

FCC Part 15C Test Report

FCC ID: 2ANFRMT-303

Product Name:	Digital Proportional System
Trademark:	N/A
Model Name :	MT-303 MT-303RX, MT-302, MT-302RE
Prepared For : Address :	SHENZHEN EXPORTPRO TECHNOLOGY CO., LTD 2nd Floor, 99 Industrial Centre, Western Industrial Park, Shajing Town, Baoan District Shenzhen, Guangdong 518104 China
Prepared By : Address :	Shenzhen BCTC Testing Co., Ltd. BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road, Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China
Test Date:	Mar. 25, 2020 – Apr. 29, 2020
Date of Report :	Apr. 29, 2020
Report No.:	BCTC2003001600E

TEST RESULT CERTIFICATION

Applicant's name : SHENZHEN EXPORTPRO TECHNOLOGY CO., LTD
Address : 2nd Floor, 99 Industrial Centre, Western Industrial Park,
Shajing Town, Baoan District Shenzhen, Guangdong
518104 China

Manufacture's Name : SHENZHEN EXPORTPRO TECHNOLOGY CO., LTD
Address : 2nd Floor, 99 Industrial Centre, Western Industrial Park,
Shajing Town, Baoan District Shenzhen, Guangdong
518104 China

Product description

Product name : Digital Proportional System
Trademark : N/A
Model and/or type reference MT-303
..... : MT-303RX, MT-302, MT-302RE

Standards : FCC Part15.247
ANSI C63.10:2013
558074 D01 15.247 Meas Guidance v05r02

This device described above has been tested by BCTC, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Prepared by(Engineer): Cai Fangzhong



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(Note: N/A means not applicable)

1. TEST SUMMARY

Test procedures according to the technical standards:

FCC Part15 (15.247) , Subpart C			
Standard Section	Test Item	Judgment	Remark
§15.207	Conducted emission AC power port	N/A	
§15.247(b)(1)	Conducted peak output power for FHSS	PASS	
§15.247(a)(1)	20dB Occupied bandwidth	PASS	
§15.247(a)(1)(iii)	Number of hopping frequencies	PASS	
§15.247(a)(1)(iii)	Dwell Time	PASS	
§15.247(d)	Spurious RF conducted emissions	PASS	
§15.247(d)	Band edge	PASS	
§15.247(d) & §15.209 & §15.205	Spurious radiated emissions for transmitter	PASS	
§15.207	Conducted emission AC power port	PASS	
15.203	Antenna Requirement	PASS	
Note: (1) "N/A" denotes test is not applicable in this Test Report			

2. TEST FACILITY

Shenzhen BCTC Testing Co., Ltd.

Add. : BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road, Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China

Test Firm Registration Number: 712850

IC Registered No.: 23583

3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	3m chamber Radiated spurious emission(30MHz-1GHz)	U=4.3dB
2	3m chamber Radiated spurious emission(1GHz-18GHz)	U=4.5dB
3	3m chamber Radiated spurious emission(18GHz-40GHz)	U=3.34dB
4	Conducted Adjacent channel power	U=1.38dB
5	Conducted output power uncertainty Above 1G	U=1.576dB
6	Conducted output power uncertainty below 1G	U=1.28dB
7	humidity uncertainty	U=5.3%
8	Temperature uncertainty	U=0.59°C

4. GENERAL INFORMATION

4.1 GENERAL DESCRIPTION OF EUT

Equipment	Digital Proportional System	
Trade Name	N/A	
Model Name	MT-303 MT-303RX, MT-302, MT-302RE	
Model Difference	All the model are the same circuit and RF module, except model names .	
Product Description	The EUT is a Digital Proportional System	
	Operation Frequency:	2417-2480 MHz
	Modulation Type:	GFSK
	Number Of Channel	64CH
	Antenna Designation:	Internal Antenna
	Antenna Gain	0dBi
Channel List	Please refer to the section 4.4	
Ratings	DC 6V	
Connecting I/O Port(s)	Please refer to the User's Manual	
Hardware Version:	H1.0	
Software Version:	S1.0	

4.2 Test Setup Configuration

See test photographs attached in *EUT TEST SETUP PHOTOGRAPHS* for the actual

Radiated Spurious Emission Test

E-1 EUT

4.3 Support Equipment

No.	Device Type	Brand	Model	Series No.	Data Cable
E-1	Digital Proportional System	N/A	MT-303	N/A	EUT

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.4 Channel List

CH	Frequency (MHz)	CH	Frequency (MHz)	CH	Frequency (MHz)	CH	Frequency (MHz)
1	2417	21	2437	41	2457	61	2477
2	2418	22	2438	42	2458	62	2478
3	2419	23	2439	43	2459	63	2479
4	2420	24	2440	44	2460	64	2480
5	2421	25	2441	45	2461		
6	2422	26	2442	46	2462		
7	2423	27	2443	47	2463		
8	2424	28	2444	48	2464		
9	2425	29	2445	49	2465		
10	2426	30	2446	50	2466		
11	2427	31	2447	51	2467		
12	2428	32	2448	52	2468		
13	2429	33	2449	53	2469		
14	2430	34	2450	54	2470		
15	2431	35	2451	55	2471		
16	2432	36	2452	56	2472		
17	2433	37	2453	57	2473		
18	2434	38	2454	58	2474		
19	2435	39	2455	59	2475		
20	2436	40	2456	60	2476		

4.5 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.

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

The EUT is Continue Transmitting.

The software is installed in operation system, named "RFTestTool.apk", Version 1.0.

Test Mode	Test mode	Low channel	Middle channel	High channel
1	Transmitting(GFSK)	2417MHz	2447MHz	2480MHz
2	Transmitting (Radiated emission)			

5. TEST FACILITY AND TEST INSTRUMENT USED

5.1 Test Facility

All measurement facilities used to collect the measurement data are located at BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road, Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

5.2 Test Instrument Used

RF conduction and Radiation Test equipment

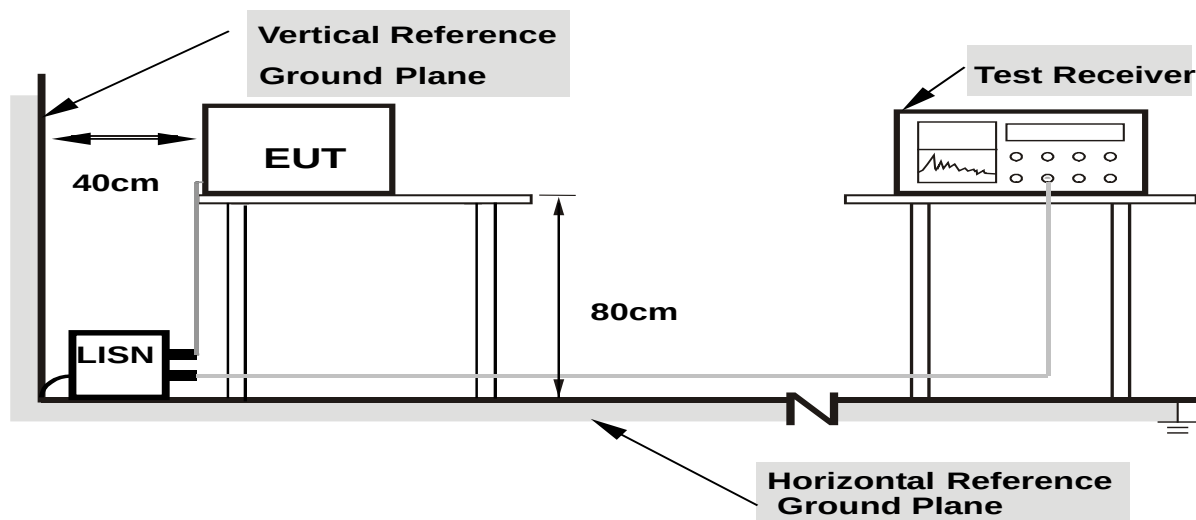
Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	Spectrum Analyzer (9kHz-26.5GHz)	Agilent	E4407B	MY45109572	Jun. 13, 2019	Jun. 12, 2020
2	Test Receiver (9kHz-7GHz)	R&S	ESR7	101154	Jun. 13, 2019	Jun. 12, 2020
3	Bilog Antenna (30MHz-3GHz)	SCHWARZB ECK	VULB9163	VULB9163-942	Jun. 22, 2019	Jun. 21, 2020
4	Horn Antenna (1GHz-18GHz)	SCHWARZB ECK	BBHA9120D	1541	Jun. 22, 2019	Jun. 21, 2020
5	Horn Antenna (18GHz-40GHz)	SCHWARZB ECK	BBHA9170	822	Jun. 22, 2019	Jun. 21, 2020
6	Amplifier (9KHz-6GHz)	SCHWARZB ECK	BBV9744	9744-0037	Jun. 25, 2019	Jun. 24, 2020
7	Amplifier (0.5GHz-18GHz)	SCHWARZB ECK	BBV9718	9718-309	Jun. 25, 2019	Jun. 24, 2020
8	Amplifier (18GHz-40GHz)	MITEQ	TTA1840-35-HG	2034381	Jun. 17, 2019	Jun. 16, 2020
9	Loop Antenna (9KHz-30MHz)	SCHWARZB ECK	FMZB1519B	014	Jul. 02, 2019	Jul. 01, 2020
10	RF cables1 (9kHz-30MHz)	Huber+Suhner	9kHz-30MHz	B1702988-0008	Jun. 25, 2019	Jun. 24, 2020
11	RF cables2 (30MHz-1GHz)	Huber+Suhner	30MHz-1GHz	1486150	Jun. 25, 2019	Jun. 24, 2020
12	RF cables3 (1GHz-40GHz)	Huber+Suhner	1GHz-40GHz	1607106	Jun. 25, 2019	Jun. 24, 2020
13	Power Metter	Keysight	E4419B	\	Jun. 17, 2019	Jun. 16, 2020
14	Power Sensor (AV)	Keysight	E9 300A	\	Jun. 17, 2019	Jun. 16, 2020
15	Signal Analyzer 20kHz-26.5GHz	KEYSIGHT	N9020A	MY49100060	Jun. 13, 2019	Jun. 12, 2020
16	Spectrum Analyzer 9kHz-40GHz	Agilent	FSP40	100363	Jun. 13, 2019	Jun. 12, 2020
17	D.C. Power Supply	LongWei	TPR-6405D	\	\	\
18	Software	Frad	EZ-EMC	FA-03A2 RE	\	\

Conduction Test equipment

Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	Test Receiver	R&S	ESR3	102075	Jun. 13, 2019	Jun. 12, 2020
2	LISN	SCHWARZBECK	NSLK8127	8127739	Jun. 13, 2019	Jun. 12, 2020
3	LISN	R&S	ENV216	101375	Jun. 13, 2019	Jun. 12, 2020
4	RF cables	Huber+Suhnar	9kHz-30MHz	B1702988-0008	Jun. 25, 2019	Jun. 24, 2020
5	Software	Frad	EZ-EMC	EMC-CON 3A1	\	\

6. CONDUCTED EMISSIONS

6.1 Block Diagram Of Test Setup



Note: 1.Support units were connected to second LISN.
 2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

6.2 Limit

FREQUENCY (MHz)	Limit (dBuV)		Standard
	Quasi-peak	Average	
0.15 -0.5	66 - 56 *	56 - 46 *	FCC
0.50 -5.0	56.00	46.00	FCC
5.0 -30.0	60.00	50.00	FCC

6.3 Test procedure

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

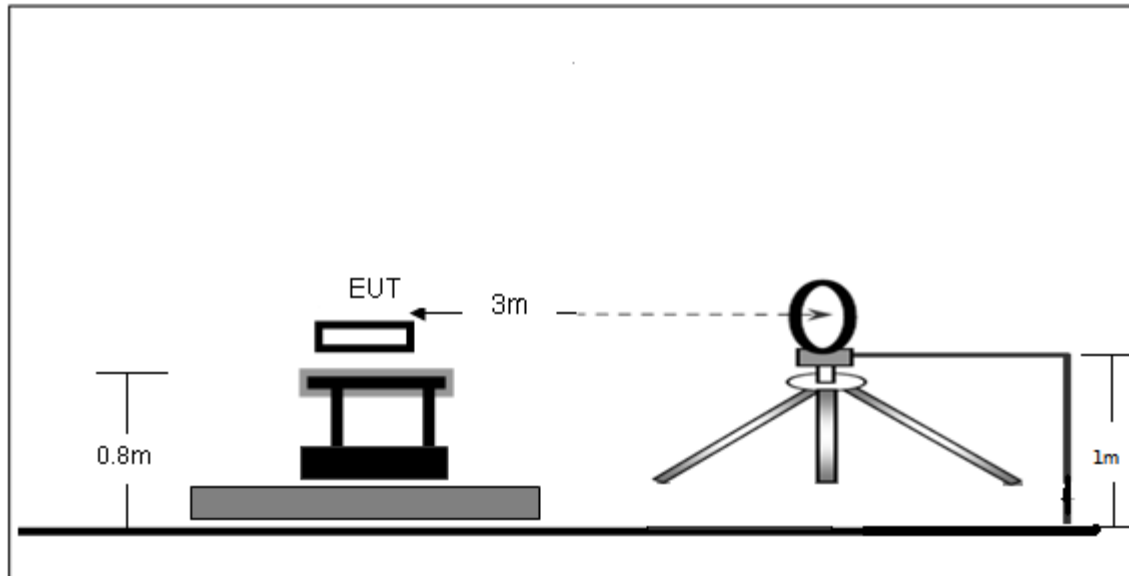
6.4 Test Result

NOTE: This EUT is powered by the battery only, this test item is not applicable.

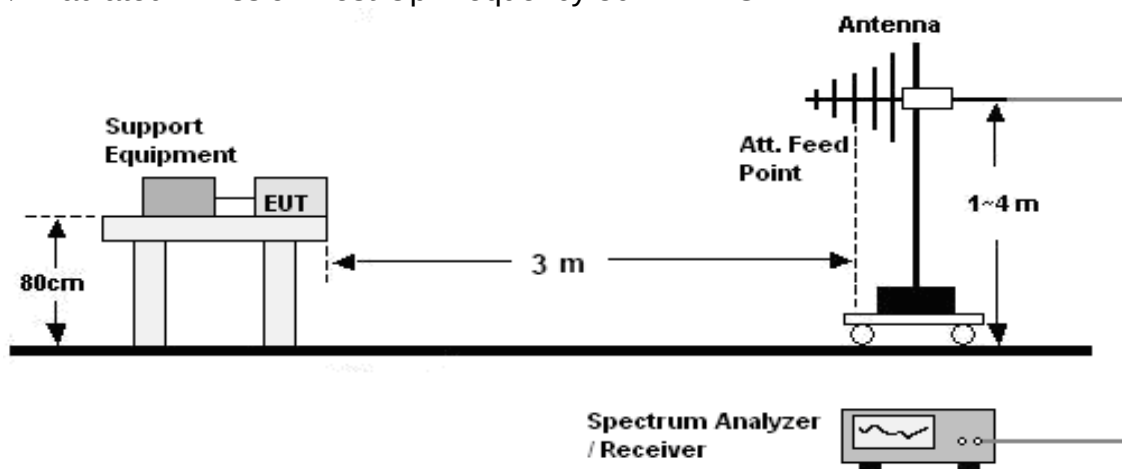
7. RADIATED EMISSIONS

7.1 Block Diagram Of Test Setup

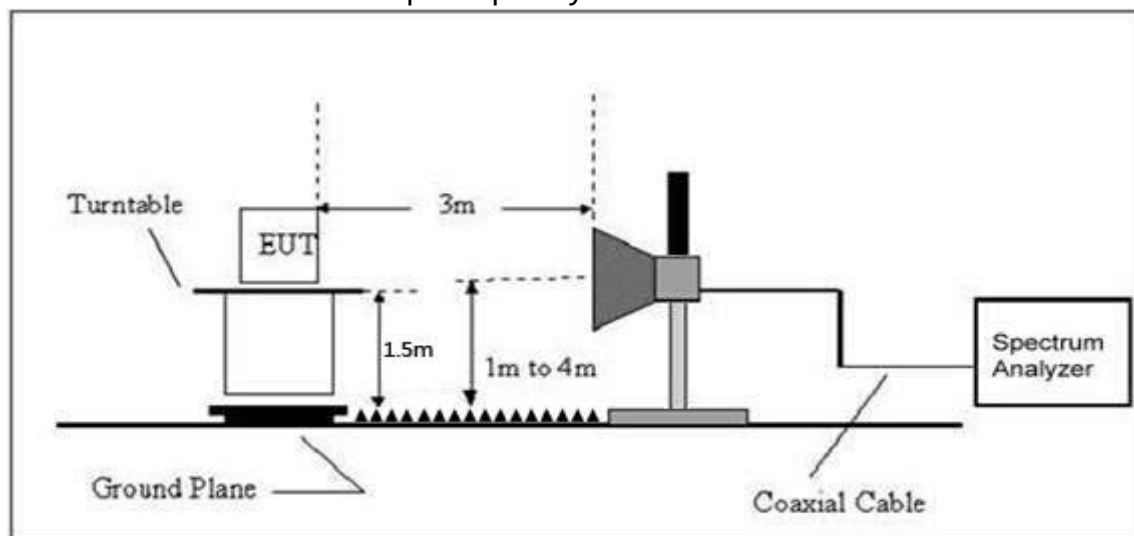
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



7.2 Limit

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency	Field Strength	Distance	Field Strength Limit at 3m Distance	
(MHz)	uV/m	(m)	uV/m	dBuV/m
0.009 ~ 0.490	$2400/F(\text{kHz})$	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	$24000/F(\text{kHz})$	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	$20\log^{(500)}$

7.3 Test procedure

Receiver Parameter	Setting
Attenuation	Auto
9kHz~150kHz	RBW 200Hz for QP
150kHz~30MHz	RBW 9kHz for QP
30MHz~1000MHz	RBW 120kHz for QP

Spectrum Parameter	Setting
1-25GHz	RBW 1 MHz /VBW 1 MHz for Peak, RBW 1 MHz / VBW 10Hz for Average

Below 1GHz test procedure as below:

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Above 1GHz test procedure as below:

- g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change from table 0.8 metre to 1.5 metre(Above 18GHz the distance is 1 meter and table is 1.5 metre).
- h. Test the EUT in the lowest channel ,the middle channel ,the Highest channel.

Note:

Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

7.4 Test Result

Between 9KHz – 30MHz

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101 kPa	Test Voltage :	DC 6V
Test Mode :	Mode 2	Polarization :	--

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	PASS
--	--	--	--	PASS

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

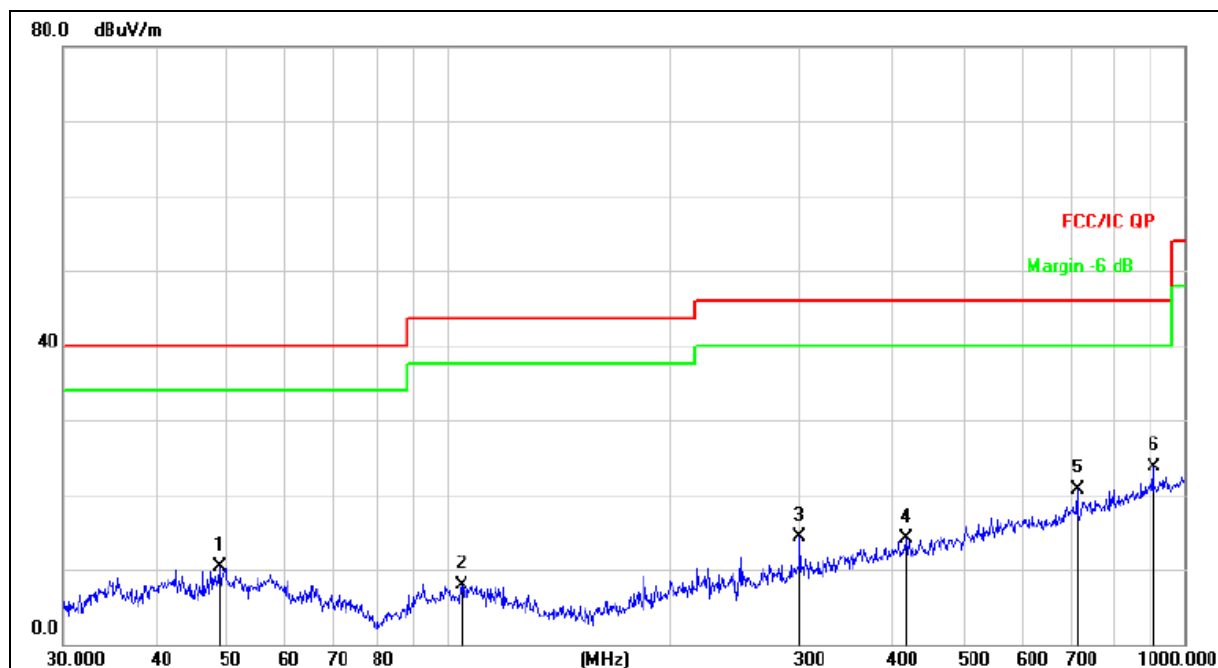
Distance extrapolation factor = $40 \log (\text{specific distance}/\text{test distance})$ (dB);

Limit line = specific limits(dBuv) + distance extrapolation factor.

Test all the modes and only worst case was reported.

Between 30MHz – 1GHz

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101kPa	Test Voltage :	DC 6V
Test Mode :	Mode 2	Polarization :	Horizontal

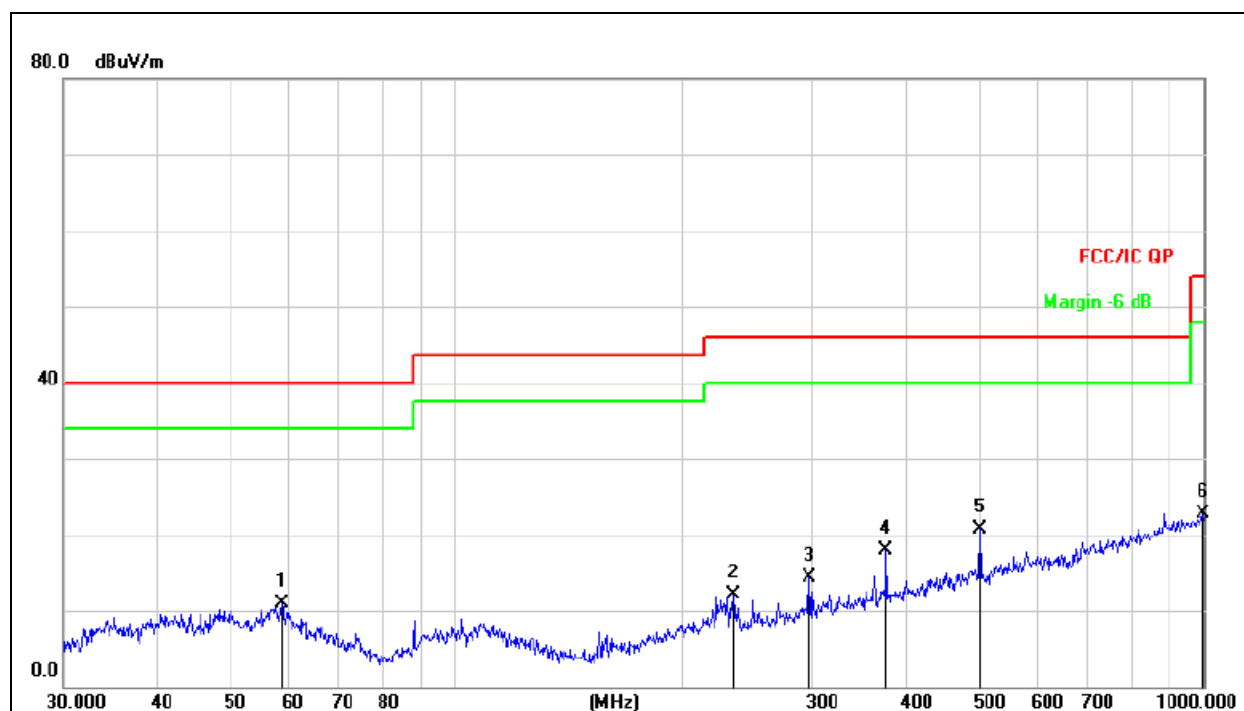


Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		48.8429	25.15	-14.91	10.24	40.00	-29.76	QP
2		104.1701	24.41	-16.55	7.86	43.50	-35.64	QP
3		300.3672	27.93	-13.59	14.34	46.00	-31.66	QP
4		417.6411	24.79	-10.69	14.10	46.00	-31.90	QP
5		714.1734	25.55	-4.91	20.64	46.00	-25.36	QP
6	*	906.4824	25.09	-1.45	23.64	46.00	-22.36	QP

Temperature:	26°C	Relative Humidity:	54%
Pressure:	101kPa	Test Voltage :	DC 6V
Test Mode :	Mode 2	Polarization :	Vertical



Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		58.6126	26.63	-15.76	10.87	40.00	-29.13	QP
2		234.9909	27.62	-15.50	12.12	46.00	-33.88	QP
3		297.2241	27.92	-13.69	14.23	46.00	-31.77	QP
4		375.9385	29.58	-11.64	17.94	46.00	-28.06	QP
5	*	501.1790	29.71	-8.91	20.80	46.00	-25.20	QP
6		996.4996	23.55	-0.83	22.72	54.00	-31.28	QP

Remark:

Test all the modes and only worst case was reported. The worst mode is GFSK, Low Channel.

Between 1-25GHz

Polar (H/V)	Frequency	Meter Reading	Pre-ampli fier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
GFSK Low Channel:2417MHz									
V	4834.00	50.86	35.91	8.11	29.36	52.42	74.00	-21.58	Pk
V	4834.00	43.91	35.91	8.11	29.36	45.47	54.00	-8.53	AV
V	7251.00	52.11	35.66	9.63	34.21	60.29	74.00	-13.71	Pk
V	7251.00	40.98	35.66	9.63	34.21	49.16	54.00	-4.84	AV
H	4834.00	51.01	35.91	8.11	29.36	52.57	74.00	-21.43	Pk
H	4834.00	43.85	35.91	8.11	29.36	45.41	54.00	-8.59	AV
H	7251.00	49.22	35.66	9.63	34.21	57.40	74.00	-16.60	Pk
H	7251.00	40.98	35.66	9.63	34.21	49.16	54.00	-4.84	AV

Polar (H/V)	Frequency	Meter Reading	Pre-ampli fier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
GFSK Middle Channel:2447MHz									
V	4894.00	53.97	35.89	8.23	29.47	55.78	74.00	-18.22	Pk
V	4894.00	43.34	35.89	8.23	29.47	45.15	54.00	-8.85	AV
V	7341.00	52.22	35.65	9.66	34.33	60.56	74.00	-13.44	Pk
V	7341.00	40.59	35.65	9.66	34.33	48.93	54.00	-5.07	AV
H	4894.00	54.96	35.89	8.23	29.47	56.77	74.00	-17.23	Pk
H	4894.00	43.64	35.89	8.23	29.47	45.45	54.00	-8.55	AV
H	7341.00	50.48	35.65	9.66	34.33	58.82	74.00	-15.18	Pk
H	7341.00	40.45	35.65	9.66	34.33	48.79	54.00	-5.21	AV

Polar (H/V)	Frequency	Meter Reading	Pre-ampli fier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detecto r Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
GFSK High Channel:2480MHz									
V	4960.00	53.04	35.83	8.32	29.51	55.04	74.00	-18.96	Pk
V	4960.00	43.63	35.83	8.32	29.51	45.63	54.00	-8.37	AV
V	7440.00	51.84	35.72	9.71	34.62	60.45	74.00	-13.55	Pk
V	7440.00	40.23	35.72	9.71	34.62	48.84	54.00	-5.16	AV
H	4960.00	54.68	35.83	8.32	29.51	56.68	74.00	-17.32	Pk
H	4960.00	43.78	35.83	8.32	29.51	45.78	54.00	-8.22	AV
H	7440.00	48.80	35.72	9.71	34.62	57.41	74.00	-16.59	Pk
H	7440.00	40.10	35.72	9.71	34.62	48.71	54.00	-5.29	AV

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier,
Margin= Emission Level - Limit
2. If peak below the average limit, the average emission was no test.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

7.5 RADIATED Band EMISSION MEASUREMENT

Test Requirement:

FCC Part15 C Section 15.209 and 15.205

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(²)
13.36-13.41			

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Limit (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	2300MHz
Stop Frequency	2520
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

TEST PROCEDURE

Above 1GHz test procedure as below:

- a. 1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.

- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- g. Test the EUT in the lowest channel,the Highest channel

Note:

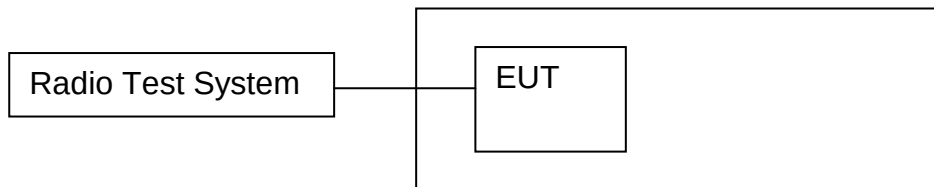
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

TEST RESULT

	Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre- amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission evel (dBuV/m)	Limits (dBuV/m)		Result
							PK	☐ PK	AV	
GFSK	Low Channel 2417MHz									
	H	2390.00	62.26	38.06	7.42	20.15	51.77	74.00	54.00	PASS
	H	2400.00	50.91	38.06	7.42	20.15	40.42	74.00	54.00	PASS
	V	2390.00	62.14	38.06	7.42	20.15	51.65	74.00	54.00	PASS
	V	2400.00	51.23	38.06	7.42	20.15	40.74	74.00	54.00	PASS
	High Channel 2480MHz									
	H	2483.50	60.66	38.17	7.45	20.54	50.48	74.00	54.00	PASS
	H	2485.50	53.43	38.17	7.45	20.54	43.25	74.00	54.00	PASS
	V	2483.50	61.08	38.17	7.45	20.54	50.90	74.00	54.00	PASS
	V	2485.50	50.89	38.17	7.45	20.54	40.71	74.00	54.00	PASS
Remark:										
1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier, Margin= Emission Level - Limit										
2. If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.										

8. CONDUCTED EMISSION

8.1 Block Diagram Of Test Setup



8.2 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)).

8.3 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:

Below 30MHz:

RBW = 100kHz, VBW = 300kHz, Sweep = auto

Detector function = peak, Trace = max hold

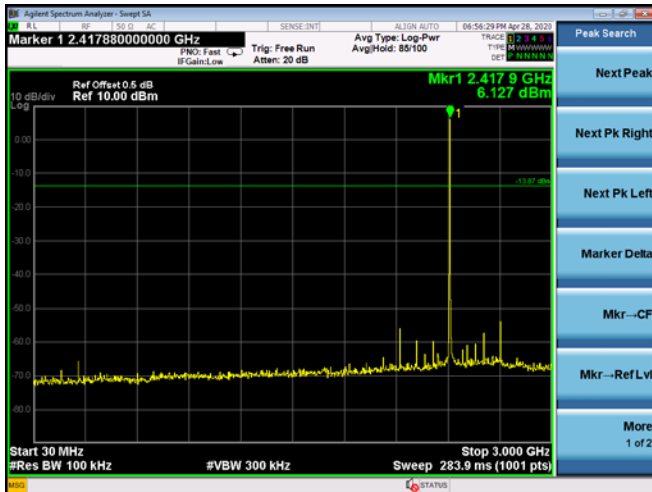
Above 30MHz:

RBW = 100KHz, VBW = 300KHz, Sweep = auto

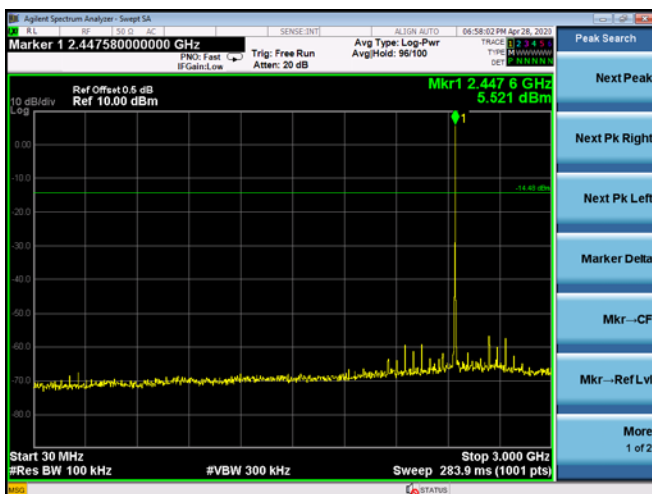
Detector function = peak, Trace = max hold

8.4 Test Result

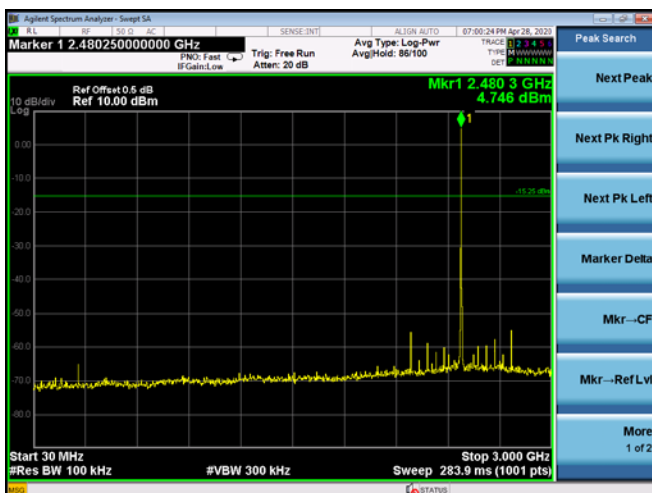
30MHz – 25GHz GFSK Low Channel



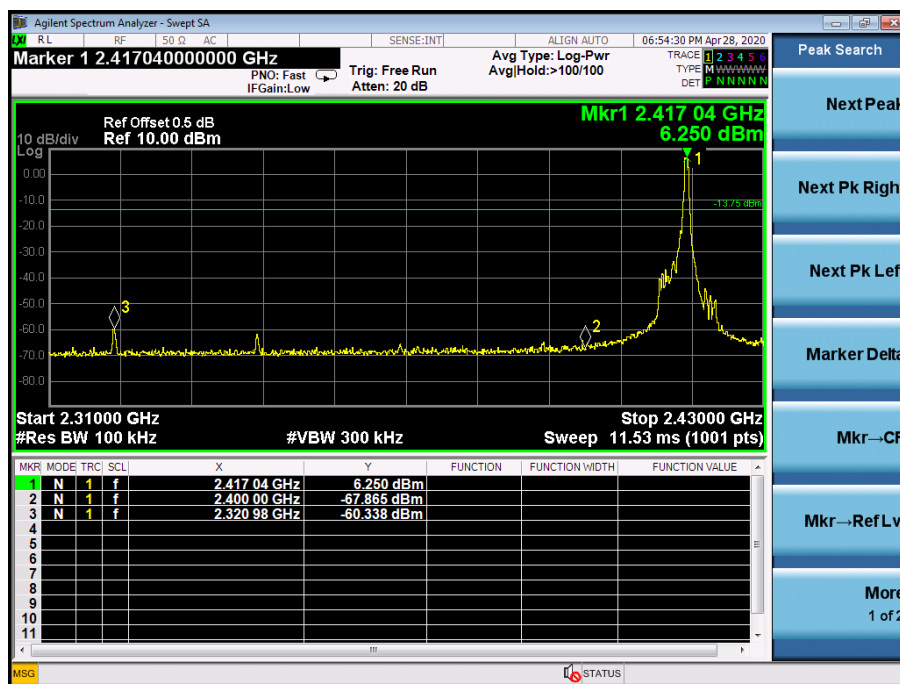
GFSK Middle Channel



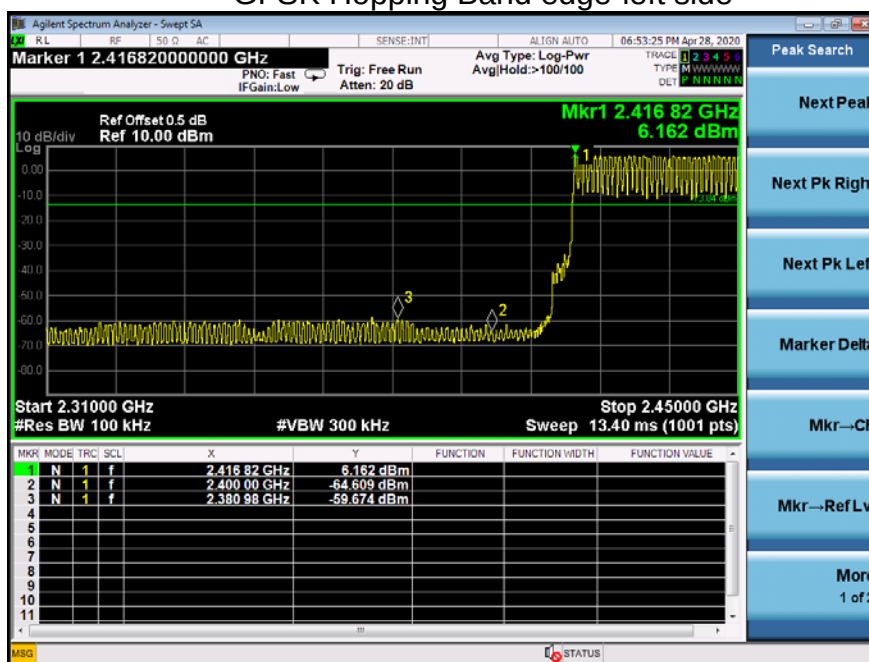
GFSK High Channel



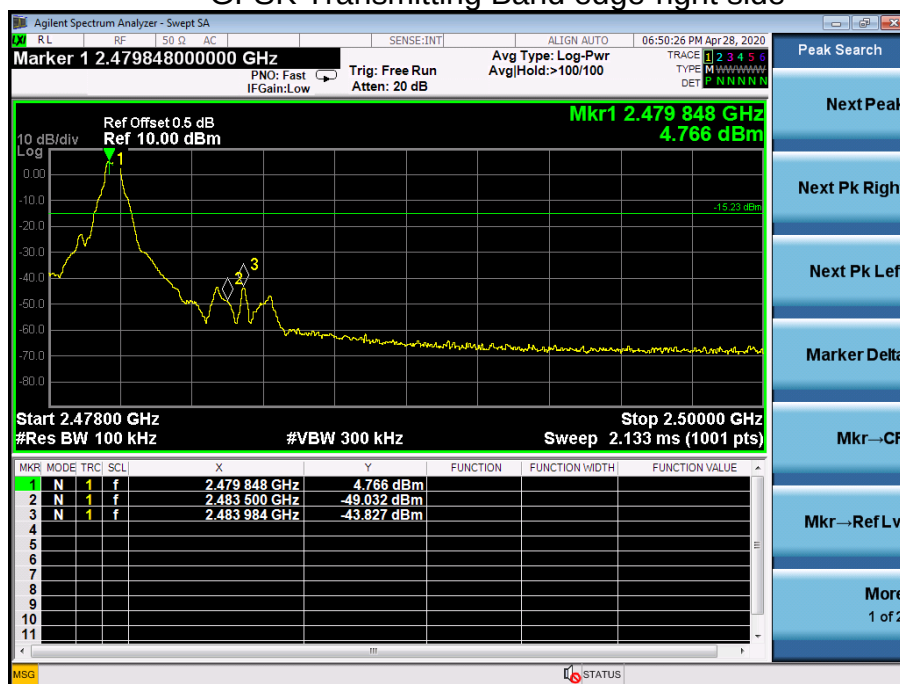
GFSK Transmitting Band edge-left side



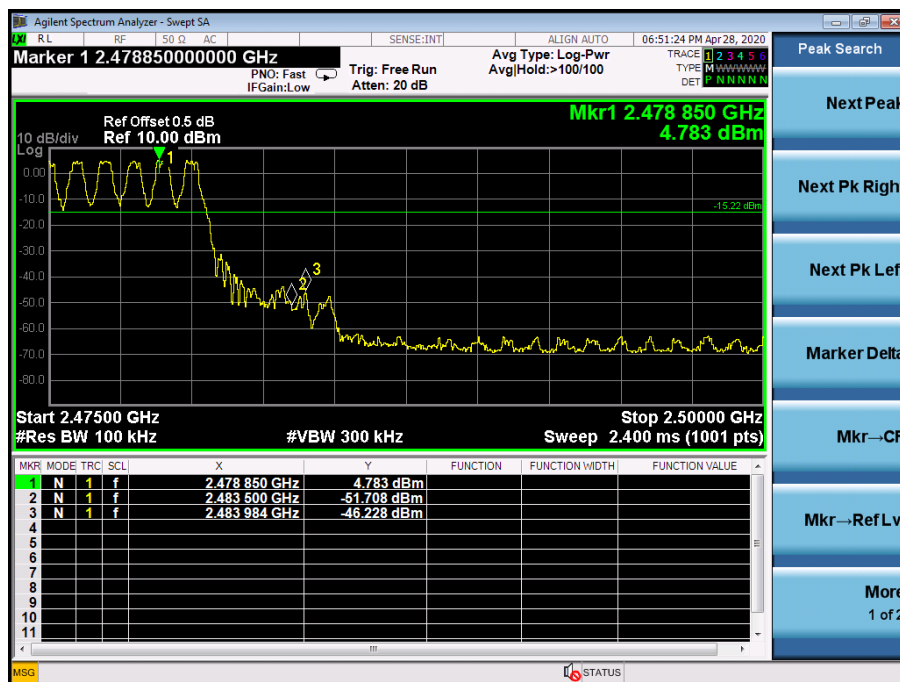
GFSK Hopping Band edge-left side



GFSK Transmitting Band edge-right side

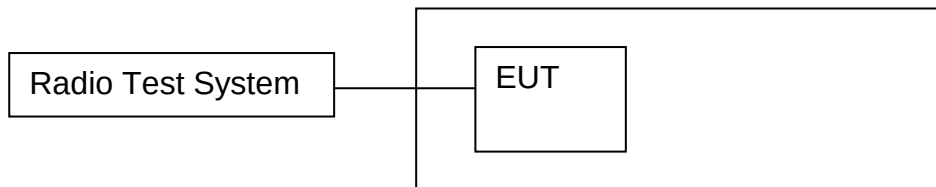


GFSK Hopping Band edge-right side



9. 20 DB BANDWIDTH

9.1 Block Diagram Of Test Setup



9.2 Limit

N/A

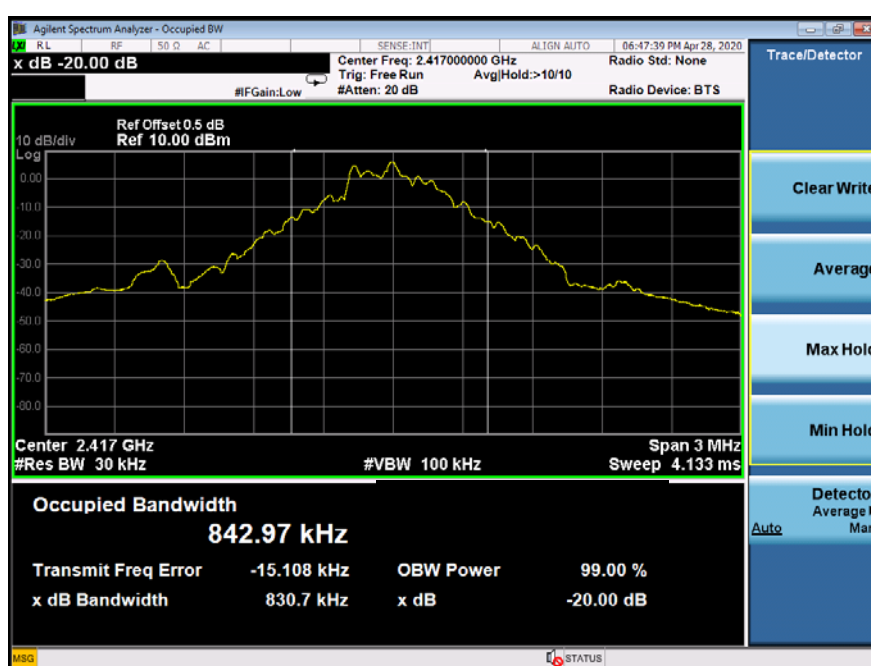
9.3 Test procedure

1. Set RBW = 30kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

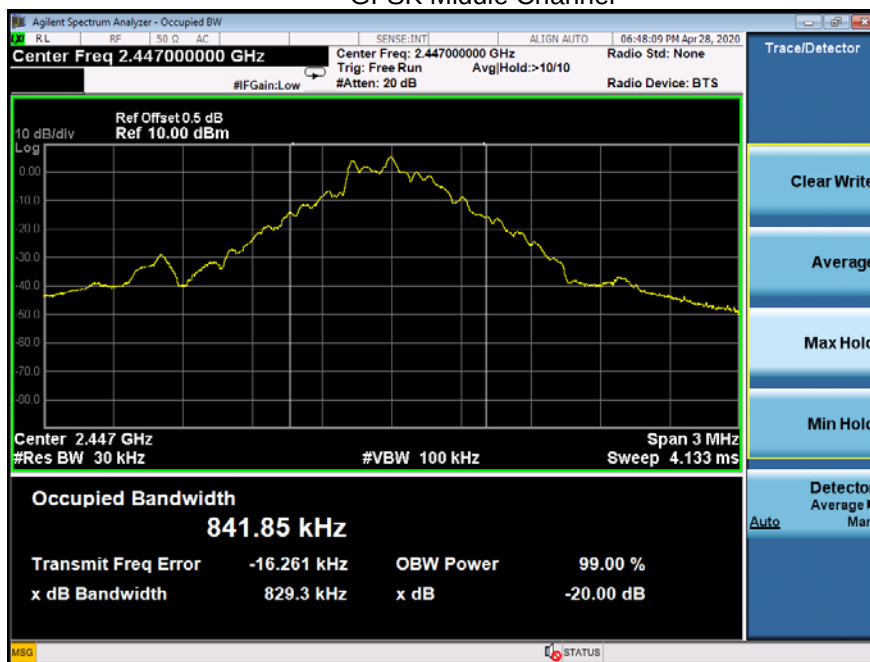
9.4 Test Result

Modulation	Test Channel	Bandwidth(MHz)
GFSK	Low	0.831
GFSK	Middle	0.829
GFSK	High	0.805

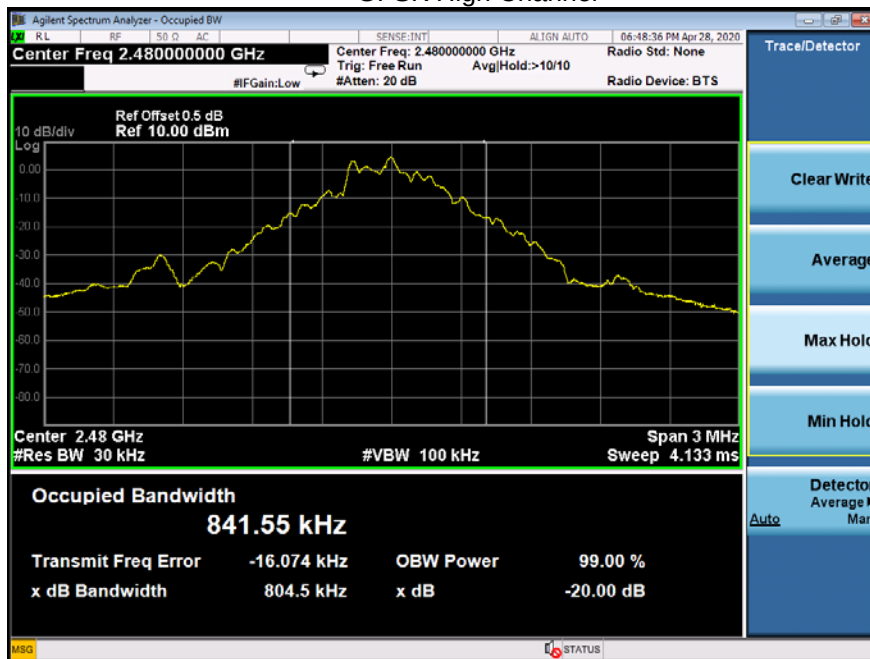
Test plots
GFSK Low Channel



GFSK Middle Channel

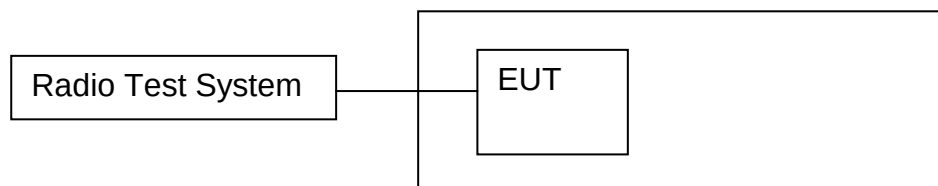


GFSK High Channel



10. MAXIMUM PEAK OUTPUT POWER

10.1 Block Diagram Of Test Setup



10.2 Limit

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.

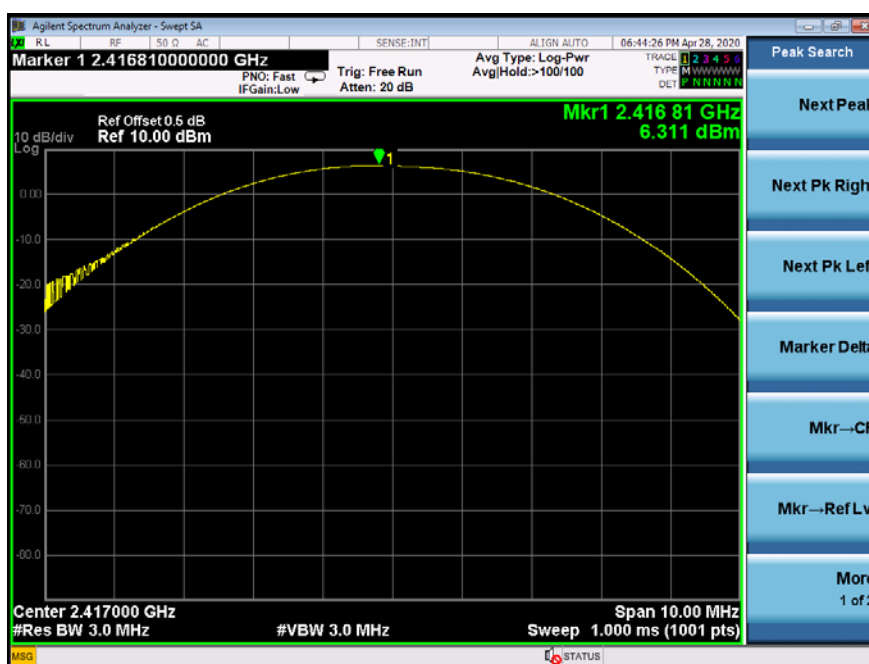
10.3 Test procedure

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.

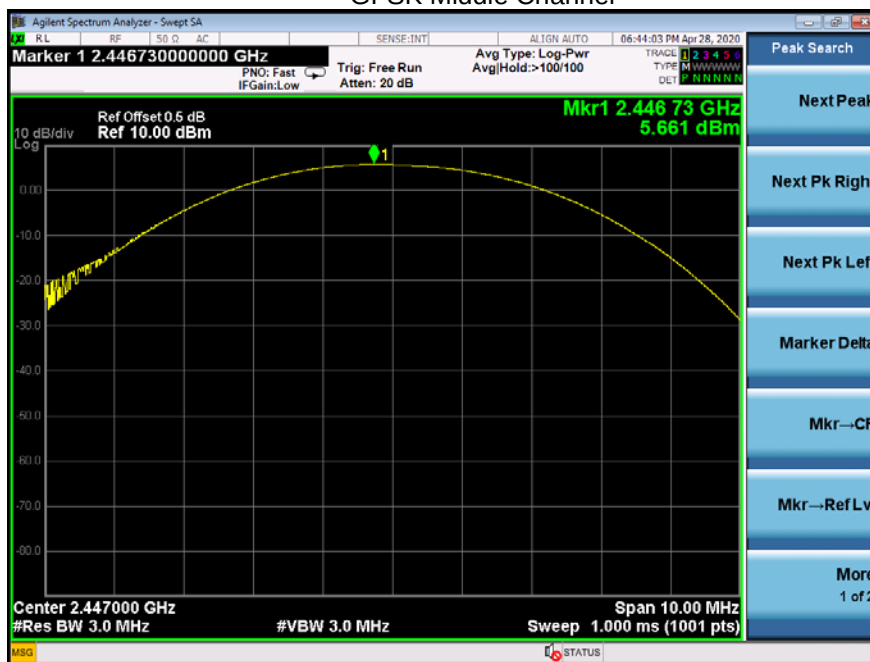
10.4 Test Result

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	6.31	21
GFSK	Middle	5.66	21
GFSK	High	4.91	21

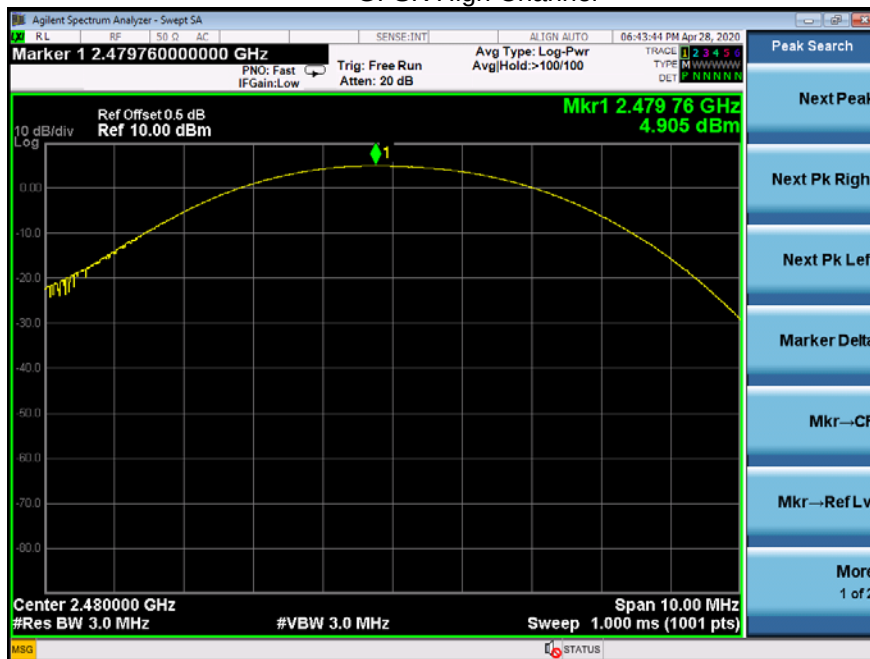
Test plots
GFSK Low Channel



GFSK Middle Channel

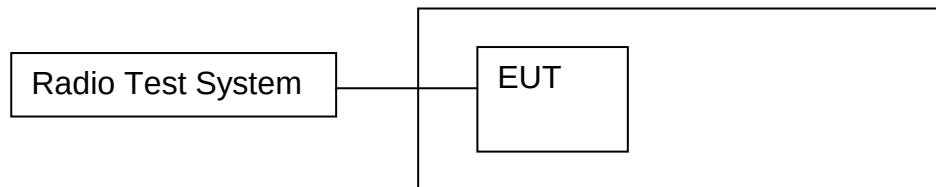


GFSK High Channel



11. HOPPING CHANNEL SEPARATION

11.1 Block Diagram Of Test Setup



11.2 Limit

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.

11.3 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 = 2.0MHz. 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.

11.4 Test Result

Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	1.000	0.554	PASS
GFSK	Middle	1.000	0.553	PASS
GFSK	High	1.006	0.537	PASS

Test plots
GFSK Low Channel



GFSK Middle Channel

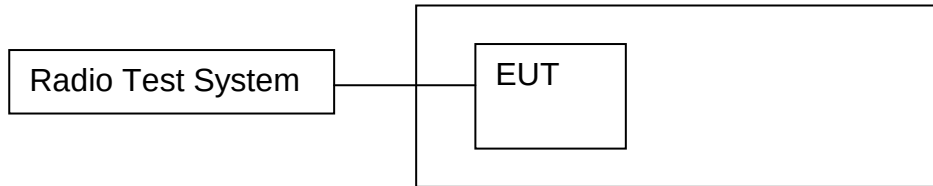


GFSK High Channel



12. NUMBER OF HOPPING FREQUENCY

12.1 Block Diagram Of Test Setup



12.2 Limit

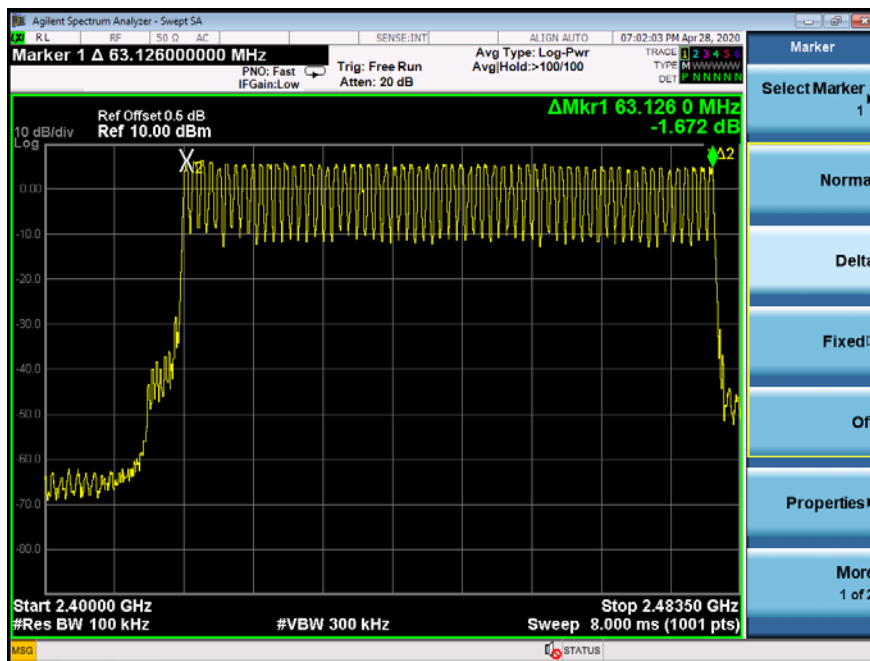
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

12.3 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.
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;

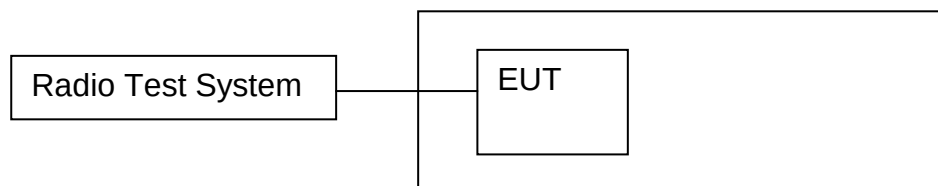
12.4 Test Result

Test Plots:
64 Channels in total
GFSK



13. DWELL TIME

13.1 Block Diagram Of Test Setup



13.2 Limit

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.

13.3 Test procedure

- 1) Span: Zero span, centered on a hopping channel.
- 2) RBW shall be $\leq$ channel spacing and where possible RBW should be set $\gg 1 / T$, where T is the expected dwell time per channel.
- 3) 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.
- 4) Detector function: Peak.
- 5) Trace: Max hold.

13.4 Test Result

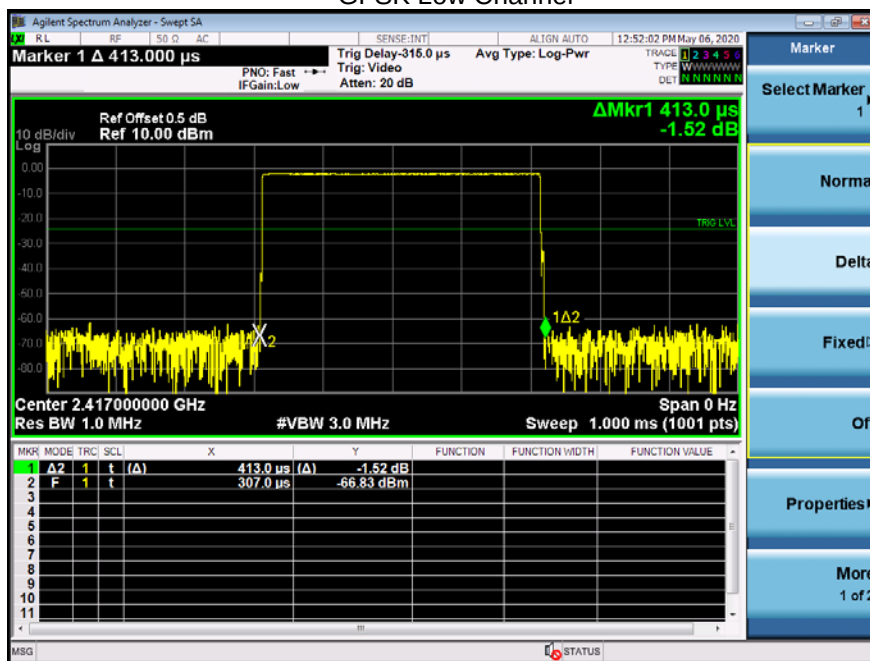
The dwell time within a period in data mode is independent from the packet type (packet length).

The test period: $T = 0.4 \text{ Second} * 64 \text{ Channel} = 25.6 \text{ s}$

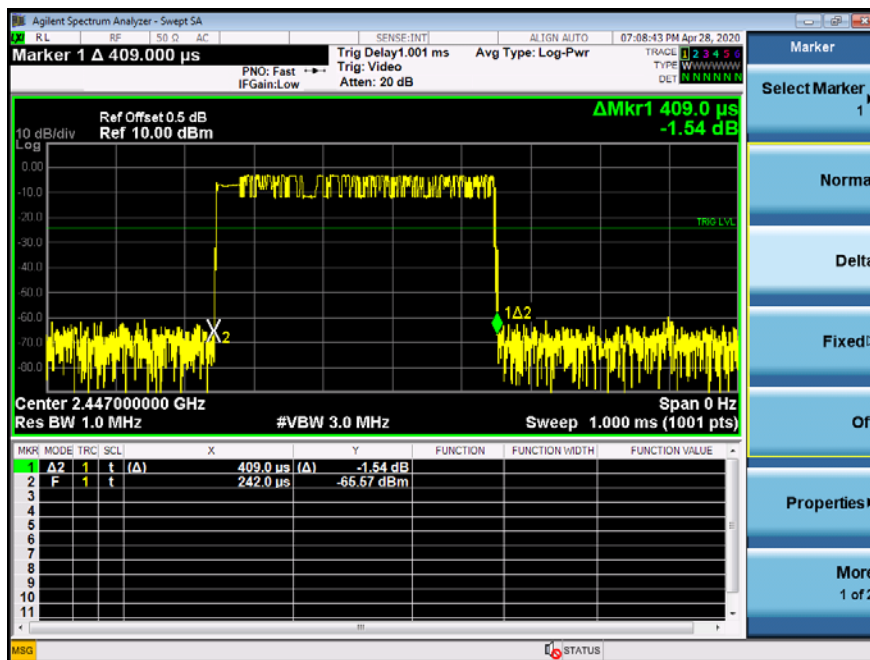
Total time occupancy= pulse time (ms) * Total bins

Modulation	Channel Data	pulse time(ms)	Time Occupancy (ms)	Limits(ms)	Results
GFSK	Low	0.413	43.778	400	Pass
GFSK	Middle	0.409	43.354	400	Pass
GFSK	Hight	0.413	43.778	400	Pass

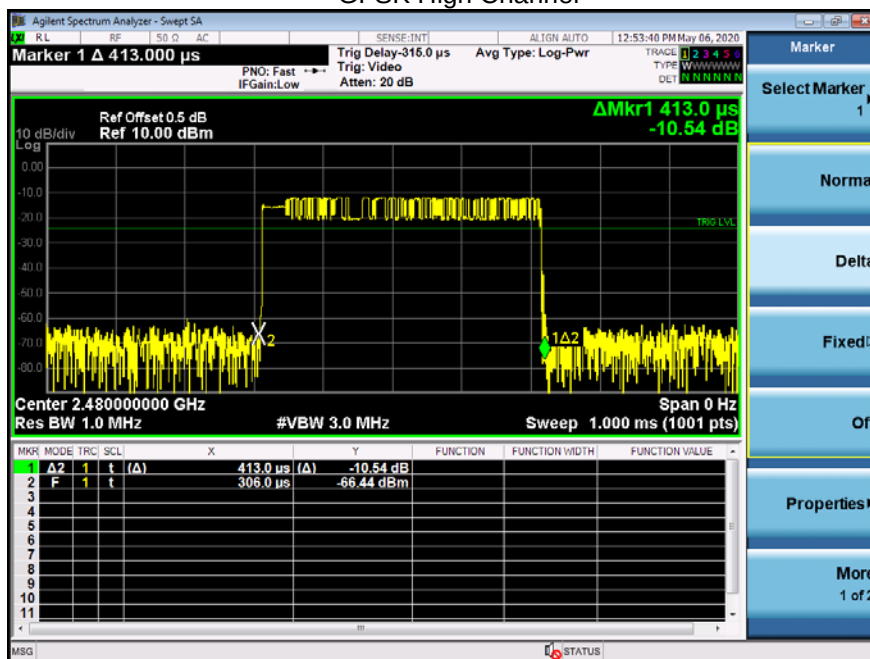
Test Plots
GFSK Low Channel



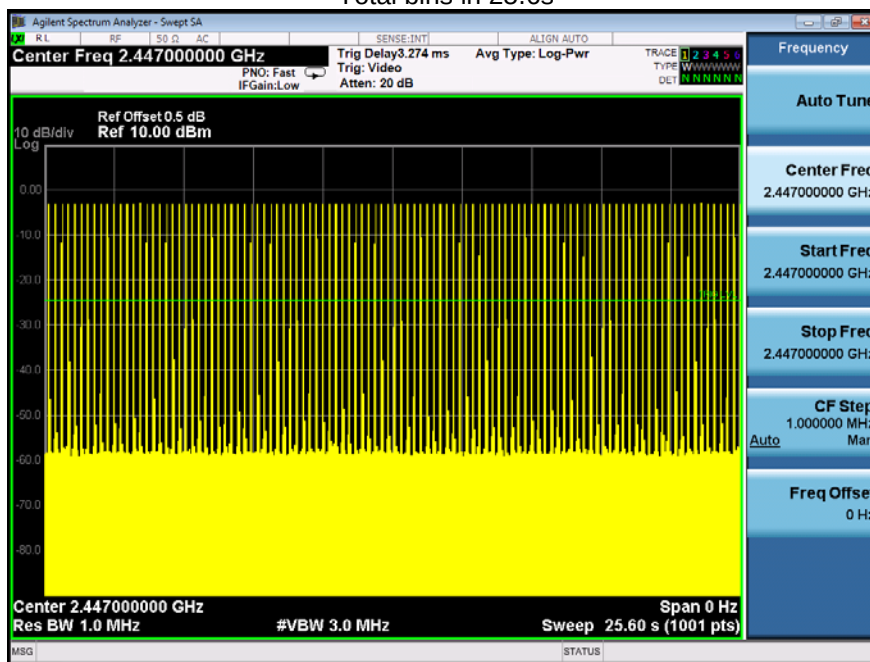
GFSK Middle Channel



GFSK High Channel



Total bins in 25.6s



Total bins in is 106

14. 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.

The EUT antenna is Internal Antenna, antenna Gain 0dBi. It comply with the standard requirement.

15. EUT PHOTOGRAPHS



16. EUT TEST SETUP PHOTOGRAPHS

Spurious emissions



***** END OF REPORT *****