



TESTING CERT #3478.01



TEST REPORT

EUT Description	WiGig, WLAN and BT, 2x2 PCIe M.2 2230 adapter card
Brand Name	Intel® Tri Band Wireless-AC 18265
Model Name	18265NGW, 18265NGW LC
Serial Number	TA#: J30458-002 WF MAC: 34:13:E8:34:41:60 / 34:13:E8:44:A8:B2 / 34:13:E8:44:CF:34 BT MAC: 34:13:E8:34:41:64 / 34:13:E8:44:A8:B6 / 34:13:E8:34:54:9C (see section 4)
FCC/IC ID	FCC ID: PD918265NG IC ID: 1000M-18265NG
Antenna type	Universe Technology
Hardware/Software Version	HW config: 33.10 Test SW: DRTU version 03789_1_9_0G (driver version: 19.1.0.1) Test SW RSE: DRTU version 03293_1_8_9G (driver version: 19.1.0.1)
Date of Sample Receipt	2016-08-30
Date of Test	2016-10-06/ 2016-10-26
Features	WiGig + 802.11 a/b/g/n/ac Wireless LAN + BDR/EDR 2.1 + BLE 4.2 (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 15C RSS-247 issue 1, RSS-Gen issue 4 (see section 1)
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Test Report number	160830-01.TR05
Revision Control	Rev. 00

The test results relate only to the samples tested.
The test report shall not be reproduced in full, without written approval of the laboratory.

Reviewed by

Approved by

Walid El Hajj
(RF Test Lead)

Olivier FARGANT
(Technical Manager)

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

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1. Standards, reference documents and applicable test methods

1. FCC 47 CFR part 15 - Subpart C – §15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
2. FCC 47 CFR part 15 - Subpart C – §15.209 Radiated emission limits; general requirements.
3. Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems - DA 00-705 Released March 30, 2000
4. RSS-247 Issue 1 - Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
5. RSS-Gen Issue 4 - General Requirements for Compliance of Radio Apparatus.
6. ANSI C63.10-2013 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

2. General conditions, competences and guarantees

- ✓ Intel Mobile Communications Wireless RF Lab (Intel WRF Lab) is a testing laboratory accredited by the American Association for Laboratory Accreditation (A2LA).
- ✓ Intel Mobile Communications Wireless RF Lab (Intel WRF Lab) is an Accredited Test Firm listed by the FCC, with Designation Number FR0011.
- ✓ Intel Mobile Communications Wireless RF Lab (Intel WRF Lab) is a Registered Test Site listed by IC, with IC Assigned Code 1000Y.
- ✓ 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.
- ✓ Complete or partial reproduction of the report cannot be made without written permission of Intel WRF Lab.

3. Environmental Conditions

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

Temperature	23 °C ± 1 °C
Humidity	46 % ± 7 %

4. Test samples

Sample	Control #	Description	Model	Serial #	Date of reception	Note
#01	160830-01.S01	WiGig/WiFi/ BT Module	18265NGW	WFM: 34:13:E8:34:41:60 BDM: 34:13:E8:34:41:64 WGM: 34:13:E8:34:41:65	2016-08-30	Used for conducted tests
	15081801.S01	Extender board	PCB00432	ASS00432-001 4324612-083	2015-08-17	
	160107-01.S21	AC/DC Adapter	SPU60-102	08741181 1350	2016-01-07	
	160202-02.S22	Laptop Dell	Latitude E5440	8P8YN32	2016-02-10	
#02	160830-01.S06	WiGig/WiFi/ BT Module	18265NGW	WFM: 34:13:E8:44:A8:B2 BDM: 34:13:E8:44:A8:B6 WGM: 34:13:E8:44:A8:B7	2016-08-30	Used for radiated tests (from 30 MHz to 1 GHz and 18 GHz to 26.5 GHz)
	160830-01.S38	Extender board	PCB00469	ASS00469-001 4694213-099	2016-09-27	
	15051101.S09	Laptop	DELL E5440	9FSYN32	2015-05-12	
#03	160830-01.S11	WiGig/WiFi/ BT Module	18265NGW	WFM: 34:13:E8:44:CF:34 BDM: 34:13:E8:44:CF:38 WGM: 34:13:E8:44:CF:39	2016-08-30	Used for radiated tests (from 1 GHz to 18 GHz)
	160830-01.S21	Extender Rev-2	PCB00469	4694213-245	2016-09-02	
	160202-02.S29	Control Laptop	Dell Latitude E6430	D41QVY1	2016-03-18	
	160202-02.S19	PCI Extender	PCB00284	ASS0248 2480614- 071	2016-02-10	
	160202-02.S20	ExpressCard Adapter	-	600010757	2016-02-12	

NA: Not Applicable

5. EUT features

These are the detailed bands and modes supported by the Equipment under Test:

WiGig	60 GHz (57.24 – 63.72 GHz)
802.11b/g/n	2.4 GHz (2400.0 – 2483.5 MHz)
802.11a/n/ac	5.2GHz (5150.0 – 5250.0 MHz) 5.3 GHz (5250.0 – 5350.0 MHz) 5.6 GHz (5470.0 – 5725.0 MHz) 5.8 GHz (5725.0 – 5850.0 MHz)
BDR/EDR 2.1 BLE 4.2	2.4 GHz (2400.0 – 2483.5 MHz)

6. Remarks and comments

N/A

7. Test Verdicts summary

7.1. BT Basic Data Rate / Enhanced Data Rate

FCC part	RSS part	Test name	Verdict
15.247 (a) (1)	RSS-247 Clause 5.1 (1) and (2)	20dB Bandwidth and Carrier frequency separation	P
15.247 (a) (1) (iii)	RSS-247 Clause 5.1 (4)	Number of hopping channels	P
15.247 (a) (1) (iii)	RSS-247 Clause 5.1 (4)	Time of Occupancy (Dwell Time)	P
15.247 (b) (1)	RSS-247 Clause 5.4 (2)	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	Out-of-band Emissions (radiated)	P

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

8. Document Revision History

Revision #	Date	Modified by	Details
Rev. 00	2016-10-06	A.SAYOUD I. KHARRAT	First Issue

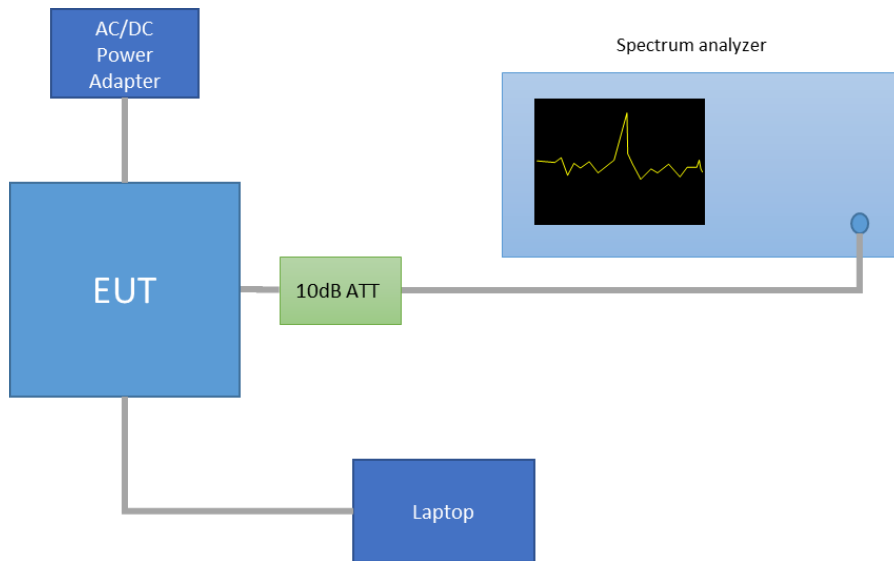
Annex A. Test & System Description

A.1 Measurement system

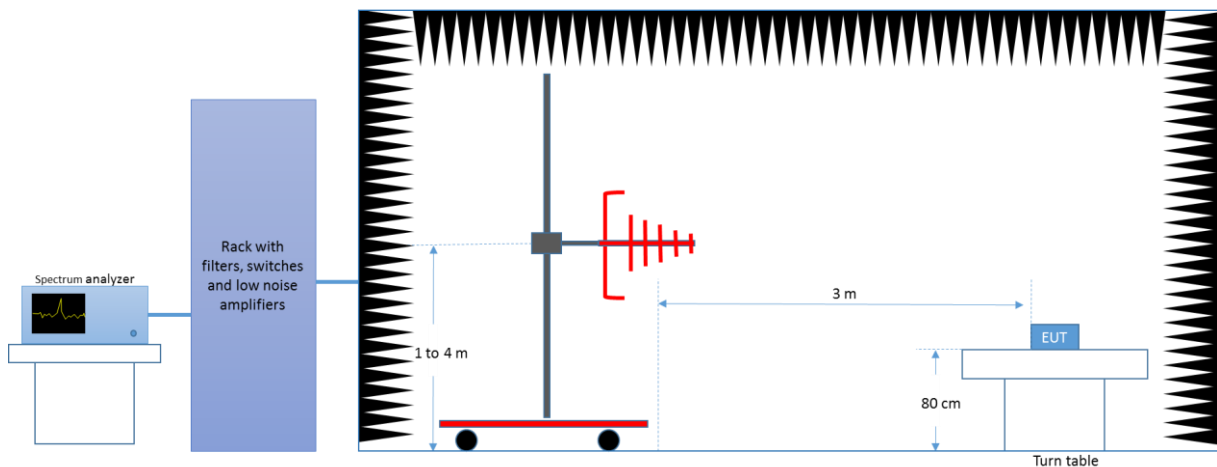
Measurements were performed using the following setups.

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.

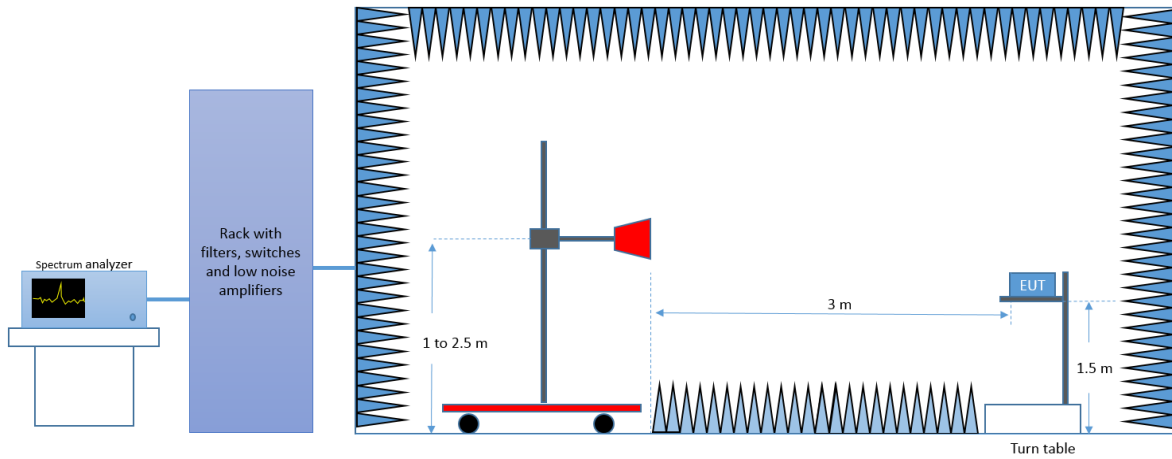
Conducted Setup



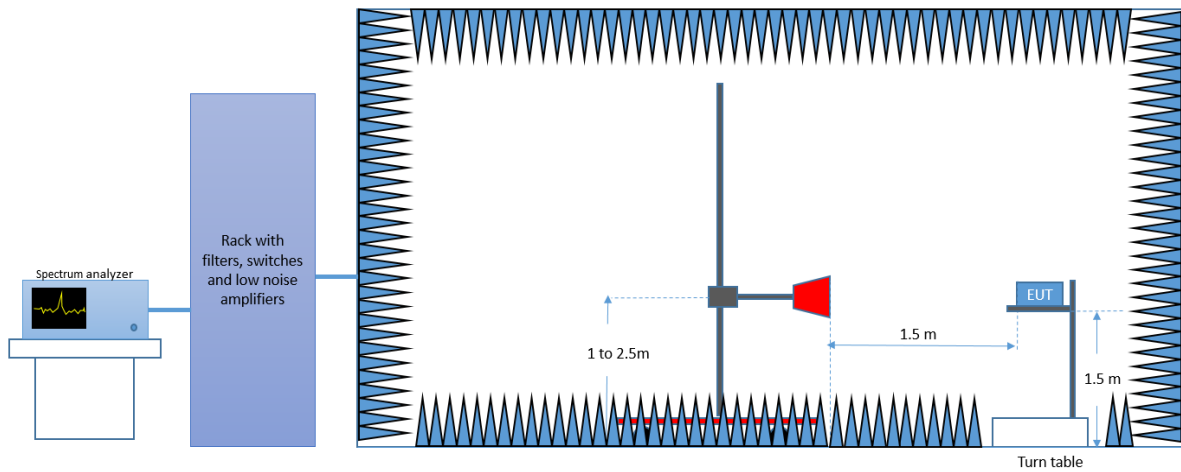
Radiated Setup < 1GHz



Radiated Setup 1GHz - 18GHz



Radiated Setup 18 GHz – 26.5 GHz



A.2 Test Equipment List

Conducted Setup

ID#	Device	Type/Model	Serial Number	Manufacturer	Cal. Date	Cal. Due Date
0310	Spectrum analyzer	FSV40	101425	Rohde & Schwarz	2015-03-25	2017-03-25

Radiated Setup

ID#	Device	Type/Model	Serial Number	Manufacturer	Cal. Date	Cal. Due Date
0420	Spectrum analyzer	FSV40	101556	Rohde & Schwarz	2016-04-15	2018-04-15
0133	Spectrum analyzer	FSV40	101358	Rohde & Schwarz	2016-04-15	2018-04-15
0137	Log antenna 30 MHz – 1 GHz	3142E	00156946	ETS Lindgren	2015-12-11	2017-12-11
0138	Horn antenna 1 GHz – 6.4 GHz	3117	00152266	ETS Lindgren	2016-03-14	2018-03-14
0248	Double Ridge Antenna with preamplifier 1 GHz – 18 GHz	3117	00167062	ETS Lindgren	2016-07-26	2018-07-26
0141	Double Ridge Horn Antenna 1 GHz – 18 GHz	3117	00157736	ETS Lindgren	2016-04-13	2018-04-13
0409	Pre-Amplifier	3117-PA	00157993	ETS Lindgren	N/A	N/A
0139	Horn Antenna 18 GHz - 26.5 GHz	114514	00167100	ETS Lindgren	2016-03-16	2018-03-16
0135	Semi Anechoic chamber	FACT 3	5720	ETS Lindgren	2016-04-28	2018-04-28
0337	Full Anechoic chamber	RFD_FA_100	5996	ETS Lindgren	2016-04-28	2018-04-28
0329	Measurement Software	EMC32	100401	Rohde & Schwarz	N/A	N/A
0530	Measurement Software	EMC32	100623	Rohde & Schwarz	N/A	N/A
0296	Power Supply	6673A	MY41000318	Agilent	N/A	N/A
0346	Multimeter	34401A	US36054685	HP	2016-02-04	2018-02-04
0038	Power Meter	ML2487B	952010	ANRITSU	2015-09-24	2017-09-24

A.3 Measurement Uncertainty Evaluation

The system uncertainty evaluation is shown in the below table:

Measurement type	Uncertainty [±dB]
Conducted Power (power meter)	± 1.0
Conducted spurious emission	± 2.9
Radiated test < 1GHz	± 3.8
Radiated test 1GHz -26 GHz	± 4.7

Annex B. Test Results

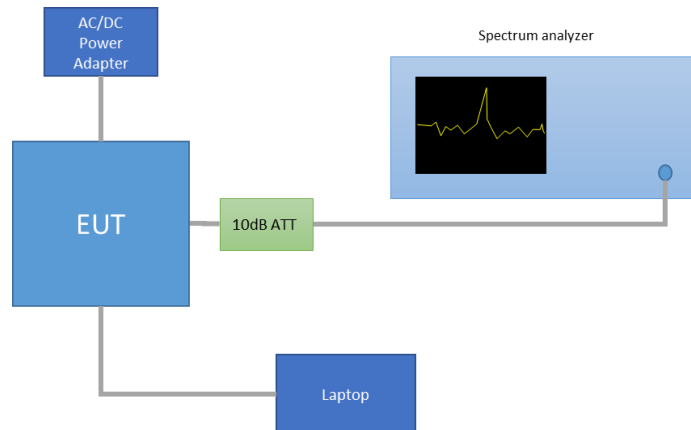
B.1 20dB Bandwidth and Carrier frequency separation

Test limits:

FCC part	RSS part	Limits
15.247 (a) (1)	RSS-247 Clause 5.1 (1) and (2)	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.

Test procedure:

The setup below was used to measure the 20dB Bandwidth and Carrier frequency separation. 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.

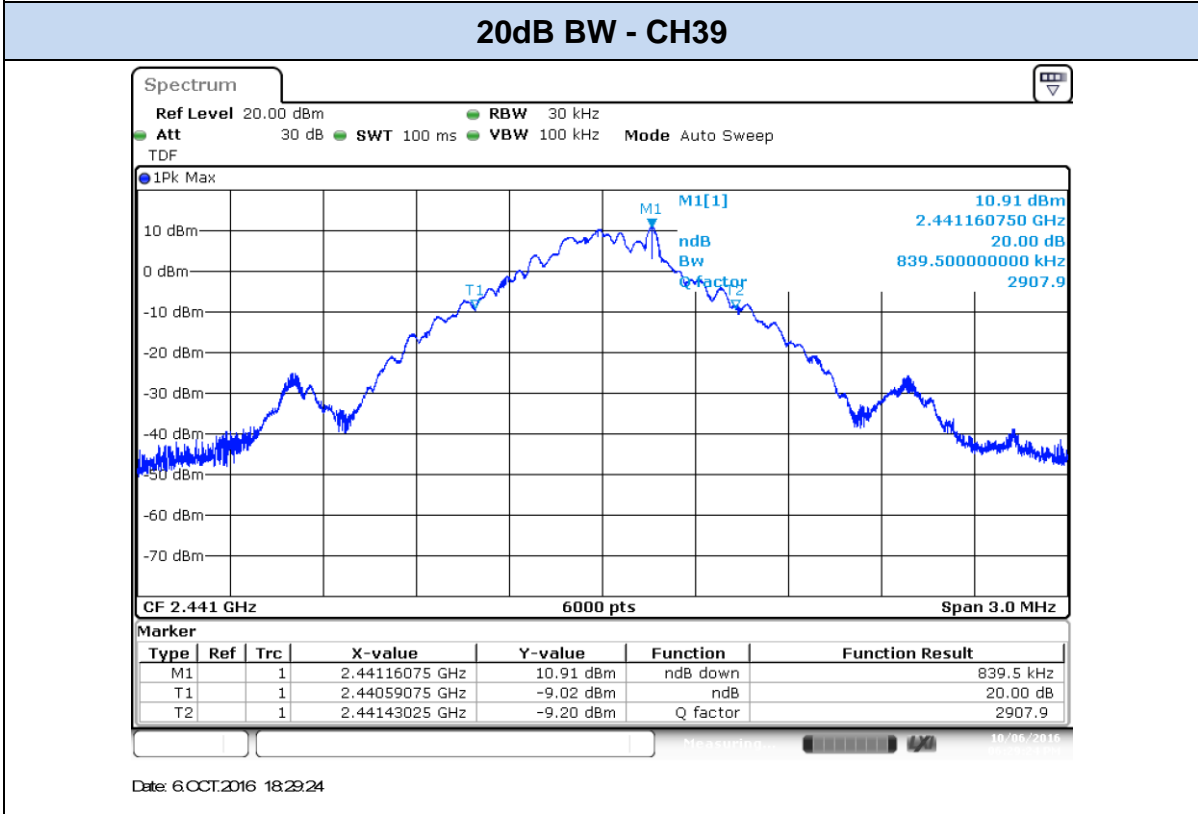
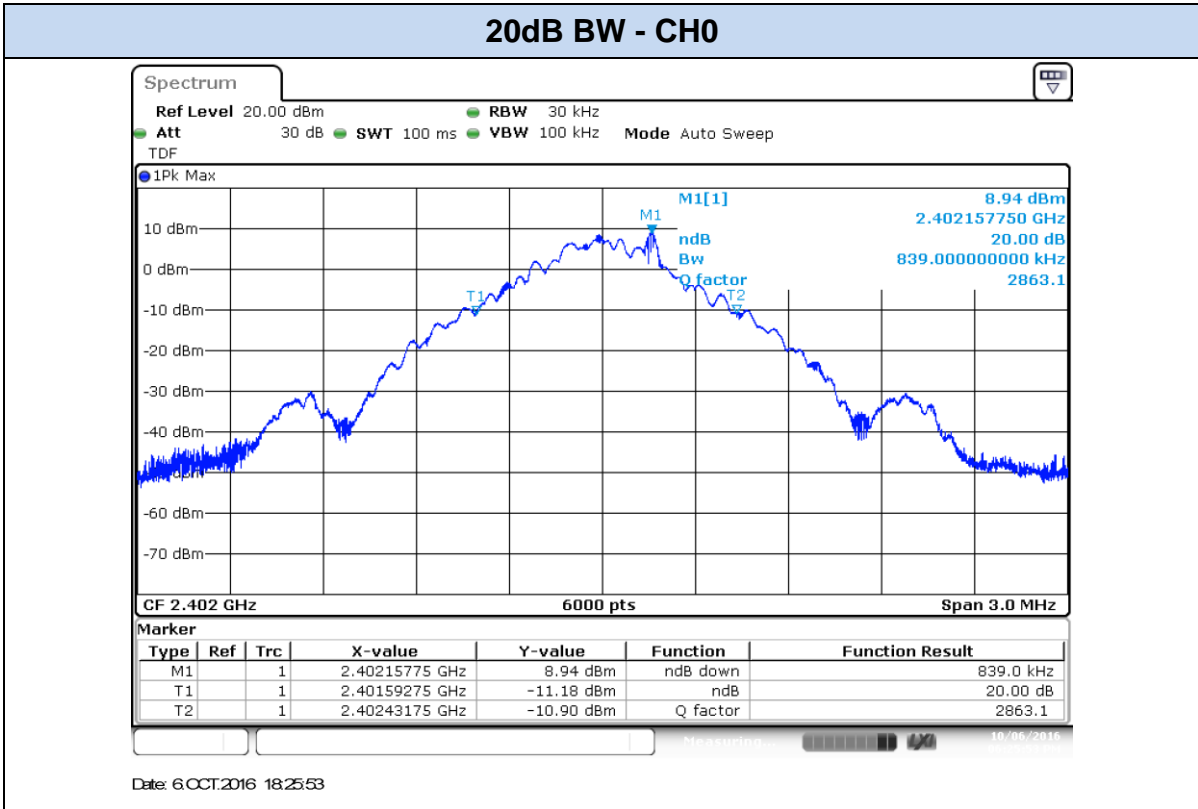


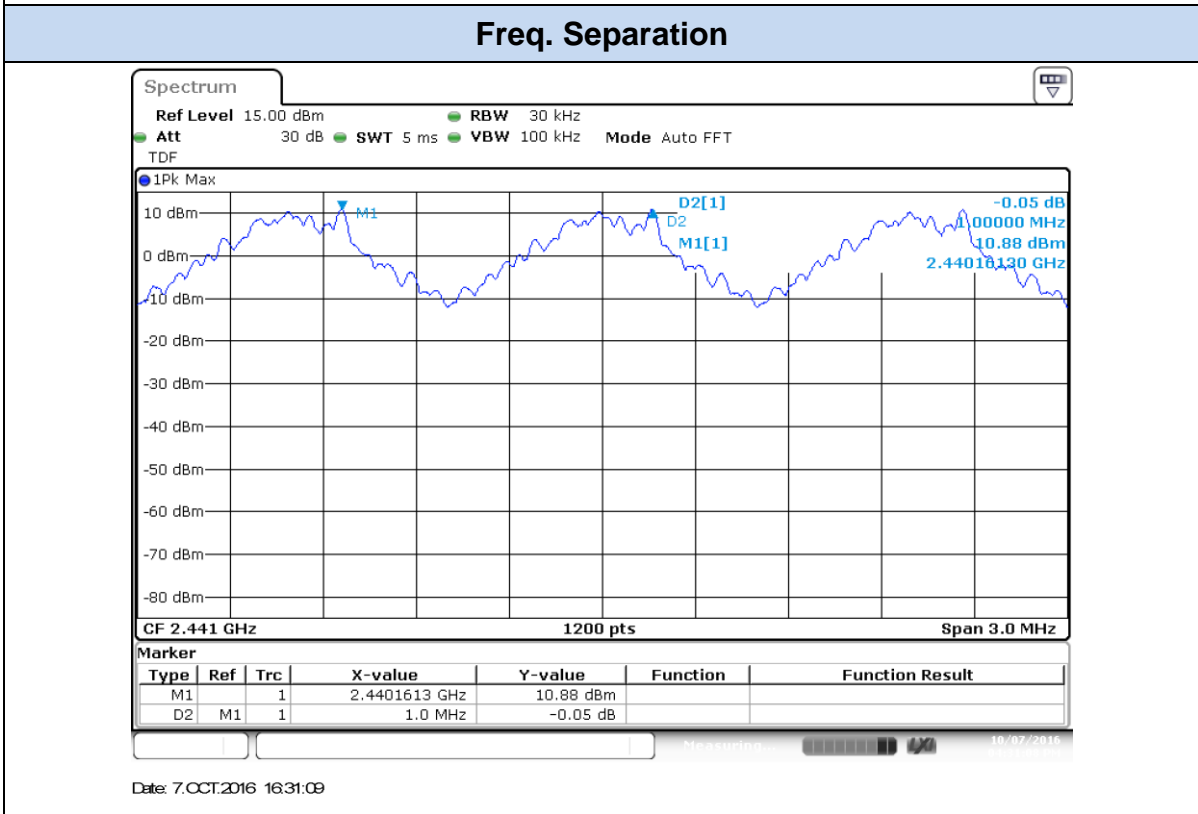
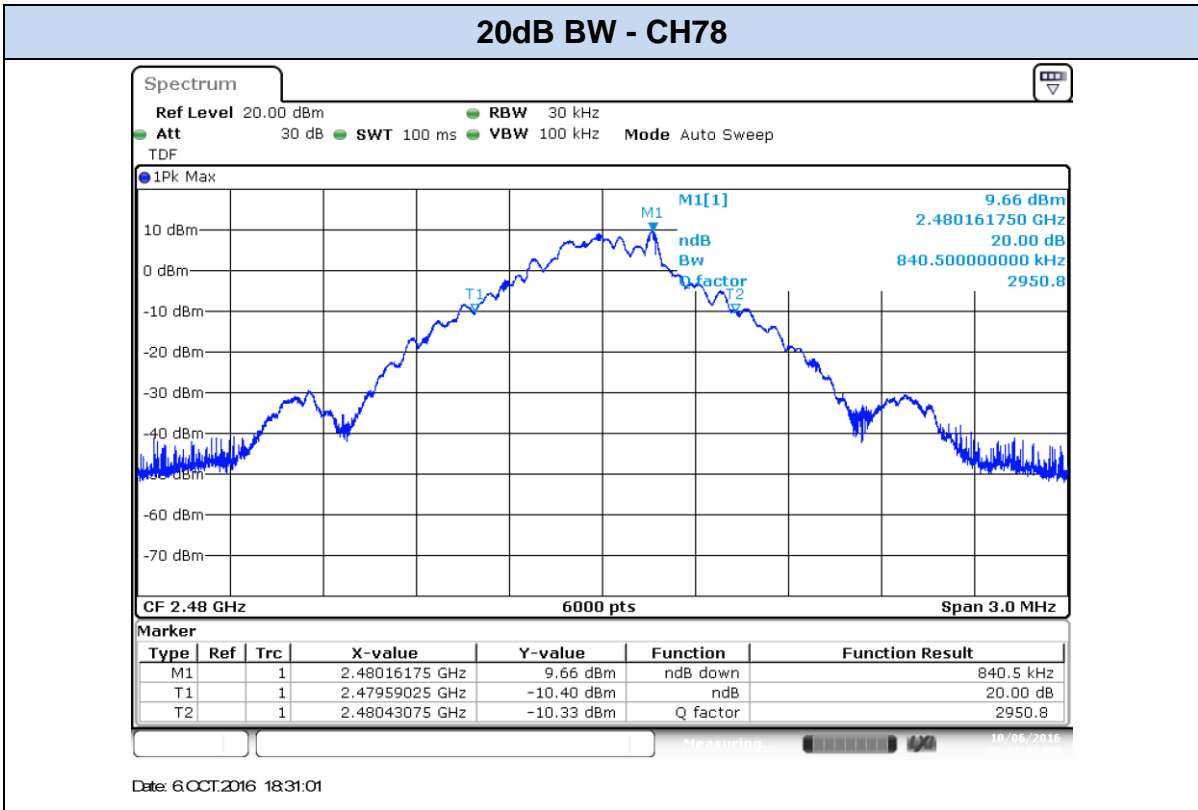
Results tables:

Mode	Channel Number	Frequency [MHz]	20dB BW [MHz]	Freq. Separation [kHz]
Basic Rate GFSK	0	2402	0.839	1000
	39	2441	0.840	
	78	2480	0.841	
EDR $\pi/4$ -DQPSK	0	2402	1.412	1000
	39	2441	1.411	
	78	2480	1.415	
EDR 8-DPSK	0	2402	1.424	1000
	39	2441	1.436	
	78	2480	1.426	

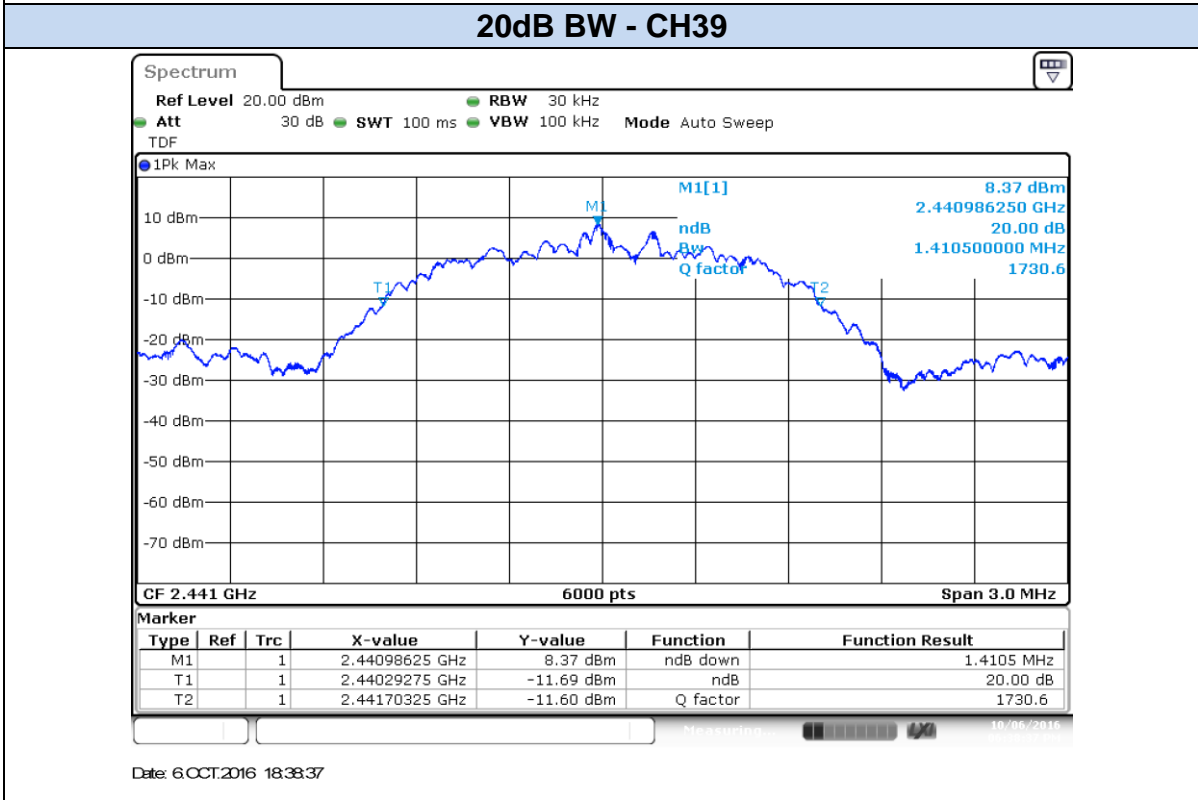
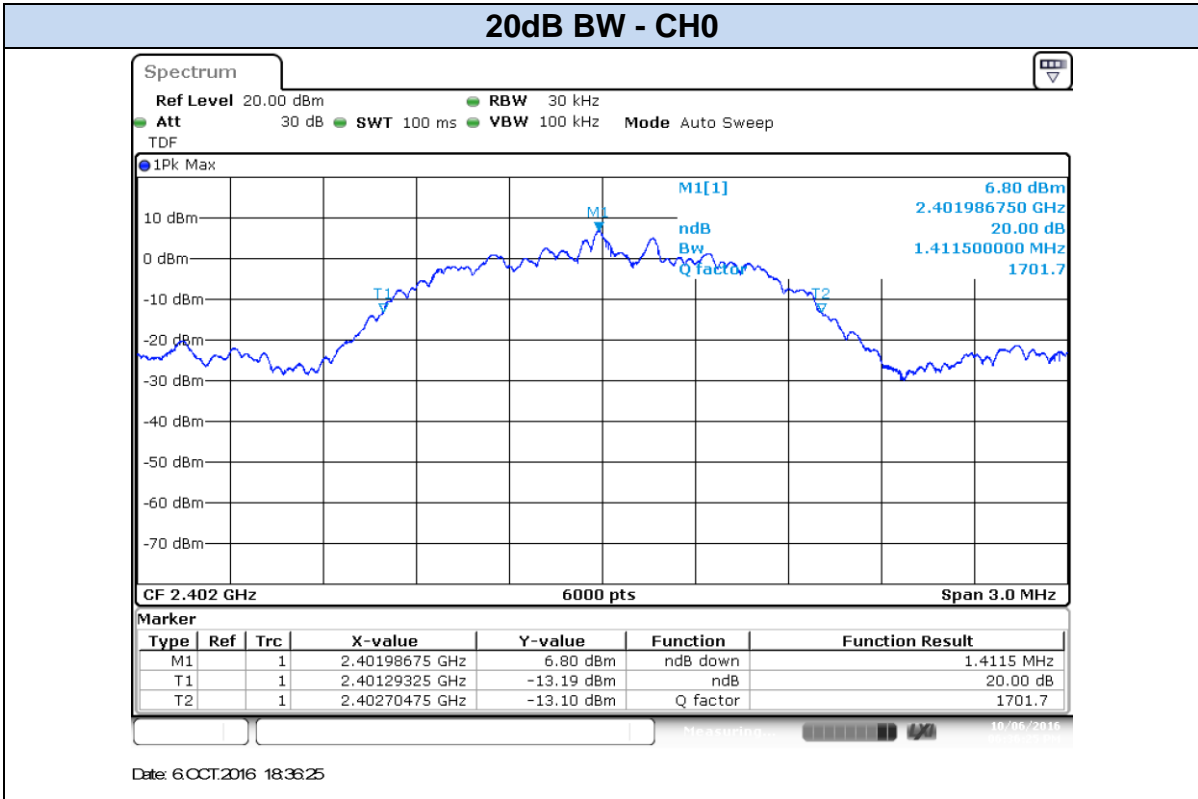
Results screenshot:

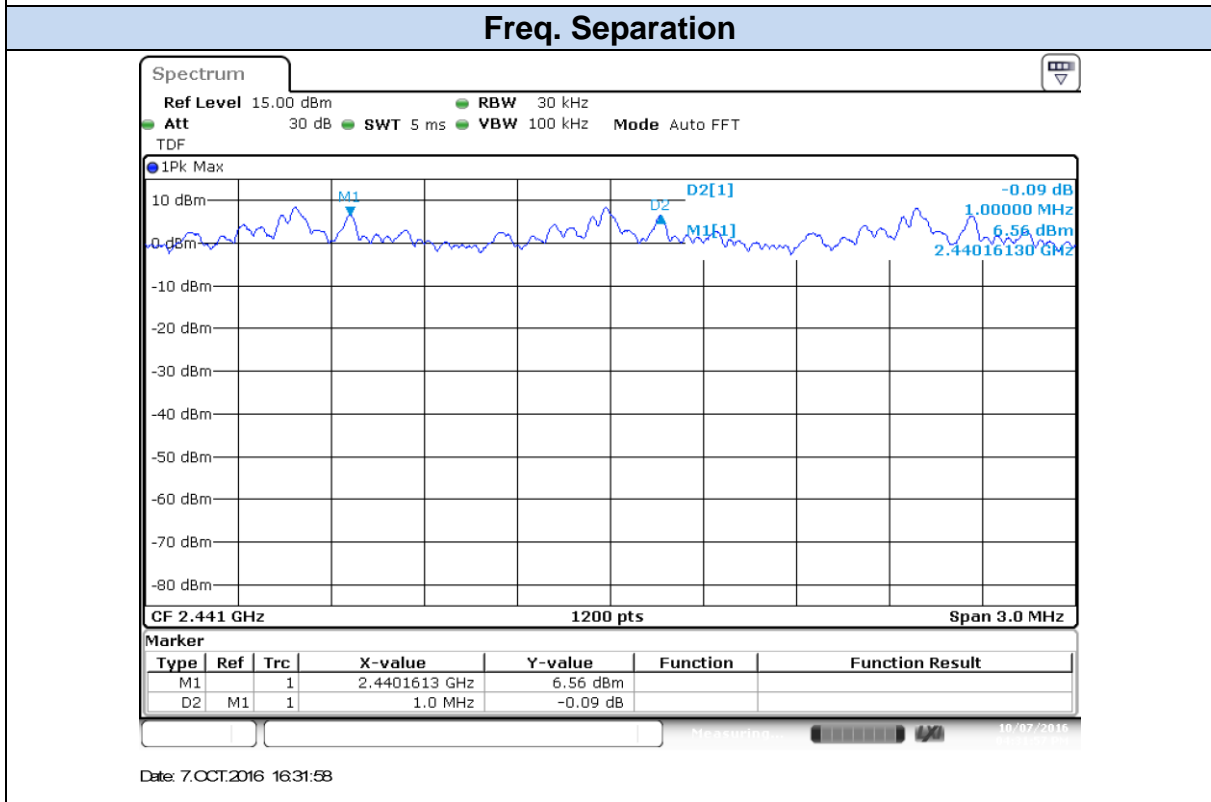
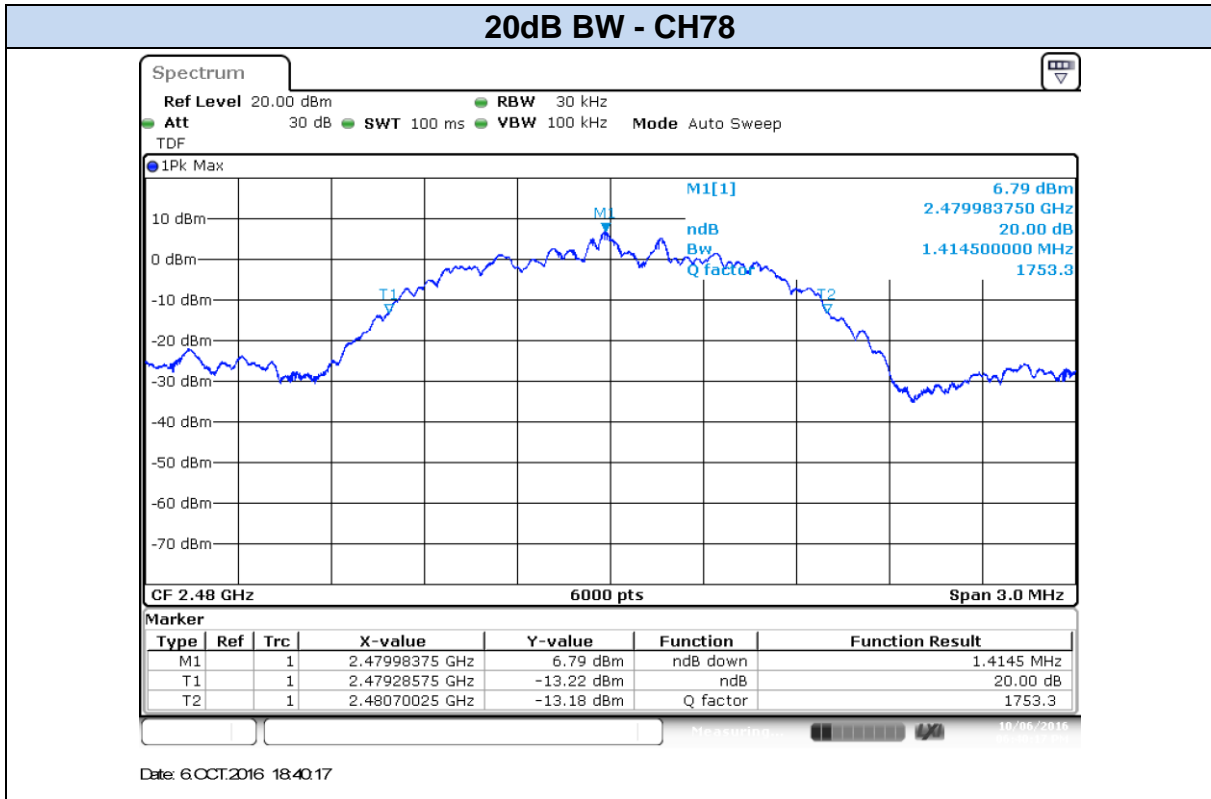
Basic Rate - GFSK



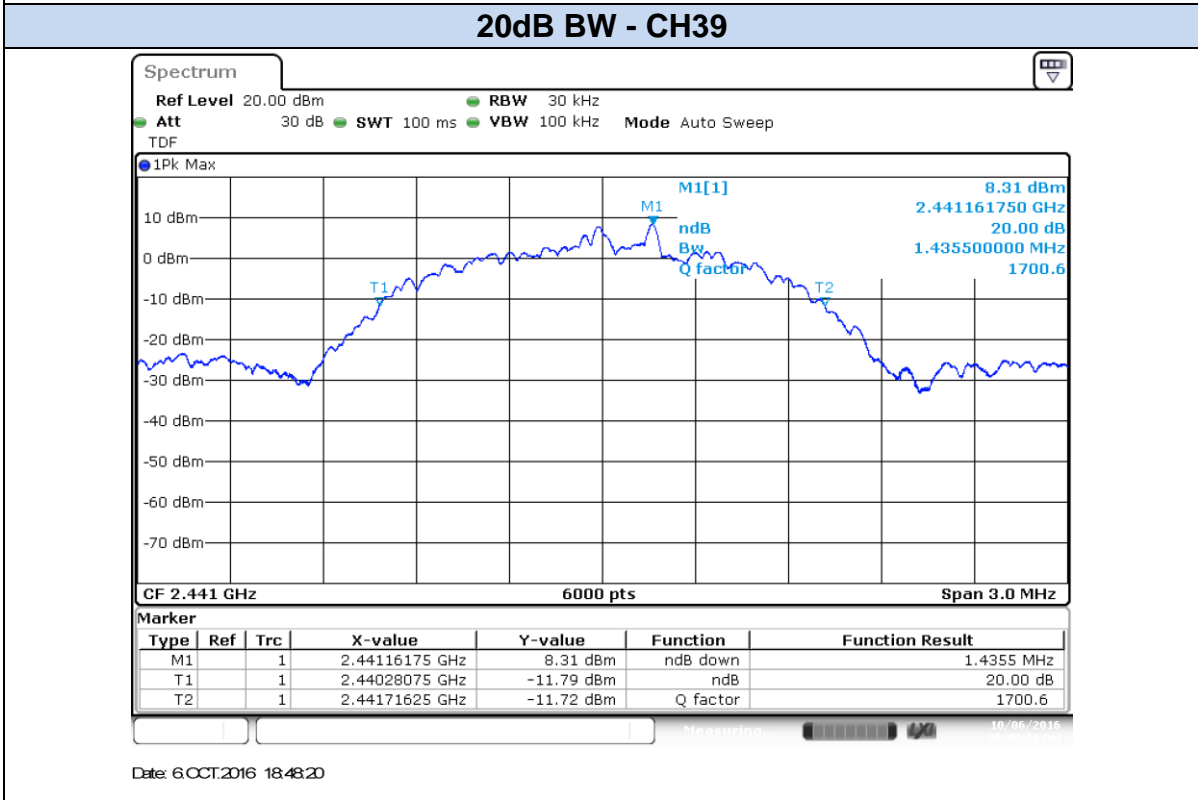
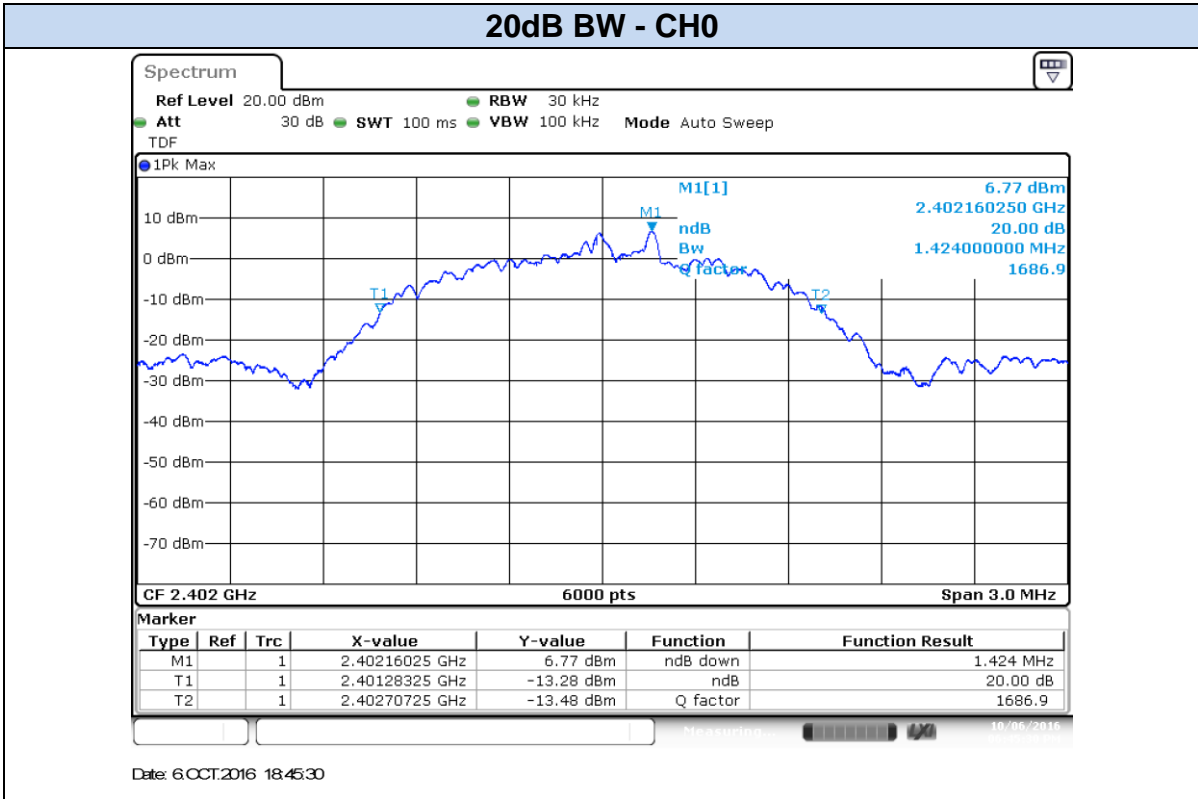


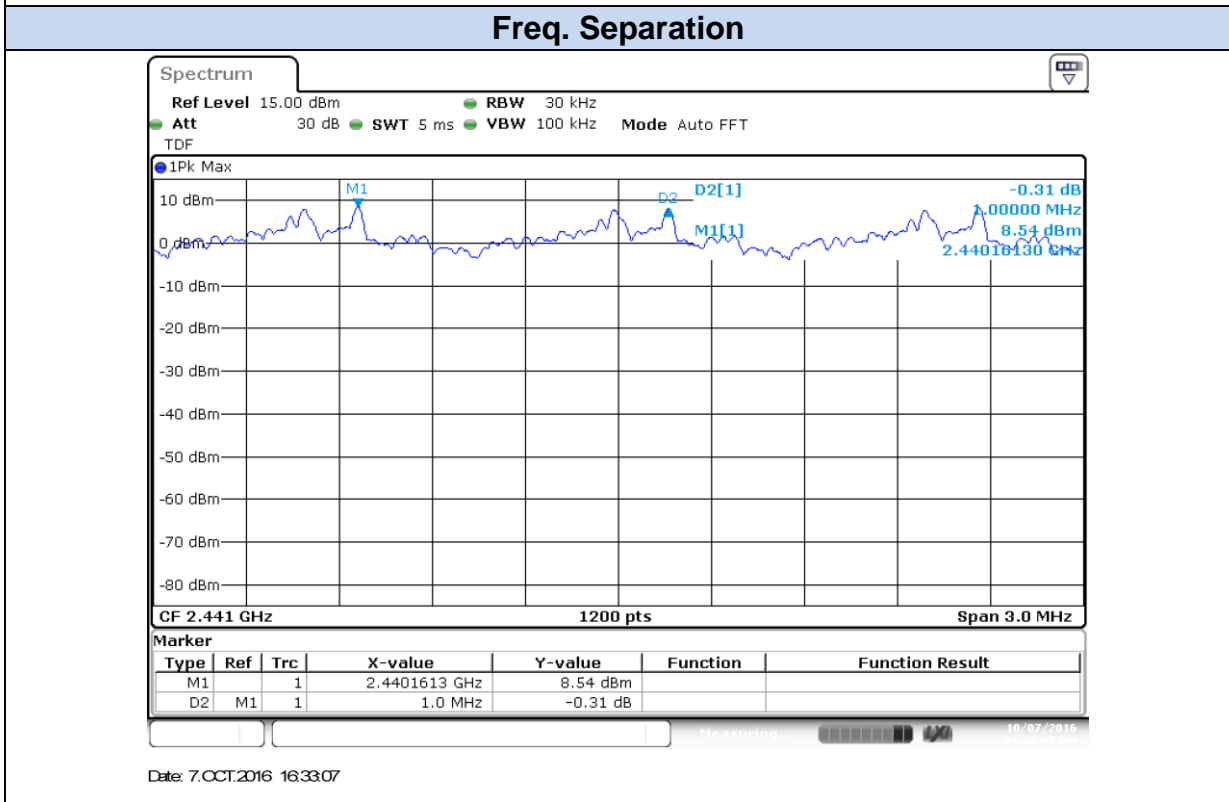
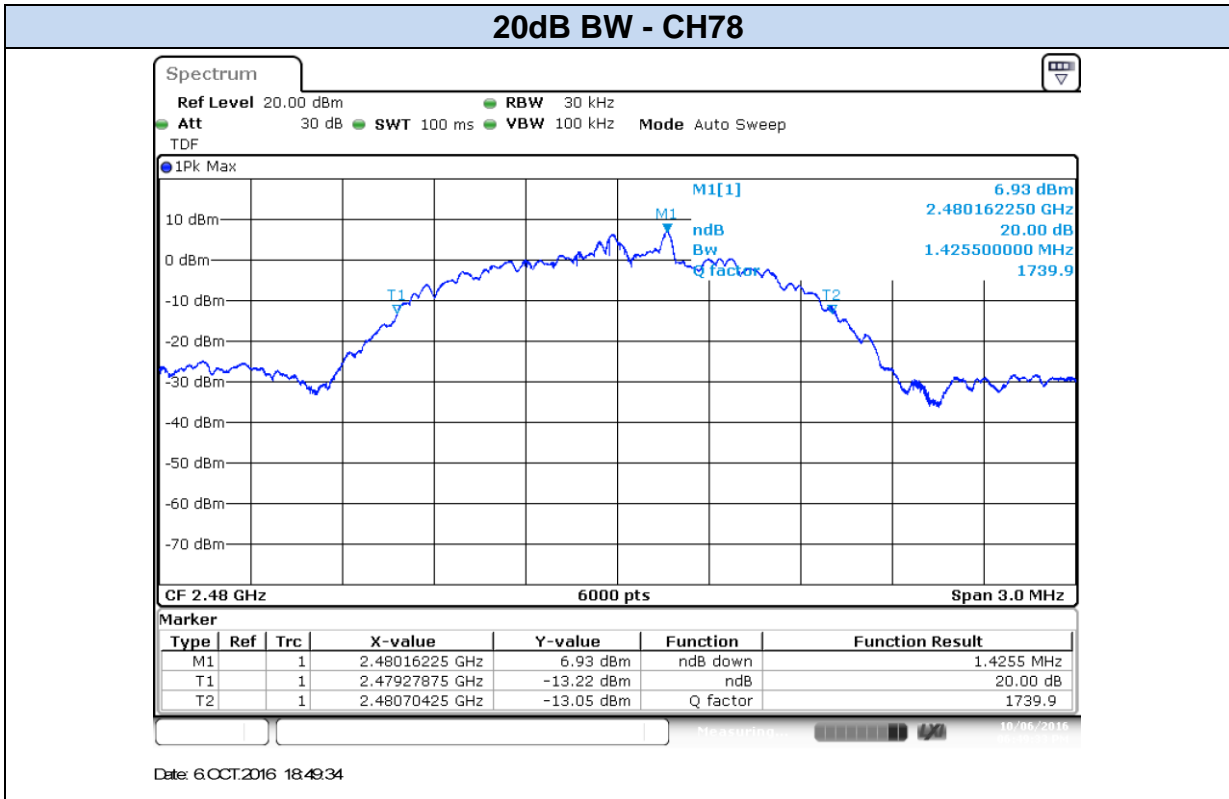
EDR – $\pi/4$ -DQPSK





EDR – 8-DPSK





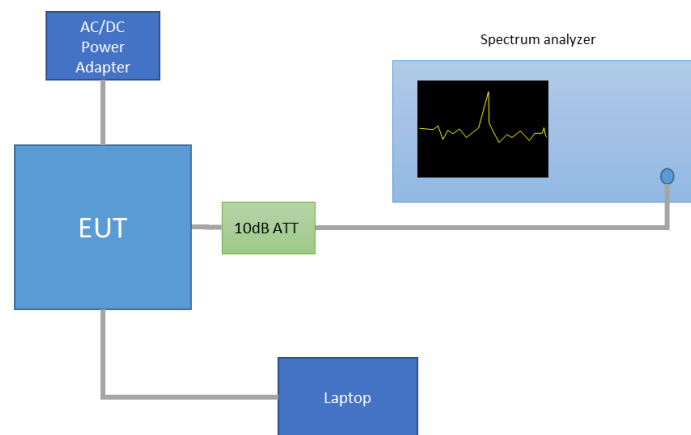
B.2 Number of hopping channels

Test limits:

FCC part	RSS part	Limits
15.247 (a) (1) (iii)	RSS-247 Clause 5.1 (4)	Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

Test procedure:

The setup below 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.

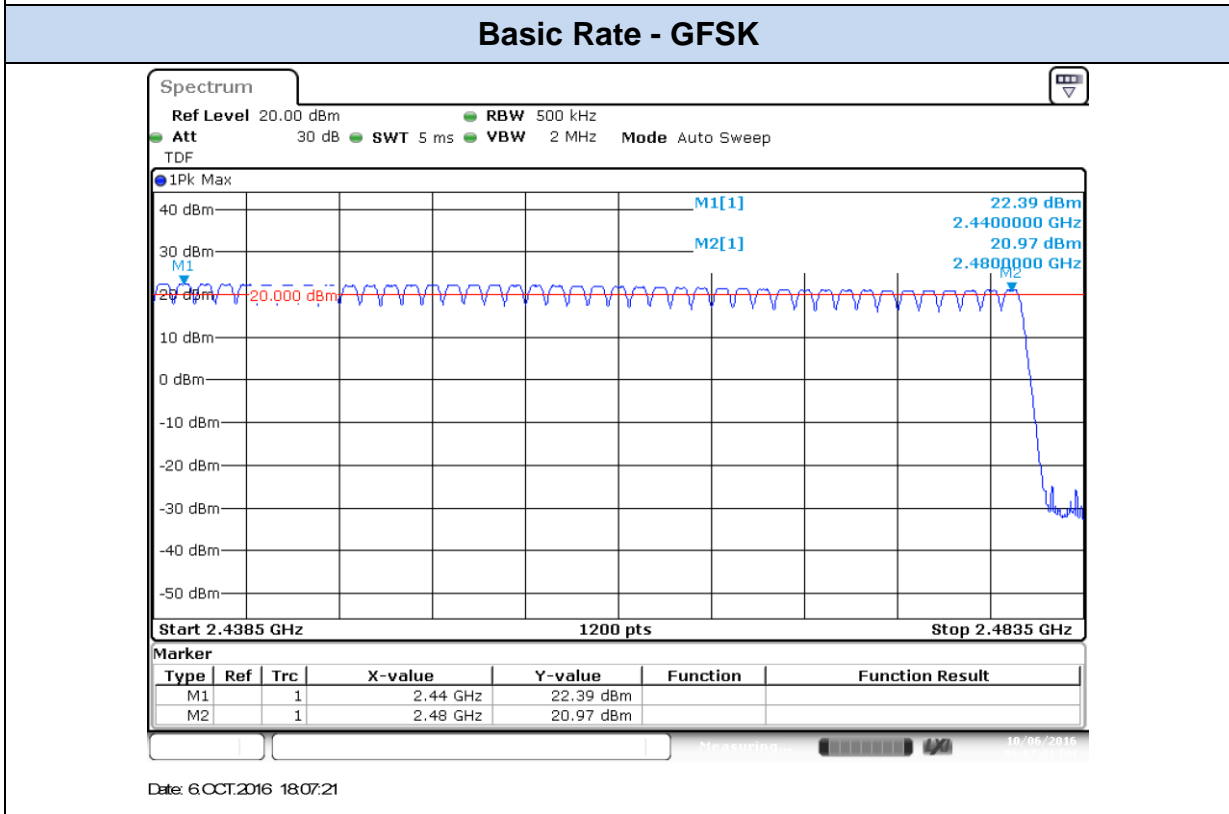
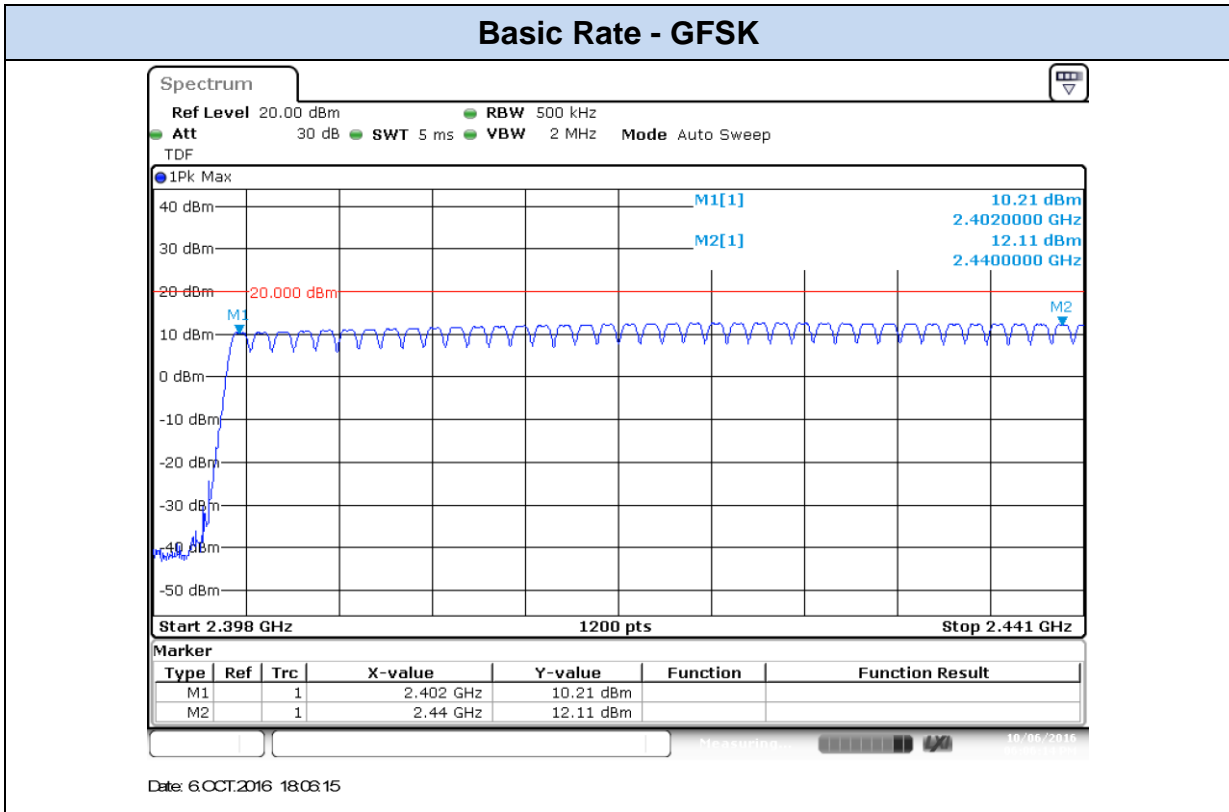


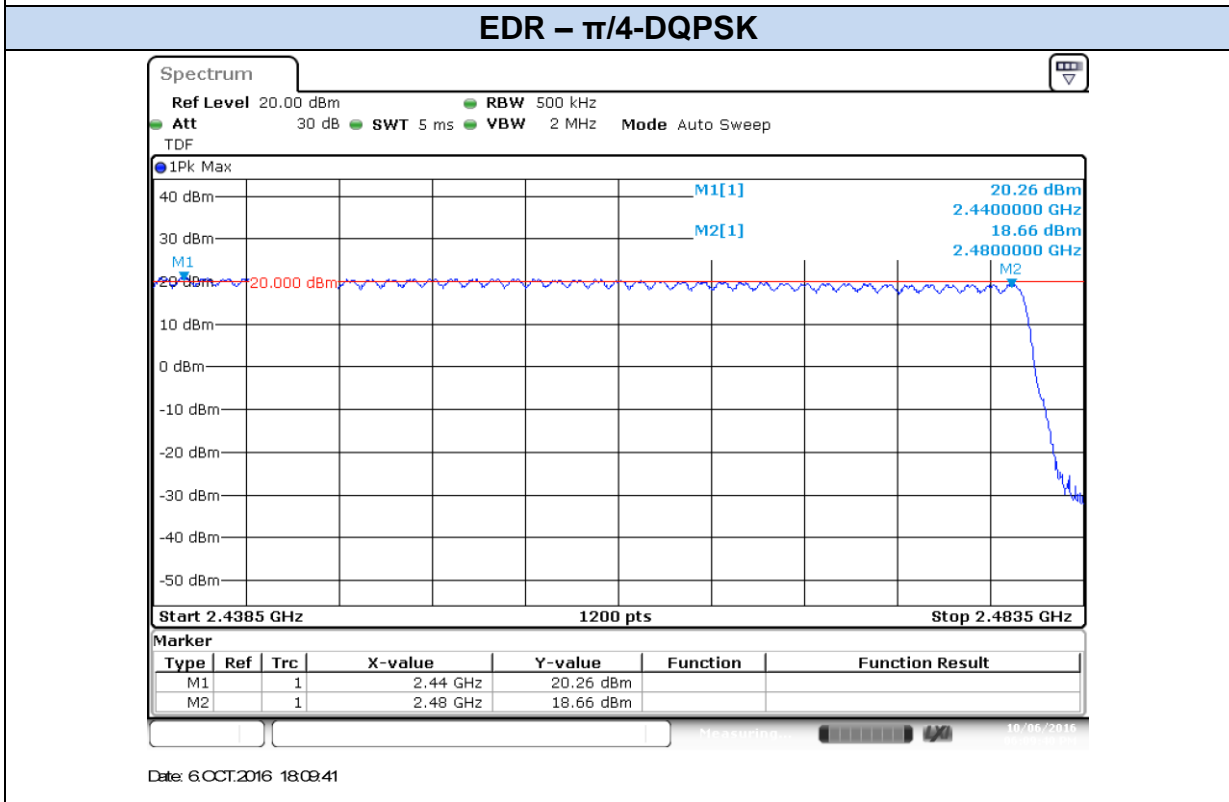
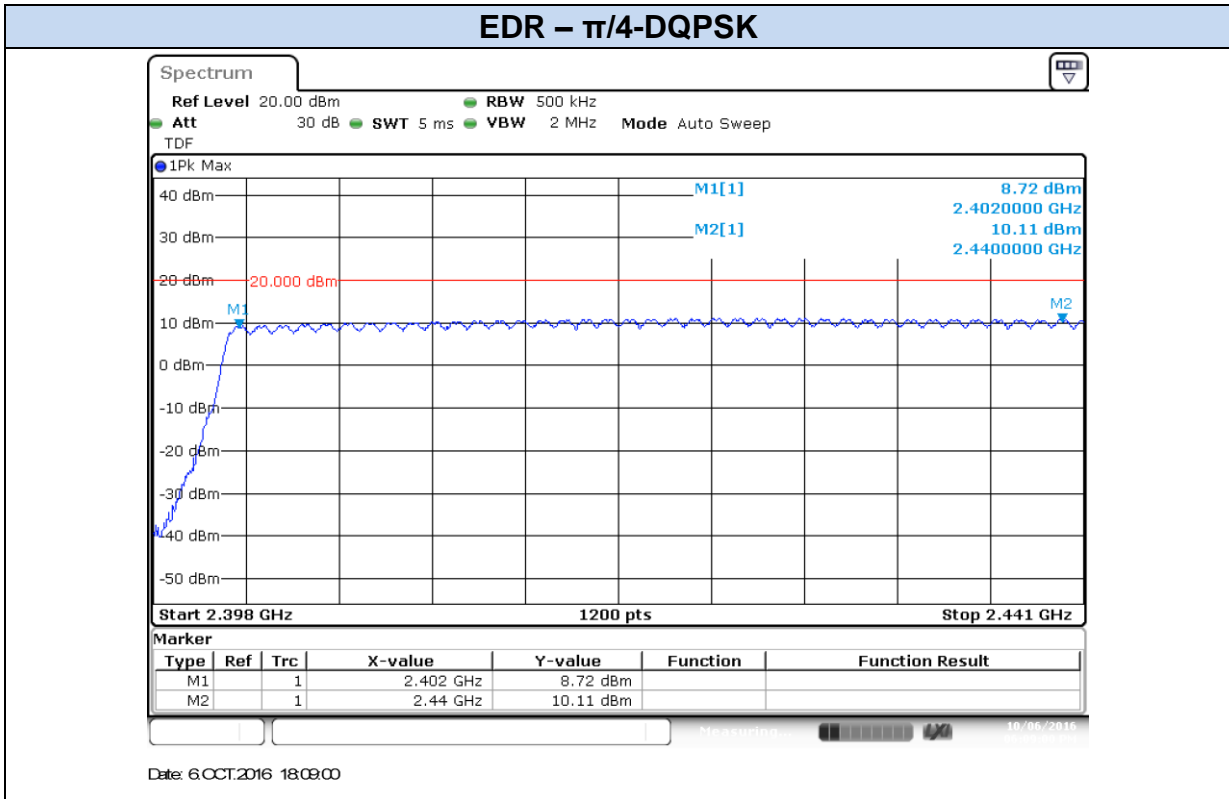
Results tables:

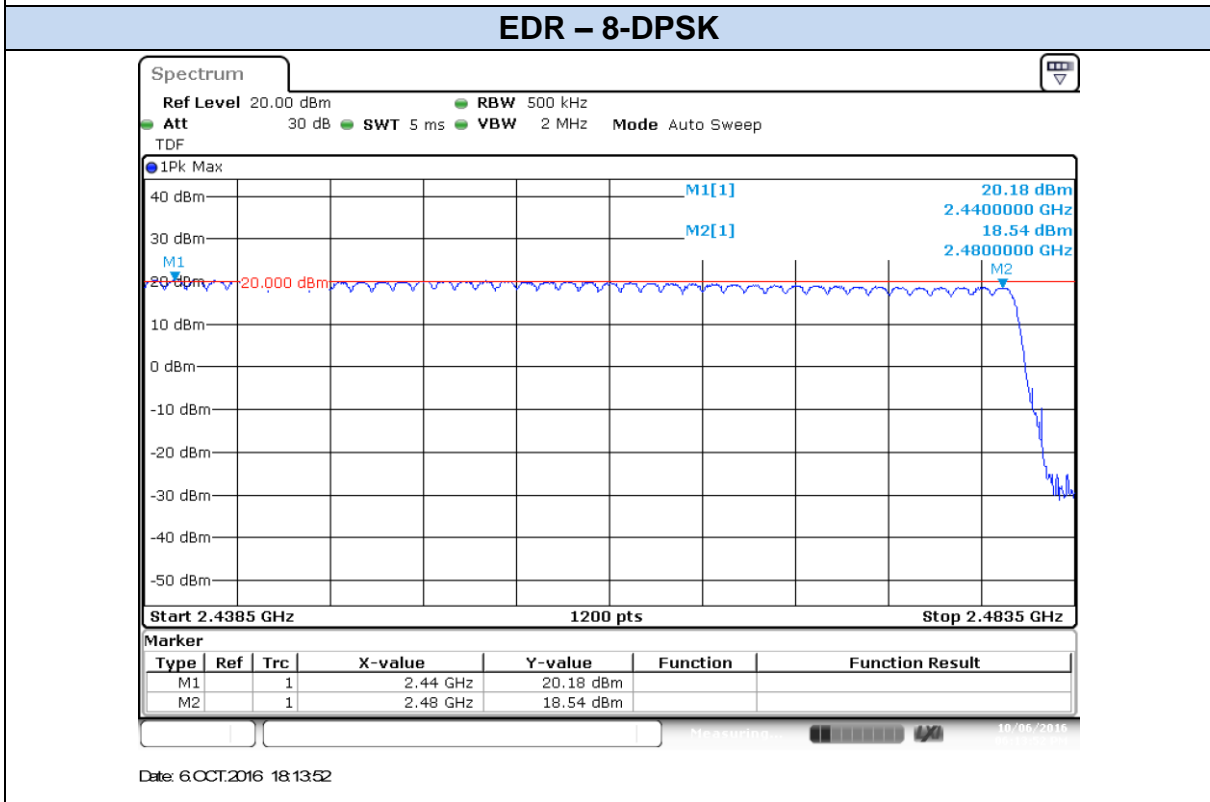
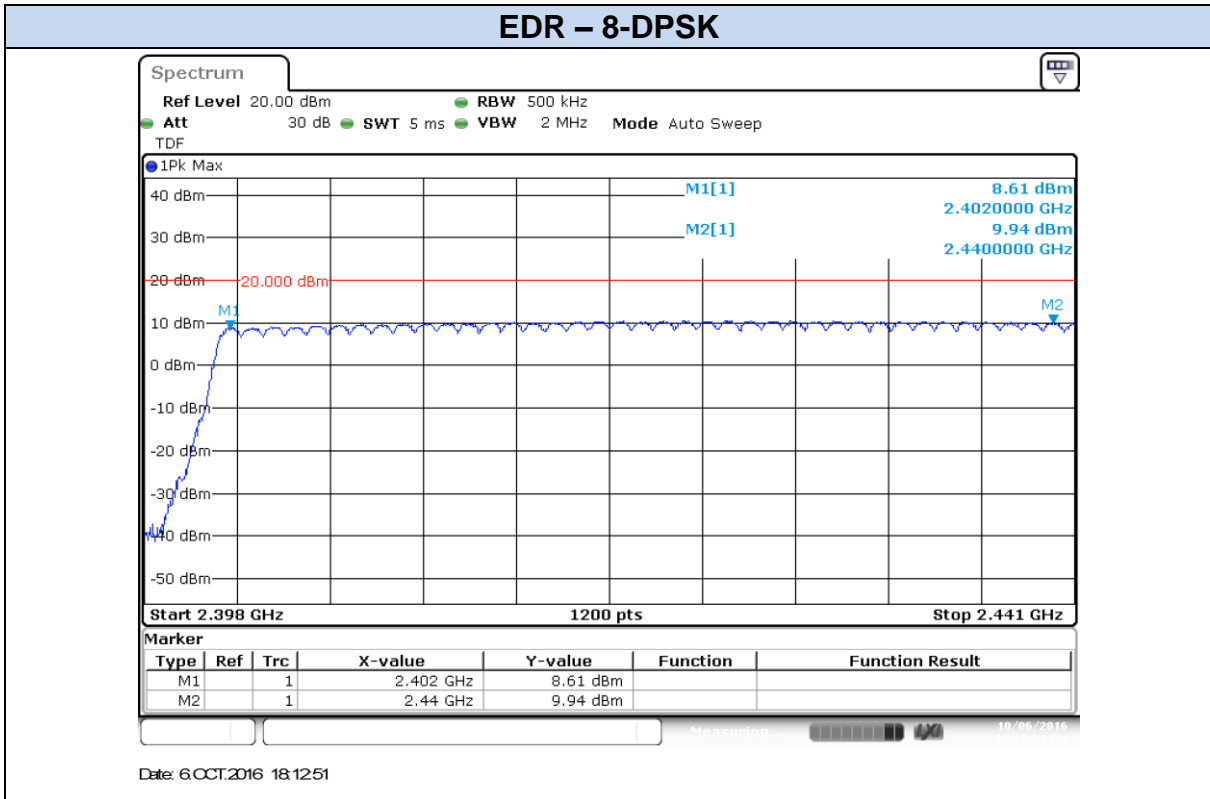
Mode	Number of hopping channels
Basic Rate GFSK	79
EDR $\pi/4$ -DQPSK	79
EDR 8-DPSK	79

Results screenshot:

Number of hopping channels







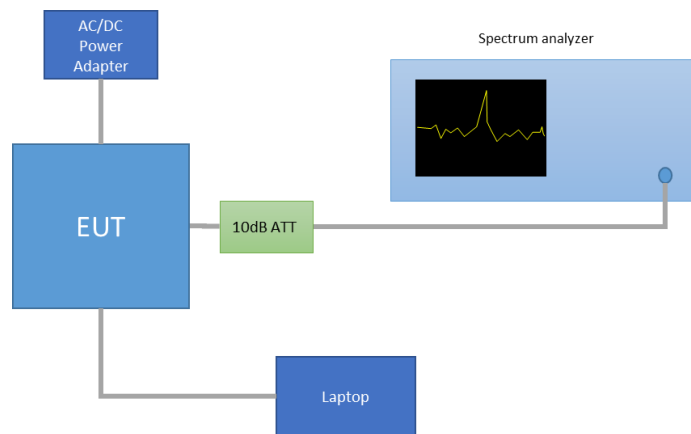
B.3 Time of Occupancy (Dwell Time)

Test limits:

FCC part	RSS part	Limits
15.247 (a) (1) (iii)	RSS-247 Clause 5.1 (4)	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.

Test procedure:

The setup below 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.

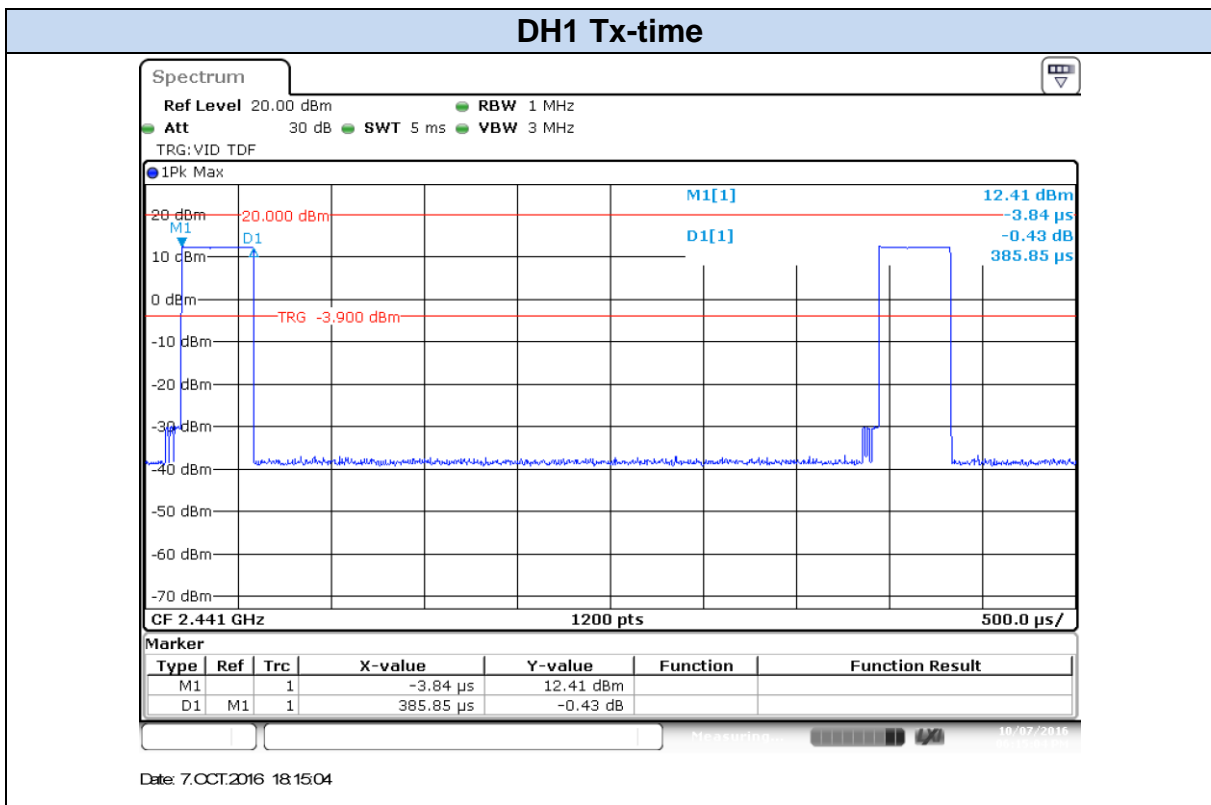
Thus, the total time of occupancy is obtained by multiplying the calculated maximum number of appearances per packet type and the measured Tx-time, as shown in the results screenshots.

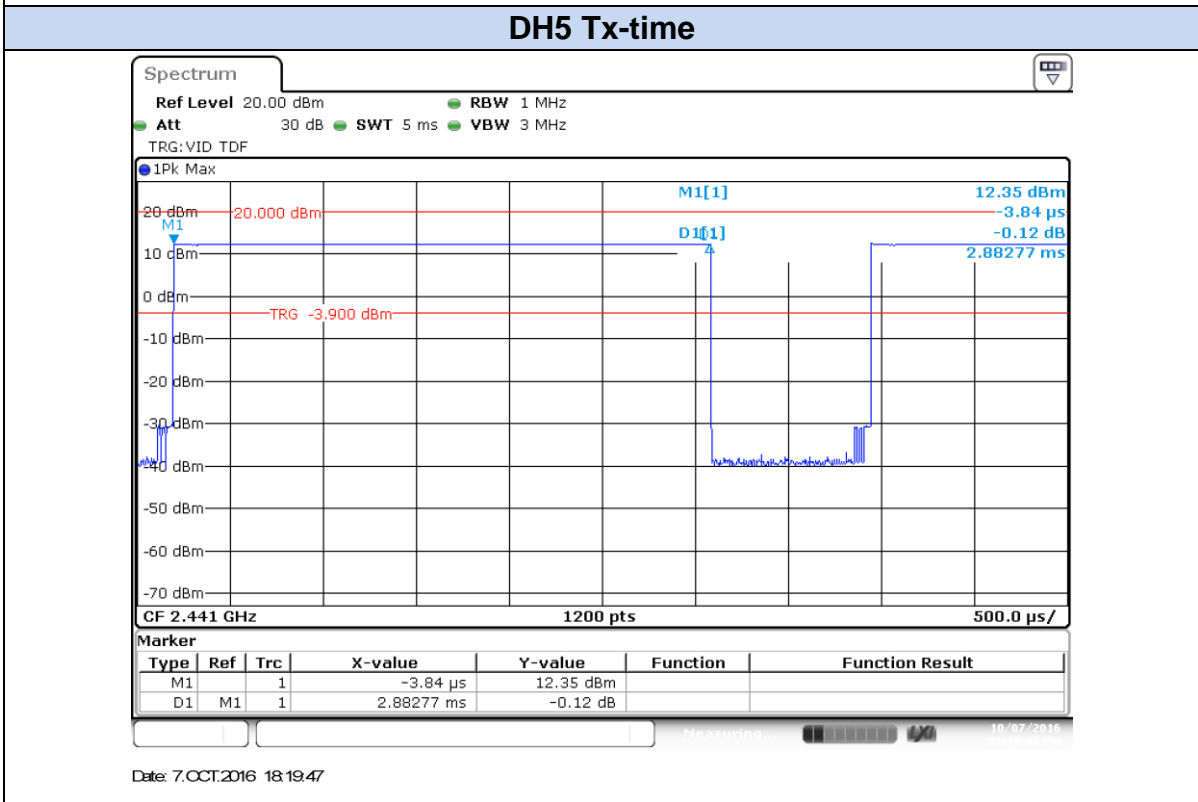
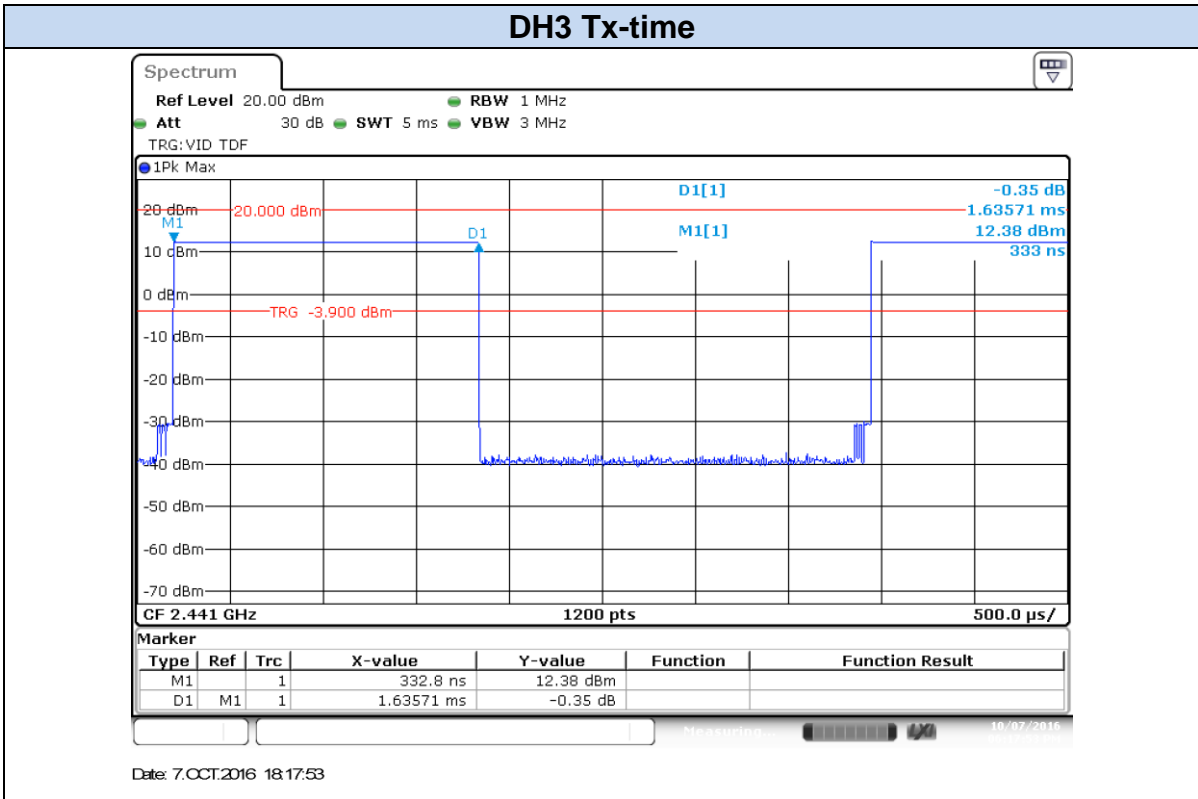
Results tables:

Mode	Packet Type	Times of appearance	Tx-time [ms]	Dwell Time [ms]
Basic Rate GFSK	DH1	320.11	0.386	123.56
	DH3	161.16	1.636	263.66
	DH5	106.49	2.883	307.01
EDR $\pi/4$ -DQPSK	2-DH1	320.11	0.393	125.80
	2-DH3	161.16	1.646	265.27
	2-DH5	106.49	2.880	306.69
EDR 8-DPSK	3-DH1	320.11	0.391	125.16
	3-DH3	161.16	1.643	264.79
	3-DH5	106.49	2.886	307.33

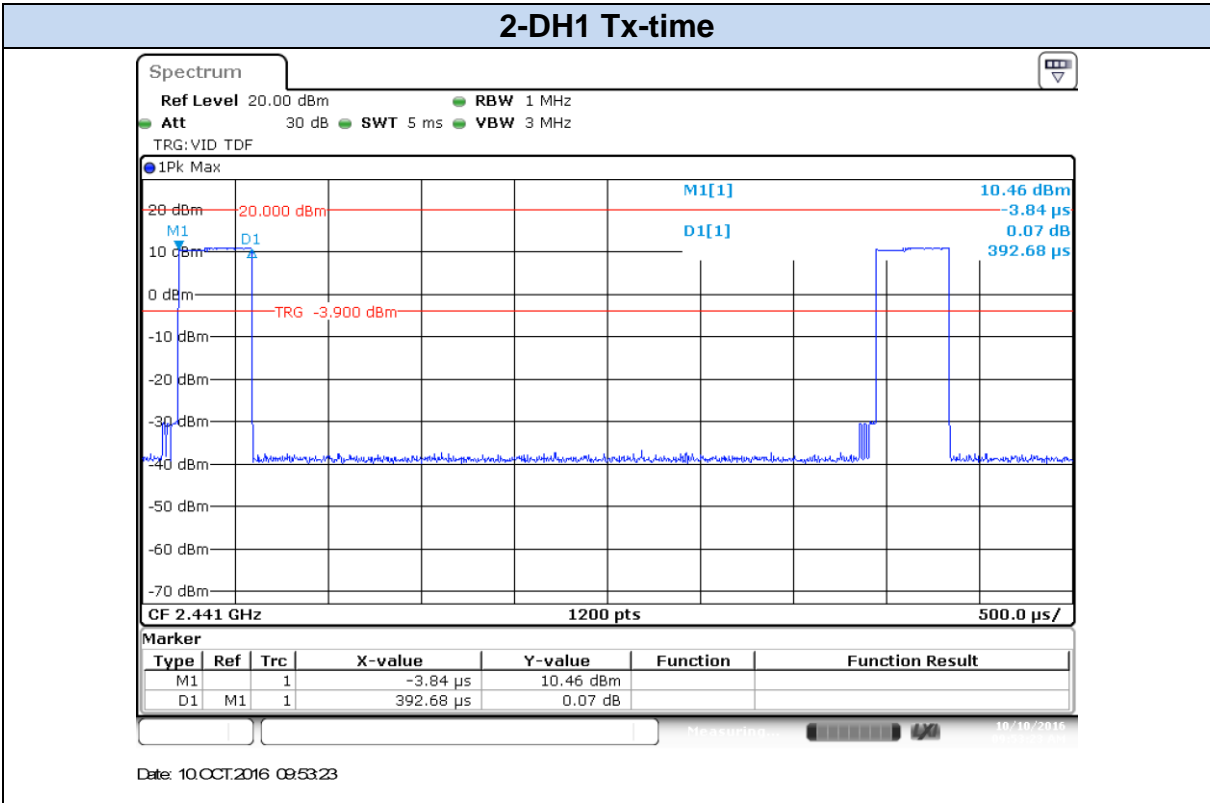
Results Screenshots:

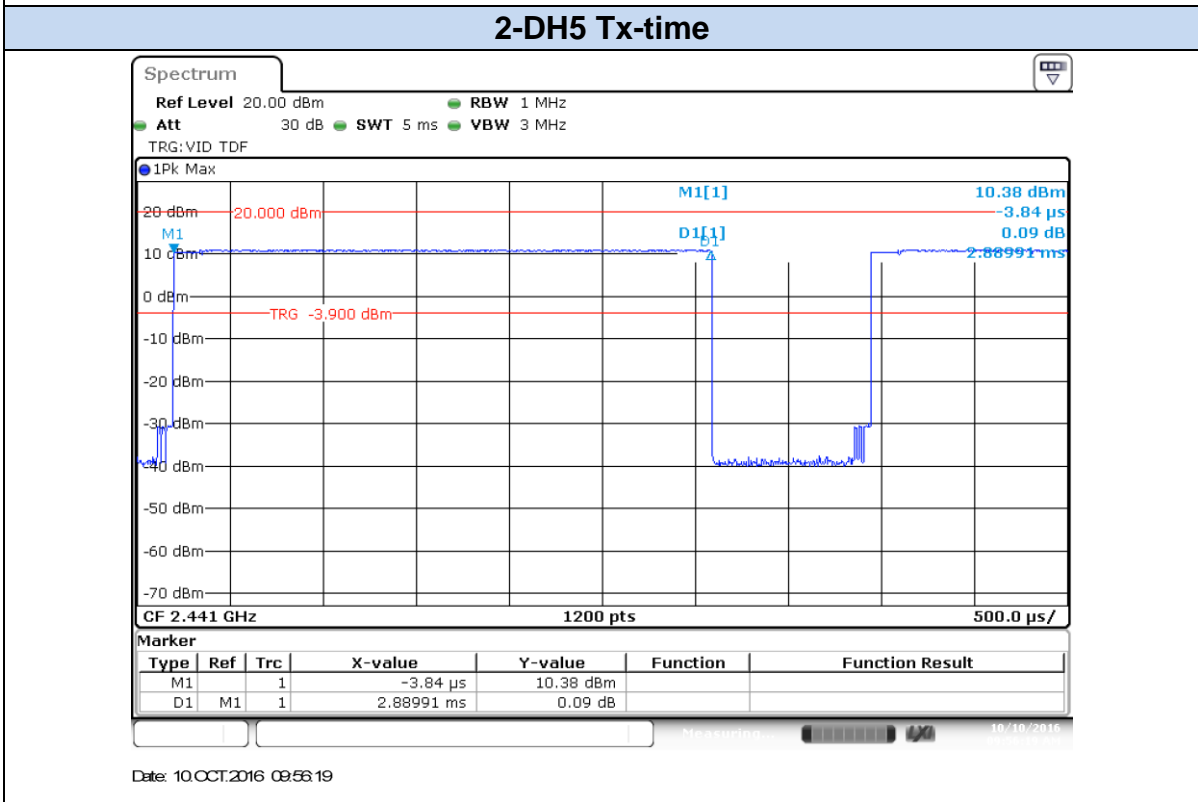
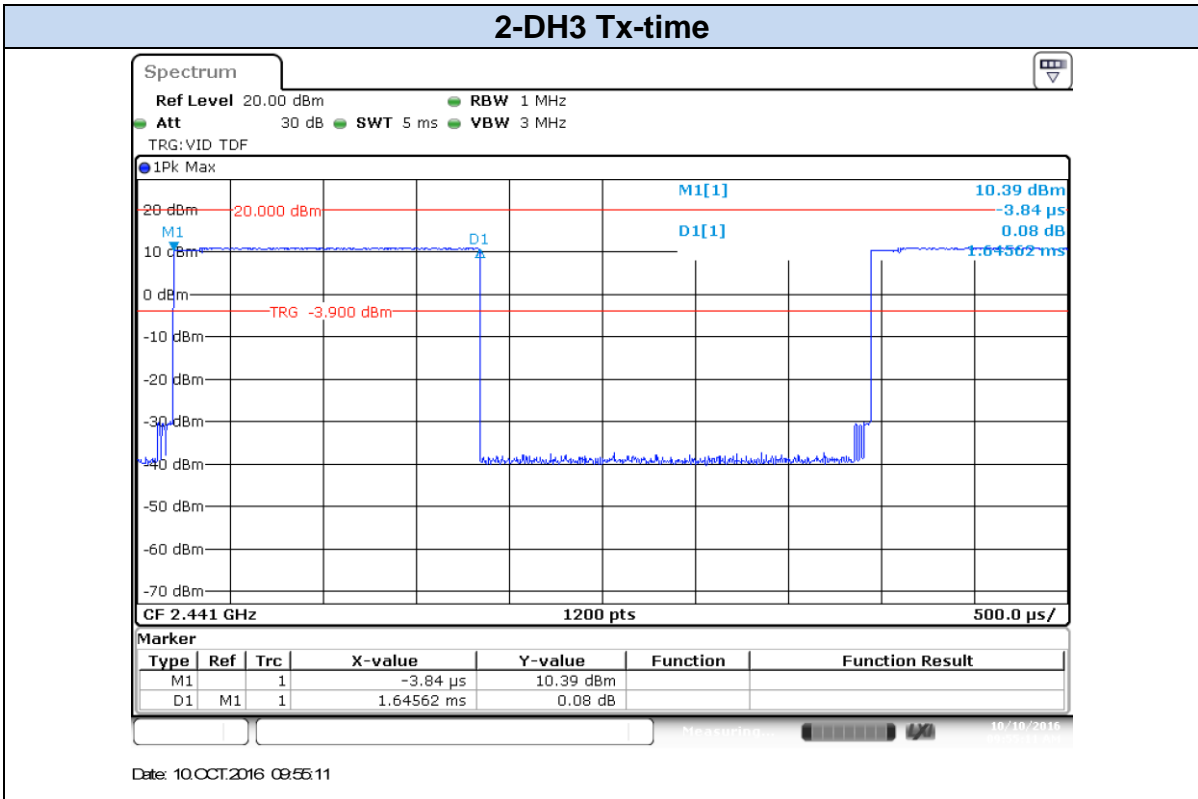
BDR – GFSK



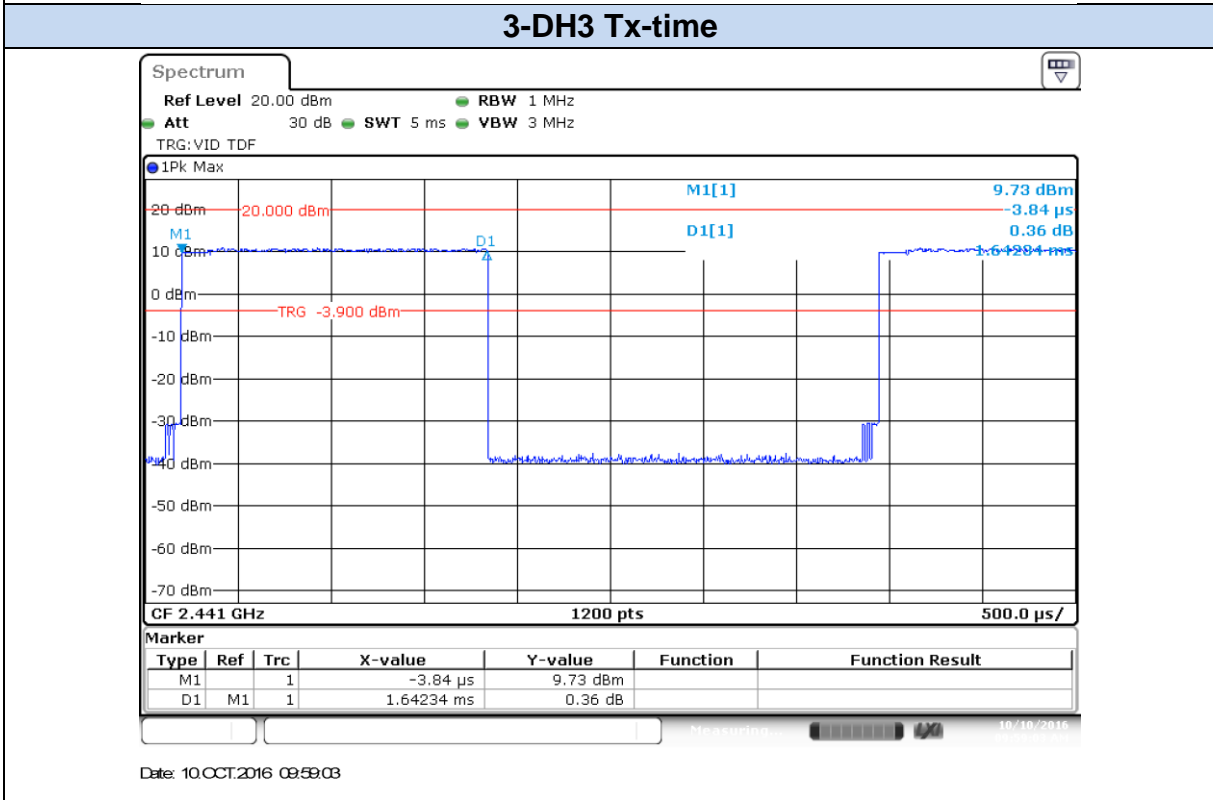
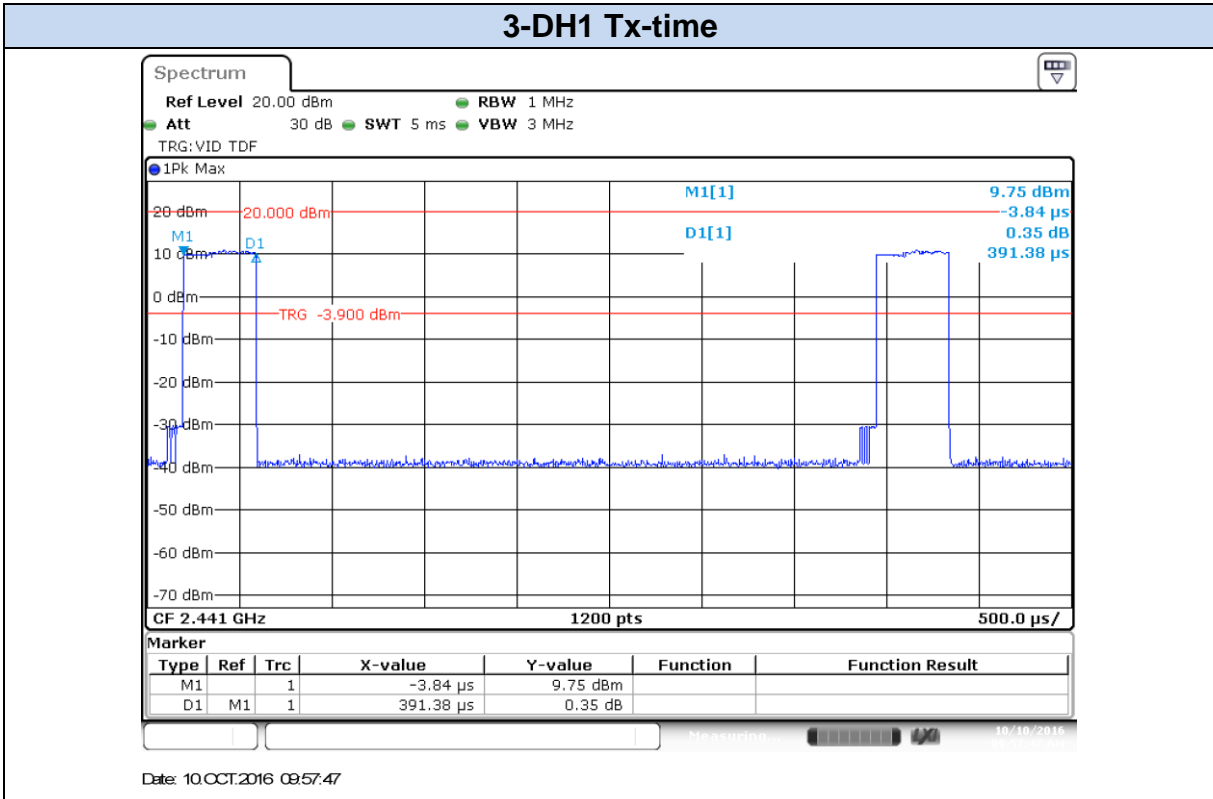


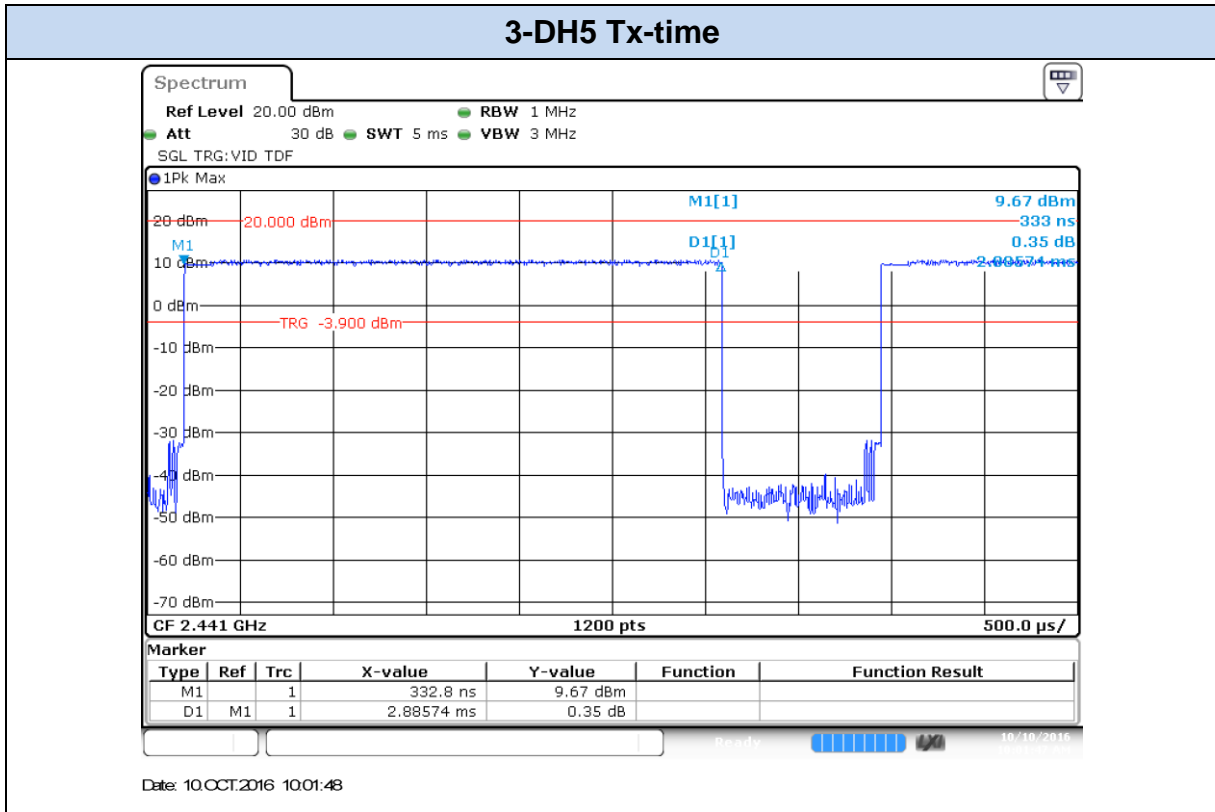
EDR – $\pi/4$ -DQPSK





EDR – 8-DPSK





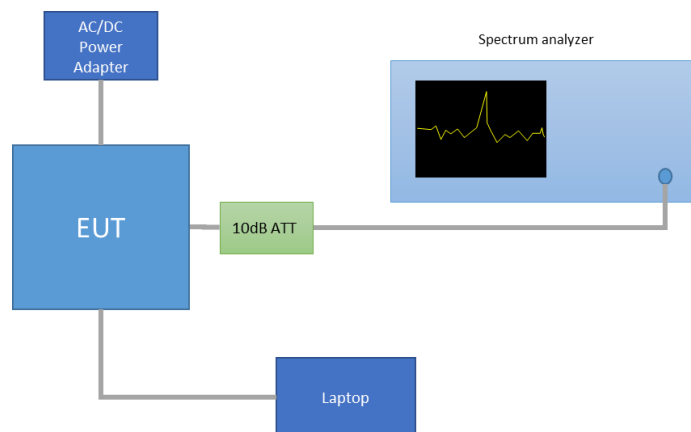
B.4 Maximum Peak Output Power and antenna gain

Test limits:

FCC part	RSS part	Limits
15.247 (b) (1)	RSS-247 Clause 5.4 (2)	<p>(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:</p> <p>(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. (...)</p> <p>(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.</p>

Test procedure:

The setup below 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.



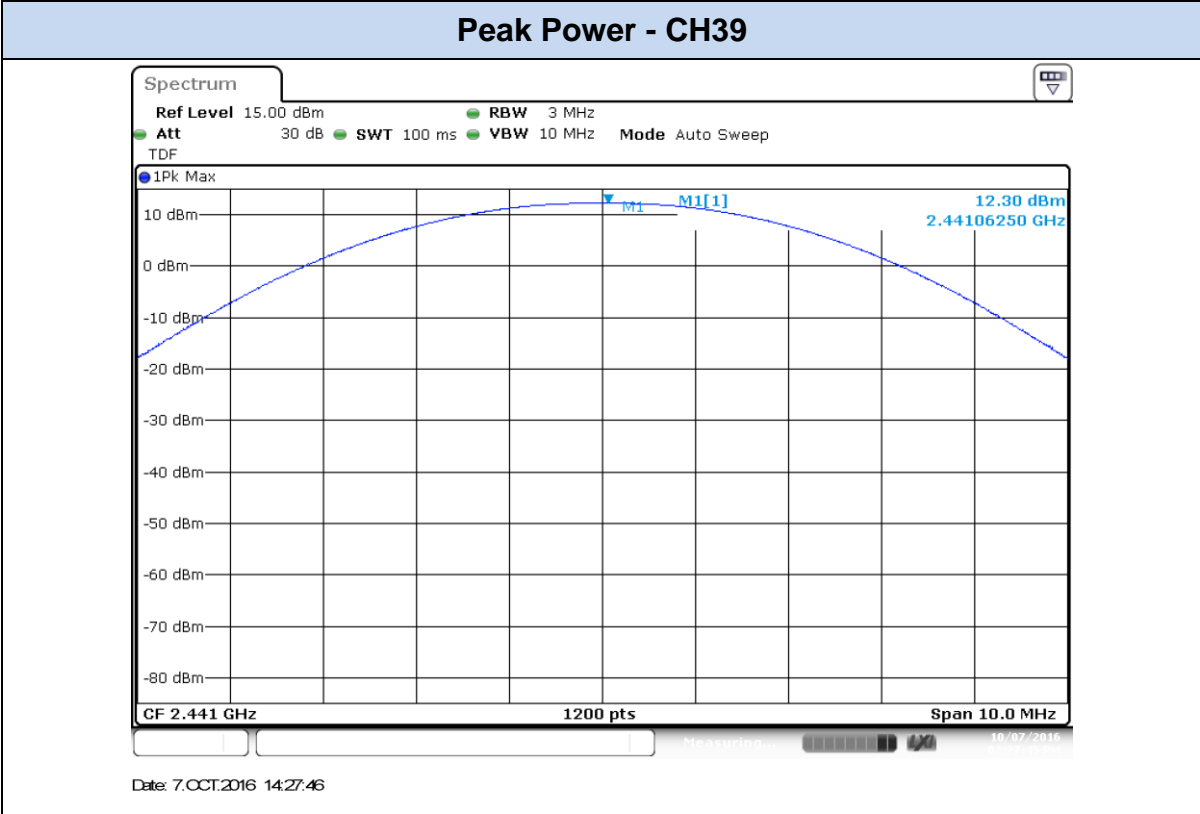
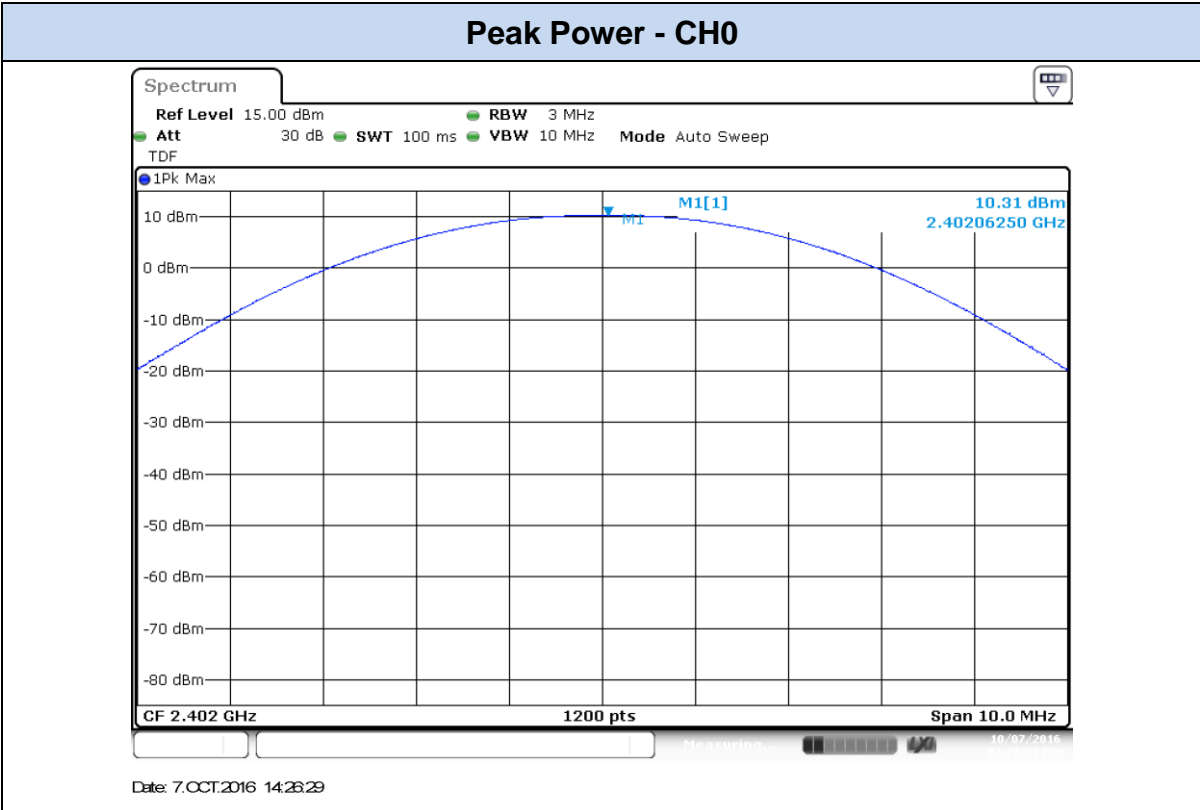
The declared maximum antenna gain is 3.24dBi.

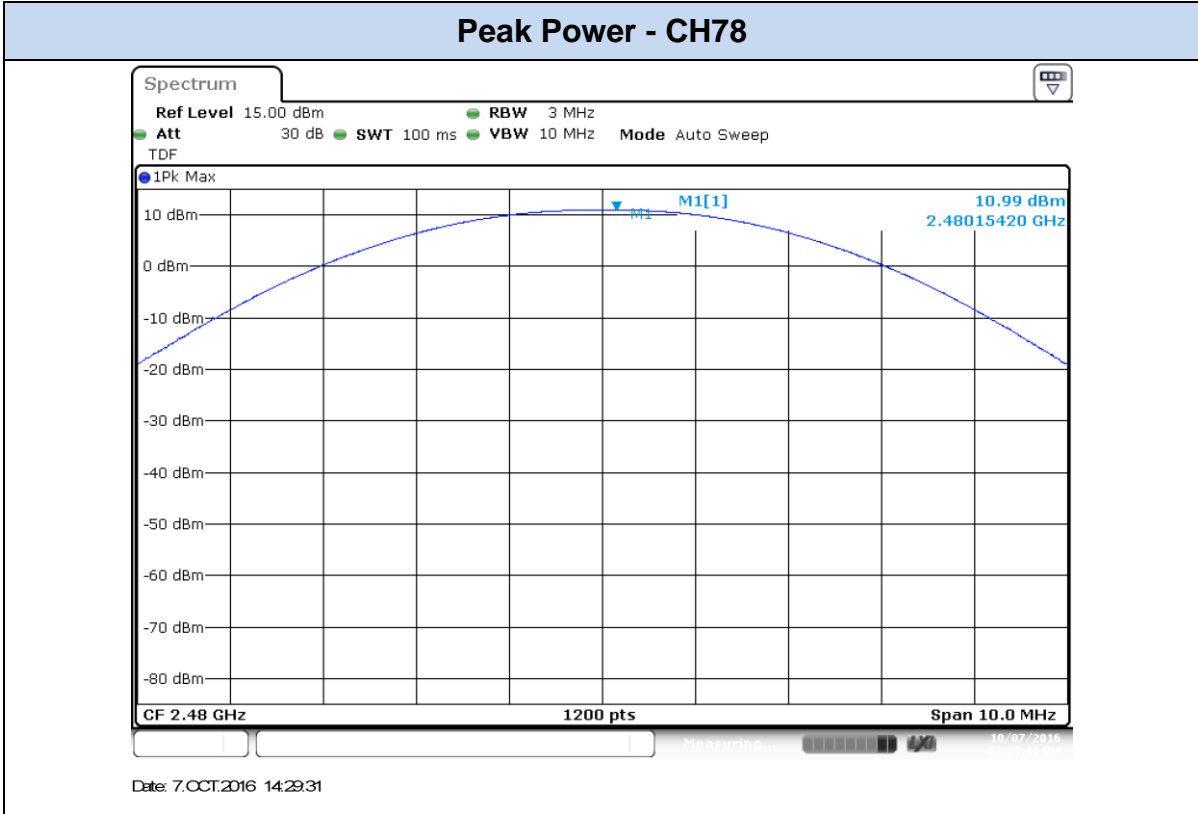
Results tables:

Mode	Channel Number	Frequency [MHz]	Peak Power [dBm]	Peak Power [mW]	Peak Power EIRP [dBm]	Peak Power EIRP [mW]
Basic Rate GFSK	0	2402	10.31	10.74	13.55	22.65
	39	2441	12.30	16.98	15.54	35.81
	78	2480	10.99	12.56	14.23	26.49
EDR $\pi/4$ -DQPSK	0	2402	9.83	09.62	13.07	20.28
	39	2441	11.64	14.59	14.88	30.76
	78	2480	10.23	10.54	13.47	22.23
EDR 8-DPSK	0	2402	9.48	8.870	12.72	18.71
	39	2441	11.25	13.34	14.49	28.12
	78	2480	9.90	09.77	13.14	20.61

Results Screenshot:

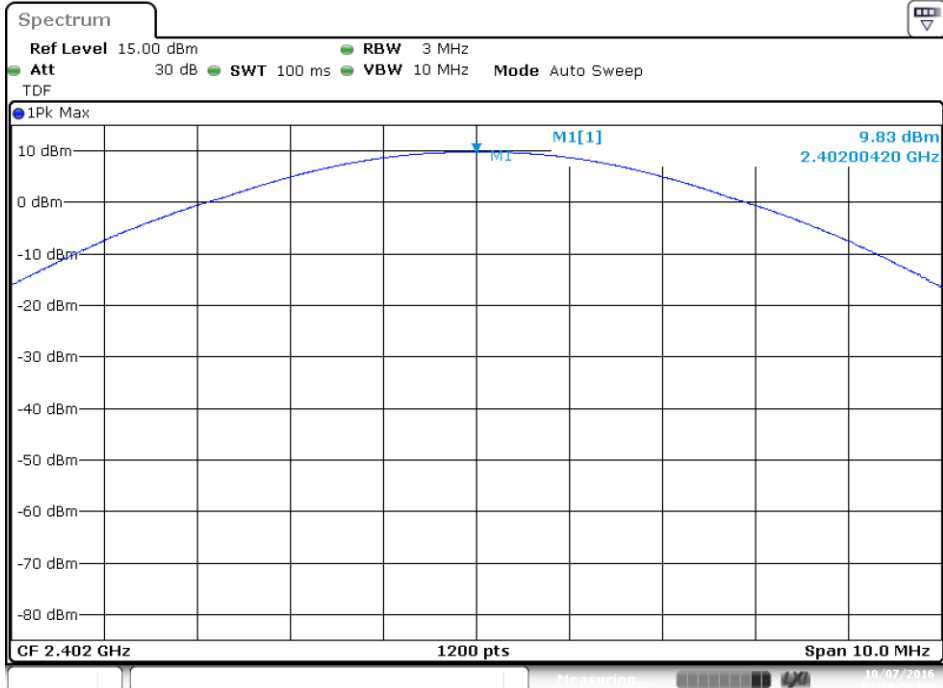
Basic Rate - GFSK



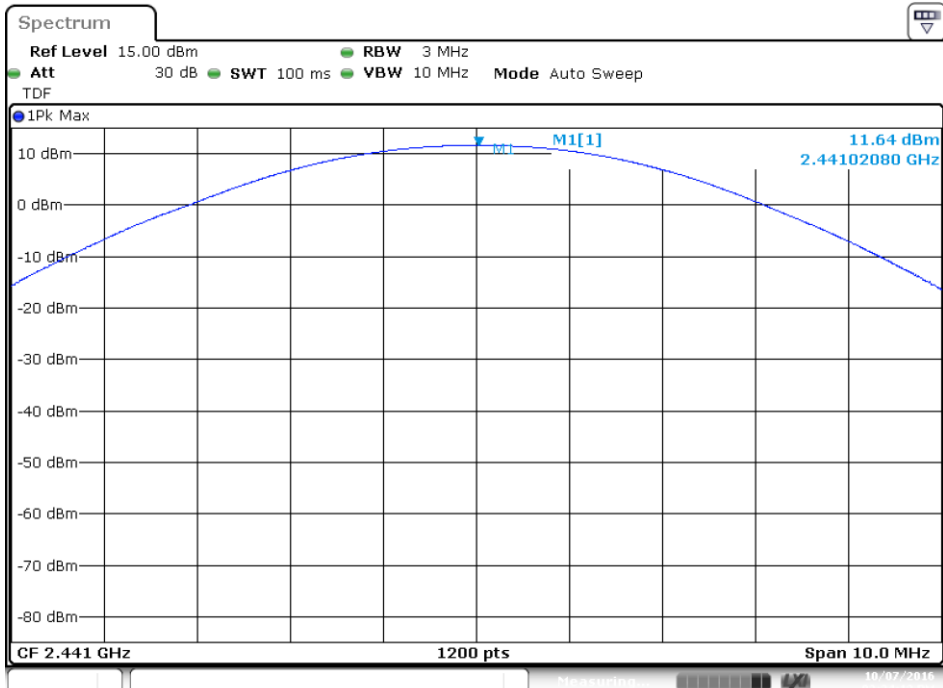


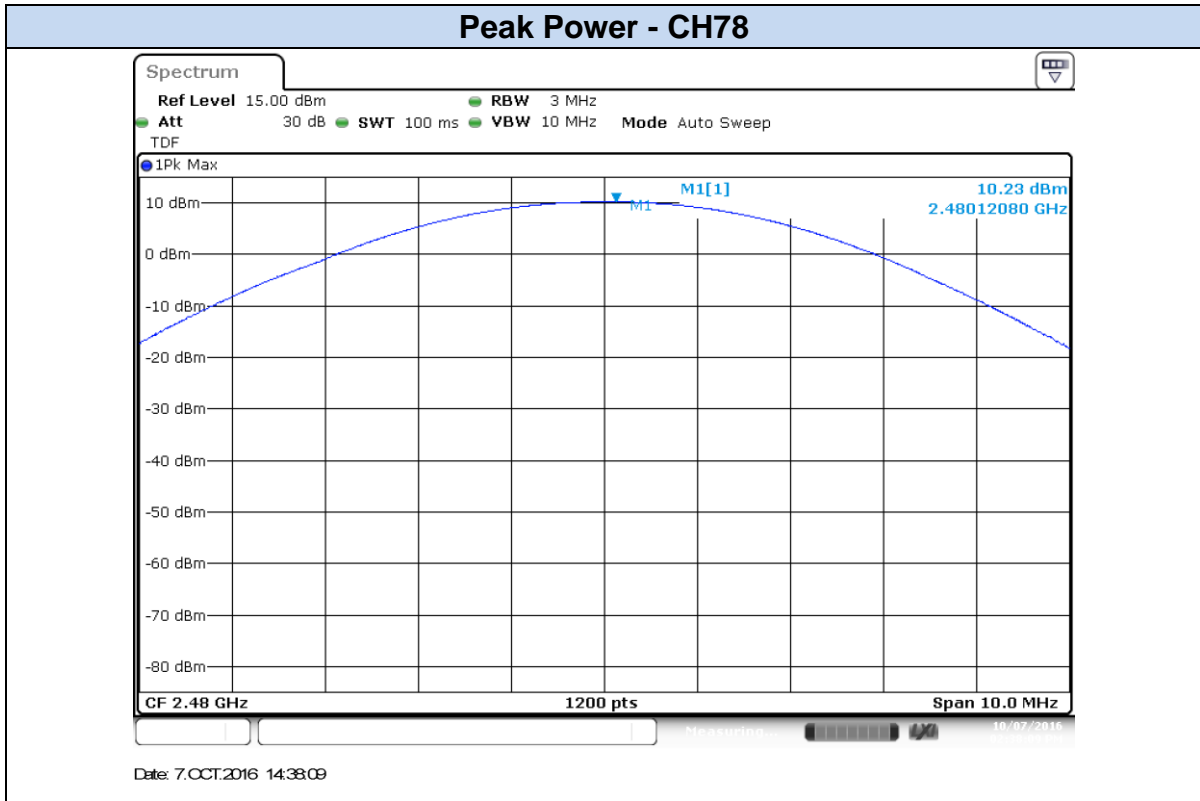
EDR - $\pi/4$ -DQPSK

Peak Power - CH0

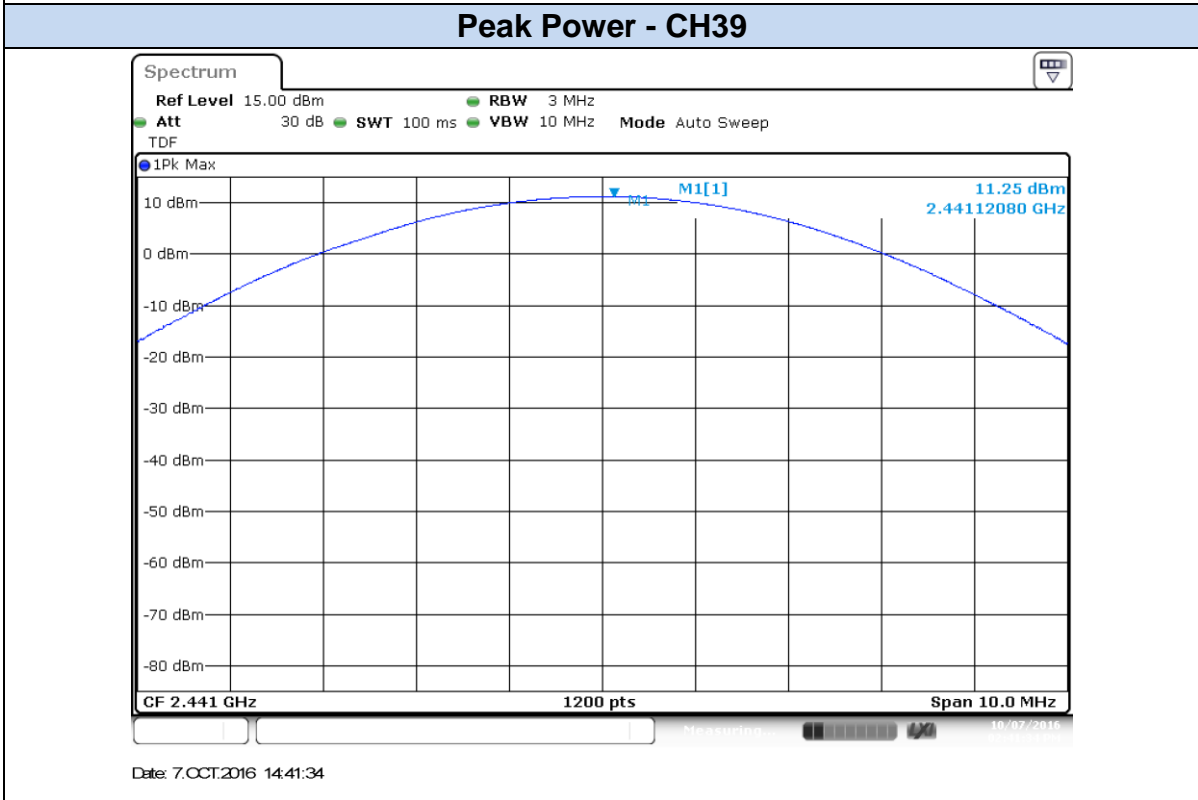
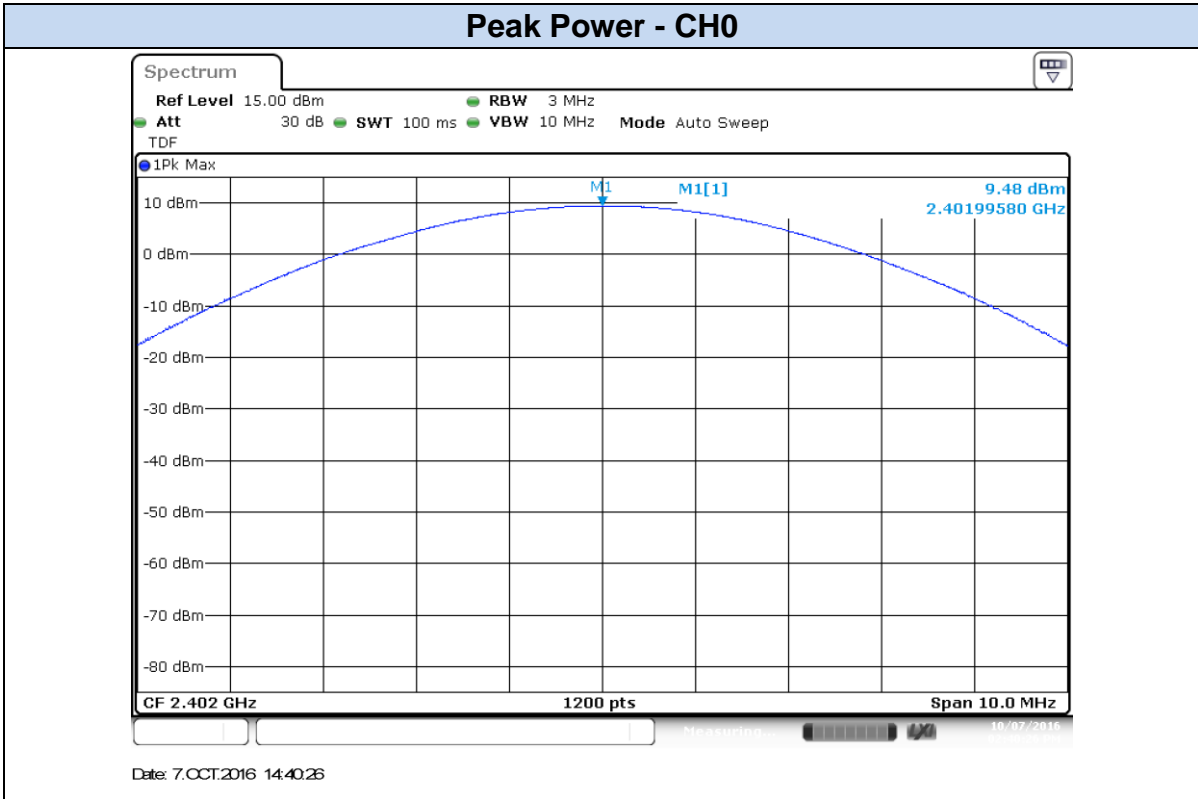


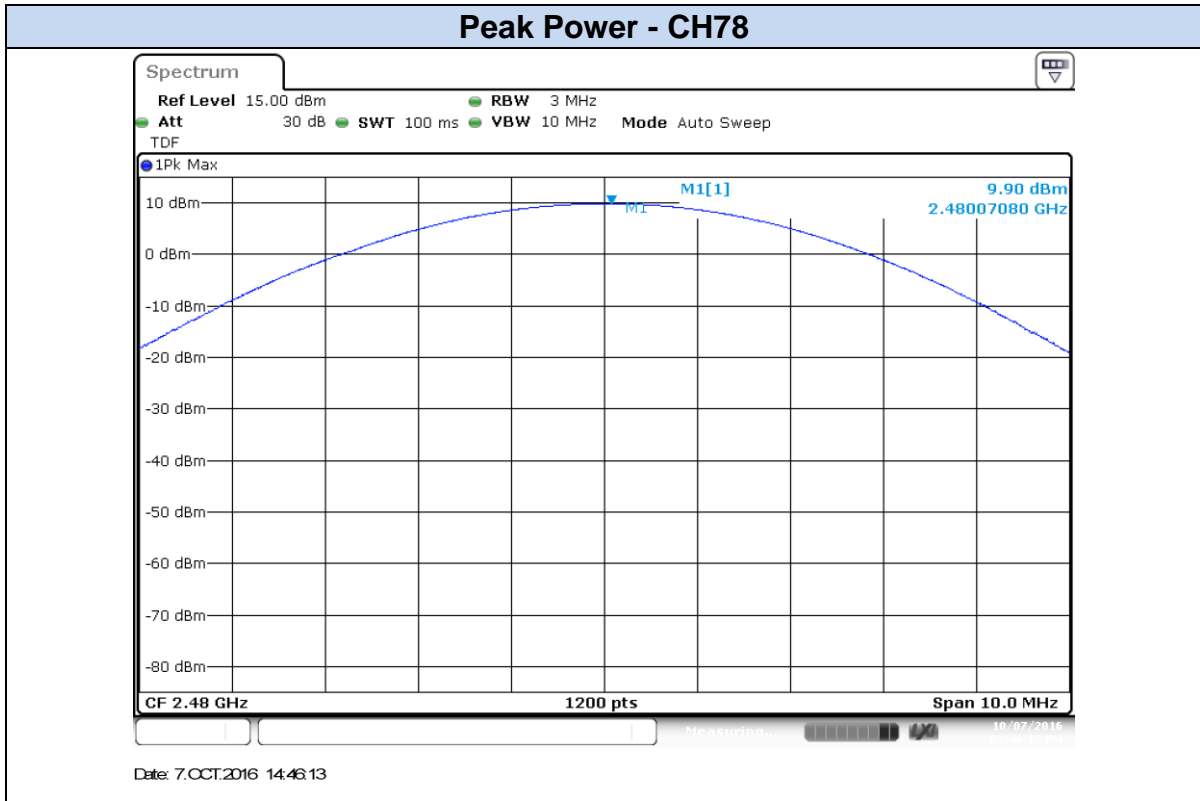
Peak Power - CH39





EDR – 8-DPSK





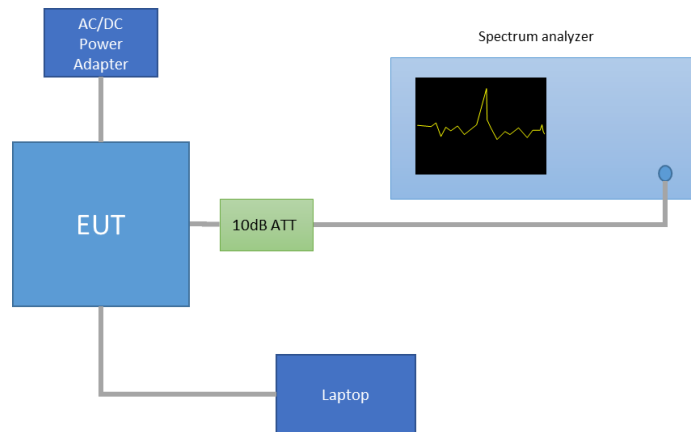
B.5 Out-of-band emissions (conducted)

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.

Test procedure:

The setup below 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.

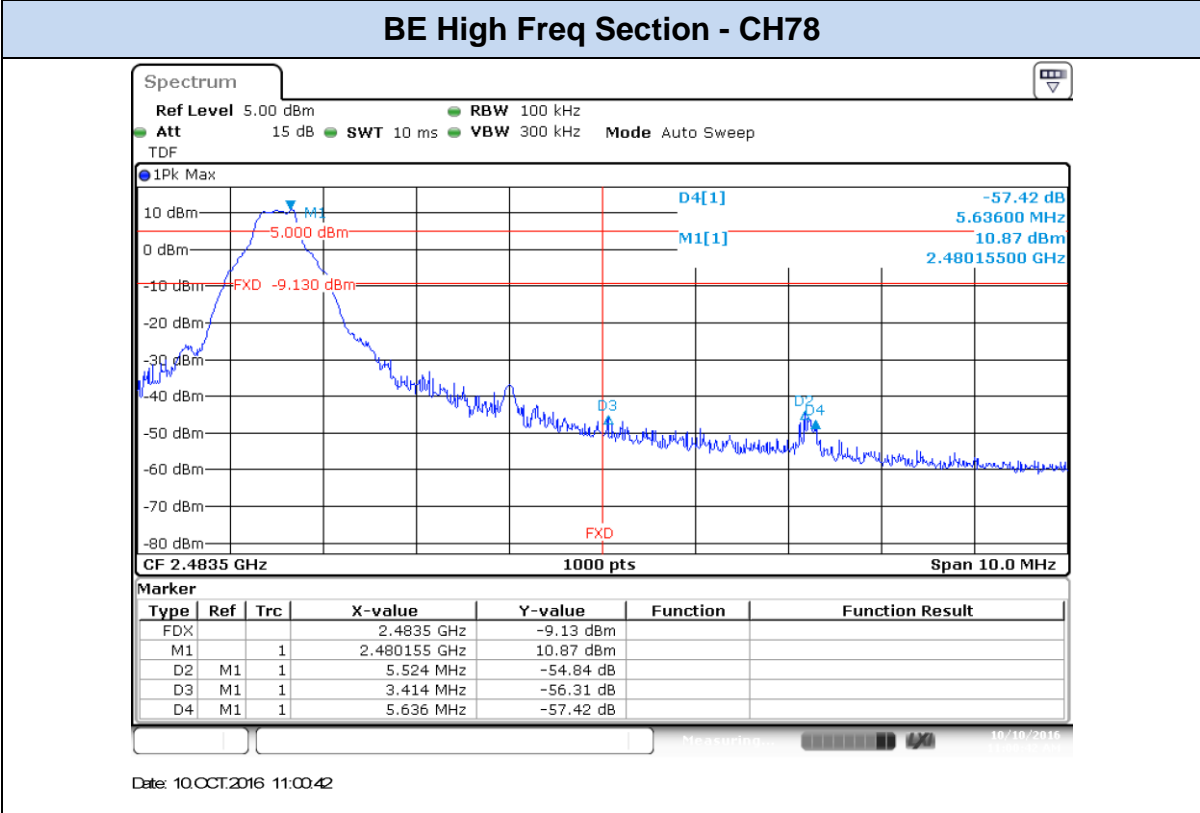
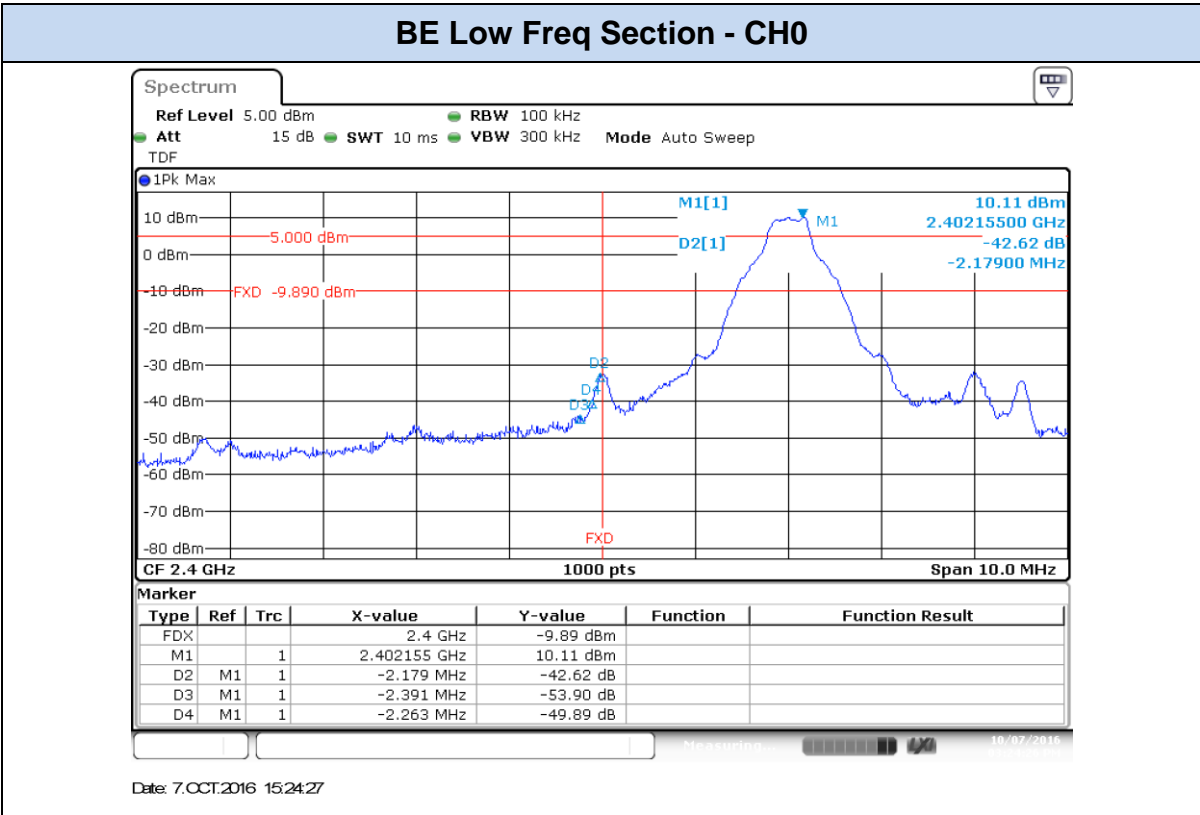


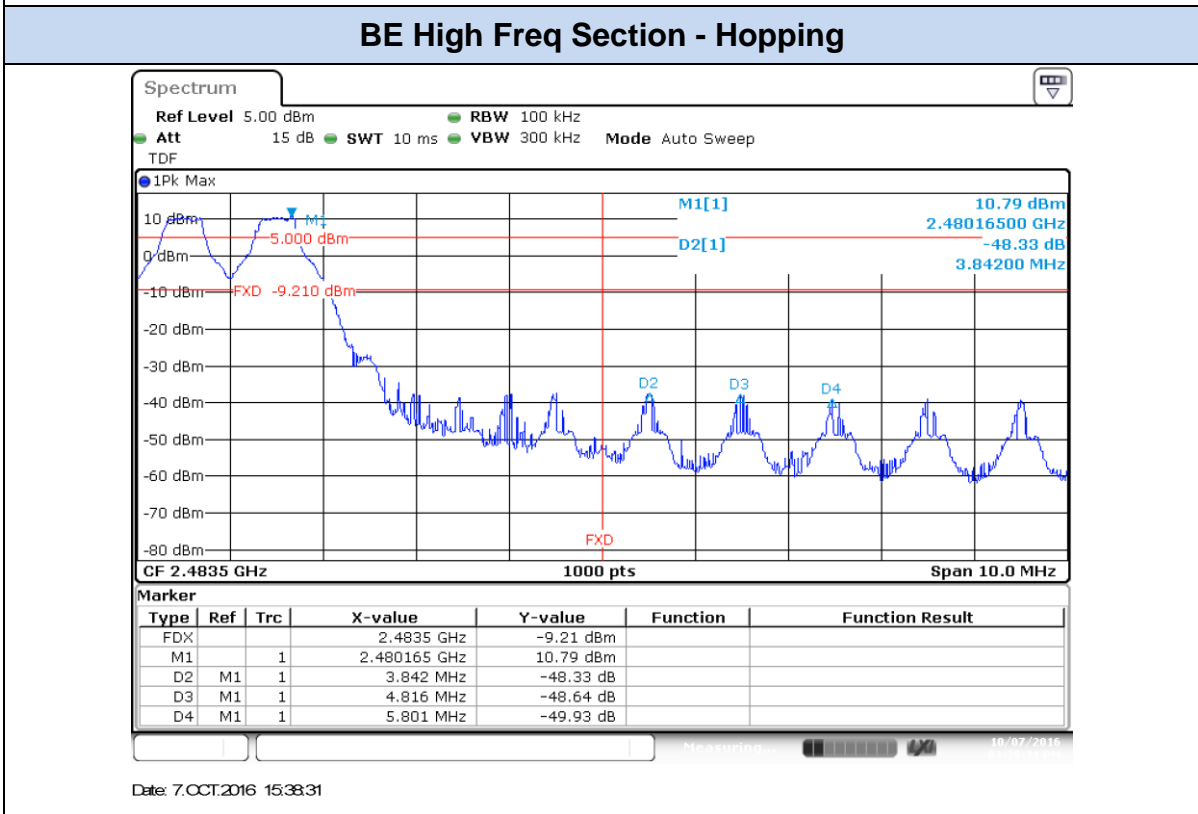
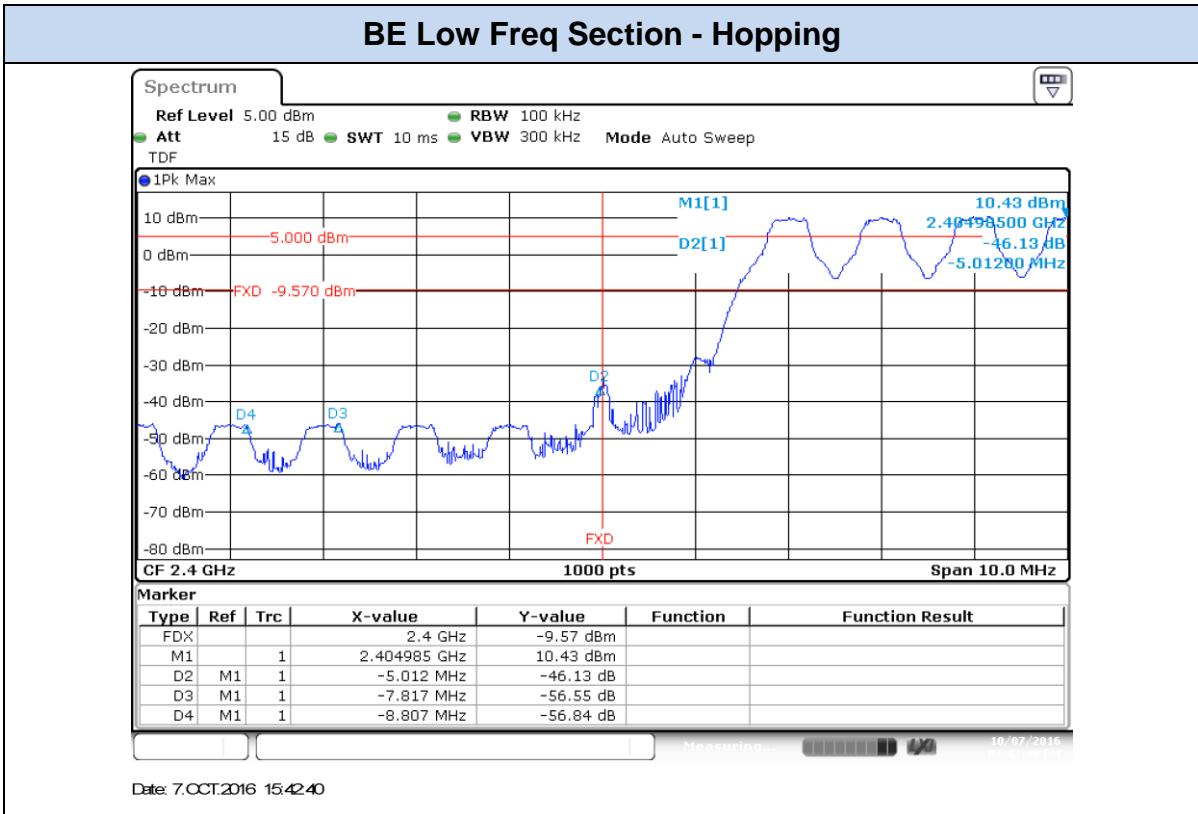
Note: these PSD_{Peak} values are shown just as a reference for the compliance of the Out-of-band Measurements. Thus the RBW used for these measurements was 100 kHz.

Mode	CH	Frequency [MHz]	PSD Peak [dBm]
Basic Rate - GFSK	0	2402	10.11
	39	2441	12.03
	78	2480	10.87
EDR – $\pi/4$ -DQPSK	0	2402	08.41
	39	2441	10.01
	78	2480	08.54
EDR – 8-DPSK	0	2402	07.91
	39	2441	09.44
	78	2480	08.16

Band Edge results Screenshot:

Basic Rate - GFSK





EDR – $\pi/4$ -DQPSK

