

TEST REPORT

EUT Description	WLAN and BT, 2x2 PCIe M.2 2230 adapter card
Brand Name	Intel® Wi-Fi 6 AX204
Model Name	AX204NGW
FCC/IC ID	FCC ID: PD9AX204NG ; IC ID 1000M-AX204NG
Date of Test Start/End	2022-03-08 / 2022-03-11
Features	802.11ax R2, Dual Band, 2x2 Wi-Fi 6 + 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	220225-01.TR05
Revision Control	Rev. 00 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 _____

Khodor RIDA
(Test Engineer Lead)

Cheiel IN
(Technical Manager Deputy)

Intel Corporation S.A.S – WRF Lab
425 rue de Goa – Le Cargo B6 - 06600, Antibes, France
Tel. +33493001400 / Fax +33493001401

Table of Contents

1. Standards, reference documents and applicable test methods	3
2. General conditions, competences and guarantees	3
3. Environmental Conditions	4
4. Test samples	5
5. EUT Features	6
6. Remarks and comments	7
7. Test Verdicts summary	7
7.1. BT BASIC RATE / ENHANCED DATA RATE	7
8. Document Revision History	7
Annex A. Test & System Description	8
A.1 MEASUREMENT SYSTEM	8
A.2 TEST EQUIPMENT LIST	10
A.3 MEASUREMENT UNCERTAINTY EVALUATION	12
Annex B. Test Results	13
B.1 20dB BANDWIDTH AND CARRIER FREQUENCY SEPARATION	13
B.1.1 Test limits	13
B.1.2 Results tables	13
B.1.3 Results screenshot	14
B.2 NUMBER OF HOPPING CHANNELS	17
B.2.1 Test limits	17
B.2.2 Test procedure	17
B.2.3 Results tables	17
B.3 TIME OF OCCUPANCY (DWELL TIME)	21
B.3.1 Test procedure	21
B.3.2 Results tables	21
B.3.3 Results Screenshot	22
B.4 MAXIMUM PEAK OUTPUT POWER ANTENNA GAIN	28
B.4.1 Test Limits	28
B.4.2 Test procedure	28
B.4.3 Results tables	28
B.4.4 Results Screenshot	29
B.5 OUT-OF-BAND EMISSION (CONDUCTED)	31
B.5.1 Test limits	31
B.5.2 Test procedure	31
B.5.3 Test results	32
B.6 RADIATED SPURIOUS EMISSION	38
B.6.1 Standards references	38
B.6.2 Test procedure	38
B.6.3 Test Results	39
Annex C. Photographs	43
C.1 TEST SETUP	43
C.2 TEST SAMPLE	45

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	$21.0^{\circ}\text{C} \pm 1.2^{\circ}\text{C}$
Humidity	$43.0\% \pm 17.0\%$

4. Test samples

Sample	Control #	Description	Model	Serial #	Date of receipt	Note
#01	220225-01.S01	WiFi Module	AX204NGW	C8CB9E88AA68	2022-03-04	Used for 30 MHz-1 GHz Radiated Spurious Emissions tests
	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	
	210611-02.S13	Main Antenna	SkyCross	-	2021-07-02	
	210611-02.S14	Aux Antenna	SkyCross	-	2021-07-02	
#02	220225-01.S02	WiFi Module	AX204NGW	C8CB9E8A9BE	2022-03-04	Used for 1 GHz-26 GHz Radiated Spurious Emissions tests
	210611-02.S17	Adapter	PowerBy SNJ A4	-	2021-07-02	
	200602-03.S06	Absorber	-	-	2020-07-03	
	200611-03.S26	Extender	ADEXELEC	-	2020-07-01	
	170000-01.S01	Laptop	Latitude E5470	DBPLMC2	2017-03-28	
	210611-02.S11	Main Antenna	SkyCross	-	2021-07-02	
	210611-02.S12	Aux Antenna	SkyCross	-	2021-07-02	
#03	220225-01.S05	WiFi Module	AX204NGW	C8CB9E88A93C	2022-03-04	RF Conducted
	170000-01.S02	Laptop	Latitude E5470	21HTPF2	2017-03-28	
	200611-01.S12	Extender	XVT EXTENDER SNJ A4	-	2020-11-30	

5. EUT Features

The herein information is provided by the customer

Brand Name	Intel® Wi-Fi 6 AX204		
Model Name	AX204NGW		
Software Version	DRTU_01188_99.0.69C		
Driver Version	22.140.22111.51677		
Prototype / Production	Production		
Supported Radios	802.11b/g/n/ax	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 – 5895.0 MHz)	
Antenna Information	Bluetooth 5.2	2.4GHz (2400.0 – 2483.5 MHz)	
	Transmitter	Chain 1 (A) / Aux	Chain 2 (B) / Main
	Manufacturer	SkyCross	Skycross
	Antenna type	PIFA antenna	PIFA antenna
	Part number	N/A	N/A
	Declared antenna gain (dBi)	+3.24	+3.24

6. Remarks and comments

- 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

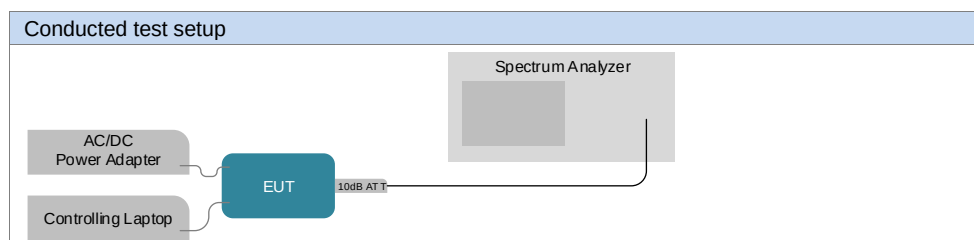
Revision #	Modified by	Revision Details
Rev. 00	K.Khatib, V.Kaculini	First Issue

Annex A. Test & System Description

A.1 Measurement System

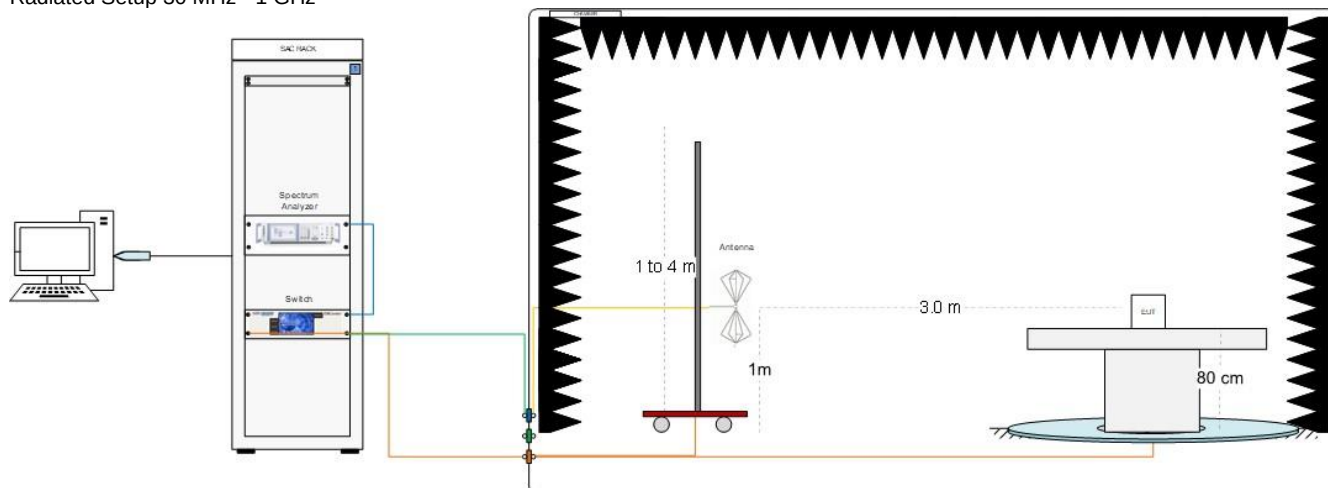
Measurements were performed using the following setups.

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.

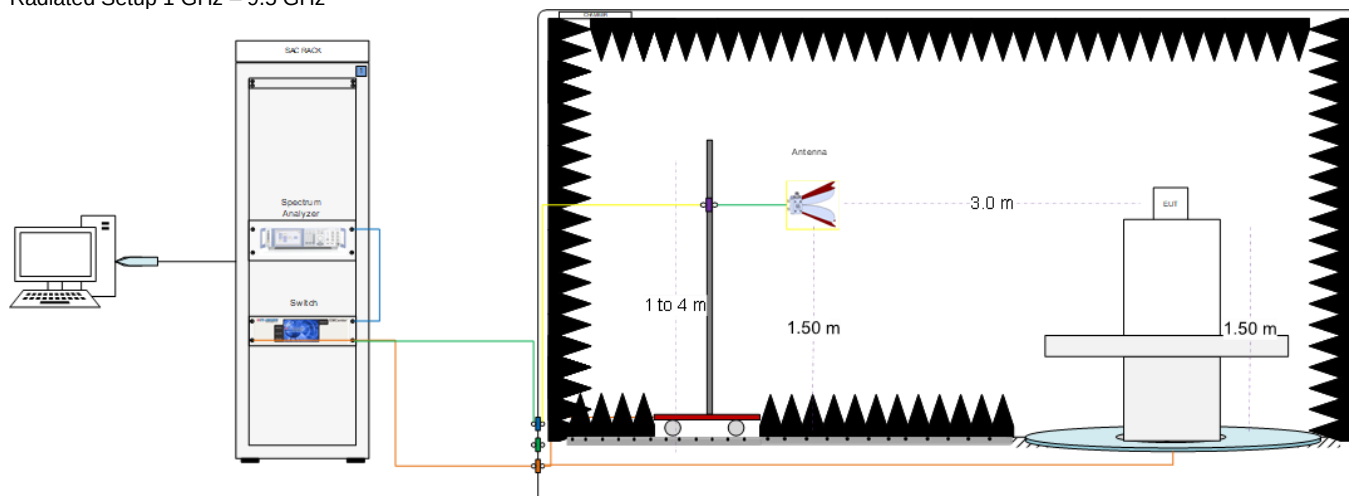


Radiated test setup

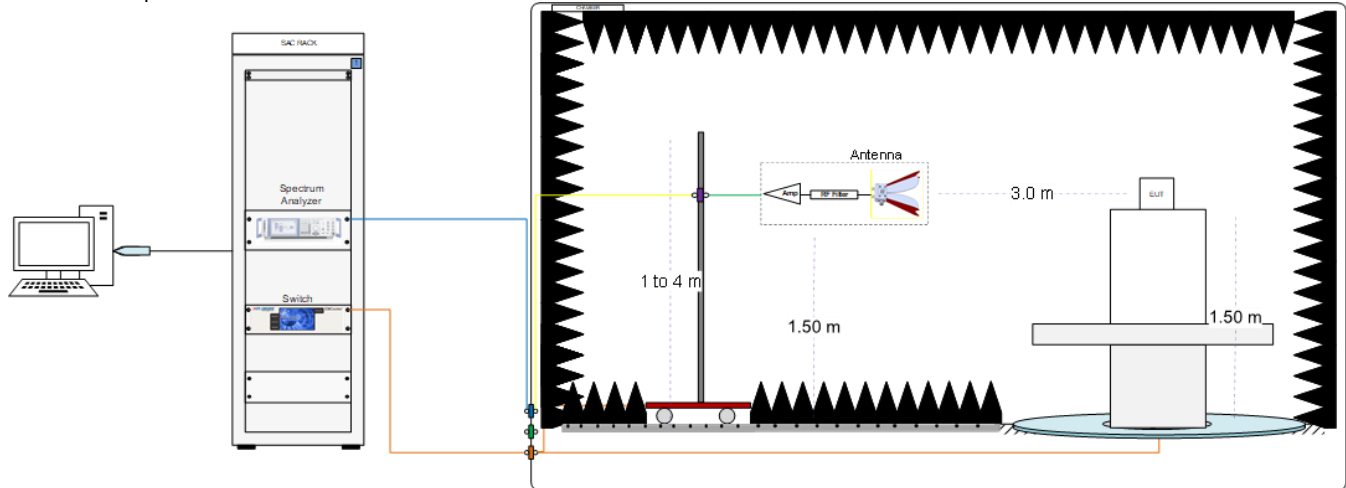
Radiated Setup 30 MHz - 1 GHz



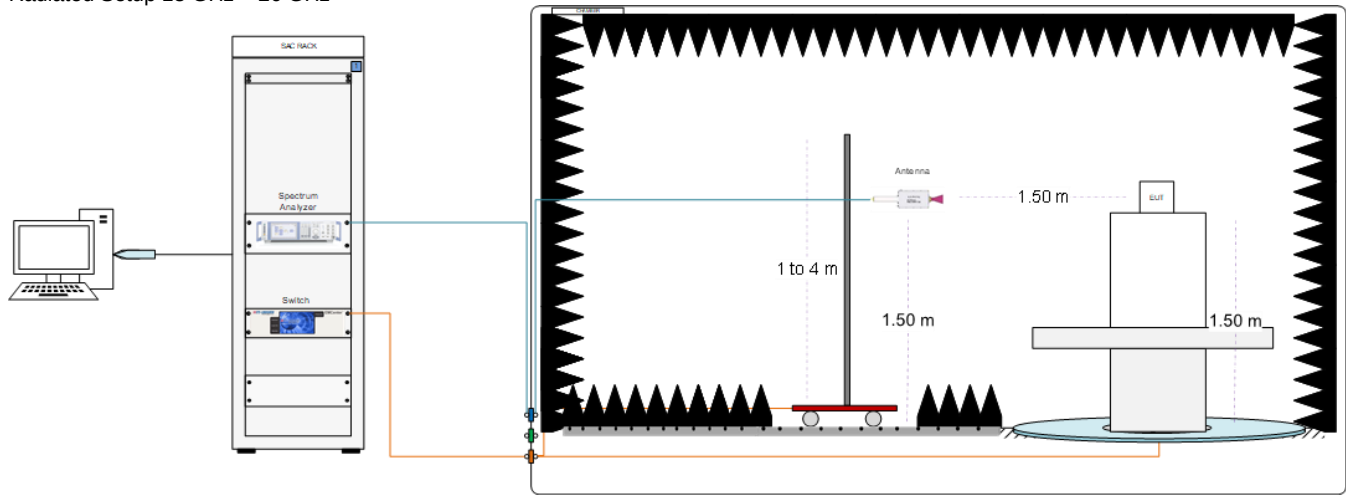
Radiated Setup 1 GHz – 9.5 GHz



Radiated Setup 9.5 GHz - 18 GHz



Radiated Setup 18 GHz – 26 GHz



Sample Calculation

The spurious received voltage $V(\text{dB}\mu\text{V})$ in the spectrum Analyzer is converted to Electric field strength using the transducer factor F corresponding to the Rx path Loss:

$$F (\text{dB/m}) = \text{Rx Antenna Factor (dB/m)} + \text{Cable losses (dB)} - \text{Amplifiers Gain (dBi)}$$

$$E (\text{dB}\mu\text{V/m}) = V(\text{dB}\mu\text{V}) + F (\text{dB/m})$$

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:

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

where

$E_{\text{SpecLimit}}$ is the field strength of the emission at the distance specified by the limit, in $\text{dB}\mu\text{V/m}$

E_{Meas} is the field strength of the emission at the measurement distance, in $\text{dB}\mu\text{V/m}$

D_{Meas} is the measurement distance, in m

$D_{\text{SpecLimit}}$ 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
018-002	Peak Power Meter	MA24406A	11138	ANRITSU	2021-11-24	2023-11-24
019-000	RF cable 100cm	PE360-100CM	N/A	PASTERNAK	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	2022-01-21	2024-01-21
006-001	Turntable	-	-	ETS Lindgren	N/A	N/A
006-008	Measurement Software v1.30.00	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 +Amplifier	3116C-PA	00169308bis + 00196308	ETS-Lindgren	2021-08-05	2023-08-05
006-059	RF Cable 7.0m	R286304174	20.46.369	Radiall	2022-03-04	2022-09-04
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 +Amplifier	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 Spurious Emission <26.5 GHz	± 2.93	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
Number of hopping channels	C.Requin
Time of Occupancy (Dwell Time)	C.Requin
Maximum Peak Output Power and antenna gain	C.Requin
Out-of-band Emissions (conducted)	C.Requin
Out-of-band Emissions (radiated)	K.Khatib, R.Simonini

B.1 20dB Bandwidth and carrier frequency separation

B.1.1 Test limits

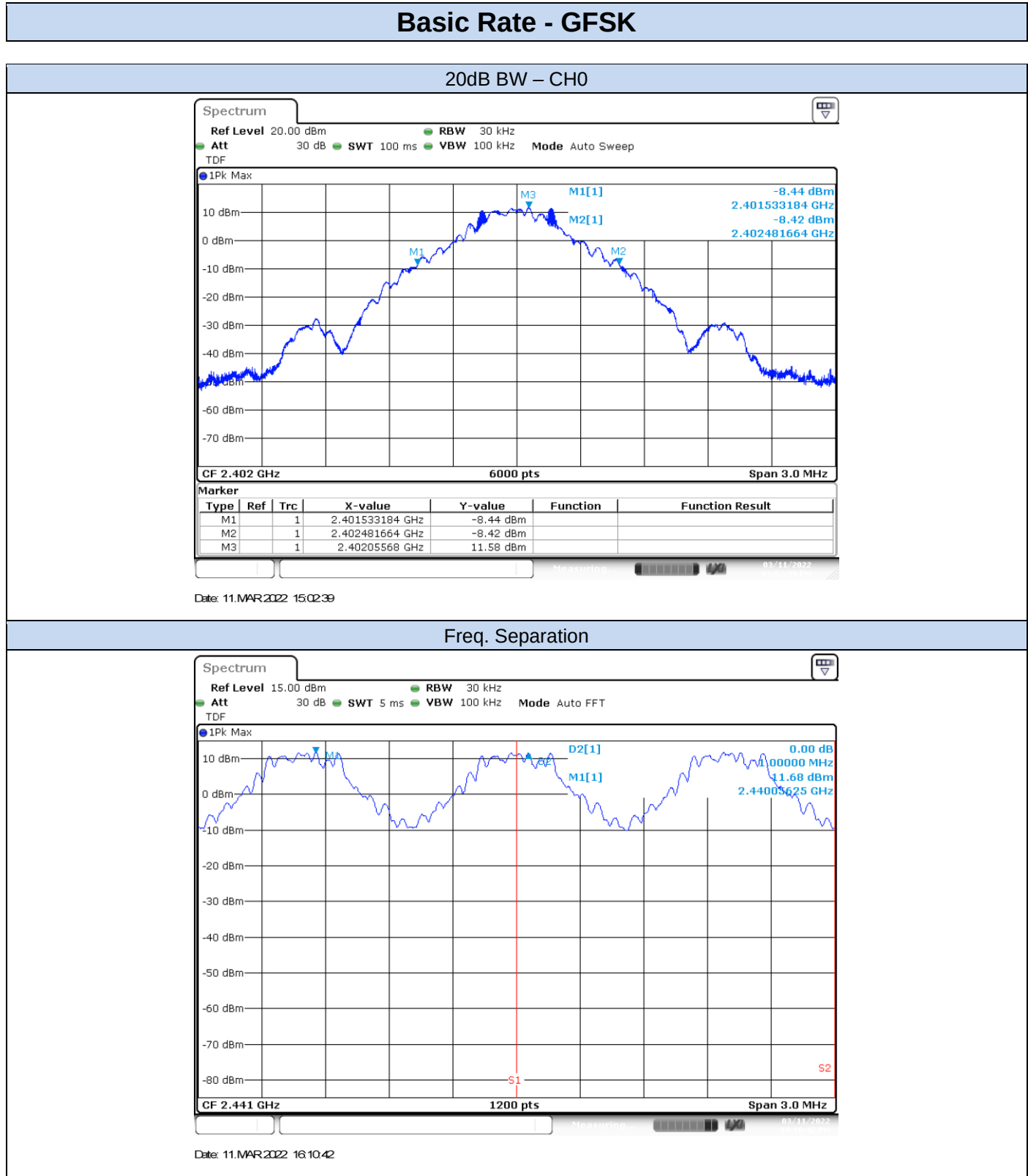
FCC part	RSS part	Limits
15.247 (a) (1)	RSS-247 Clause 5.1 (a) and (b)	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 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	0.95	1000
		39	2441	0.95	
		78	2480	0.94	
EDR $\pi/4$ -DQPSK	2DH5	0	2402	1.36	1000
		39	2441	1.36	
		78	2480	1.36	
EDR 8-DPSK	3DH5	0	2402	1.34	1000
		39	2441	1.34	
		78	2480	1.34	

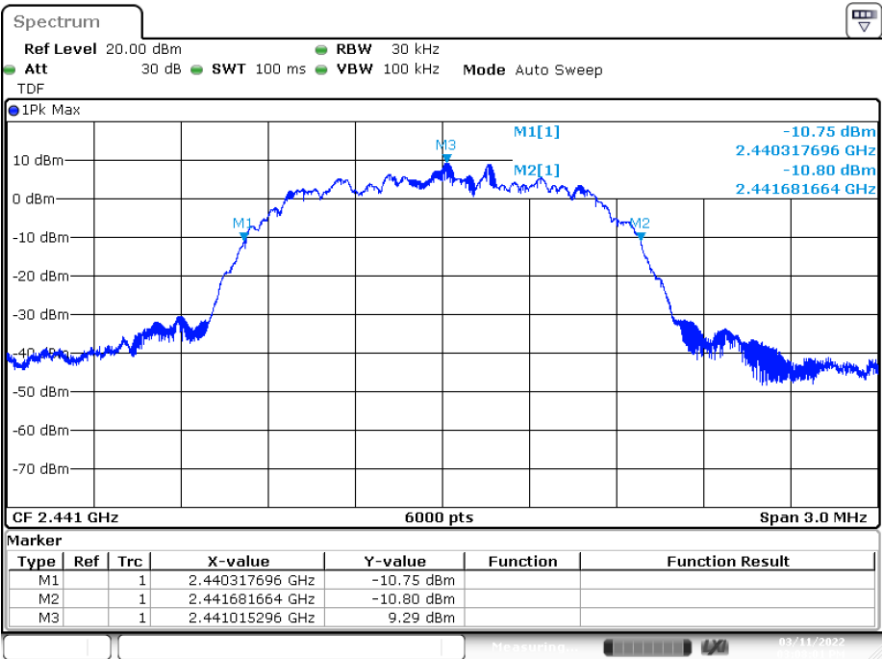
Max Value

B.1.3 Results screenshot



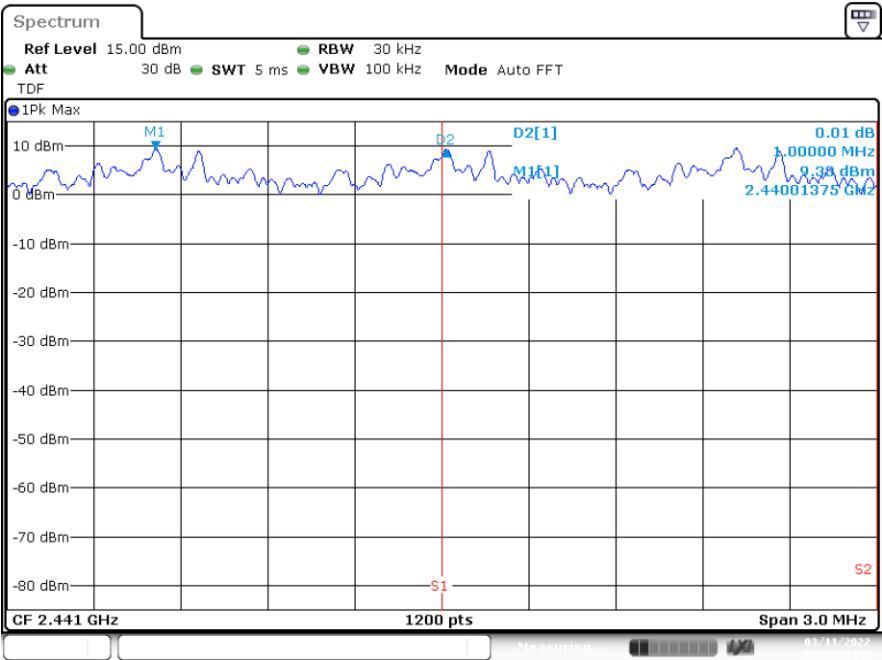
EDR – $\pi/4$ -DQPSK

20dB BW – CH39



Date: 11.MAR.2022 15:03:01

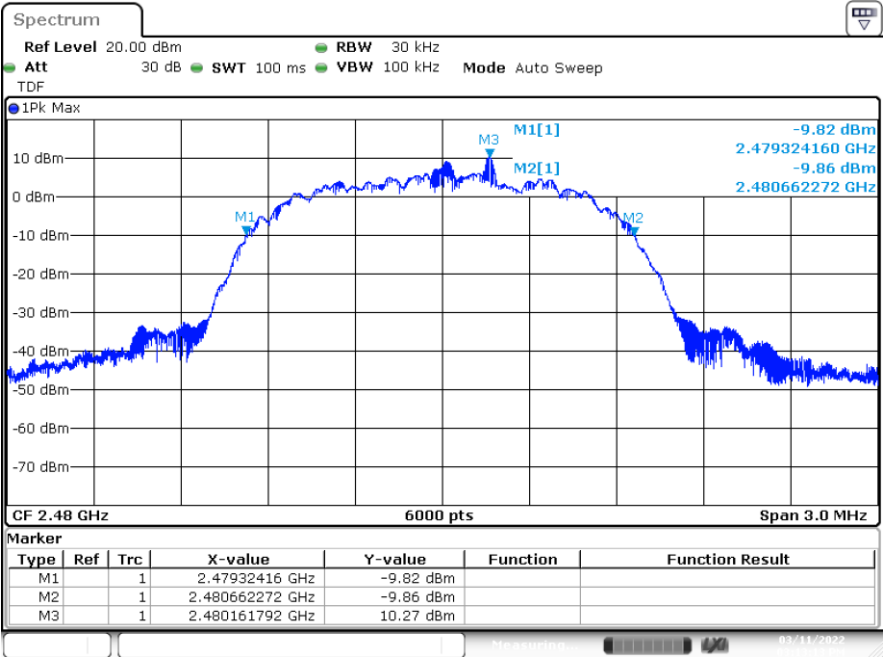
Freq. Separation



Date: 11.MAR.2022 16:13:52

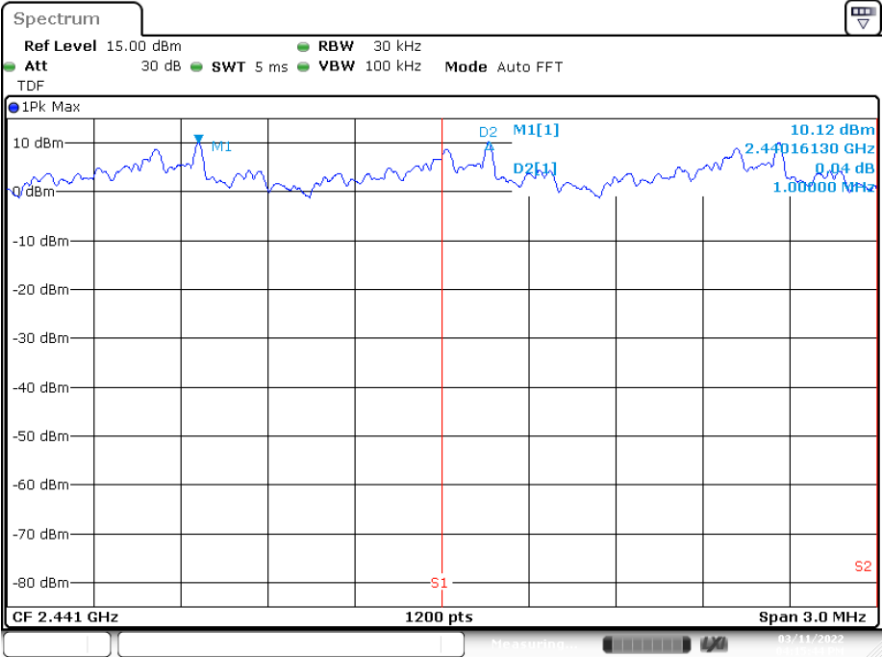
EDR – 8-DPSK

20dB BW – CH78



Date: 11.MAR.2022 15:13:13

Freq. Separation



Date: 11.MAR.2022 16:15:44

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

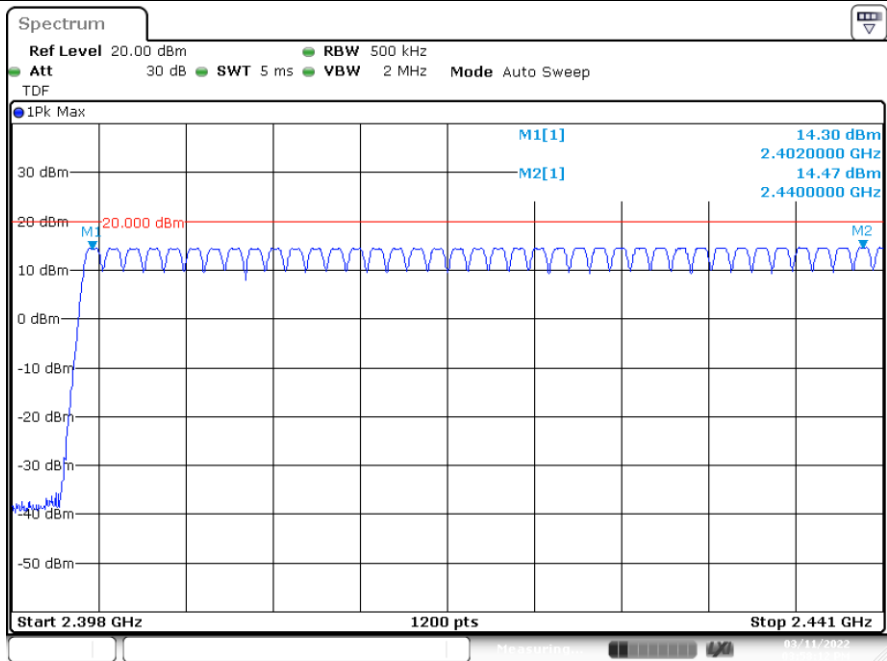
The conducted setup shown in section *Test & System Description* was used to measure the number of hopping channels. The antenna terminal of the EUT is connected to the spectrum through an attenuator, and the spectrum analyzer reading is compensated to include the RF path loss.

B.2.3 Results tables

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

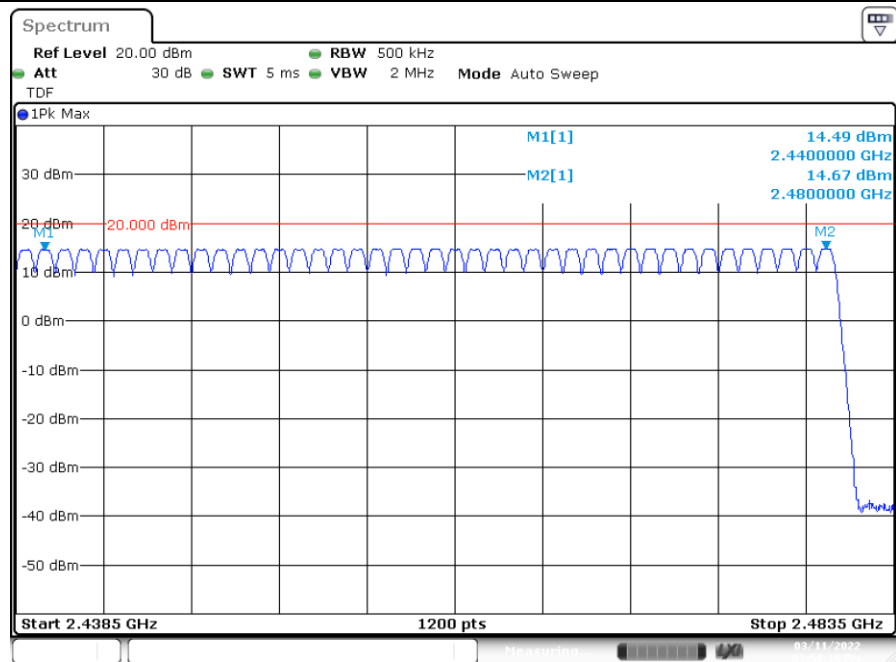
Number of hopping channels

Basic Rate – GFSK

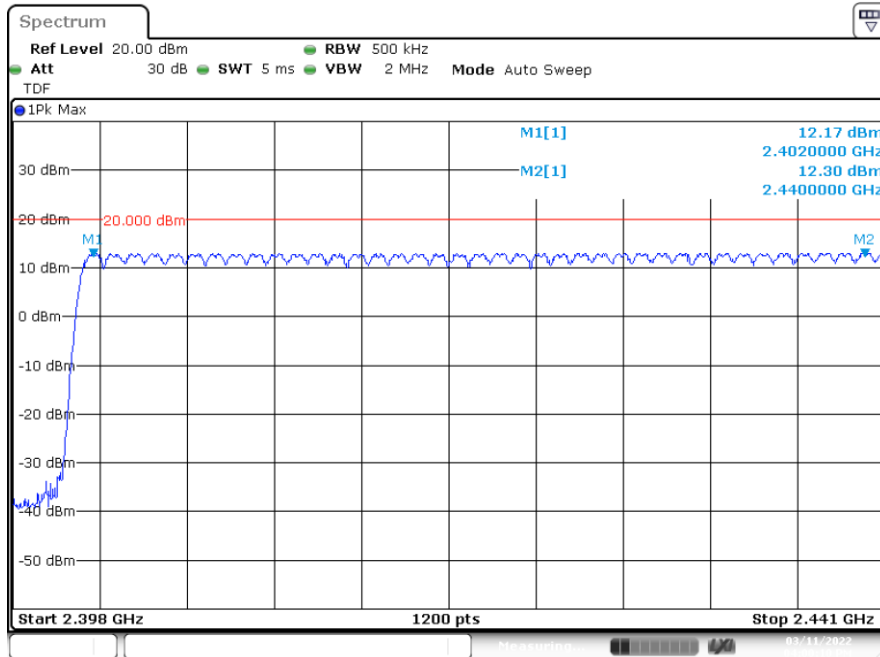


Date: 11.MAR2022 15:58:13

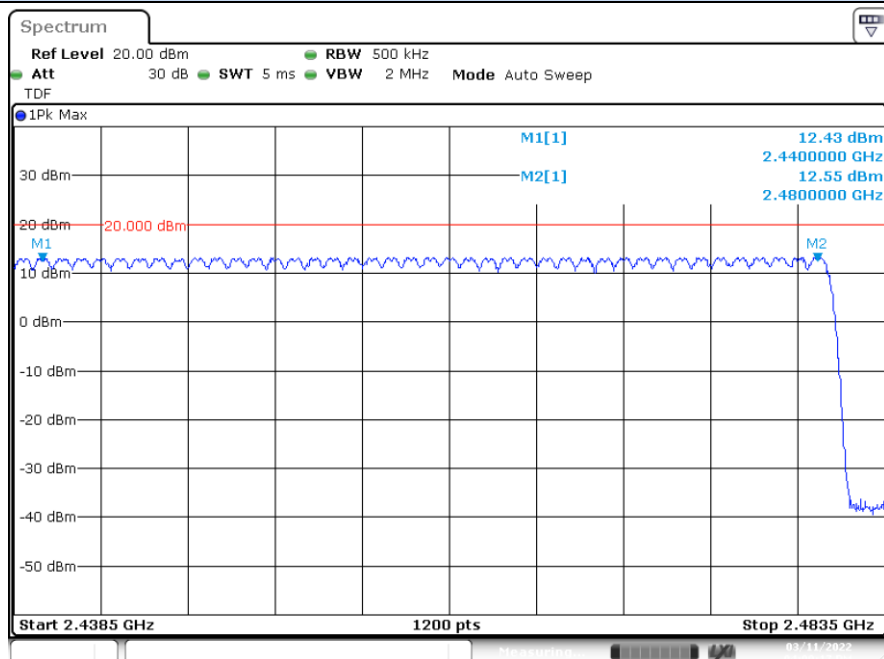
Basic Rate – GFSK



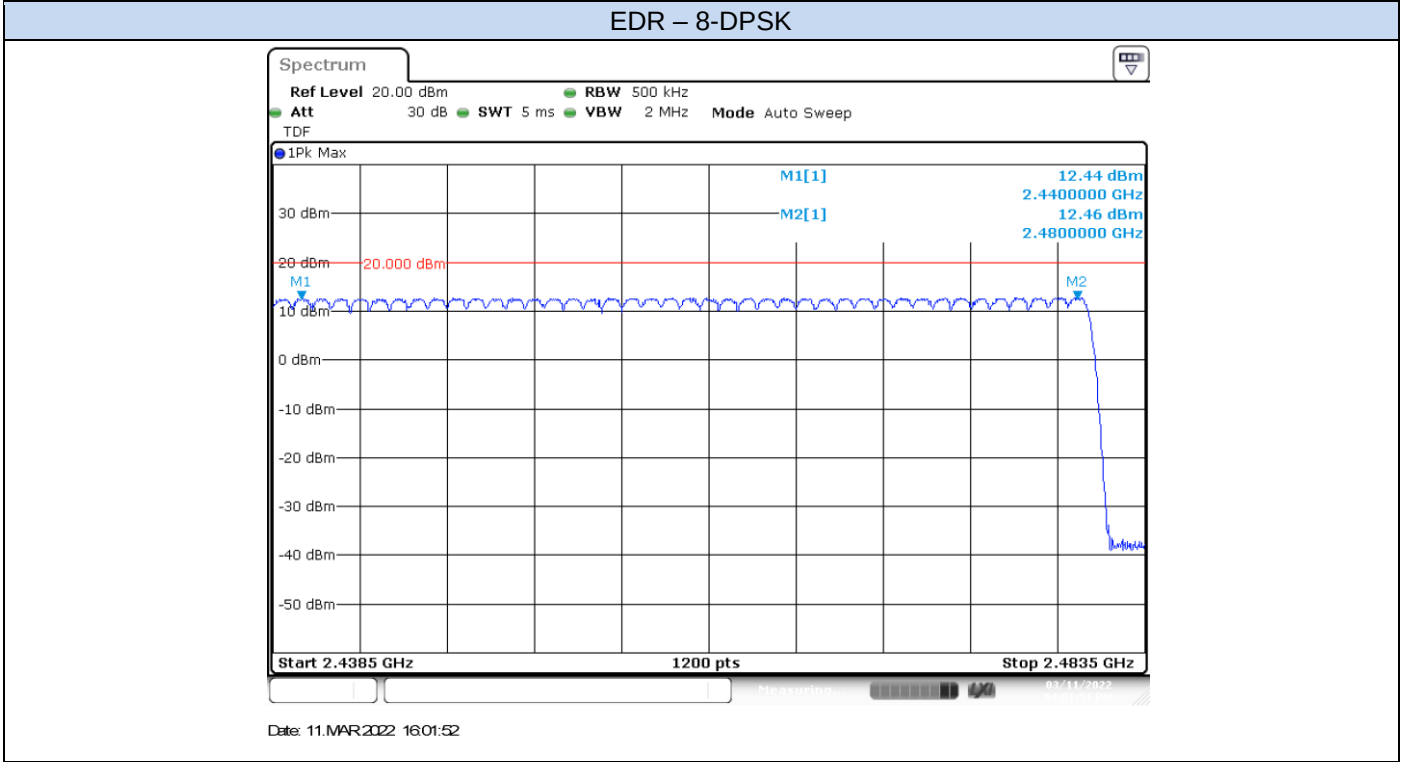
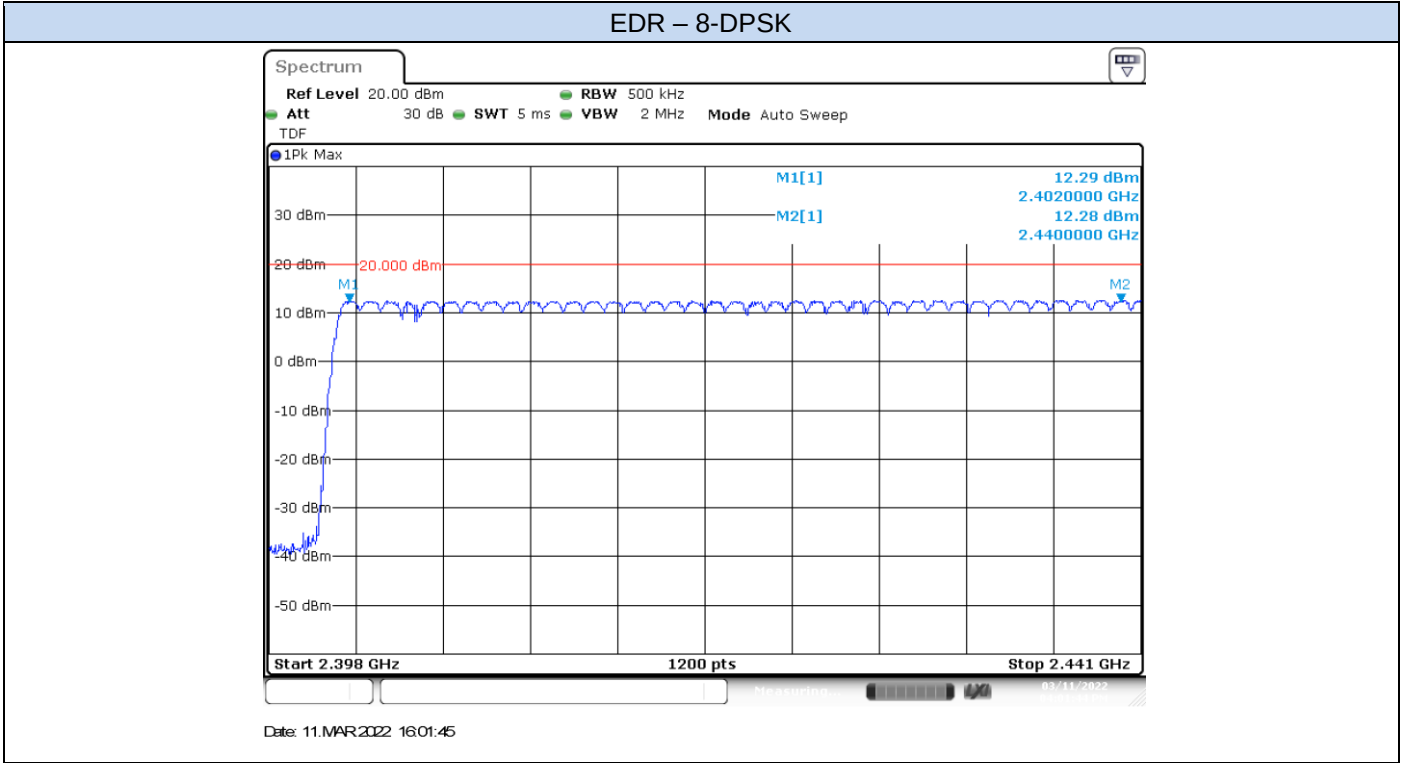
Date: 11.MAR2022 15:58:19

EDR – $\pi/4$ -DPSK

Date: 11.MAR.2022 16:00:11

EDR – $\pi/4$ -DPSK

Date: 11.MAR.2022 16:00:17



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 $0.4 \times 79 = 31.6$ seconds, each channel appears $10.13 \times 31.6 = 320.11$ 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 $0.4 \times 79 = 31.6$ seconds, each channel appears $5.1 \times 31.6 = 161.16$ times.

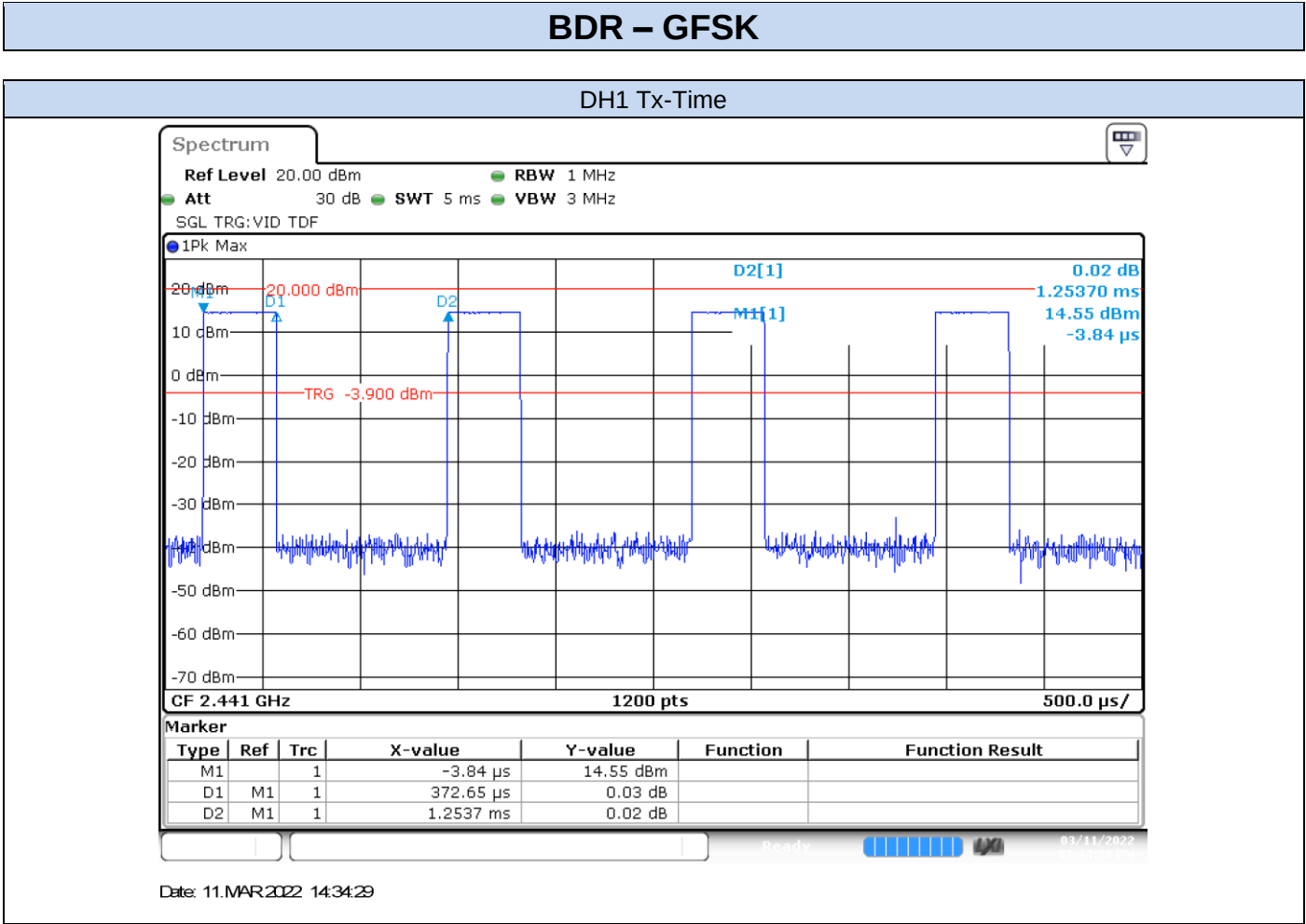
A DH5 packet, with independence of the modulation, needs 5 time slots for transmitting and 1 time slot for receiving. Then, the system makes in the worst case $1600/6 = 266.67$ hops per second with 79 channels. So each channel appears $266.67/79 = 3.37$ times per second and, for a period of $0.4 \times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

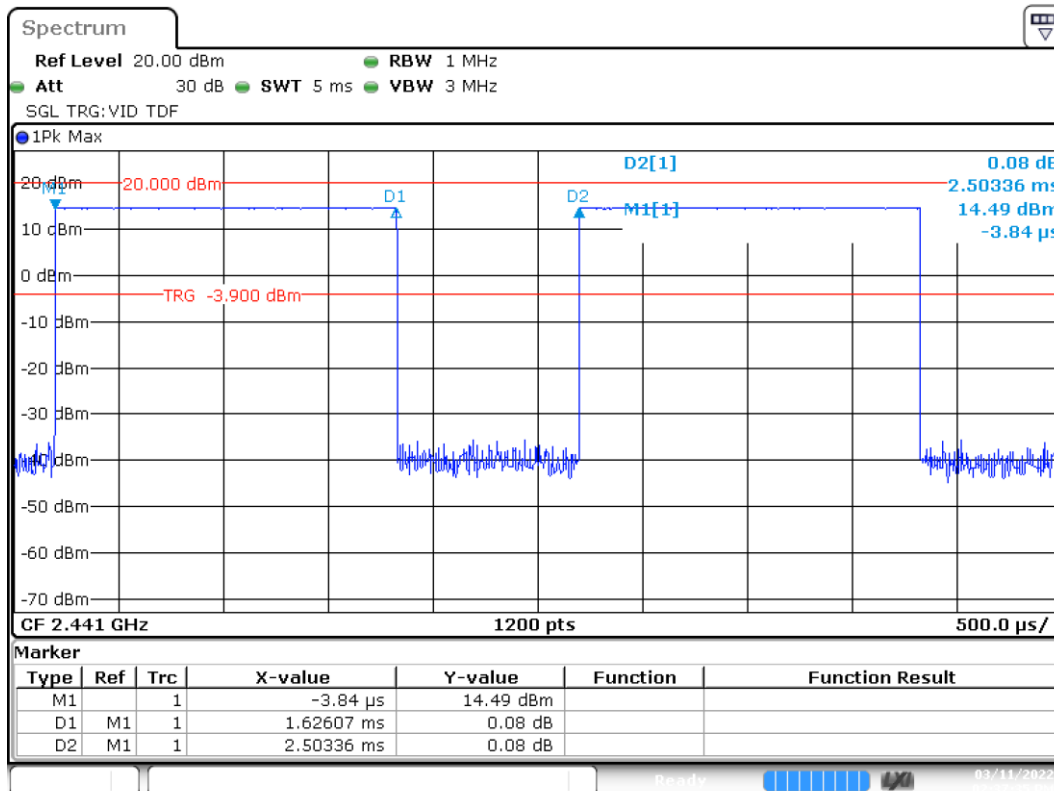
B.3.2 Results tables

Mode	Packet Type	Times of appearance	Tx-time [ms]	Dwell Time [ms]
Basic Rate GFSK	DH1	320.11	0.372	119.08
	DH3	161.16	1.626	262.05
	DH5	106.49	2.867	305.31
EDR $\pi/4$ -DQPSK	2-DH1	320.11	0.372	119.08
	2-DH3	161.16	1.630	262.69
	2-DH5	106.49	2.867	305.31
EDR 8-DPSK	3-DH1	320.11	0.380	121.64
	3-DH3	161.16	1.630	262.69
	3-DH5	106.49	2.867	305.31

B.3.3 Results Screenshot

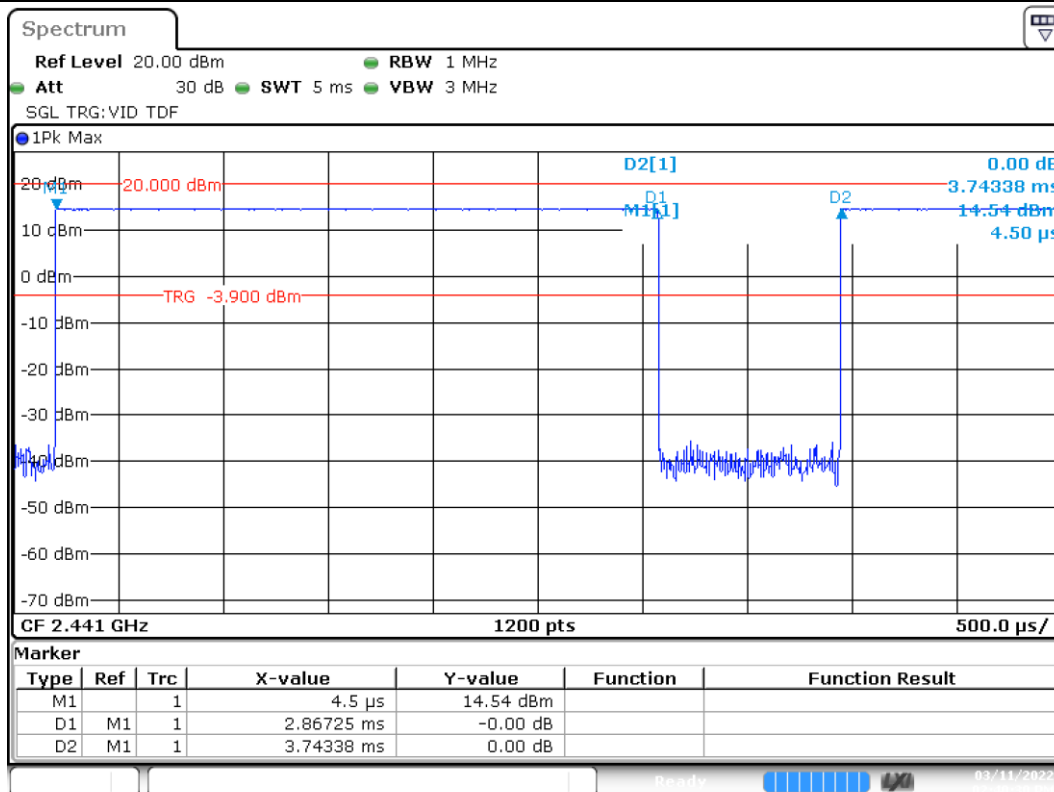


DH3 Tx-Time



Date: 11.MAR.2022 14:37:36

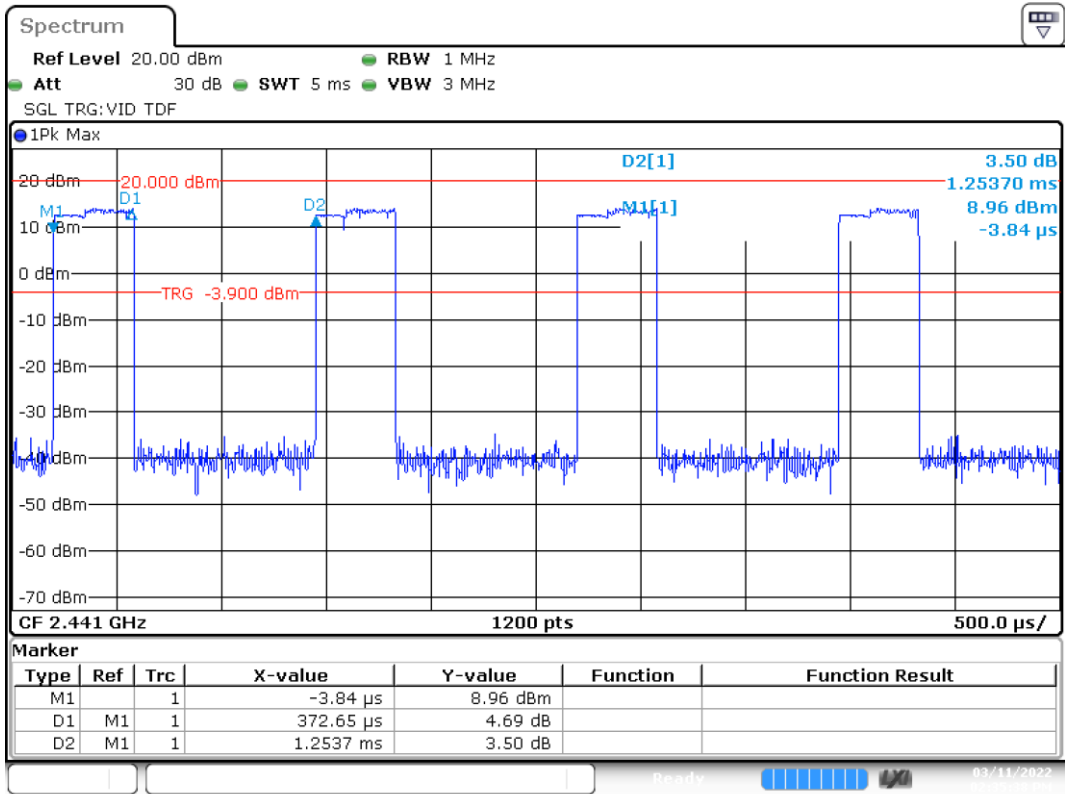
DH5 Tx-Time



Date: 11.MAR.2022 14:40:30

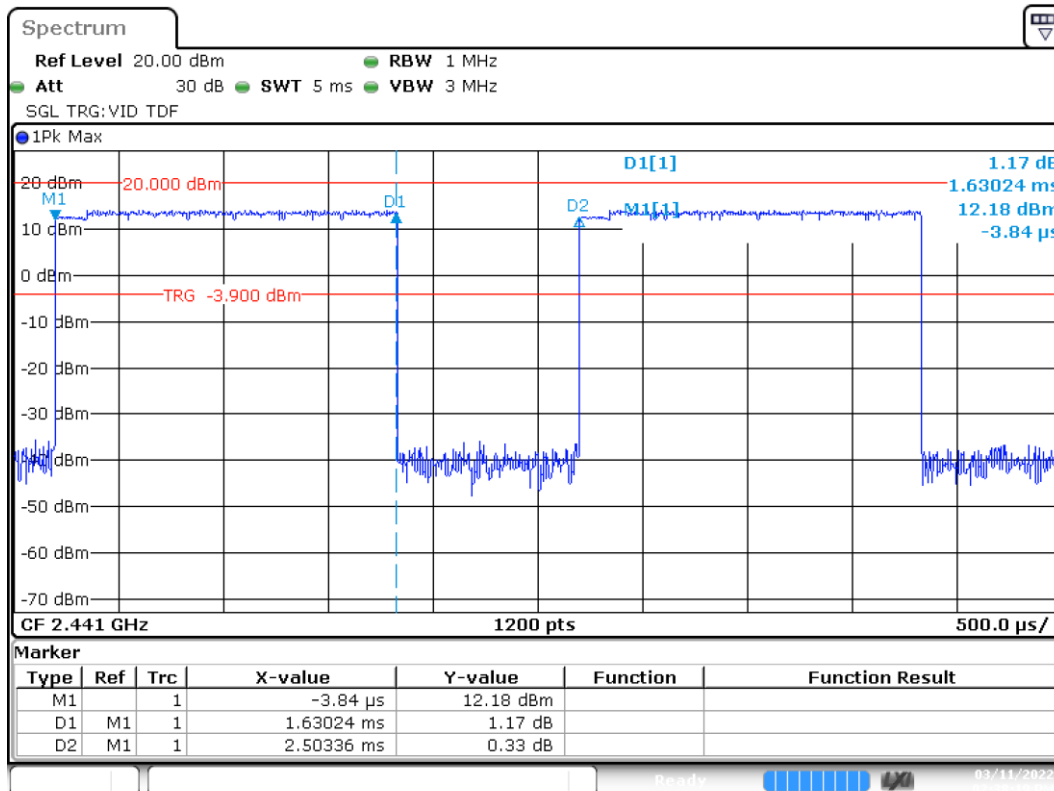
EDR – $\pi/4$ -DQPSK

2-DH1 Tx-Time



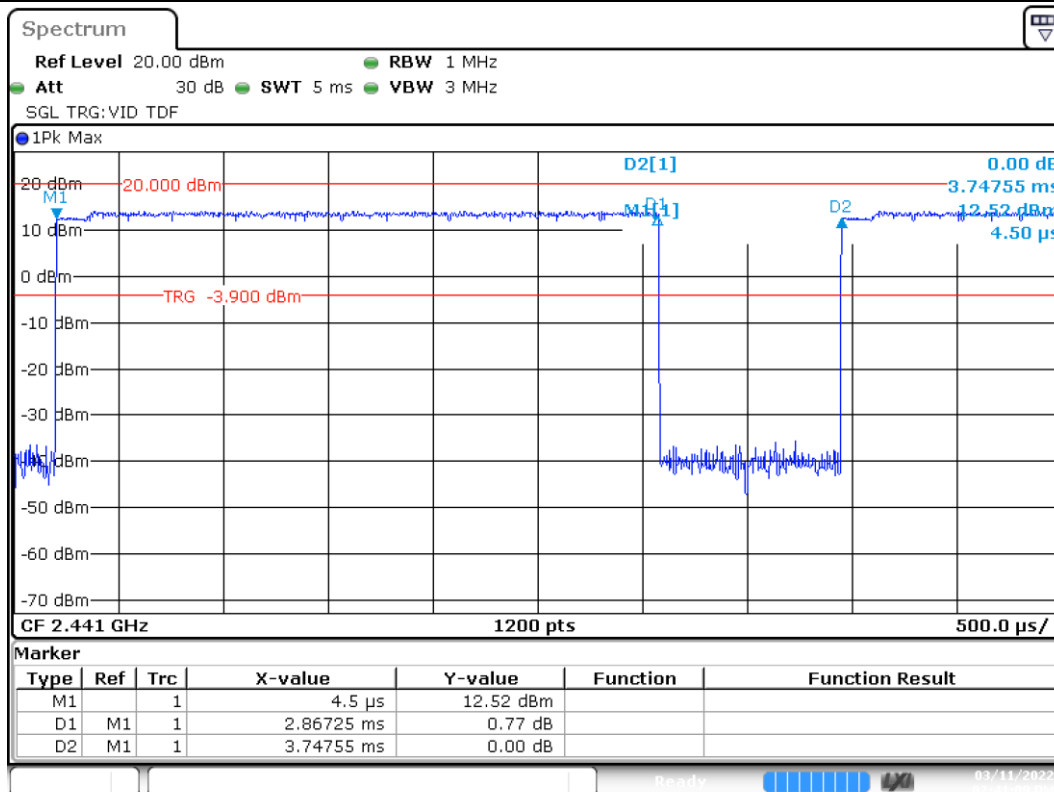
Date: 11.MAR.2022 14:35:38

2-DH3 Tx-Time



Date: 11.MAR.2022 14:38:19

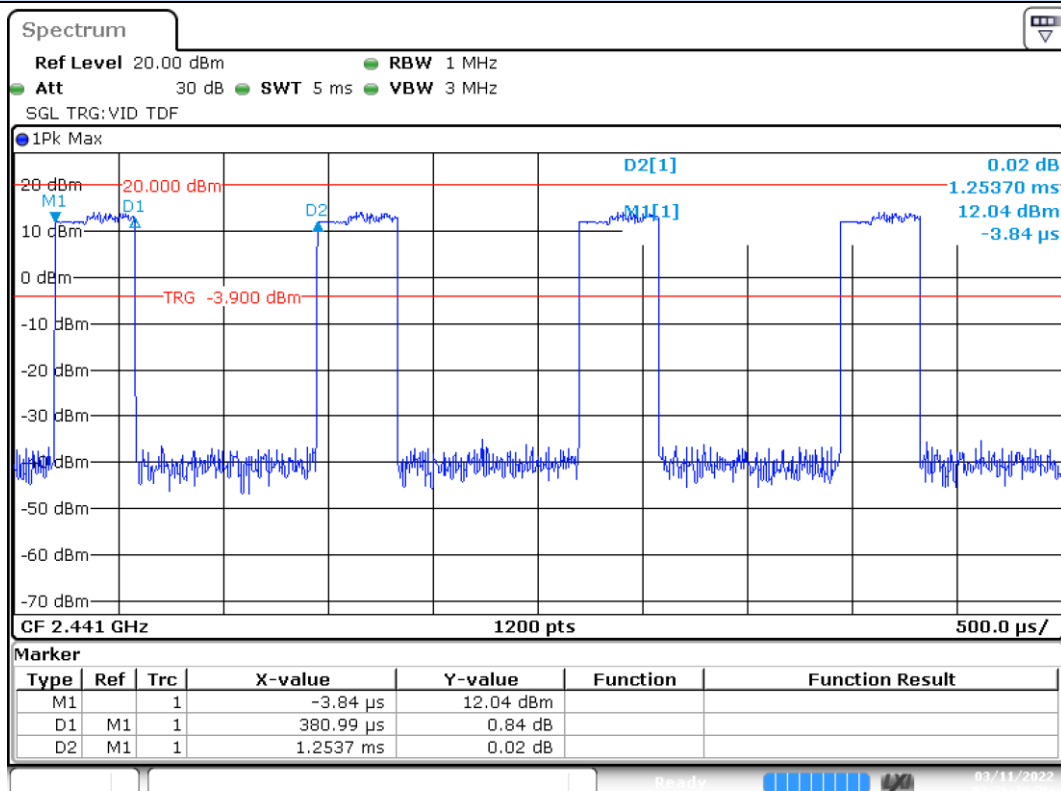
2-DH5 Tx-Time



Date: 11.MAR.2022 14:41:09

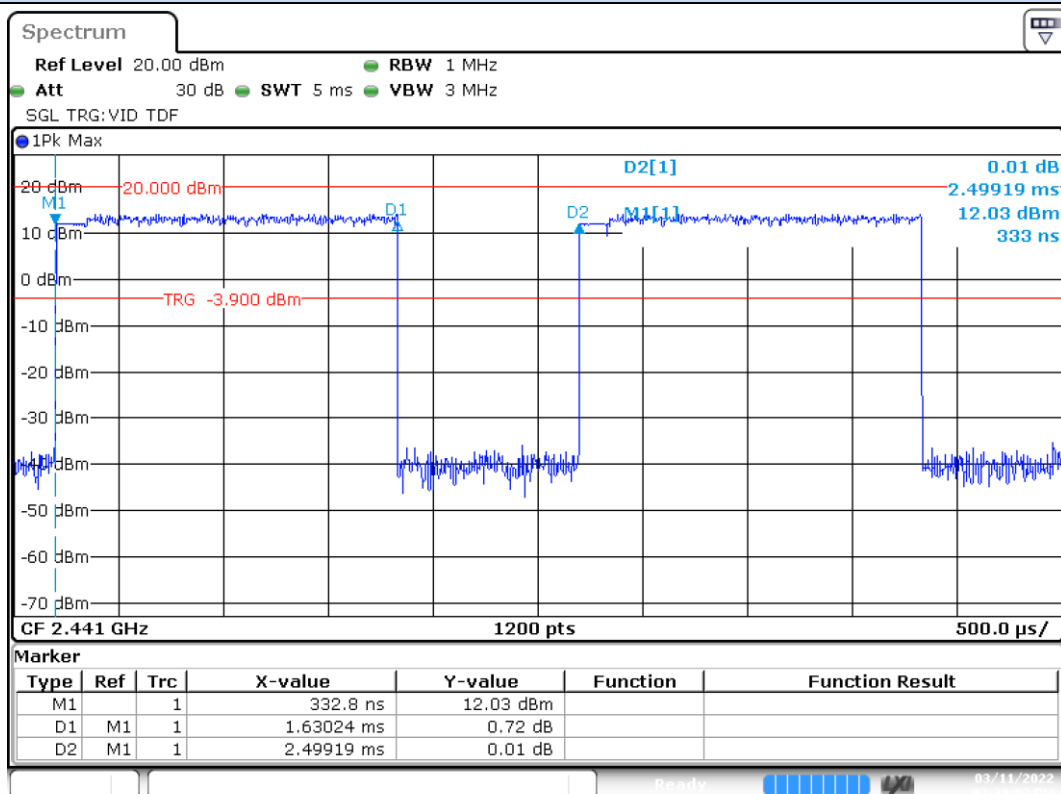
EDR – 8-DPSK

3-DH1 Tx-Time

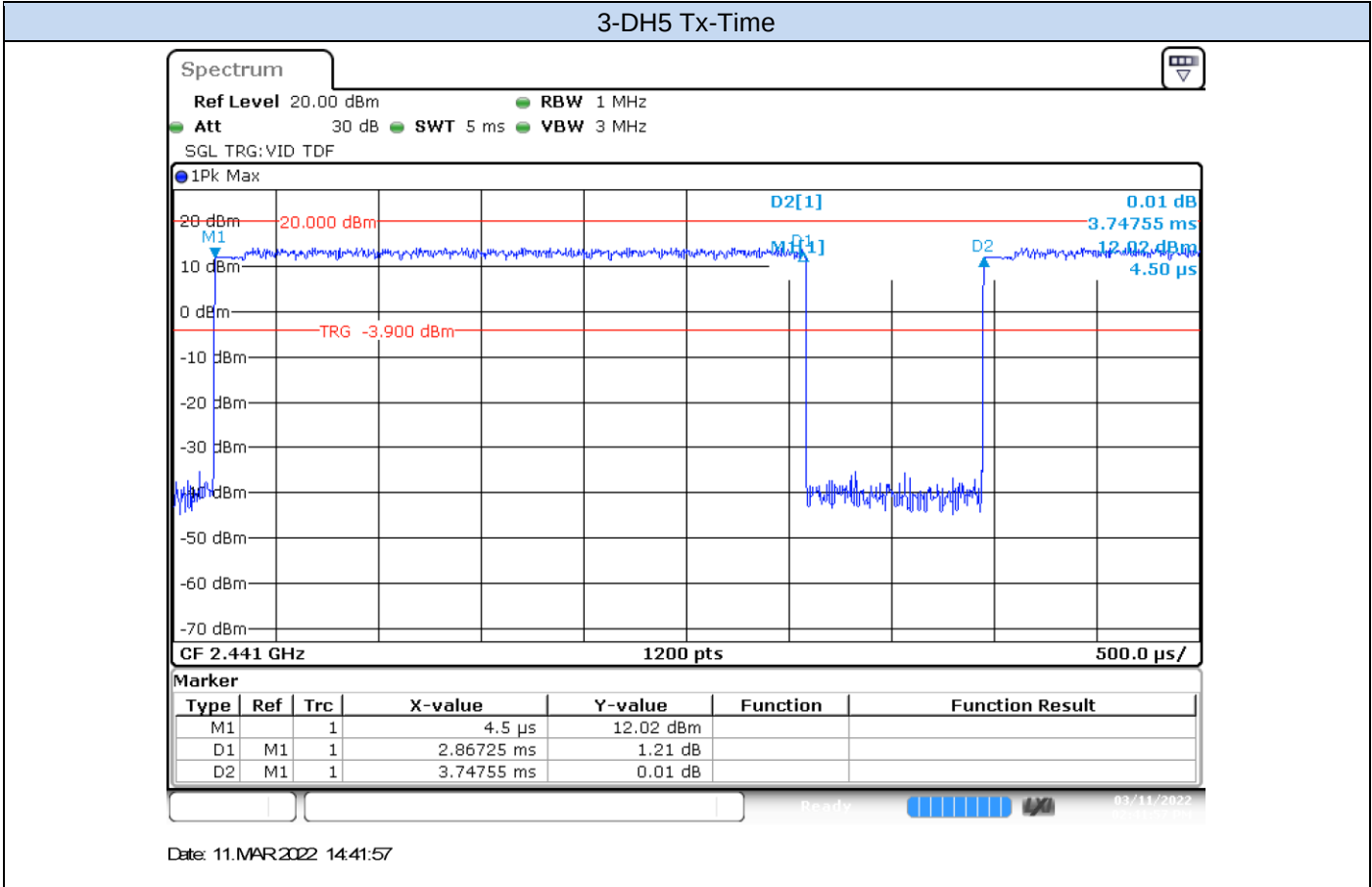


Date: 11.MAR.2022 14:36:39

3-DH3 Tx-Time



Date: 11.MAR.2022 14:39:03



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.

B.4.2 Test procedure

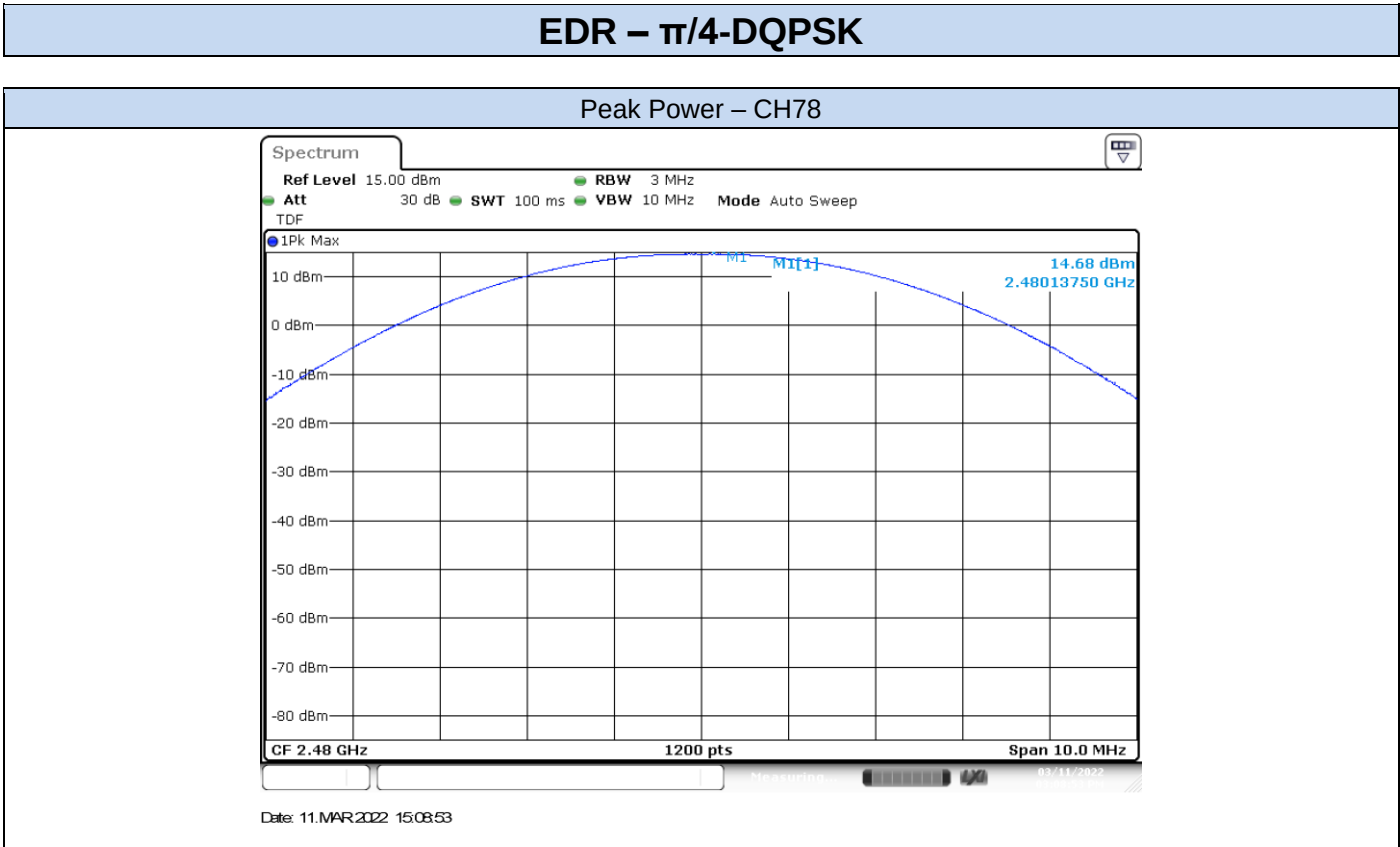
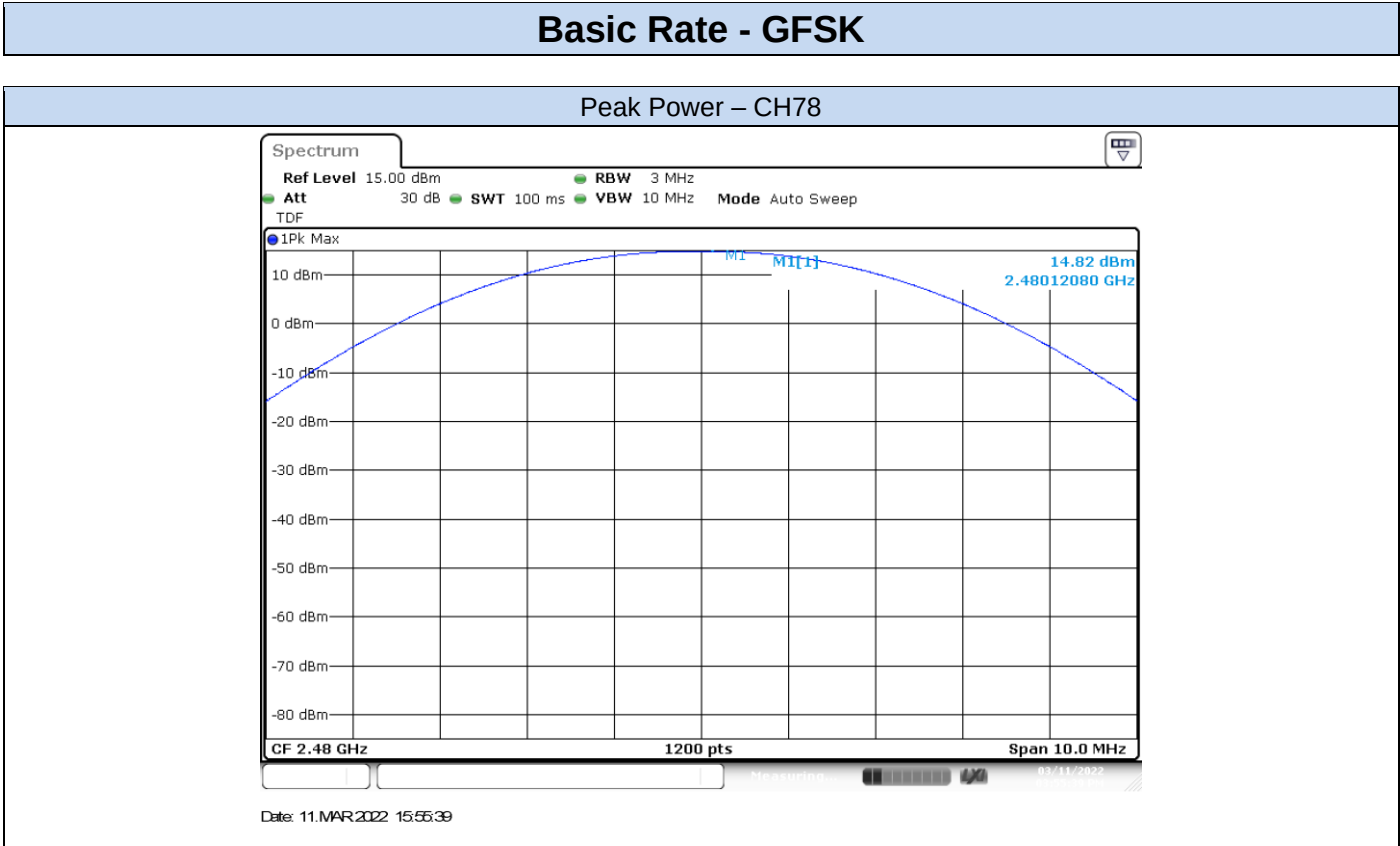
The conducted setup shown in section *Test & System Description* was used to measure the maximum peak output power. The antenna terminal of the EUT is connected to the spectrum through an attenuator, and the spectrum analyzer reading is compensated to include the RF path loss.

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	14.44	27.80	17.68	58.61
		39	2441	14.62	28.97	17.86	61.09
		78	2480	14.82	30.34	18.06	63.97
EDR $\pi/4$ -DQPSK	2DH5	0	2402	14.27	26.73	17.51	56.36
		39	2441	14.46	27.93	17.70	58.88
		78	2480	14.68	29.38	17.92	61.94
EDR 8-DPSK	3DH5	0	2402	14.32	27.04	17.56	57.02
		39	2441	14.52	28.31	17.76	59.70
		78	2480	14.71	29.58	17.95	62.37

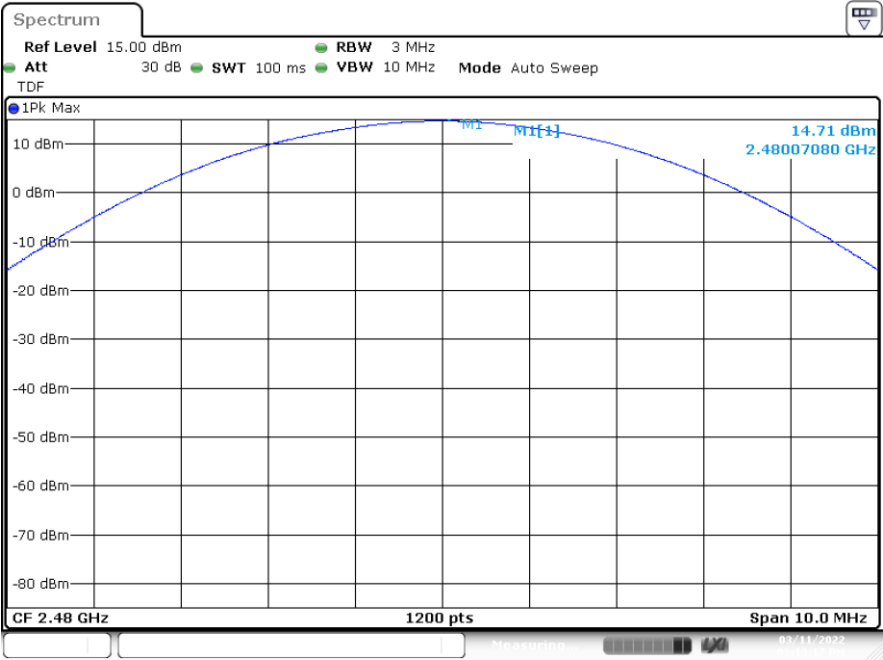
Max Value

B.4.4 Results Screenshot



EDR – 8-DPSK

Peak Power – CH78



Date: 11.MAR.2022 15:13:17

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.

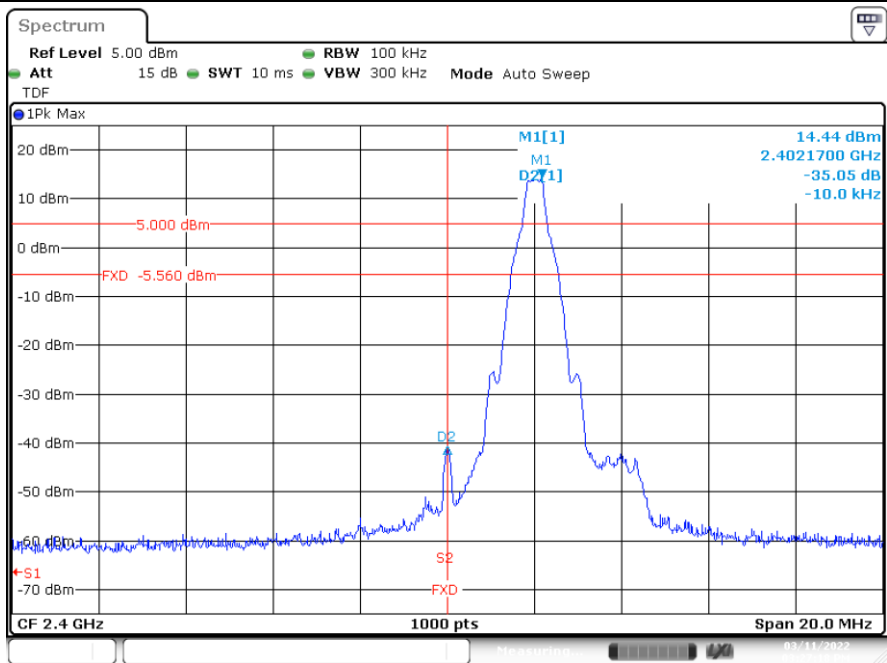
B.5.2 Test procedure

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.

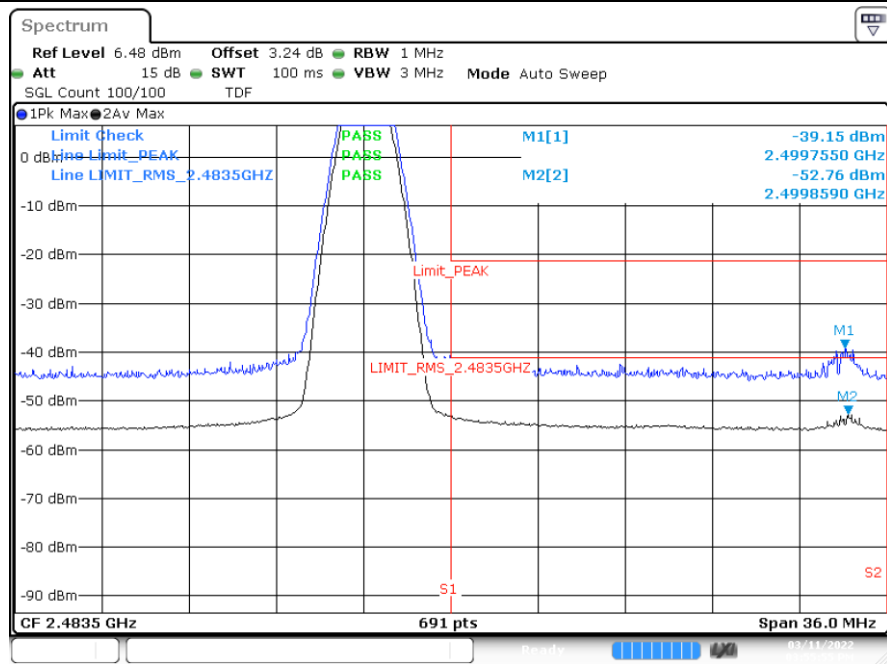
B.5.3 Test results

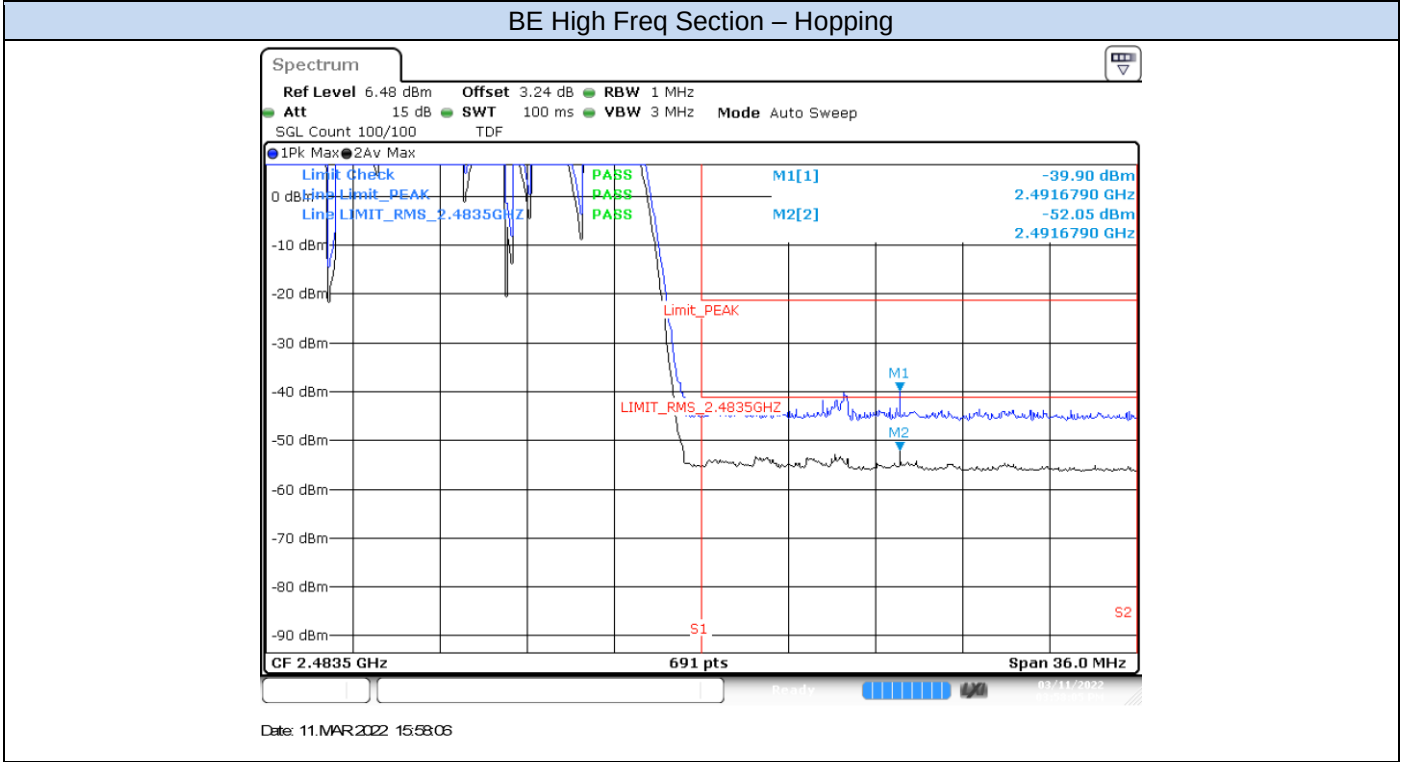
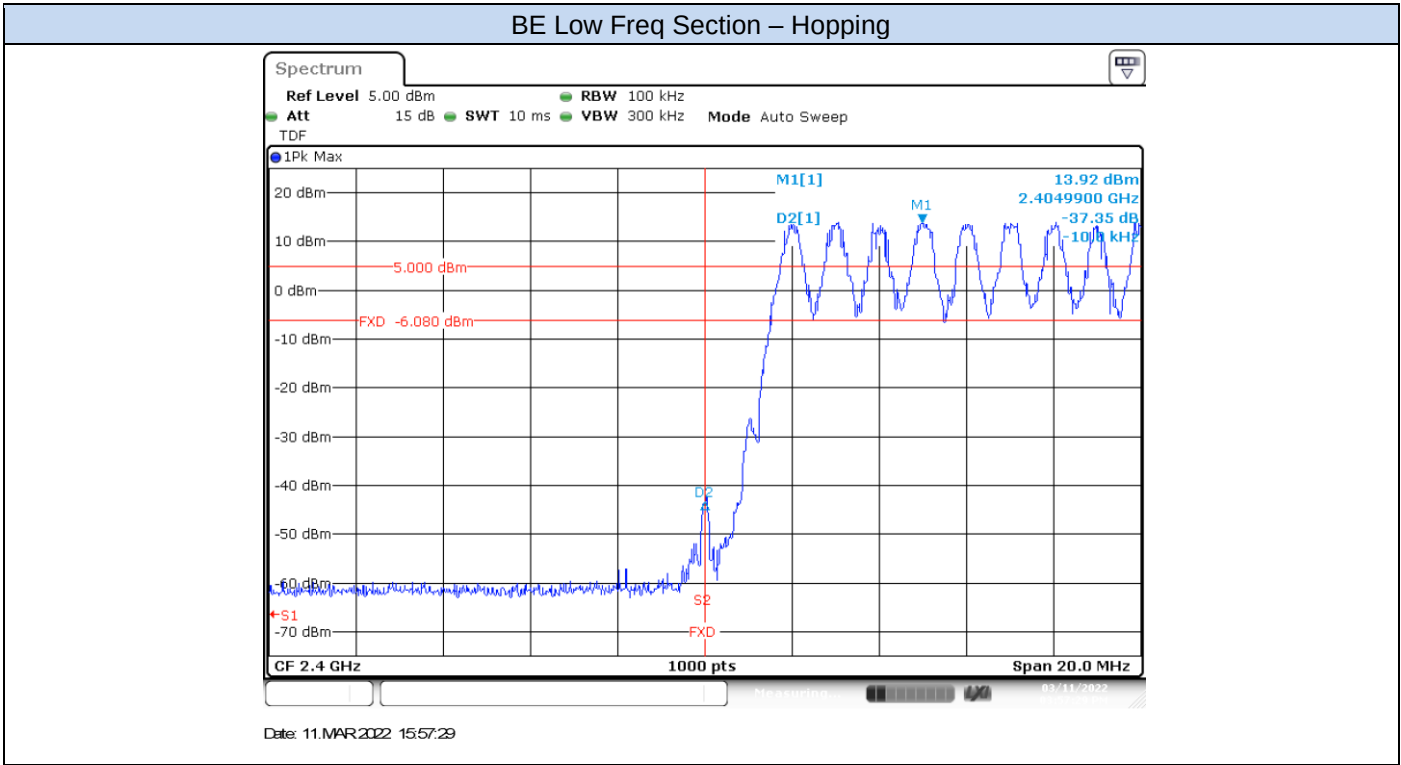
Basic Rate - GFSK

BE Low Freq Section – CH0



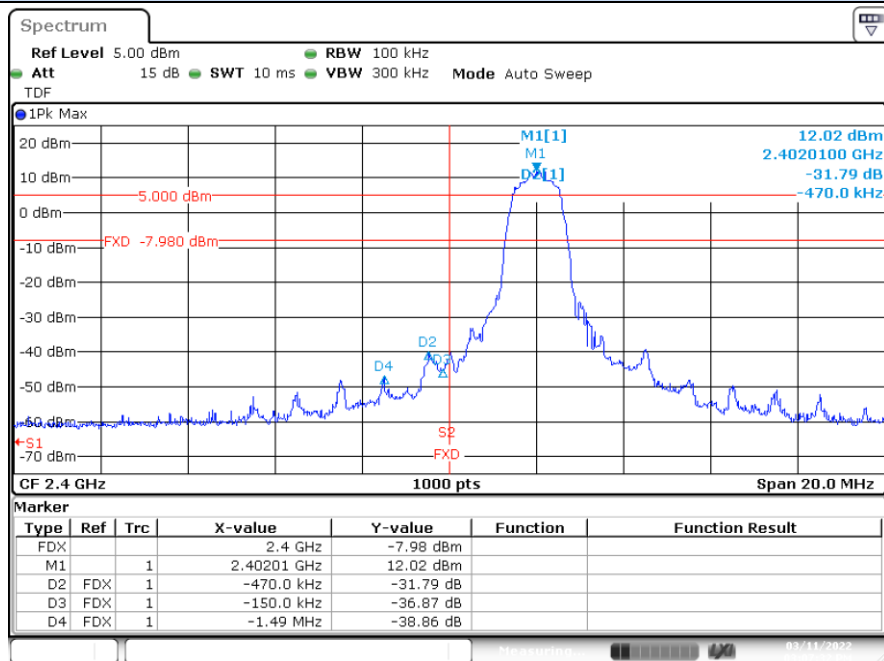
BE High Freq Section – CH78





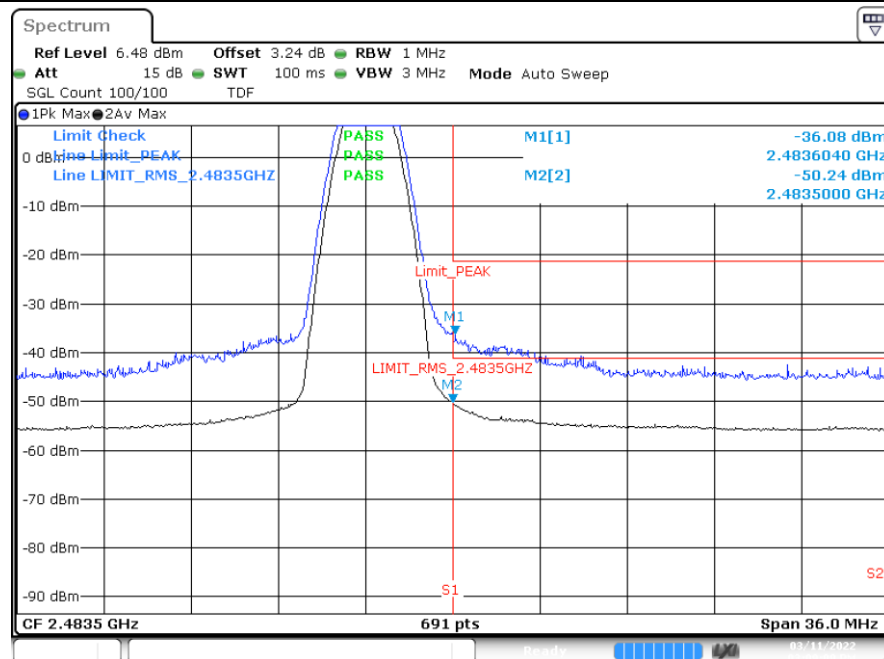
EDR – $\pi/4$ -DQPSK

BE Low Freq Section – CH0



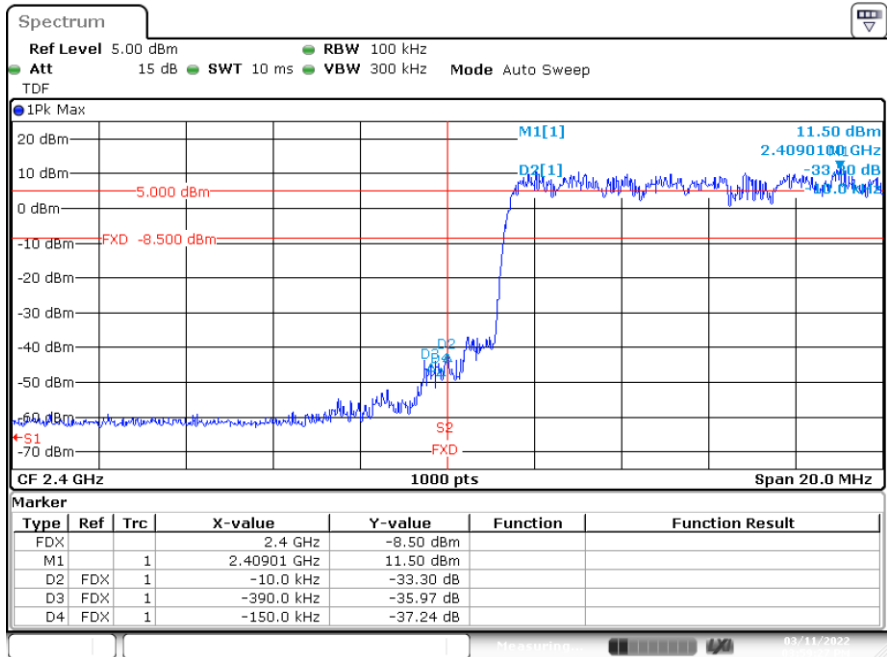
Date: 11.MAR.2022 15:07:32

BE High Freq Section – CH78



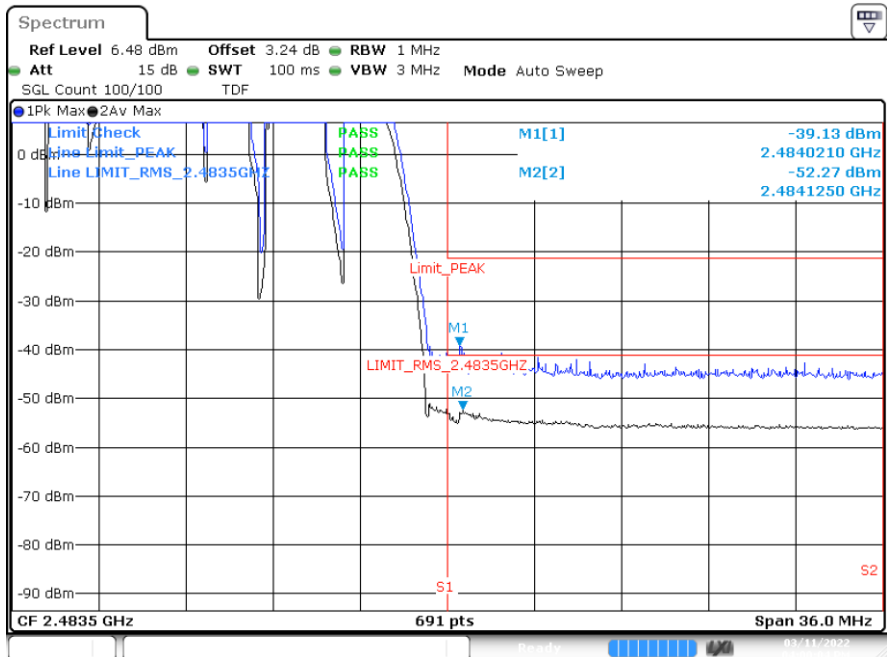
Date: 11.MAR.2022 15:09:09

BE Low Freq Section – Hopping



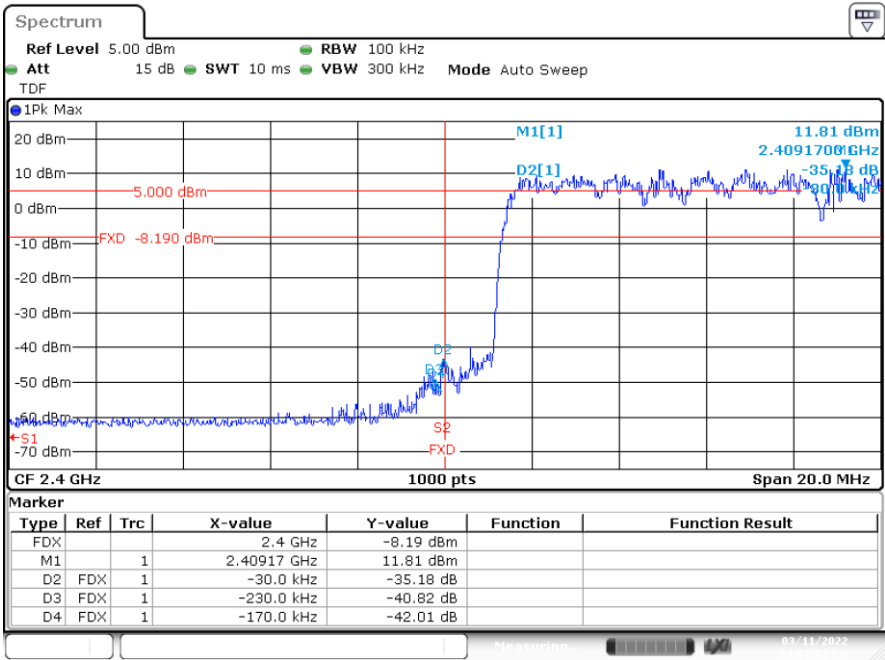
Date: 11.MAR.2022 15:59:27

BE High Freq Section – Hopping



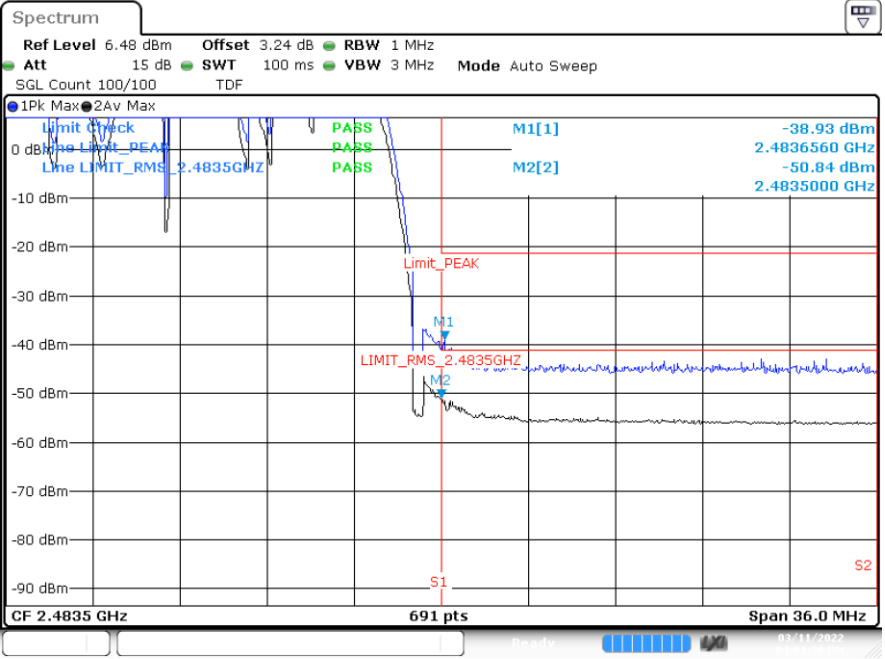
Date: 11.MAR.2022 16:00:04

BE Low Freq Section – Hopping



Date: 11.MAR.2022 16:01:02

BE High Freq Section – Hopping



Date: 11.MAR.2022 16:01:38

B.6 Radiated spurious emission

B.6.1 Standards references

FCC part	RSS part	Limits																				
15.247 (d) 15.209 (a)	RSS-247 Clause 5.5 RSS GEN A1 Clause 8.9	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 Strength (μV/m)</th><th>Field Strength (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.	Freq Range (MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Meas. Distance (m)	30-88	100	40	3	88-216	150	43.5	3	216-960	200	46	3	Above 960	500	54	3
Freq Range (MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Meas. Distance (m)																			
30-88	100	40	3																			
88-216	150	43.5	3																			
216-960	200	46	3																			
Above 960	500	54	3																			

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 360° 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	---
62.5	28.6	Quasi-Peak	40.0	11.4	V
80.0	33.6	Quasi-Peak	40.0	6.4	H
195.8	26.4	Quasi-Peak	43.5	17.1	H
199.3	27.4	Quasi-Peak	43.5	16.1	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	---
3391.5	52.2	Peak	74.0	21.8	H
3392.5	39.5	Average	54.0	14.5	H
9607.5	36.4	Average	54.0	17.6	V
9608.0	47.4	Peak	74.0	26.6	V
25811.5	48.9	Peak	74.0	25.1	V
25859.5	35.4	Average	54.0	18.6	H

CH39 DH5

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBμV/m	---	dBμV/m	dB	---
2184.5	48.2	Peak	74.0	25.8	H
2201.0	36.7	Average	54.0	17.3	H
2257.5	48.5	Peak	74.0	25.5	H
2261.0	36.7	Average	54.0	17.3	H
2320.5	48.9	Peak	74.0	25.1	H
2321.0	36.8	Average	54.0	17.2	H
9764.0	35.9	Average	54.0	18.1	V
9764.5	48.0	Peak	74.0	25.9	V
24997.0	34.6	Average	54.0	19.4	H
25000.5	47.5	Peak	74.0	26.5	H

CH78 DH5

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBμV/m	---	dBμV/m	dB	---
2239.5	48.2	Peak	74.0	25.8	H
2240.0	37.0	Average	54.0	17.0	H
2297.0	49.3	Peak	74.0	24.7	V
2300.0	36.7	Average	54.0	17.3	H
3505.0	37.4	Average	54.0	16.6	H
3505.5	49.5	Peak	74.0	24.5	H
9920.0	47.4	Peak	74.0	26.6	V
9920.0	35.4	Average	54.0	18.6	V
24168.0	47.8	Peak	74.0	26.2	H
24195.0	35.4	Average	54.0	18.6	H

EDR – $\pi/4$ -DQPSK**CH0 2DH5**

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dB μ V/m	---	dB μ V/m	dB	---
3059.5	51.1	Peak	74.0	22.9	V
3066.0	39.2	Average	54.0	14.8	H
3485.5	49.9	Peak	74.0	24.1	V
3491.0	37.2	Average	54.0	16.8	H
9607.5	47.2	Peak	74.0	26.8	H
9608.5	35.5	Average	54.0	18.5	V
24202.5	48.0	Peak	74.0	26.0	V
24226.0	35.5	Average	54.0	18.6	H

CH39 2DH5

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dB μ V/m	---	dB μ V/m	dB	---
3380.5	39.6	Average	54.0	14.4	H
3386.5	53.4	Peak	74.0	20.6	H
9763.5	35.6	Average	54.0	18.4	V
9766.0	48.0	Peak	74.0	26.0	H
24712.5	48.0	Peak	74.0	26.0	H
24751.0	33.8	Average	54.0	20.2	V

CH78 2DH5

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dB μ V/m	---	dB μ V/m	dB	---
3386.0	51.7	Peak	74.0	22.3	H
3387.5	39.6	Average	54.0	14.3	H
9910.5	48.3	Peak	74.0	25.7	H
9920.0	35.1	Average	54.0	18.9	V
24569.0	48.3	Peak	74.0	25.7	V
24570.5	35.0	Average	54.0	19.1	H

EDR – 8-DPSK**CH0 3DH5**

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBμV/m	---	dBμV/m	dB	---
3087.0	39.5	Average	54.0	14.5	H
3094.5	51.6	Peak	74.0	22.4	V
9607.0	47.6	Peak	74.0	26.4	V
9608.0	35.9	Average	54.0	18.1	V
24502.5	47.2	Peak	74.0	26.8	H
24531.5	35.0	Average	54.0	19.0	H

CH39 3DH5

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBμV/m	---	dBμV/m	dB	---
3350.5	51.5	Peak	74.0	22.5	H
3380.0	39.5	Average	54.0	14.5	V
9761.0	48.6	Peak	74.0	25.4	V
9764.0	36.0	Average	54.0	18.0	V
24221.5	48.4	Peak	74.0	25.6	H
24250.0	35.8	Average	54.0	18.2	H

CH78 3DH5

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBμV/m	---	dBμV/m	dB	---
3091.5	39.3	Average	54.0	14.7	H
3095.0	51.7	Peak	74.0	22.3	H
9918.5	48.7	Peak	74.0	25.3	V
9920.5	35.6	Average	54.0	18.4	V
24274.0	48.6	Peak	74.0	25.4	H
24288.5	35.4	Average	54.0	18.6	V