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TEST REPORT

Report Reference No. ..... :	**CHTEW2012013502**	Report verification:
Project No. ..... :	**SHT2012030407EW**	
FCC ID ..... :	**ZSW-30-075**	
Applicant's name ..... :	**b mobile HK Limited**	
Address.....:	Flat 18; 14/F Block 1; Golden Industrial Building;16-26 Kwai Tak Street; Kwai Chung; New Territories; Hong Kong.	
Manufacturer.....:	b mobile HK Limited	
Address.....:	Flat 18; 14/F Block 1; Golden Industrial Building;16-26 Kwai Tak Street; Kwai Chung; New Territories; Hong Kong.	
Test item description ..... :	**Mobile Phone**	
Trade Mark .....:	Bmobile	
Model/Type reference.....:	AX687	
Listed Model(s) .....:	AX687+, AX689	
Standard ..... :	**FCC CFR Title 47 Part 15 Subpart C Section 15.247**	
Date of receipt of test sample…….....:	Dec. 09, 2020	
Date of testing……..:	Dec. 10, 2020- Dec. 21, 2020	
Date of issue……....:	Dec. 22, 2020	
Result..... ……..:	**PASS**	

Compiled by (Position+Printed name+Signature):	File administrators Silvia Li	Silvia Li
Supervised by (Position+Printed name+Signature):	Project Engineer Aaron Fang	Aaron.Fang
Approved by (Position+Printed name+Signature):	RF Manager Hans Hu	Hans Hu

Testing Laboratory Name ..... :	**Shenzhen Huatongwei International Inspection Co., Ltd.**
Address.....:	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

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1. TEST STANDARDS AND REPORT VERSION

1.1. Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

ANSI C63.10-2013: American National Standard forTesting Unlicensed Wireless Devicese

1.2. Report version

Revision No.	Date of issue	Description
N/A	2020-12-22	Add list models, update supplier of power IC,make difference test on Spurious Emissions (radiated), others are the same as report No. TRE1810027103

2. TEST DESCRIPTION

Test Item	Section in CFR 47	Result	Test Engineer
Antenna Requirement	15.203/15.247 (c)	PASS	Xiaokang Tan
AC Power Line Conducted Emissions	15.207	PASS	Tony Duan
Conducted Peak Output Power	15.247 (b)(1)	PASS	Xiaokang Tan
20 dB Bandwidth	15.247 (a)(1)	PASS	Xiaokang Tan
Carrier Frequencies Separation	15.247 (a)(1)	PASS	Xiaokang Tan
Hopping Channel Number	15.247 (a)(1)	PASS	Xiaokang Tan
Dwell Time	15.247 (a)(1)	PASS	Xiaokang Tan
Pseudorandom Frequency Hopping Sequence	15.247(b)(4)	PASS	Xiaokang Tan
Restricted band	15.247(d)/15.205	PASS	Shower Dai
Radiated Emissions	15.247(d)/15.209	PASS	Pan Xie

Note: The measurement uncertainty is not included in the test result.

3. SUMMARY

3.1. Client Information

Applicant:	b mobile HK Limited
Address:	Flat 18; 14/F Block 1; Golden Industrial Building;16-26 Kwai Tak Street; Kwai Chung; New Territories; Hong Kong.
Manufacturer:	b mobile HK Limited
Address:	Flat 18; 14/F Block 1; Golden Industrial Building;16-26 Kwai Tak Street; Kwai Chung; New Territories; Hong Kong.

3.2. Product Description

Name of EUT:	Mobile Phone
Trade Mark:	Bmobile
Model No.:	AX687
Listed Model(s):	AX687+, AX689
IMEI:	Conducted: 863595039996835 Radiated: 863595039996892
Power supply:	DC 3.7V
Adapter information:	Input:100-240Va.c. 50/60Hz 0.2A Output:5.0Vd.c. 500mA
Hardware version:	FS280-MB-V7.0
Software version:	V01
Bluetooth	
Version:	Supported BT4.2+EDR
Modulation:	GFSK, π/4DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	PIFA Antenna
Antenna gain:	0.5dBi

3.3. Operation state

➢ **Test frequency list**

According to section 15.31(m), regards to the operating frequency range over 10 MHz, must select three channel which were tested. the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, please see the above gray bottom.

Channel	Frequency (MHz)
00	2402
01	2403
⋮	⋮
39	2441
⋮	⋮
77	2479
78	2480

➢ **TEST MODE**

For RF test items:
The engineering test program was provided and enabled to make EUT continuous transmit
For AC power line conducted emissions:
The EUT was set to connect with the Bluetooth instrument under large package sizes transmission.
For Radiated suprious emissions test item:
The engineering test program was provided and enabled to make EUT continuous transmit. The EUT in each of three orthogonal axis emissions had been tested ,but only the worst case (X axis) data recorded in the report.

3.4. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- ● - supplied by the manufacturer
- ○ - supplied by the lab

	/	Manufacturer:	/
		Model No.:	/
	/	Manufacturer:	/
		Model No.:	/

3.5. Modifications

No modifications were implemented to meet testing criteria.

4. TEST ENVIRONMENT

4.1. Address of the test laboratory

Laboratory: Shenzhen Huatongwei International Inspection Co., Ltd.
Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

4.2. Test Facility

CNAS-Lab Code: L1225

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No.: 3902.01

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 762235

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files.

IC-Registration No.:5377A

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No.: 5377A.

ACA

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

4.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15~35°C
Relative Humidity:	30~60 %
Air Pressure:	950~1050mba

4.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors in calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report according to TR-100028-01 “Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1” and TR-100028-02 “Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2” and is documented in the Shenzhen Huatongwei International Inspection Co., Ltd. quality system according to ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Here after the best measurement capability for Shenzhen Huatongwei International Inspection Co., Ltd. is reported:

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Conducted spurious emissions 9kHz~40GHz	1.60 dB	(1)
Radiated spurious emissions 9kHz~40GHz	2.20 dB	(1)
Conducted Emissions 9kHz~30MHz	3.39 dB	(1)
Radiated Emissions 30~1000MHz	4.24 dB	(1)
Radiated Emissions 1~18GHz	5.16 dB	(1)
Radiated Emissions 18~40GHz	5.54 dB	(1)
Occupied Bandwidth	---------	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

4.5. Equipments Used during the Test

Conducted Emissions						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. (mm-dd-yy)	Next Cal. (mm-dd-yy)
1	EMI Test Receiver	R&S	ESCI	101247	10/27/2018	10/26/2019
2	Artificial Mains	SCHWARZBECK	NNLK 8121	573	10/27/2018	10/26/2019
3	Pulse Limiter	R&S	ESH3-Z2	101488	10/27/2018	10/26/2019
4	RF Connection Cable	HUBER+SUHNER	EF400	N/A	11/21/2017	11/20/2018
5	Test Software	R&S	ES-K1	N/A	N/A	N/A

Radiated Emissions(Below 1GHz)						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. (mm-dd-yy)	Next Cal. (mm-dd-yy)
1	Semi-Anechoic Chamber	Albatross projects	SAC-3m-02	C11121	2018/09/30	2021/09/29
2	EMI Test Receiver	R&S	ESCI	100900	2020/10/19	2021/10/18
3	Loop Antenna	R&S	HFH2-Z2	100020	2018/04/02	2021/04/02
4	Ultra-Broadband Antenna	SCHWARZBECK	VULB9163	546	2020/04/28	2023/04/27
5	Pre-amplifer	SCHWARZBECK	BBV 9742	N/A	2020/11/12	2021/11/11
6	RF Connection Cable	HUBER+SUHNER	N/A	N/A	2020/05/27	2021/05/26
7	RF Connection Cable	HUBER+SUHNER	SUCOFLEX104	501184/4	2020/05/27	2021/05/26
8	Test Software	R&S	ES-K1	N/A	N/A	N/A
9	Turntable	Maturo Germany	TT2.0-1T	N/A	N/A	N/A
10	Antenna Mast	Maturo Germany	TAM-4.0-P	N/A	N/A	N/A
11	Temperature and Humidity Meter	KEJIAN	KJ03	N/A	N/A	N/A

Radiated Emissions(Above 1GHz)						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. (mm-dd-yy)	Next Cal. (mm-dd-yy)
1	Anechoic Chamber	Albatross projects	SAC-3m-01	C11121	09/30/2018	09/29/2021
2	Horn Antenna	SCHWARZBECK	9120D	1011	03/27/2017	03/26/2020
3	Preamplifier	BONN	BLWA0160-2M	1811887	11/14/2018	11/13/2019
4	Broadband Pre-amplifier	SCHWARZBECK	BBV 9718	9718-248	04/28/2018	04/27/2019
5	Spectrum Analyzer	R&S	FSP40	100597	10/27/2018	10/26/2019
6	RF Connection Cable	HUBER+SUHNER	RE-7-FL	N/A	11/15/2018	11/14/2019
7	RF Connection Cable	HUBER+SUHNER	RE-7-FH	N/A	11/15/2018	11/14/2019
8	Test Software	Audix	E3	N/A	N/A	N/A
9	Turntable	Maturo Germany	TT2.0-1T	N/A	N/A	N/A
10	Antenna Mast	Maturo Germany	CAM-4.0-P-12	N/A	N/A	N/A
11	Temperature and Humidity Meter	MINGLE	YH101	N/A	10/30/2018	10/29/2019

RF Conducted Test						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. (mm-dd-yy)	Next Cal. (mm-dd-yy)
1	Spectrum Analyzer	R&S	FSV40	100048	11/11/2017	11/10/2018
2	EXA Signal Analyzer	Agilent	N9020A	184247	9/29/2018	9/28/2019
3	OSP	R&S	OSP120	101317	N/A	N/A

5. TEST CONDITIONS AND RESULTS

5.1. Antenna requirement

Requirement

FCC CFR Title 47 Part 15 Subpart C 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 use of a permanently attached antenna or of anantenna that uses a unique coupling to the intentional radiator, 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.

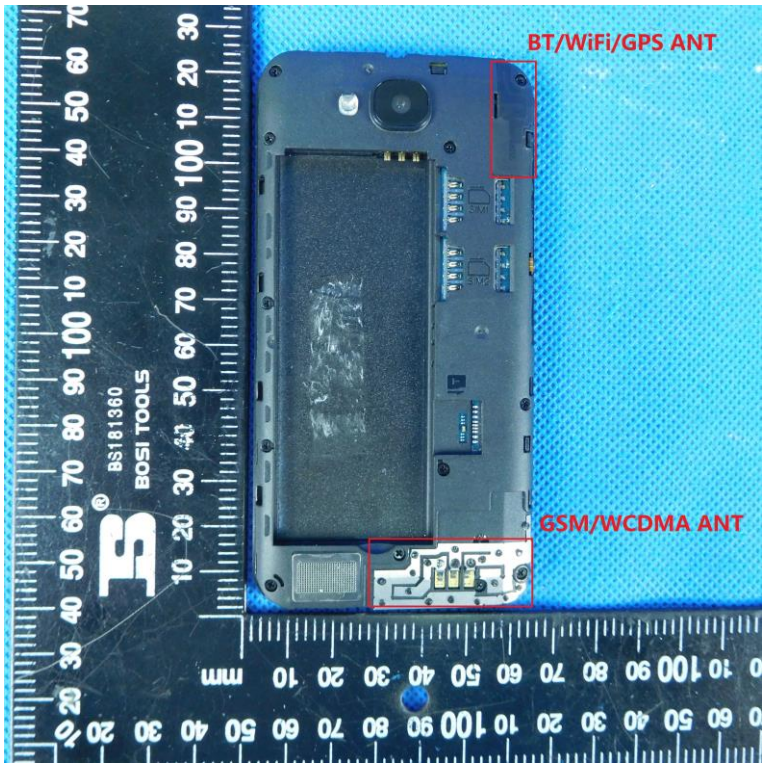
FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):

(i) Systems operating in the 2400~2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Test Result:

☒ **Passed** ☐ **Not Applicable**

The directional gain of the antenna less than 6 dBi, please refer to the below antenna photo.



5.2. Conducted Emissions (AC Main)

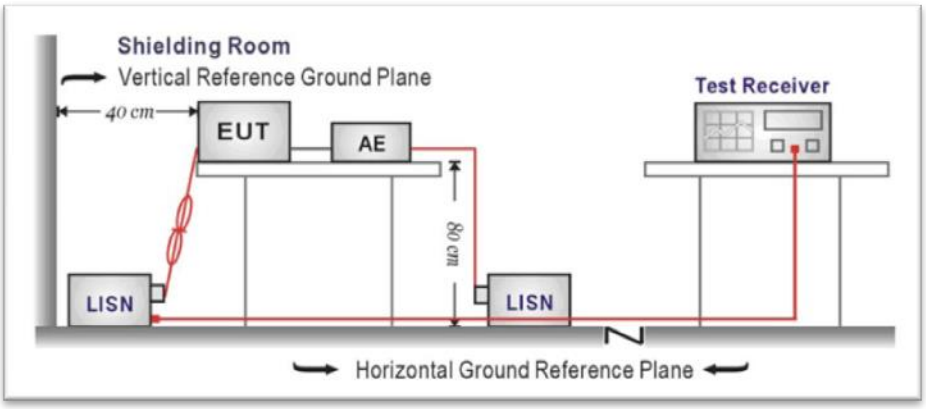
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST CONFIGURATION



TEST PROCEDURE

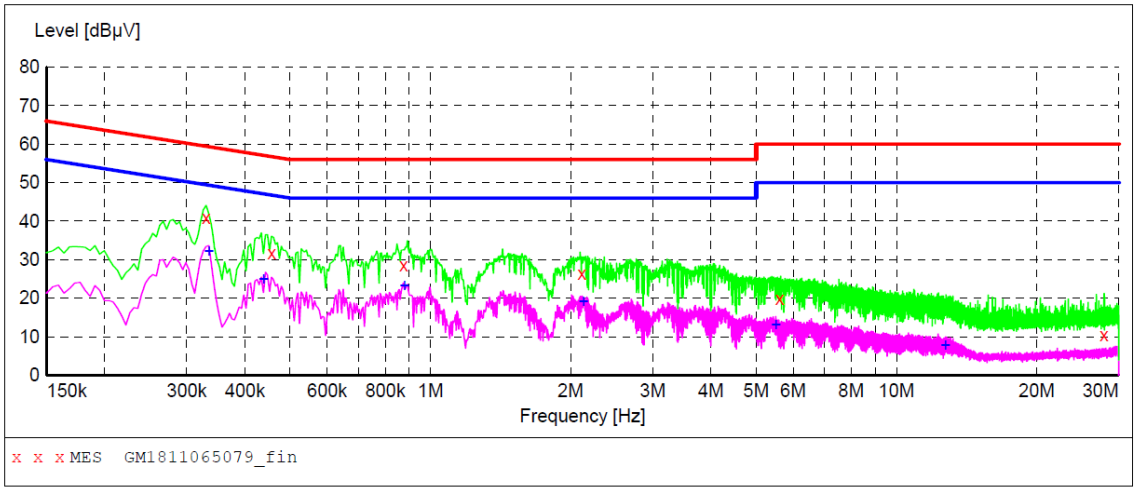
1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment.
4. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
5. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor,was individually connected through a LISN to the input power source.
6. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
7. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Note:
1) Transd= Cable lose + Pulse Limiter Factor + Artificial Mains Factor
2) Margin= Limit - Level

Test Line:	L



MEASUREMENT RESULT: "GM1811065079_fin"

11/6/2018 6:18PM

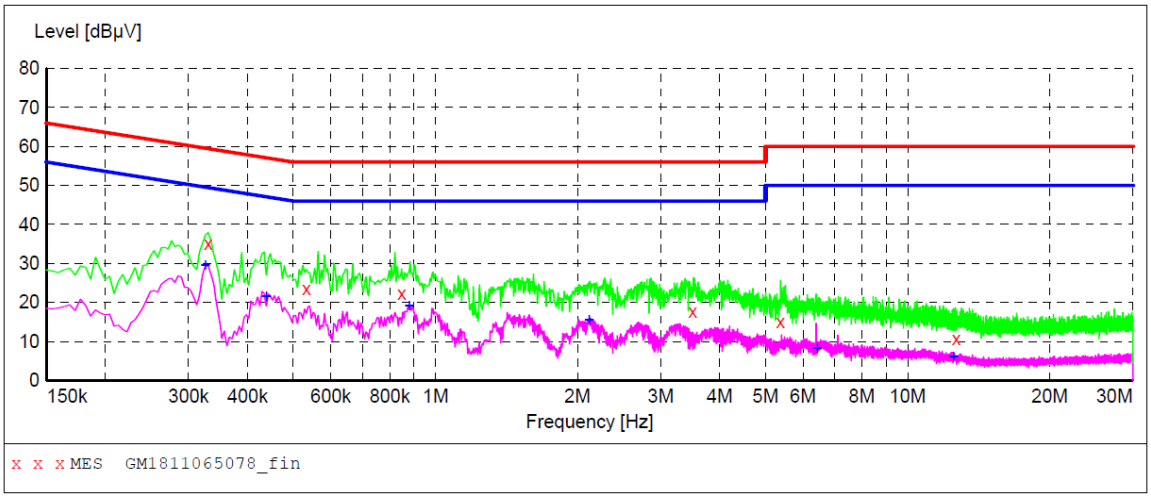
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.330000	40.80	10.1	60	18.7	QP	L1	GND
0.456000	31.70	10.1	57	25.1	QP	L1	GND
0.874500	28.50	9.9	56	27.5	QP	L1	GND
2.112000	26.50	10.0	56	29.5	QP	L1	GND
5.608500	19.90	10.0	60	40.1	QP	L1	GND
27.888000	10.30	10.5	60	49.7	QP	L1	GND

MEASUREMENT RESULT: "GM1811065079_fin2"

11/6/2018 6:18PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.334500	32.20	10.1	49	17.1	AV	L1	GND
0.438000	24.90	10.1	47	22.2	AV	L1	GND
0.879000	23.20	9.9	46	22.8	AV	L1	GND
2.130000	19.00	10.0	46	27.0	AV	L1	GND
5.505000	13.20	10.0	50	36.8	AV	L1	GND
12.718500	7.90	10.2	50	42.1	AV	L1	GND

Test Line:	N



MEASUREMENT RESULT: "GM1811065078_fin"

11/6/2018 6:15PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.330000	35.00	10.1	60	24.5	QP	N	GND
0.532500	23.40	10.0	56	32.6	QP	N	GND
0.847500	22.20	9.9	56	33.8	QP	N	GND
3.502500	17.70	10.0	56	38.3	QP	N	GND
5.374500	14.90	10.0	60	45.1	QP	N	GND
12.655500	10.70	10.2	60	49.3	QP	N	GND

MEASUREMENT RESULT: "GM1811065078_fin2"

11/6/2018 6:15PM

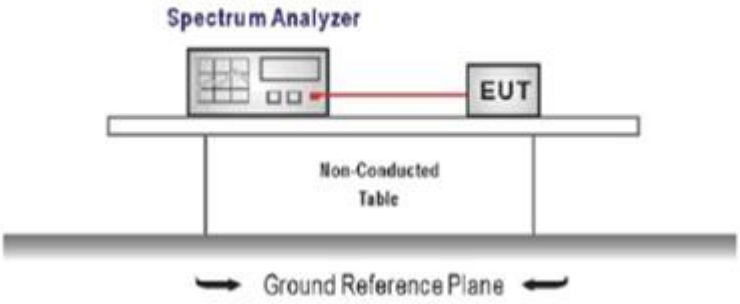
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.325500	29.50	10.1	50	20.1	AV	N	GND
0.438000	21.50	10.1	47	25.6	AV	N	GND
0.879000	19.00	9.9	46	27.0	AV	N	GND
2.116500	15.50	10.0	46	30.5	AV	N	GND
6.432000	8.20	10.0	50	41.8	AV	N	GND
12.507000	6.00	10.2	50	44.0	AV	N	GND

5.3. Conducted Peak Output Power

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 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 CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the pathloss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
   RBW≥ the 20 dB bandwidth of the emission being measured, VBW≥RBW
   Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

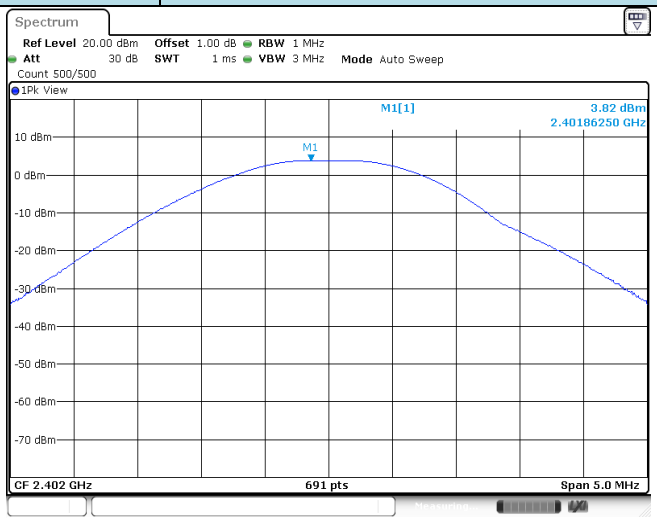
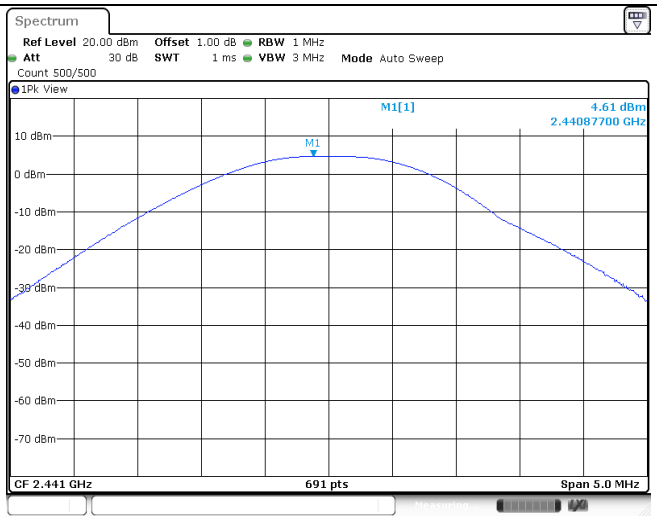
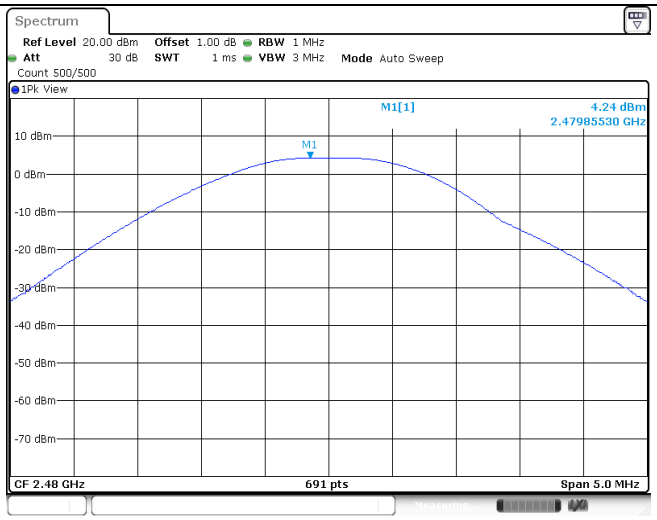
TEST MODE:

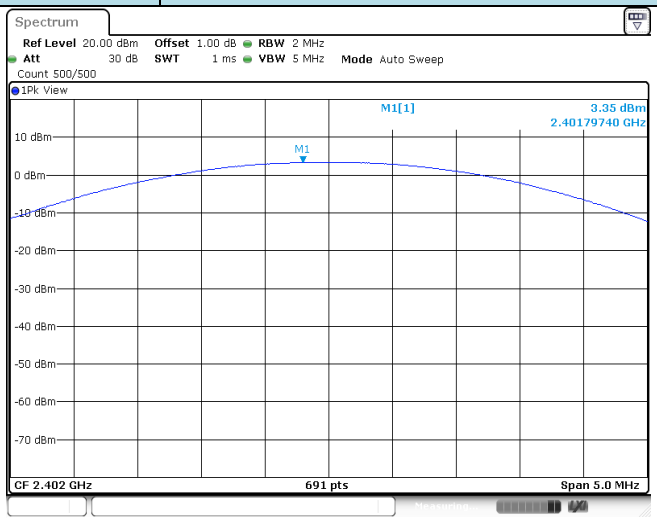
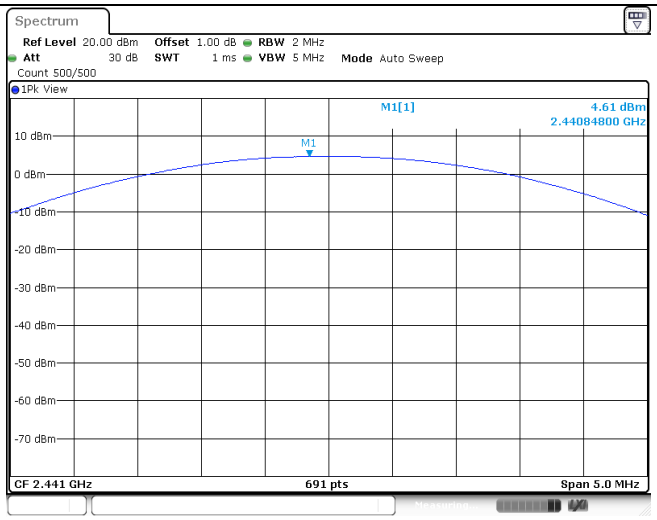
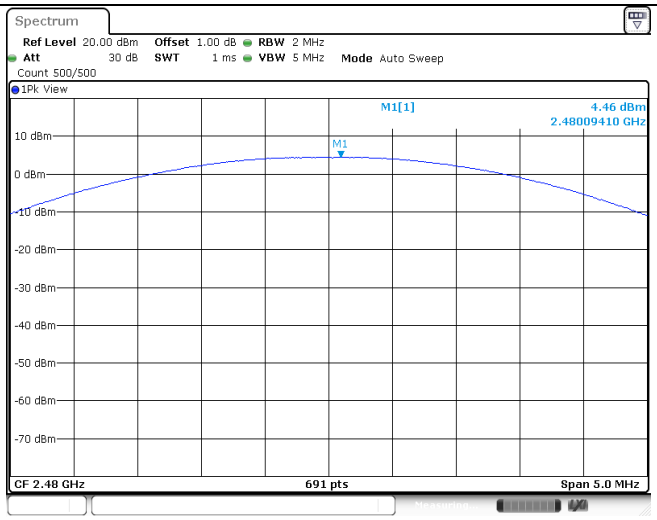
Please refer to the clause 3.3

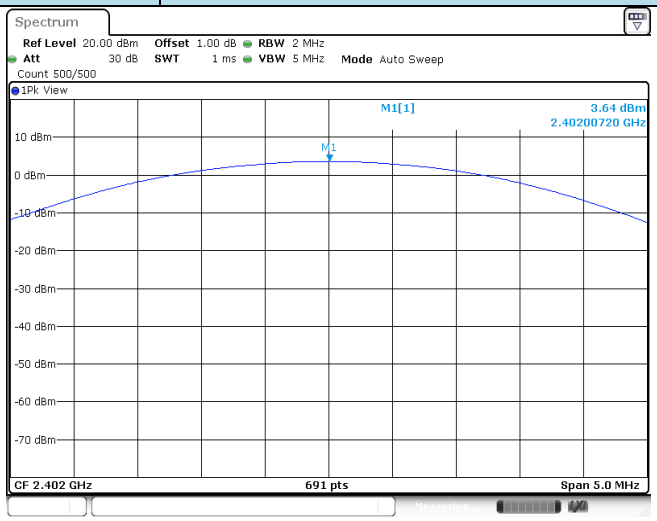
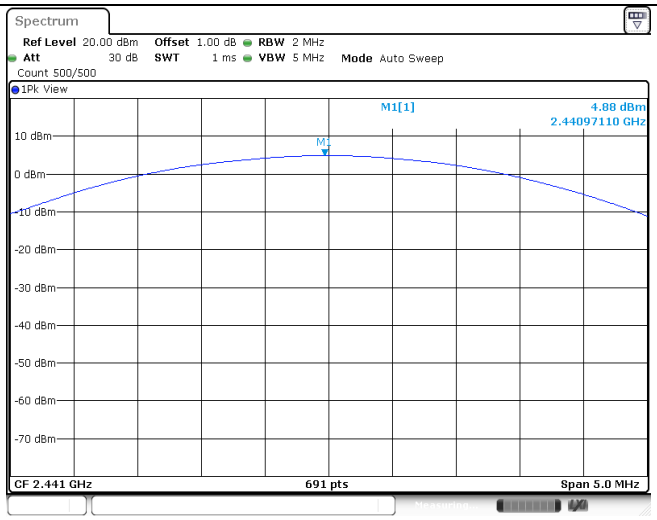
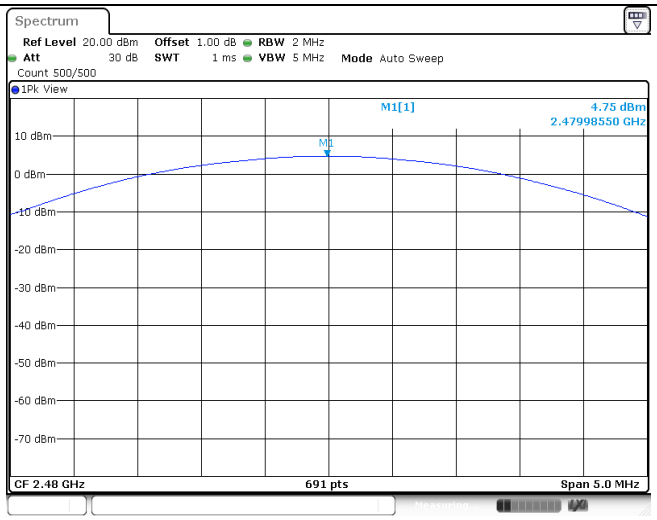
TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Modulation type	Channel	Output power (dBm)	Limit (dBm)	Result
GFSK	00	3.82	≤ 30.00	Pass
	39	4.61		
	78	4.24		
π/4DQPSK	00	3.35	≤ 21.00	Pass
	39	4.61		
	78	4.46		
8DPSK	00	3.64	≤ 21.00	Pass
	39	4.88		
	78	4.75		

Modulation Type:	GFSK
CH00	
CH39	
CH78	

Modulation Type:	π/4DQPSK
CH00	
CH39	
CH78	

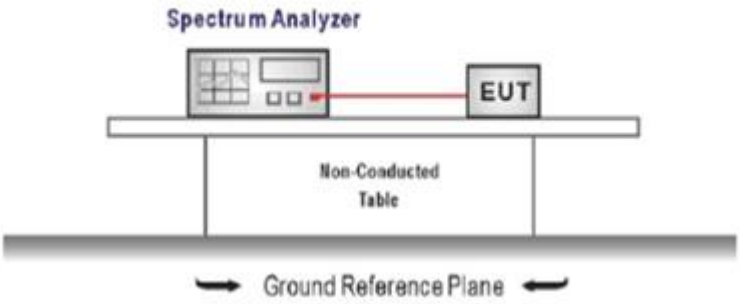
Modulation Type:	8DPSK
CH00	
CH39	
CH78	

5.4. 20 dB Bandwidth

LIMIT

N/A

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
   RBW ≥ 1% of the 20 dB bandwidth, VBW ≥ RBW
   Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

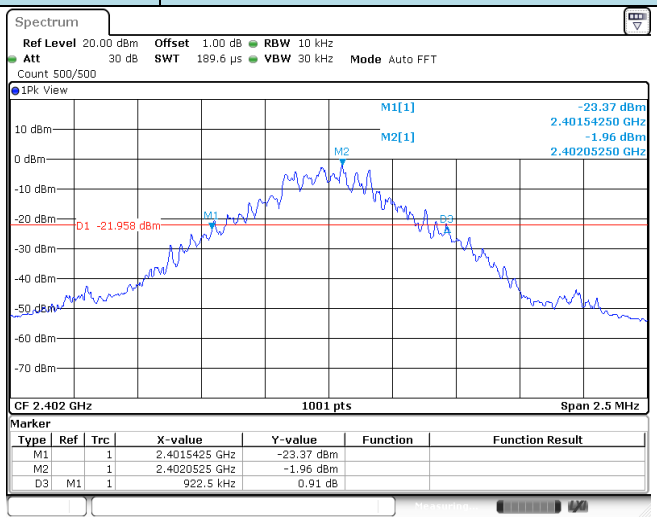
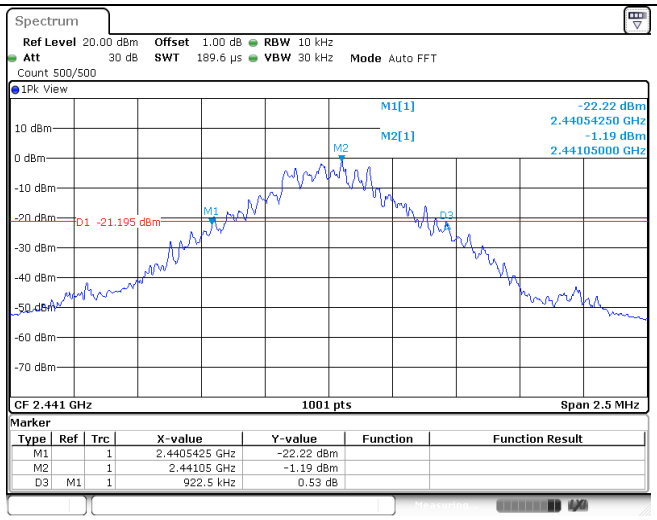
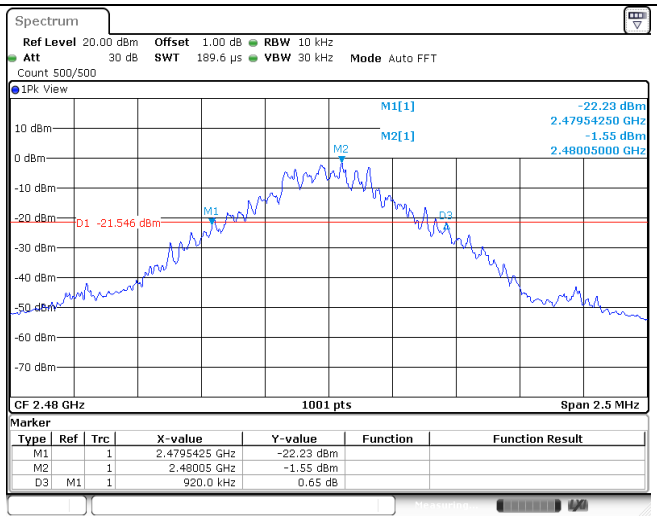
TEST MODE:

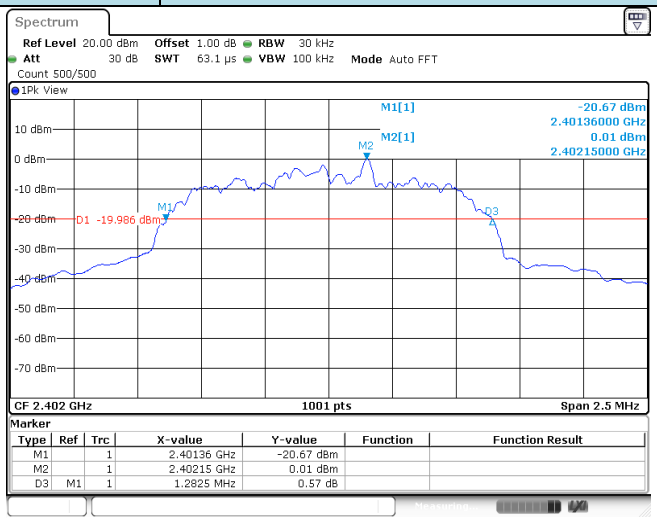
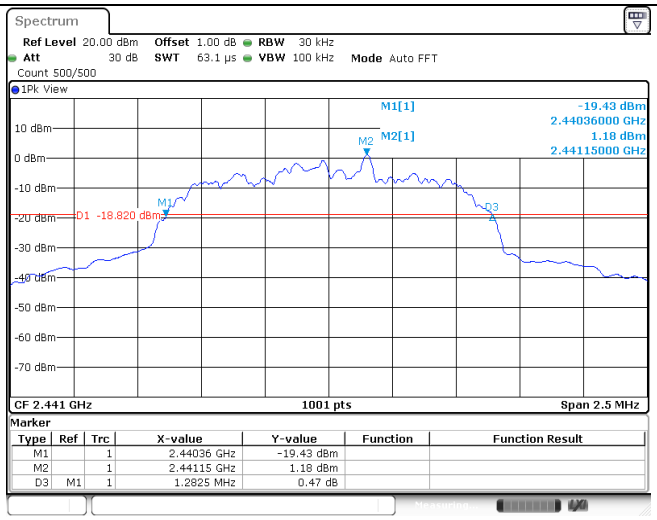
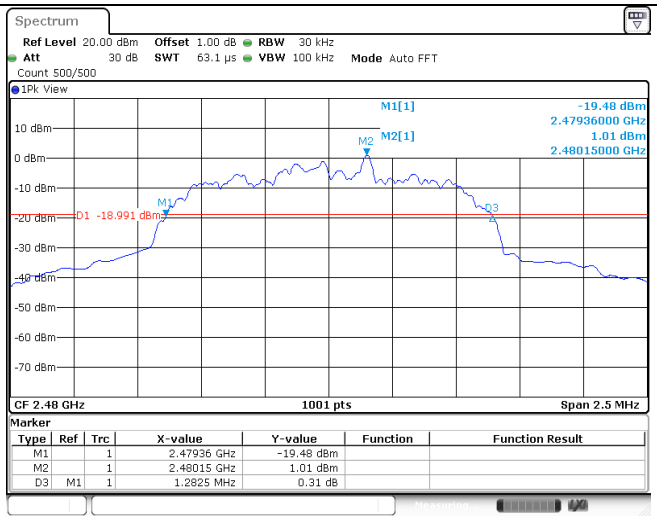
Please refer to the clause 3.3

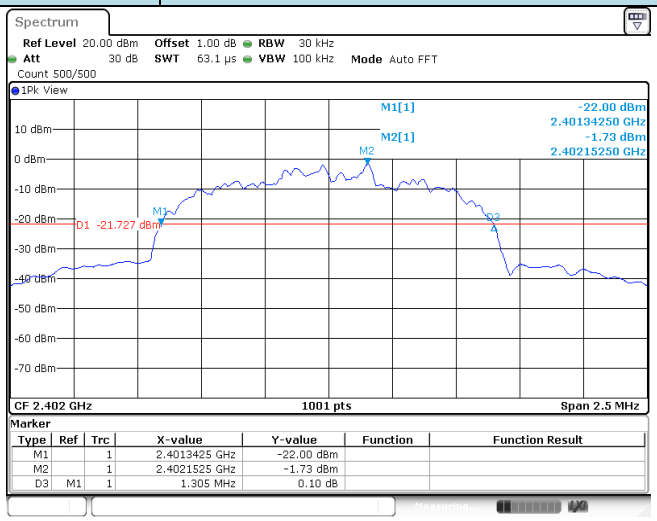
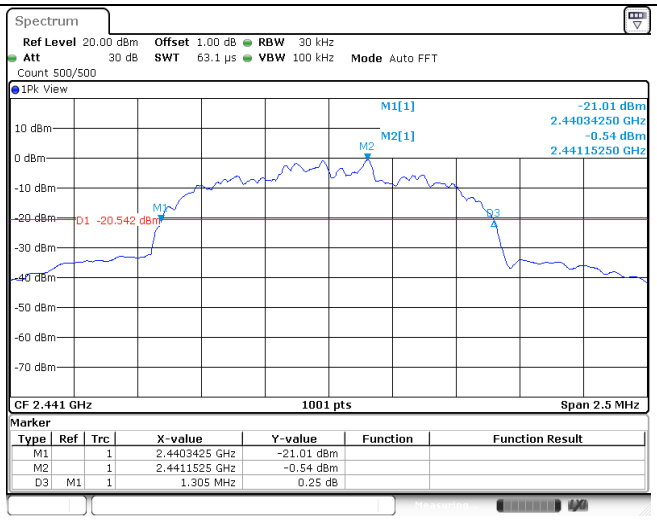
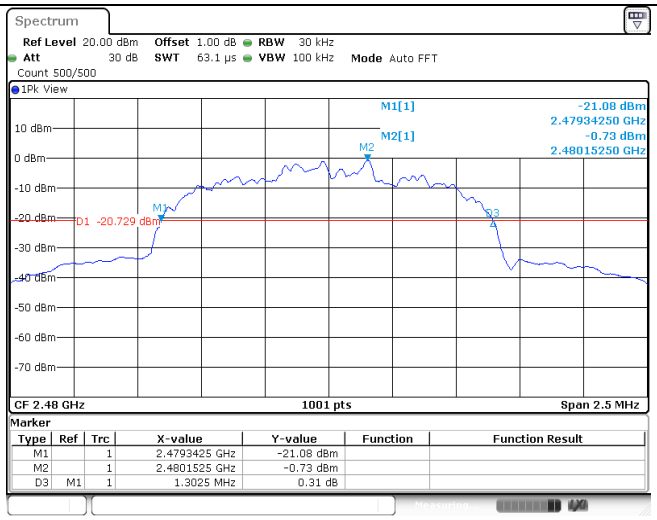
TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Modulation type	Channel	20 dB Bandwidth (MHz)	Limit (MHz)	Result
GFSK	00	0.92	-	Pass
	39	0.92		
	78	0.92		
π/4DQPSK	00	1.28	-	Pass
	39	1.28		
	78	1.28		
8DPSK	00	1.31	-	Pass
	39	1.31		
	78	1.30		

Modulation Type:	GFSK
CH00	
CH39	
CH78	

Modulation Type:	π/4DQPSK
CH00	
CH39	
CH78	

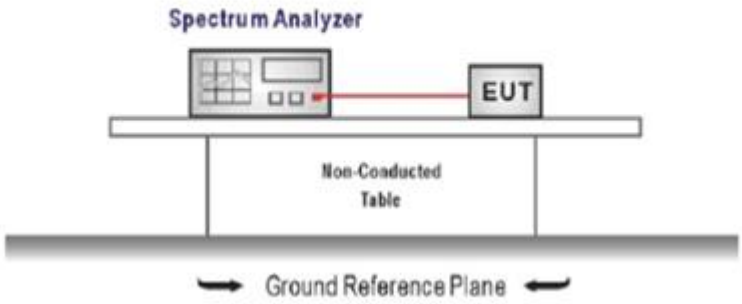
Modulation Type:	8DPSK
CH00	
CH39	
CH78	

5.5. Carrier Frequencies Separation

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 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.

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels
   RBW ≥ 1% of the span, VBW ≥ RBW
   Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

TEST MODE:

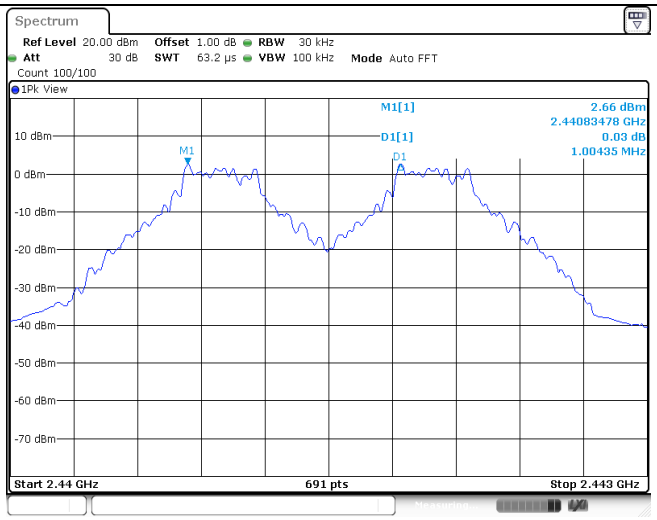
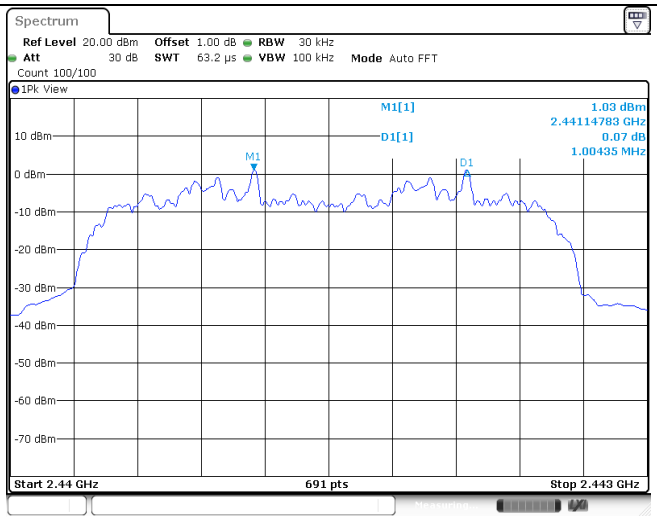
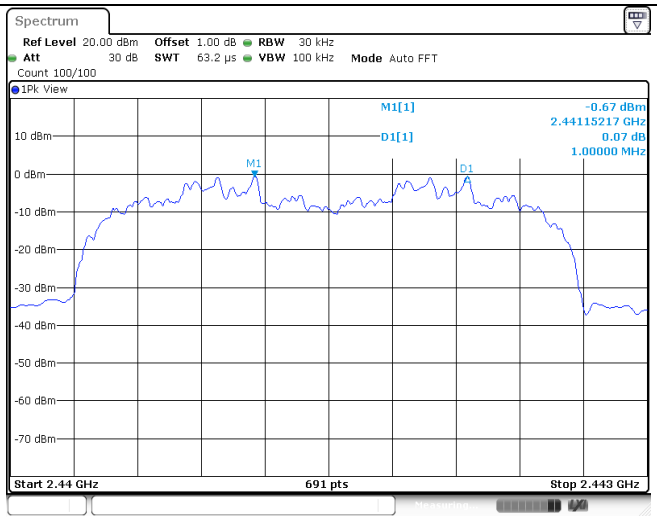
Please refer to the clause 3.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Modulation type	Channel	Carrier Frequencies Separation (MHz)	Limit (MHz) *	Result
GFSK	39	1.00	≥0.92	Pass
π/4DQPSK	39	1.00	≥0.85	Pass
8DPSK	39	1.00	≥0.87	Pass

Note:
*: GFSK limit = The maximum 20 dB Bandwidth for GFSK modulation on the section 5.4.
π/4DQPSK limit = 2/3 * The maximum 20 dB Bandwidth for π/4DQPSK modulation on the section 5.4.
8DPSK limit = 2/3 * The maximum 20 dB Bandwidth for 8DPSK modulation on the section 5.4

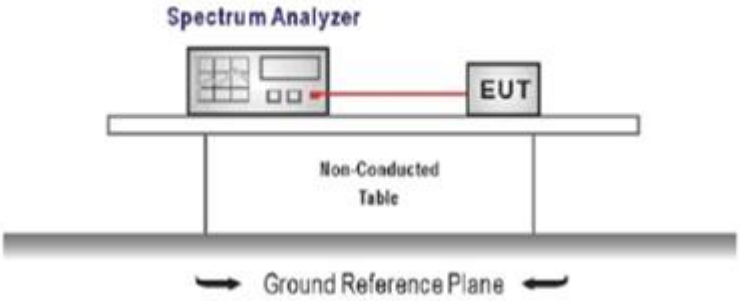
GFSK	
π/4DQPSK	
8DPSK	

5.6. Hopping Channel Number

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):Frequency hopping systems in the 2400–2483.5 MHz band shall use at least **15** channels.

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Span = the frequency band of operation
   RBW ≥ 1% of the span, VBW ≥ RBW
   Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

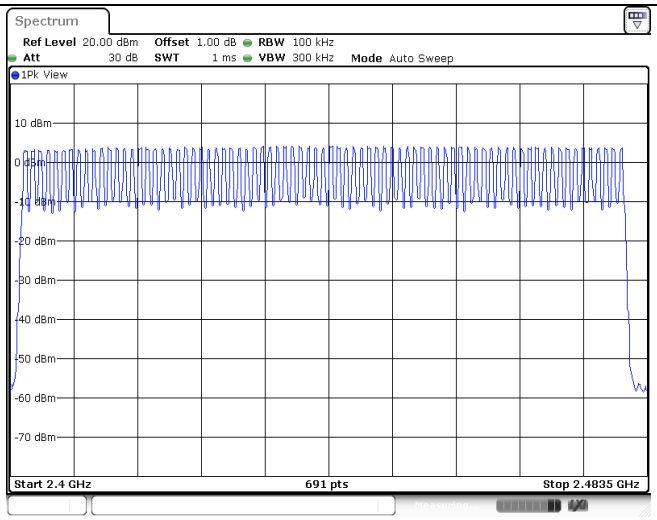
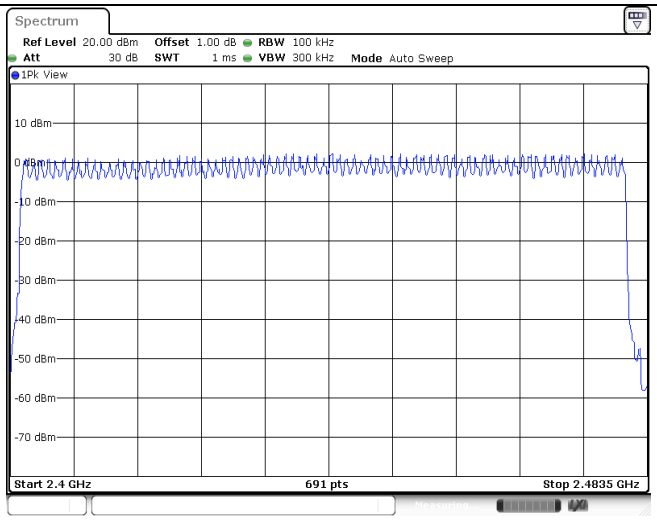
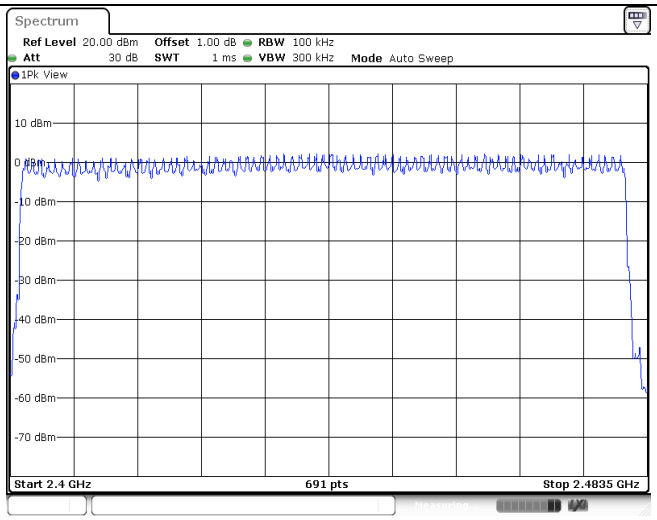
TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Modulation type	Channel number	Limit	Result
GFSK	79	≥15.00	Pass
π/4DQPSK	79		
8DPSK	79		

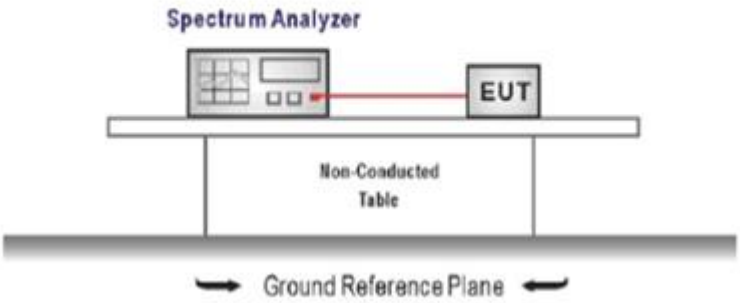
GFSK	
π/4DQPSK	
8DPSK	

5.7. Dwell Time

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):The average time of occupancy on any channel shall not be greater than 0.4 seconds within a pe-riod of 0.4 seconds multiplied by the number of hopping channels employed.

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Span = zero span, centered on a hopping channel, RBW= 1 MHz, VBW ≥ RBW
   Sweep = as necessary to capture the entire dwell time per hopping channel,
   Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

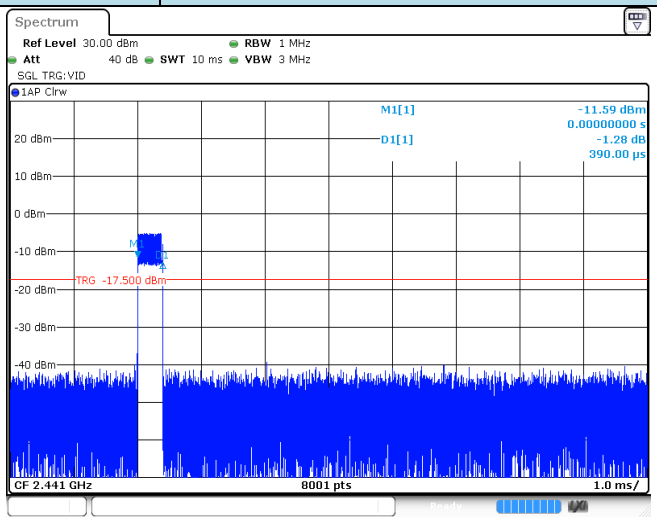
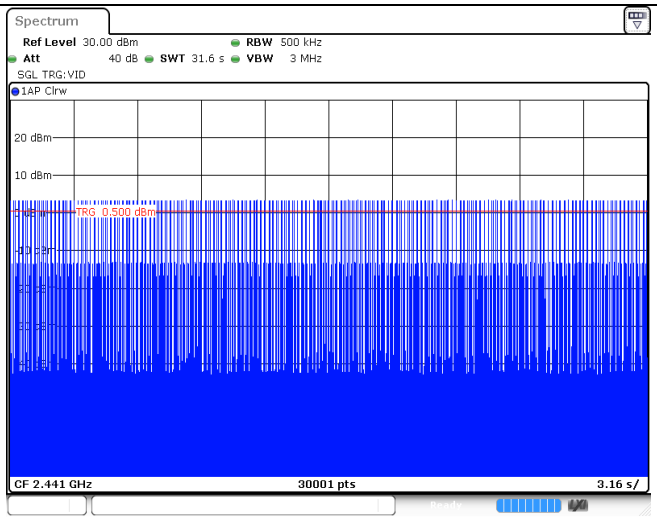
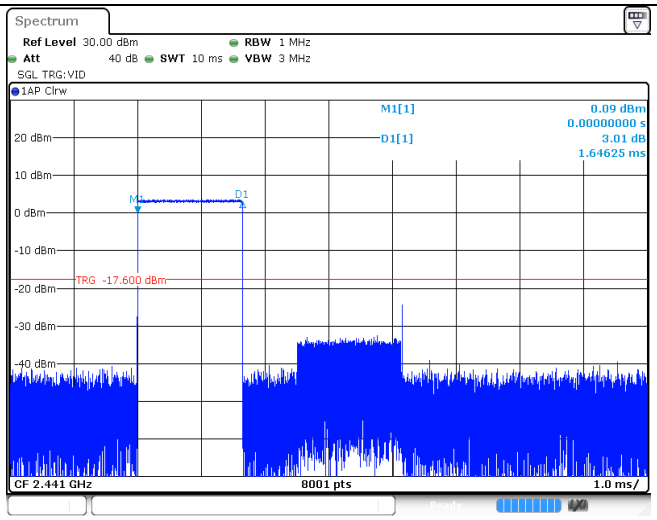
TEST MODE:

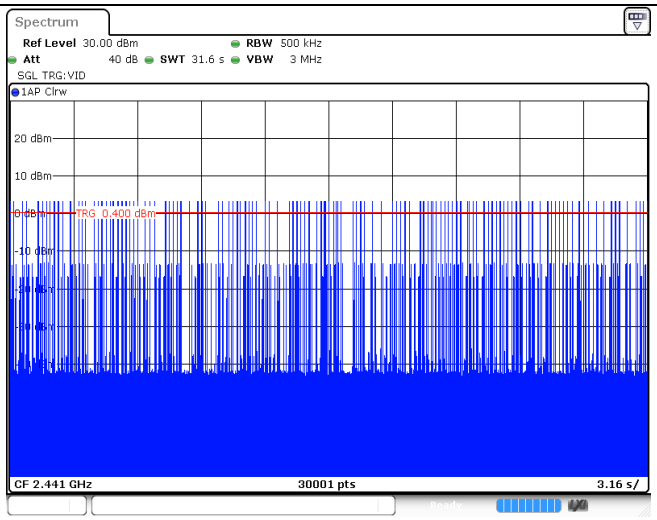
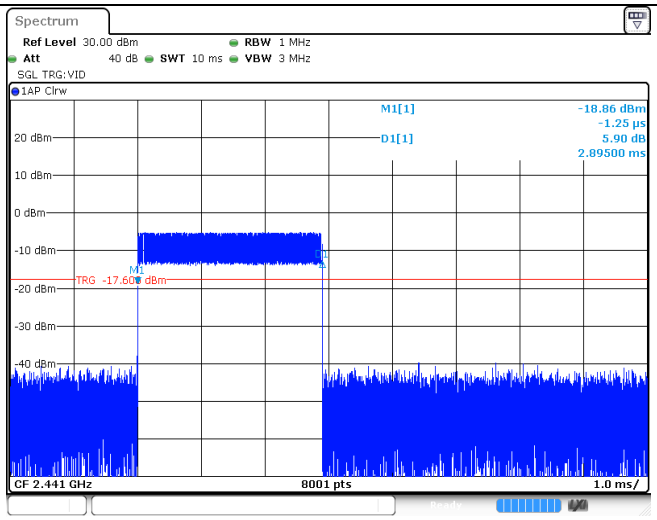
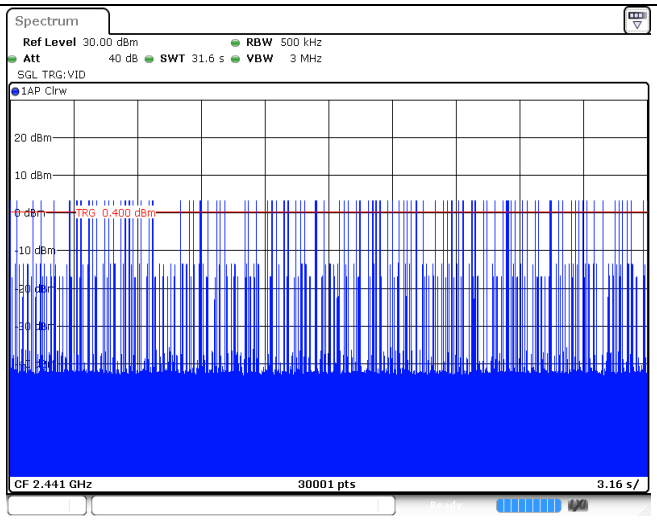
Please refer to the clause 3.3

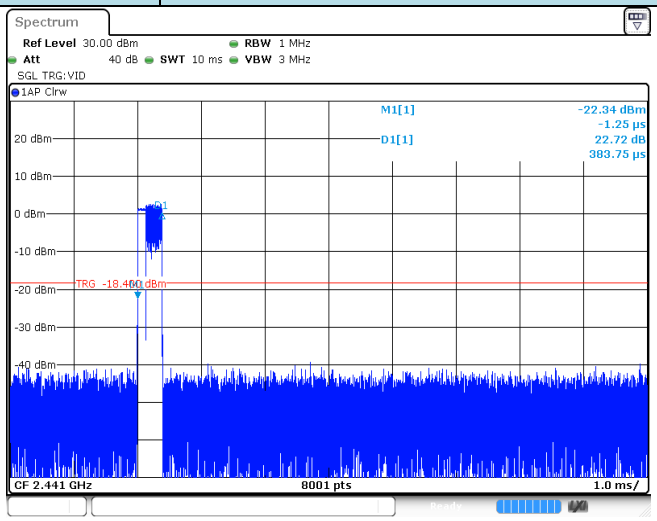
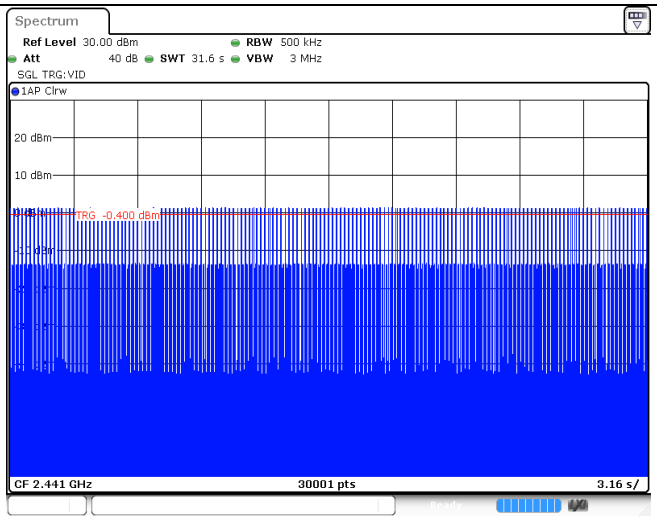
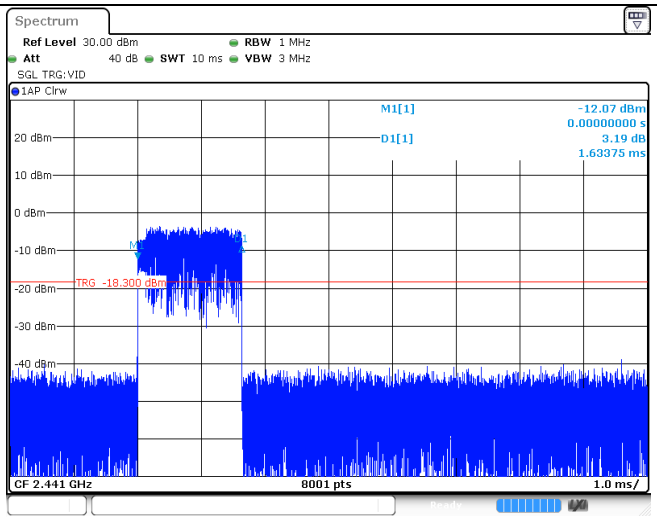
TEST RESULTS

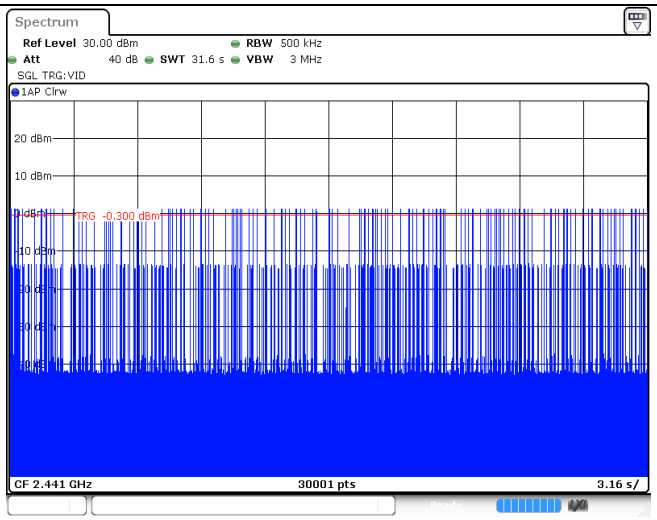
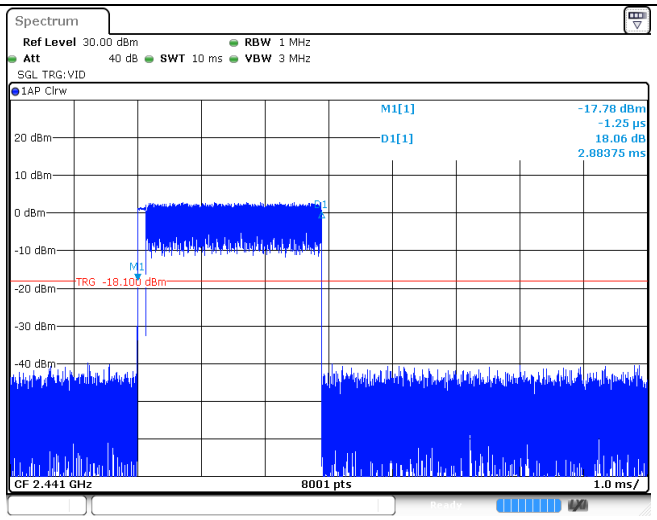
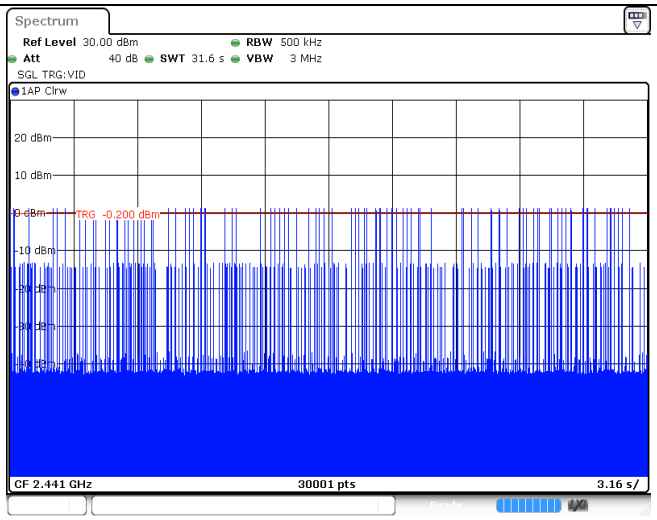
☒ **Passed** ☐ **Not Applicable**

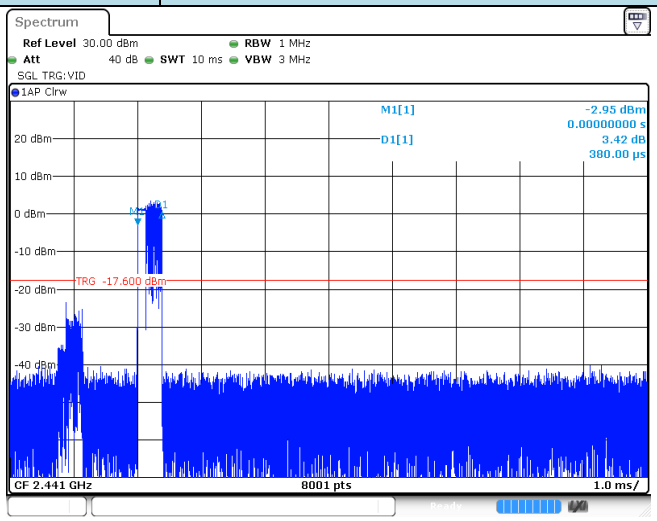
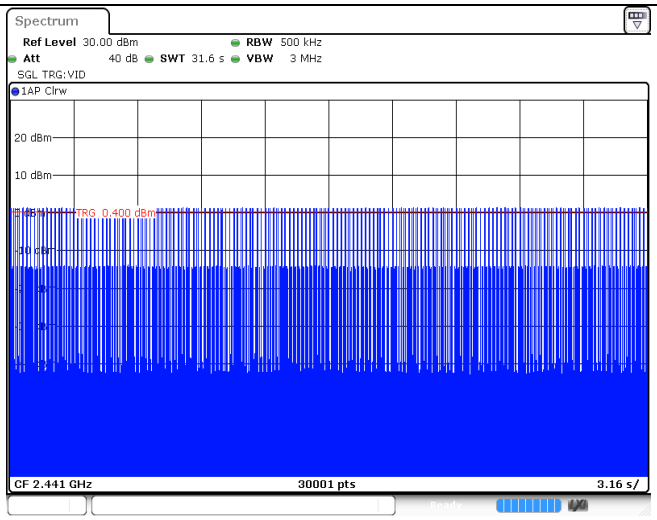
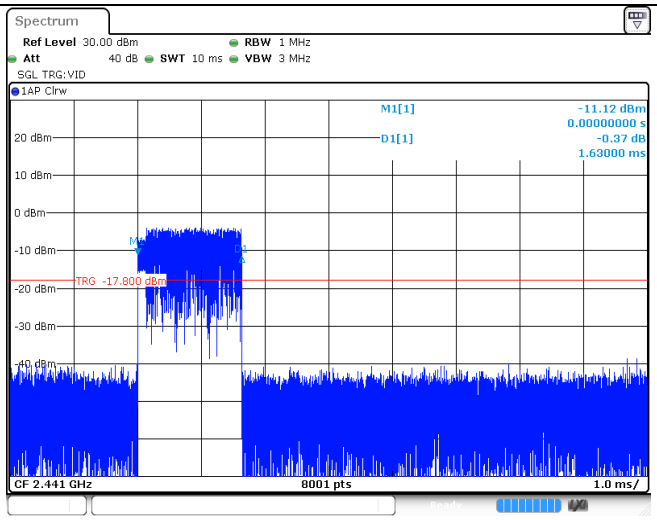
Modulation type	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell time (Second)	Limit (Second)	Result
GFSK	DH1	0.39	317.00	0.12	≤ 0.40	Pass
	DH3	1.65	163.00	0.27		
	DH5	2.90	110.00	0.32		
π/4DQPSK	2DH1	0.38	319.00	0.12	≤ 0.40	Pass
	2DH3	1.63	159.00	0.26		
	2DH5	2.88	96.00	0.28		
8DPSK	3DH1	0.38	318.00	0.12	≤ 0.40	Pass
	3DH3	1.63	164.00	0.27		
	3DH5	2.88	109.00	0.31		

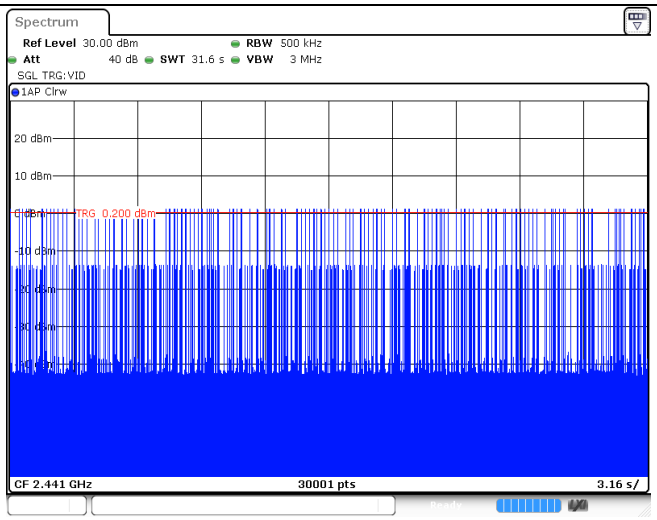
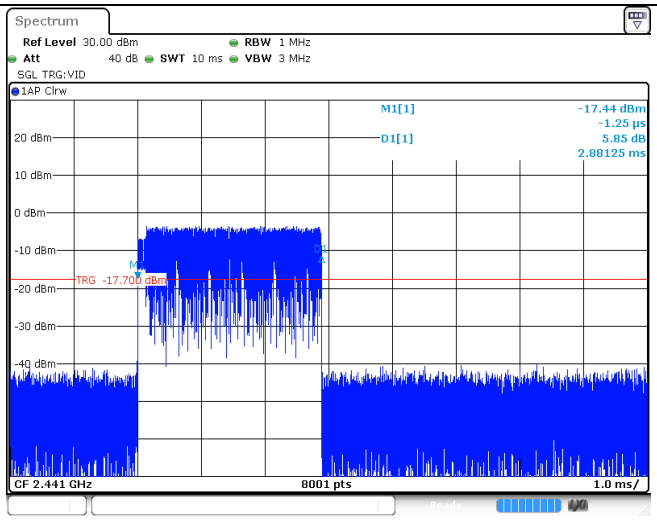
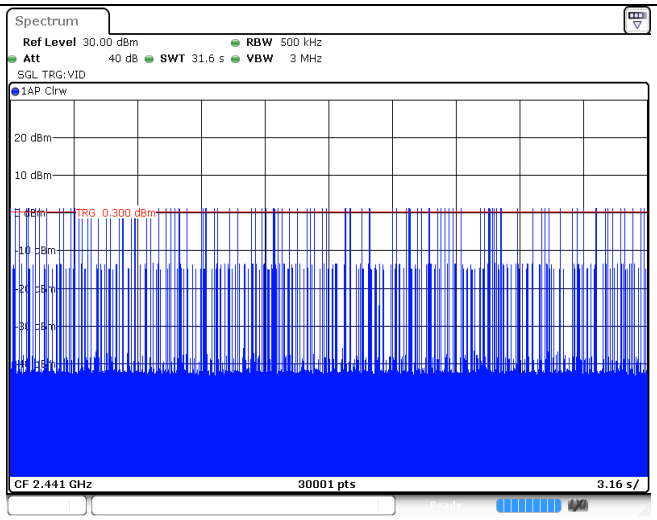
Modulation Type:	GFSK
DH1 Burst width	
DH1 Burst number	
DH3 Burst width	

DH3 Burst number	
DH5 Burst width	
DH5 Burst number	

Modulation Type:	π/4DQPSK
2DH1 Burst width	
2DH1 Burst number	
2DH3 Burst width	

2DH3 Burst number	
2DH5 Burst width	
2DH5 Burst number	

Modulation Type:	π/4DQPSK
3DH1 Burst width	
3DH1 Burst number	
3DH3 Burst width	

3DH3 Burst number	
3DH5 Burst width	
3DH5 Burst number	

5.8. Pseudorandom Frequency Hopping Sequence

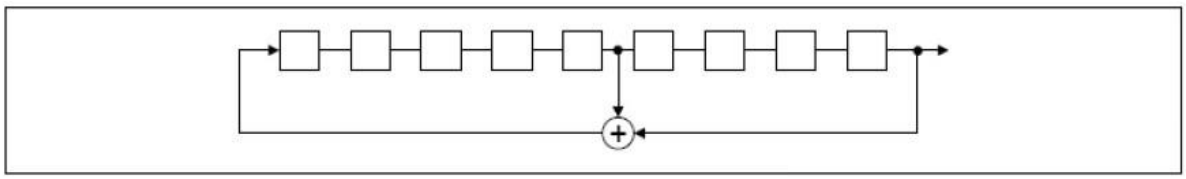
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):Frequency hopping systems shall have hopping channel carrier fre-quencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Al-ternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier fre-quencies 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. The system shall hop to chan-nel frequencies that are selected at the system hopping rate from a pseudo ran-domly ordered list of hopping fre-quencies. Each frequency must be used equally on the average by each trans-mitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their cor-responding transmitters and shall shift frequencies in synchronization with the transmitted signals.

TEST RESULTS

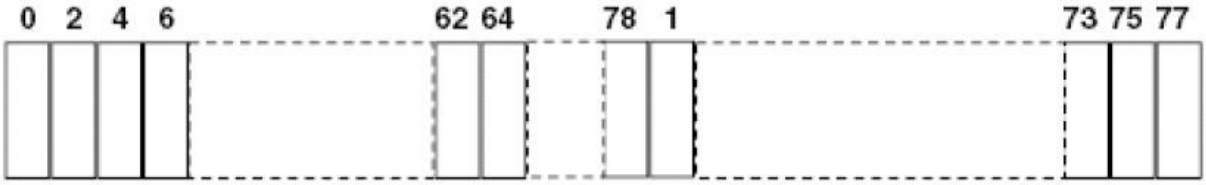
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage.And the result is fed back to the input of the friststage.The sequence begins with the frist one of 9 consecutive ones,forexample:the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An explame of pseudorandom frequency hopping sequence as follows:



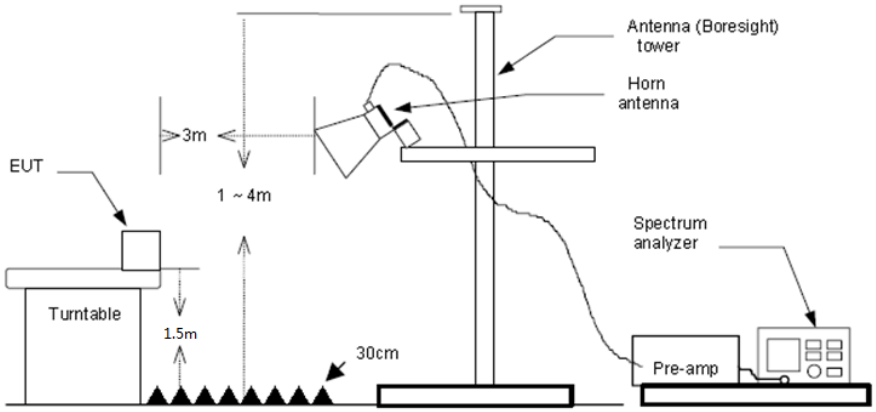
Each frequency used equally one the average by each transmitter.
The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

5.9. Restricted band (radiated)

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, Radiated Emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the Radiated Emissions limits specified in §15.209(a) (see §15.205(c)).

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10:2013 for compliance to FCC 47CFR 15.247 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT waspositioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. Thisis repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. The receiver set as follow:
   RBW=1 MHz, VBW=3 MHz Peak detector for Peak value
   RBW=1 MHz, VBW=10 Hz Peak detector for Average value.

TEST MODE:
Please refer to the clause 3.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Note:
1) Final level= Read level + Antenna Factor+ Cable Loss- Preamp Factor
2) Have pre-scan all modulation mode, found the GFSK modulation which it was worst case, so only the worst case's data on the test report.
3) The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.

Test channel:					CH00				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2310.00	29.34	28.05	6.62	37.59	26.42	74.00	-47.58	Horizontal	Peak
2390.03	29.76	27.65	6.75	37.59	26.57	74.00	-47.43	Horizontal	Peak
2310.00	31.88	28.05	6.62	37.59	28.96	74.00	-45.04	Vertical	Peak
2390.03	31.58	27.65	6.75	37.59	28.39	74.00	-45.61	Vertical	Peak
2310.00	17.48	28.05	6.62	37.59	14.56	54.00	-39.44	Horizontal	Average
2390.03	17.53	27.65	6.75	37.59	14.34	54.00	-39.66	Horizontal	Average
2310.00	19.20	28.05	6.62	37.59	16.28	54.00	-37.72	Vertical	Average
2390.03	19.17	27.65	6.75	37.59	15.98	54.00	-38.02	Vertical	Average

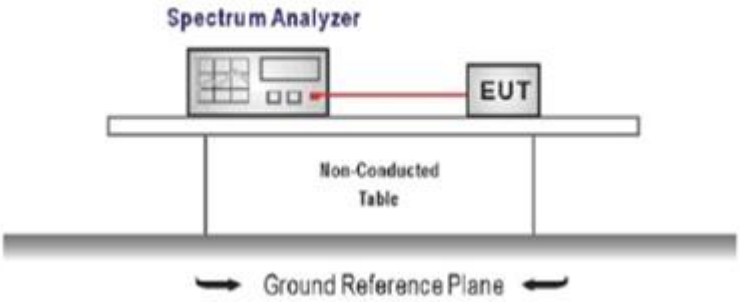
Test channel:					CH78				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2483.50	53.38	27.26	6.83	37.59	49.88	74.00	-24.12	Horizontal	Peak
2500.00	30.47	27.20	6.84	37.59	26.92	74.00	-47.08	Horizontal	Peak
2483.50	52.35	27.26	6.83	37.59	48.85	74.00	-25.15	Vertical	Peak
2500.00	31.22	27.20	6.84	37.59	27.67	74.00	-46.33	Vertical	Peak
2483.50	22.34	27.26	6.83	37.59	18.84	54.00	-35.16	Horizontal	Average
2500.00	17.70	27.20	6.84	37.59	14.15	54.00	-39.85	Horizontal	Average
2483.50	22.34	27.26	6.83	37.59	18.84	54.00	-35.16	Vertical	Average
2500.00	18.36	27.20	6.84	37.59	14.81	54.00	-39.19	Vertical	Average

5.10. Band edge and Spurious Emissions (conducted)

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.

TEST CONFIGURATION



TEST PROCEDURE

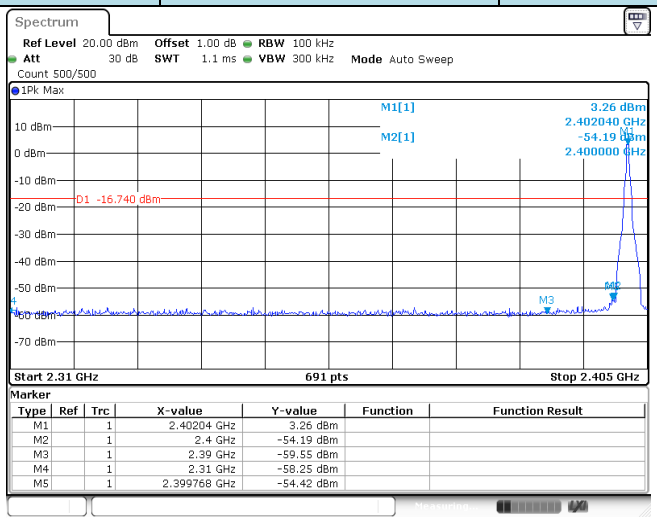
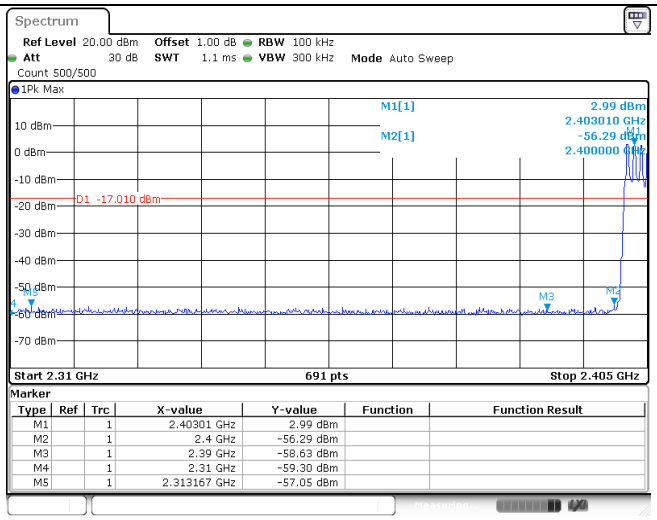
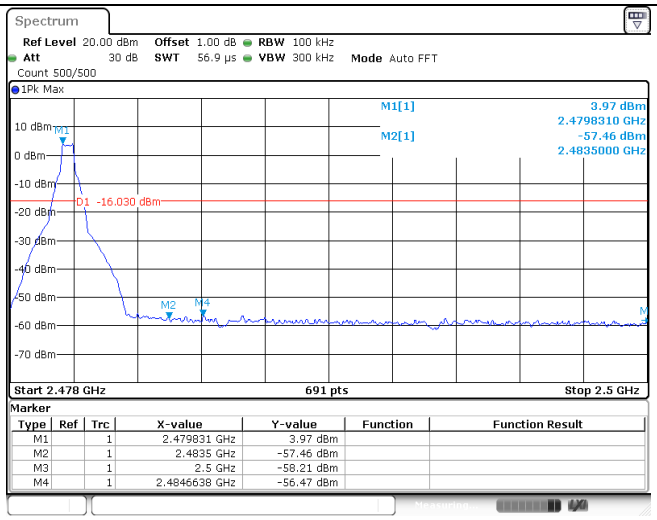
1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   RBW = 100 kHz, VBW ≥ RBW, scan up through 10th harmonic.
   Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

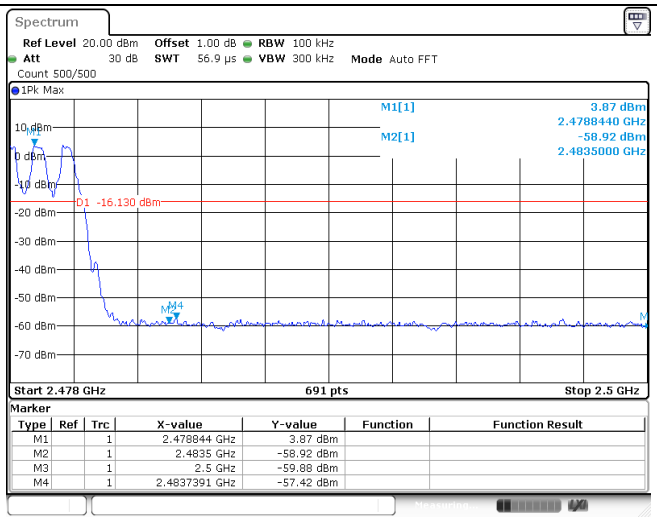
TEST MODE:

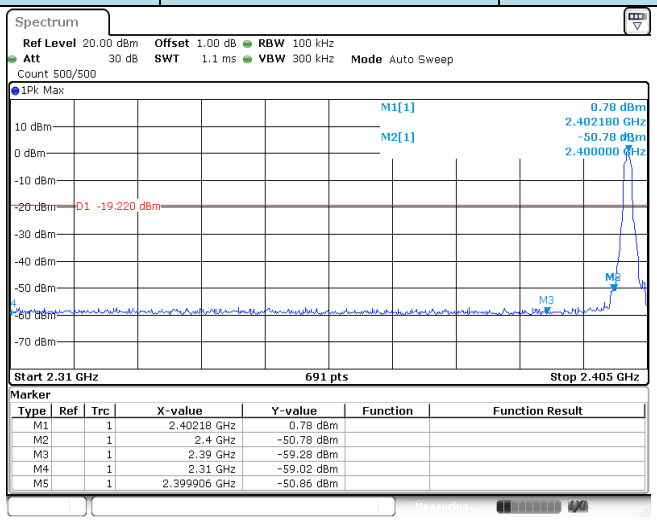
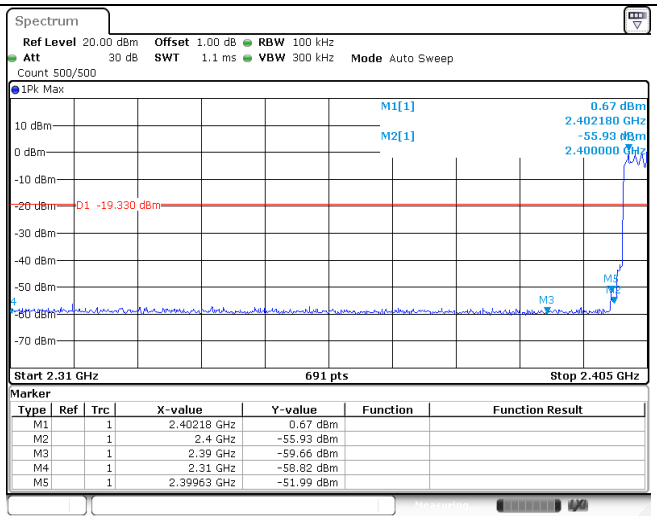
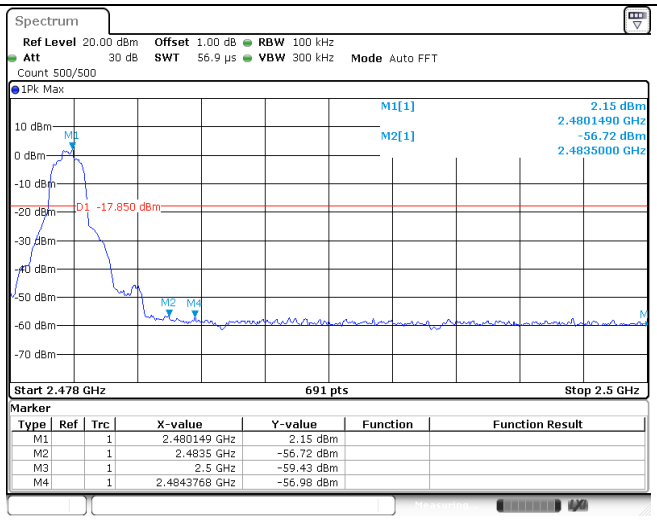
Please refer to the clause 3.3

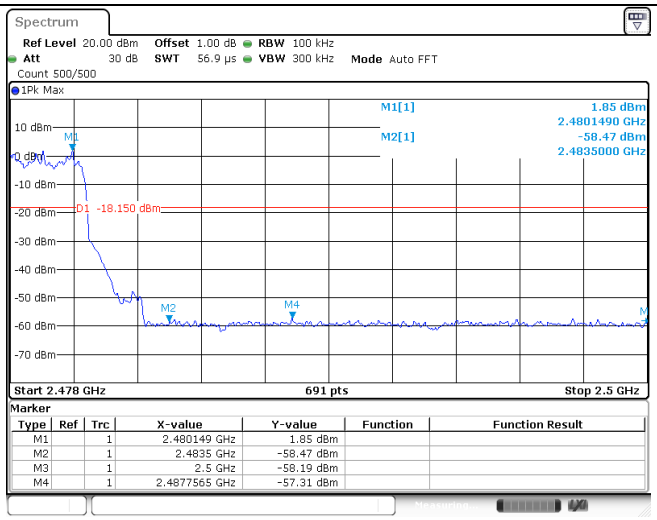
TEST RESULTS

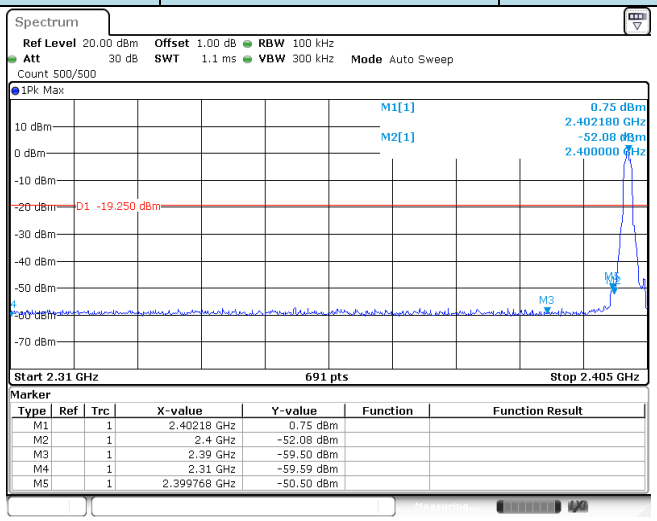
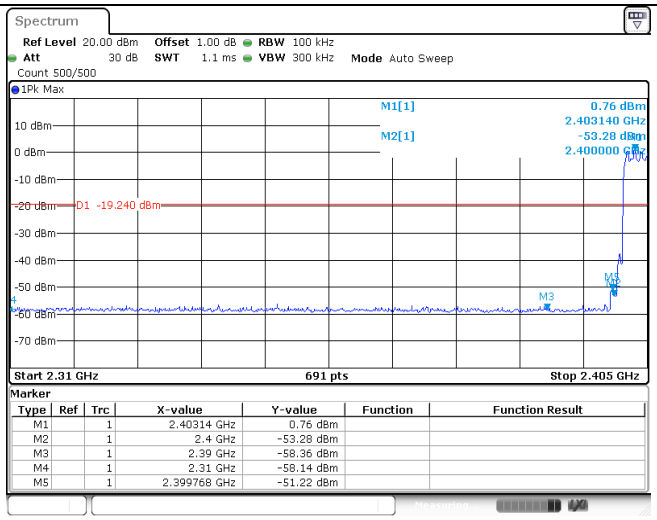
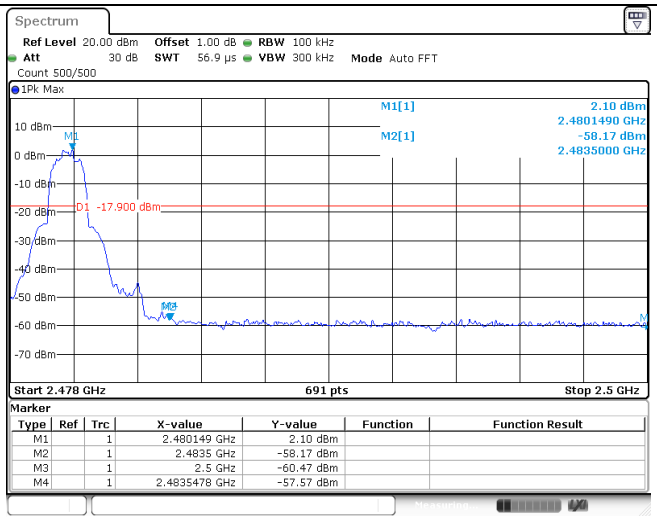
☒ **Passed** ☐ **Not Applicable**

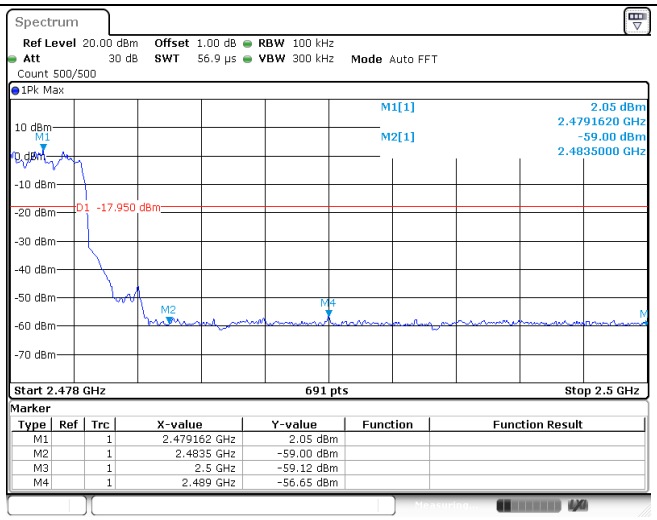
Test Item:	Band edge	Modulation type:	GFSK
CH00 No hopping mode			
CH00 Hopping mode			
CH78 No hopping mode			

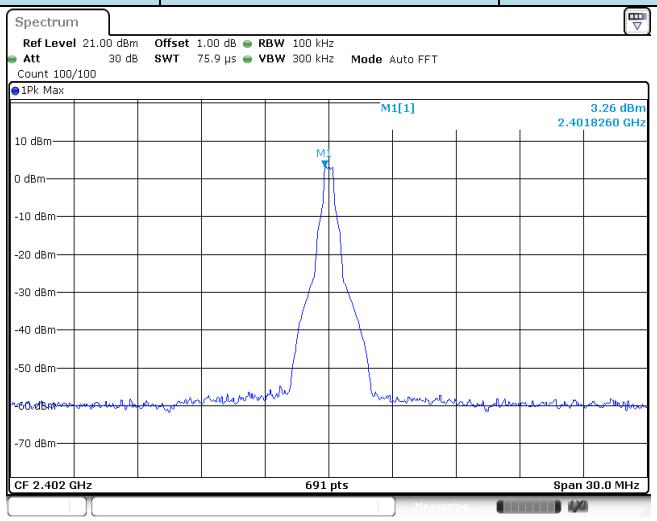
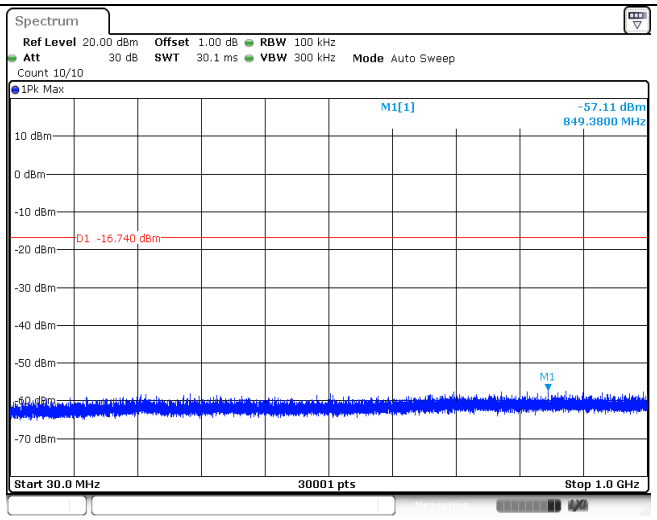
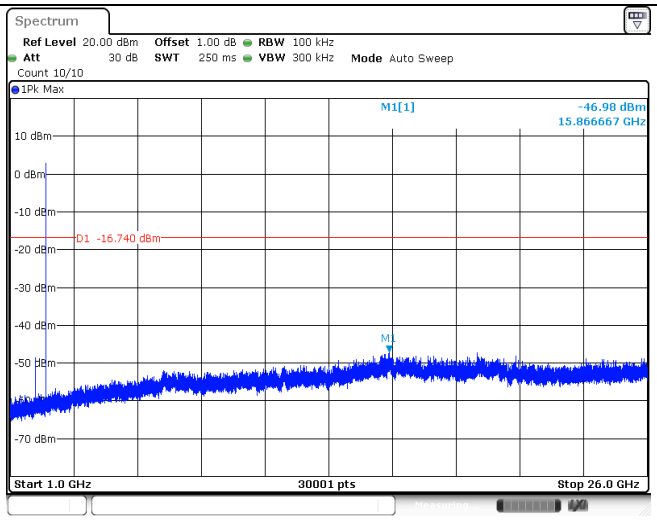
CH78 Hopping mode	

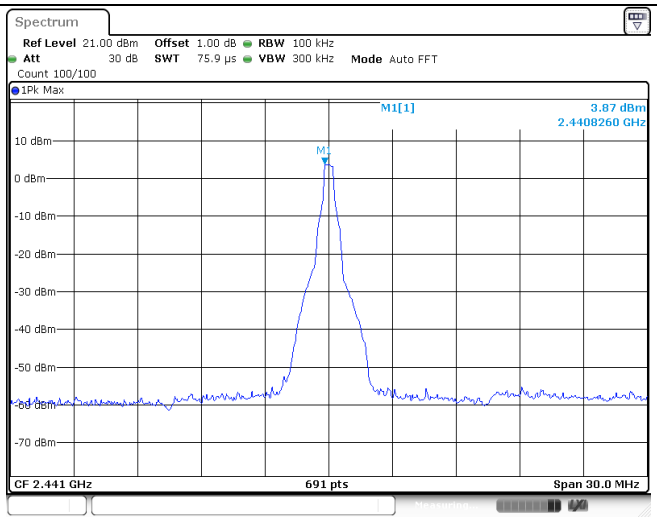
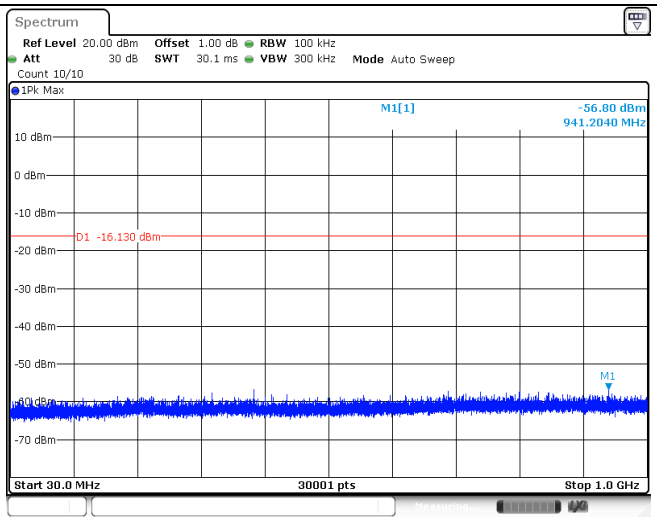
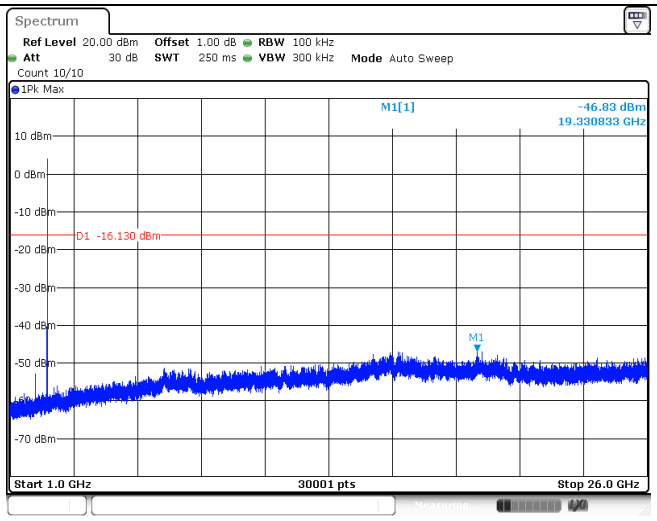
Test Item:	Band edge	Modulation type:	π/4DQPSK
CH00 No hopping mode			
CH00 Hopping mode			
CH78 No hopping mode			

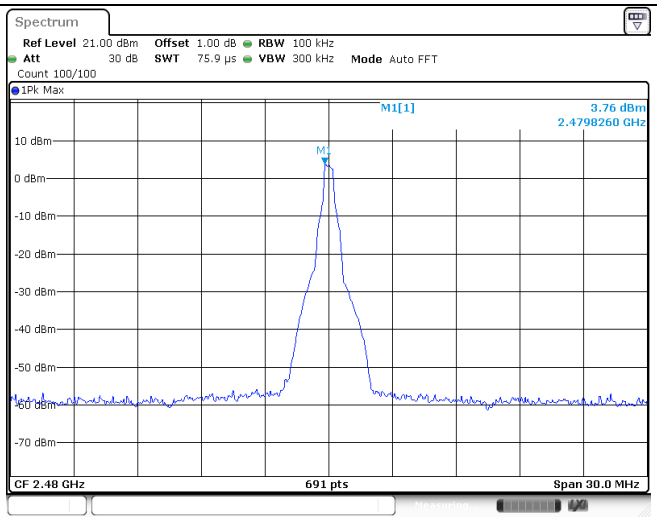
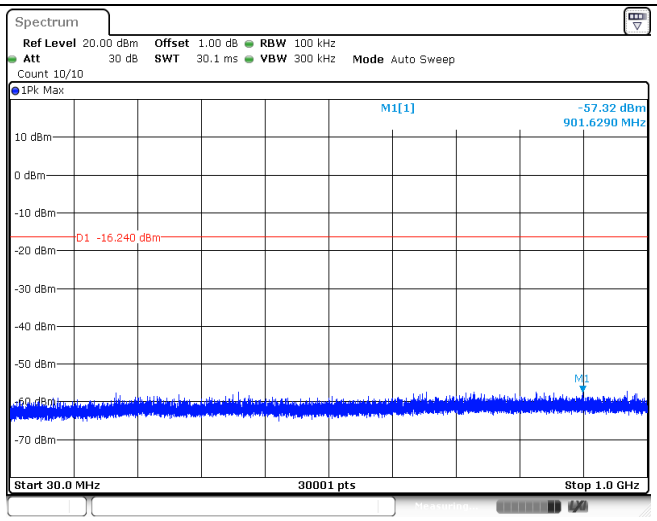
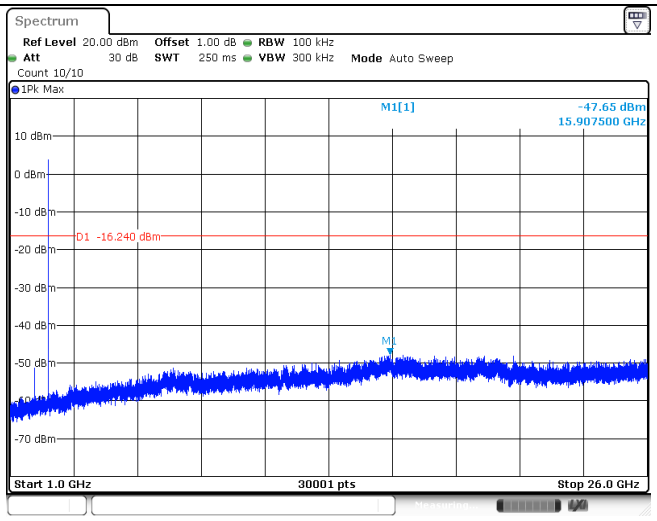
CH78 Hopping mode	

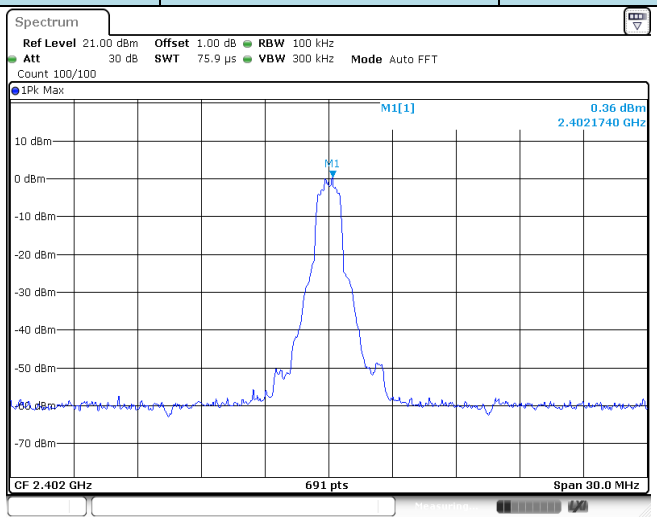
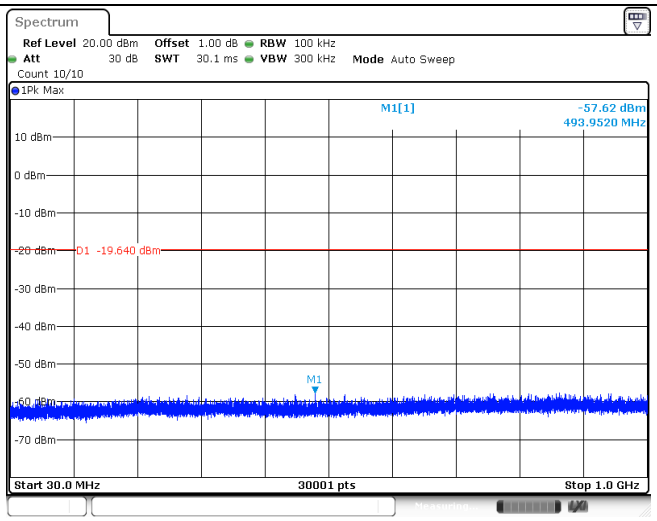
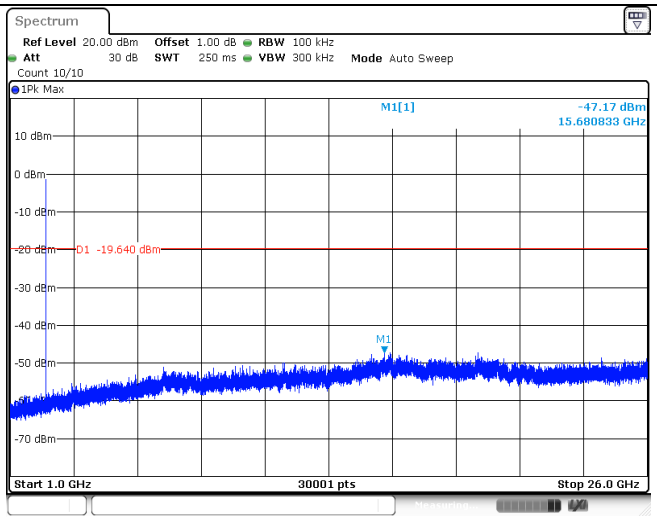
Test Item:	Band edge	Modulation type:	8DPSK
CH00 No hopping mode			
CH00 Hopping mode			
CH78 No hopping mode			

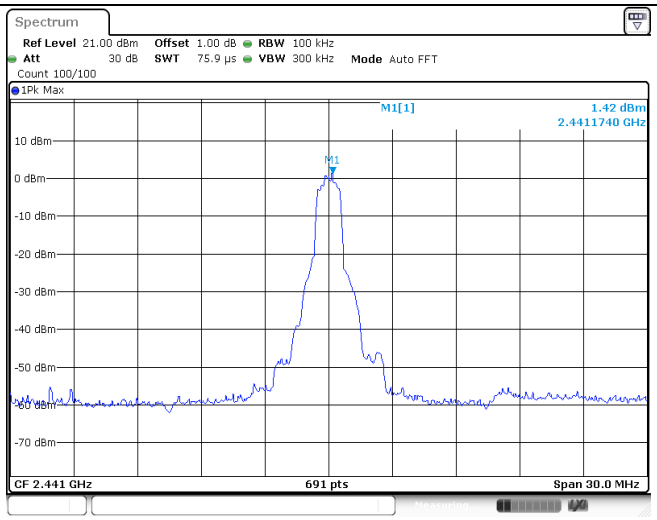
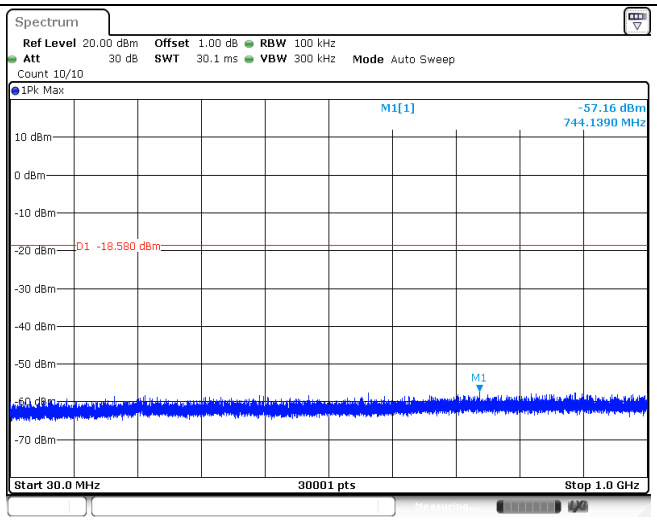
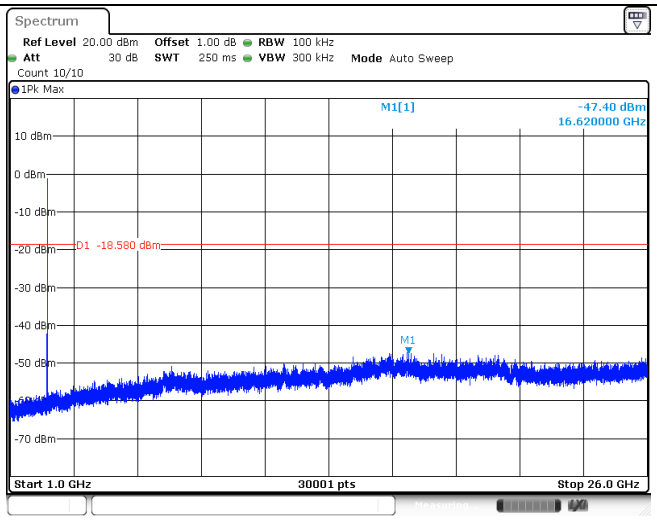
CH78 Hoppig mode	

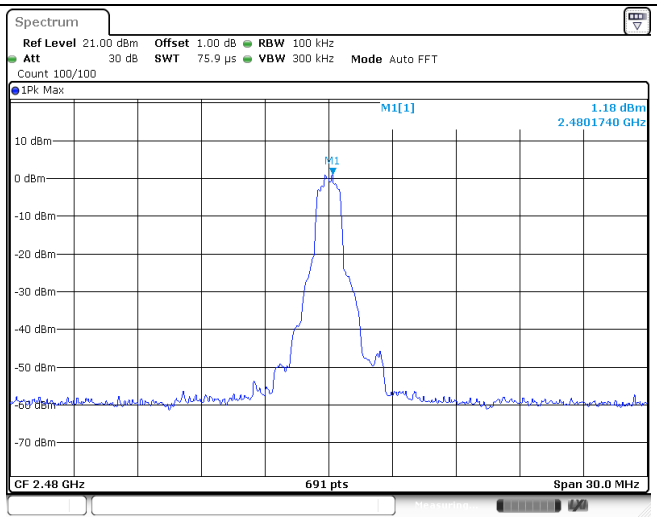
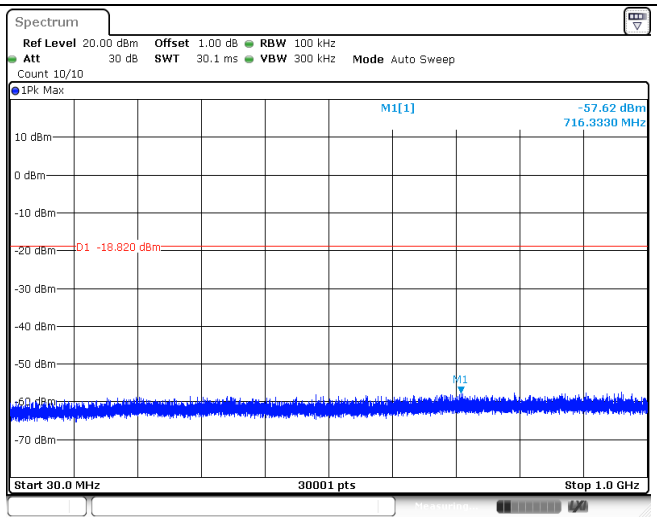
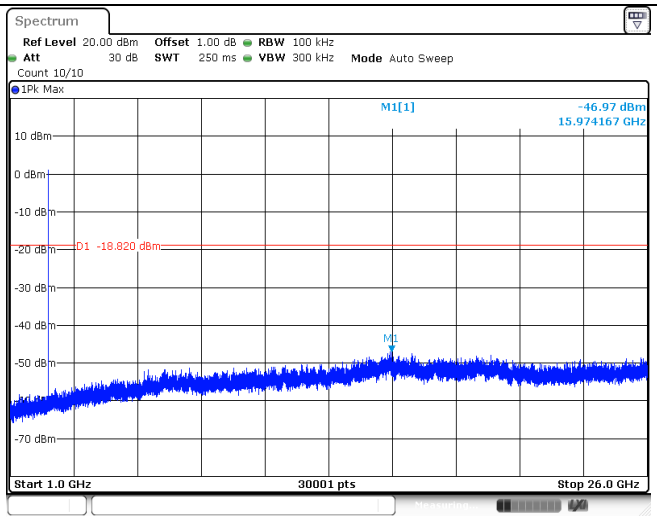
Test Item:	SE	Modulation type:	GFSK
CH00 Reference level	
CH00 30MHz~1000MHz	
CH00 1GHz~26GHz	

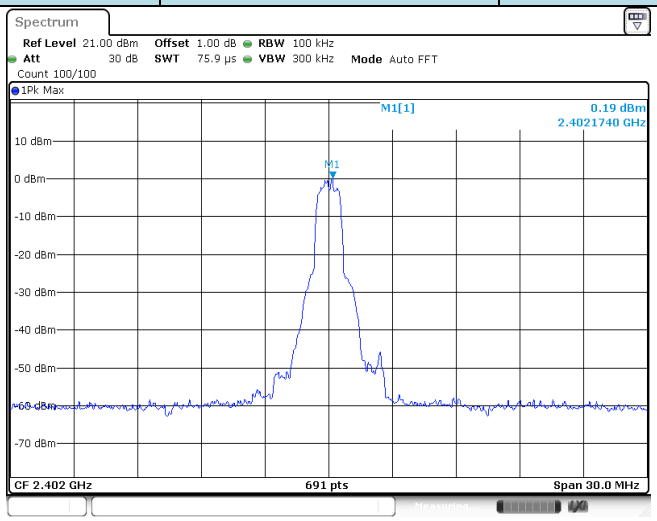
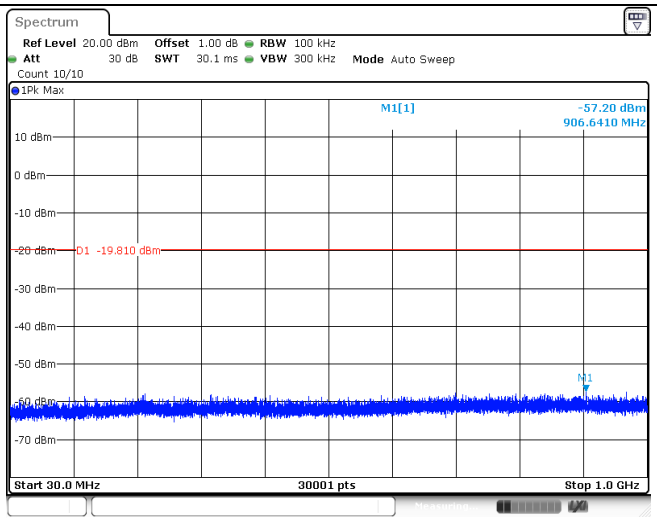
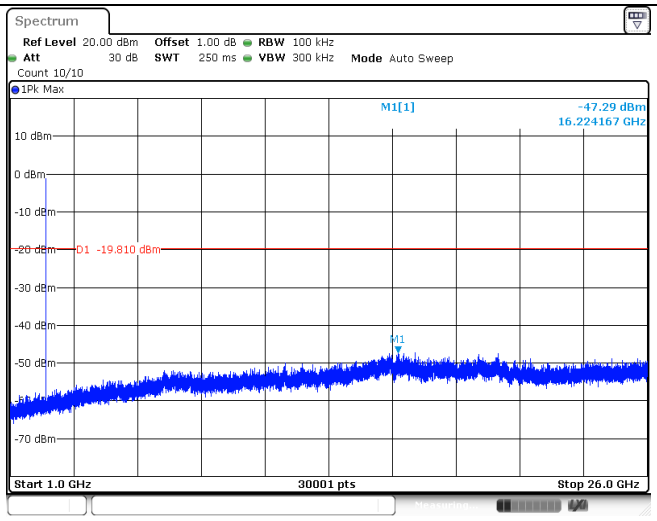
CH39 Reference level	
CH39 30MHz~1000MHz	
CH39 1GHz~26GHz	

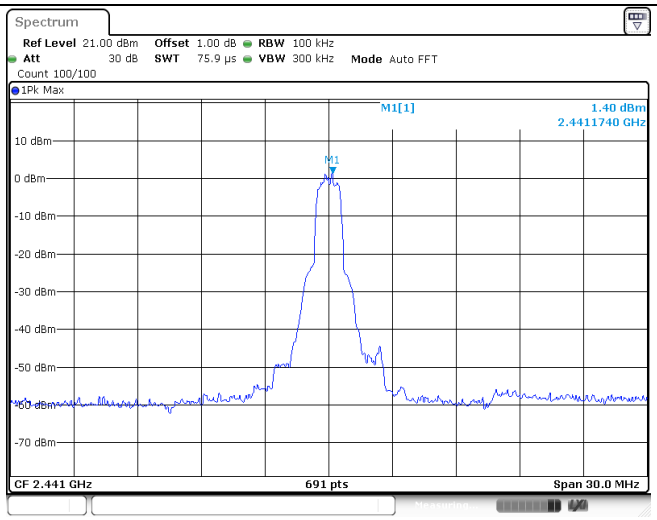
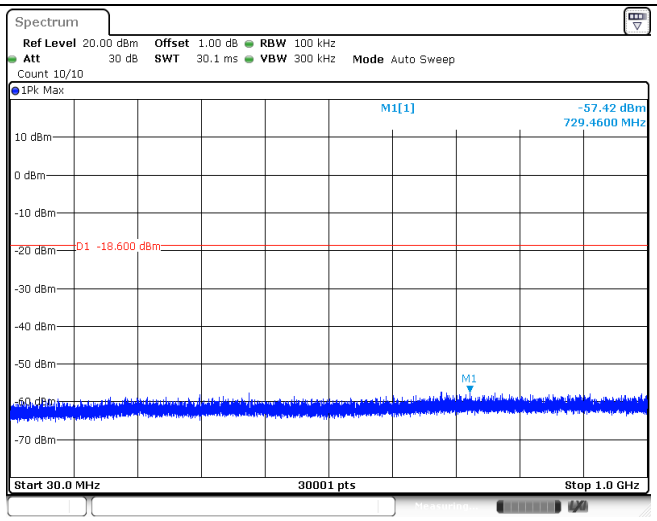
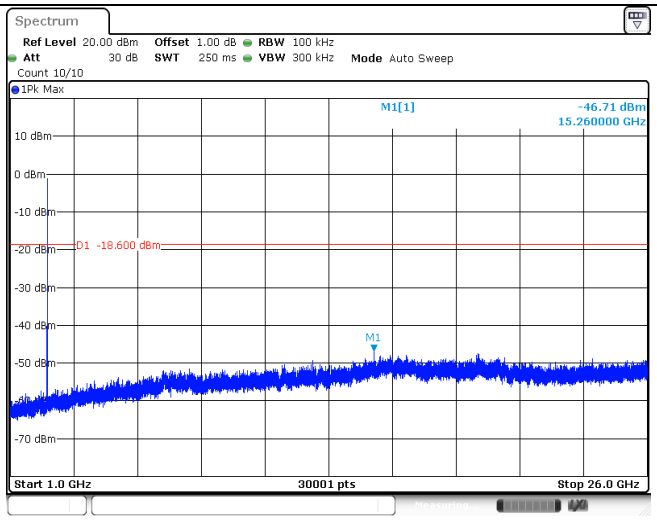
CH78 Reference level	
CH78 30MHz~1000MHz	
CH78 1GHz~26GHz	

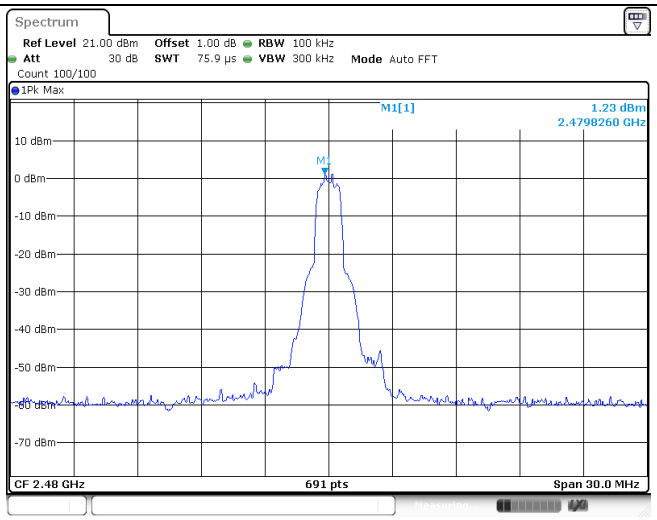
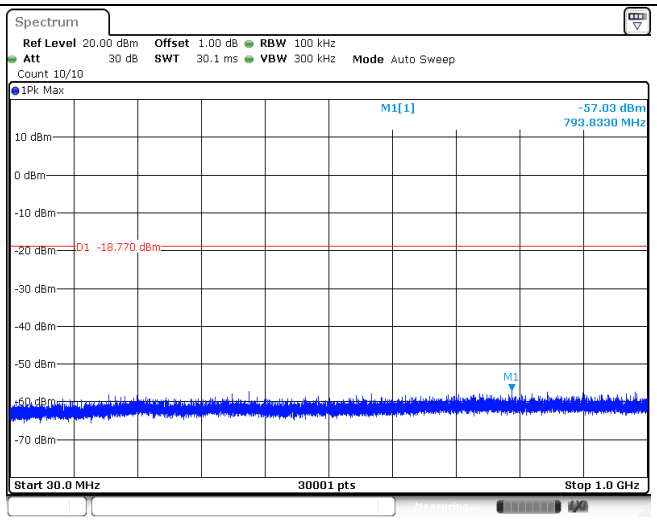
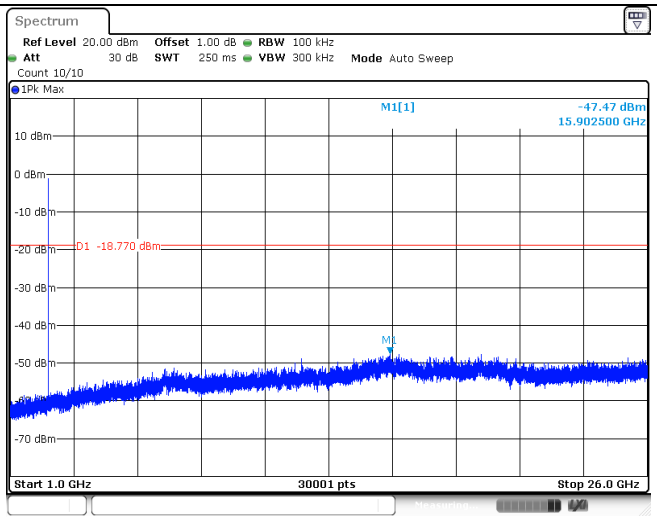
Test Item:	SE	Modulation type:	π/4DQPSK
CH00 Reference level			
CH00 30MHz~1000MHz			
CH00 1GHz~26GHz			

CH39 Reference level	
CH39 30MHz~1000MHz	
CH39 1GHz~26GHz	

CH78 Reference level	
CH78 30MHz~1000MHz	
CH78 1GHz~26GHz	

Test Item:	SE	Modulation type:	8DPSK
CH00 Reference level			
CH00 30MHz~1000MHz			
CH00 1GHz~26GHz			

CH39 Reference level	
CH39 30MHz~1000MHz	
CH39 1GHz~26GHz	

CH78 Reference level	
CH78 30MHz~1000MHz	
CH78 1GHz~26GHz	

5.11. Spurious Emissions (radiated)

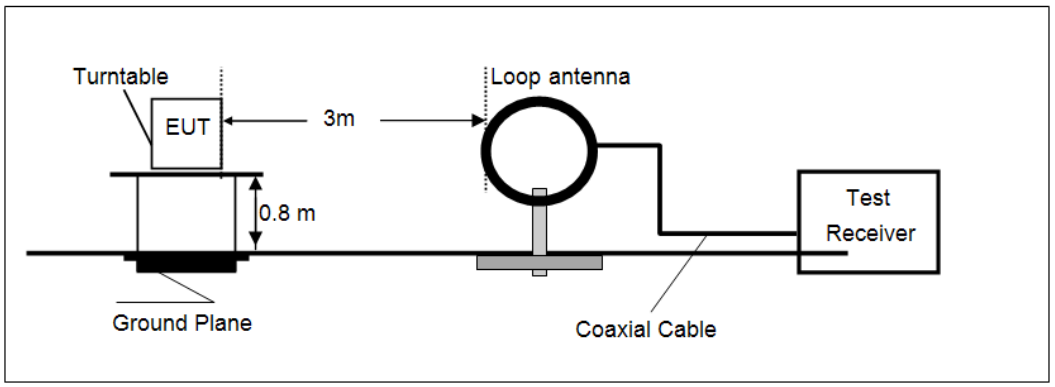
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209

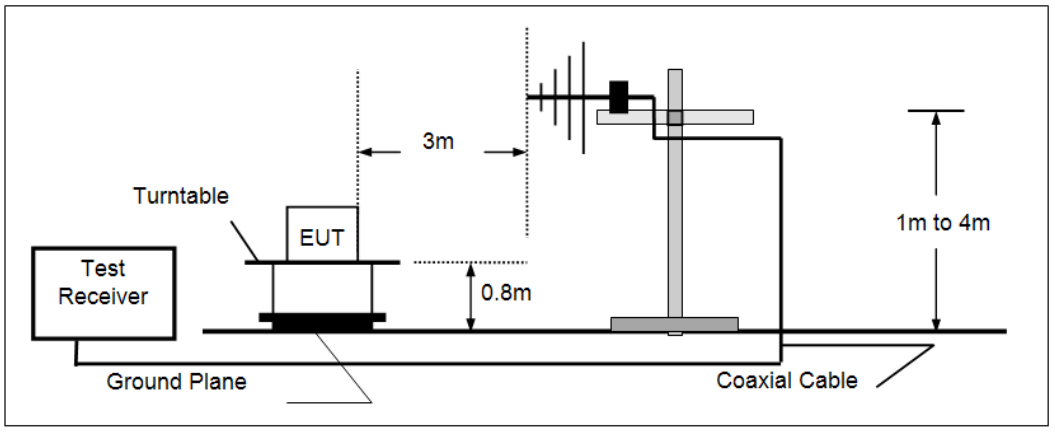
Frequency	Limit (dBuV/m @3m)	Value
30 MHz ~ 88 MHz	40.00	Quasi-peak
88 MHz ~ 216 MHz	43.50	Quasi-peak
216 MHz ~ 960 MHz	46.00	Quasi-peak
960 MHz ~ 1 GHz	54.00	Quasi-peak
Above 1 GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

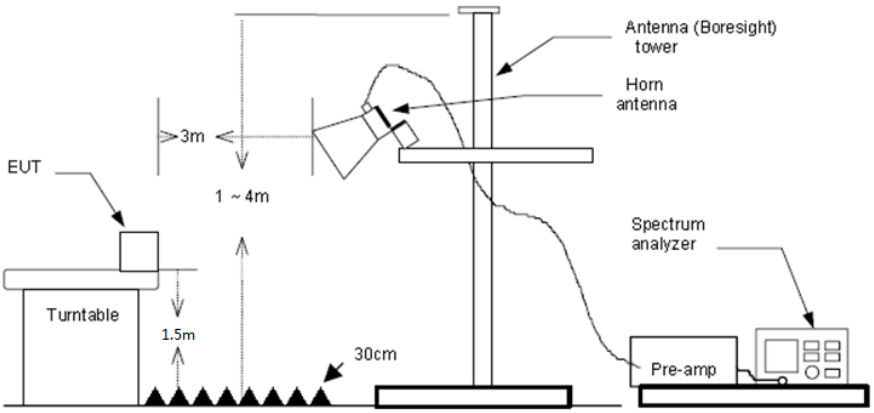
- Below 30 MHz



- 30 MHz ~1000 MHz



- Above 1 GHz



TEST PROCEDURE

1. The EUT was tested according to ANSI C63.10:2013.
2. The EUT is placed on a turn table with 0.8 meter above ground for below 1GHz, 1.5 meter above ground for above 1GHz.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Below 1 GHz:
   RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;
   If the emission level of the EUT measured by the peak detectoris 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
   (3) From 1 GHz to 10th harmonic:
   RBW=1 MHz, VBW=3 MHz Peak detector for Peak value
   RBW=1 MHz, VBW=10 Hz Peak detector for Average value.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Note:

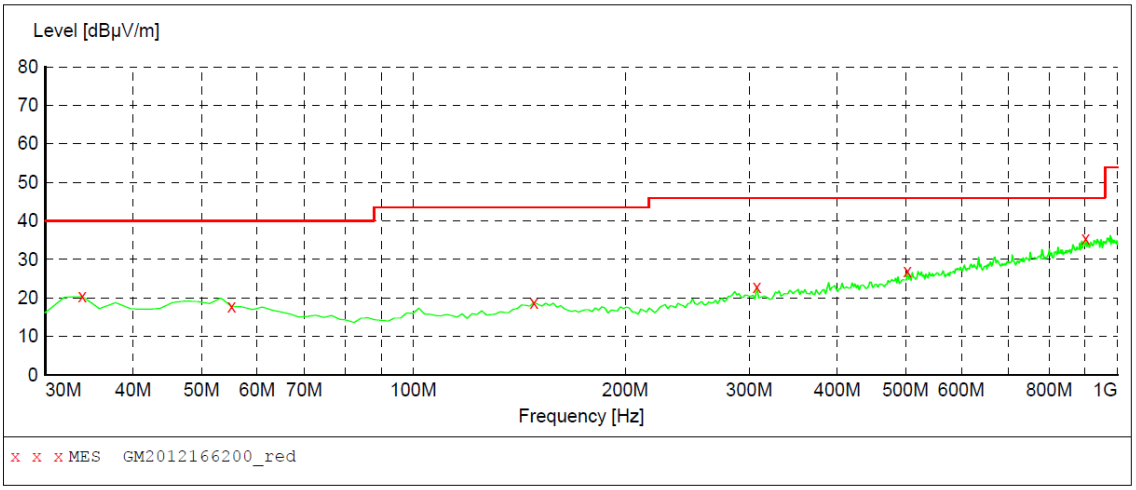
1) Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2) The emission levels of other frequencies are very lower than the limit and not show in test report.
3) Below 1 GHz,Have pre-scan all modulation mode, found the GFSK modulation High channel which it was worst case, so only the worst case's data on the test report.
4) Above 1 GHz,Have pre-scan all modulation mode, found the GFSK modulation which it was worst case, so only the worst case's data on the test report
5) The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.

➢ **9 kHz ~ 30 MHz**

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

➢ **30 MHz ~ 1 GHz**

Polarization:	Vertical

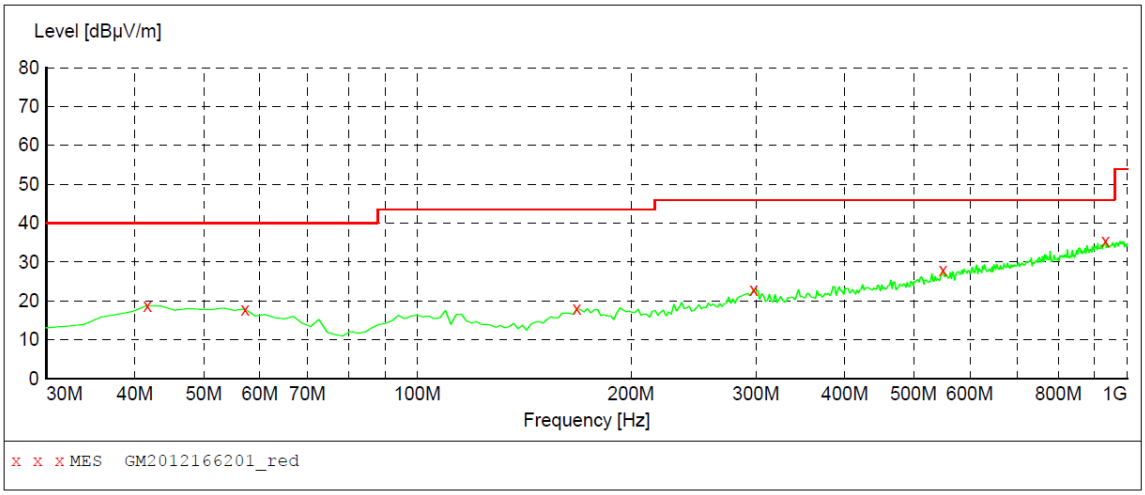


MEASUREMENT RESULT: "GM2012166200_red"

12/16/2020 2:58AM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
33.880000	20.40	-12.5	40.0	19.6	QP	100.0	45.00	VERTICAL
55.220000	17.80	-9.1	40.0	22.2	QP	100.0	0.00	VERTICAL
148.340000	18.90	-13.6	43.5	24.6	QP	100.0	34.00	VERTICAL
307.420000	22.80	-6.8	46.0	23.2	QP	100.0	69.00	VERTICAL
503.360000	27.10	-1.2	46.0	18.9	QP	100.0	10.00	VERTICAL
901.060000	35.40	7.6	46.0	10.6	QP	100.0	0.00	VERTICAL

Polarization:	Horizontal



MEASUREMENT RESULT: "GM2012166201_red"

12/16/2020 3:01AM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
41.640000	18.80	-9.5	40.0	21.2	QP	100.0	205.00	HORIZONTAL
57.160000	17.90	-9.3	40.0	22.1	QP	100.0	34.00	HORIZONTAL
167.740000	18.00	-12.8	43.5	25.5	QP	100.0	69.00	HORIZONTAL
297.720000	22.80	-7.0	46.0	23.2	QP	100.0	160.00	HORIZONTAL
549.920000	27.90	-0.1	46.0	18.1	QP	100.0	185.00	HORIZONTAL
932.100000	35.50	8.0	46.0	10.5	QP	100.0	185.00	HORIZONTAL

➢ **1 GHz ~ 25 GHz**

CH00									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
1150.28	36.56	25.91	4.55	37.25	29.77	74.00	-44.23	Vertical	Peak
3143.98	35.15	28.80	7.65	37.45	34.15	74.00	-39.85	Vertical	Peak
5099.49	31.47	31.90	9.75	35.18	37.94	74.00	-36.06	Vertical	Peak
8002.06	31.81	37.10	12.30	33.07	48.14	74.00	-25.86	Vertical	Peak
1689.41	35.38	25.17	5.74	37.29	29.00	74.00	-45.00	Horizontal	Peak
3873.75	34.81	29.67	8.60	36.85	36.23	74.00	-37.77	Horizontal	Peak
6109.67	31.50	32.54	10.86	34.03	40.87	74.00	-33.13	Horizontal	Peak
8002.06	31.23	37.10	12.30	33.07	47.56	74.00	-26.44	Horizontal	Peak

CH39									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
1232.12	35.89	26.27	4.71	37.21	29.66	74.00	-44.34	Vertical	Peak
3128.01	34.84	28.80	7.63	37.46	33.81	74.00	-40.19	Vertical	Peak
4547.56	32.17	30.80	9.37	36.20	36.14	74.00	-37.86	Vertical	Peak
8002.06	31.64	37.10	12.30	33.07	47.97	74.00	-26.03	Vertical	Peak
1759.64	35.23	25.32	5.88	37.36	29.07	74.00	-44.93	Horizontal	Peak
3672.11	34.36	29.30	8.35	37.00	35.01	74.00	-38.99	Horizontal	Peak
5588.88	31.81	31.81	10.26	34.37	39.51	74.00	-34.49	Horizontal	Peak
7921.00	31.65	36.78	12.68	33.06	48.05	74.00	-25.95	Horizontal	Peak

CH78									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
1232.12	36.36	26.27	4.71	37.21	30.13	74.00	-43.87	Vertical	Peak
3128.01	35.52	28.80	7.63	37.46	34.49	74.00	-39.51	Vertical	Peak
6235.36	31.80	32.97	11.01	33.90	41.88	74.00	-32.12	Vertical	Peak
7663.17	31.76	36.14	12.89	33.04	47.75	74.00	-26.25	Vertical	Peak
1176.94	36.14	26.12	4.61	37.24	29.63	74.00	-44.37	Horizontal	Peak
3072.77	34.83	28.75	7.57	37.51	33.64	74.00	-40.36	Horizontal	Peak
5603.13	31.47	31.79	10.28	34.36	39.18	74.00	-34.82	Horizontal	Peak
7781.10	31.36	36.10	13.21	33.05	47.62	74.00	-26.38	Horizontal	Peak

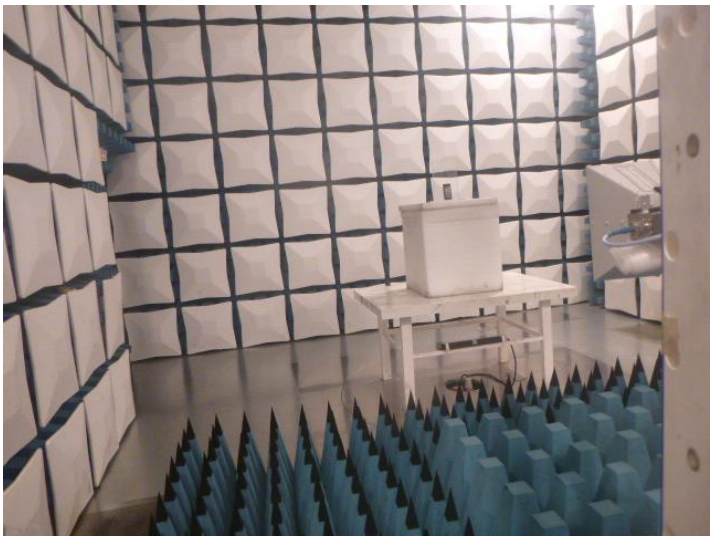
Remark:

1. Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.
3. The emission levels of other frequencies are very lower than the limit and not show in test report.

6. TEST SETUP PHOTOS

Conducted Emissions (AC Mains)

Radiated Emissions



7. EXTERANAL AND INTERNAL PHOTOS

Reference to the test report No.: CHTEW20120135

--------End of Report--------