

TEST REPORT

Reference No. : WTS17S1299188-1E
FCC ID : 2ALZL-AA5230
Applicant..... : Goldwood Sound, Inc.
Address..... : 9333 Oso Ave. Chatsworth, CA 91311, United States
Manufacturer : Flyball Electronic (Shenzhen) Co., Ltd.
Address..... : 5-6 Building, Zhiji Industrial Park, Jinye Road, Kuichong Street,
LongGang District, Shenzhen, China.
Product..... : 5.1 CH MULTIMEDIA SPEAKER SYSTEM
Model(s) : AA5230
Brand Name : **Acoustic
AUDIO**
by Goldwood
Standards..... : FCC CFR47 Part 15.247:2017
Date of Receipt sample : 2017-12-22
Date of Test : 2017-12-23 to 2018-01-08
Date of Issue..... : 2018-01-25
Test Result..... : **Pass**

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

Prepared By:

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Approved by:

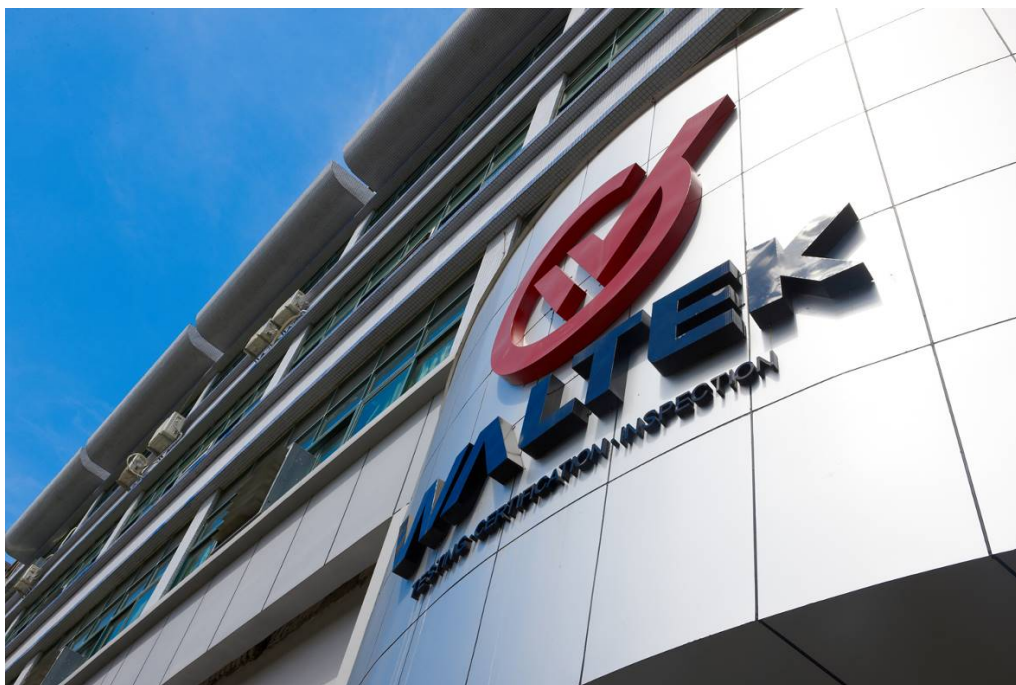
Robin Zhou
Robin Zhou / Test Engineer



Philo Zhong
Philo Zhong / Manager

1 Laboratories Introduction

Waltek Services (Shenzhen) Co., Ltd is a professional third-party testing and certification laboratory with multi-year product testing and certification experience, established strictly in accordance with ISO/IEC 17025 requirements, and accredited by ILAC (International Laboratory Accreditation Cooperation) member. A2LA (American Association for Laboratory Accreditation) of USA, Meanwhile, Waltek has got recognition as registration and accreditation laboratory from EMSD (Electrical and Mechanical Services Department), and American Energy star, FCC(The Federal Communications Commission), CEC(California energy efficiency), IC(Industry Canada). It's the strategic partner and data recognition laboratory of international authoritative organizations, such as Intertek(ETL-SEMKO), TÜV Rheinland, TÜV SÜD, etc.



Waltek Services (Shenzhen) Co., Ltd is one of the largest and the most comprehensive third party testing laboratory in China. Our test capability covered four large fields: safety test. Electro Magnetic Compatibility (EMC), and energy performance, wireless radio. As a professional, comprehensive, justice international test organization, we still keep the scientific and rigorous work attitude to help each client satisfy the international standards and assist their product enter into globe market smoothly.

1.1 Test Facility

Waltek Services (Shenzhen) Co., Ltd.

A. Accreditations for Conformity Assessment (International)

Country/Region	Accreditation Body	Scope	Note
USA	A2LA (Certificate No.: 4243.01)	FCC ID \ DOC \ VOC	1
Canada		IC ID \ VOC	2
Japan		MIC-T \ MIC-R	-
Europe		EMCD \ RED	-
Taiwan		NCC	-
Hong Kong		OFCA	-
Australia		RCM	-
India		International Services	WPC
Thailand	NTC		-
Singapore	IDA		-
Note: 1. FCC Designation No.: CN1201. Test Firm Registration No.: 523476. 2. IC Canada Registration No.: 7760A			

B. TCBs and Notify Bodies Recognized Testing Laboratory.

Recognized Testing Laboratory of ...	Notify body number
TUV Rheinland	Optional.
Intertek	
TUV SUD	
SGS	
Phoenix Testlab GmbH	0700
Element Materials Technology Warwick Ltd	0891
Timco Engineering, Inc.	1177
Eurofins Product Service GmbH	0681

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3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS17S1299188-1E	2017-12-22	2017-12-23 to 2018-01-08	2018-01-09	original	-	Replaced
WTS17S1299188-1E	2017-12-22	2017-12-23 to 2018-01-08	2018-01-25	revision1	Updated Equipments List	Valid

4 General Information

4.1 General Description of E.U.T

Product	: 5.1 CH MULTIMEDIA SPEAKER SYSTEM
Model(s)	: AA5230
Model Description	: N/A
Hardware Version	: V0.0
Software Version	: V0.0

4.2 Details of E.U.T

Operation Frequency	: 2402~2480MHz
Type of Modulation	: GFSK, $\pi/4$ DQPSK, 8DPSK
Antenna installation	: PCB Printed Antenna
Antenna Gain	: 0dBi
Ratings	: ~120V 60Hz

4.3 Channel List

Bluetooth Classic mode

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2402	2	2403	3	2404	4	2405
5	2406	6	2407	7	2408	8	2409
9	2410	10	2411	11	2412	12	2413
13	2414	14	2415	15	2416	16	2417
17	2418	18	2419	19	2420	20	2421
21	2422	22	2423	23	2424	24	2425
25	2426	26	2427	27	2428	28	2429
29	2430	30	2431	31	2432	32	2433
33	2434	34	2435	35	2436	36	2437
37	2438	38	2439	39	2440	40	2441
41	2442	42	2443	43	2444	44	2445
45	2446	46	2447	47	2448	48	2449
49	2450	50	2451	51	2452	52	2453
53	2454	54	2455	55	2456	56	2457
57	2458	58	2459	59	2460	60	2461
61	2462	62	2463	63	2464	64	2465
65	2466	66	2467	67	2468	68	2469
69	2470	70	2471	71	2472	72	2473
73	2474	74	2475	75	2476	76	2477
77	2478	78	2479	79	2480	-	-

4.4 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests; the worst data were recorded and reported.

Test mode	Low channel	Middle channel	High channel
Transmitting	2402MHz	2441MHz	2480MHz

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	101155	2017-09-12	2018-09-11
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	2017-09-12	2018-09-11
3.	Limiter	York	MTS-IMP-136	261115-001-0024	2017-09-12	2018-09-11
4.	Cable	LARGE	RF300	-	2017-09-12	2018-09-11
3m Semi-anechoic Chamber for Radiation Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Spectrum Analyzer	R&S	FSP30	100091	2017-04-29	2018-04-28
2	Broad-band Horn Antenna(1-18GHz)	SCHWARZBECK	BBHA 9120 D	667	2017-04-09	2018-04-08
3	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2017-04-13	2018-04-12
4	Coaxial Cable (above 1GHz)	Top	1GHz-18GHz	EW02014-7	2017-04-13	2018-04-12
5	Spectrum Analyzer	R&S	FSP40	100501	2017-10-20	2018-10-19
6	Broad-band Horn Antenna(18-40GHz)	SCHWARZBECK	BBHA 9170	BBHA9170651	2017-10-25	2018-10-24
7	Microwave Broadband Preamplifier (18-40GHz)	SCHWARZBECK	BBV 9721	100472	2017-10-25	2018-10-24
8	Cable	Top	18-40GHz	-	2017-10-25	2018-10-24
3m Semi-anechoic Chamber for Radiation Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No	Last Calibration Date	Calibration Due Date
1	Test Receiver	R&S	ESCI	101296	2017-04-13	2018-04-12
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2017-04-13	2018-04-12
3	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	2017-04-09	2018-04-08
4	Amplifier	ANRITSU	MH648A	M43381	2017-04-13	2018-04-12
5	Cable	HUBER+SUHNER	CBL2	525178	2017-04-13	2018-04-12
6	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	2017-09-12	2018-09-11
RF Conducted Testing						

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	2017-09-12	2018-09-11
2	Spectrum Analyzer	R&S	FSL6	100959	2017-09-12	2018-09-11

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (30M~1000MHz)
	± 5.47 dB (1000M~25000MHz)
Conducted Spurious Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)

5.3 Subcontracted

Whether parts of tests for the product have been subcontracted to other labs:

☐ Yes ☒ No

If Yes, list the related test items and lab information:

Test Lab: N/A

Lab address: N/A

Test items: N/A

6 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	Pass
Band edge	15.247(d) 15.205(a)	Pass
Conduct Emission	15.207	Pass
Bandwidth	15.247(a)(1)	Pass
Maximum Peak Output Power	15.247(b)(1)	Pass
Frequency Separation	15.247(a)(1)	Pass
Number of Hopping Frequency	15.247(a)(1)(iii)	Pass
Dwell time	15.247(a)(1)(iii)	Pass
Antenna Requirement	15.203	Pass
RF Exposure	1.1307(b)(1)	Pass
Note: Pass=Compliance; Fail=Not Compliance; NT=Not Tested; N/A=Not Applicable.		

7 Conducted Emission

Test Requirement: FCC CFR 47 Part 15 Section 15.207

Test Method: ANSI C63.10:2013

Test Result: PASS

Frequency Range: 150kHz to 30MHz

Class/Severity: Class B

Limit:

Frequency (MHz)	Limit (dBμV)	
	Qsi-peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	50	60
5 to 30	60	50

7.1 E.U.T. Operation

Operating Environment :

Temperature: 22.8 °C

Humidity: 52.6 % RH

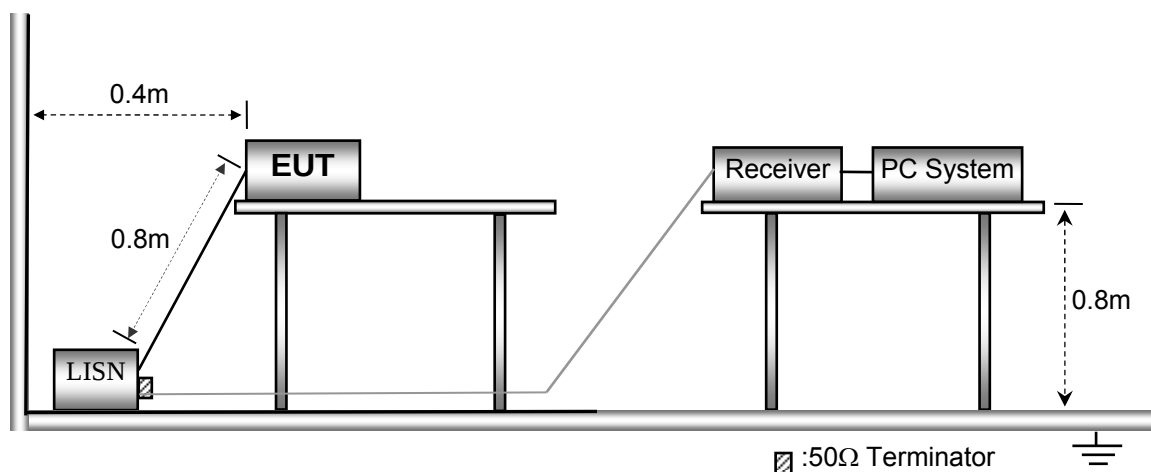
Atmospheric Pressure: 101.2kPa

EUT Operation :

The test was performed in Transmitting mode, the worst test data (GFSK modulation Low channel) were shown in the report.

7.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2013.



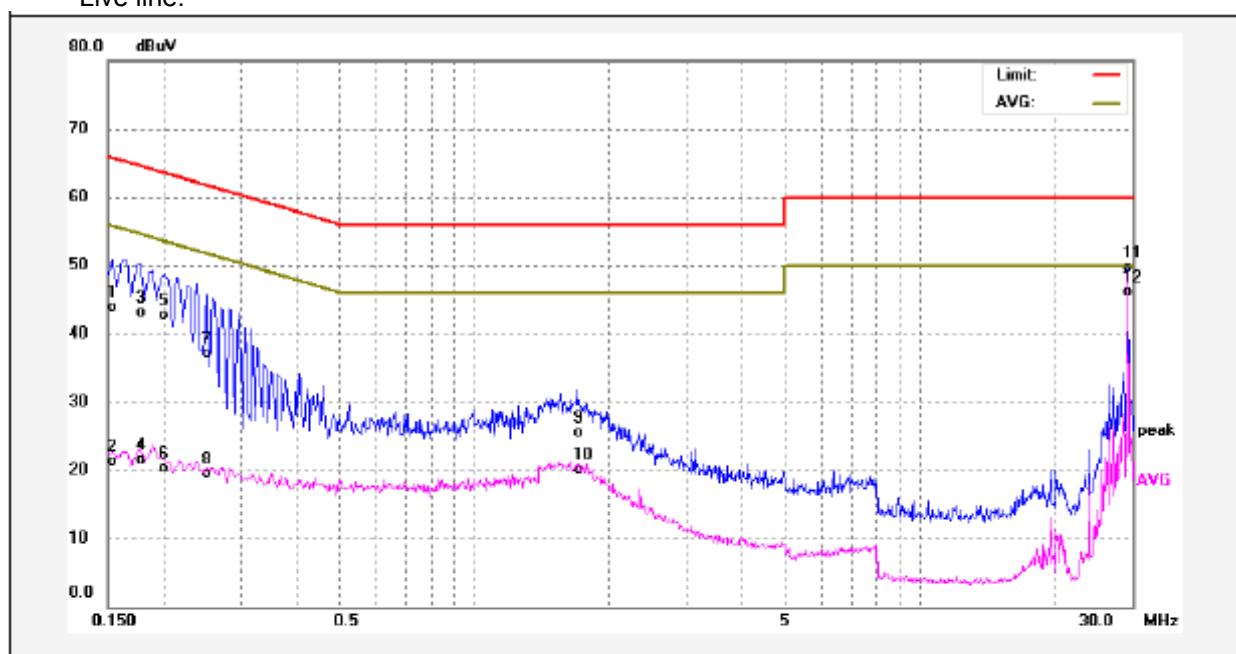
7.3 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

7.4 Conducted Emission Test Result

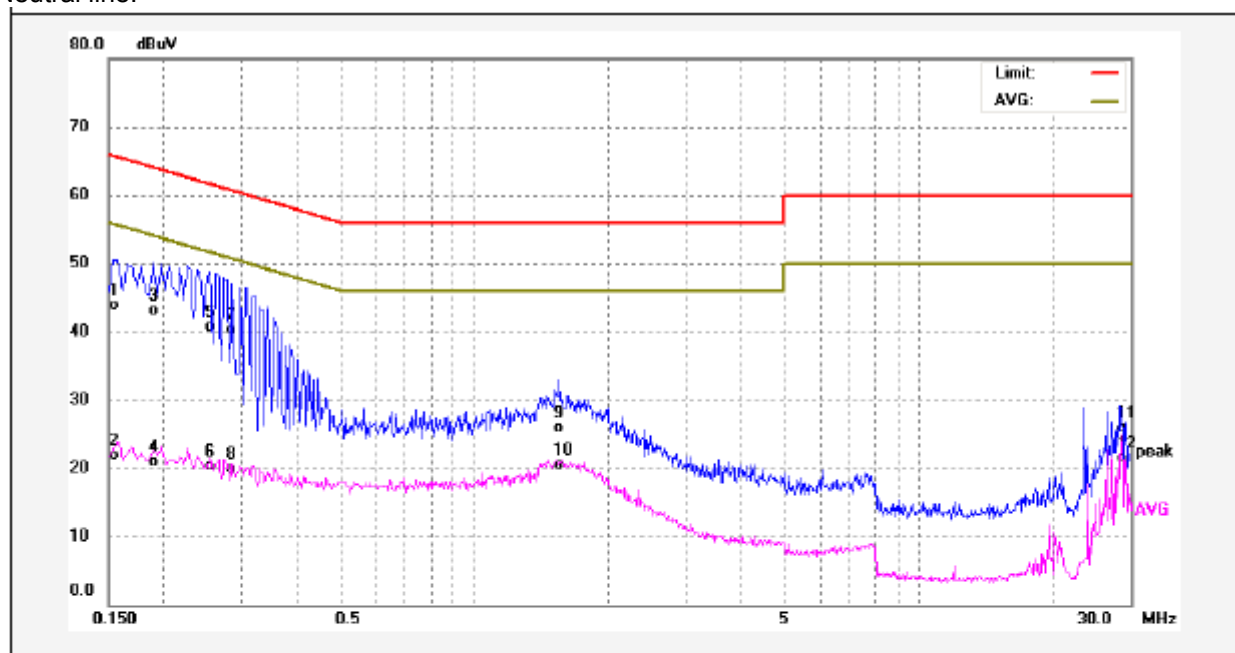
Remark: only the worst data (GFSK modulation Low channel mode) were reported

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1539	33.86	10.02	43.88	65.78	-21.90	QP	
2	0.1539	11.35	10.02	21.37	55.78	-34.41	AVG	
3	0.1780	33.29	9.87	43.16	64.57	-21.41	QP	
4	0.1780	11.67	9.87	21.54	54.57	-33.03	AVG	
5	0.2020	32.71	9.92	42.63	63.52	-20.89	QP	
6	0.2020	10.29	9.92	20.21	53.52	-33.31	AVG	
7	0.2500	27.06	10.01	37.07	61.75	-24.68	QP	
8	0.2500	9.58	10.01	19.59	51.75	-32.16	AVG	
9	1.6940	15.28	10.17	25.45	56.00	-30.55	QP	
10	1.6940	10.03	10.17	20.20	46.00	-25.80	AVG	
11	29.2540	39.13	10.65	49.78	60.00	-10.22	QP	
12	29.2540	35.45	10.65	46.10	50.00	-3.90	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Remark
1	0.1539	33.98	10.02	44.00	65.78	-21.78	QP	
2	0.1539	11.85	10.02	21.87	55.78	-33.91	AVG	
3	0.1900	33.29	9.90	43.19	64.03	-20.84	QP	
4	0.1900	11.03	9.90	20.93	54.03	-33.10	AVG	
5	0.2540	30.76	10.01	40.77	61.62	-20.85	QP	
6	0.2540	10.32	10.01	20.33	51.62	-31.29	AVG	
7	0.2860	30.39	9.99	40.38	60.64	-20.26	QP	
8	0.2860	9.91	9.99	19.90	50.64	-30.74	AVG	
9	1.5540	15.77	10.16	25.93	56.00	-30.07	QP	
10	1.5540	10.32	10.16	20.48	46.00	-25.52	AVG	
11	28.3220	15.25	10.63	25.88	60.00	-34.12	QP	
12	28.3220	10.83	10.63	21.46	50.00	-28.54	AVG	

8 Radiated Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: ANSI C63.10:2013

Test Result: PASS

Measurement Distance: 3m

Limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
1.705 ~ 30	30	30	$100 * 30$	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

8.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 51.1 % RH

Atmospheric Pressure: 101.2kPa

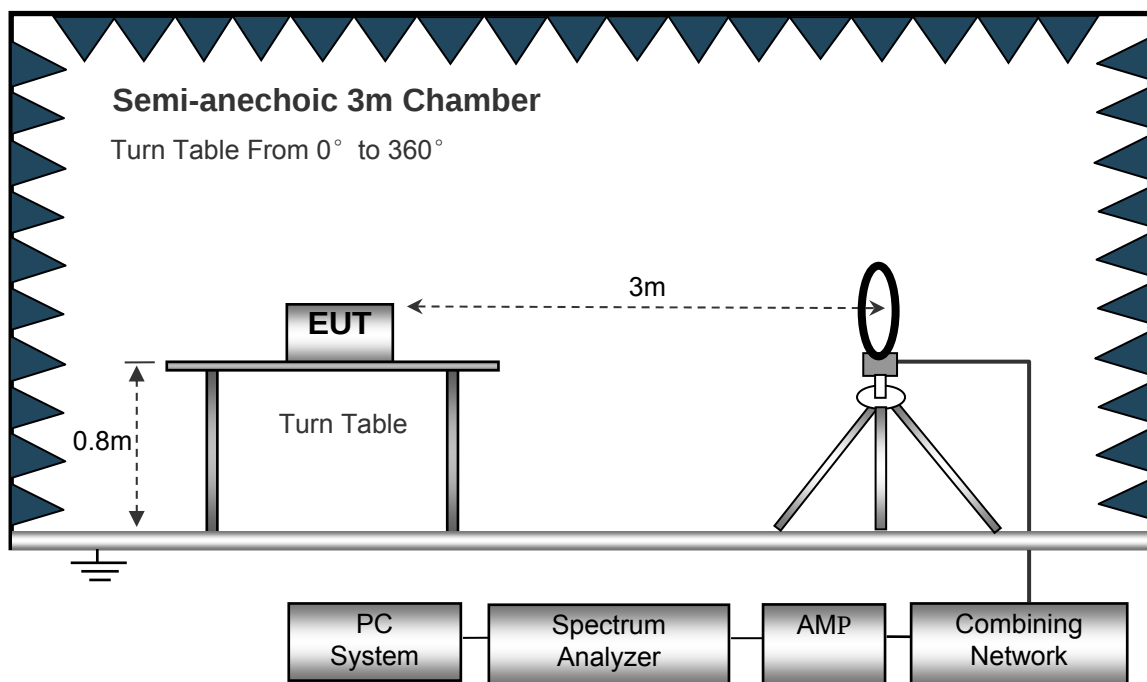
EUT Operation :

The test was performed in Transmitting mode, the worst test data (GFSK modulation) were shown in the report.

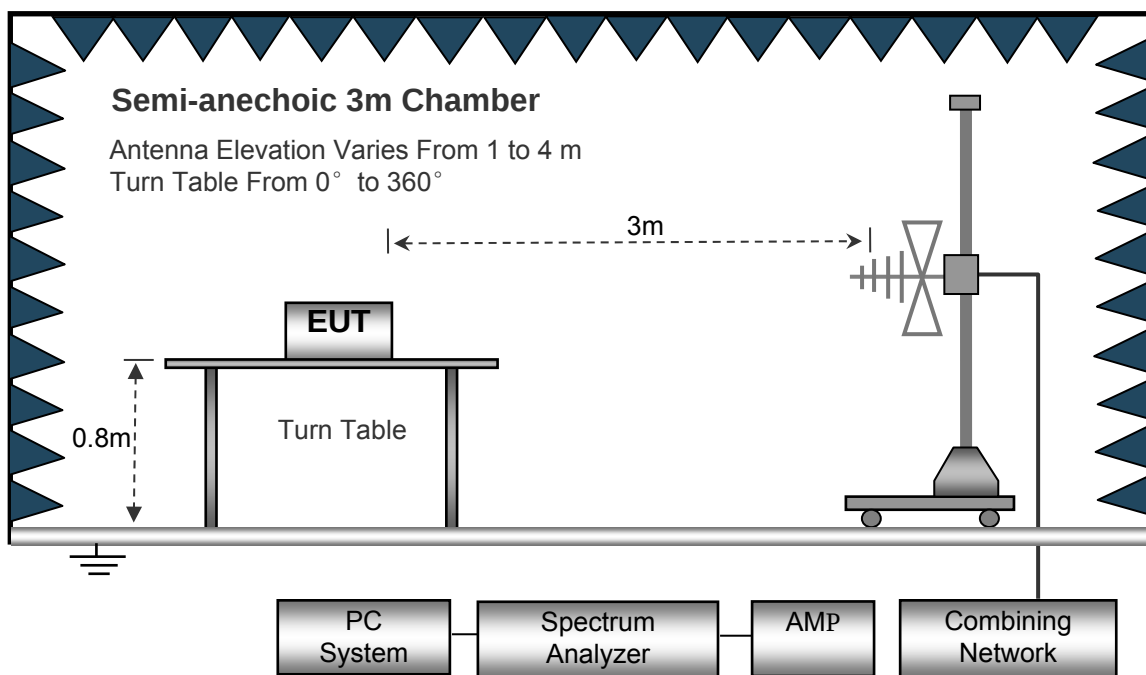
8.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10:2013.

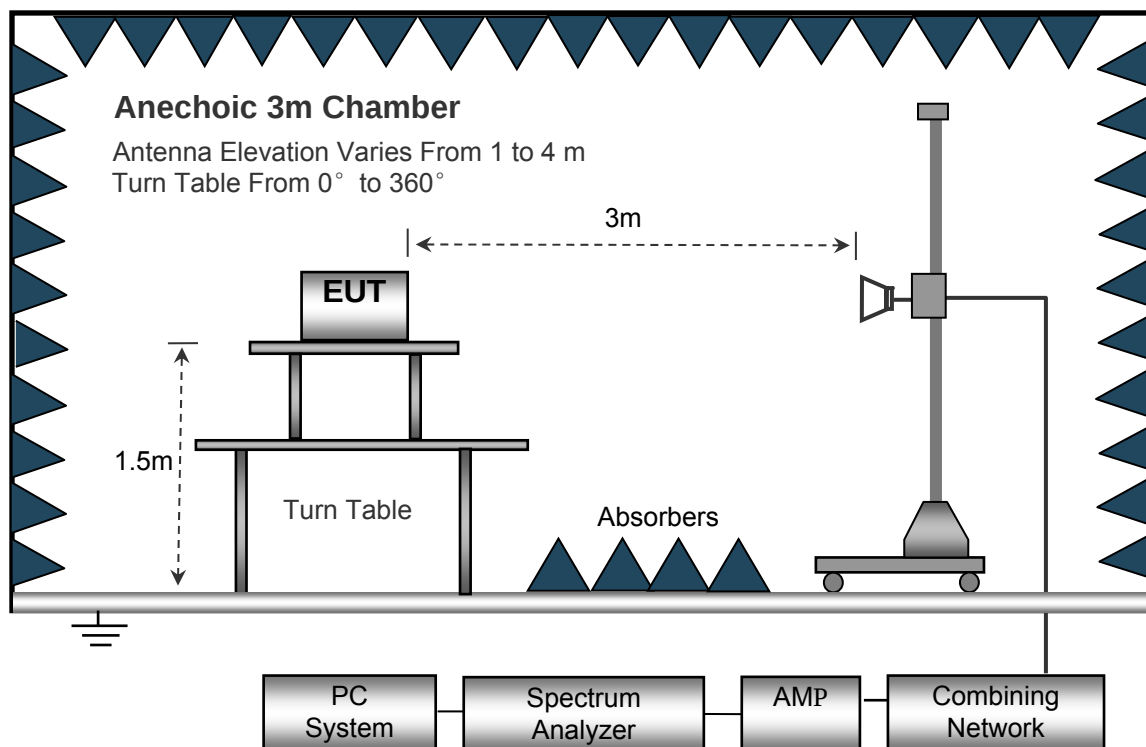
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



8.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed Auto
 IF Bandwidth..... 10kHz
 Video Bandwidth..... 10kHz
 Resolution Bandwidth..... 10kHz

30MHz ~ 1GHz

Sweep Speed Auto
 Detector PK
 Resolution Bandwidth..... 100kHz
 Video Bandwidth..... 300kHz

Above 1GHz

Sweep Speed Auto
 Detector PK
 Resolution Bandwidth..... 1MHz
 Video Bandwidth..... 3MHz
 Detector Ave.
 Resolution Bandwidth..... 1MHz
 Video Bandwidth..... 10Hz

8.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane for below 1GHz and 1.5m for above 1GHz.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the Z position. So the data shown was the Z position only.

8.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

8.6 Summary of Test Results

Test Frequency: 9 kHz~30 MHz

The measurements were more than 20 dB below the limit and not reported.

Test Frequency: 30 MHz ~ 18 GHz

Remark: only the worst data (GFSK modulation) were reported.

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Low Channel 2402MHz									
96.10	46.62	QP	141	1.5	H	-18.95	27.67	43.50	-15.83
96.10	57.86	QP	105	1.9	V	-18.95	38.91	43.50	-4.59
4804.00	48.61	PK	169	2.0	V	-1.06	47.55	74.00	-26.45
4804.00	43.66	Ave	169	2.0	V	-1.06	42.60	54.00	-11.40
7206.00	45.78	PK	357	1.5	H	1.33	47.11	74.00	-26.89
7206.00	36.49	Ave	357	1.5	H	1.33	37.82	54.00	-16.18
2349.09	46.76	PK	349	1.7	V	-13.19	33.57	74.00	-40.43
2349.09	38.60	Ave	349	1.7	V	-13.19	25.41	54.00	-28.59
2364.40	42.55	PK	347	1.2	H	-13.14	29.41	74.00	-44.59
2364.40	37.59	Ave	347	1.2	H	-13.14	24.45	54.00	-29.55
2489.26	44.49	PK	169	1.8	V	-13.08	31.41	74.00	-42.59
2489.26	37.89	Ave	169	1.8	V	-13.08	24.81	54.00	-29.19

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Middle Channel 2441MHz									
96.10	45.34	QP	249	1.3	H	-18.95	26.39	43.50	-17.11
96.10	57.13	QP	43	1.9	V	-18.95	38.18	43.50	-5.32
4882.00	46.20	PK	75	2.0	V	-0.62	45.58	74.00	-28.42
4882.00	42.23	Ave	75	2.0	V	-0.62	41.61	54.00	-12.39
7323.00	38.90	PK	303	1.9	H	2.21	41.11	74.00	-32.89
7323.00	34.56	Ave	303	1.9	H	2.21	36.77	54.00	-17.23
2348.91	45.55	PK	309	1.3	V	-13.19	32.36	74.00	-41.64
2348.91	37.91	Ave	309	1.3	V	-13.19	24.72	54.00	-29.28
2364.77	43.40	PK	286	1.6	H	-13.14	30.26	74.00	-43.74
2364.77	38.61	Ave	286	1.6	H	-13.14	25.47	54.00	-28.53
2490.38	44.74	PK	277	1.5	V	-13.08	31.66	74.00	-42.34
2490.38	38.60	Ave	277	1.5	V	-13.08	25.52	54.00	-28.48

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK High Channel 2480MHz									
96.10	45.46	QP	114	1.5	H	-18.95	26.51	43.50	-16.99
96.10	57.27	QP	124	1.4	V	-18.95	38.32	43.50	-5.18
4960.00	43.89	PK	111	1.1	V	-0.24	43.65	74.00	-30.35
4960.00	40.39	Ave	111	1.1	V	-0.24	40.15	54.00	-13.85
7440.00	39.26	PK	118	1.9	H	2.84	42.10	74.00	-31.90
7440.00	36.23	Ave	118	1.9	H	2.84	39.07	54.00	-14.93
2326.17	45.28	PK	358	1.2	V	-13.19	32.09	74.00	-41.91
2326.17	38.81	Ave	358	1.2	V	-13.19	25.62	54.00	-28.38
2351.93	44.20	PK	53	1.6	H	-13.14	31.06	74.00	-42.94
2351.93	37.43	Ave	53	1.6	H	-13.14	24.29	54.00	-29.71
2488.08	44.92	PK	295	1.1	V	-13.08	31.84	74.00	-42.16
2488.08	38.45	Ave	295	1.1	V	-13.08	25.37	54.00	-28.63

Test Frequency: 18 GHz~25 GHz

The measurements were more than 20 dB below the limit and not recorded

9 Band Edge Measurement

Test Requirement:	Section 15.247(d) In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method:	ANSI C63.10:2013
Test Limit:	Regulation 15.247 (d), 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, 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) (see §15.205(c)).
Test Mode:	Transmitting

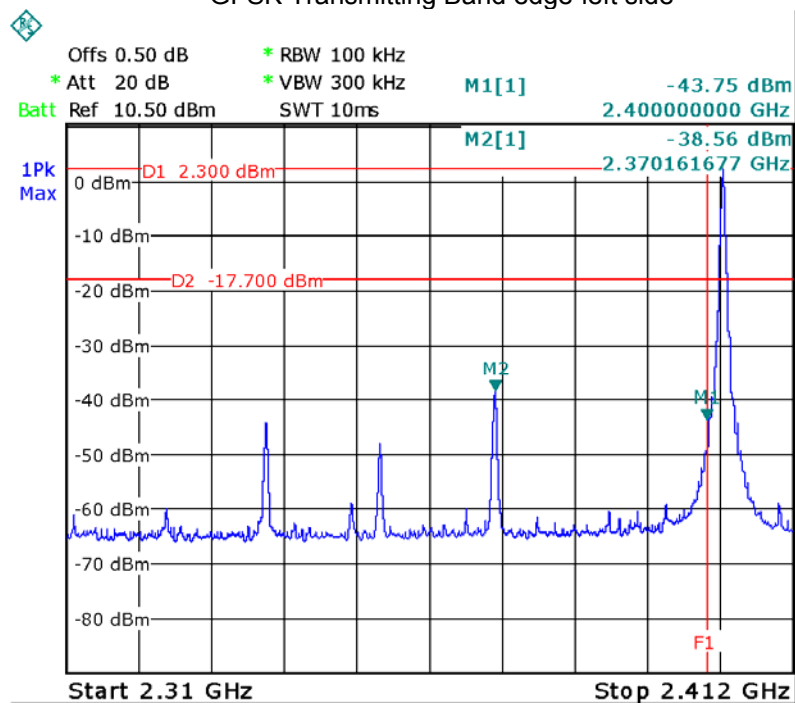
9.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

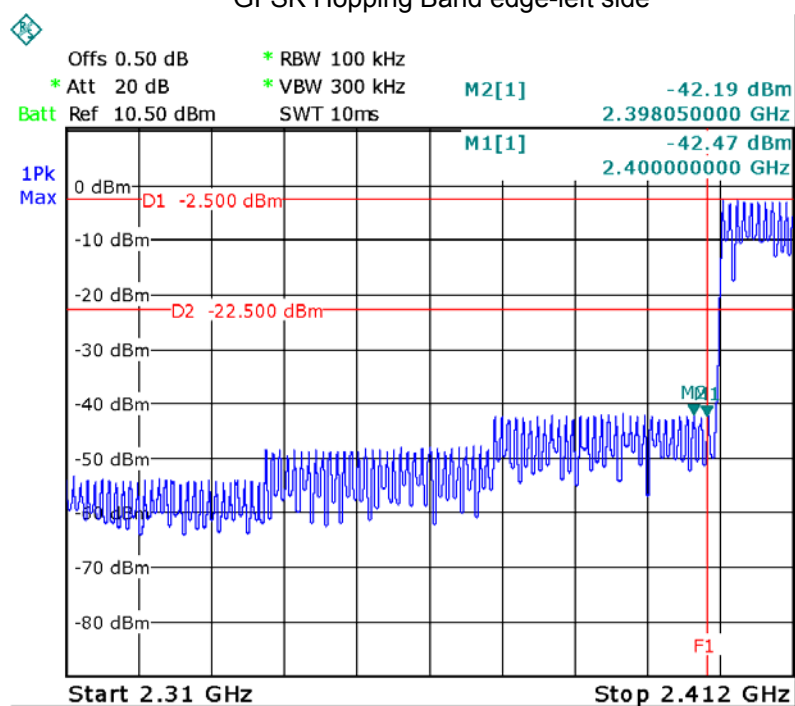
9.2 Test Result

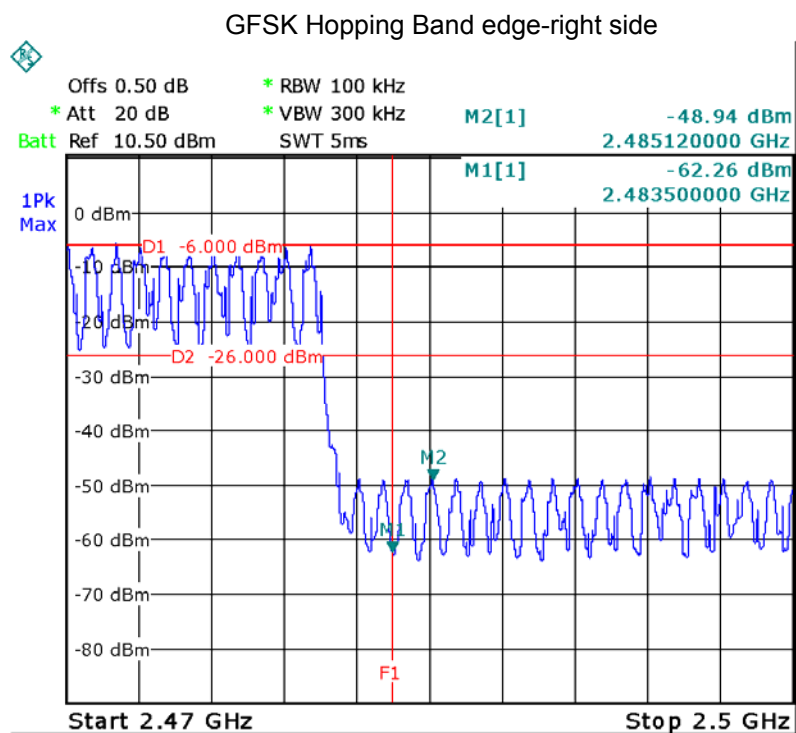
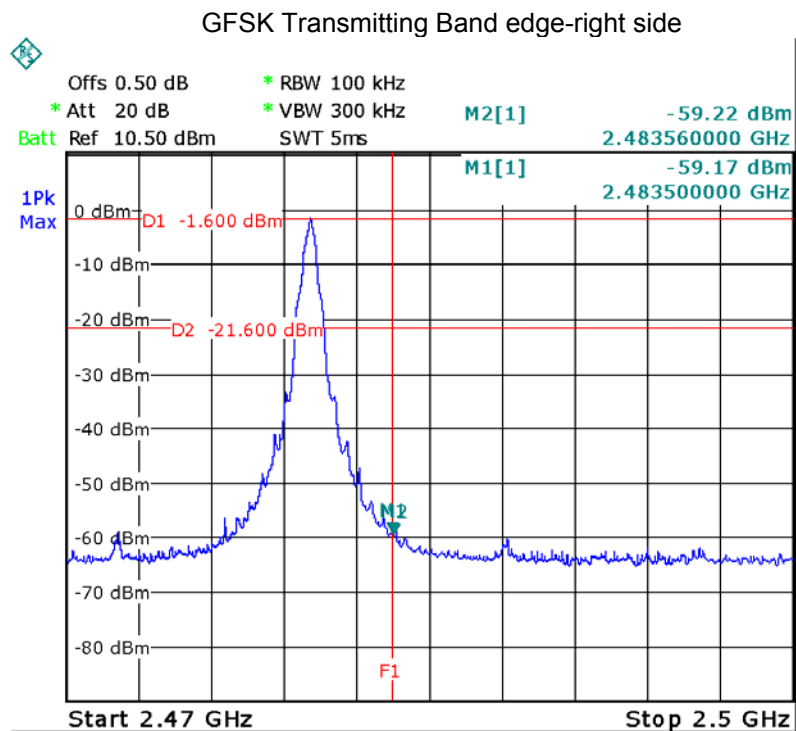
Test plots

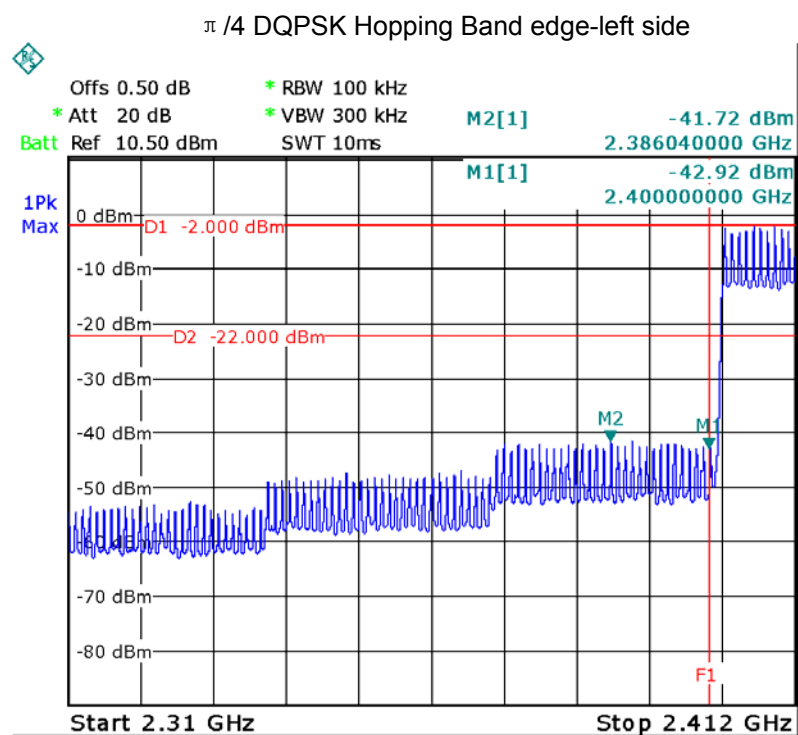
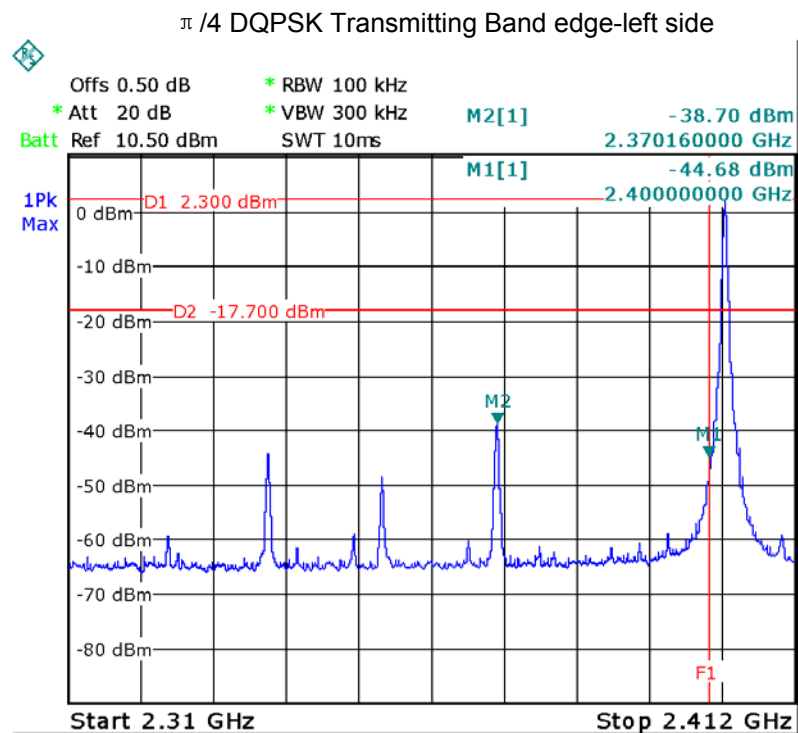
GFSK Transmitting Band edge-left side

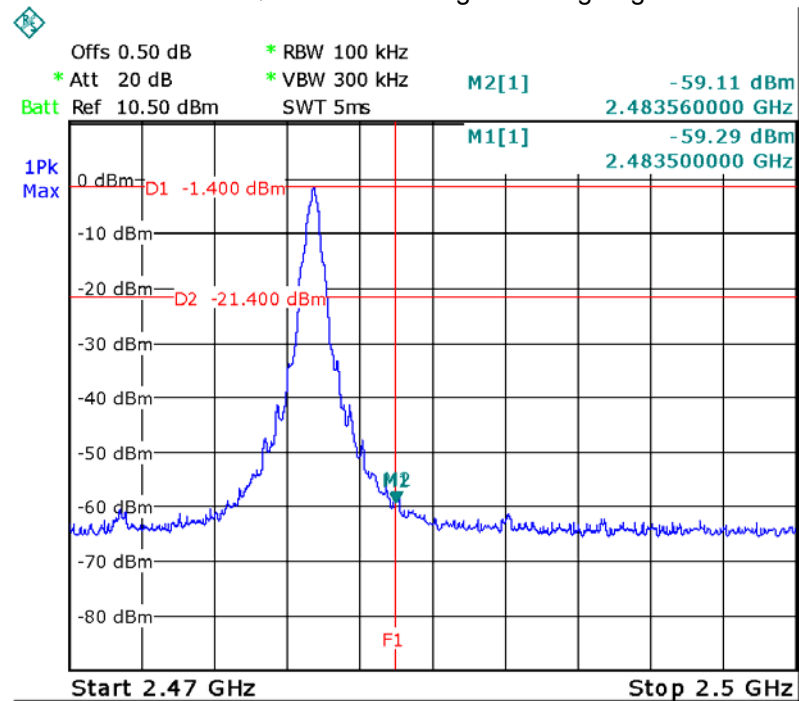
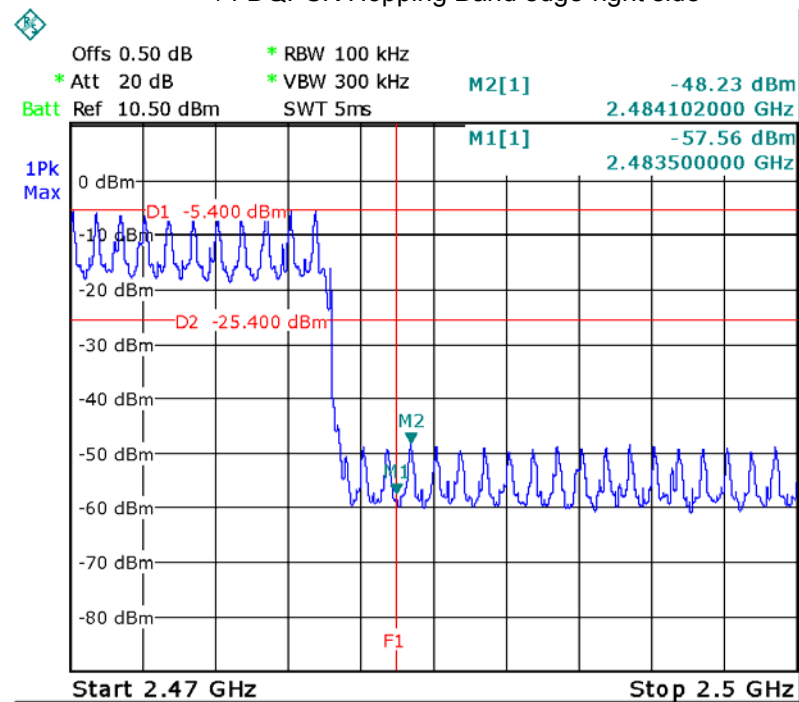


GFSK Hopping Band edge-left side

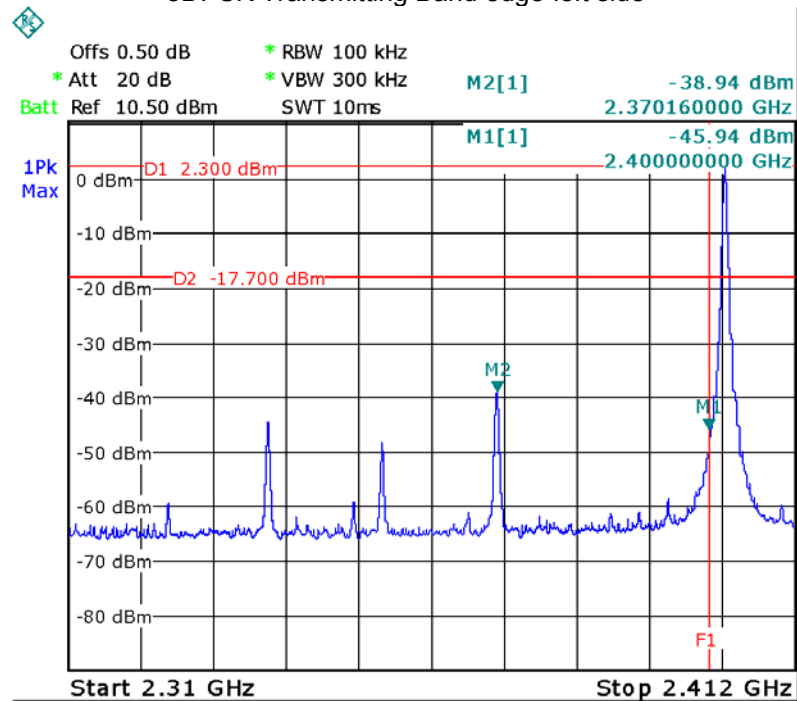




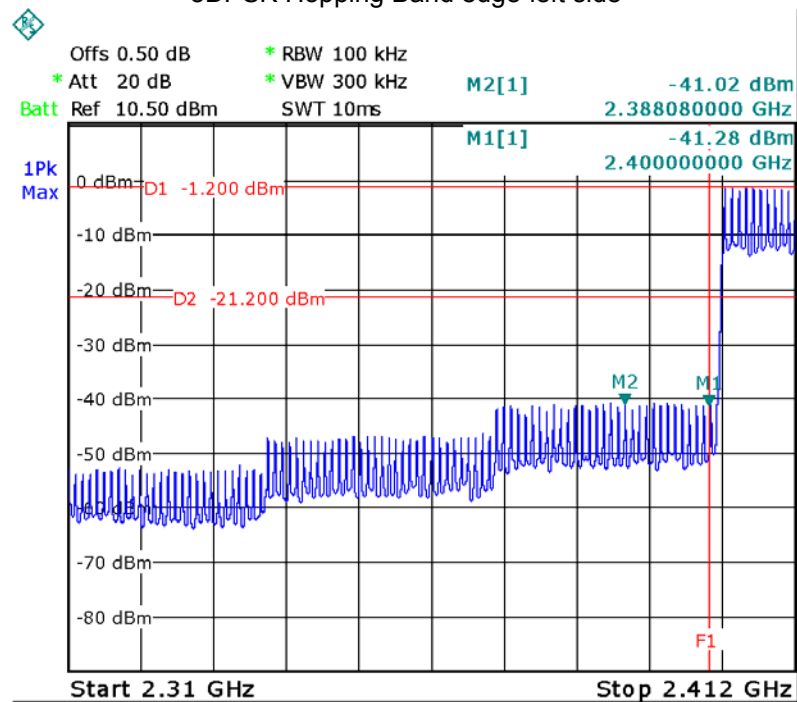


$\pi/4$ DQPSK Transmitting Band edge-right side $\pi/4$ DQPSK Hopping Band edge-right side

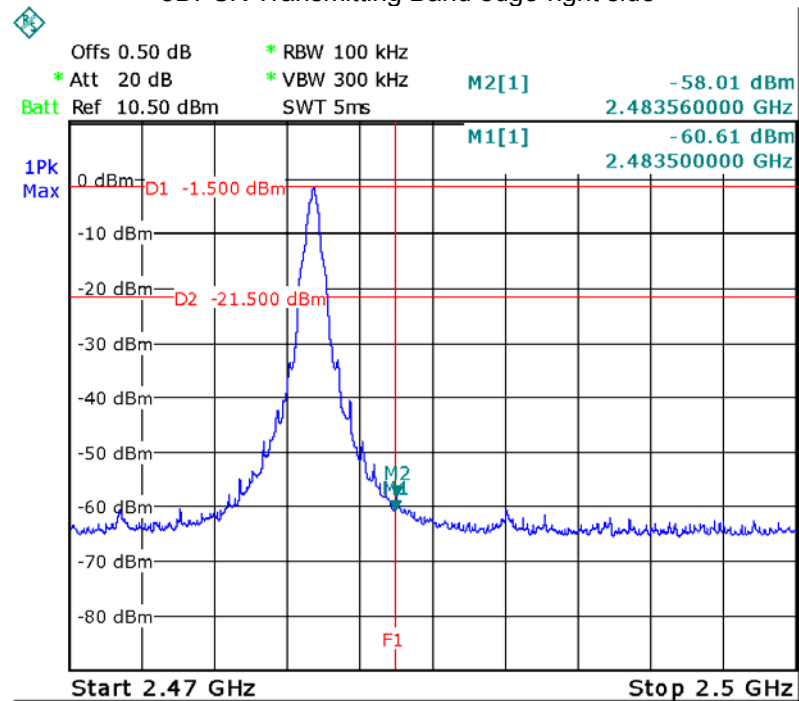
8DPSK Transmitting Band edge-left side



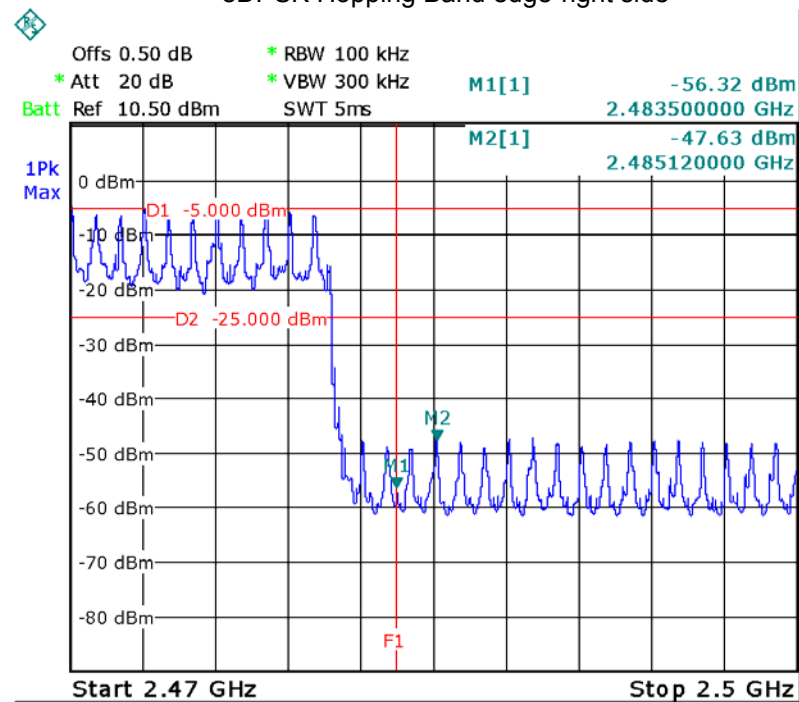
8DPSK Hopping Band edge-left side



8DPSK Transmitting Band edge-right side



8DPSK Hopping Band edge-right side



10 Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: ANSI C63.10:2013

Test Mode: Test in fixing operating frequency at low, Middle, high channel.

10.1 Test Procedure

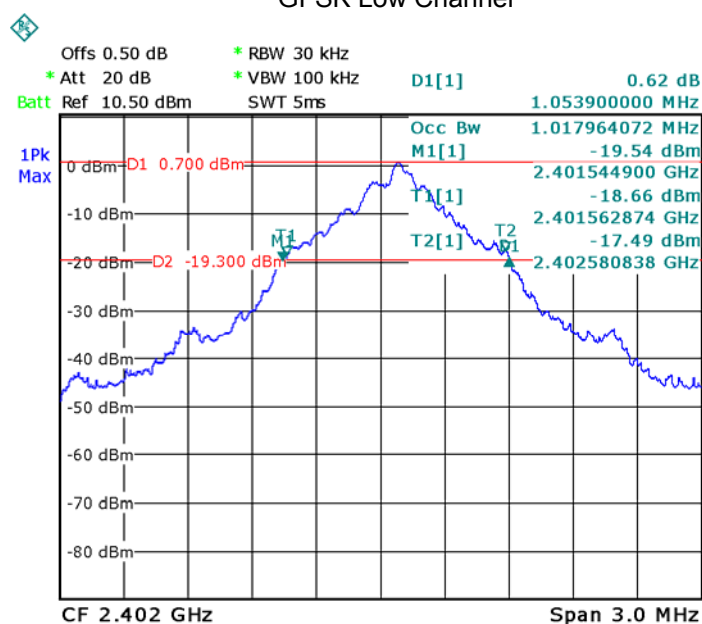
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 30kHz, VBW = 100kHz

10.2 Test Result

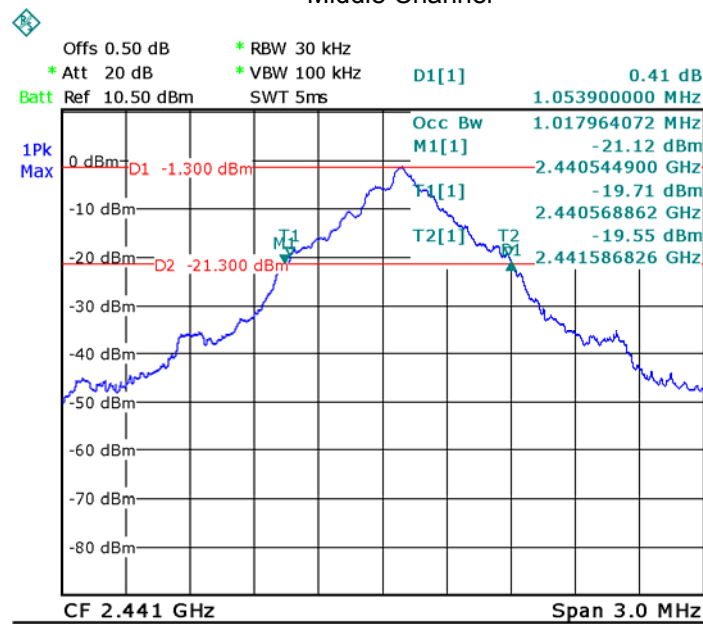
Modulation	Test Channel	99% Bandwidth(MHz)	20dB Bandwidth(MHz)
GFSK	Low	1.018	1.054
GFSK	Middle	1.018	1.054
GFSK	High	1.012	1.054
$\pi/4$ DQPSK	Low	1.114	1.126
$\pi/4$ DQPSK	Middle	1.192	1.198
$\pi/4$ DQPSK	High	1.228	1.240
8DPSK	Low	1.108	1.048
8DPSK	Middle	1.174	1.180
8DPSK	High	1.222	1.258

Test plots

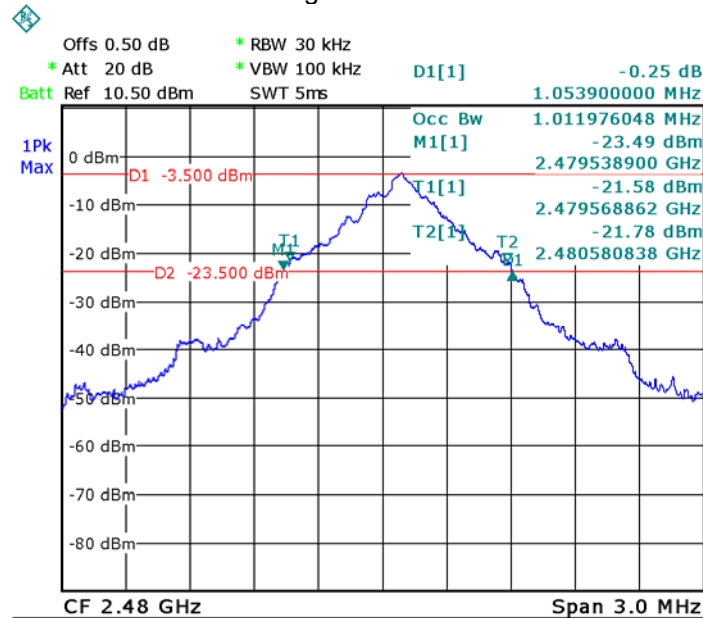
GFSK Low Channel



Middle Channel

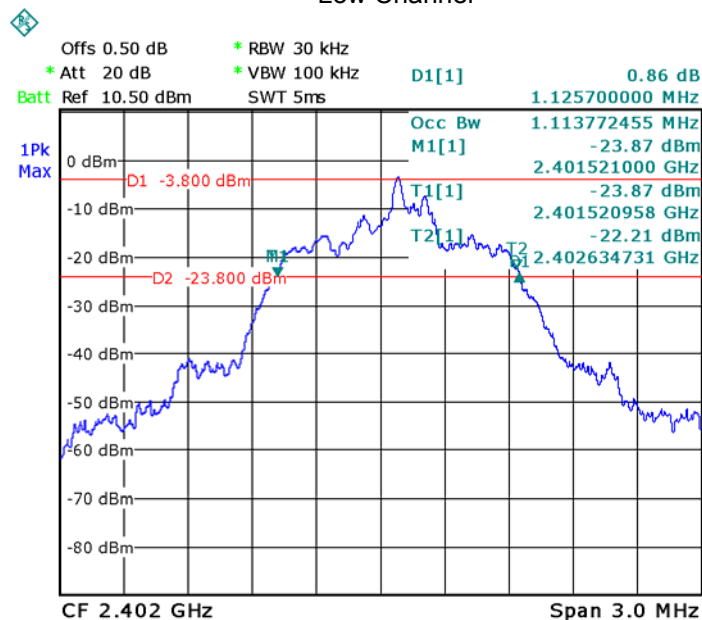


High Channel

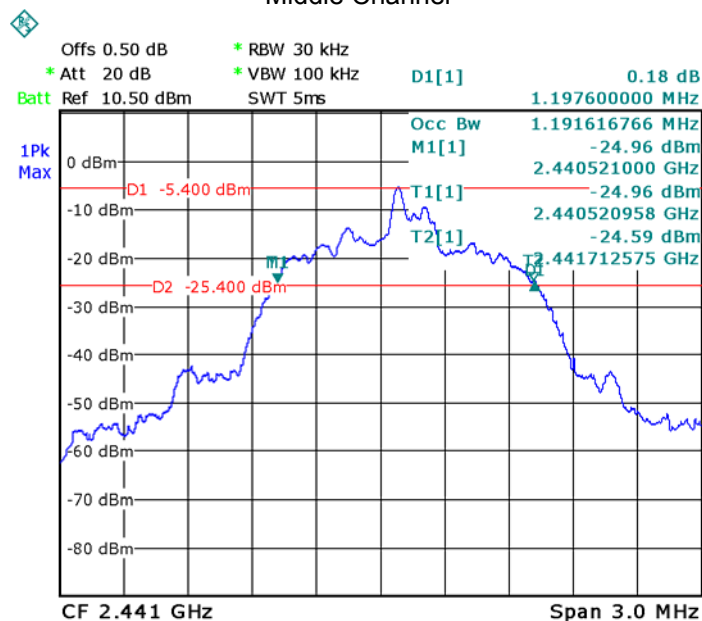


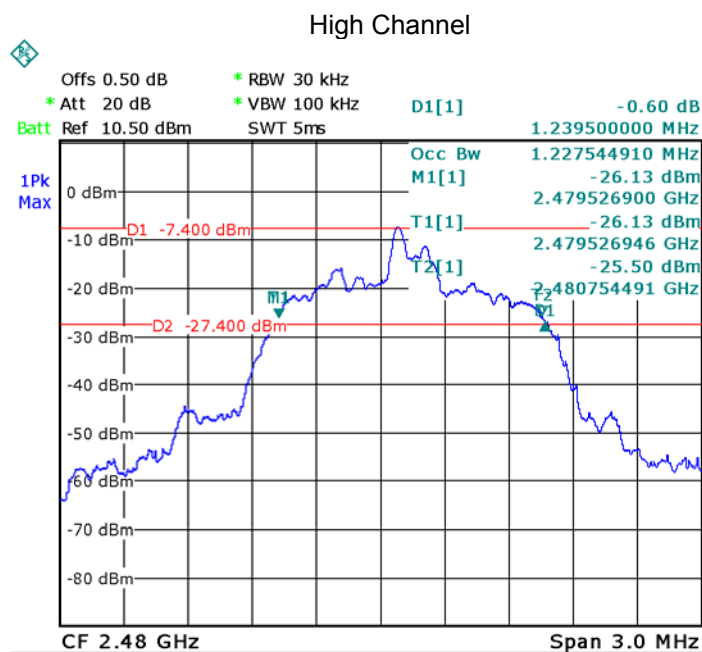
Modulation: $\pi/4$ DQPSK

Low Channel

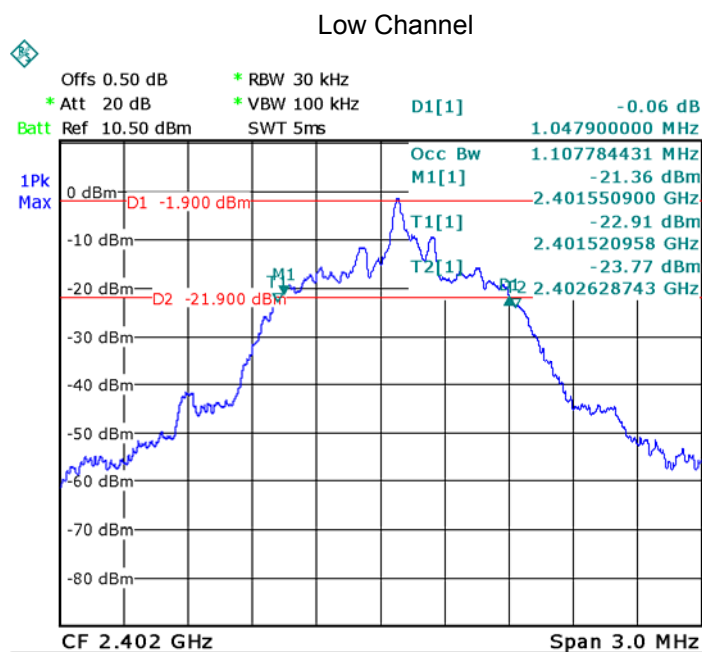


Middle Channel

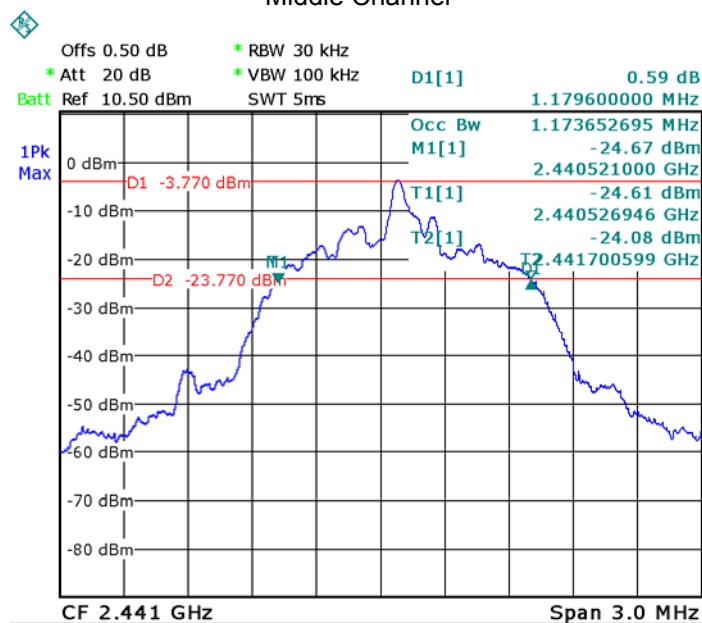




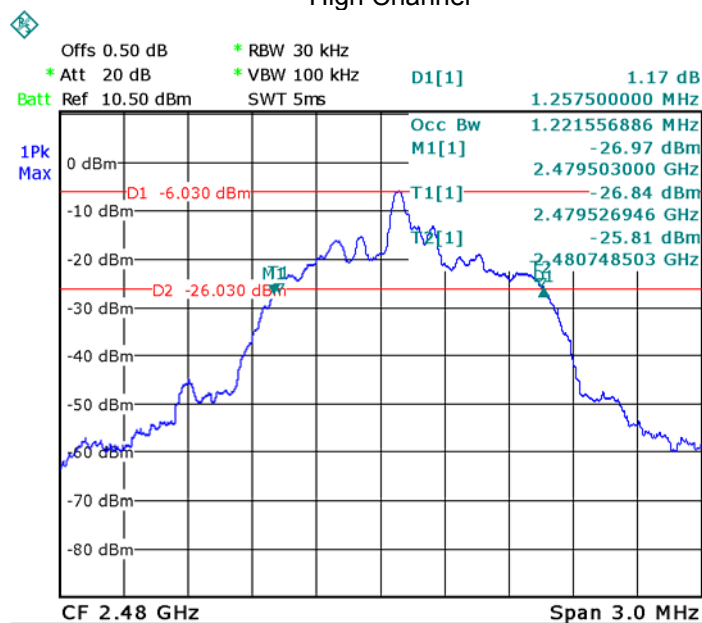
Modulation: 8DPSK



Middle Channel



High Channel



11 Maximum Peak Output Power

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	ANSI C63.10:2013
Test Limit:	Regulation 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.
Test mode:	Test in fixing frequency transmitting mode.

11.1 Test Procedure

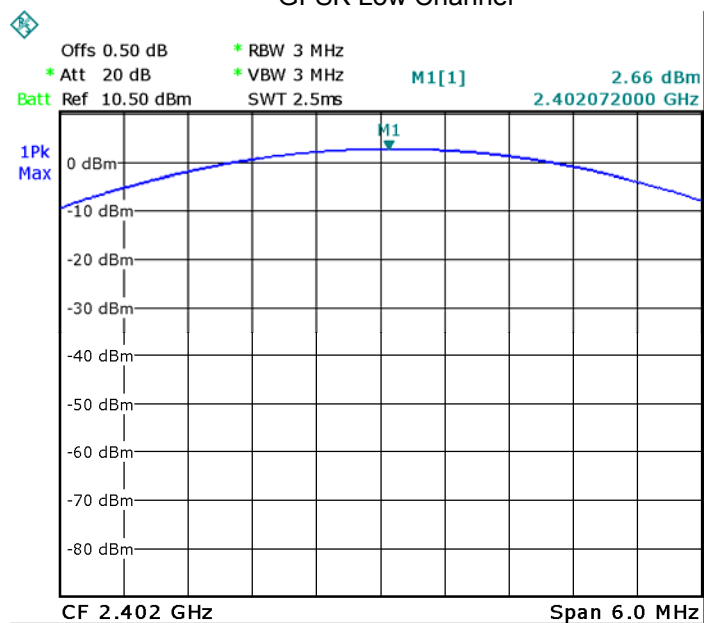
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3MHz. VBW = 3MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

11.2 Test Result

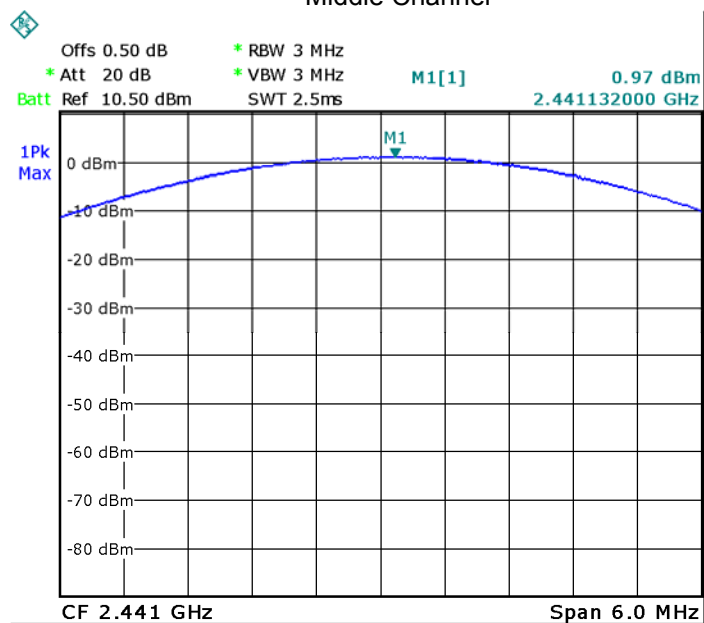
Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	2.66	30
GFSK	Middle	0.97	30
GFSK	High	-1.31	30
$\pi/4$ DQPSK	Low	2.36	21
$\pi/4$ DQPSK	Middle	0.69	21
$\pi/4$ DQPSK	High	-1.26	21
8DPSK	Low	2.19	21
8DPSK	Middle	0.68	21
8DPSK	High	-1.16	21

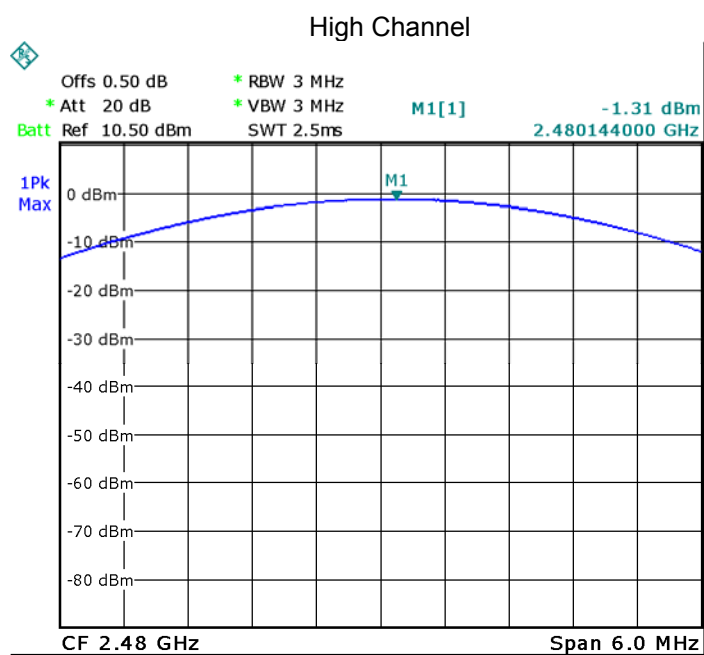
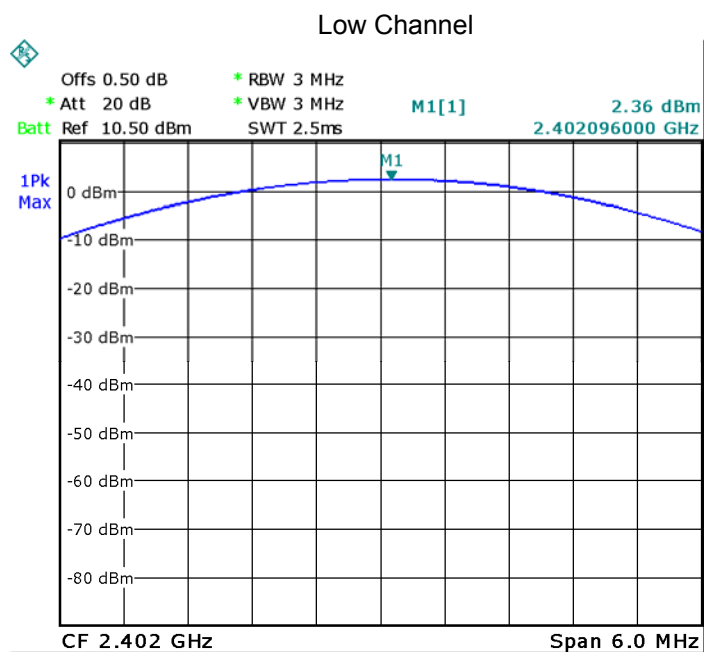
Test plots

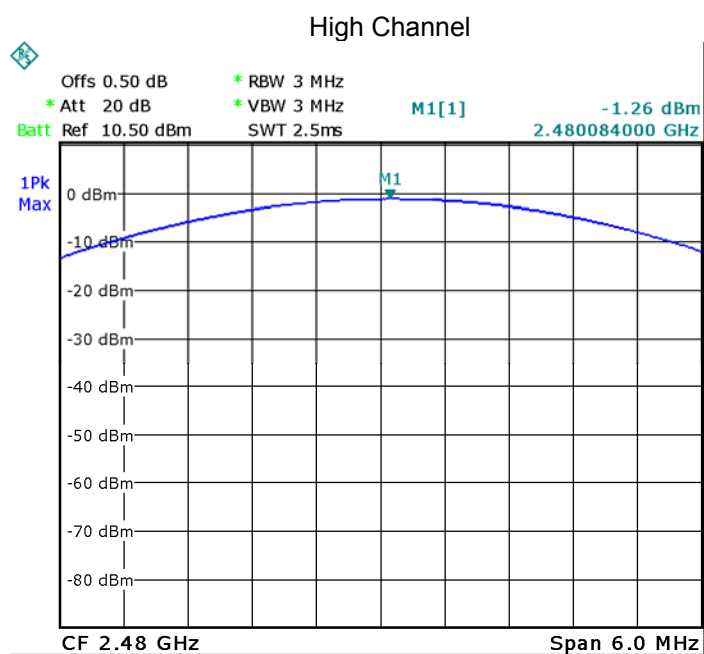
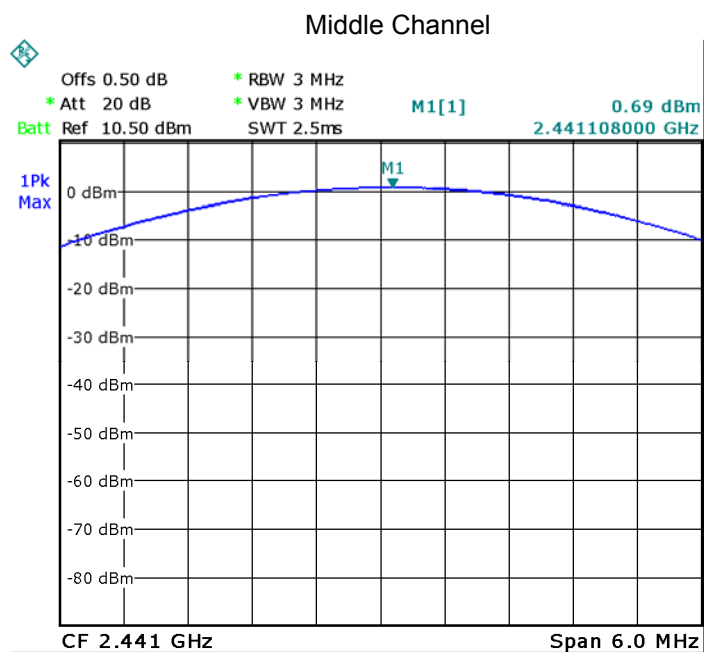
GFSK Low Channel



Middle Channel

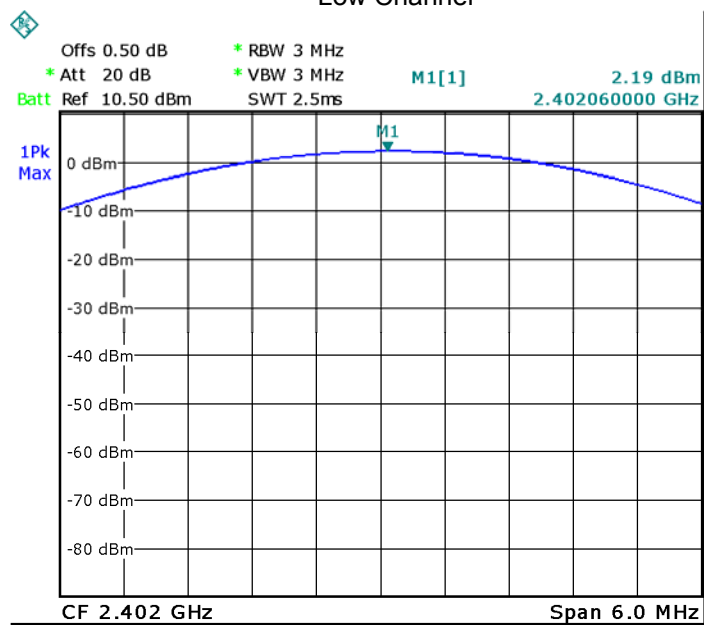


Modulation: $\pi/4$ DQPSK

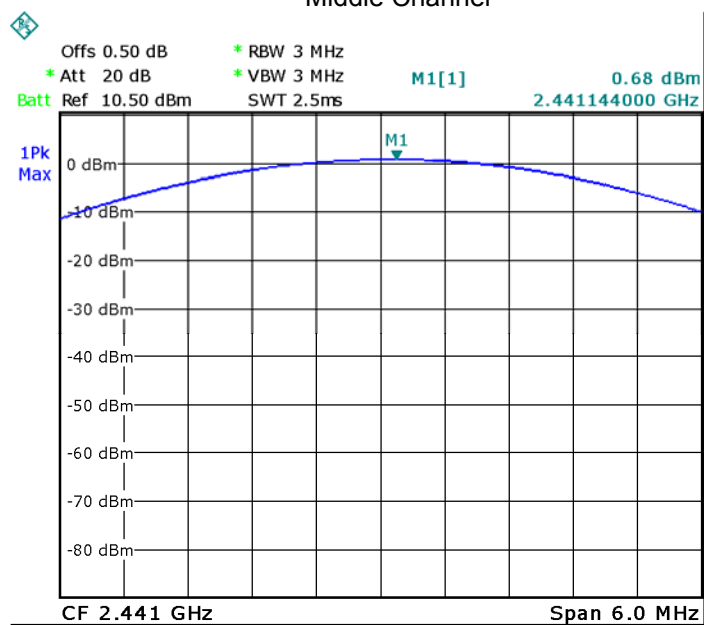


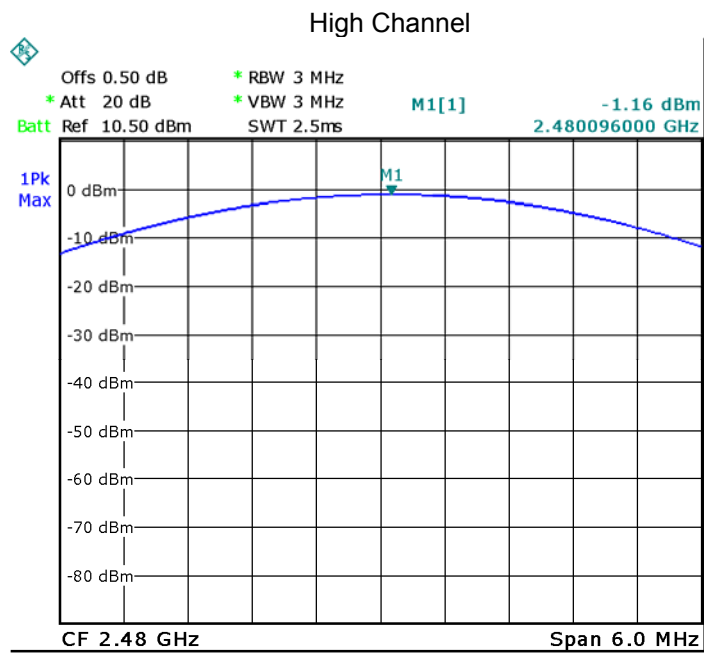
Modulation: 8DPSK

Low Channel



Middle Channel





12 Hopping Channel Separation

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	ANSI C63.10:2013
Test Limit:	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 0.125W.
Test Mode:	Test in hopping transmitting operating mode.

12.1 Test Procedure

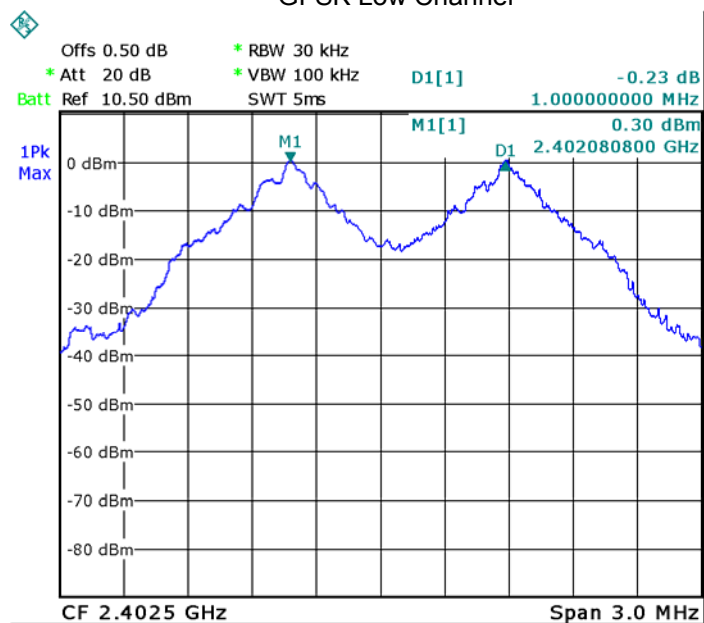
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30kHz. VBW = 100kHz , Span = 3.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

12.2 Test Result

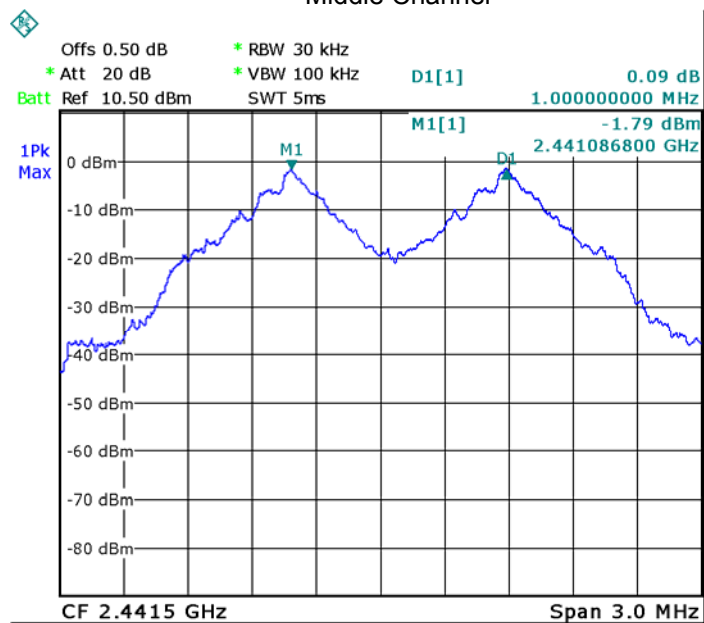
Modulation	Test Channel	Separation (MHz)	Result
GFSK	Low	1.000	PASS
GFSK	Middle	1.000	PASS
GFSK	High	1.000	PASS
$\pi/4$ DQPSK	Low	1.000	PASS
$\pi/4$ DQPSK	Middle	1.000	PASS
$\pi/4$ DQPSK	High	1.000	PASS
8DPSK	Low	1.000	PASS
8DPSK	Middle	1.000	PASS
8DPSK	High	1.000	PASS

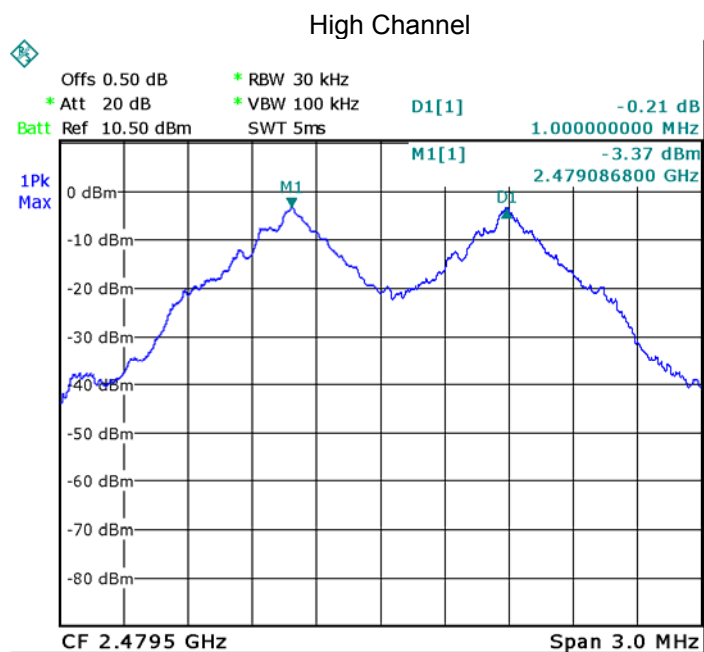
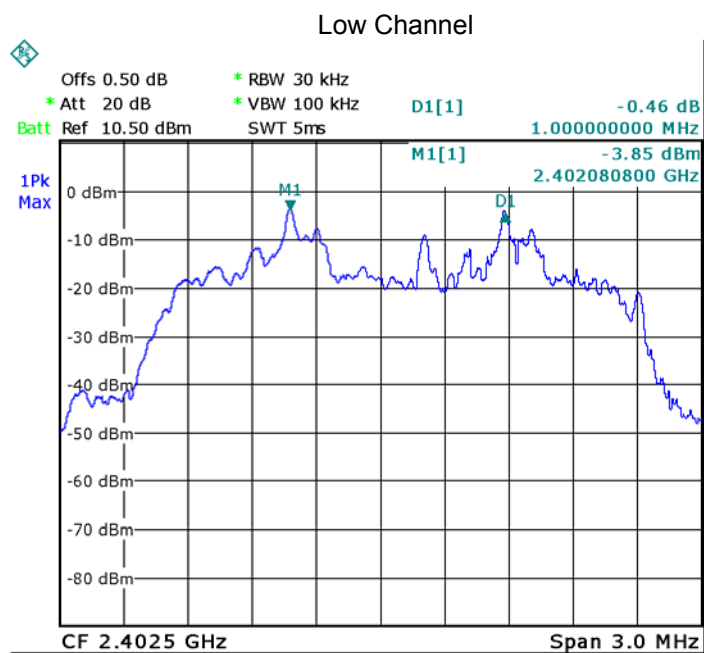
Test plots

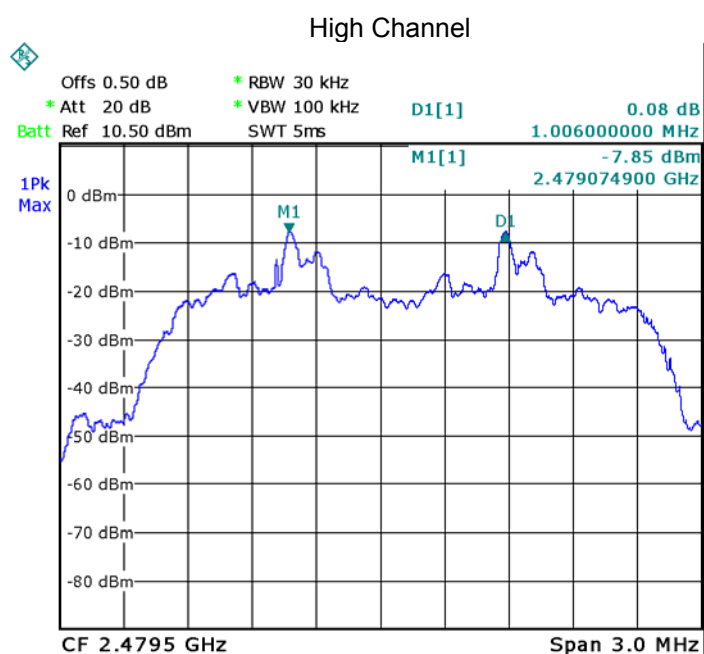
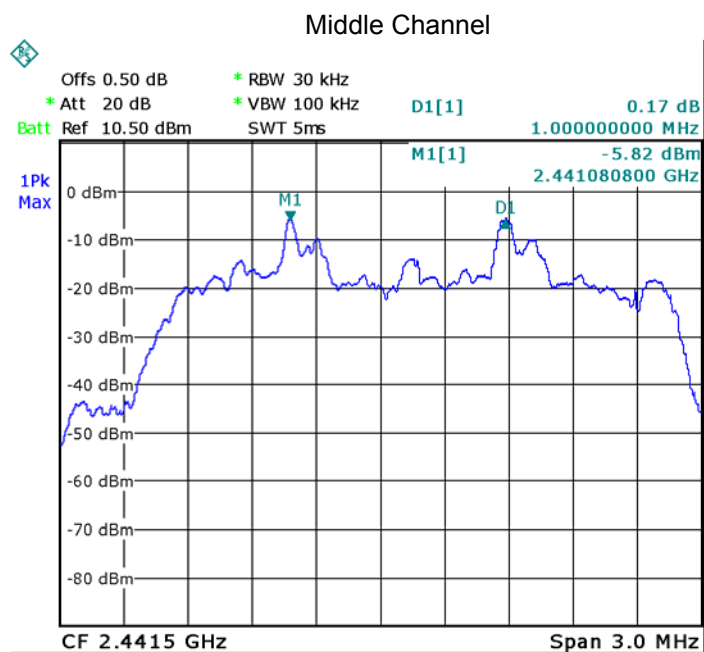
GFSK Low Channel



Middle Channel

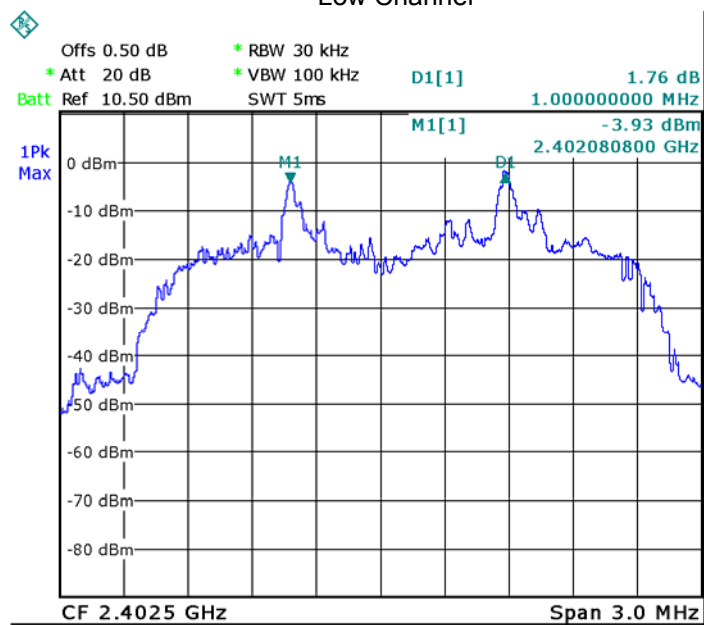


Modulation: $\pi/4$ DQPSK

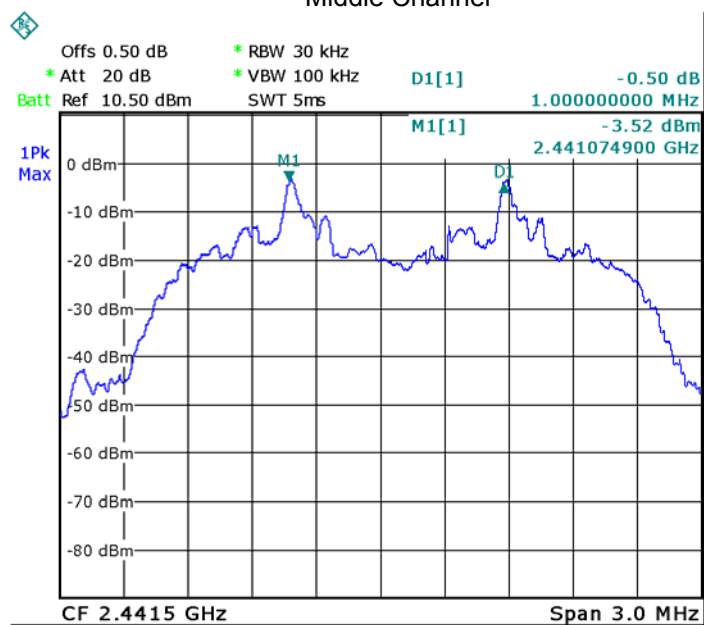


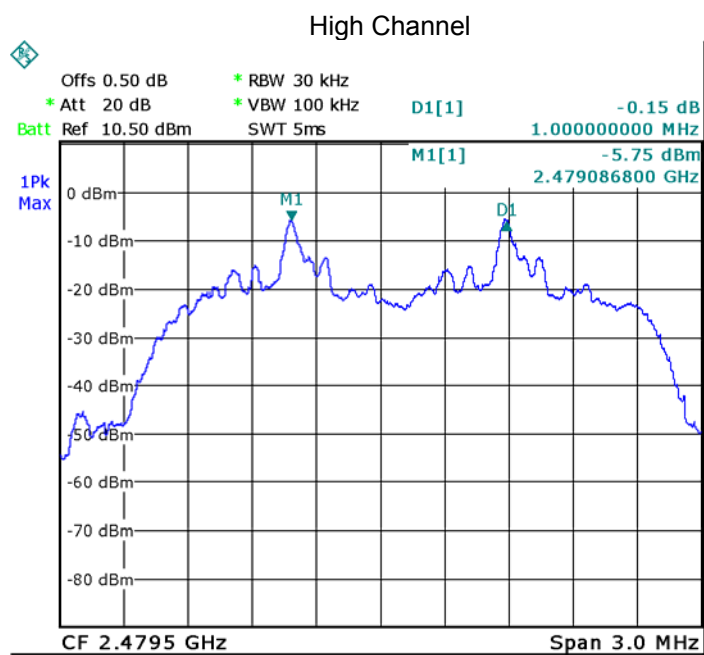
Modulation: 8DPSK

Low Channel



Middle Channel





13 Number of Hopping Frequency

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	ANSI C63.10:2013
Test Limit:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode:	Test in hopping transmitting operating mode.

13.1 Test Procedure

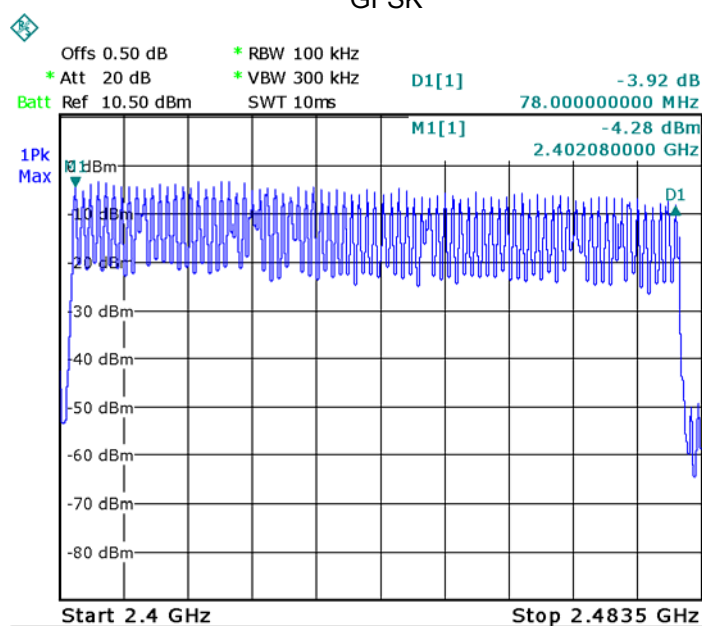
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100 KHz. VBW = 300 KHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz.
Sweep=auto;

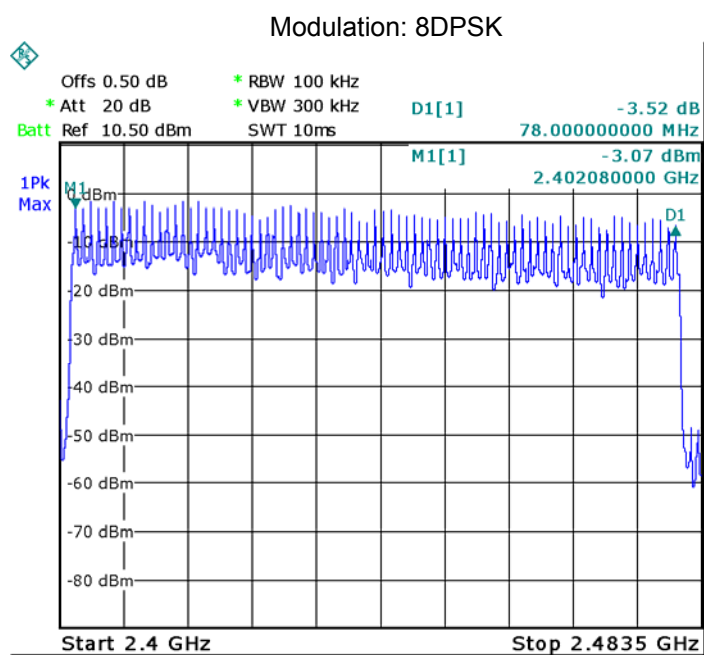
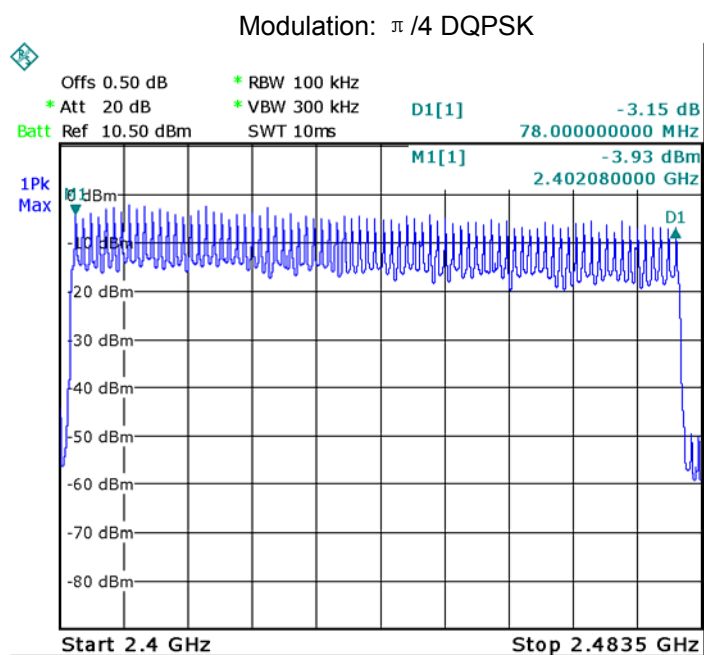
13.2 Test Result

Test Plots:

79 Channels in total

GFSK





14 Dwell Time

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	ANSI C63.10:2013
Test Limit:	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.
Test Mode:	Test in hopping transmitting operating mode.

14.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. Centred on a hopping channel;
3. Set RBW = 1MHz and VBW = 3MHz. Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 and DH1 packet transmitting.
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

14.2 Test Result

DH5 Packet permit maximum $1600 / 79 / 6$ hops per second in each channel (5 time slots RX, 1 time slot TX).

DH3 Packet permit maximum $1600 / 79 / 4$ hops per second in each channel (3 time slots RX, 1 time slot TX).

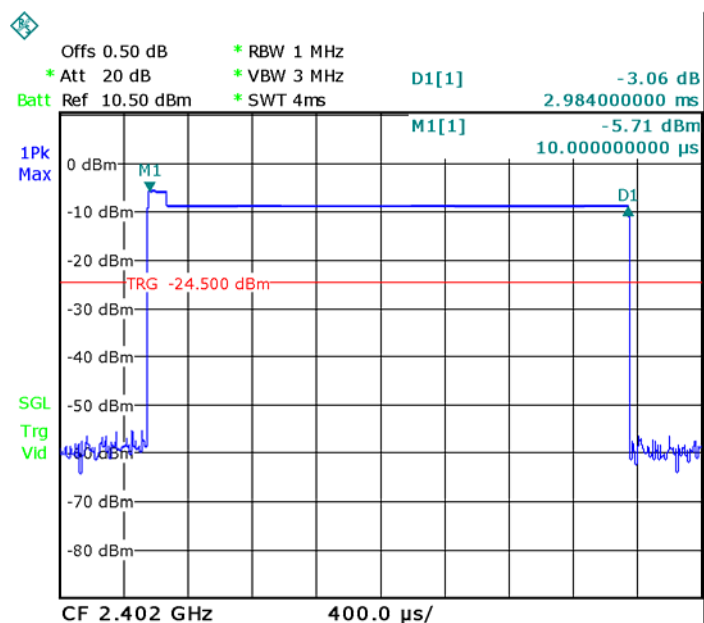
DH1 Packet permit maximum $1600 / 79 / 2$ hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

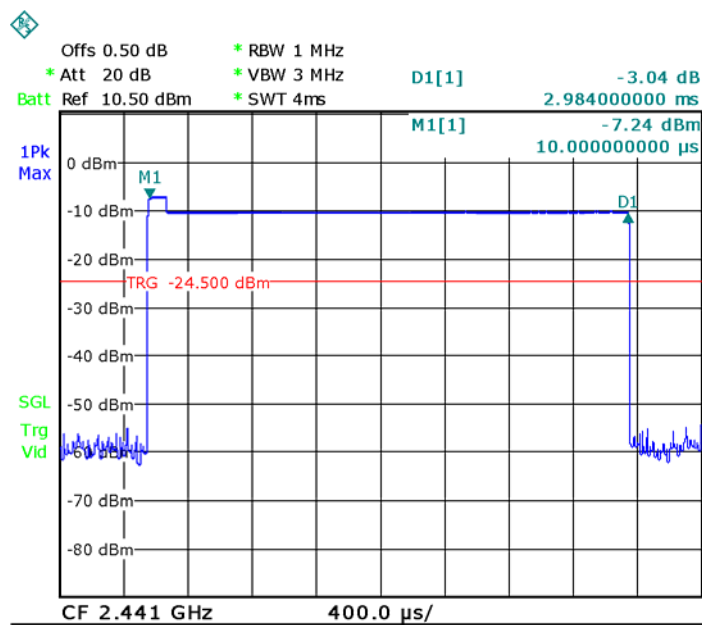
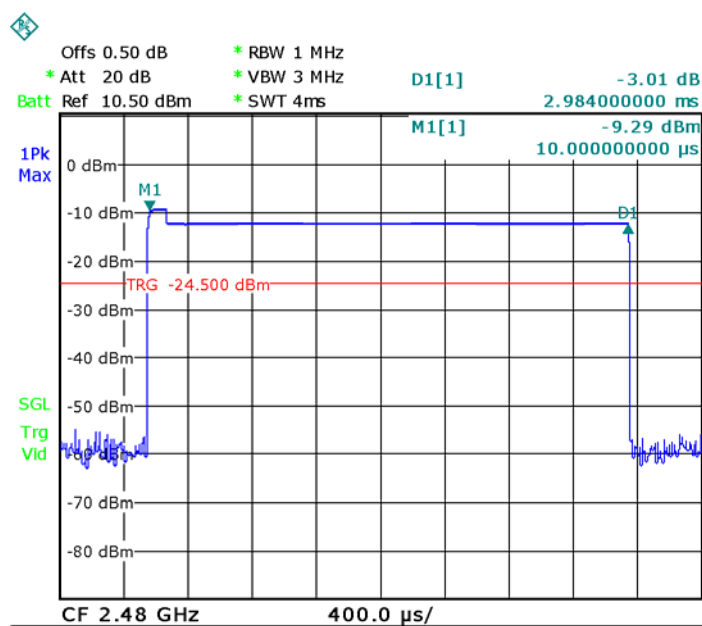
Data Packet	Dwell Time(s)
DH5	$1600/79/6*0.4*79*(MkrDelta)/1000$
DH3	$1600/79/4*0.4*79*(MkrDelta)/1000$
DH1	$1600/79/2*0.4*79*(MkrDelta)/1000$
Remark: Mkr Delta is once pulse time.	

Modulation	Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
GFSK	DH5	Low	2.984	0.318	0.4
		middle	2.984	0.318	0.4
		High	2.984	0.318	0.4
$\pi/4$ DQPSK	DH5	Low	2.984	0.318	0.4
		middle	2.984	0.318	0.4
		High	2.984	0.318	0.4
8DPSK	DH5	Low	2.984	0.318	0.4
		middle	2.984	0.318	0.4
		High	2.984	0.318	0.4

Remark: Only the worst-case is recorded.

Test Plots GFSK DH5 Low Channel

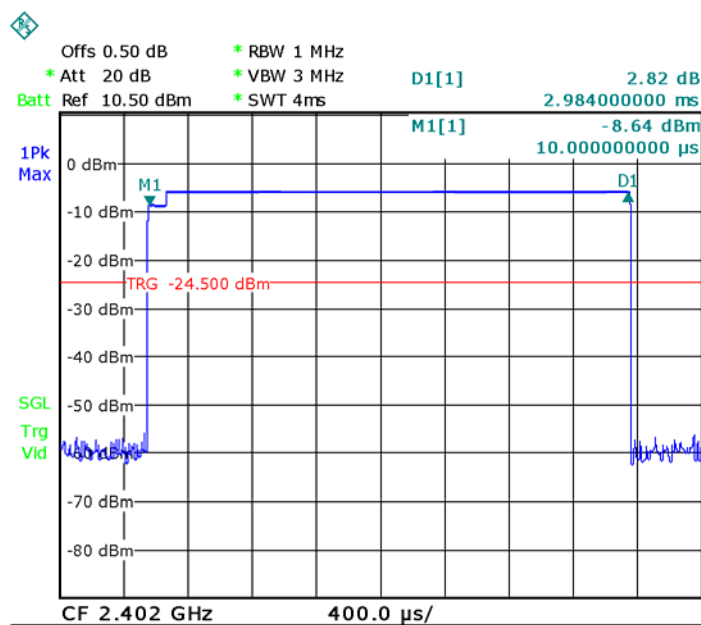


Data Packet:
DH5.Middle channelData Packet:
DH5, High channel

$\pi/4$ DQPSK

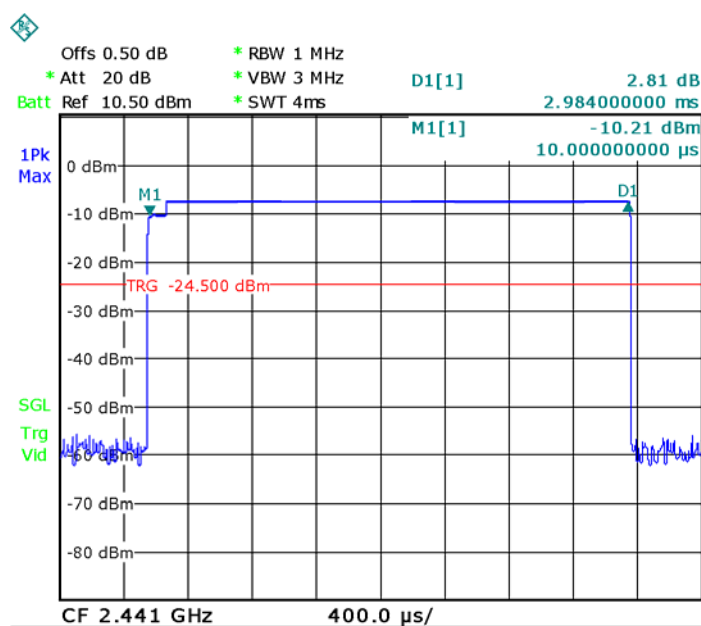
Data Packet:

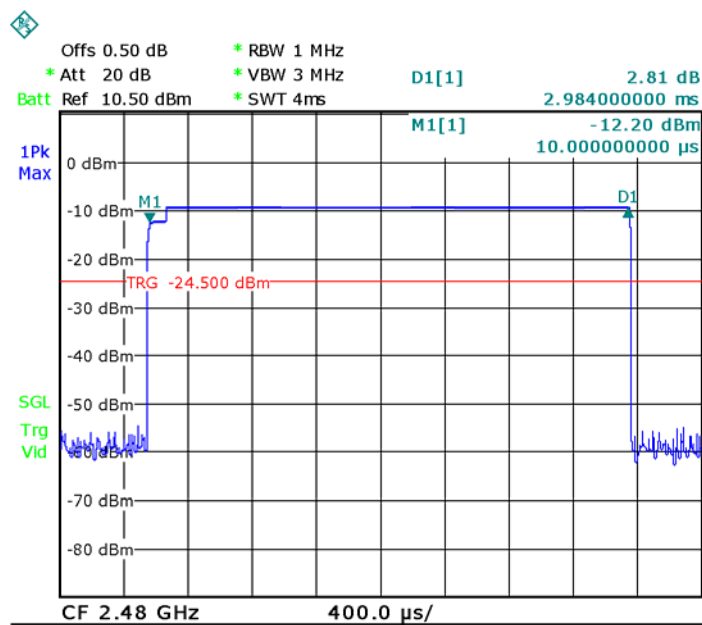
DH5, Low channel



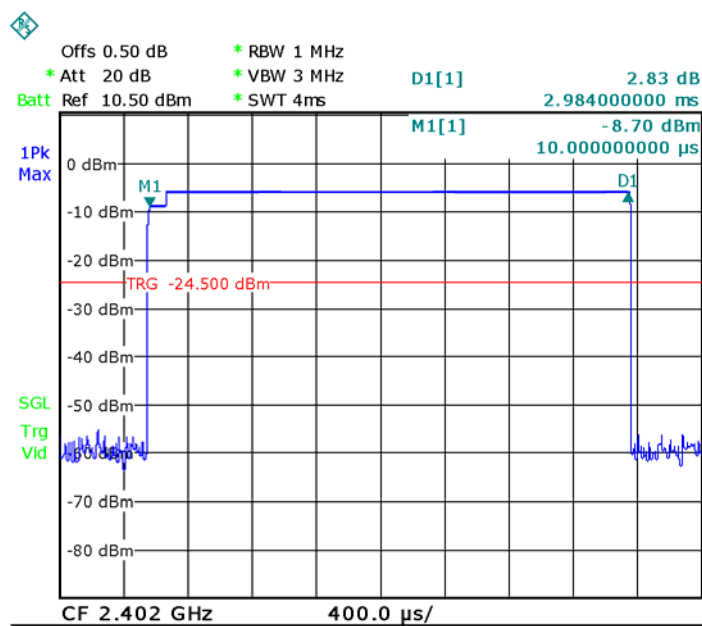
Data Packet:

DH5, Middle channel

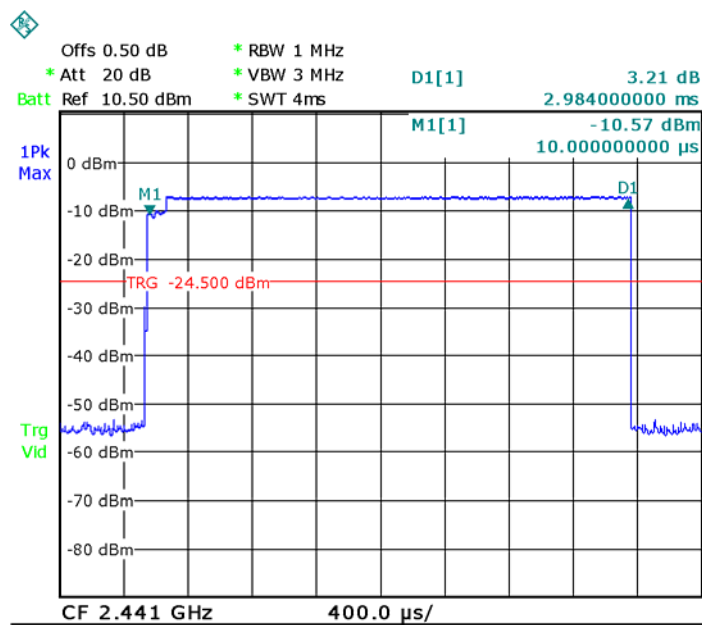


Data Packet:
DH5, High channel

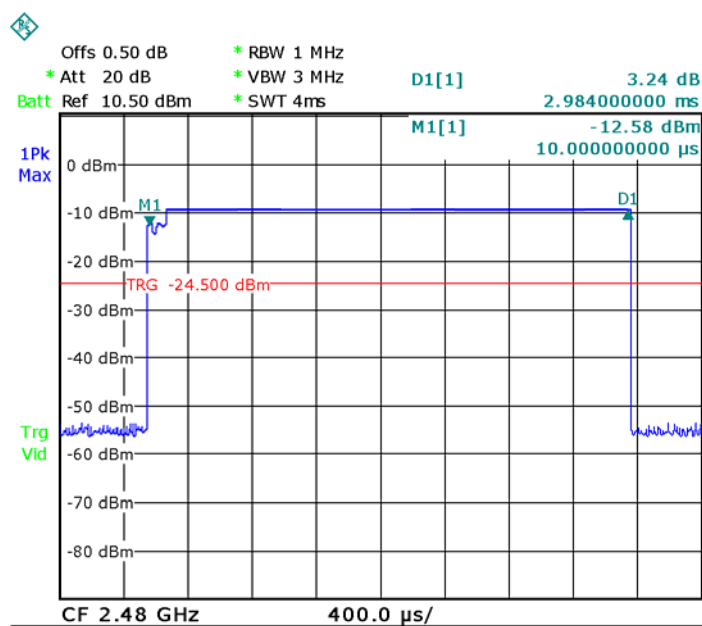
8DPSK

Data Packet:
DH5, Low channel

Data Packet:
DH5, Middle channel



Data Packet:
DH5, High channel



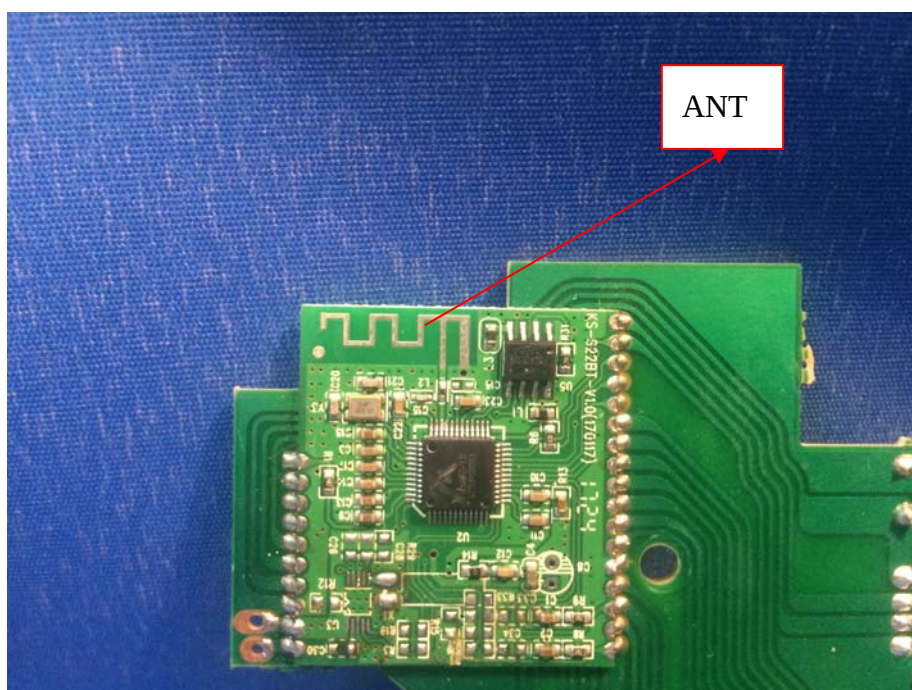
15 Antenna Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall 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 this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Result:

The EUT has one PCB Printed Antenna, the gain is 0dBi. meets the requirements of FCC 15.203.



16 FCC ID: 2ALZL-AA5230 RF Exposure

Note: Please refer to RF Exposure test report: WTS17S1299188-2E.

17 Photographs-Model AA5230 Test Setup

Note: Please refer to Photos: WTS17S1299188-3E.

18 Photographs - Constructional Details

18.1 Model AA5230-External Photos

Note: Please refer to Photos: WTS17S1299188-3E.

18.2 Model AA5230 – Internal Photos

Note: Please refer to Photos: WTS17S1299188-3E.

=====End of Report=====