



TEST REPORT

Report Reference No..... : TRE1712002904 R/C.....: 23847
FCC ID..... : WA6S5701
Applicant's name..... : Verykool USA Inc
Address..... : 3636 Nobel Drive,Suite 325, San Diego,CA 92122 USA
Manufacturer..... : HUAWO TECHNOLOGY LIMITED
Address..... : 3 floor west,B building,New world shopping plaza,Gushu 2nd road,
Xixiang street,Baoan District,Shenzhen,China
Test item description : Mobile Phone
Trade Mark : Verykool
Model/Type reference..... : s5702
Listed Model(s)..... : s5701
Standard : FCC CFR Title 47 Part 15 Subpart C Section 15.247
Date of receipt of test sample..... : Dec.05, 2017
Date of testing..... : Dec.05, 2017 - Dec.25, 2017
Date of issue..... : Dec.26, 2017
Result..... : PASS

Compiled by
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Candy Liu

Edward Pan

Hans Hu

Testing Laboratory Name : Shenzhen Huatongwei International Inspection Co., Ltd.
Address..... : 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao,
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The test report merely correspond to the test sample.

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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 for Testing Unlicensed Wireless Devices

1.2. Report version

Version No.	Date of issue	Description
00	Dec.26, 2017	Original

2. TEST DESCRIPTION

Test Item	Section in CFR 47	Result	Test Engineer
Antenna Requirement	15.203/15.247 (c)	Pass	William Wang
AC Power Line Conducted Emissions	15.207	Pass	William Wang
Conducted Peak Output Power	15.247 (b)(1)	Pass	Baozhu Hu
20 dB Bandwidth	15.247 (a)(1)	Pass	Baozhu Hu
Carrier Frequencies Separation	15.247 (a)(1)	Pass	Baozhu Hu
Hopping Channel Number	15.247 (a)(1)	Pass	Baozhu Hu
Dwell Time	15.247 (a)(1)	Pass	Baozhu Hu
Pseudorandom Frequency Hopping Sequence	15.247(b)(4)	Pass	Baozhu Hu
Restricted band	15.247(d)/15.205	Pass	Baozhu Hu
Radiated Emissions	15.247(d)/15.209	Pass	Baozhu Hu

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

3. SUMMARY

3.1. Client Information

Applicant:	Verykool USA Inc
Address:	3636 Nobel Drive,Suite 325, San Diego,CA 92122 USA
Manufacturer:	HUAWO TECHNOLOGY LIMITED
Address:	3 floor west,B building,New world shopping plaza,Gushu 2nd road, Xixiang street,Baoan District,Shenzhen,China

3.2. Product Description

Name of EUT:	Mobile Phone
Trade Mark:	Verykool
Model No.:	s5702
Listed Model(s):	s5701
IMEI 1 :	352484079998752
IMEI 2 :	352484079999874
Power supply:	DC 3.8V
Adapter information:	Input: 100-240Va.c., 50/60Hz, 0.2A Output: 5Vd.c.,1000mA
Hardware version:	MF0MCCRA1-1
Software version:	s5072_VK_Movi_Dual_SW_V1.0
Bluetooth	
Version:	Supported BT4.1+EDR
Modulation:	GFSK, $\pi/4$ DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	Integral antenna
Antenna gain:	-1.2dBi

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.:5377B-1

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.: 5377B-1.

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	11/11/2017	11/10/2018
2	Artificial Mains	SCHWARZBECK	NNLK 8121	573	11/11/2017	11/10/2018
3	Pulse Limiter	R&S	ESH3-Z2	101488	11/11/2017	11/10/2018
4	Test Software	R&S	ES-K1	N/A	N/A	N/A
5	RF Connection Cable	HUBER+SUHNER	EF400	N/A	11/21/2017	11/20/2018
6	Single Balanced Telecom Pair ISN	FCC	FCC-TLISN-T2-02	20371	11/11/2017	11/10/2018
7	Two Balanced Telecom Pairs ISN	FCC	FCC-TLISN-T4-02	20373	11/11/2017	11/10/2018
8	Four Balanced Telecom Pairs ISN	FCC	FCC-TLISN-T8-02	20375	11/11/2017	11/10/2018
9	V-Network	R&S	ESH3-Z6	100211	11/11/2017	11/10/2018
10	V-Network	R&S	ESH3-Z6	100210	11/11/2017	11/10/2018
11	2-Line V-Network	R&S	ESH3-Z5	100049	11/11/2017	11/10/2018

Radiated 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	11/11/2017	11/10/2018
2	Loop Antenna	R&S	HFH2-Z2	100020	11/20/2017	11/19/2018
3	Ultra-Broadband Antenna	SCHWARZBECK	VULB9163	538	4/5/2017	4/4/2018
4	Horn Antenna	SCHWARZBECK	9120D	1011	3/27/2017	3/26/2018
5	Horn Antenna	SCHWARZBECK	BBHA9170	25841	3/27/2017	3/26/2018
6	Preamplifier	SCHWARZBECK	BBV 9743	9743-0022	10/18/2017	10/17/2018
7	Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-248	10/18/2017	10/17/2018
8	High pass filter	Compliance Direction systems	BSU-6	34202	11/11/2017	11/10/2018
9	Turntable	MATURO	TT2.0	/	N/A	N/A
10	Antenna Mast	MATURO	TAM-4.0-P	/	N/A	N/A
11	EMI Test Software	R&S	ESK1	N/A	N/A	N/A
12	EMI Test Software	Audix	E3	N/A	N/A	N/A

13	RF Connection Cable	HUBER+SUHNER	3m 3GHz S	N/A	11/21/2017	11/20/2018
14	RF Connection Cable	HUBER+SUHNER	3m 3GHz RG	N/A	11/21/2017	11/20/2018
15	RF Connection Cable	HUBER+SUHNER	6m 18GHz S	N/A	11/21/2017	11/20/2018

RF Conducted Method						
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	OSP	R&S	OSP120	101317	N/A	N/A
3	OSP	R&S	OSP-B157	100890	N/A	N/A
4	Signal generator	R&S	SMB100A	177956	11/11/2017	11/10/2018
5	Vector signal generator	R&S	SMBV100A	260790	7/20/2017	7/19/2018
6	EXA Signal Analyzer	Agilent	N9020A	184247	9/22/2017	9/21/2018
7	Power Meter	Agilent	U2021XA	178231	9/22/2017	9/21/2018
8	DAQ Device	Agilent	U2531A	132812	9/22/2017	9/21/2018

The Cal.Interval was one year.

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 an antenna 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.

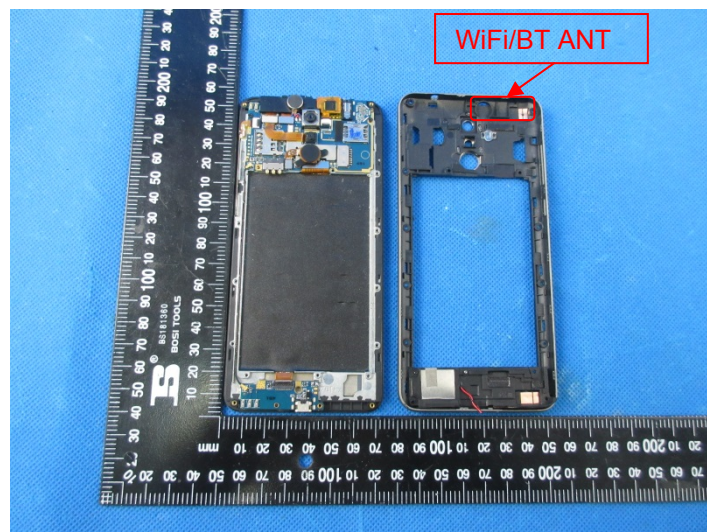
FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):

(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)

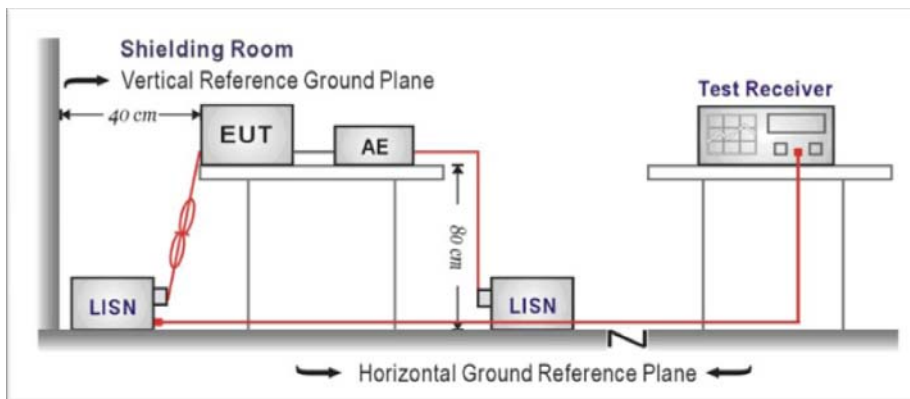
LIMIT

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

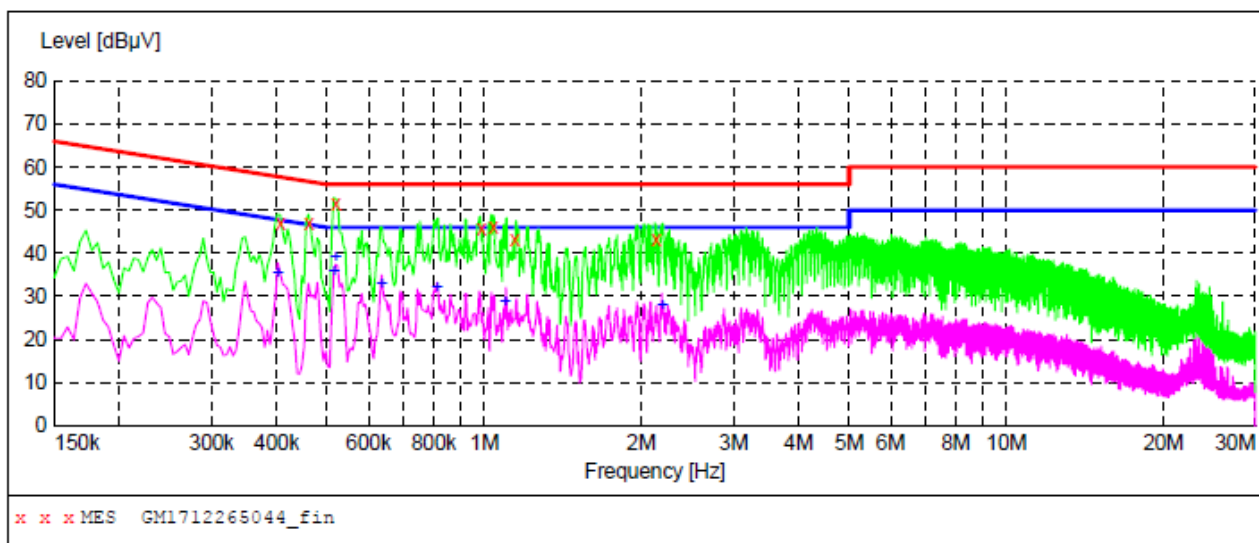
☒ Passed ☐ Not Applicable

Note:

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

Test Line:

L

**MEASUREMENT RESULT: "GM1712265044_fin"**

26/12/2017 13:51

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.406500	46.90	9.9	58	10.8	QP	L1	GND
0.460500	47.10	9.9	57	9.6	QP	L1	GND
0.519000	51.40	10.0	56	4.6	QP	L1	GND
0.987000	45.90	10.1	56	10.1	QP	L1	GND
1.041000	46.30	10.1	56	9.7	QP	L1	GND
1.144500	43.10	10.1	56	12.9	QP	L1	GND
2.130000	43.20	10.1	56	12.8	QP	L1	GND

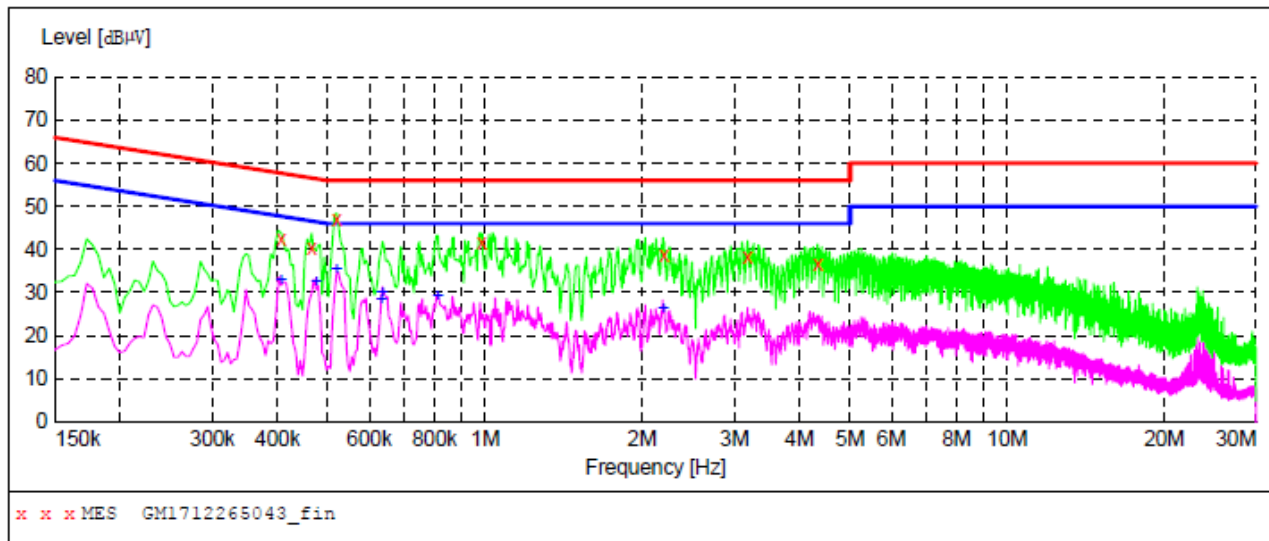
MEASUREMENT RESULT: "GM1712265044_fin2"

26/12/2017 13:51

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.402000	35.30	9.9	48	12.5	AV	L1	GND
0.514500	35.80	10.0	46	10.2	AV	L1	GND
0.519000	39.10	10.0	46	6.9	AV	L1	GND
0.636000	32.70	10.0	46	13.3	AV	L1	GND
0.811500	32.00	10.0	46	14.0	AV	L1	GND
1.095000	28.80	10.1	46	17.2	AV	L1	GND
2.193000	27.70	10.1	46	18.3	AV	L1	GND

Test Line:

N

**MEASUREMENT RESULT: "GM1712265043_fin"**

26/12/2017 13:48

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.406500	42.40	9.9	58	15.3	QP	N	GND
0.465000	40.30	9.9	57	16.3	QP	N	GND
0.519000	47.10	10.0	56	8.9	QP	N	GND
0.982500	41.50	10.1	56	14.5	QP	N	GND
2.197500	38.80	10.1	56	17.2	QP	N	GND
3.178500	38.30	10.1	56	17.7	QP	N	GND
4.335000	36.60	10.2	56	19.4	QP	N	GND

MEASUREMENT RESULT: "GM1712265043_fin2"

26/12/2017 13:48

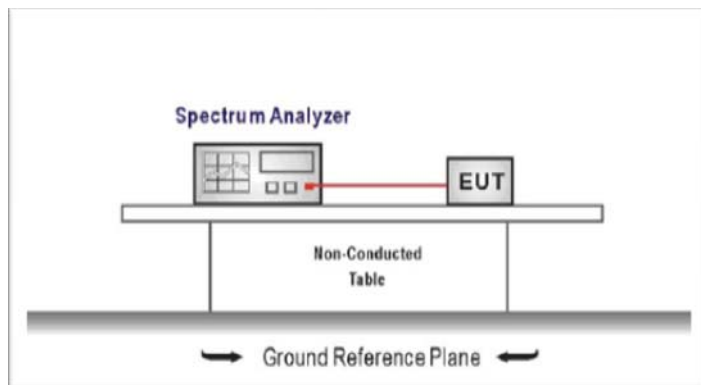
Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.406500	32.80	9.9	48	14.9	AV	N	GND
0.474000	32.30	9.9	46	14.1	AV	N	GND
0.519000	35.20	10.0	46	10.8	AV	N	GND
0.631500	28.20	10.0	46	17.8	AV	N	GND
0.636000	30.10	10.0	46	15.9	AV	N	GND
0.811500	29.10	10.0	46	16.9	AV	N	GND
2.193000	26.40	10.1	46	19.6	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 $\geq$ the 20 dB bandwidth of the emission being measured, VBW $\geq$ 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	4.01	≤ 30.00	Pass
	39	4.30		
	78	3.73		
$\pi/4$ DQPSK	00	3.97	≤ 21.00	Pass
	39	4.21		
	78	3.66		
8DPSK	00	4.08	≤ 21.00	Pass
	39	4.35		
	78	3.83		

Modulation Type:		GFSK	
CH00			
CH39			
CH78			

Modulation Type:		$\pi/4$ DQPSK	
CH00			
CH39			
CH78			

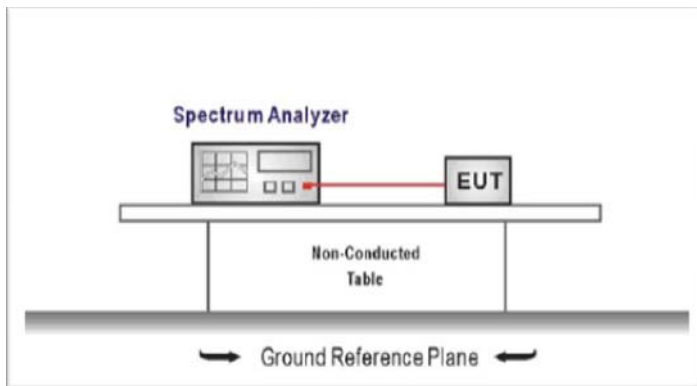
Modulation Type:		8DPSK	
CH00			Frequency Auto Tune Center Freq 2.40200000 GHz Start Freq 2.399500000 GHz Stop Freq 2.404500000 GHz CF Step 500.000 kHz Auto Man Freq Offset 0 Hz
CH39			Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.438500000 GHz Stop Freq 2.443500000 GHz CF Step 500.000 kHz Auto Man Freq Offset 0 Hz
CH78			Frequency Auto Tune Center Freq 2.480000000 GHz Start Freq 2.477500000 GHz Stop Freq 2.482500000 GHz CF Step 500.000 kHz Auto Man Freq Offset 0 Hz

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 $\geq$ 1% of the 20 dB bandwidth, VBW $\geq$ RBW
 Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

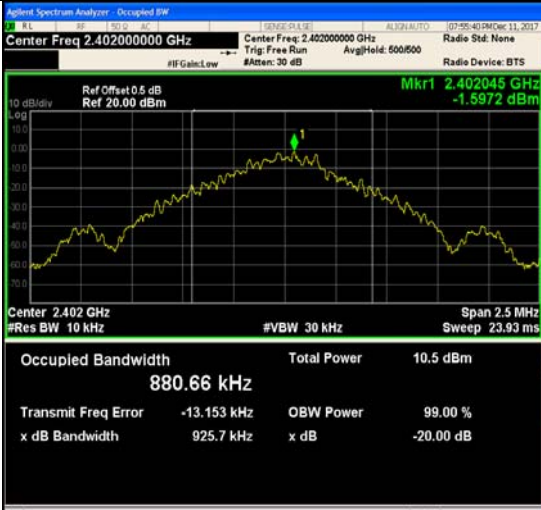
TEST MODE:

Please refer to the clause 3.3

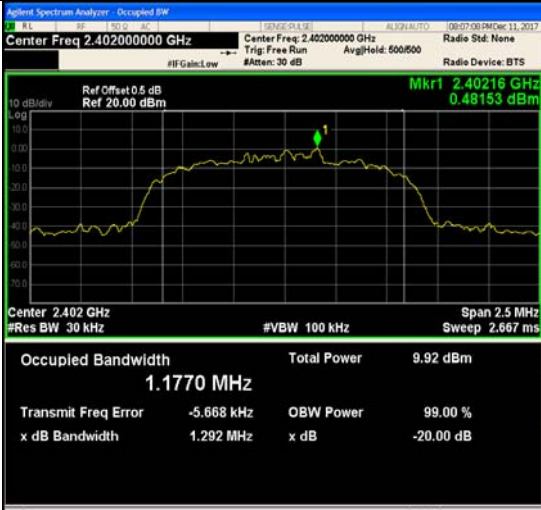
TEST RESULTS

☒ Passed ☐ Not Applicable

Modulation type	Channel	20 dB Bandwidth (MHz)	Limit (MHz)	Result
GFSK	00	0.93	-	Pass
	39	0.93		
	78	0.93		
$\pi/4$ DQPSK	00	1.29	-	Pass
	39	1.29		
	78	1.29		
8DPSK	00	1.29	-	Pass
	39	1.30		
	78	1.29		

Modulation Type:		GFSK	
CH00		 Agilent Spectrum Analyzer - Occupied BW Center Freq 2.402000000 GHz Center Freq: 2.402000000 GHz Trig: Free Run Avg/Hold: 500/500 Radio Std: None Radio Device: BTS Ref Offset 0.5 dB Ref 20.00 dBm Mkr1 2.402045 GHz -1.5972 dBm Center 2.402 GHz #Res BW 10 kHz #VBW 30 kHz Span 2.5 MHz Sweep 23.93 ms Occupied Bandwidth 880.66 kHz Total Power 10.5 dBm Transmit Freq Error -13.153 kHz OBW Power 99.00 % x dB Bandwidth 925.7 kHz x dB -20.00 dB Frequency Center Freq 2.402000000 GHz CF Step 250.000 kHz Freq Offset 0 Hz	
CH39		 Agilent Spectrum Analyzer - Occupied BW Center Freq 2.441000000 GHz Center Freq: 2.441000000 GHz Trig: Free Run Avg/Hold: 500/500 Radio Std: None Radio Device: BTS Ref Offset 0.5 dB Ref 20.00 dBm Mkr1 2.441045 GHz -1.3492 dBm Center 2.441 GHz #Res BW 10 kHz #VBW 30 kHz Span 2.5 MHz Sweep 23.93 ms Occupied Bandwidth 880.25 kHz Total Power 10.8 dBm Transmit Freq Error -12.801 kHz OBW Power 99.00 % x dB Bandwidth 925.9 kHz x dB -20.00 dB Frequency Center Freq 2.441000000 GHz CF Step 250.000 kHz Freq Offset 0 Hz	
CH78		 Agilent Spectrum Analyzer - Occupied BW Center Freq 2.480000000 GHz Center Freq: 2.480000000 GHz Trig: Free Run Avg/Hold: 500/500 Radio Std: None Radio Device: BTS Ref Offset 0.5 dB Ref 20.00 dBm Mkr1 2.4800475 GHz -1.8546 dBm Center 2.48 GHz #Res BW 10 kHz #VBW 30 kHz Span 2.5 MHz Sweep 23.93 ms Occupied Bandwidth 878.97 kHz Total Power 10.2 dBm Transmit Freq Error -12.927 kHz OBW Power 99.00 % x dB Bandwidth 925.5 kHz x dB -20.00 dB Frequency Center Freq 2.480000000 GHz CF Step 250.000 kHz Freq Offset 0 Hz	

Modulation Type:		$\pi/4$ DQPSK
CH00		Frequency Center Freq 2.402000000 GHz CF Step 250.000 kHz Freq Offset 0 Hz
CH39		Frequency Center Freq 2.441000000 GHz CF Step 250.000 kHz Freq Offset 0 Hz
CH78		Frequency Center Freq 2.480000000 GHz CF Step 250.000 kHz Freq Offset 0 Hz

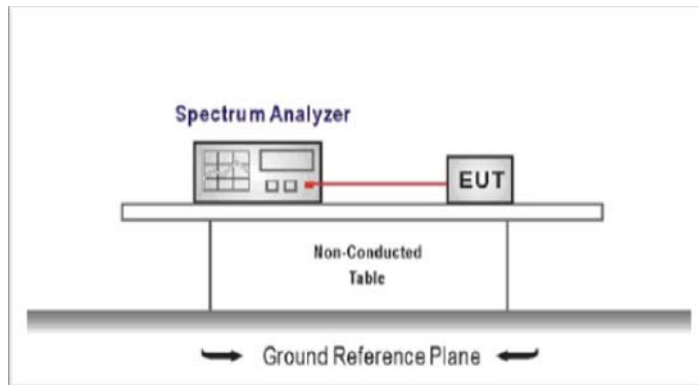
Modulation Type:		8DPSK	
CH00			Frequency Center Freq 2.402000000 GHz CF Step 250.000 kHz Freq Offset 0 Hz
CH39			Frequency Center Freq 2.441000000 GHz CF Step 250.000 kHz Freq Offset 0 Hz
CH78			Frequency Center Freq 2.480000000 GHz CF Step 250.000 kHz Freq Offset 0 Hz

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 minimum of 25 kHz or the $2/3 \times 20$ dB bandwidth of the hopping channel, whichever is greater.

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 $\geq 1\%$ of the span, VBW $\geq$ 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	≥ 0.93	Pass
$\pi/4$ DQPSK	39	1.00	≥ 0.86	Pass
8DPSK	39	1.00	≥ 0.87	Pass

Note:

*: GFSK limit = The maximum 20 dB Bandwidth for GFSK modulation on the section 5.4.

$\pi/4$ DQPSK limit = $2/3 \times$ The maximum 20 dB Bandwidth for $\pi/4$ DQPSK modulation on the section 5.4.

8DPSK limit = $2/3 \times$ The maximum 20 dB Bandwidth for 8DPSK modulation on the section 5.4

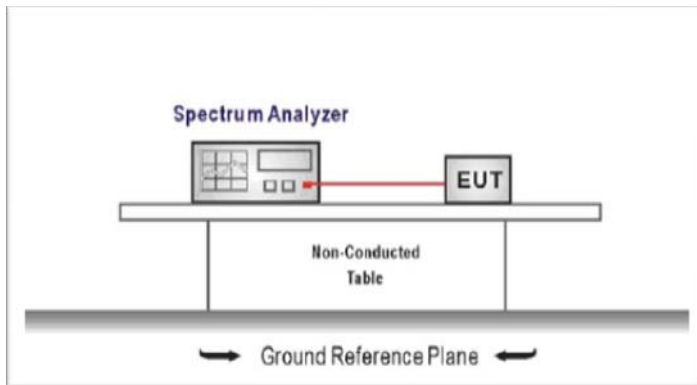
GFSK		
$\pi/4$ DQPSK		
8DPSK		

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 $\geq$ 1% of the span, VBW $\geq$ RBW
Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

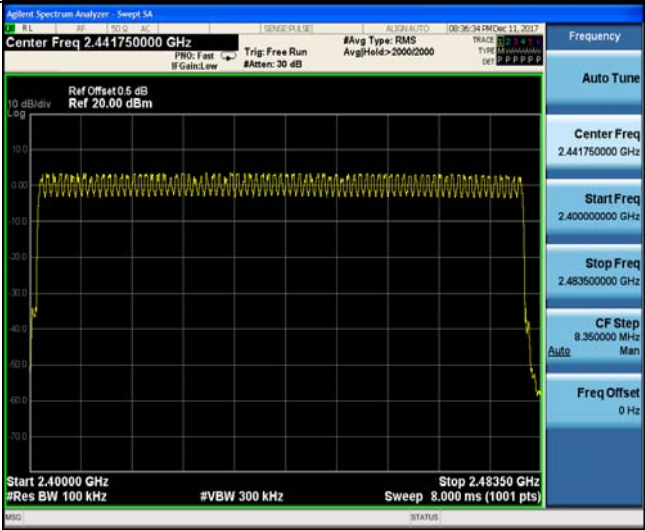
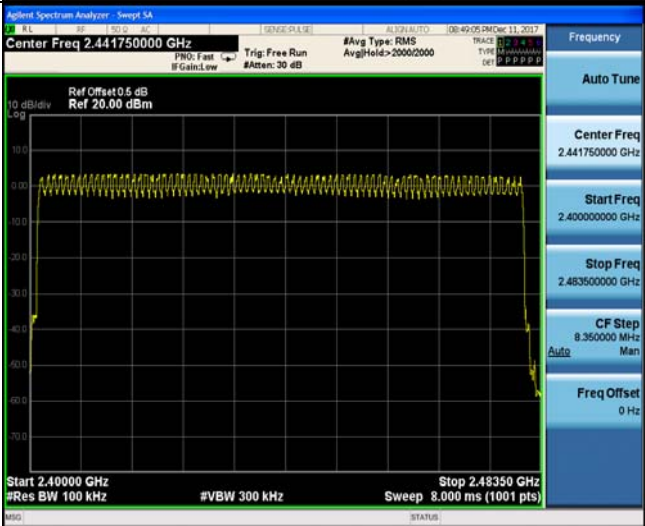
TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

☒ Passed ☐ Not Applicable

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

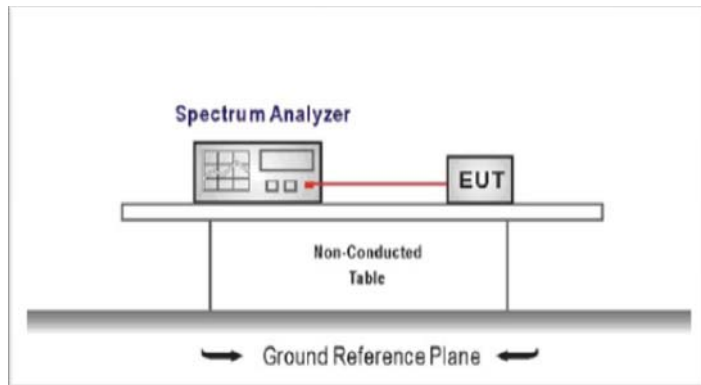
GFSK		
$\pi/4$ DQPSK		
8DPSK		

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 $\geq$ 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.

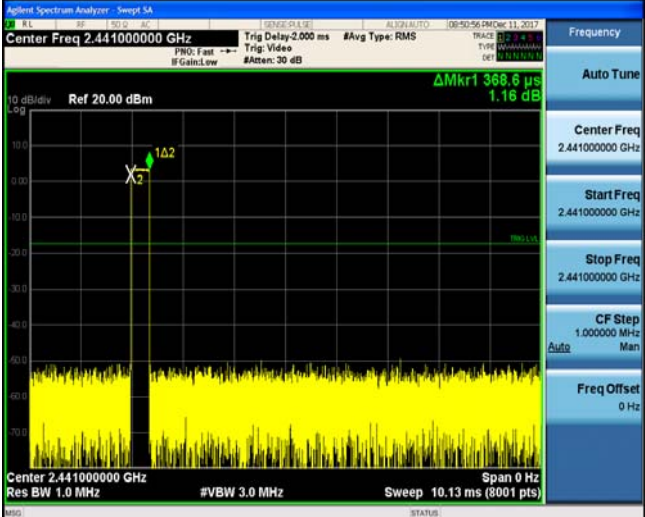
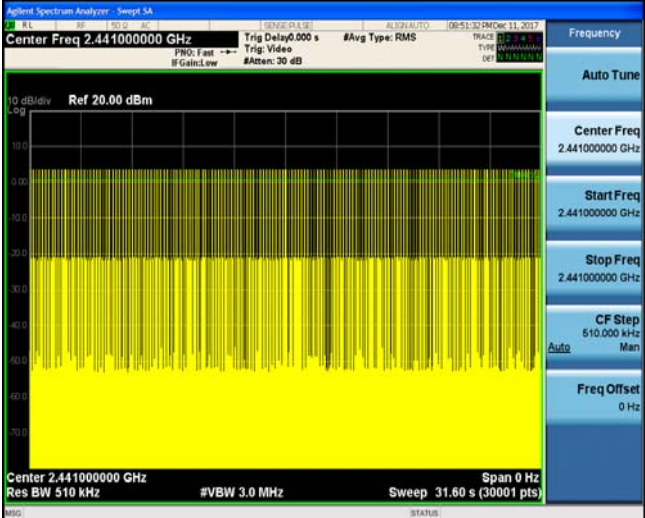
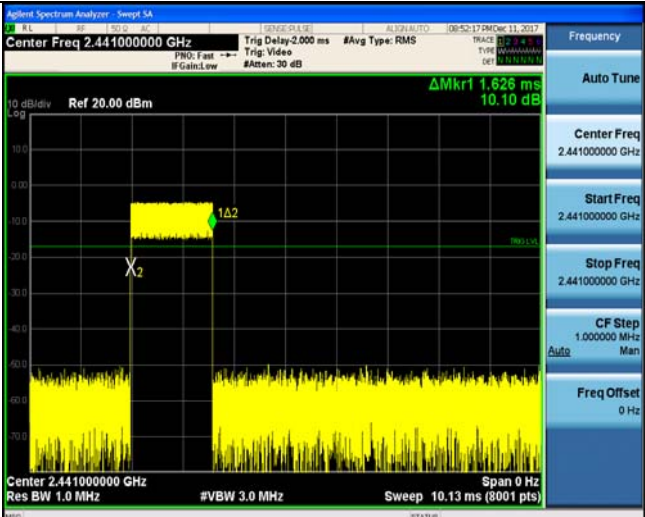
TEST MODE:

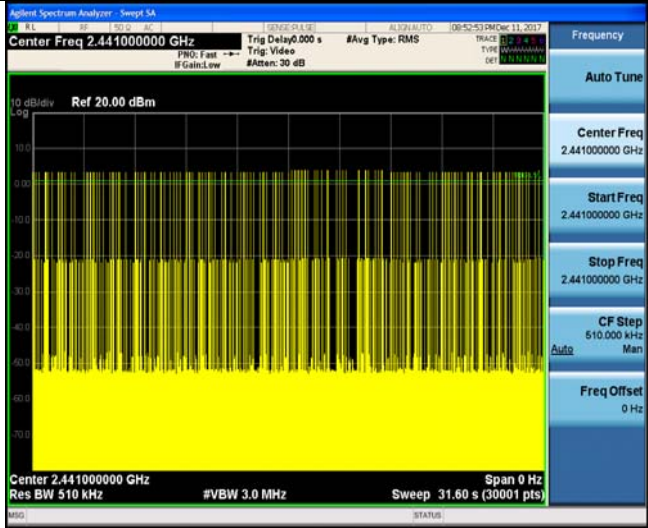
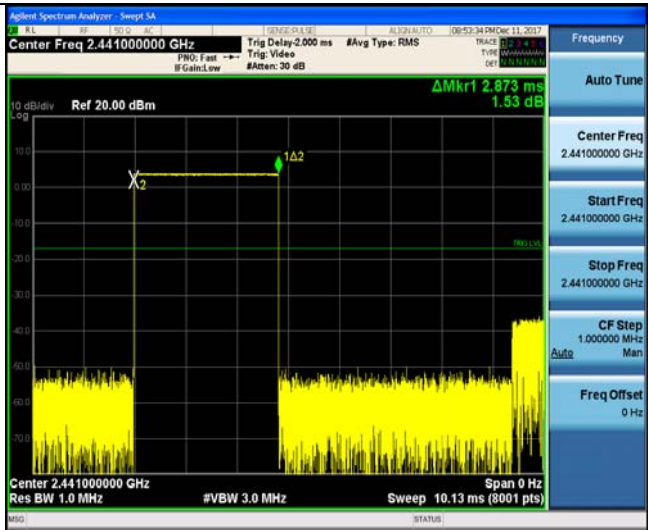
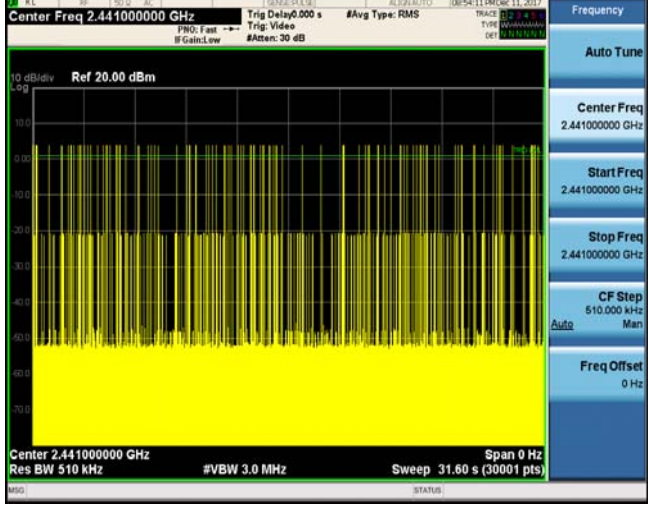
Please refer to the clause 3.3

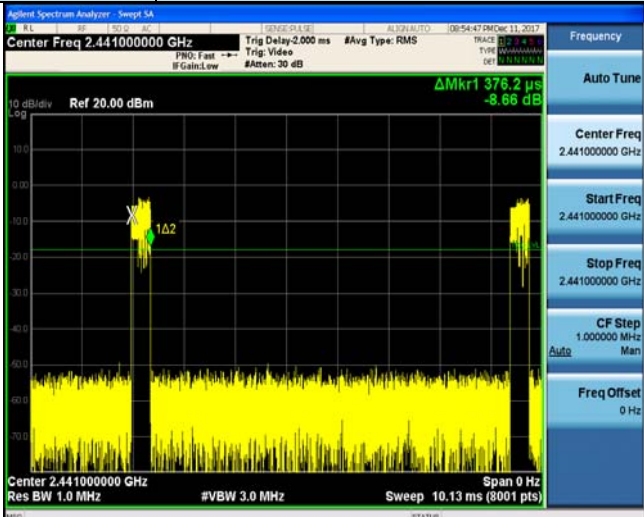
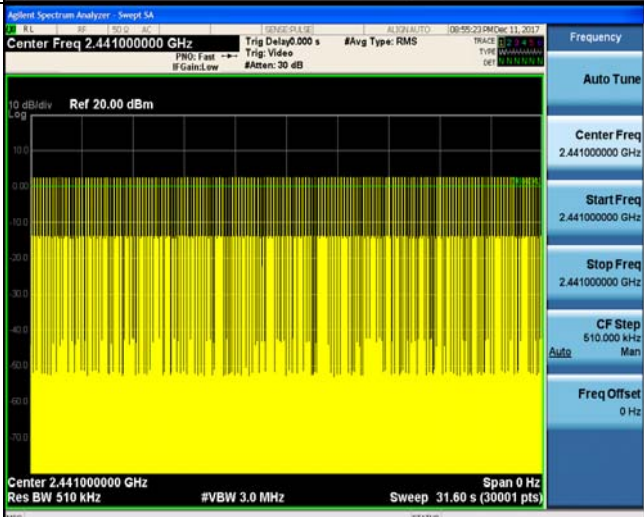
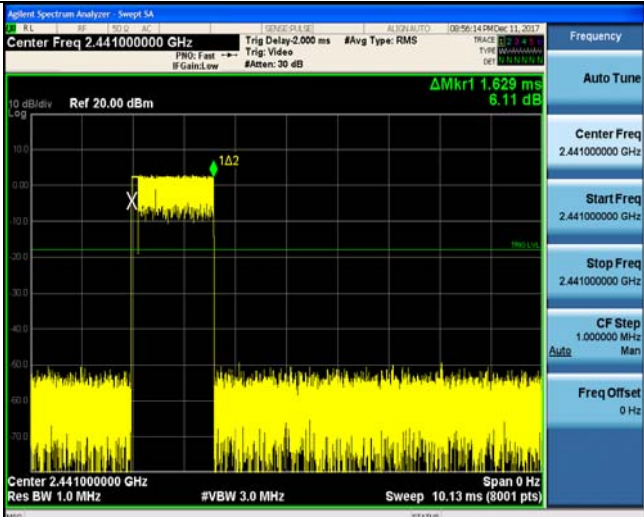
TEST RESULTS

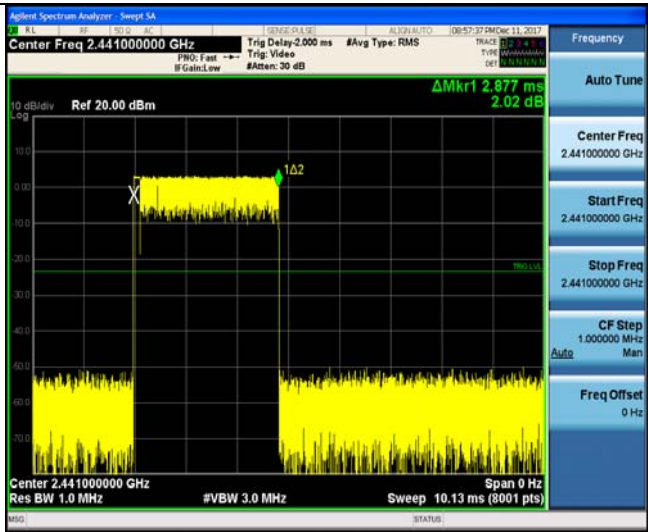
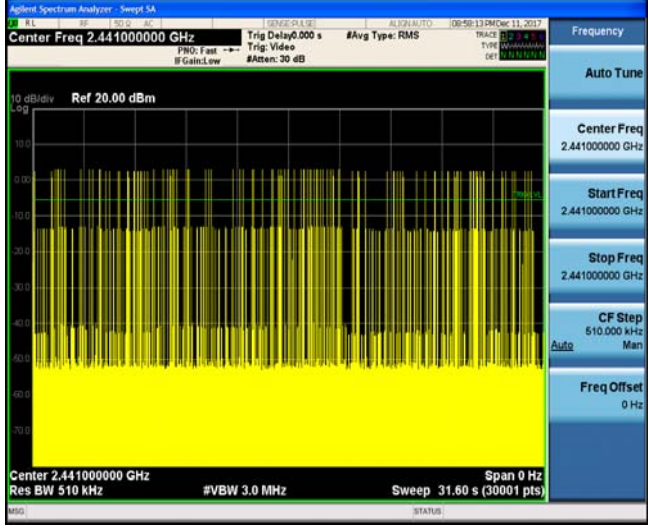
☒ Passed ☐ Not Applicable

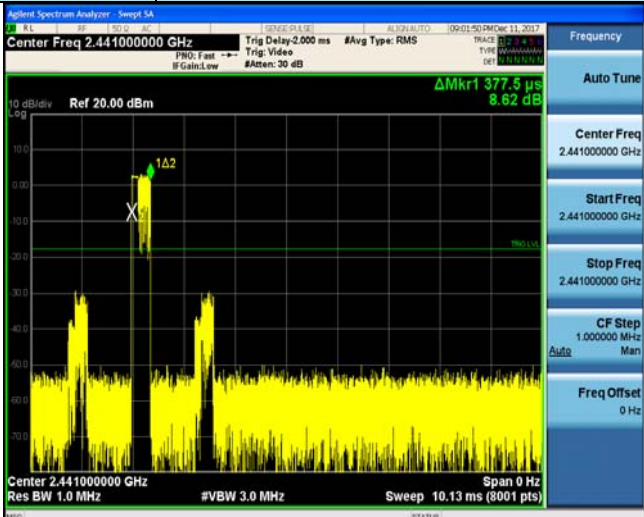
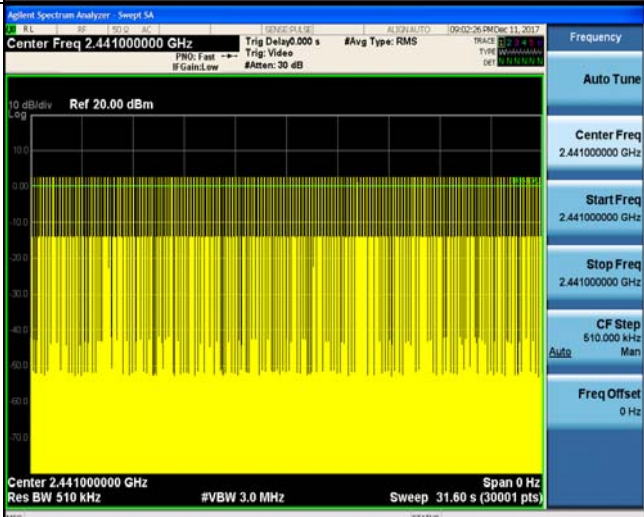
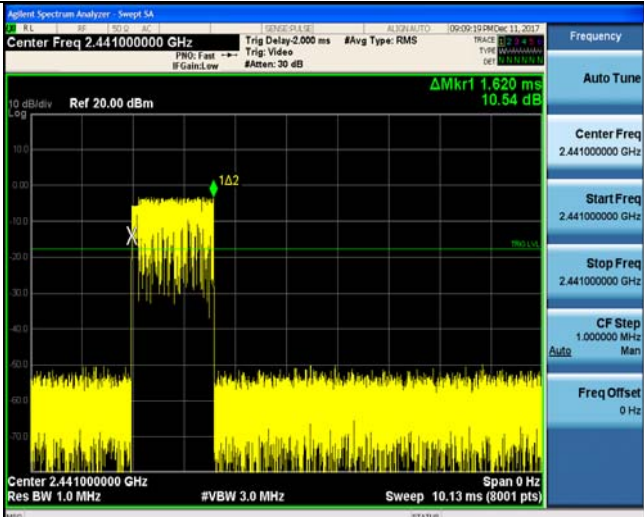
Modulation type	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell time (Second)	Limit (Second)	Result
GFSK	DH1	0.37	314.00	0.12	≤ 0.40	Pass
	DH3	1.63	159.00	0.26		
	DH5	2.87	100.00	0.29		
$\pi/4$ DQPSK	2DH1	0.38	314.00	0.12	≤ 0.40	Pass
	2DH3	1.63	158.00	0.26		
	2DH5	2.88	106.00	0.31		
8DPSK	3DH1	0.38	318.00	0.12	≤ 0.40	Pass
	3DH3	1.62	160.00	0.26		
	3DH5	2.88	94.00	0.27		

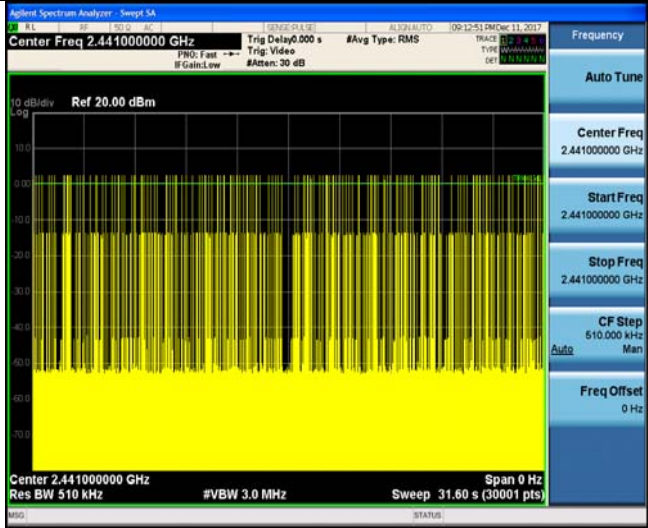
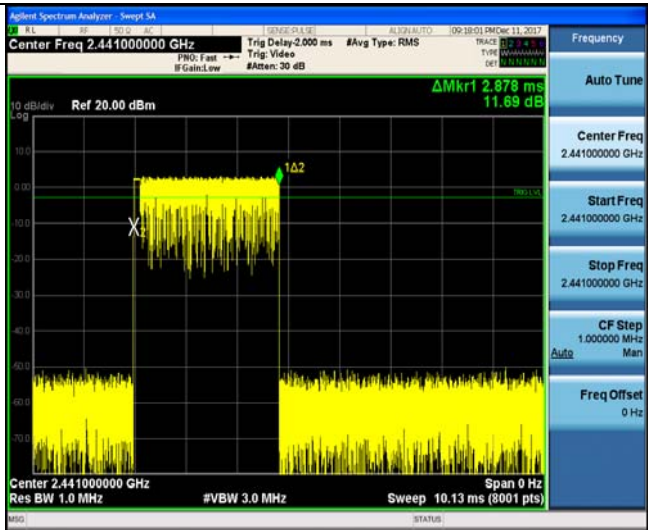
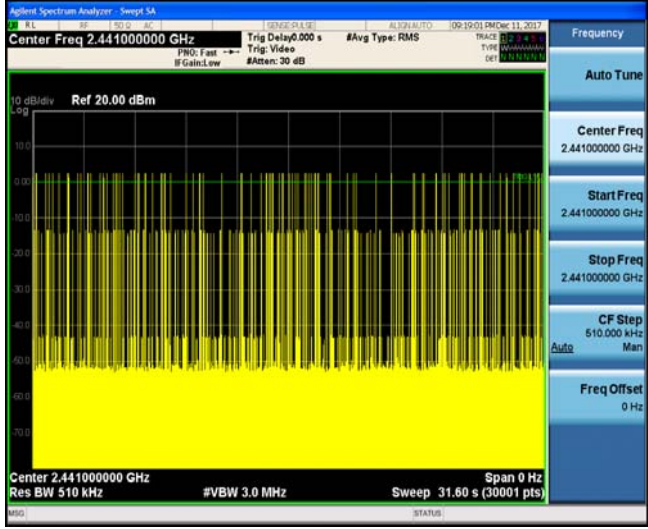
Modulation Type:		GFSK	
DH1			Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz Stop Freq 2.441000000 GHz CF Step 1.000000 MHz Freq Offset 0 Hz
			Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz Stop Freq 2.441000000 GHz CF Step 510.000 kHz Freq Offset 0 Hz
DH3			Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz Stop Freq 2.441000000 GHz CF Step 1.000000 MHz Freq Offset 0 Hz

		
		
DH5		

Modulation Type:		$\pi/4$ DQPSK
2DH1		
		
2DH3		

		
2DH5		
		

Modulation Type:		8DPSK
3DH1		Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz Stop Freq 2.441000000 GHz CF Step 1.000000 MHz Auto Man Freq Offset 0 Hz
		Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz Stop Freq 2.441000000 GHz CF Step 510.000 kHz Auto Man Freq Offset 0 Hz
3DH3		Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz Stop Freq 2.441000000 GHz CF Step 1.000000 MHz Auto Man Freq Offset 0 Hz

		
3DH5		
		

5.8. Pseudorandom Frequency Hopping Sequence

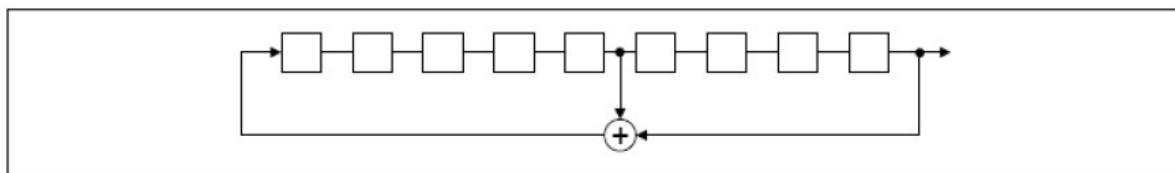
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1): Frequency hopping systems shall have hopping channel carrier 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. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo-randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

TEST RESULTS

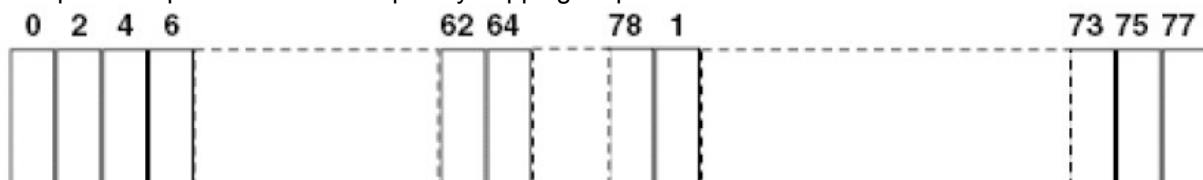
The pseudorandom frequency hopping sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones, for example: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

- Number of shift register stages: 9
- Length of pseudo-random sequence: $2^9 - 1 = 511$ bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example 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.

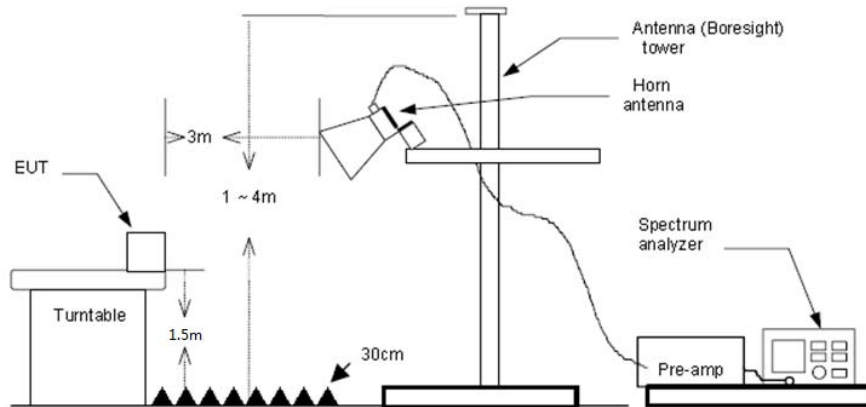
5.9. Restricted band (radiated)

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 was positioned 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. This is 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:

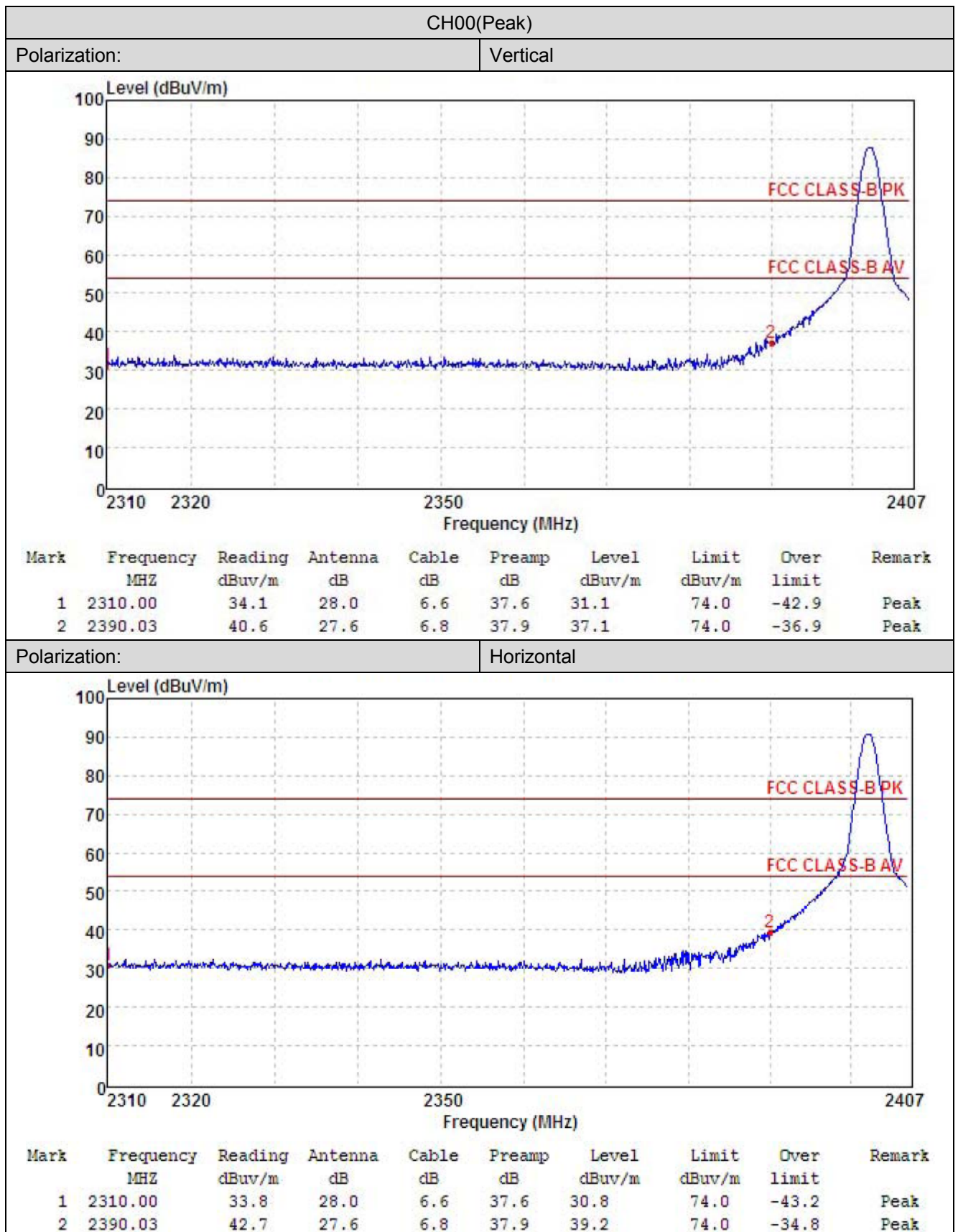
Please refer to the clause 3.3

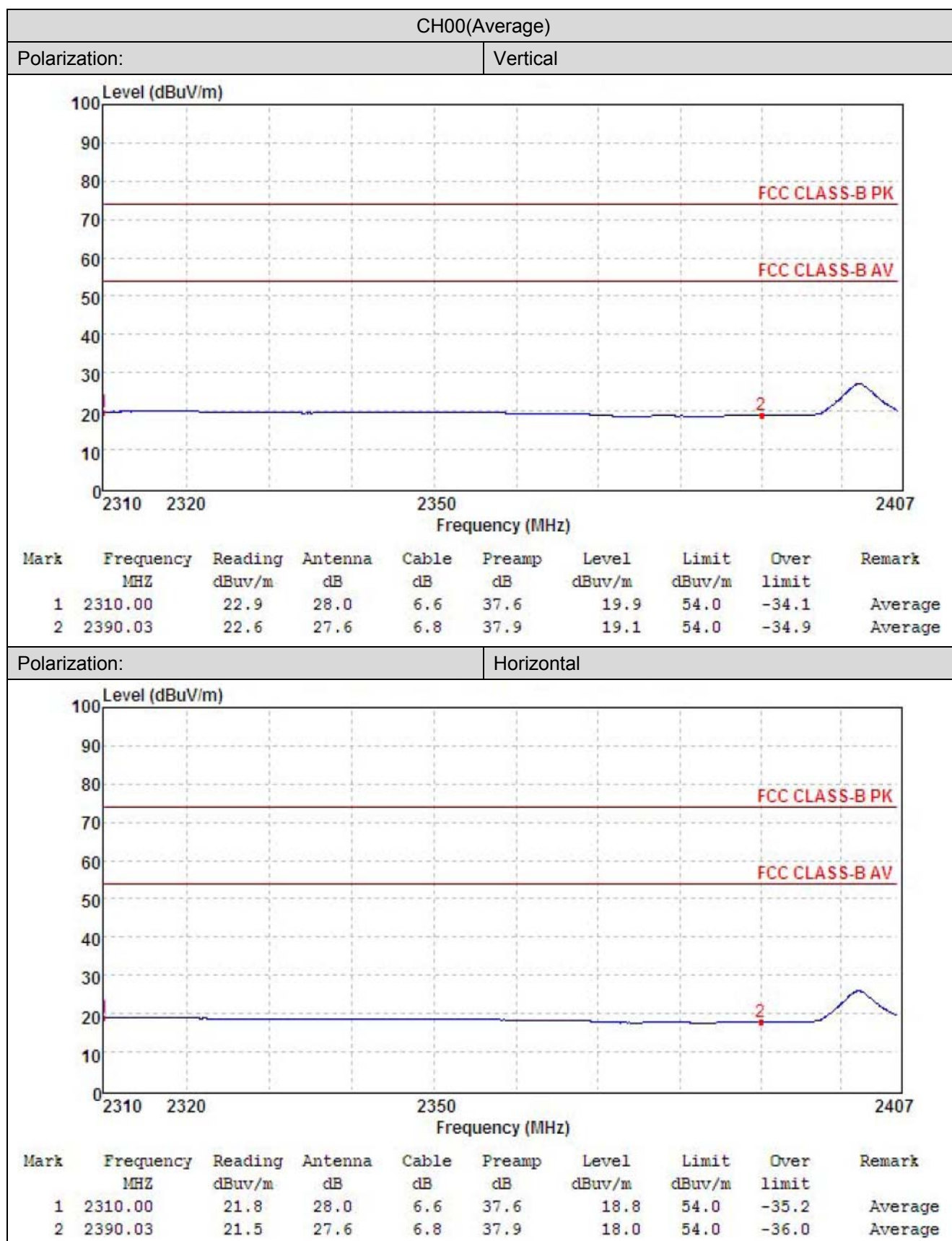
TEST RESULTS

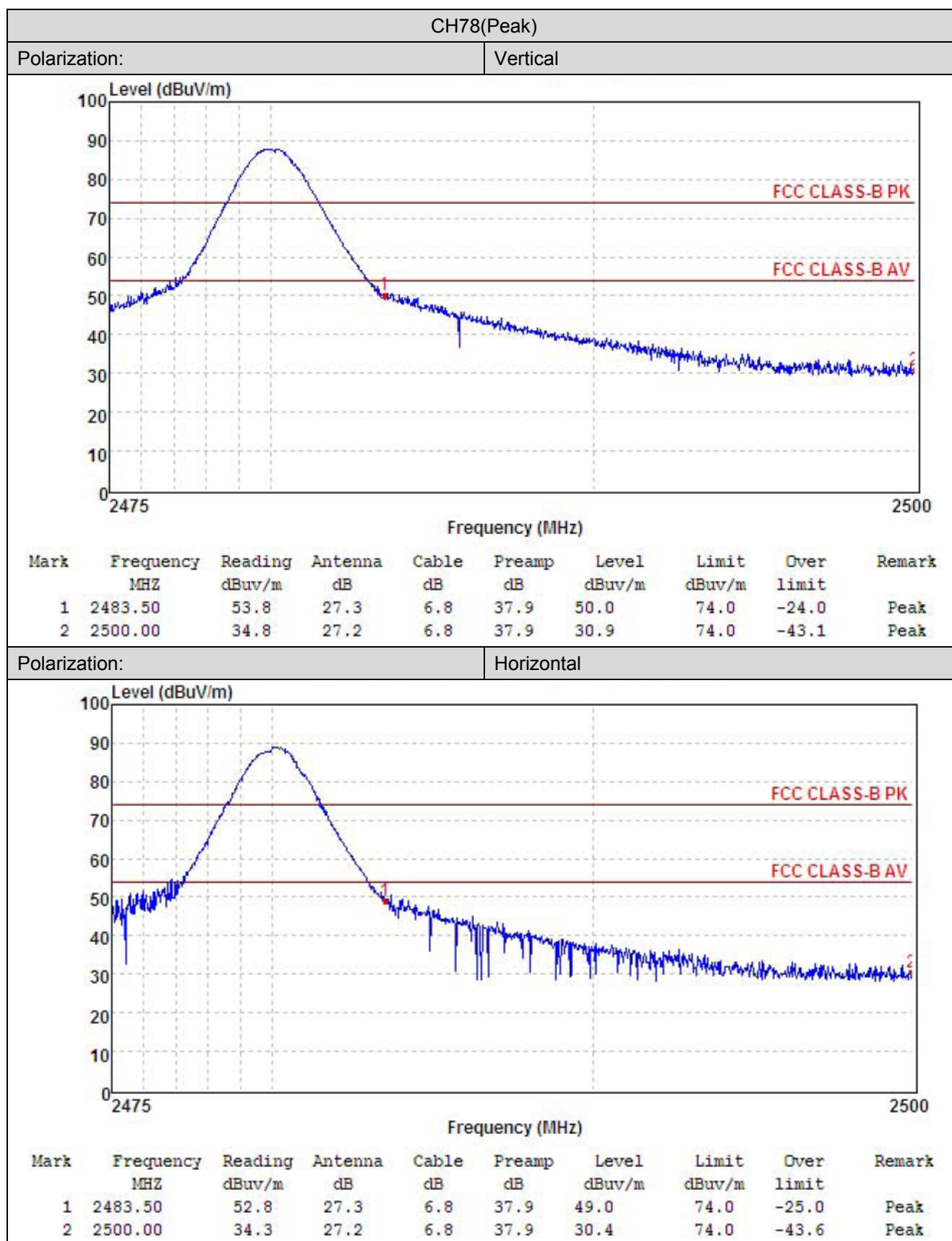
☒ Passed ☐ Not Applicable

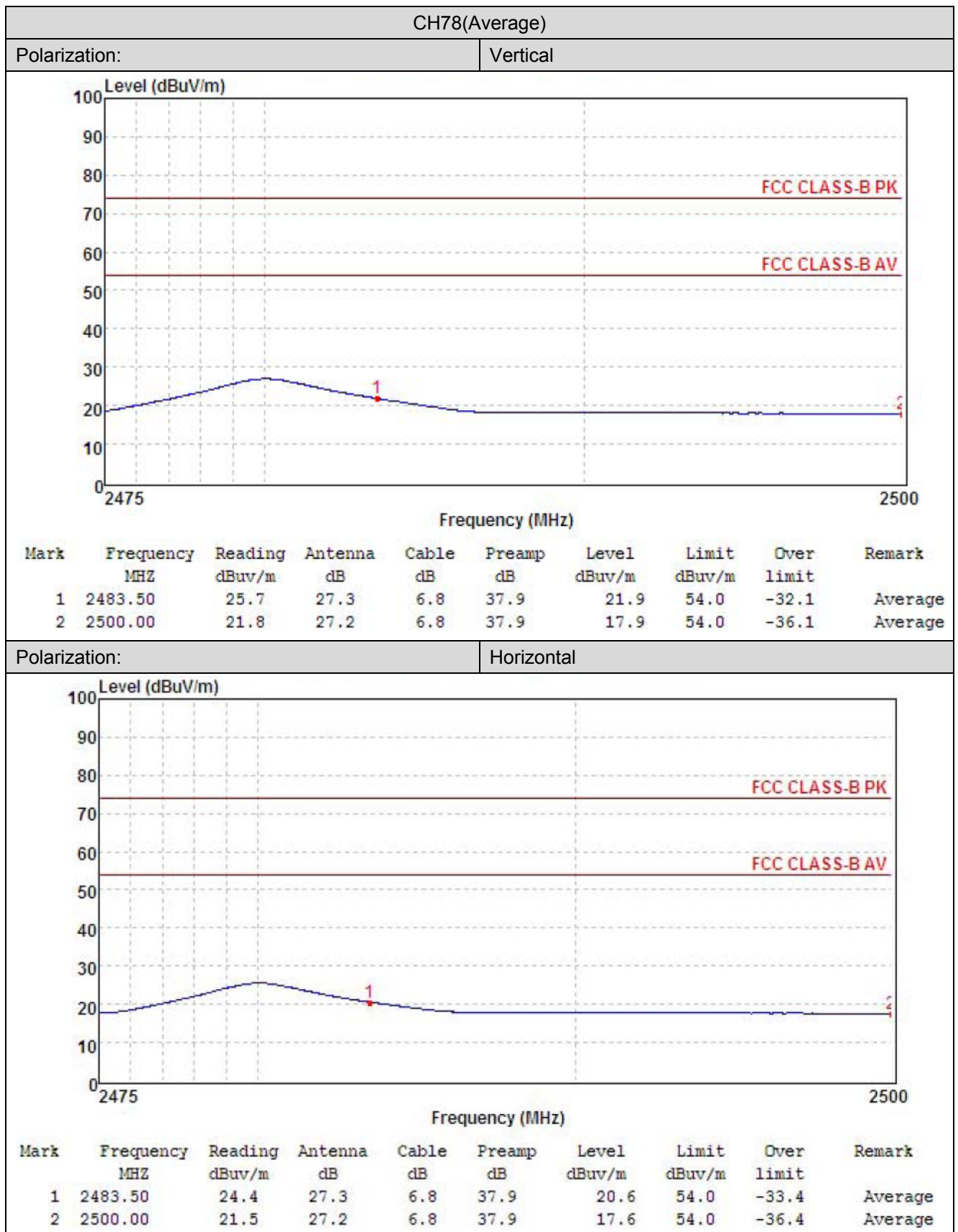
Note:

- 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.







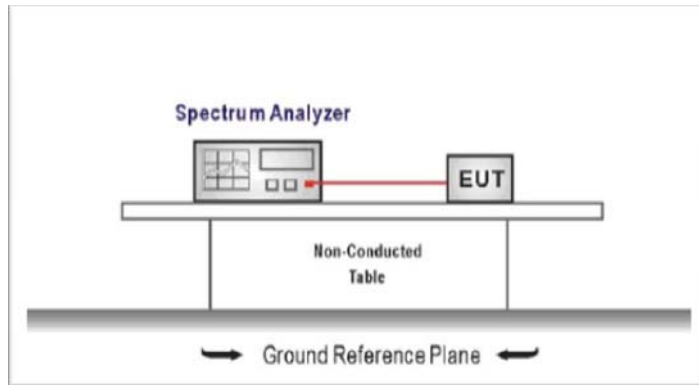


5.10. Band edge and Spurious Emissions (conducted)

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

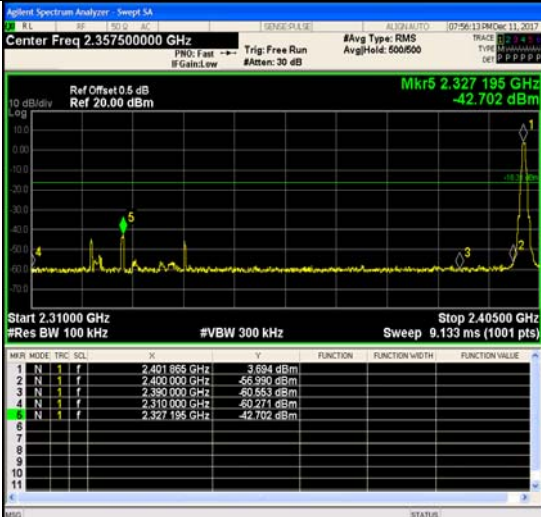
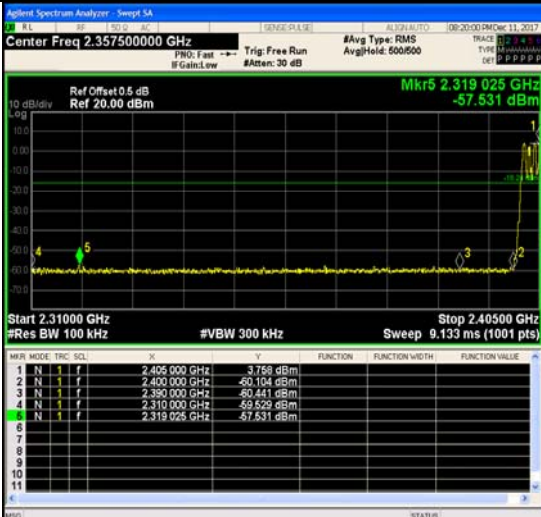
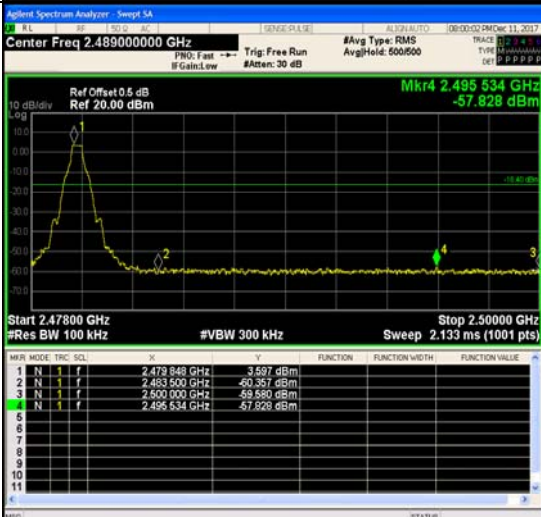
1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
RBW = 100 kHz, VBW $\geq$ 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

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:	$\pi/4$ DQPSK
CH00 No hopping mode			
CH00 Hopping mode			
CH78 No hopping mode			

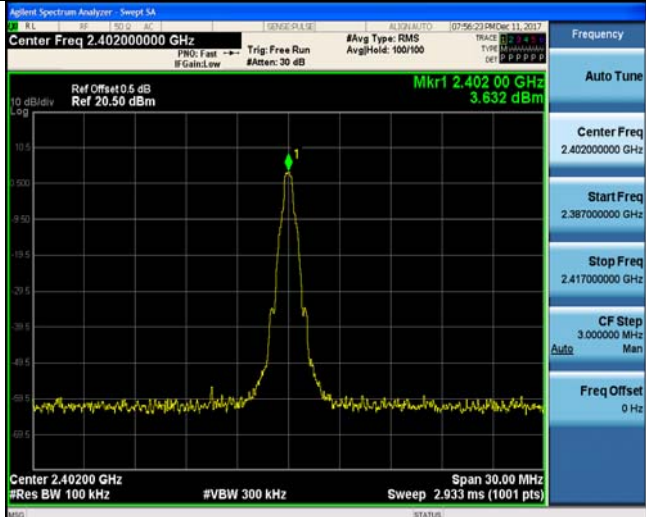
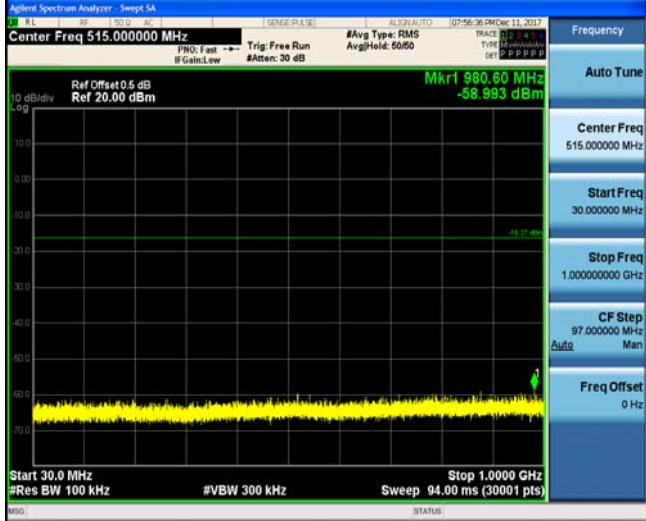
CH78
Hopping mode



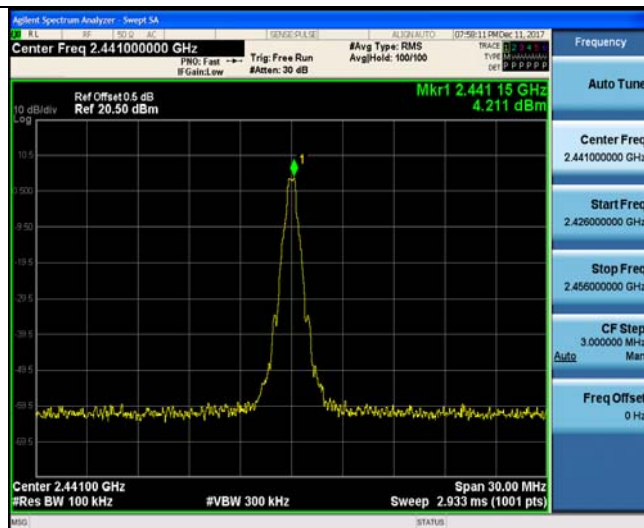
Test Item:	Band edge	Modulation type:	8DPSK
CH00 No hopping mode			
CH00 Hopping mode			
CH78 No hopping mode			

CH78
Hoppig mode



Test Item:	SE	Modulation type:	GFSK
reference level CH00			
CH00			
			

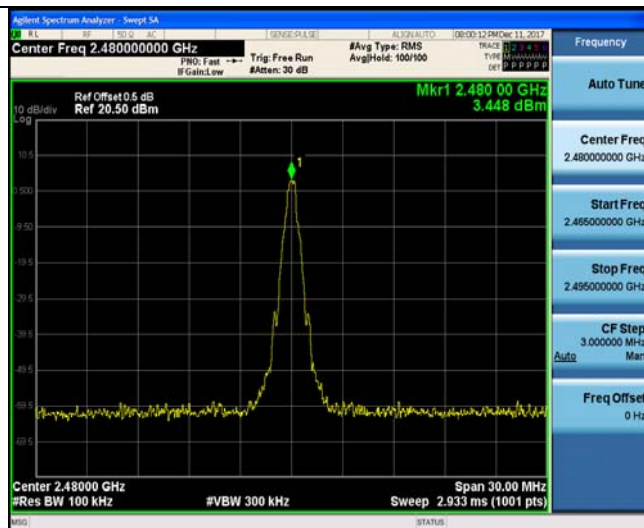
reference level CH39



CH39

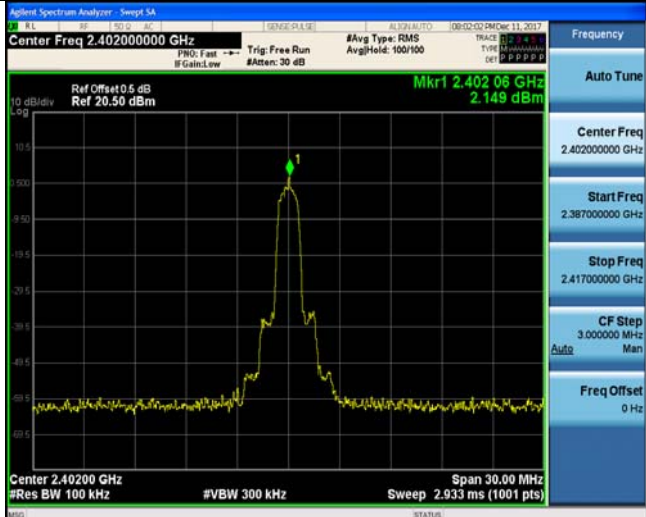


reference level CH78

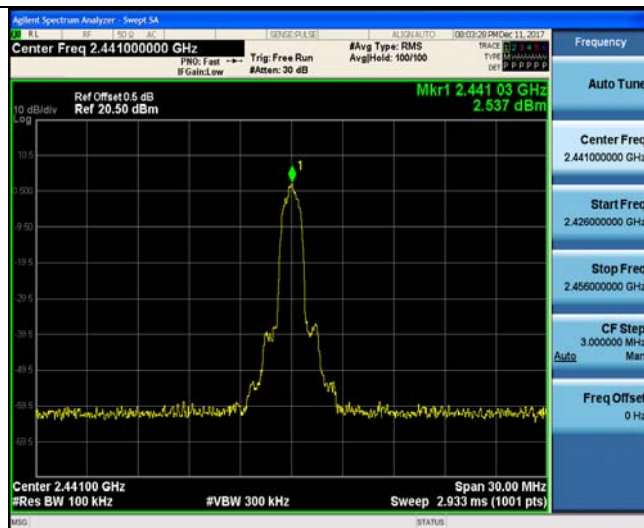


CH78

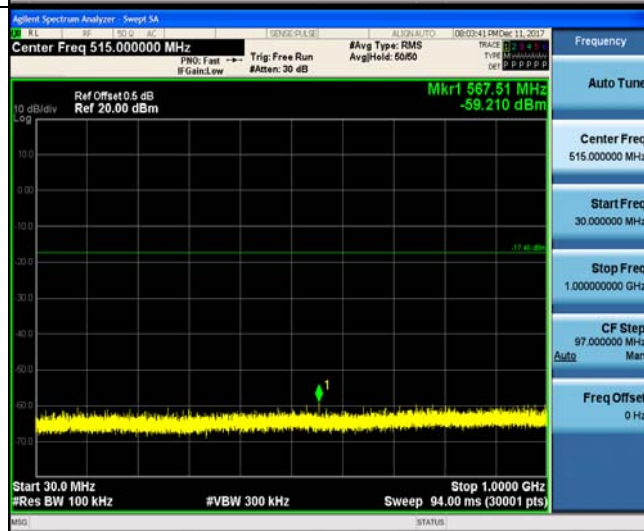


Test Item:	SE	Modulation type:	$\pi/4$ DQPSK
reference level CH00			
CH00			
			

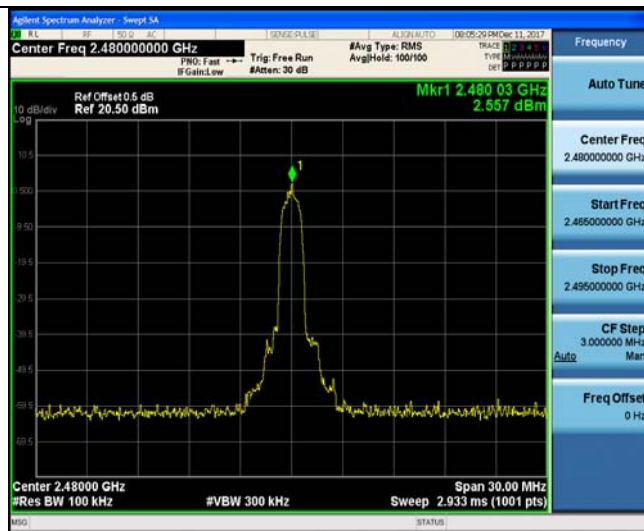
reference level CH39



CH39

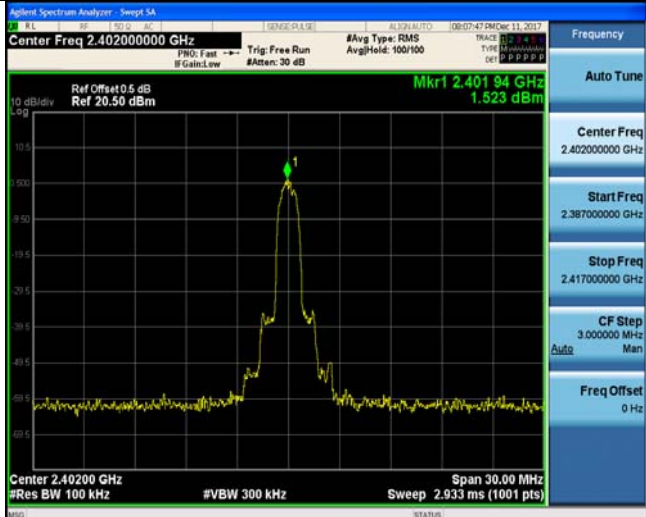


reference level CH78

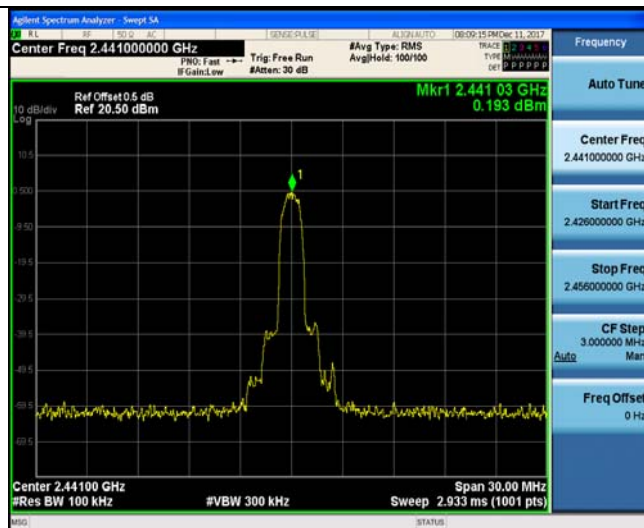


CH78



Test Item:	SE	Modulation type:	8DPSK
reference level CH00			
CH00			
			

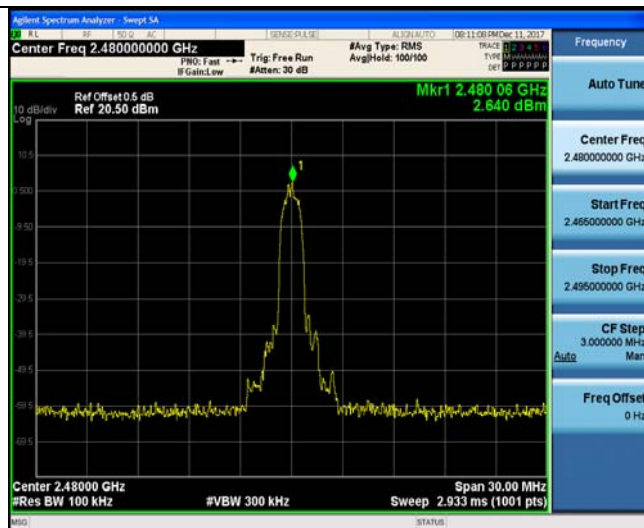
reference level CH39



CH39



reference level CH78



CH78



5.11. Spurious Emissions (radiated)

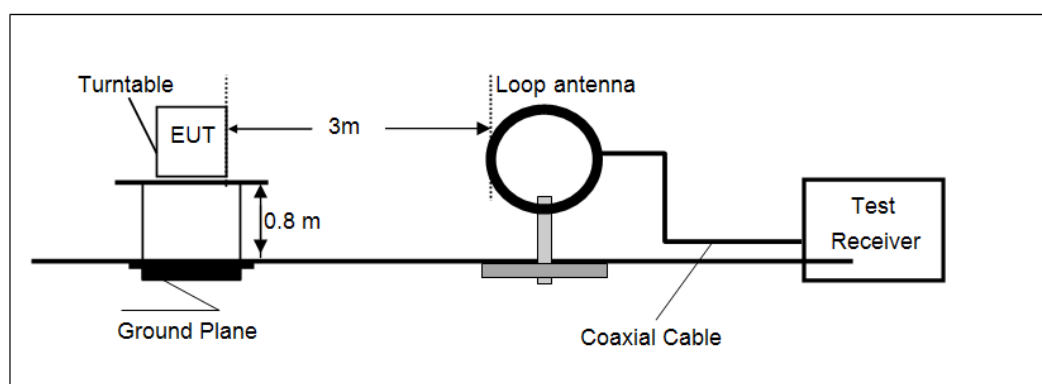
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209

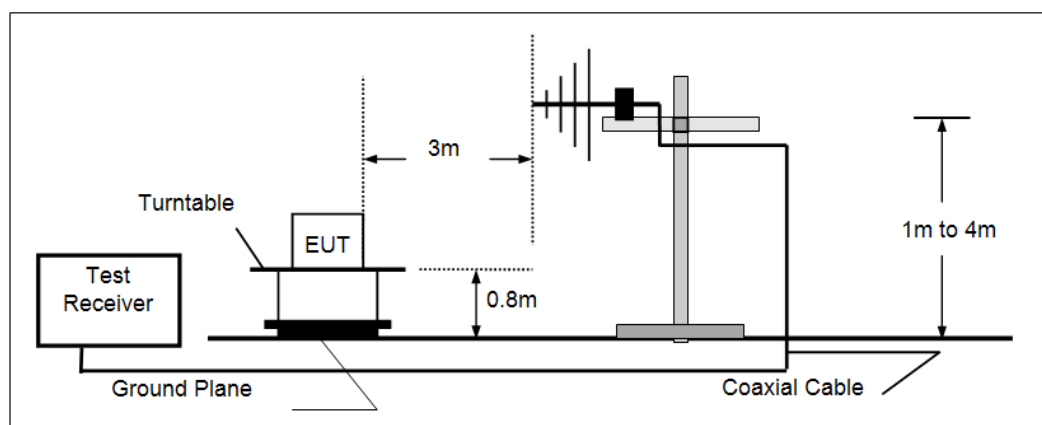
Frequency	Limit (dBuV/m @3m)	Value
30 MHz ~ 88 MHz	40.00	Quasi-peak
88 MHz ~ 216 MHz	43.50	Quasi-peak
216 MHz ~ 960 MHz	46.00	Quasi-peak
960 MHz ~ 1 GHz	54.00	Quasi-peak
Above 1 GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

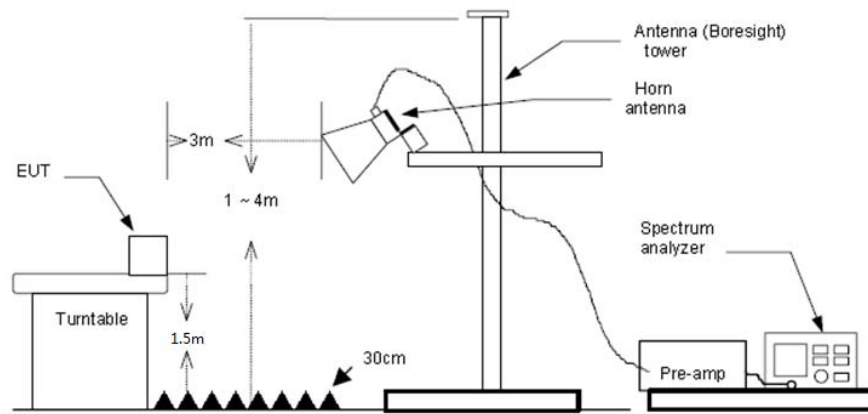
- Below 30 MHz



- 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 which is 0.8 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned 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. This is repeated for both horizontal and vertical polarization of the antenna.
5. 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 detector is 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) Above 1 GHz, 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.

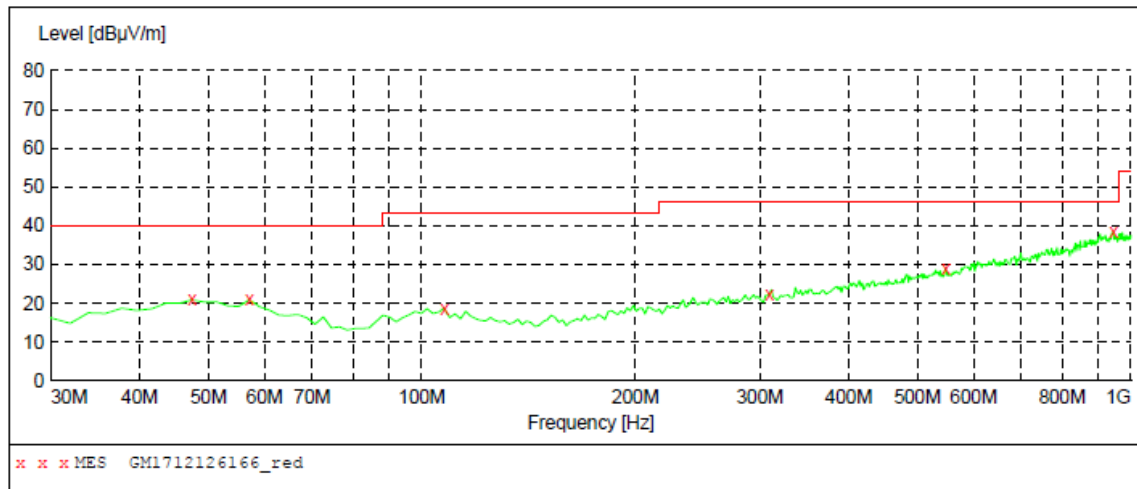
➤ 9 kHz ~ 30 MHz

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

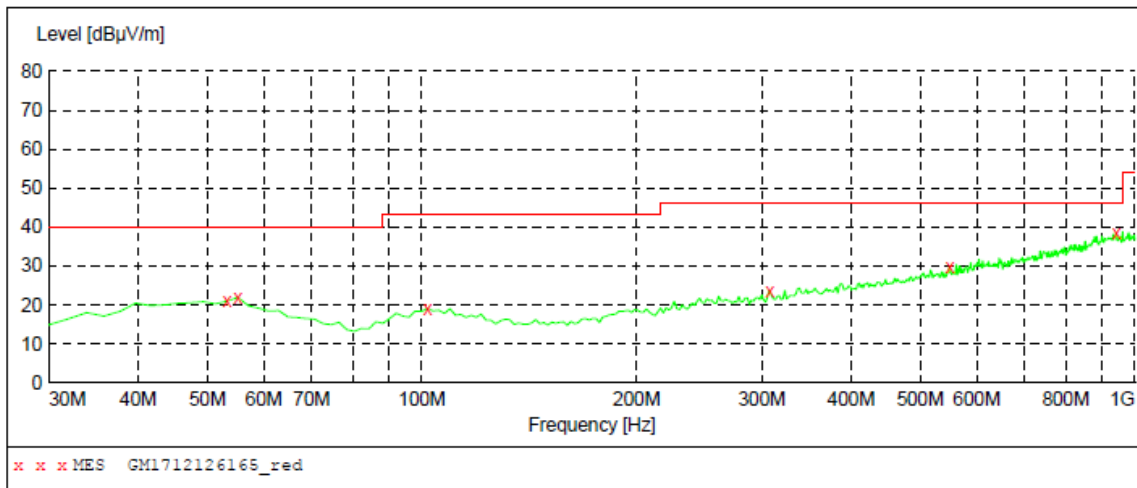
**MEASUREMENT RESULT: "GM1712126166_red"**

12/12/2017 11:59PM

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	20.90	-8.8	40.0	19.1	QP	100.0	130.00	VERTICAL
57.160000	20.90	-9.4	40.0	19.1	QP	100.0	336.00	VERTICAL
107.600000	18.80	-10.6	43.5	24.7	QP	100.0	130.00	VERTICAL
309.360000	22.20	-7.1	46.0	23.8	QP	100.0	130.00	VERTICAL
547.980000	29.00	-0.8	46.0	17.0	QP	100.0	248.00	VERTICAL
945.680000	38.30	7.2	46.0	7.7	QP	100.0	351.00	VERTICAL

Polarization:

Horizontal

**MEASUREMENT RESULT: "GM1712126165_red"**

12/12/2017 11:56PM

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
53.280000	21.00	-9.0	40.0	19.0	QP	100.0	99.00	HORIZONTAL
55.220000	22.00	-9.2	40.0	18.0	QP	300.0	81.00	HORIZONTAL
101.780000	19.10	-10.5	43.5	24.4	QP	100.0	163.00	HORIZONTAL
307.420000	23.70	-7.1	46.0	22.3	QP	300.0	0.00	HORIZONTAL
549.920000	29.70	-0.8	46.0	16.3	QP	100.0	249.00	HORIZONTAL
941.800000	38.30	7.2	46.0	7.7	QP	300.0	171.00	HORIZONTAL

➤ 1 GHz ~ 25 GHz

CH00									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
1884.83	47.29	25.31	6.09	37.21	41.48	74.00	-32.52	Vertical	Peak
3700.26	37.50	29.30	8.39	38.25	36.94	74.00	-37.06	Vertical	Peak
4809.50	45.80	31.58	9.55	36.93	50.00	74.00	-24.00	Vertical	Peak
9611.66	36.50	39.07	13.73	35.19	54.11	74.00	-19.89	Vertical	Peak
4809.50	29.50	31.58	9.55	36.93	33.70	54.00	-20.30	Vertical	Average
2081.55	42.75	26.63	6.34	37.32	38.40	74.00	-35.60	Horizontal	Peak
3607.26	37.71	29.30	8.28	38.27	37.02	74.00	-36.98	Horizontal	Peak
4809.50	51.78	31.58	9.55	36.93	55.98	74.00	-18.02	Horizontal	Peak
7209.02	34.77	36.21	11.87	35.07	47.78	74.00	-26.22	Horizontal	Peak
4809.50	39.67	31.58	9.55	36.93	43.87	54.00	-10.13	Horizontal	Average

CH39									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
1561.22	36.36	25.24	5.46	36.67	30.39	74.00	-43.61	Vertical	Peak
3184.25	36.03	28.80	7.70	38.20	34.33	74.00	-39.67	Vertical	Peak
4883.52	47.85	31.43	9.59	36.73	52.14	74.00	-21.86	Vertical	Peak
7527.83	32.11	36.13	12.49	34.92	45.81	74.00	-28.19	Vertical	Peak
4883.52	30.24	31.43	9.59	36.73	34.53	54.00	-19.47	Vertical	Average
1626.12	35.36	24.98	5.62	36.77	29.19	74.00	-44.81	Horizontal	Peak
3184.25	35.47	28.80	7.70	38.20	33.77	74.00	-40.23	Horizontal	Peak
4883.52	52.64	31.43	9.59	36.73	56.93	74.00	-17.07	Horizontal	Peak
7319.96	35.94	36.30	11.99	34.92	49.31	74.00	-24.69	Horizontal	Peak
4883.52	32.40	31.43	9.59	36.73	36.69	54.00	-17.31	Horizontal	Average

CH78									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
1518.11	36.92	25.63	5.34	36.61	31.28	74.00	-42.72	Vertical	Peak
3625.67	35.91	29.30	8.30	38.26	35.25	74.00	-38.75	Vertical	Peak
4958.68	47.17	31.46	9.64	36.52	51.75	74.00	-22.25	Vertical	Peak
7154.17	32.47	35.93	11.86	35.01	45.25	74.00	-28.75	Vertical	Peak
4958.68	30.37	31.46	9.64	36.52	34.95	54.00	-19.05	Vertical	Average
1711.05	36.24	25.22	5.79	36.95	30.30	74.00	-43.70	Horizontal	Peak
3719.15	35.73	29.36	8.41	38.25	35.25	74.00	-38.75	Horizontal	Peak
4958.68	54.90	31.46	9.64	36.52	59.48	74.00	-14.52	Horizontal	Peak
7451.57	35.85	36.20	12.24	34.86	49.43	74.00	-24.57	Horizontal	Peak
4958.68	34.58	31.46	9.64	36.52	39.16	54.00	-14.84	Horizontal	Average

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(test frequency band is 1GHz to 25GHz) are very lower than the limit and not show in test report.

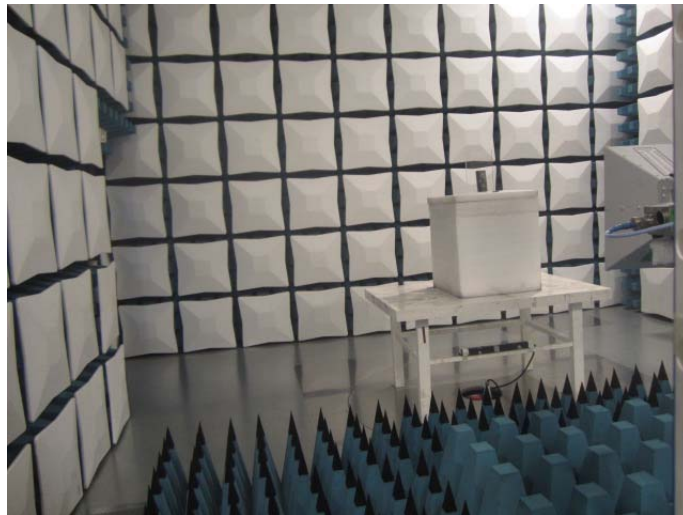
6. TEST SETUP PHOTOS

Conducted Emissions (AC Mains)



Radiated Emissions





7. EXTERANAL AND INTERNAL PHOTOS

Reference to the test report No.: TRE1712002901

.....End of Report.....