RF Test Report
Bluetooth

Report No.	:	FCCCBNW-WAY-P22080128
Customer	:	SAM JIN CO., LTD.
Address	:	81, Anyangcheonseo-ro, Manan-gu Anyang-si, Gyeonggi-do, 430-817, Korea
Use of Report	:	Certification
Model Name	:	ATS2853BTB
FCC ID	:	2AF4S-MV2853BTB
IC ID	:	20753-MV2853BTB
Date of Test	:	2022.09.01 to 2022.09.19
Test Method Used	:	FCC 47 CFR PART 15 Subpart C (Section §15.247) ISED RSS-247
Testing Environment	:	Refer to the Test Condition
ISED# / CAB Identifier	:	26316 / KR0158

Test Result : ☒ **Pass** ☐ **Fail**

ISSUED BY: BV CPS ADT Korea Ltd., EMC/RF Laboratory

ADDRESS: Innoplex No.2 106, Sinwon-ro 306, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea 16675

TEST LOCATION: HeungAn-daero 49, DongAn-gu, Anyang-si, Gyeonggi-do, Korea, 14119

Tested by

Name : Jinyeop Kim (Signature)

Technical Manager

Name : Sooyeon Kim (Signature)

2022. 09. 19

BV CPS ADT Korea Ltd.

RELEASE CONTROL RECORD

REPORT NO.	REASON FOR CHANGE	DATE ISSUED
FCCCBNW-WAY-P22080128	Original release	2022.09.19

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1 Summary of Test Results

The EUT has been tested according to the following specifications

Applied Standard : FCC Part 15, Subpart C 15.247, RSS-247					
FCC Part Section(s)	**RSS Section(s)**	**Test Description**	**Limit**	**Test Result**	**Reference**
15.247(b)(1)	RSS-247 [5.4(2)]	Maximum Peak Output Power	< 1 Watt if ≥ 75 non-overlapping channels used	PASS	Section 3.2
15.247(a)(1)	RSS-247 [5.1(2)]	Carrier Frequency Separation	> 2/3 of 20 dB BW for systems with Output Power < 125 mW	PASS	Section 3.3
15.247(a)(1)(iii)	RSS-247 [5.1(1)]	20 dB Channel Bandwidth	N/A	PASS	Section 2.5
-	RSS-Gen [6.7]	Occupied Bandwidth (99 % Bandwidth)	N/A	PASS	Section 2.5
15.247(a)(1)(iii)	RSS-247 [5.1(4)]	Number of Hopping Channels	> 15 Channels	PASS	Section 3.4
15.247(a)(1)(iii)	RSS-247 [5.1(4)]	Time of Occupancy (Dwell Time)	< 0.4 sec in 31.6 sec period	PASS	Section 3.5
15.247(d)	RSS-247 [5.5]	Band Edge / Out-of-Band Emissions (Conducted Spurious Emission)	> 20 dBc	PASS	Section 3.6
15.205 15.209	RSS-Gen [8.9]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in Restricted bands must meet the radiated limits detailed in 15.209	PASS	Section 3.6
15.207	RSS-Gen [8.8]	AC Conducted Emissions (150 kHz – 30 MHz)	< FCC 15.207 limits	PASS	Section 3.7

NOTES

1) The general test methods used to test on this devices are ANSI C63.10.

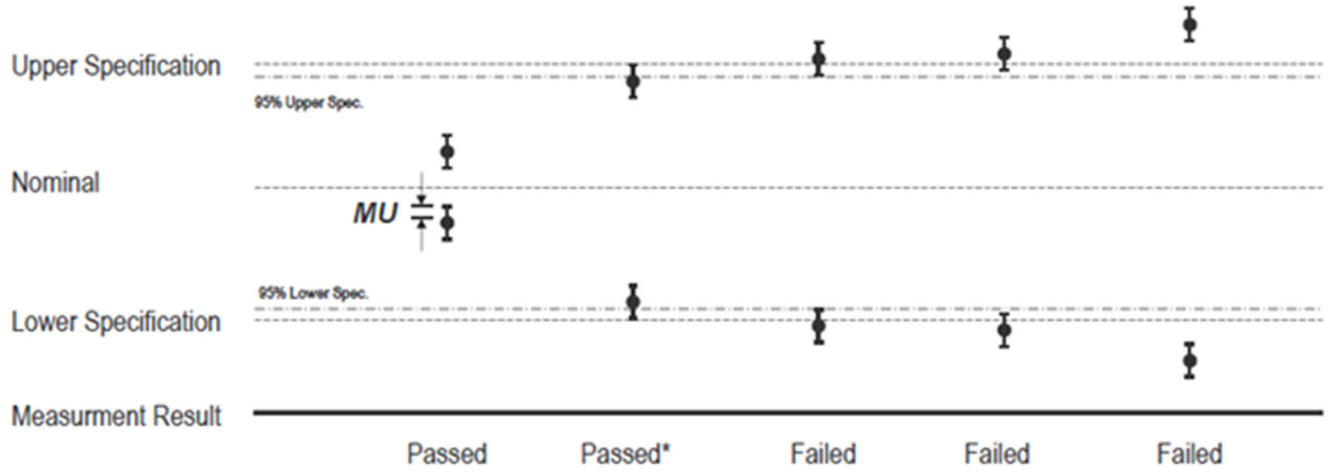
2) If The Frequency Hopping System operating in 2400-2483.5MHz band and the output power less than 125mW. The hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of hopping channel whichever is greater.

3) Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

4) According to exploratory test no any obvious emission were detected from 9 ㎑ to 30 ㎒.

Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

1.1 Decision Rules for Statement of Conformity



QUA-52 Decision Rule(QA Document) was applied.

Step 1) : Reference Check, Daily Check, Peripheral device Check

Step 2) : Re-test Procedure (Repeat the test maximum 3 times, Different Test Engineer)

1) If the original test results are subject to retesting and the judgement is unclear, the retest is carried out.
2) If the result of the first retest is the same as the initial test, the judgement is made based on the value.
3) If the result of the first retest differ from the results of the initial test, the second re-test is carried out.
4) After completion of the second retest, the average of the three test results is determined as the final result. However, if the deviation of the three test values is more than 5 % of the reference value, the technical manager should review the reproducibility of the test from the beginning.

1.2 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2

Measurement Items	Frequency Range	Expanded Uncertainty U = *k*Uc (*k* = 2)
Conducted Emissions at main ports	150 kHz – 30 MHz	2.99
Radiated Spurious Emissions	9 kHz – 30 MHz	1.92
	30 MHz – 1 GHz	4.00
	1 GHz – 18 GHz	5.68
	18 GHz – 26.5 GHz	5.24

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of k = 2.

2 General Information

2.1 General Description of EUT

Product	Bluetooth Module
Brand	SAM JIN CO., LTD.
Model	ATS2853BTB
Identification No. of EUT	-
Series Model	-
Model Difference	-
HVIN	ATS2853BTB
Power Supply	DC 3.3 V
Modulation Type	BDR(GFSK), EDR(π/4DQPSK), EDR(8DPSK)
Transfer Rate	1 Mbps, 2 Mbps, 3 Mbps
Operating Frequency	2 402 ㎒ – 2 480 ㎒
Number of Channel	79 Channels
Output Power	BDR(GFSK) : 5.12 dBm (3.25 mW) EDR(π/4DQPSK) : 5.35 dBm (3.43 mW) EDR(8DPSK) : 5.90 dBm (3.89 mW)
Antenna Type	PCB Pattern Antenna
Antenna Connector	Internal
H/W Version	V1.0
S/W Version	V1000.0
Test Device Information	-

NOTES

1) The above equipment has been tested by **Bureau Veritas Consumer Products Services ADT Korea**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

2) The following antennas were provided to the EUT

Antenna	Type	Connector	Peak Gain (dBi)
			2.4 GHz
Bluetooth	PCB Pattern Antenna	Internal	3.74

3) List of Accessories

Accessories	Brand	Model	Manufacturer	Specification
USB Cable	-	-	-	0.5 m

4) Auxiliary test equipment

Accessories	Brand	Model	Manufacturer	Specification
Notebook PC	Samsung Electronics Co., Ltd.	NT950XBV	Samsung Electronics Suzhou Computer Co,. Ltd.	-
Notebook Adaptor	Samsung Electronics Co., Ltd.	PSCV650105A	Samsung Electronics Co., Ltd.	Input : AC 100 – 240 V 50 – 60 Hz Output : DC 19 V

2.2 Description of Test Mode

[Test Channel of EUT]

Channel	Frequency [MHz]	Channel	Frequency [MHz]	Channel	Frequency [MHz]	Channel	Frequency [MHz]
0	2 402	20	2 422	40	2 442	60	2 462
1	2 403	21	2 423	41	2 443	61	2 463
2	2 404	22	2 424	42	2 444	62	2 464
3	2 405	23	2 425	43	2 445	63	2 465
4	2 406	24	2 426	44	2 446	64	2 466
5	2 407	25	2 427	45	2 447	65	2 467
6	2 408	26	2 428	46	2 448	66	2 468
7	2 409	27	2 429	47	2 449	67	2 469
8	2 410	28	2 430	48	2 450	68	2 470
9	2 411	29	2 431	49	2 451	69	2 471
10	2 412	30	2 432	50	2 452	70	2 472
11	2 413	31	2 433	51	2 453	71	2 473
12	2 414	32	2 434	52	2 454	72	2 474
13	2 415	33	2 435	53	2 455	73	2 475
14	2 416	34	2 436	54	2 456	74	2 476
15	2 417	35	2 437	55	2 457	75	2 477
16	2 418	36	2 438	56	2 458	76	2 478
17	2 419	37	2 439	57	2 459	77	2 479
18	2 420	38	2 440	58	2 460	78	2 480
19	2 421	39	2 441	59	2 461		

2.2.1 Test Mode Applicability and Tested Channel Details

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned on X axis for radiated emission. Following channel(s) was(were) selected for the final test as listed below :

EUT Configure mode	Applicable to				Description
	RE < 1G	RE ≥ 1G	PLC	APCM	
-	√	√	√	√	-

Where RE ≥ 1 G : Radiated Emission above 1 GHz & Bandedge Measurement
RE < 1 G : Radiated Emission below 1 GHz
PLC : Power Line Conducted Emission
APCM : Antenna Port Conducted Measurement

Radiated Emission Test (Below 1 GHz)

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.

☒ Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Type	Packet Type
0 to 78	0	BDR(GFSK)	DH5

Radiated Emission Test (Above 1 GHz)

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.

☒ Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Type	Packet Type
0 to 78	0, 39, 78	BDR(GFSK)	DH5
0 to 78	0, 39, 78	EDR(8DPSK)	3DH5

Radiated Emission Test (Above 18 GHz)

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.

☒ Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Type	Packet Type
0 to 78	0	BDR(GFSK)	DH5

Power line Conducted Emission Test

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.

☒ Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Type	Packet Type
0 to 78	0	BDR(GFSK)	DH5

Antenna Port Conducted Measurement

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture), and packet types.

☒ Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Type	Packet Type
0 to 78	0, 39, 78	BDR(GFSK)	DH5
0 to 78	0, 39, 78	EDR(8DPSK)	3DH5

Test Condition

Applicable to	Environmental Conditions	Test Voltage	Tested by
RE < 1G	(20.7 ± 2) °C, (49.1 ± 3) % R.H.	DC 3.3 V	Sooyeon Kim
RE ≥ 1G	(20.4 ± 2) °C, (49.8 ± 3) % R.H.	DC 3.3 V	Sooyeon Kim
PLC	(21.5 ± 2) °C, (48.8 ± 3) % R.H.	AC 120 V, 60 Hz	Sooyeon Kim
APCM	(20.4 ± 2) °C, (49.7 ± 3) % R.H.	DC 3.3 V	Sooyeon Kim

2.3 Maximum Output Power

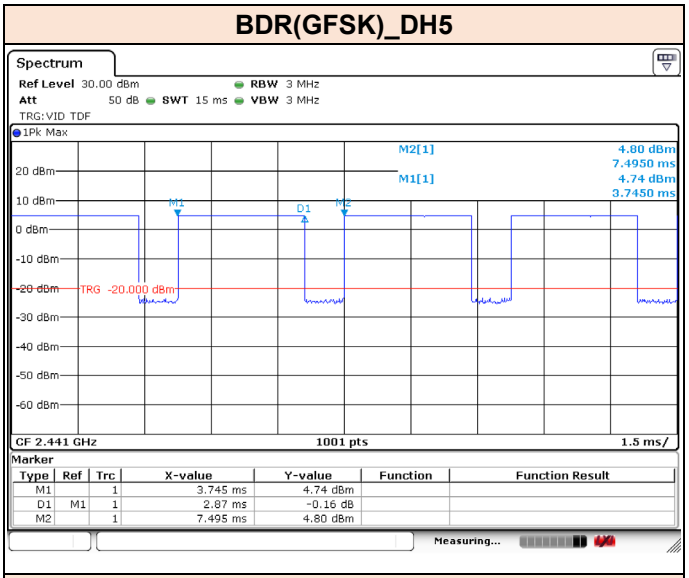
Frequency Range [MHz]	Test Items	Test Mode	Packet Type	Result [dBm]	Result [mW]
2 402 ~ 2 480	Peak Power	BDR(GFSK)	DH1	4.94	3.12
			DH3	5.01	3.17
			DH5	5.12	3.25
		EDR(π/4DQPSK)	2DH1	4.98	3.15
			2DH3	5.34	3.42
			2DH5	5.35	3.43
		EDR(8DPSK)	3DH1	4.97	3.14
			3DH3	5.37	3.44
			3DH5	5.90	3.89
	Average Power	BDR(GFSK)	DH1	-0.63	0.86
			DH3	2.73	1.87
			DH5	3.52	2.25
		EDR(π/4DQPSK)	2DH1	-1.41	0.72
			2DH3	1.51	1.42
			2DH5	2.22	1.67
		EDR(8DPSK)	3DH1	-1.45	0.72
			3DH3	1.47	1.40
			3DH5	2.22	1.67

2.4 Duty Cycle of Test Signal

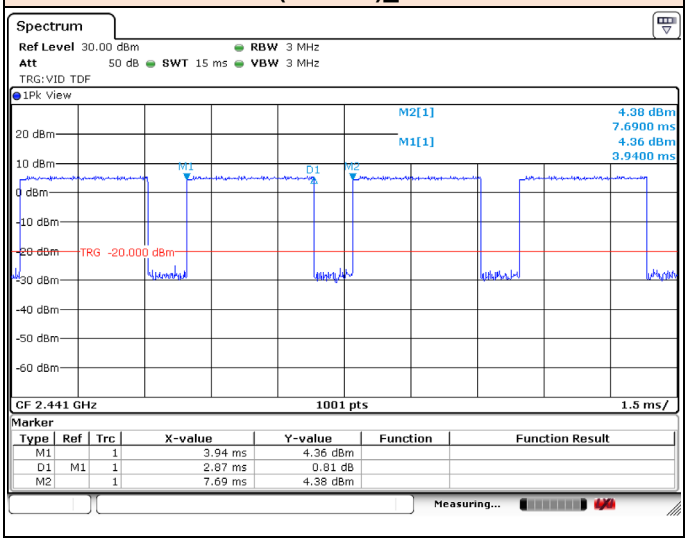
Test Mode	Test Items	Packet Type	On Time B [msec]	Period [msec]	Duty Cycle X [Linear]	Duty Cycle [%]	DCCF [dB]	1/T Min. VBW [kHz]
BDR(GFSK)	Duty Cycle	DH5	2.870	3.750	0.765	76.5	1.16	0.348
EDR(8DPSK)	Duty Cycle	3DH5	2.870	3.750	0.765	76.5	1.16	0.348

Test Plot of Duty Cycle

BDR(GFSK)_DH5



EDR(8DPSK)_3DH5

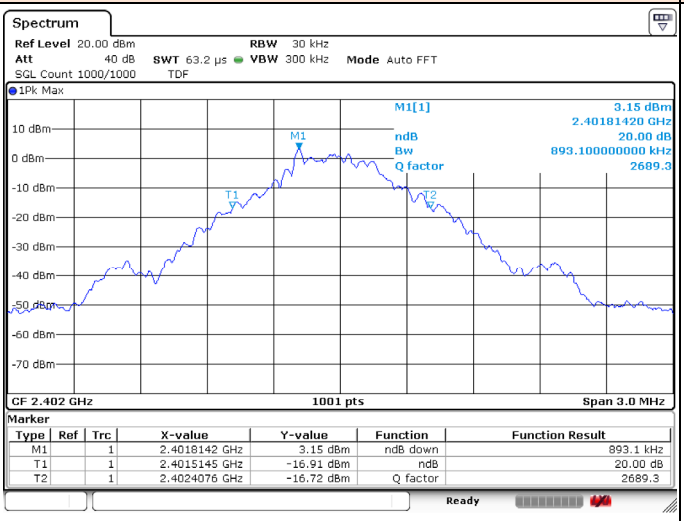
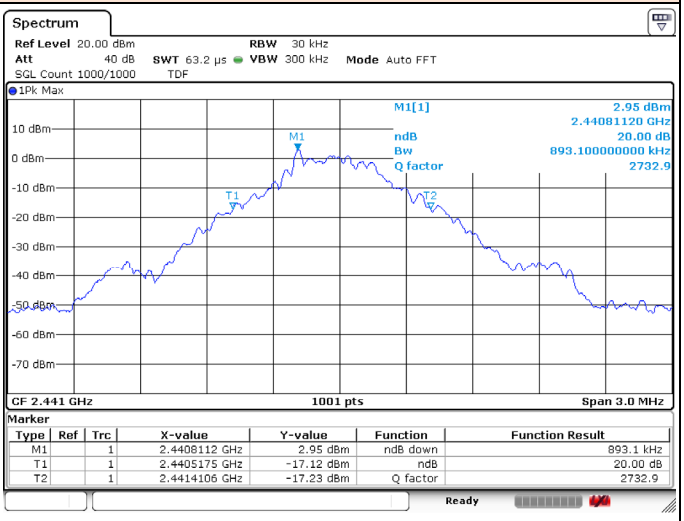
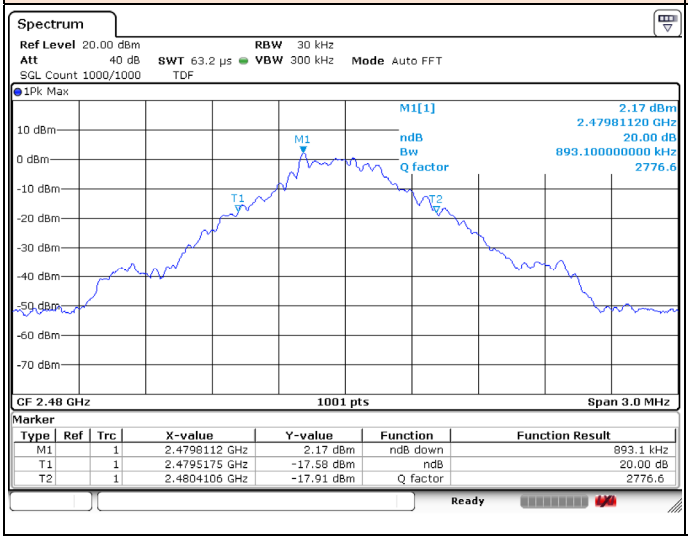


2.5 20 dB and 99 % Bandwidth

[Test Data of 20 dB Bandwidth and 99 % Bandwidth]

Test Mode	Channel	Frequency [MHz]	20 dB BW [MHz]	99 BW [MHz]
BDR(GFSK)	Lowest	2 402	0.893	0.899
	Middle	2 441	0.893	0.887
	Highest	2 480	0.893	0.917
Worst Result			0.893	0.917
EDR(8DPSK)	Lowest	2 402	1.211	1.190
	Middle	2 441	1.256	1.172
	Highest	2 480	1.256	1.193
Worst Result			1.256	1.193

Test Plot of 20 dB Bandwidth

<table>
<tr><th colspan="2">20 dB Bandwidth_BDR(GFSK)</th></tr>
<tr><th>BDR(GFSK)_2 402 MHz</th><th>BDR(GFSK)_2 441 MHz</th></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><th>BDR(GFSK)_2 480 MHz</th><th>-</th></tr>
<tr><td> 
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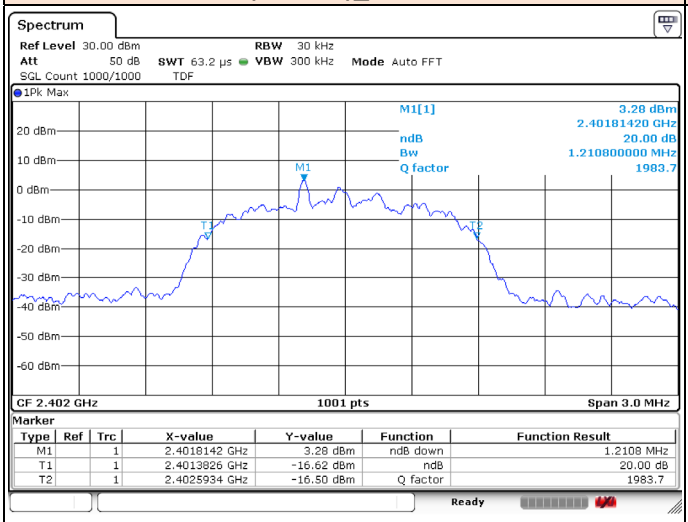
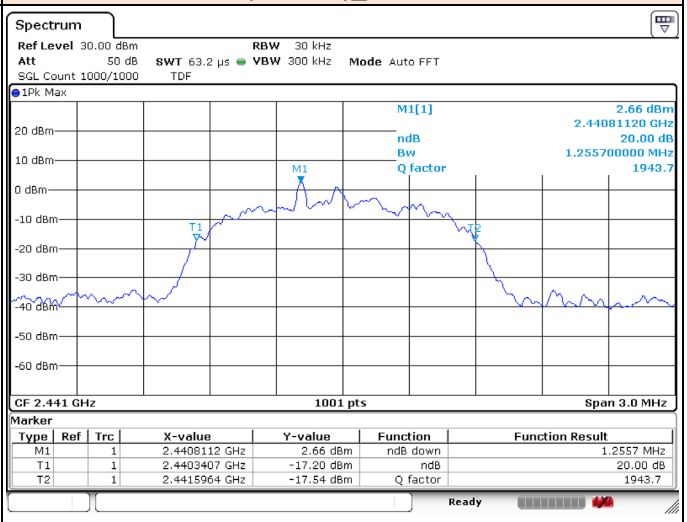
20 dB Bandwidth_EDR(8DPSK)

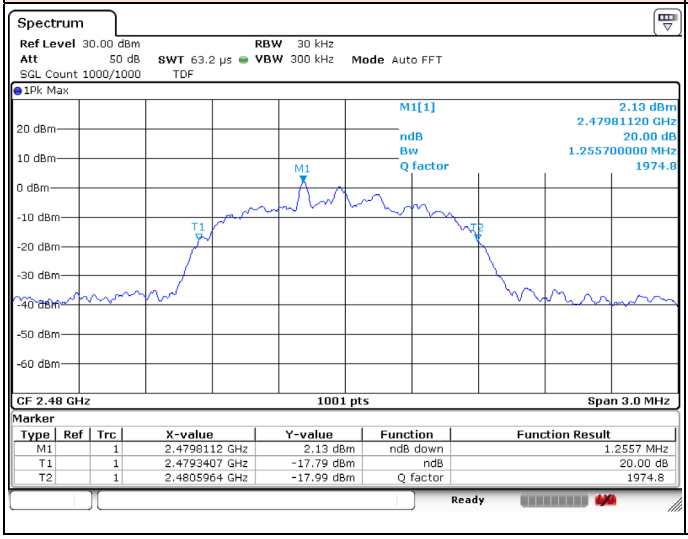
EDR(8DPSK)_2 402 MHz



EDR(8DPSK)_2 441 MHz



EDR(8DPSK)_2 480 MHz



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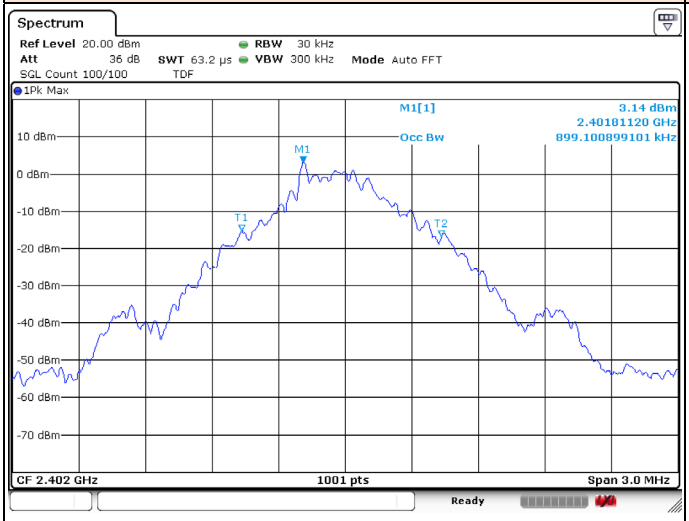
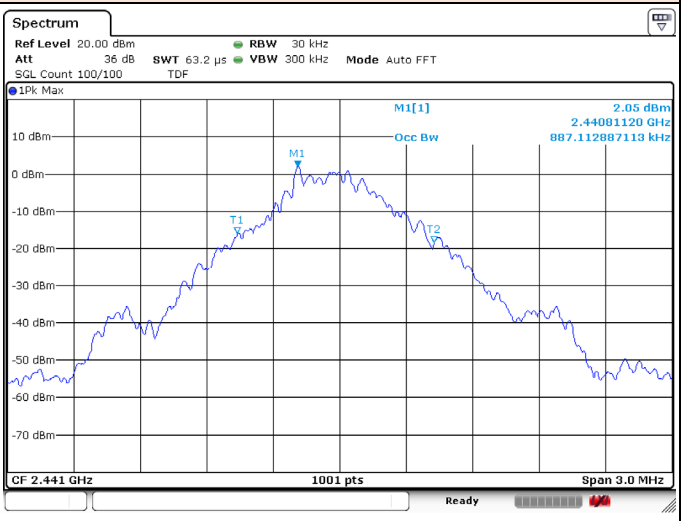
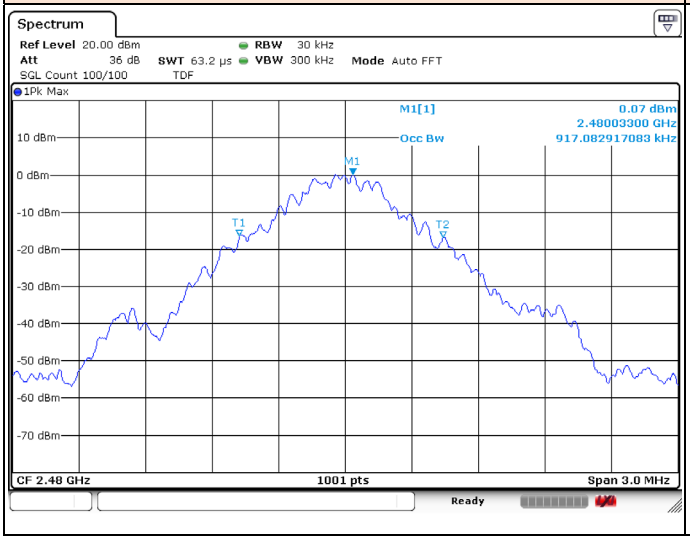
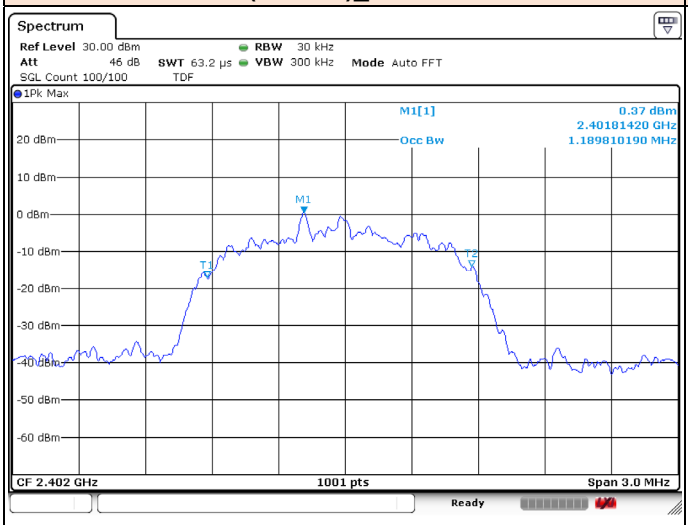
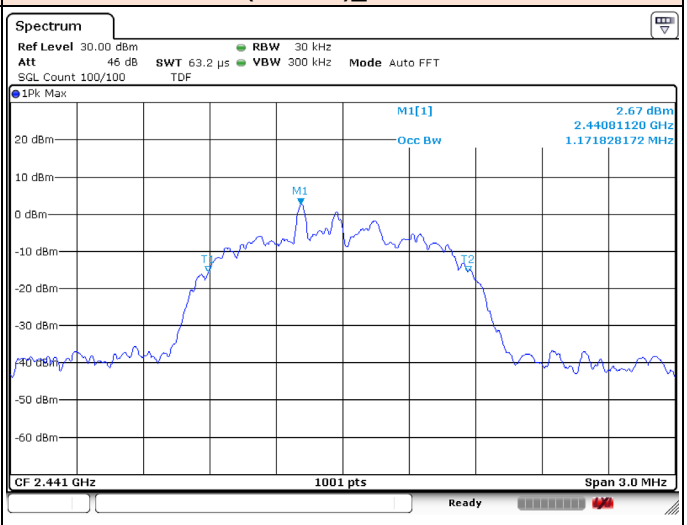
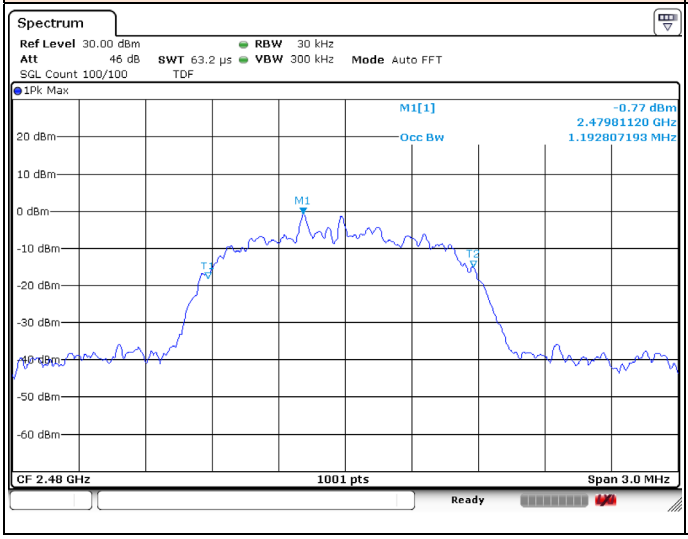
Test Plot of 99 % Bandwidth

99 % Bandwidth_BDR(GFSK)	
BDR(GFSK)_2 402 MHz	**BDR(GFSK)_2 441 MHz**
	
BDR(GFSK)_2 480 MHz	**-**
	-

99 % Bandwidth_EDR(8DPSK)	
EDR(8DPSK)_2 402 MHz	EDR(8DPSK)_2 441 MHz
	
EDR(8DPSK)_2 480 MHz	-
	-

2.6 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards.

FCC CFR 47 Part 15, Subpart C (§15.247)
KDB 558074 D01 15.247 Meas Guidance v05r02
ANSI C63.10-2020
RSS-247 Issue 2
RSS-GEN Issue 5

All test items in this test report have been performed and recorded as per the above standards.

2.7 Test Equipment

Test Equipment is traceable to the National Institute of Standards and Technology (NIST). Measurement antenna used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Equipment	Model	Serial Number	Manufacturer	Description	Cal Date	Cal Due
Loop Antenna	HFH2-Z2E	349806	R&S	Active Loop Antenna, 30 MHz	2022-02-18	2023-02-18
Bi-log Antenna	VULB 9163	1099	Schwarzbeck	Trilog Antenna, 3 GHz (with 6 dB ATT.)	2022-09-03	2023-09-03
Horn Antenna	HF907	102772	R&S	Horn Antenna, 18 GHz	2021-12-03	2022-12-03
Horn Antenna	BBHA9170	00955	Schwarzbeck	15 - 40 GHz, 10 W (cont.) 25 W (peak)	2021-12-13	2022-12-13
Amplifier	SCU08F2	8400016	R&S	Signal Conditioning Unit, 8 GHz	2021-11-23	2022-11-23
Amplifier	SCU-18F	180111	R&S	Signal Conditioning Unit, 18 GHz	2021-11-23	2022-11-23
Amplifier	JS44-18004000-33-8P	2142086	L3 Narda-MITEQ	Amplifier, 40 GHz	2021-11-29	2022-11-29
Signal analyzer	FSW50	101403	R&S	DC Coupled : 2 Hz to 50 GHz AC Coupled : 10 MHz to 50 GHz	2021-11-22	2022-11-22
Attenuator	PE7087-10	1712-2	Pasternack	10 dB Atten / 2 W / DC to 26 GHz	2021-06-04	2023-06-04
High Pass Filter	HPM17543	28	Micro-Tronics	3 GHz High Pass Filter	2021-06-04	2023-06-04
EMI Receiver	ESR	102529	R&S	DC ~ 7 GHz	2021-06-04	2022-11-23
Signal Generator	SMB100A	MY41006053	R&S	100 kHz ~ 40 GHz	2021-06-04	2023-06-03
Signal analyzer	FSV30	103631	R&S	10 Hz to 30 GHz / 1W	2021-11-22	2022-11-22
Power Splitter	1579	71667	Weinschel	DC to 26.5 GHz / 0.5 W	2021-11-30	2022-11-30
Power Meter	NRX	103577	R&S	CW mode: -20 to +20 dBm	2022-03-17	2023-03-17
Power Sensor	NRP-Z211	102376	R&S	Two Path Diode Power Sensor, Frequency range : 10 MHz to 8 GHz / Level range: -60 dBm to +20 dBm	2022-03-17	2023-03-17
Attenuator	40AH2W-10	1	Aeroflex	DC to 40 GHz / 10 dB / 2 W	2021-06-04	2022-11-30
LISN	ENV216	102437	R&S	9 kHz - 30 MHz	2021-11-23	2022-11-23
EMI Test Receiver	ESR	102529	R&S	9 kHz - 3.6 GHz	2021-11-23	2022-11-23

3 Test Results

3.1 Antenna Requirement

Except from §15.203 of the FCC Rules/Regulations:

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of the section.

- The antenna(s) of the EUT are Permanently attached.
- There are no provisions for connection to an external antenna.

Result

The EUT complies with the requirement of §15.203

3.2 Maximum Peak Output Power

3.2.1 Regulation

§15.247(a)(1) : 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.

§15.247(b)(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. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

§15.247(b)(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.

3.2.2 Test Procedure

The method of measurement used to test this FHSS device is ANSI C63.10-2020.

This is an RF conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation.

a) Use the following spectrum analyzer settings:

Peak Power Measurement

1) Span : Approximately five times the 20 dB bandwidth, centered on hopping channel.
2) RBW > 20 dB bandwidth of emission being measured.
3) VBW ≥ RBW.
4) Sweep : Auto.
5) Detector function : Peak.
6) Trace : Max hold.

b) Allow trace to stabilize

c) Use the marker-to-peak function to set the marker to the peak of the emissions

d) The indicated level is the peak output power, after any corrections for external attenuators and cables.

e) A plot of the test results and setup description shall be included in the test report.

NOTE—A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.

Average Power Measurement

Measurement using a power meter.
a) Averge Power measurement using an RF average power meter, as follows:

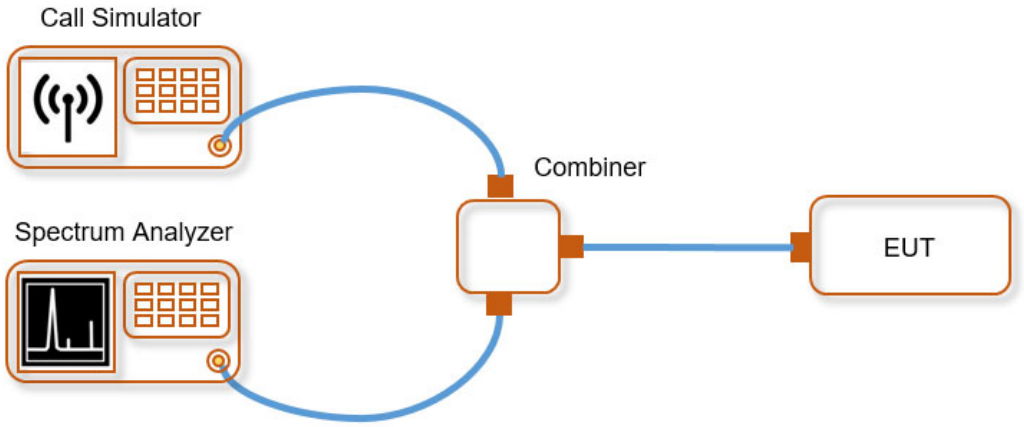
1) The EUT is configured to transmit continuously, or to transmit with a constant duty cycle.
2) At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
3) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

b) If the transmitter does not transmit continuously, measure the duty cycle, D, of the transmitter output signal.
c) Measure the average power of the transmitter.
This measurement is an average over both the ON and OFF periods of the transmitter.
d) Correct the measurement in dBm by adding [10 log (1 / D)], where D is the duty cycle.

3.2.3 Deviation from Test Standard

No deviation.

3.2.4 Test Setup



3.2.5 Test Result

[Test Data of Peak Power]

Test Mode	Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
BDR (GFSK)	Lowest	2 402	5.12	30.00	24.88
	Middle	2 441	4.74	30.00	25.26
	Highest	2 480	4.26	30.00	25.74
Worst Result			5.12	30.00	24.88
EDR (π/4DQPSK)	Lowest	2 402	5.35	21.00	15.65
	Middle	2 441	4.86	21.00	16.14
	Highest	2 480	4.58	21.00	16.42
Worst Result			5.35	21.00	15.65
EDR (8DPSK)	Lowest	2 402	5.90	21.00	15.10
	Middle	2 441	5.15	21.00	15.85
	Highest	2 480	4.66	21.00	16.34
Worst Result			5.90	21.00	15.10

[Test Data of Average Power]

Test Mode	Channel	Frequency [MHz]	Aveage Power [dBm]	Aveage Power [mW]
BDR (GFSK)	Lowest	2 402	3.52	2.25
	Middle	2 441	3.12	2.05
	Highest	2 480	2.72	1.87
EDR (8DPSK)	Lowest	2 402	2.22	1.67
	Middle	2 441	1.80	1.51
	Highest	2 480	1.41	1.38
EDR (8DPSK)	Lowest	2 402	2.22	1.67
	Middle	2 441	1.81	1.52
	Highest	2 480	1.41	1.38

Remarks
1. Peak Power(dBm) = Peak Reading Value(dBμV/m)
2. Average Power(dBm) = Average Reading Value(dBμV/m) + Duty Cycle Correction Factor(dB)

3.3 Carrier Frequency Separation

3.3.1 Regulation

§15.247(a)(1) : 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.

3.3.2 Test Procedure

The method of measurement used to test this FHSS device is ANSI C63.10-2020.

a) The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

b) Span: Wide enough to capture the peaks of two adjacent channels.

c) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.

d) Video (or average) bandwidth (VBW) ≥ RBW.

e) Sweep: Auto.

f) Detector function: Peak.

g) Trace: Max hold.

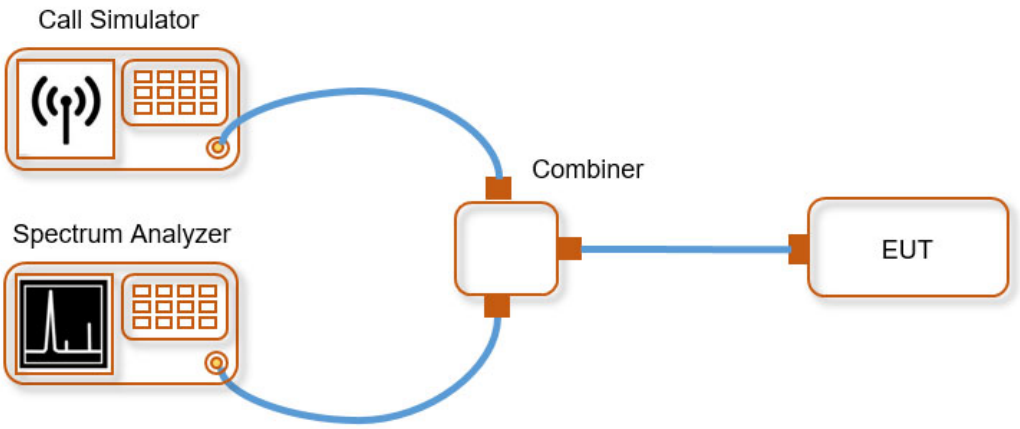
h) Allow the trace to stabilize.

i) Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Compliance of an EUT with the appropriate regulatory limit shall be determined. A plot of the data shall be included in the test report.

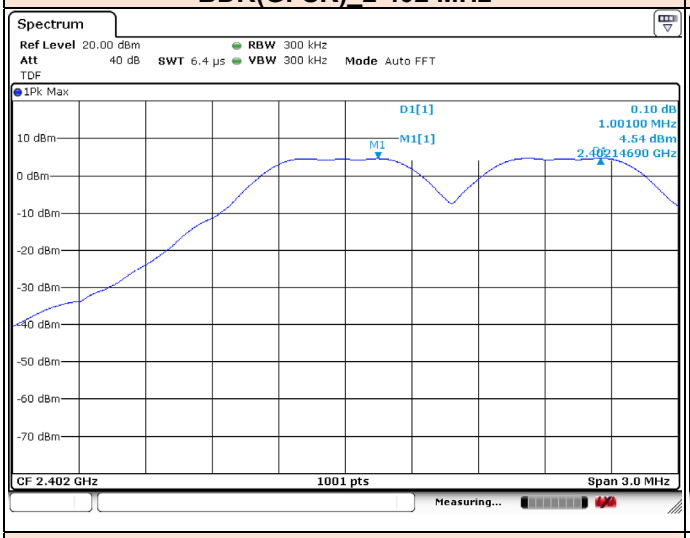
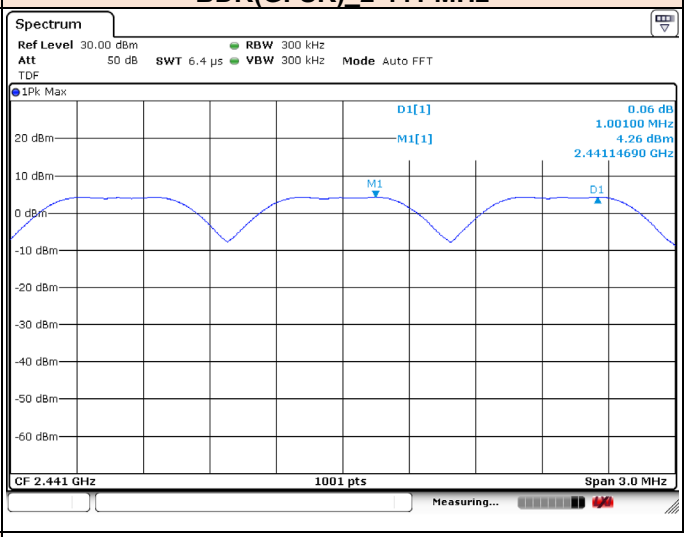
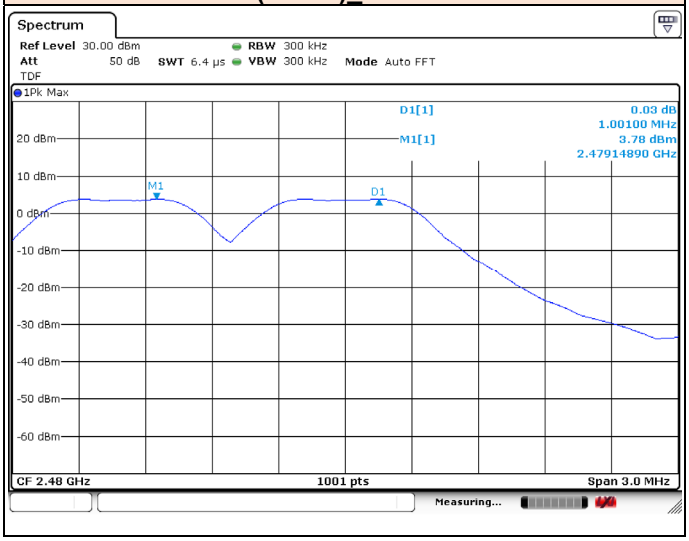
3.3.3 Deviation from Test Standard

No deviation.

3.3.4 Test Setup

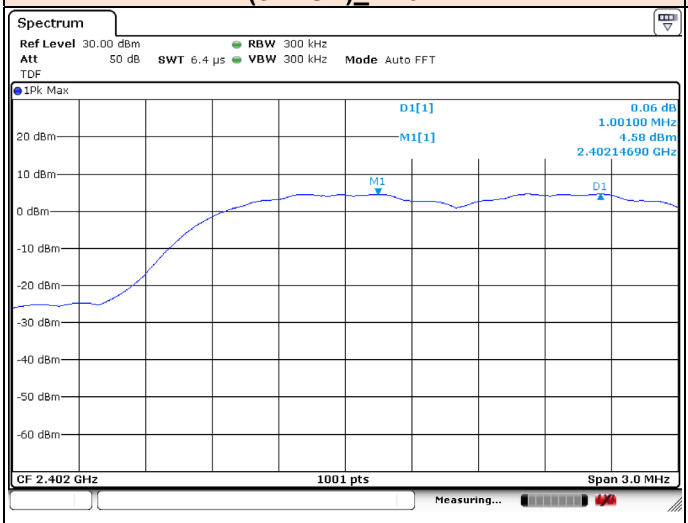


3.3.5 Test Result

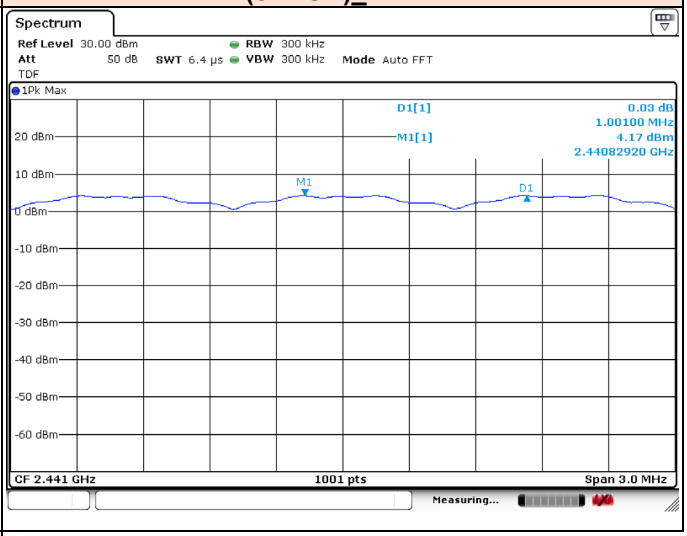
Carrier Frequency Separation_ BDR(GFSK)	
BDR(GFSK)_2 402 MHz	BDR(GFSK)_2 441 MHz
	
BDR(GFSK)_2 480 MHz	
	

Carrier Frequency Separation_ EDR(8DPSK)

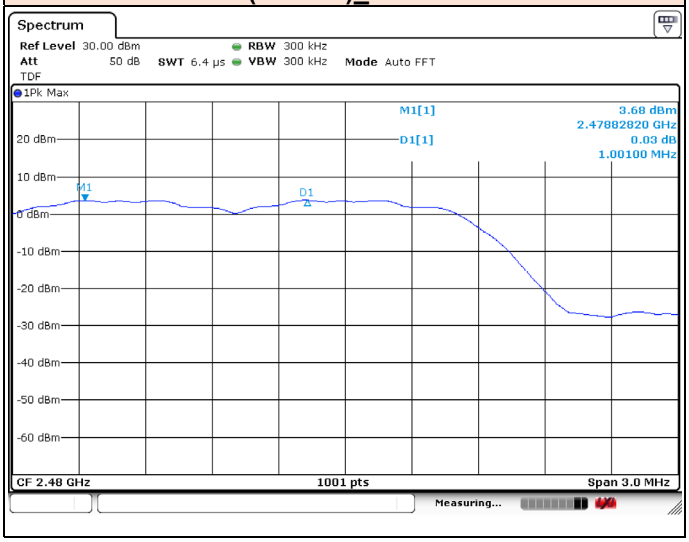
EDR(8DPSK)_2 402 MHz



EDR(8DPSK)_2 441 MHz



EDR(8DPSK)_2 480 MHz



3.4 Number of Hopping Channels

3.4.1 Regulation

§15.247(a)(1)(iii) : Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

§15.247(b)(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. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

3.4.2 Test Procedure

The method of measurement used to test this FHSS device is ANSI C63.10-2020.

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

a) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.

b) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.

c) VBW ≥ RBW.

d) Sweep: Auto.

e) Detector function: Peak.

f) Trace: Max hold.

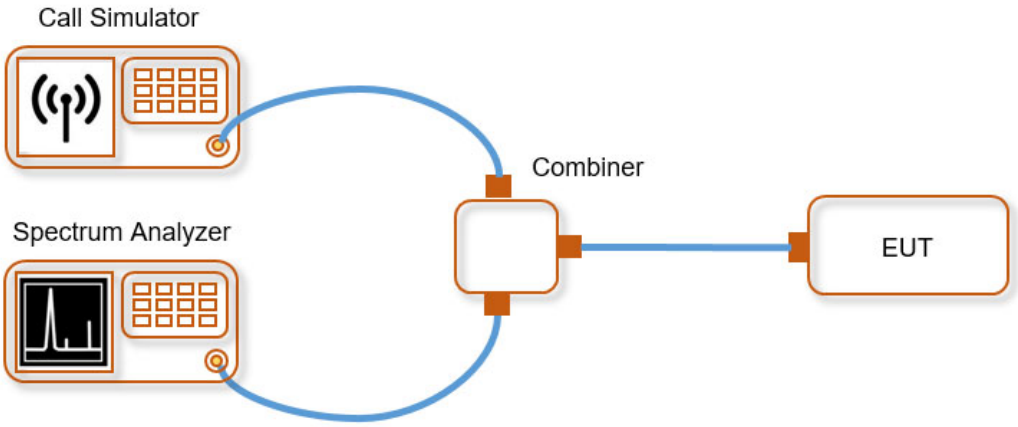
g) Allow the trace to stabilize.

It might prove necessary to break the span up into subranges to show clearly all of the hopping frequencies. Compliance of an EUT with the appropriate regulatory limit shall be determined for the number of hopping channels. A plot of the data shall be included in the test report.

3.4.3 Deviation from Test Standard

No deviation.

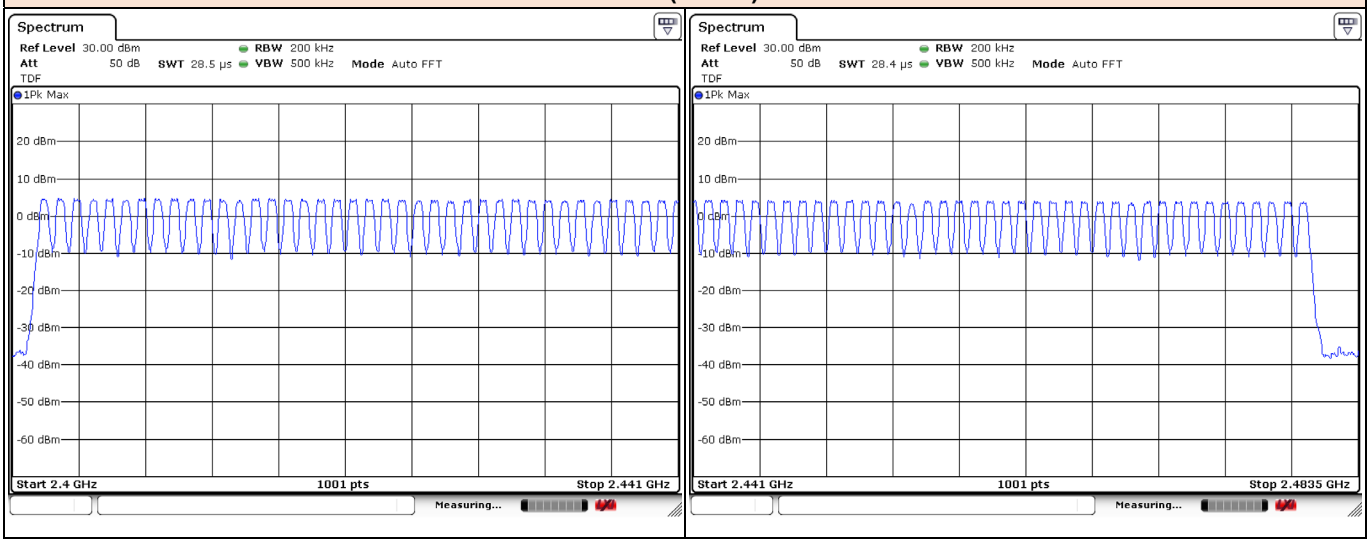
3.4.4 Test Setup



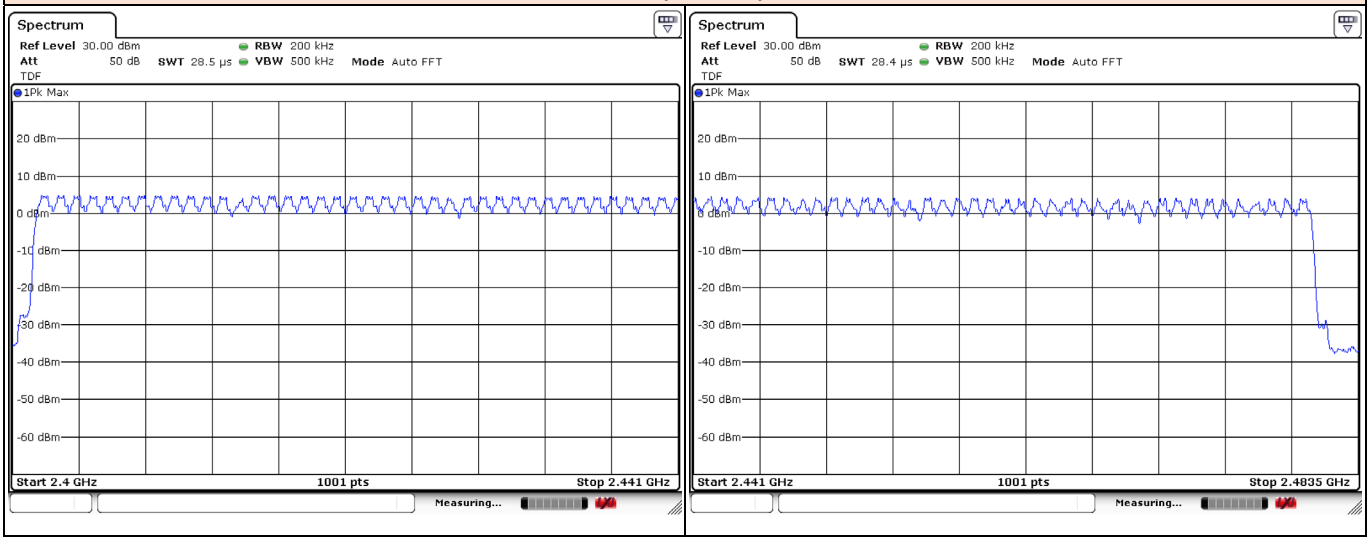
3.4.5 Test Result

[Test Plot]

Number of Hopping Channels_ BDR(GFSK)
BDR(GFSK)



Number of Hopping Channels_ EDR(8DPSK)
EDR(8DPSK)



3.5 Time of Occupancy (Dwell Time)

3.5.1 Regulation

§15.247(a)(1)(iii) : Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

3.5.2 Test Procedure

The method of measurement used to test this FHSS device is ANSI C63.10-2020.

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

a) Span: Zero span, centered on a hopping channel.

b) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.

c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.

d) Detector function: Peak.

e) Trace: Clear-write, single sweep

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) =
(number of hops on spectrum analyzer) × (period specified in the requirements / analyzer sweep time)

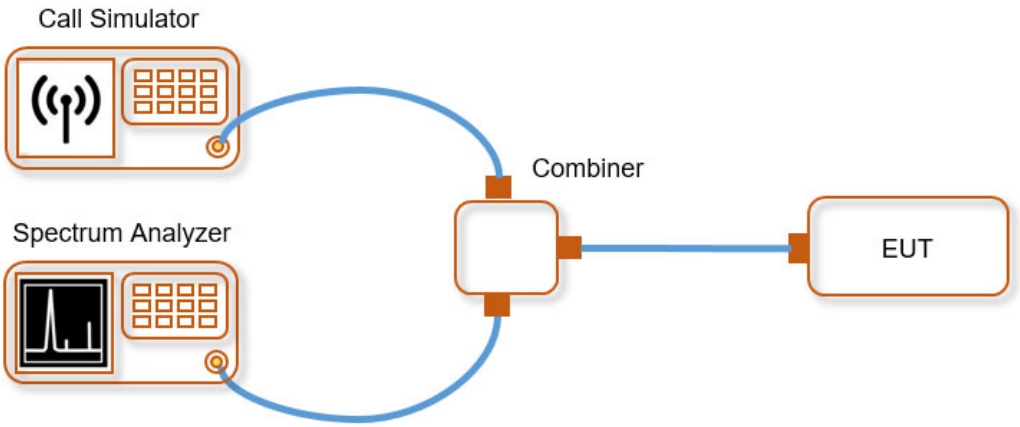
The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

The measured transmit time and time between hops shall be consistent with the values described in the operational description for the EUT.

3.5.3 Deviation from Test Standard

No deviation.

3.5.4 Test Setup

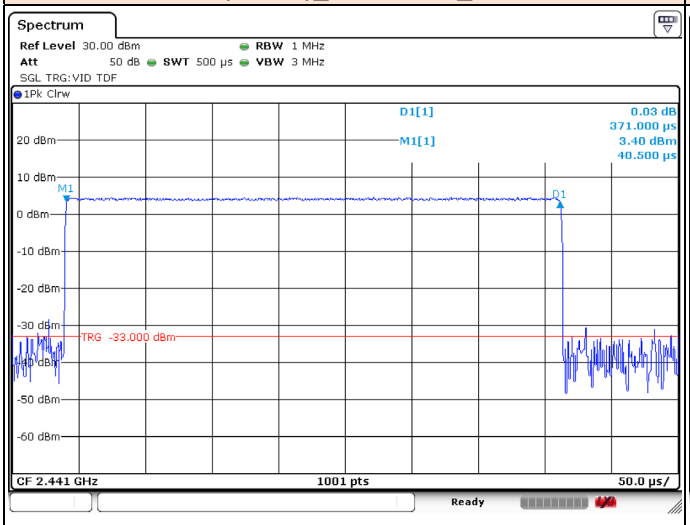
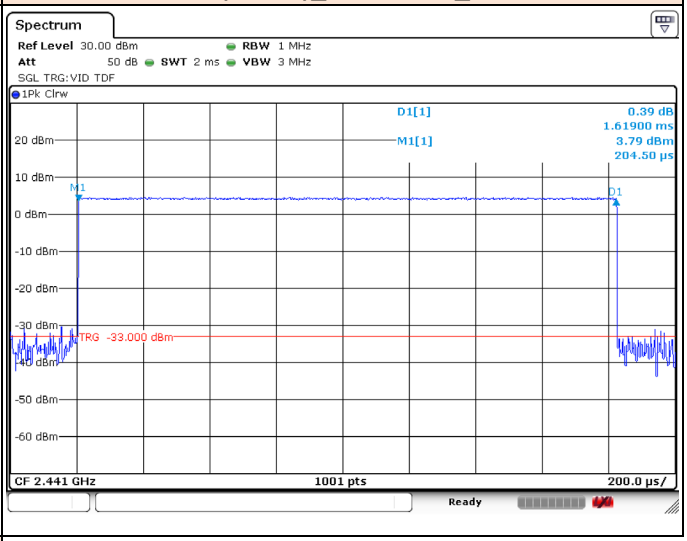


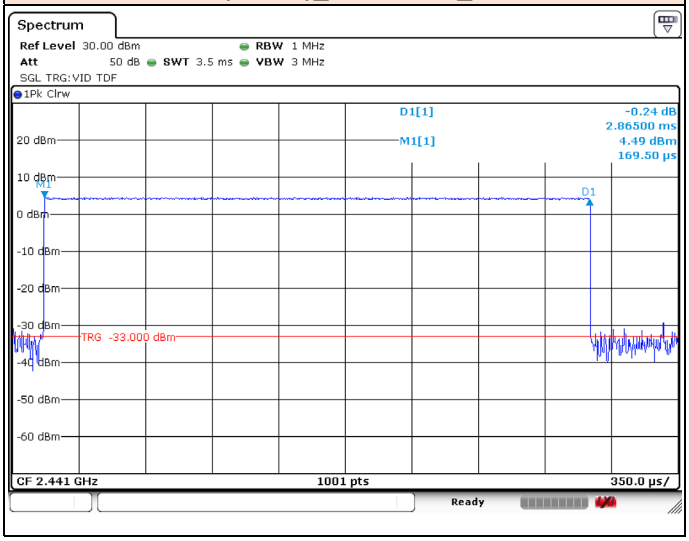
3.5.5 Test Result

[Test Data]

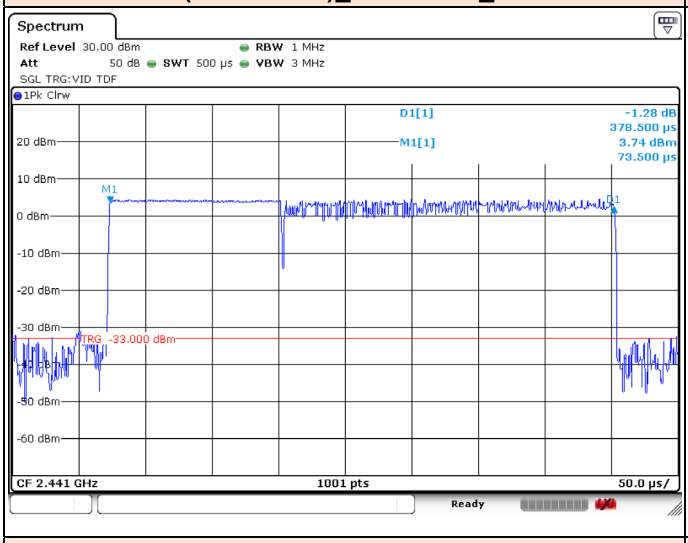
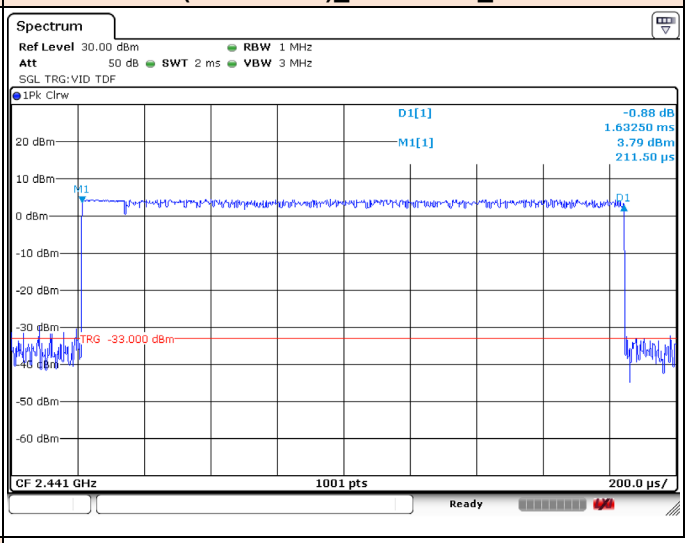
Adaptive Mode	Test Mode	Packet Type	Pulse Width [msec]	Hopping Rate [Hop/Sec]	Number of Channels	Results [sec]	Limit [sec]	Margin [sec]
Normal	BDR (GFSK)	DH1	0.371	800.00	79	0.119	0.400	0.281
		DH3	1.619	400.00	79	0.259	0.400	0.141
		DH5	2.865	266.67	79	0.306	0.400	0.094
	EDR (π/4DQPSK)	2-DH1	0.379	800.00	79	0.121	0.400	0.279
		2-DH3	1.633	400.00	79	0.261	0.400	0.139
		2-DH5	2.877	266.67	79	0.307	0.400	0.093
	EDR (8DPSK)	3-DH1	0.379	800.00	79	0.121	0.400	0.279
		3-DH3	1.625	400.00	79	0.260	0.400	0.14
		3-DH5	2.880	266.67	79	0.307	0.400	0.093
AFH	BDR (GFSK)	DH1	0.371	400.00	20	0.059	0.400	0.341
		DH3	1.621	200.00	20	0.130	0.400	0.27
		DH5	2.868	133.33	20	0.153	0.400	0.247
	EDR (π/4DQPSK)	2-DH1	0.379	400.00	20	0.061	0.400	0.339
		2-DH3	1.631	200.00	20	0.130	0.400	0.27
		2-DH5	2.877	133.33	20	0.153	0.400	0.247
	EDR (8DPSK)	3-DH1	0.379	400.00	20	0.061	0.400	0.339
		3-DH3	1.627	200.00	20	0.130	0.400	0.27
		3-DH5	2.880	133.33	20	0.154	0.400	0.246

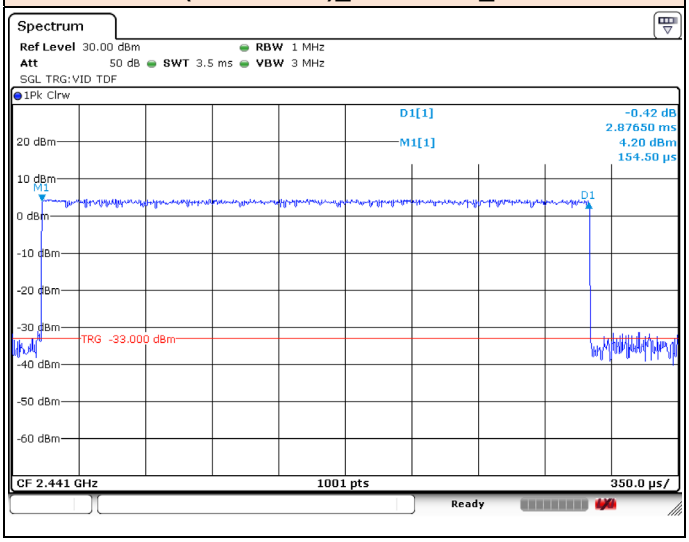
[Test Plot] – Non AFH_ BDR(GFSK)

BDR(GFSK)_2 441 MHz_DH1	BDR(GFSK)_2 441 MHz_DH3
	

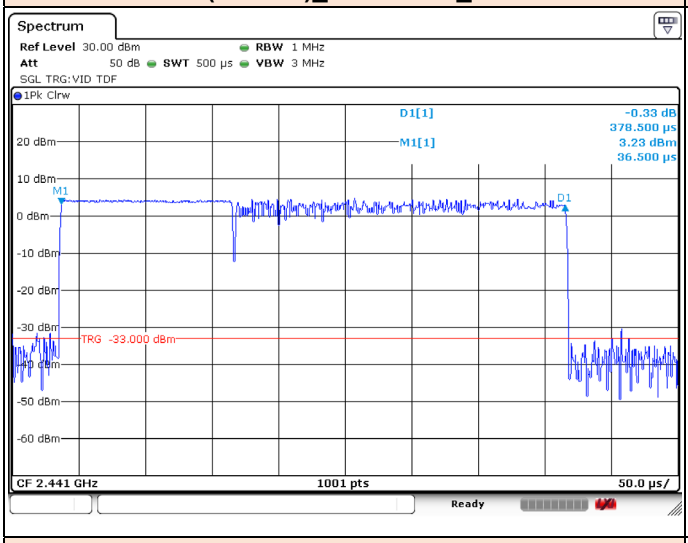
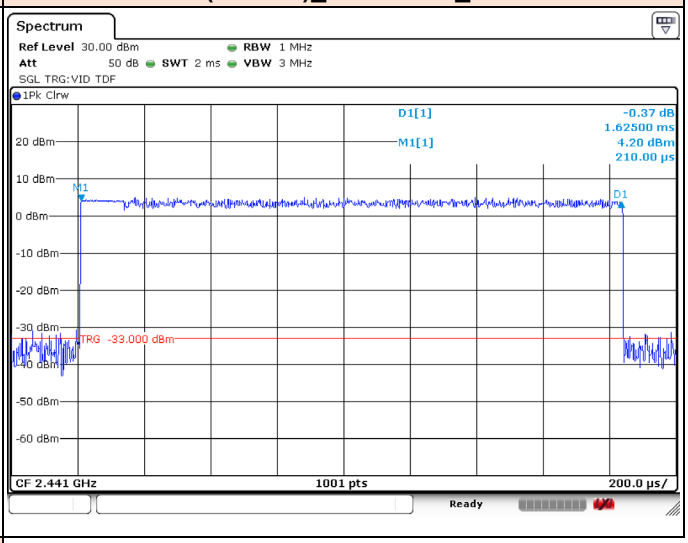
BDR(GFSK)_2 441 MHz_DH5


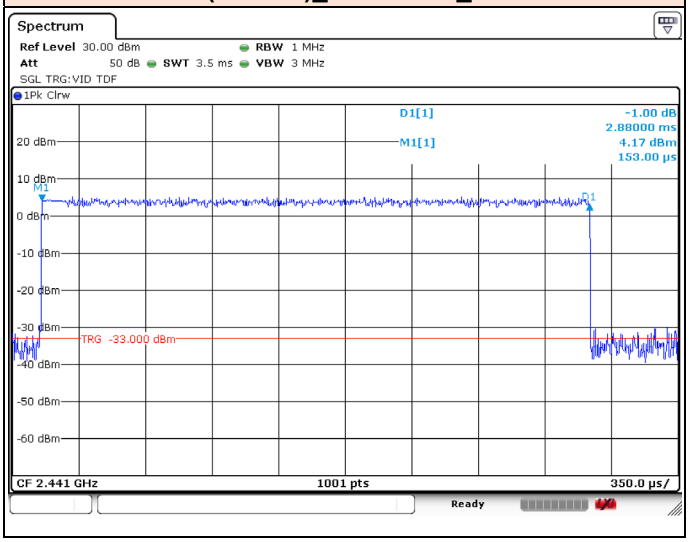
[Test Plot] – Non AFH_ EDR(π/4DQPSK)

EDR(π/4DQPSK)_2 441 MHz_2DH1	EDR(π/4DQPSK)_2 441 MHz_2DH3
	

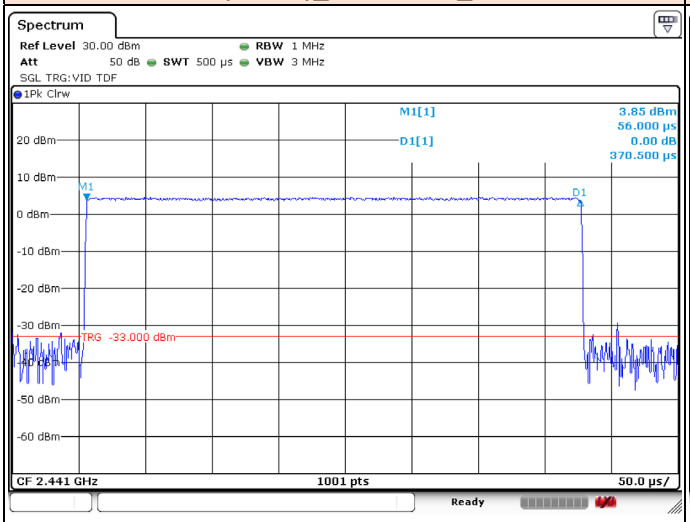
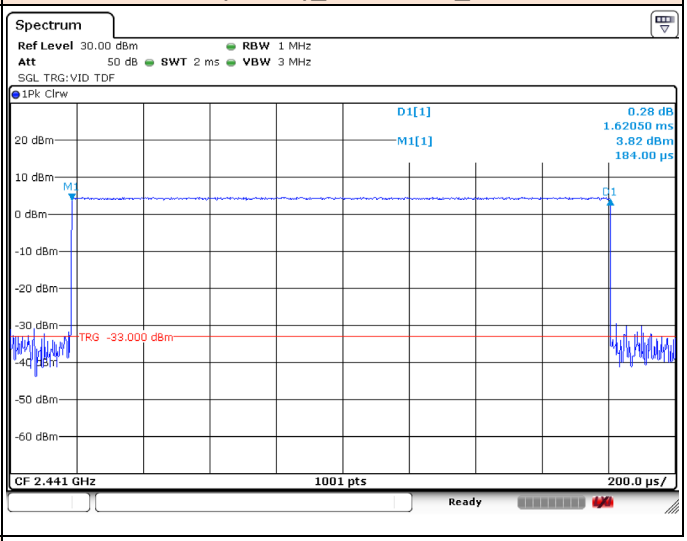
EDR(π/4DQPSK)_2 441 MHz_2DH5


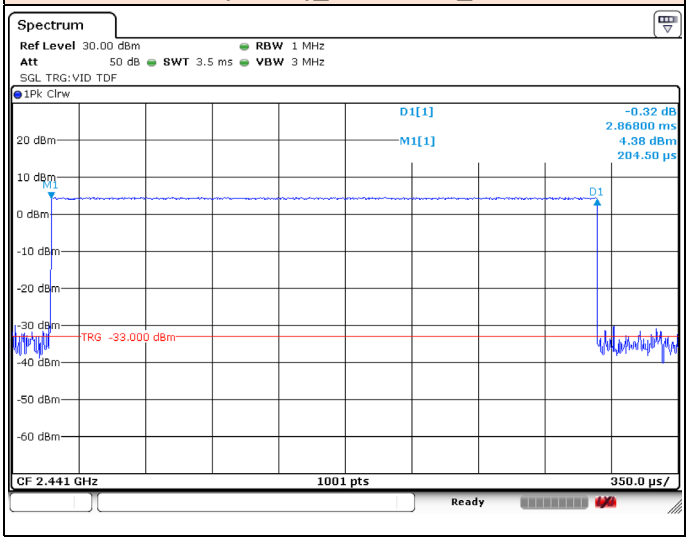
[Test Plot] – Non AFH_ EDR(8DPSK)

EDR(8DPSK)_2 441 MHz_3DH1	EDR(8DPSK)_2 441 MHz_3DH3
	

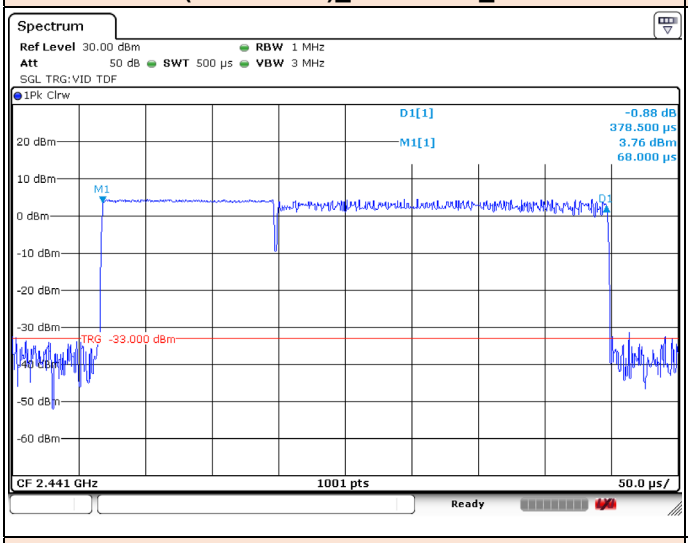
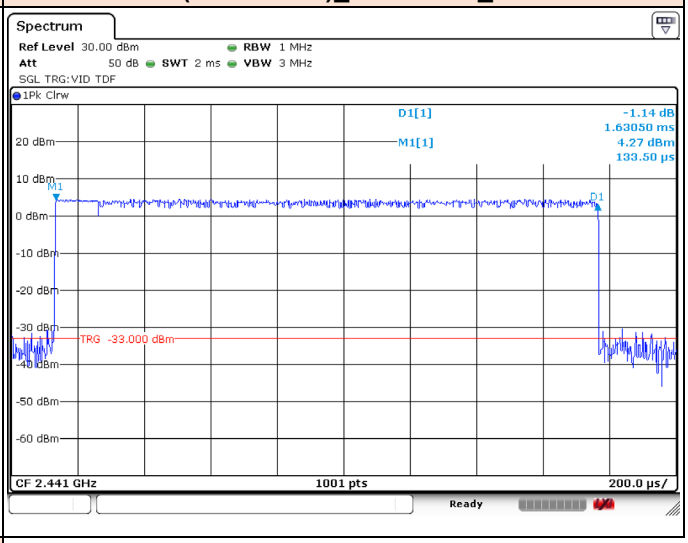
EDR(8DPSK)_2 441 MHz_3DH5


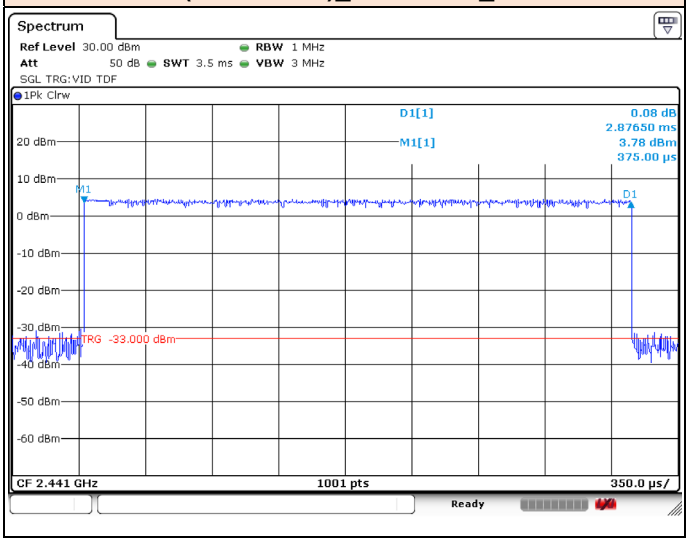
[Test Plot] – AFH_ BDR(GFSK)

BDR(GFSK)_2 441 MHz_DH1	BDR(GFSK)_2 441 MHz_DH3
	

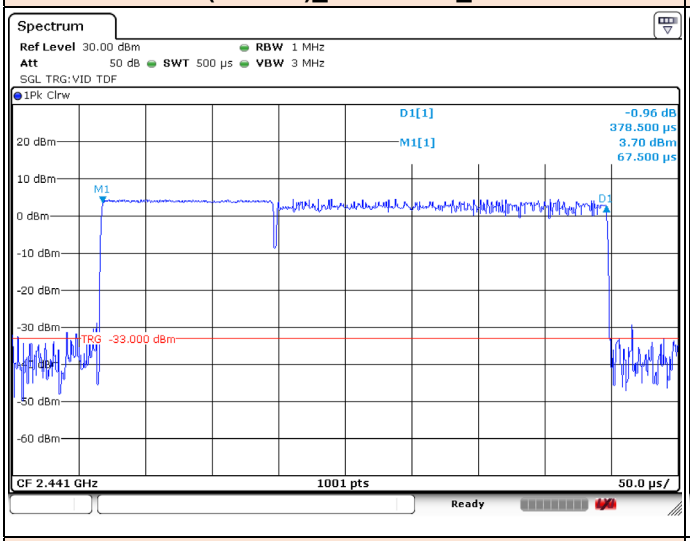
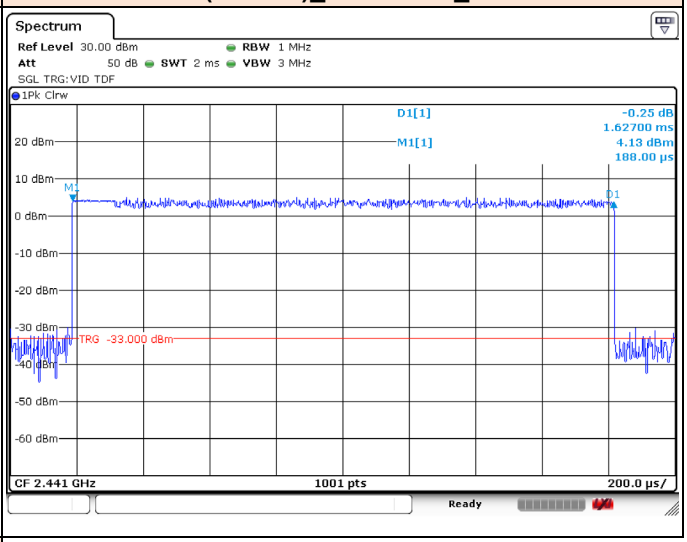
BDR(GFSK)_2 441 MHz_DH5


[Test Plot] – AFH_ EDR(π/4DQPSK)

EDR(π/4DQPSK)_2 441 MHz_2DH1	EDR(π/4DQPSK)_2 441 MHz_2DH3
	

EDR(π/4DQPSK)_2 441 MHz_2DH5


[Test Plot] – AFH_ EDR(8DPSK)

EDR(8DPSK)_2 441 MHz_3DH1	EDR(8DPSK)_2 441 MHz_3DH3
	

EDR(8DPSK)_2 441 MHz_3DH5