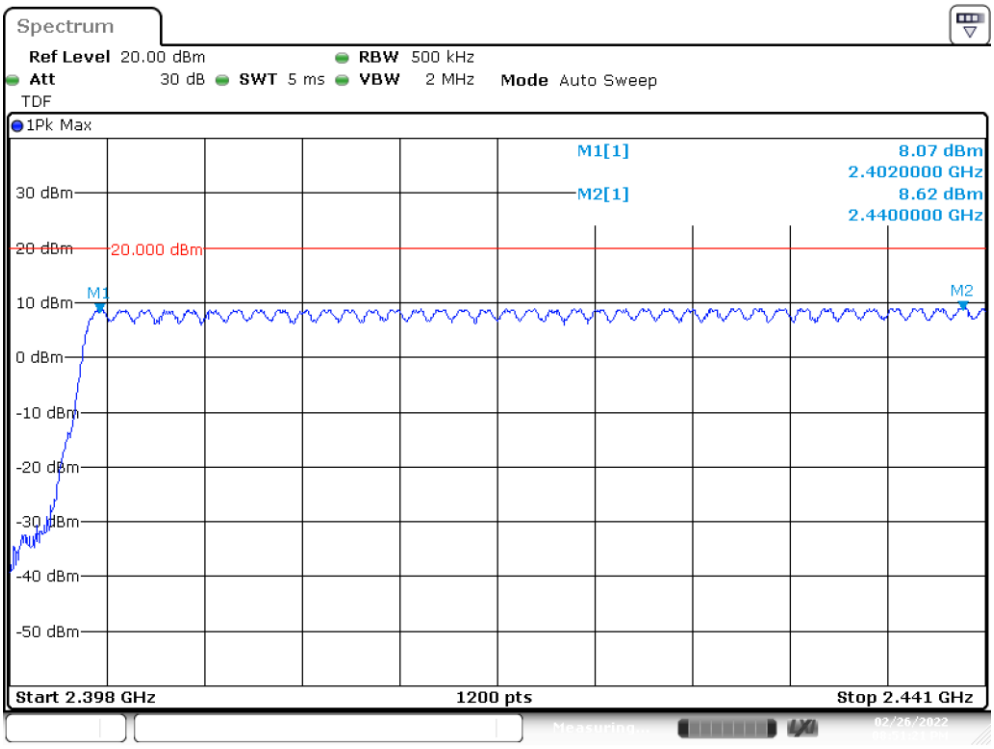
Basic Rate – GFSK



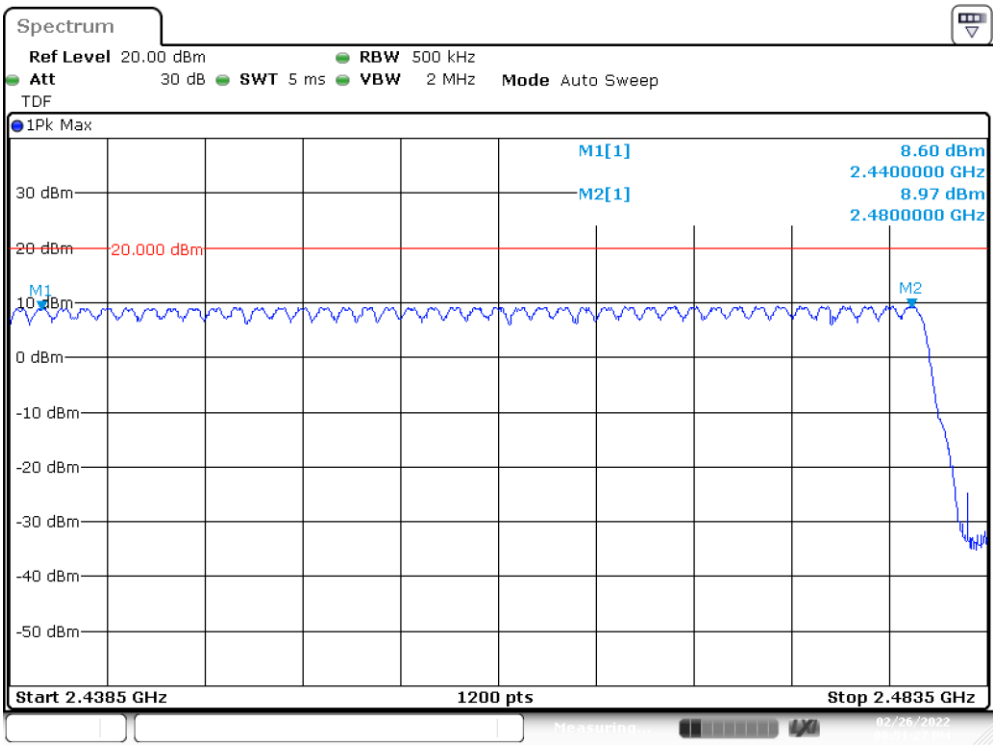
Basic Rate – GFSK



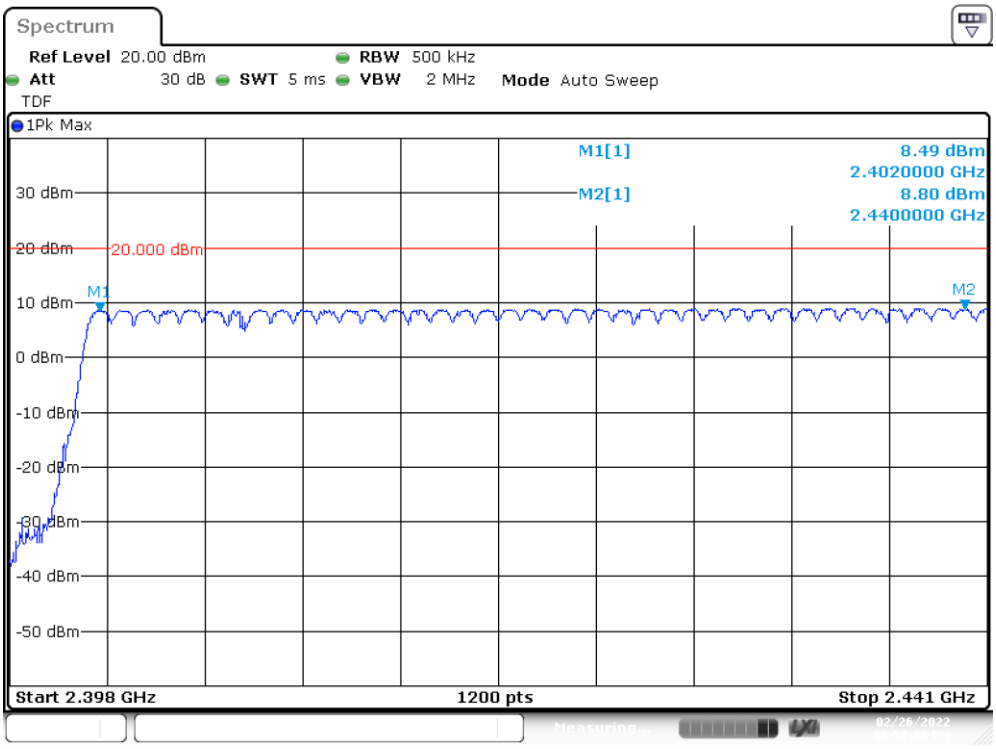
EDR – π/4-DPSK



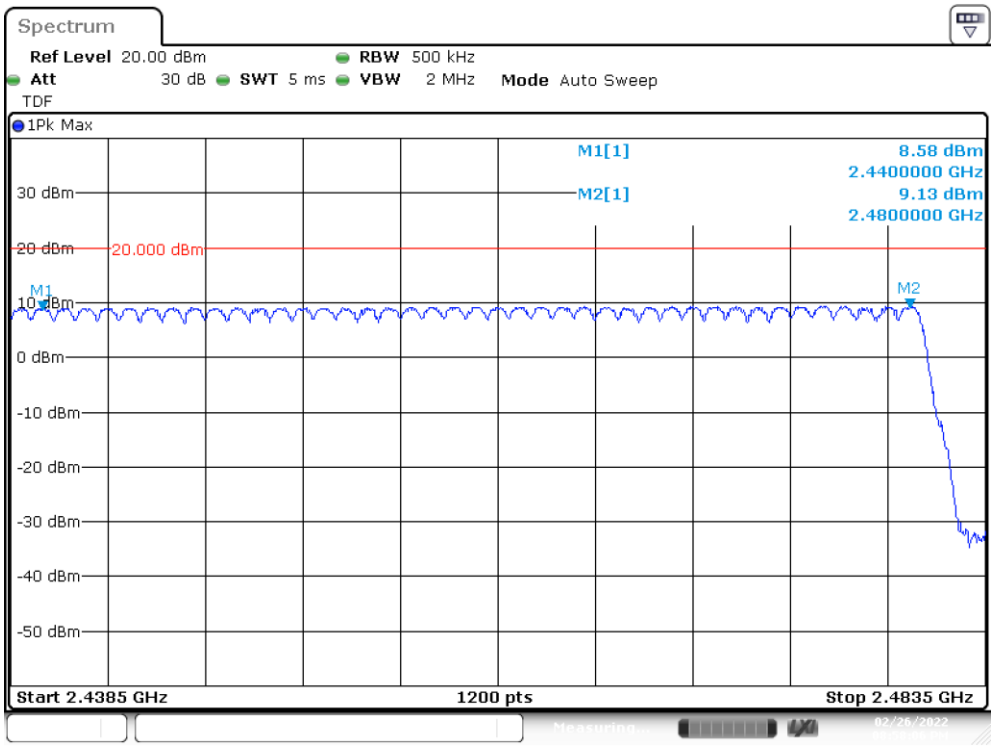
EDR – π/4-DPSK



EDR – 8-DPSK



EDR – 8-DPSK



B.3 Time of Occupancy (Dwell Time)

FCC part	RSS part	Limits
15.247 (a) (1) (iii)	RSS-247 Clause 5.1 (d)	The average time of occupancy (Dwell Time) on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

B.3.1 Test procedure

The conducted setup shown in section *Test & System Description* was used to measure the dwell time. The antenna terminal of the EUT is connected to the spectrum through an attenuator, and the spectrum analyzer reading is compensated to include the RF path loss.

In the worst case, the system makes 1600 hops per second with 79 channels, providing a 1 timeslot length of 625µs.

A DH1 packet, with independence of the modulation, needs 1 time slot for transmitting and 1 time slot for receiving. Then, the system makes in the worst case 1600/2 = 800 hops per second with 79 channels. So each channel appears 800/79 = 10.13 times per second and, for a period of 0.4 x 79 = 31.6 seconds, each channel appears 10.13 x 31.6 = 320.11 times.

A DH3 packet, with independence of the modulation, needs 3 time slots for transmitting and 1 time slot for receiving. Then, the system makes in the worst case 1600/4 = 400 hops per second with 79 channels. So each channel appears 400/79 = 5.1 times per second and, for a period of 0.4 x 79 = 31.6 seconds, each channel appears 5.1 x 31.6 = 161.16 times.

A DH5 packet, with independence of the modulation, needs 5 time slots for transmitting and 1 time slot for receiving. Then, the system makes in the worst case 1600/6 = 266.67 hops per second with 79 channels. So each channel appears 166.67/79 = 3.37 times per second and, for a period of 0.4 x 79 = 31.6 seconds, each channel appears 3.37 x 31.6 = 106.49 times.

Thus, the total time of occupancy is obtained by multiplying the calculated maximum number of appearances per packet type and the measured Tx-time, as shown in the results screenshots.

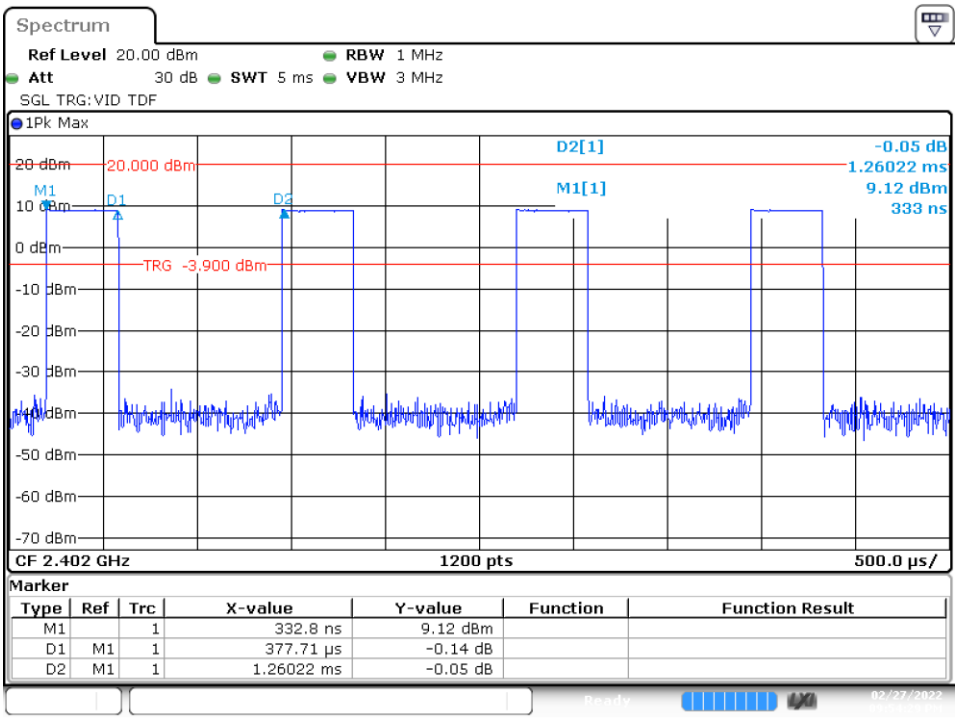
B.3.2 Results tables

Mode	Packet Type	Times of appearance	Tx-time [ms]	Dwell Time [ms]
Basic Rate GFSK	DH1	320.11	0.377	120.68
	DH3	161.16	1.624	261.72
	DH5	106.49	2.871	305.73
EDR π/4-DQPSK	2-DH1	320.11	0.384	122.92
	2-DH3	161.16	1.631	262.85
	2-DH5	106.49	2.871	305.73
EDR 8-DPSK	3-DH1	320.11	0.384	122.92
	3-DH3	161.16	1.631	262.85
	3-DH5	106.49	2.871	305.73

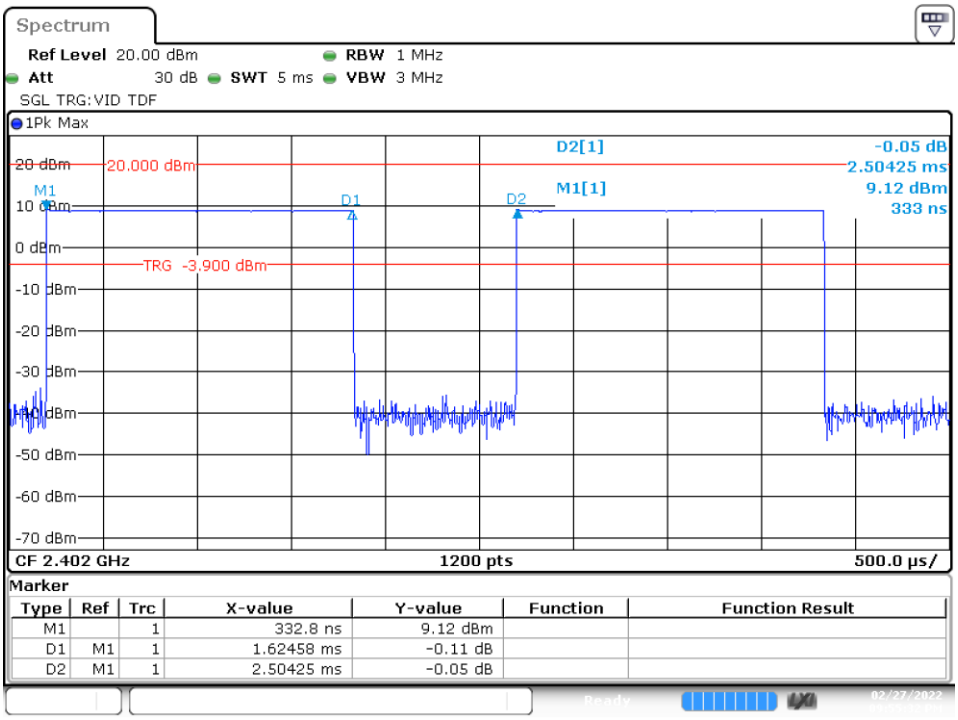
B.3.3 Results Screenshot

BDR – GFSK

DH1 Tx-Time

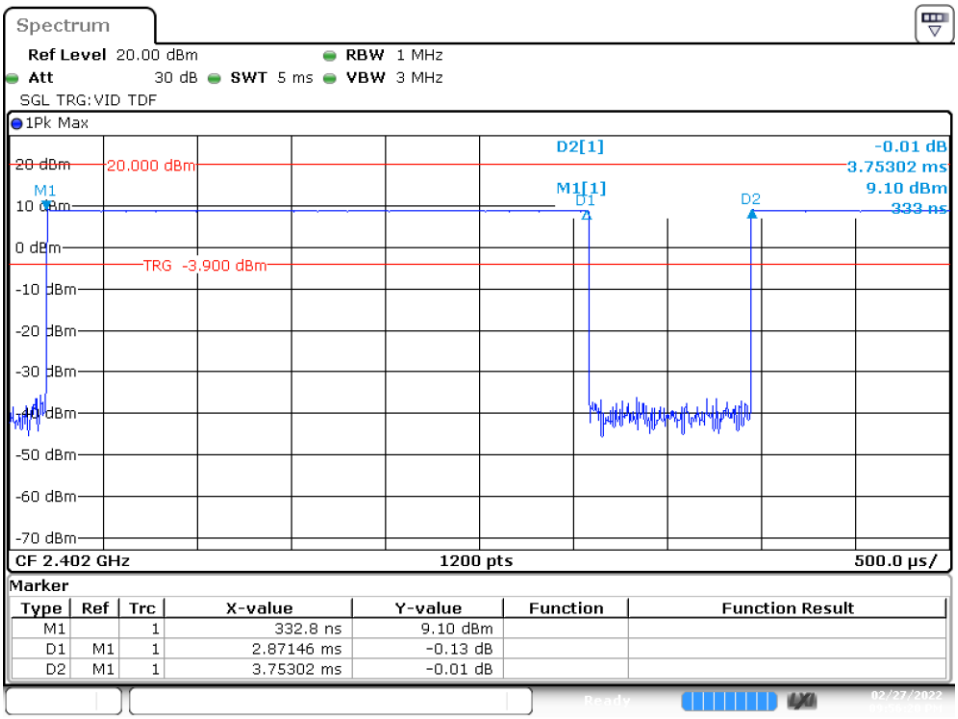


DH3 Tx-Time



Date: 27.FEB.2022 21:55:32

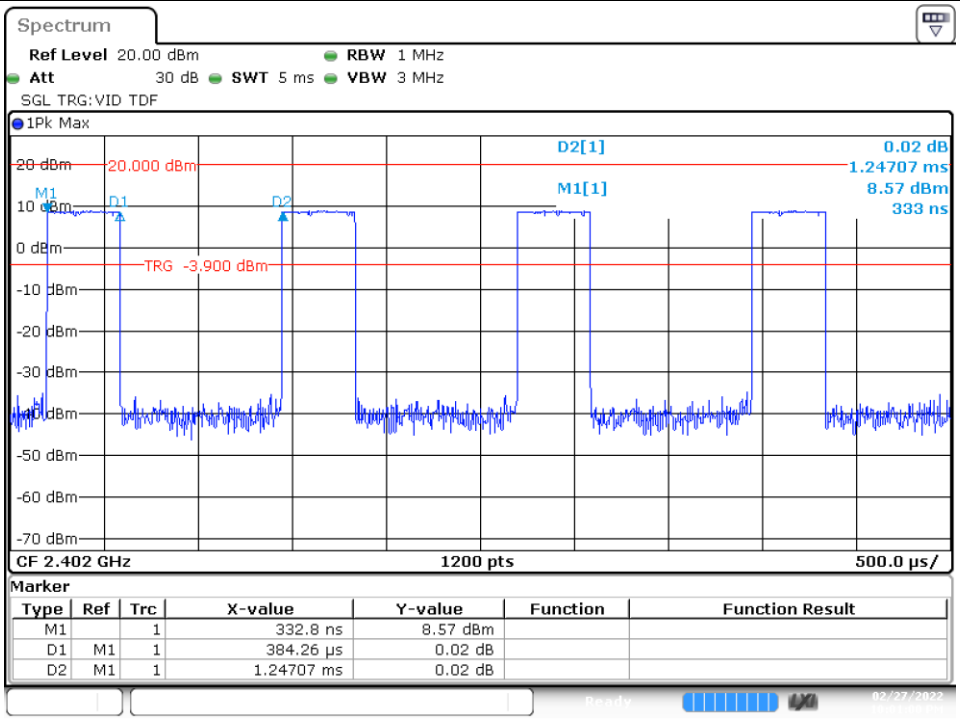
DH5 Tx-Time



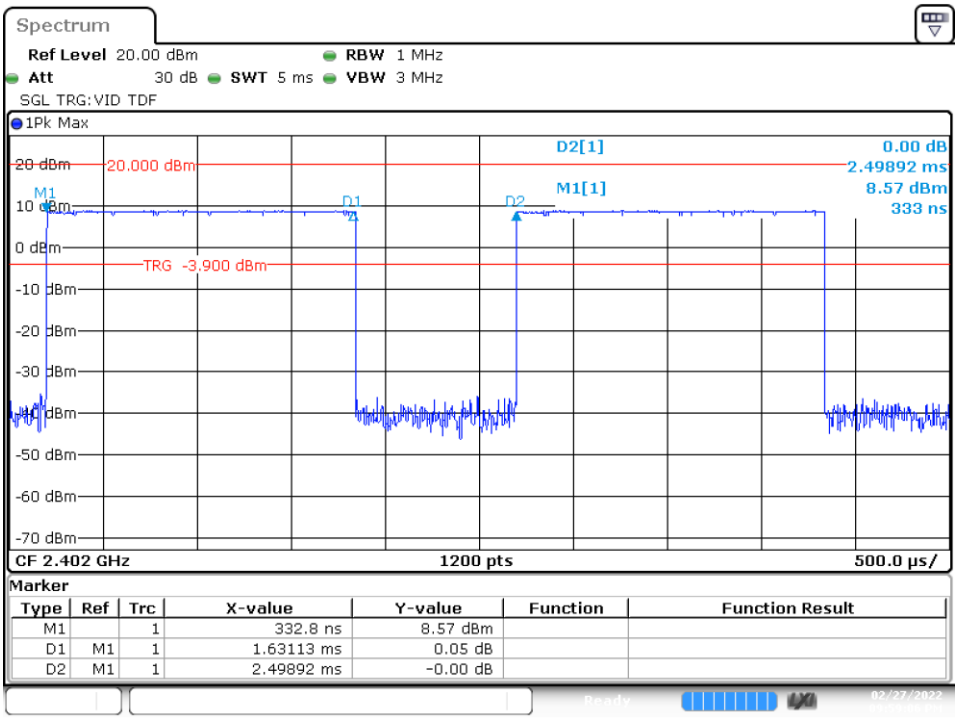
Date: 27.FEB.2022 21:56:21

EDR – π/4-DQPSK

2-DH1 Tx-Time

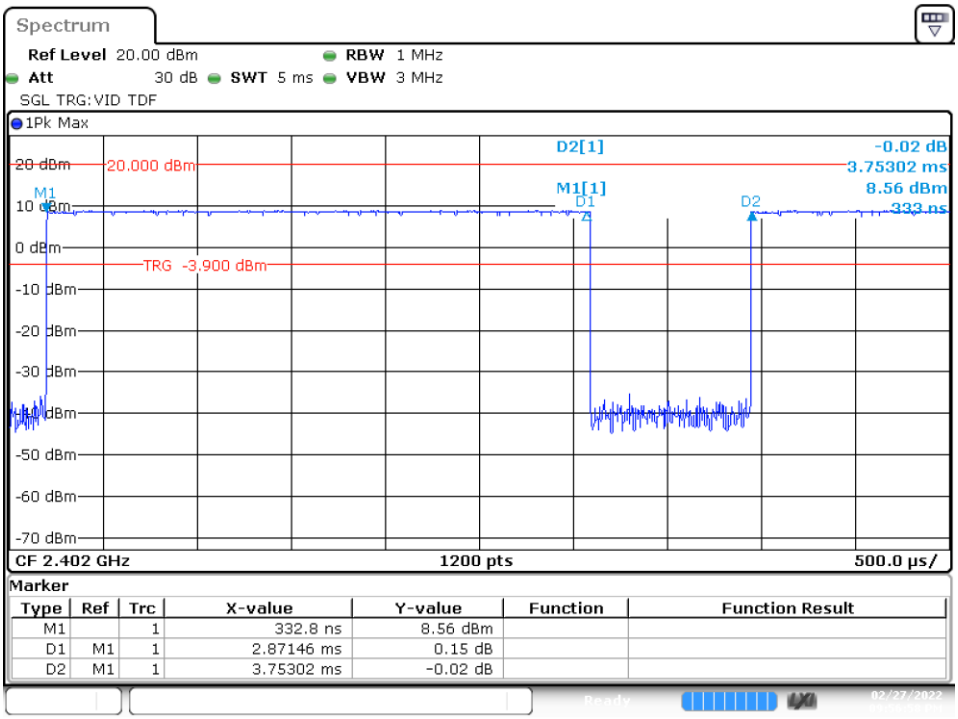


2-DH3 Tx-Time



Date: 27.FEB.2022 21:59:06

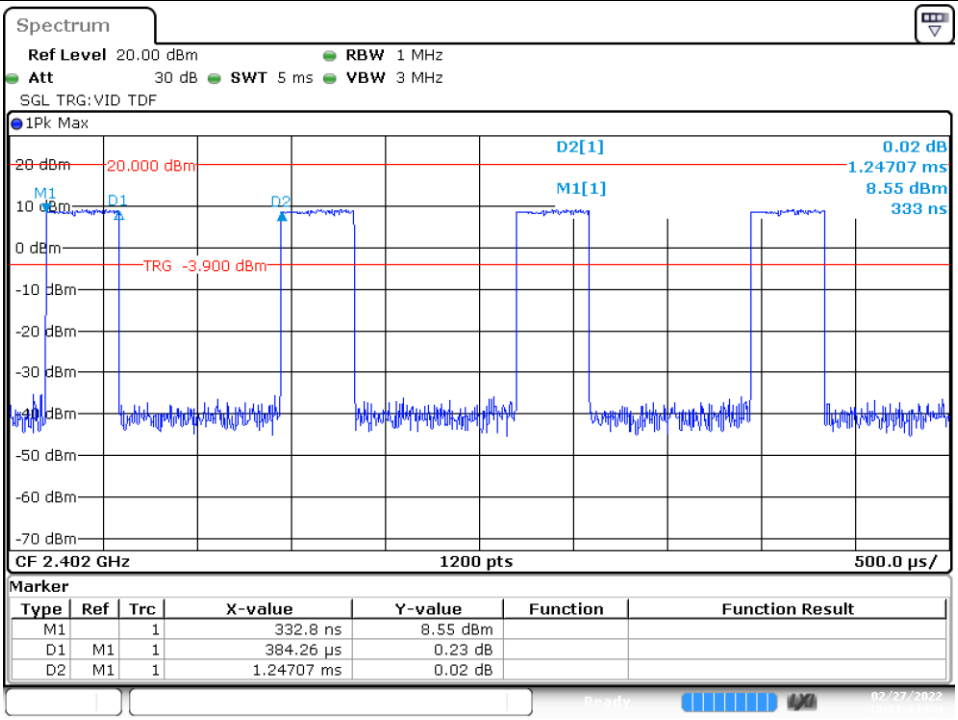
2-DH5 Tx-Time



Date: 27.FEB.2022 21:56:59

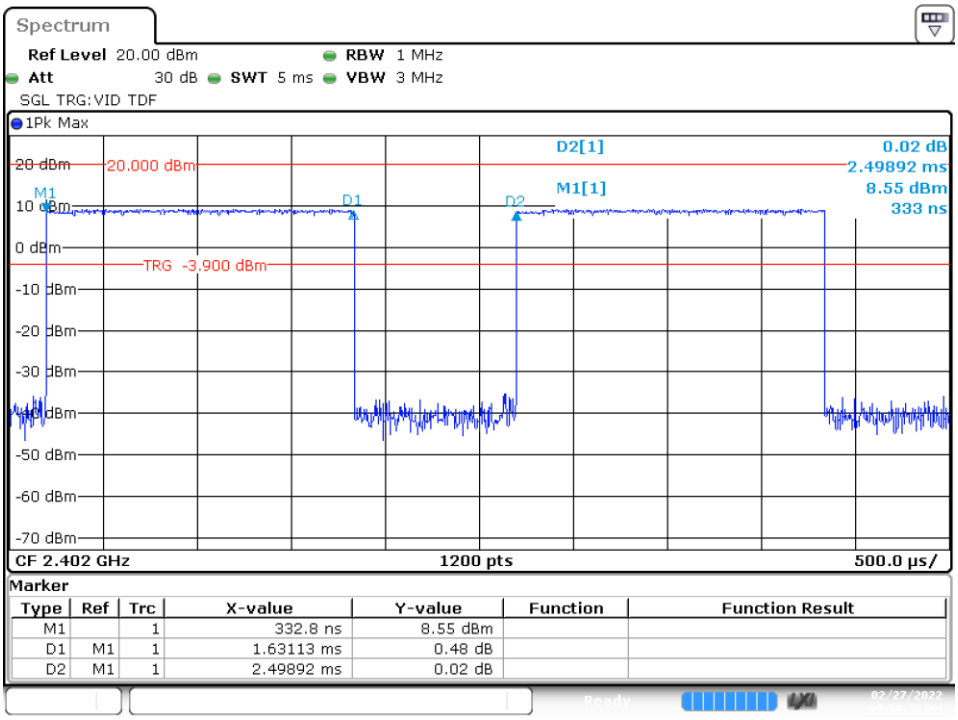
EDR – 8-DPSK

3-DH1 Tx-Time



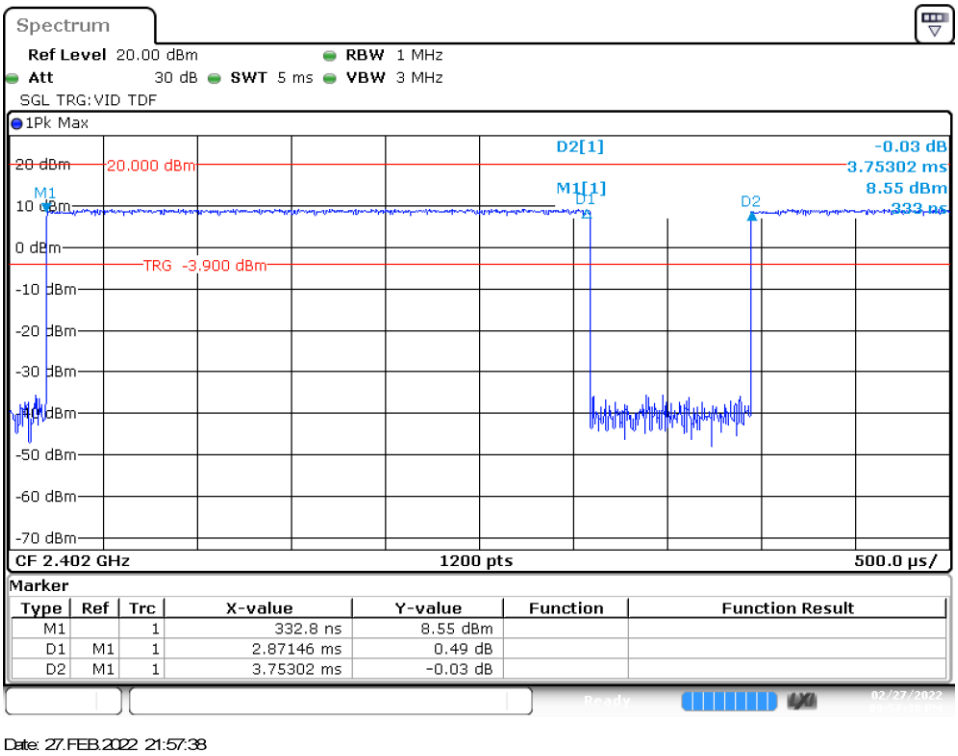
Date: 27.FEB.2022 22:01:45

3-DH3 Tx-Time



Date: 27.FEB.2022 21:58:39

3-DH5 Tx-Time



Date: 27.FEB.2022 21:57:38

B.4 Maximum Peak Output Power antenna gain

B.4.1 Test Limits

FCC part	RSS part	Limits
15.247 (b) (1)	RSS-247 Clause 5.4 (b)	(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. (…) (4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

B.4.2 Test procedure

The conducted setup shown in section *Test & System Description* was used to measure the maximum peak output power. The antenna terminal of the EUT is connected to the spectrum through an attenuator, and the spectrum analyzer reading is compensated to include the RF path loss.

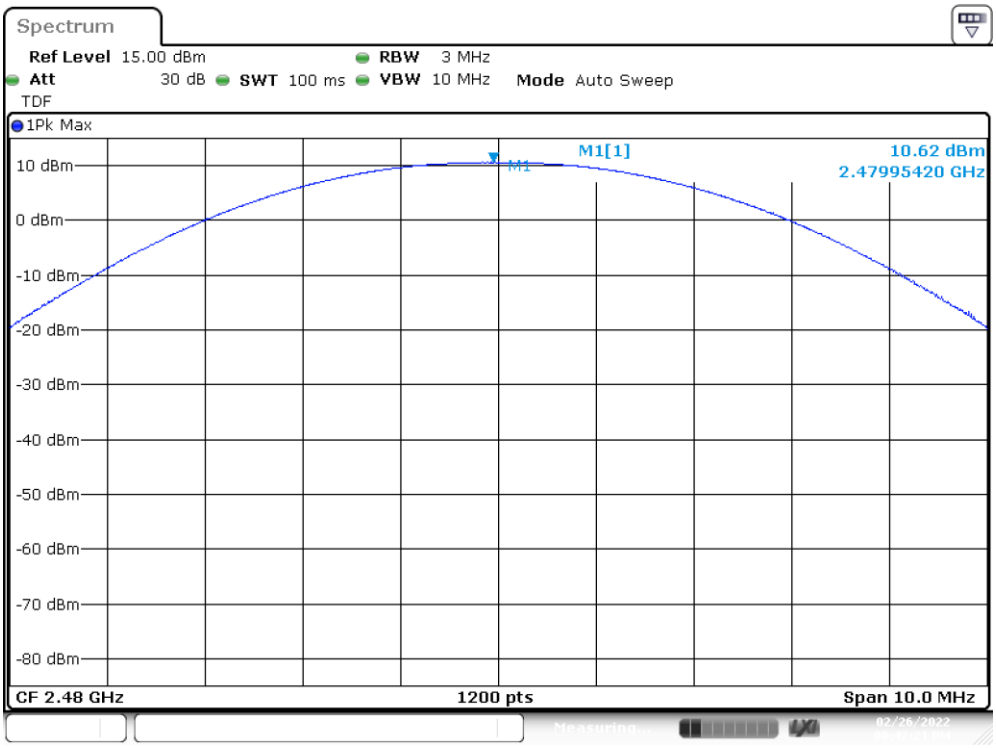
B.4.3 Results tables

Mode	Packet Type	Channel Number	Frequency [MHz]	Peak Power [dBm]	Peak Power [mW]	Peak Power EIRP [dBm]	Peak Power EIRP [mW]
Basic Rate GFSK	DH5	0	2402	9.98	9.95	16.38	43.45
		39	2441	10.22	10.52	16.62	45.92
		78	2480	10.62	11.53	17.02	50.35
EDR π/4-DQPSK	2DH5	0	2402	9.39	8.69	15.79	37.93
		39	2441	9.69	9.31	16.09	40.64
		78	2480	9.2	8.32	15.60	36.31
EDR 8-DPSK	3DH5	0	2402	9.46	8.83	15.86	38.55
		39	2441	9.74	9.42	16.14	41.11
		78	2480	9.31	8.53	15.71	37.24

B.4.4 Results Screenshot

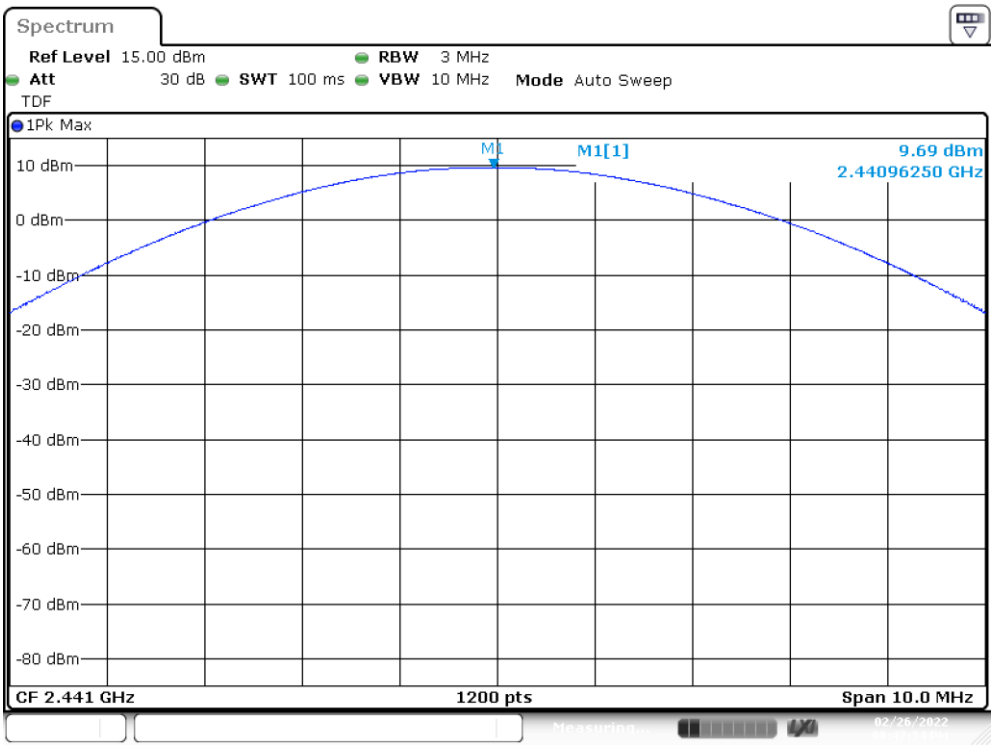
Basic Rate - GFSK

Peak Power – CH78



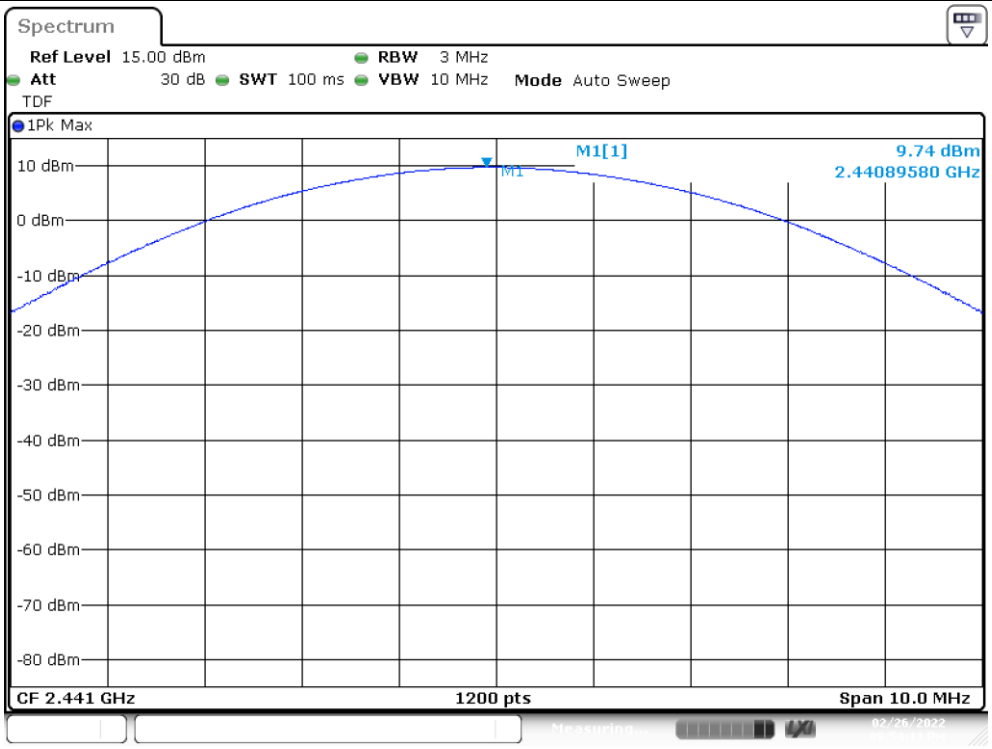
EDR – π/4-DQPSK

Peak Power – CH39



EDR – 8-DPSK

Peak Power – CH39



B.5 Out-of-band emission (conducted)

B.5.1 Test limits

FCC part	RSS part	Limits
15.247 (d)	RSS-247 Clause 5.5	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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.

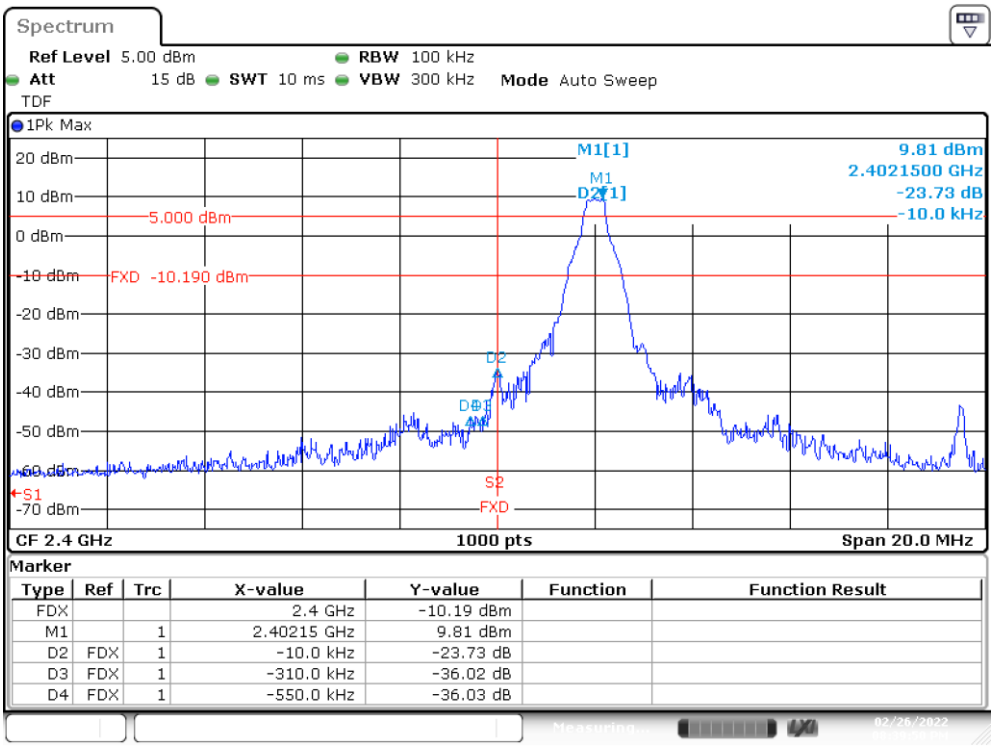
B.5.2 Test procedure

The conducted setup shown in section *Test & System Description* was used to measure the out-of-band emissions (conducted). The antenna terminal of the EUT is connected to the spectrum through an attenuator, and the spectrum analyzer reading is compensated to include the RF path loss.

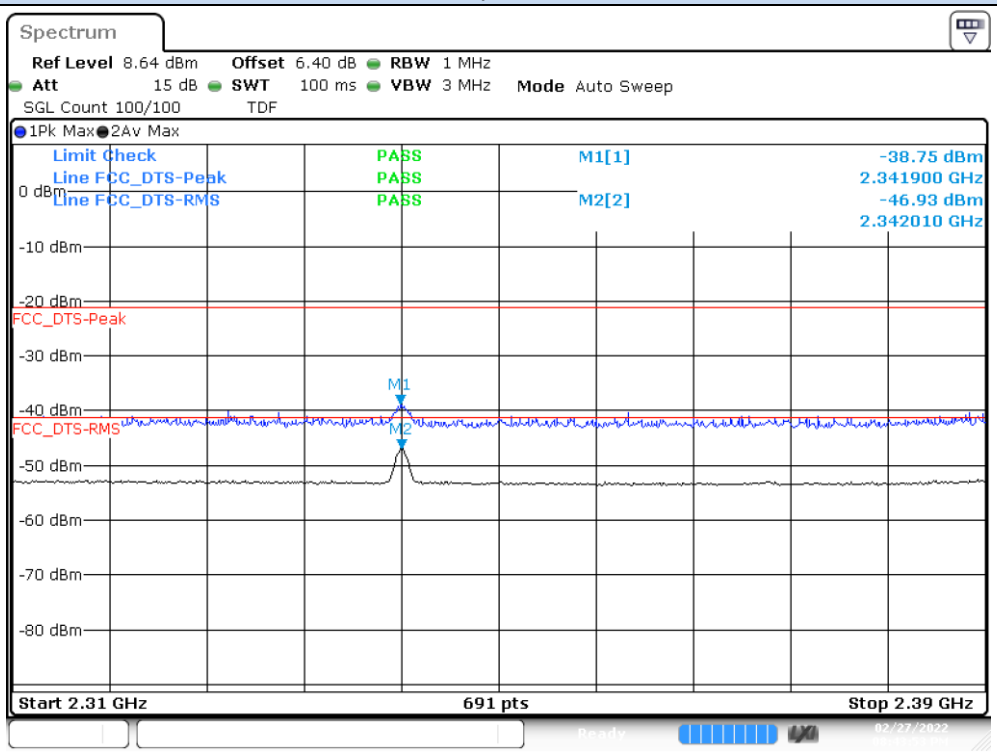
B.5.3 Test results

Basic Rate - GFSK

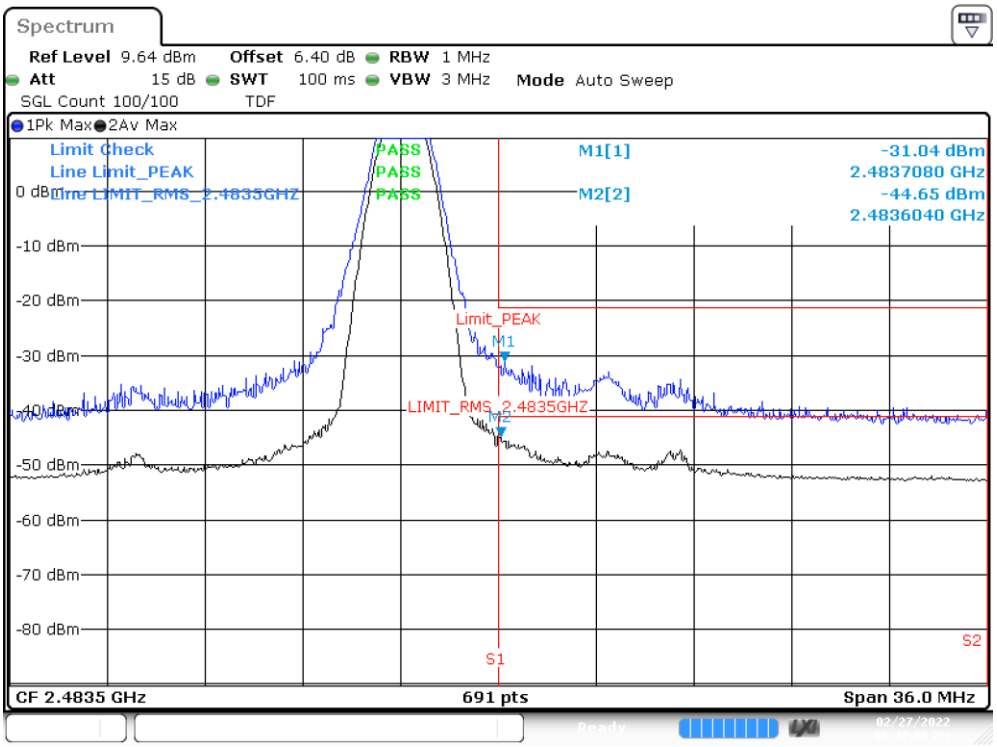
BE Low Freq Section – CH0



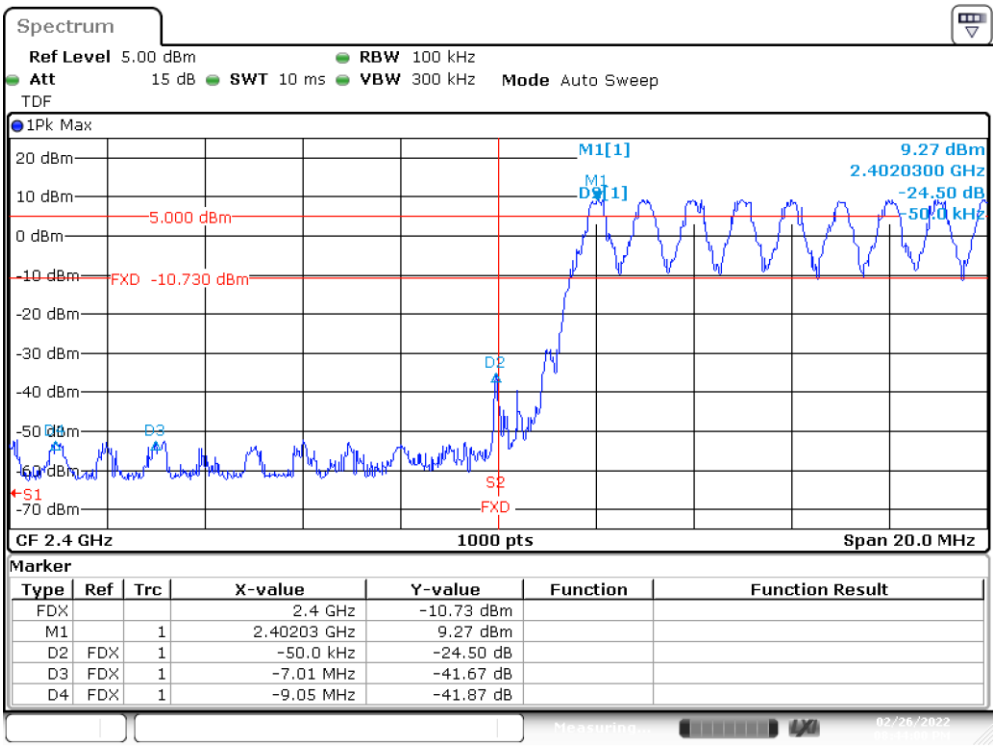
BE Low Freq Section – CH0



BE High R Freq Section - CH78

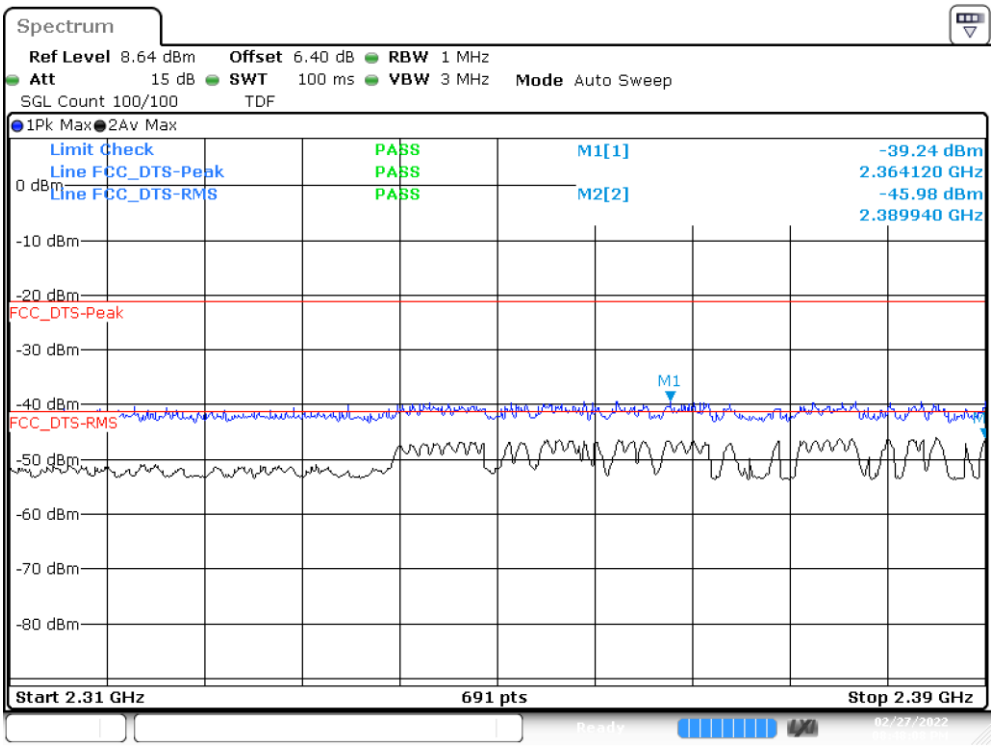


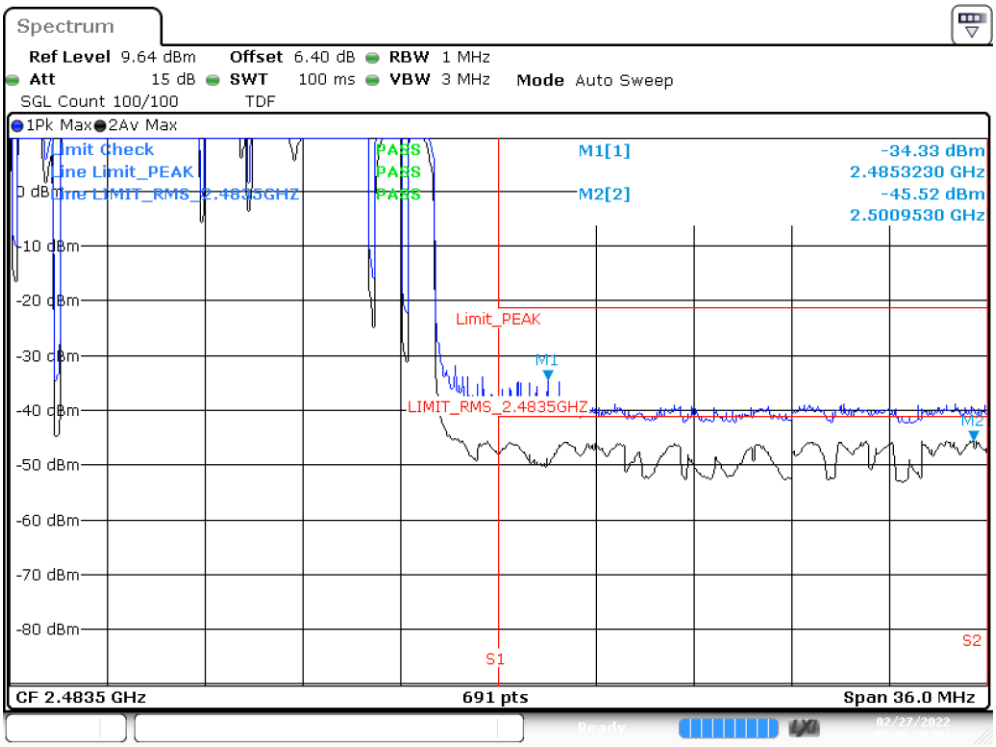
BE Low NR Freq Section - Hopping



Marker

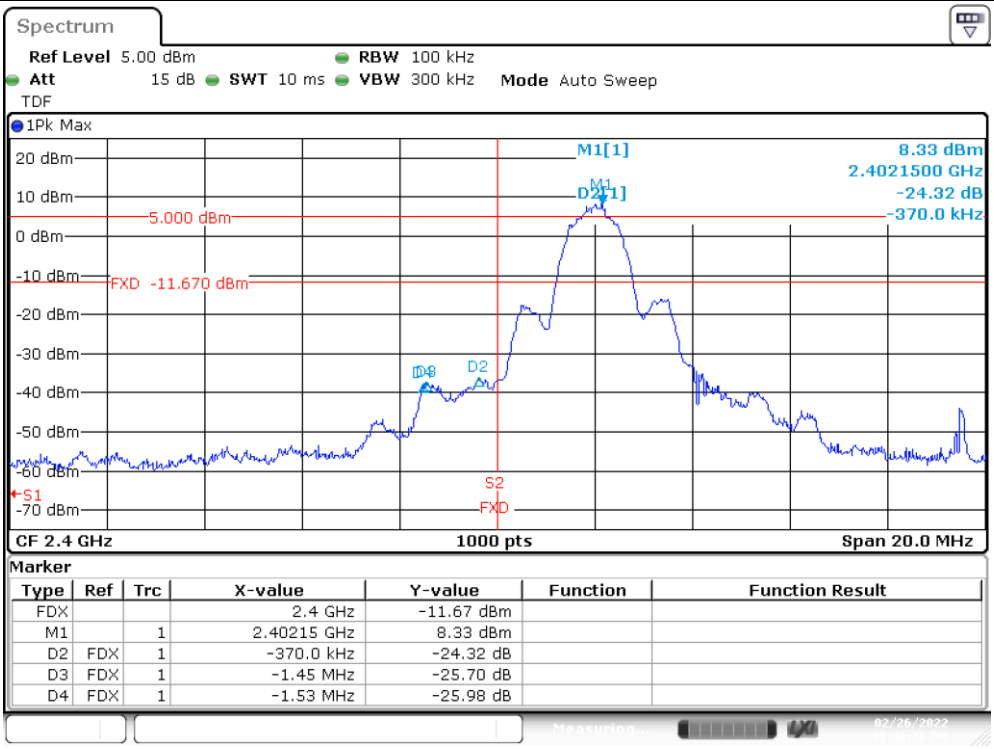
Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			2.4 GHz	-10.73 dBm		
M1		1	2.40203 GHz	9.27 dBm		
D2	FDX	1	-50.0 kHz	-24.50 dB		
D3	FDX	1	-7.01 MHz	-41.67 dB		
D4	FDX	1	-9.05 MHz	-41.87 dB		

BE Low R Freq Section - Hopping


BE High R Freq Section - Hopping


EDR – π/4-DQPSK

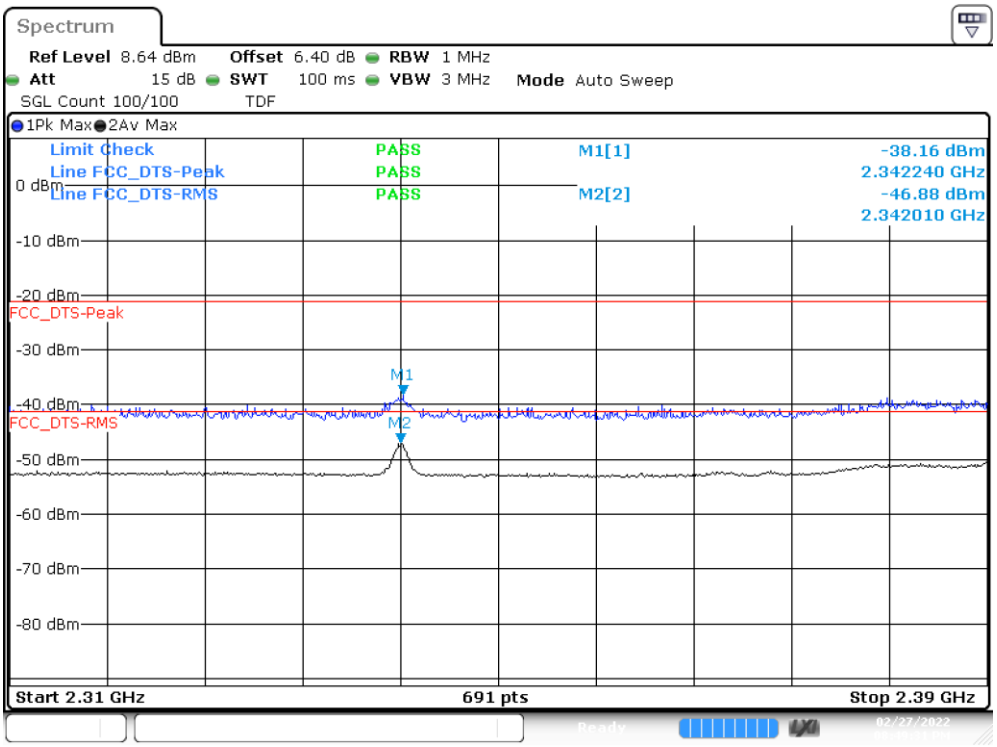
BE Low NR Freq Section - CH0



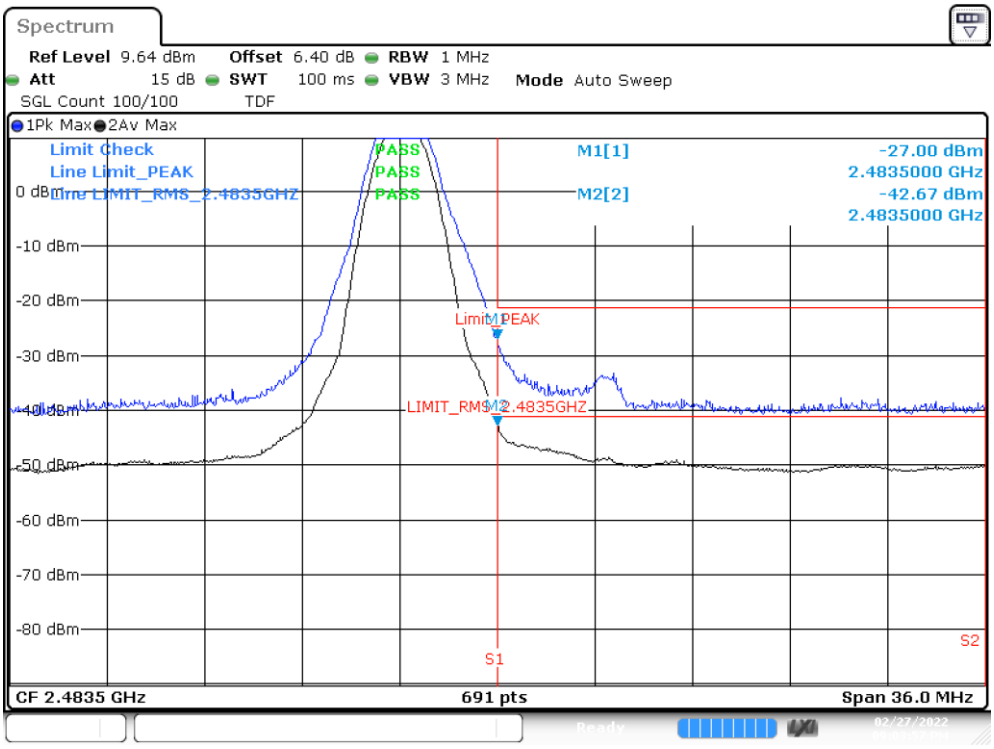
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			2.4 GHz	-11.67 dBm		
M1		1	2.40215 GHz	8.33 dBm		
D2	FDX	1	-370.0 kHz	-24.32 dB		
D3	FDX	1	-1.45 MHz	-25.70 dB		
D4	FDX	1	-1.53 MHz	-25.98 dB		

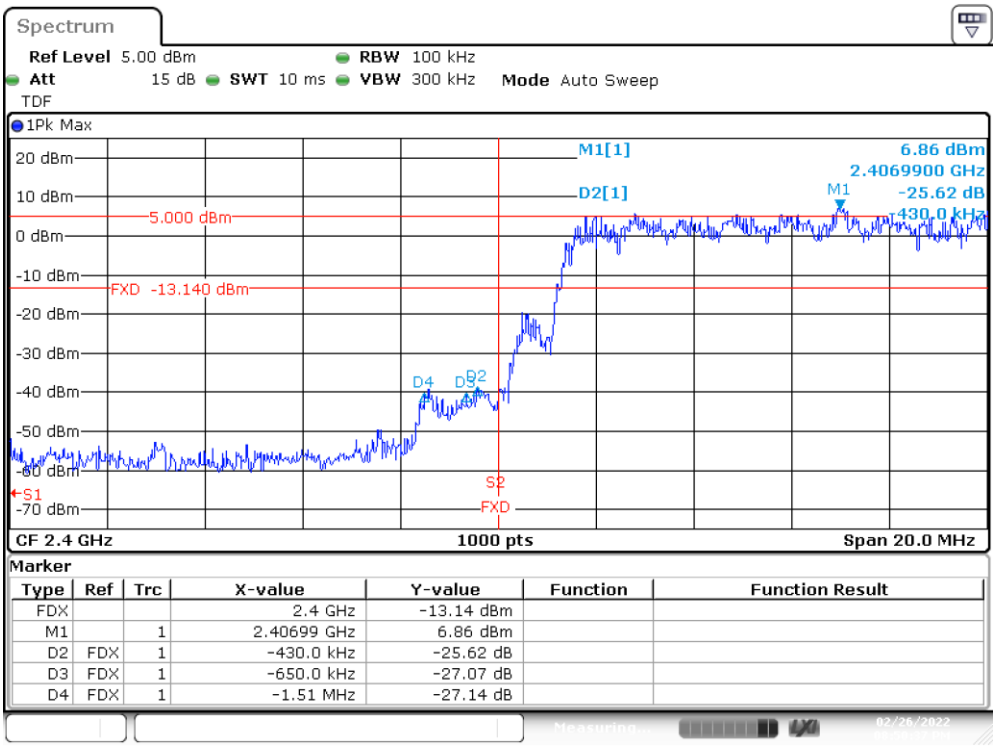
BE Low R Freq Section - CH 0



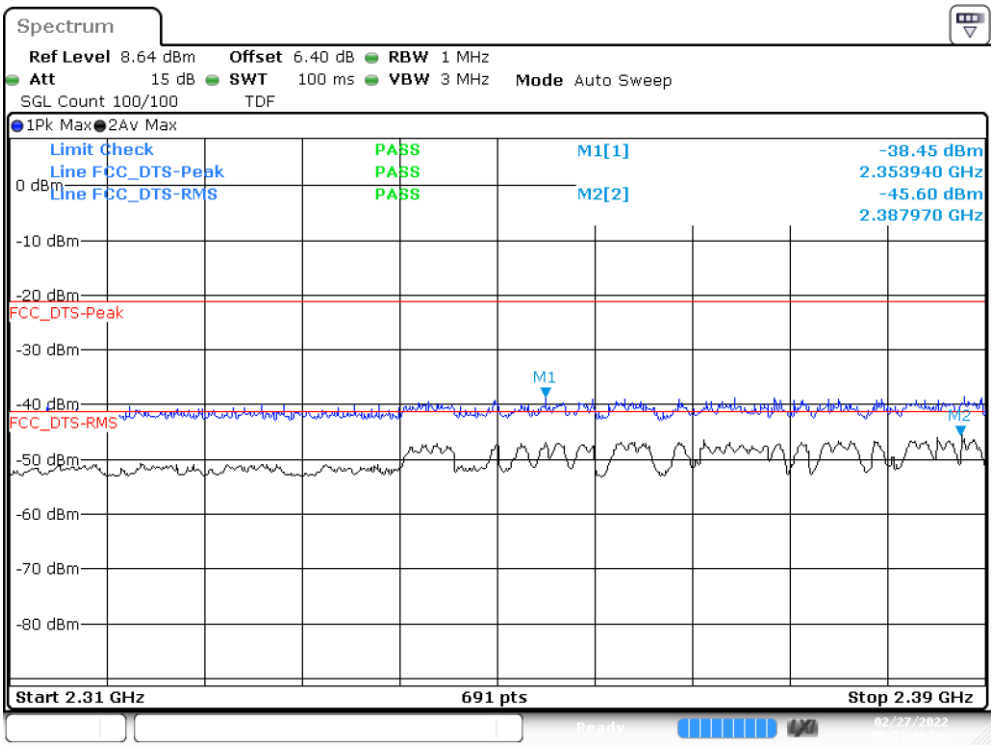
BE High R Freq Section - CH 78



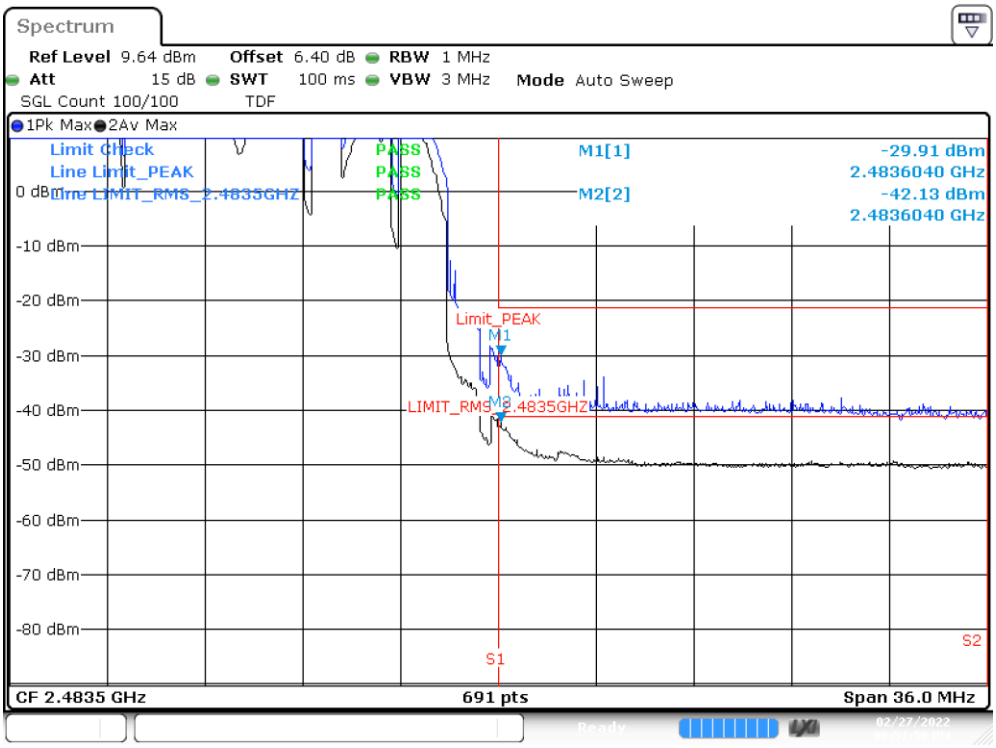
BE Low NR Freq Section - Hopping



BE Low R Freq Section - Hopping

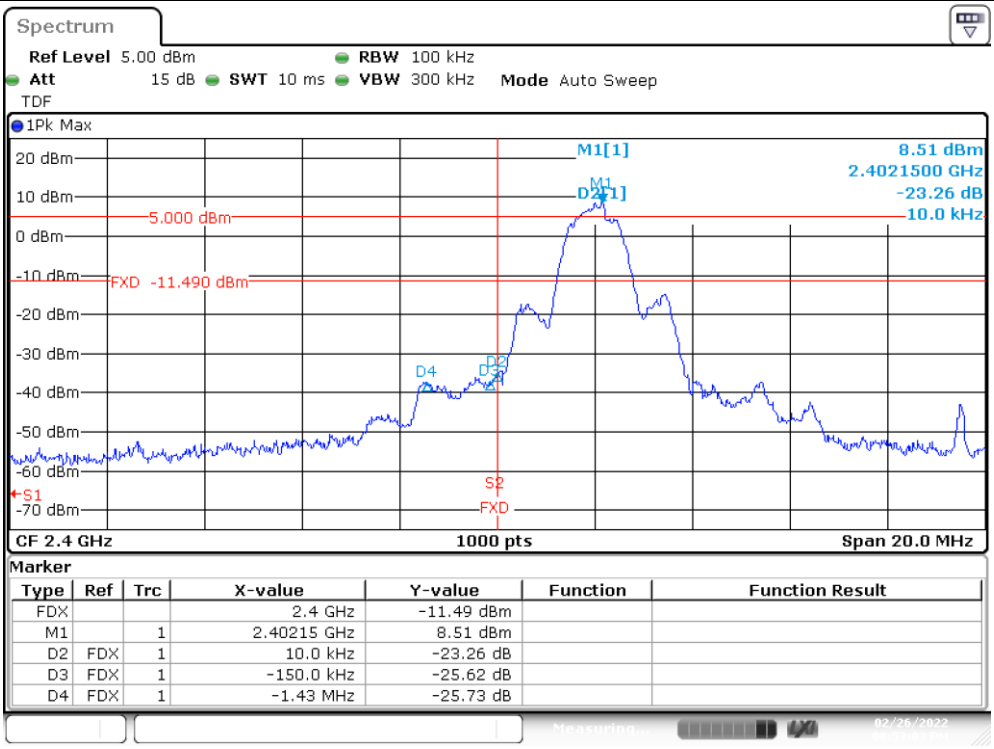


BE High R Freq Section - Hopping



EDR – 8-DPSK

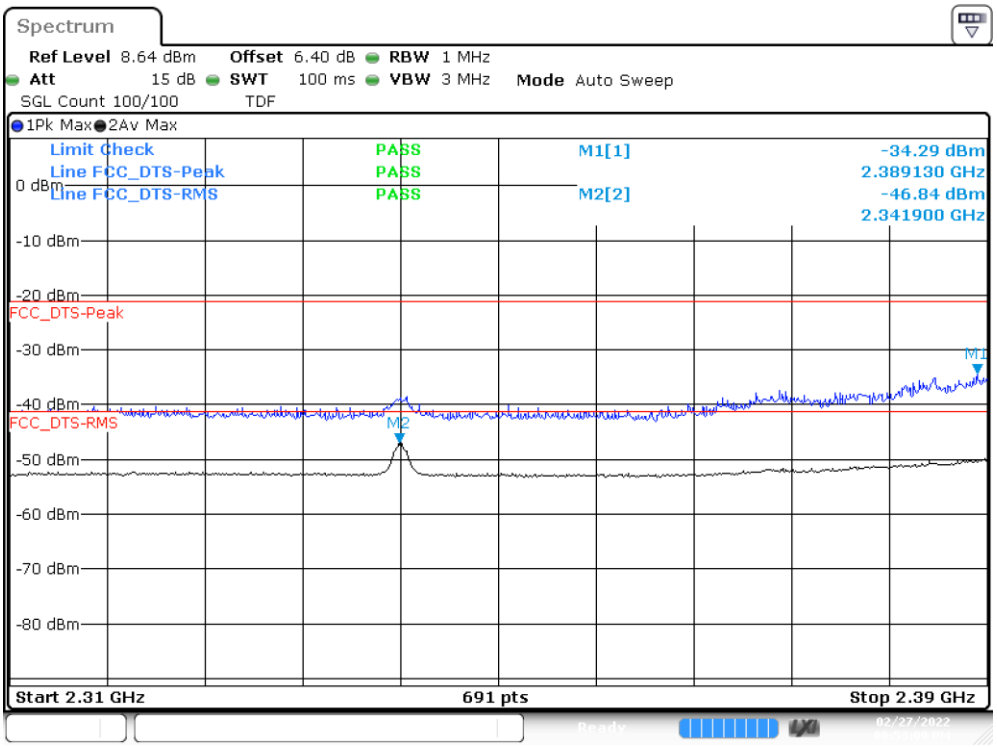
BE Low NR Freq Section - CH0



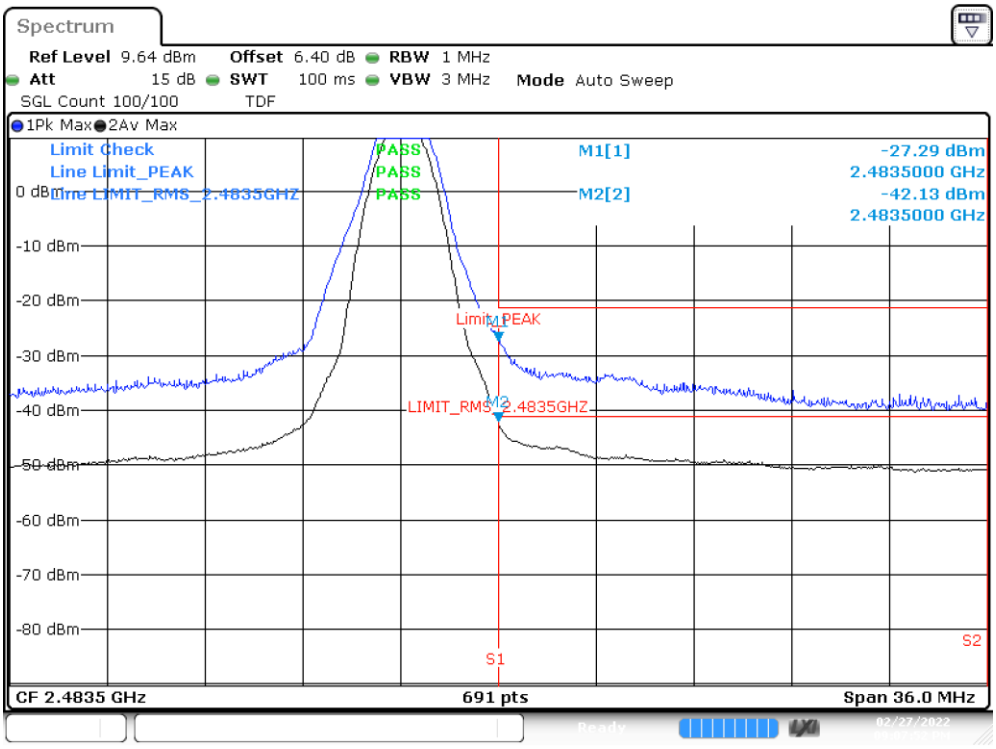
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
FDX			2.4 GHz	-11.49 dBm		
M1		1	2.40215 GHz	8.51 dBm		
D2	FDX	1	10.0 kHz	-23.26 dB		
D3	FDX	1	-150.0 kHz	-25.62 dB		
D4	FDX	1	-1.43 MHz	-25.73 dB		

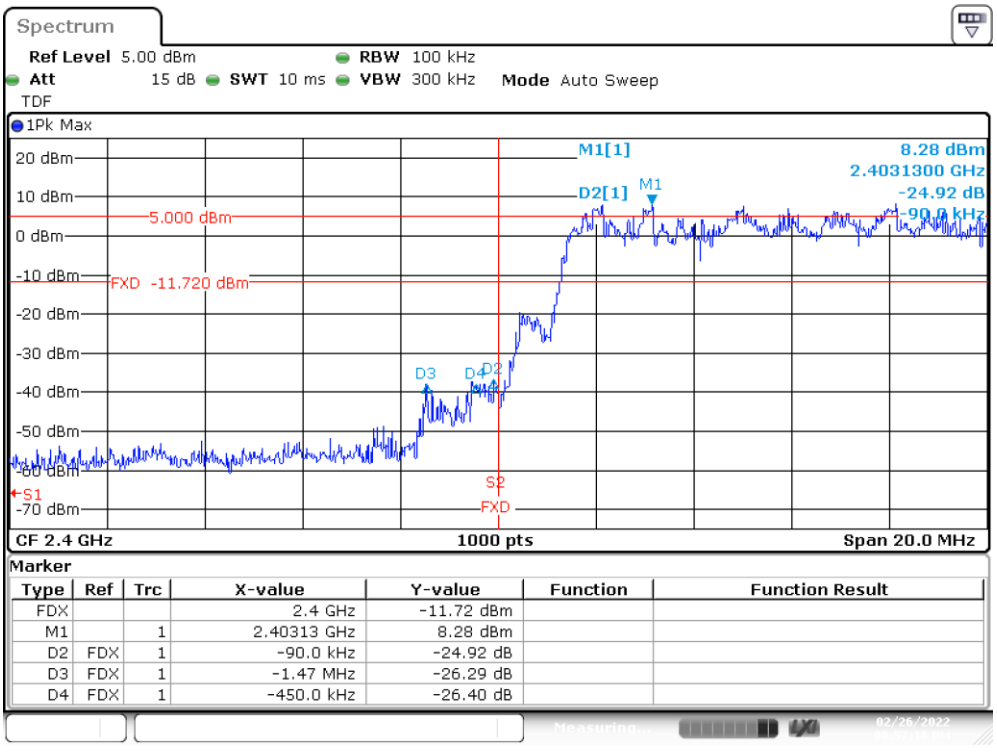
BE Low R Freq Section - CH 0



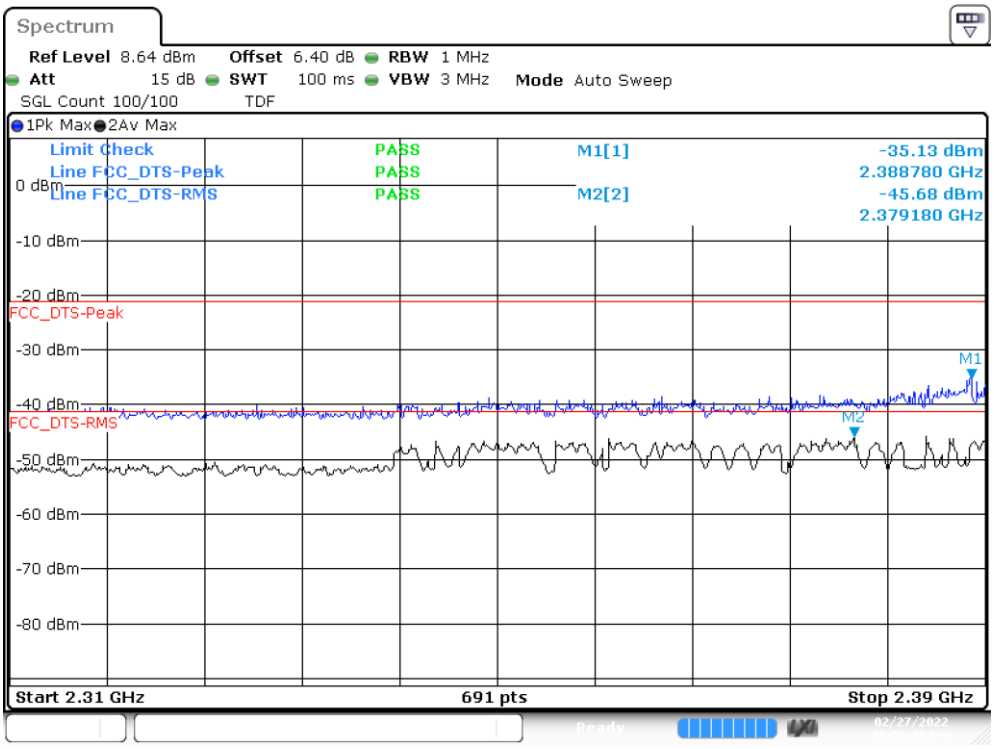
BE High R Freq Section - CH 78



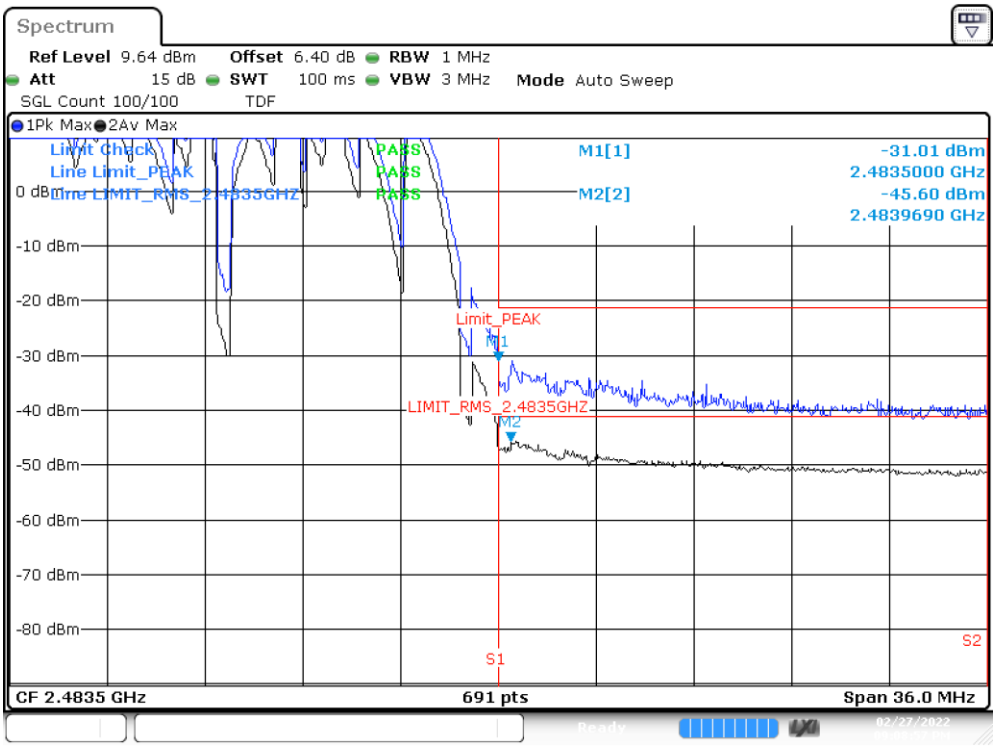
BE Low NR Freq Section - Hopping



BE Low R Freq Section - Hopping



BE High R Freq Section – Hopping



B.6 Radiated spurious emission

B.6.1 Standards references

<table>
<tr><th>FCC part</th><th>RSS part</th><th>Limits</th></tr>
<tr><td>15.247 (d)
15.209 (a)</td><td>RSS-247
Clause 5.5

RSS GEN A1
Clause 8.9</td><td>Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a):
<table>
<tr><th>Freq Range (MHz)</th><th>Field Stregth (µV/m)</th><th>Field Stregth (dBµV/m)</th><th>Meas. Distance (m)</th></tr>
<tr><td>30-88</td><td>100</td><td>40</td><td>3</td></tr>
<tr><td>88-216</td><td>150</td><td>43.5</td><td>3</td></tr>
<tr><td>216-960</td><td>200</td><td>46</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>54</td><td>3</td></tr>
</table>
The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
For average radiated emission measurements above 1000 MHz, there is also a limit specified when measuring with peak detector function, corresponding to 20 dB above the indicated values in the table.</td></tr>
</table>

B.6.2 Test procedure

The radiated setups shown in section *Test & System Description* were used to measure the radiated spurious emissions.
Depending of the frequency range and bands being tested, different antennas and filters were used.
The final measurement is done by varying the antenna height from 1 m to 4 m, the EUT azimuth over 360º and for both Vertical and Horizontal polarizations.
The radiated spurious emission was measured on the worst case configuration found.

B.6.3 Test Results

Radiated spurious - 30 MHz to 1 GHz

All modes

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBµV/m	---	dBµV/m	dB	---
33.5	20.8	Quasi-Peak	40.0	19.2	V
51.7	25.9	Quasi-Peak	40.0	14.1	V
891.6	33.1	Quasi-Peak	46.0	12.9	H

Note 1: The spurious signals detected do not depend on either the operating channel or the modulation mode.

Radiated spurious - 1 GHz to 26 GHz

BR – GFSK

CH0 DH5

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBµV/m	---	dBµV/m	dB	---
2342.0	45.2	Average	54.0	8.8	V
2342.5	54.9	Peak	74.0	19.1	V
9607.0	54.4	Peak	74.0	19.6	V
9608.0	47.9	Average	54.0	6.1	V
19214.0	49.9	Peak	74.0	24.1	H
19217.0	40.1	Average	54.0	13.9	H

CH39 DH5

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBµV/m	---	dBµV/m	dB	---
2317.5	55.5	Peak	74.0	18.5	H
2321.0	43.3	Average	54.0	10.7	V
2381.0	47.1	Average	54.0	6.8	V
2381.5	56.1	Peak	74.0	17.9	V
2501.0	48.0	Average	54.0	**6.0**	V
2501.5	57.7	Peak	74.0	16.3	V
2559.5	56.7	Peak	74.0	17.3	H
2561.0	43.8	Average	54.0	10.2	V
9763.0	53.5	Peak	74.0	20.5	V
9764.0	46.7	Average	54.0	7.3	V
19529.0	40.2	Average	54.0	13.8	H
19529.0	50.0	Peak	74.0	24.0	H

CH78 DH5

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBµV/m	---	dBµV/m	dB	---
2360.0	55.2	Peak	74.0	18.8	V
2360.0	43.3	Average	54.0	10.7	V
2539.5	55.7	Peak	74.0	18.3	V
2540.0	47.0	Average	54.0	7.0	V
7440.0	44.1	Average	54.0	9.9	H
7440.5	54.5	Peak	74.0	19.5	V
9919.5	45.0	Average	54.0	9.0	V
9920.5	53.8	Peak	74.0	20.2	V
19841.0	50.2	Peak	74.0	23.8	H
19841.0	38.7	Average	54.0	15.3	H

EDR – π/4-DQPSK

CH0 2DH5

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBµV/m	---	dBµV/m	dB	---
2282.0	54.5	Peak	74.0	19.5	H
2282.0	42.9	Average	54.0	11.1	V
2337.5	55.0	Peak	74.0	19.0	H
2342.0	47.3	Average	54.0	**6.7**	V
2520.5	55.4	Peak	74.0	18.6	H
2522.0	43.8	Average	54.0	10.2	V
9607.0	53.5	Peak	74.0	20.5	V
9607.5	45.9	Average	54.0	8.1	V
25852.0	38.7	Average	54.0	15.3	V
25853.5	50.8	Peak	74.0	23.2	V

CH39 2DH5

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBµV/m	---	dBµV/m	dB	---
2313.5	56.3	Peak	74.0	17.7	V
2321.0	43.1	Average	54.0	10.9	V
2381.0	46.2	Average	54.0	7.8	V
2381.5	55.8	Peak	74.0	18.2	V
2501.0	44.3	Average	54.0	9.7	V
2501.5	56.5	Peak	74.0	17.5	V
2561.0	55.5	Peak	74.0	18.5	V
2561.0	43.7	Average	54.0	10.3	V
9763.5	52.7	Peak	74.0	21.3	V
9763.5	44.8	Average	54.0	9.2	V
25852.5	38.8	Average	54.0	15.2	H
25853.0	51.0	Peak	74.0	23.0	H

CH78 2DH5

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBµV/m	---	dBµV/m	dB	---
2359.5	55.4	Peak	74.0	18.6	H
2360.0	43.3	Average	54.0	10.7	V
2540.0	56.4	Peak	74.0	17.6	V
2540.0	44.2	Average	54.0	9.8	V
9919.5	42.4	Average	54.0	11.6	V
9920.0	50.6	Peak	74.0	23.4	V
25852.0	51.4	Peak	74.0	22.6	V
25853.0	38.8	Average	54.0	15.2	V

EDR – 8-DPSK

CH0 3DH5

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBµV/m	---	dBµV/m	dB	---
2342.0	47.5	Average	54.0	6.5	V
2342.5	55.1	Peak	74.0	18.9	V
9607.5	45.7	Average	54.0	8.3	V
9608.5	54.0	Peak	74.0	20.1	V
25850.0	51.1	Peak	74.0	22.9	V
25850.5	38.7	Average	54.0	15.3	V

CH39 3DH5

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBµV/m	---	dBµV/m	dB	---
2321.0	43.0	Average	54.0	11.1	V
2322.5	54.9	Peak	74.0	19.1	V
2381.0	55.9	Peak	74.0	18.1	V
2381.0	48.1	Average	54.0	**5.9**	V
2500.5	56.3	Peak	74.0	17.7	V
2501.0	44.7	Average	54.0	9.3	V
2561.0	56.2	Peak	74.0	17.8	V
2561.0	43.8	Average	54.0	10.2	V
9763.5	44.2	Average	54.0	9.8	V
9764.5	53.9	Peak	74.0	20.1	V
25849.0	50.9	Peak	74.0	23.1	H
25850.0	38.7	Average	54.0	15.3	H

CH78 3DH5

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBµV/m	---	dBµV/m	dB	---
2540.0	55.8	Peak	74.0	18.2	V
2540.0	43.8	Average	54.0	10.2	V
9919.5	42.6	Average	54.0	11.4	V
9920.0	52.3	Peak	74.0	21.7	V
25852.0	50.4	Peak	74.0	23.6	V
25852.0	38.7	Average	54.0	15.3	H