Shenzhen Huatongwei International Inspection Co., Ltd.
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TEST REPORT

Report Reference No. ..... :	**TRE1709004203**	R/C…….: 48588
FCC ID ..... :	**2AEPIELEMENTQ**	
Applicant's name ..... :	**COLOMBIANA DE COMERCIO S.A.**	
Address.....:	Car.43E NO 8-71 Medellin,Colombia	
Manufacturer.....:	AMER international co.,limited	
Address.....:	23th Floor,Century Square,No. 3018 Shennan Road,Futian District,Shenzhen Guangdong,PRC	
Test item description ..... :	**ELEMENT**	
Trade Mark .....:	Kalley	
Model/Type reference.....:	Element Q	
Listed Model(s) .....:	-	
Standard ..... :	**FCC CFR Title 47 Part 15 Subpart C Section 15.247**	
Date of receipt of test sample…….....:	Sep.07,2017	
Date of testing……..:	Sep.08,2017- Sep.21,2017	
Date of issue……..:	Sep.22,2017	
Result..... ……..:	**PASS**	

Compiled by (position+printedname+signature)...:	File administrators Candy Liu	Candy Liu
Supervised by (position+printedname+signature)....:	Project Engineer : Edward Pan	Edward.Pan
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

Contents

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

Version No.	Date of issue	Description
00	Sep.22,2017	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	William Wang
20 dB Bandwidth	15.247 (a)(1)	Pass	William Wang
Carrier Frequencies Separation	15.247 (a)(1)	Pass	William Wang
Hopping Channel Number	15.247 (a)(1)	Pass	William Wang
Dwell Time	15.247 (a)(1)	Pass	William Wang
Pseudorandom Frequency Hopping Sequence	15.247(b)(4)&TCB Exclusion List (7 July 2002)	Pass	William Wang
Restricted band	15.247(d)/15.205	Pass	William Wang
Radiated Emissions	15.247(d)/15.209	Pass	William Wang

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

3. SUMMARY

3.1. Client Information

Applicant:	COLOMBIANA DE COMERCIO S.A.
Address:	Car.43E NO 8-71 Medellin,Colombia
Manufacturer:	AMER international co.,limited
Address:	23th Floor,Century Square,No. 3018 Shennan Road,Futian District,Shenzhen Guangdong,PRC

3.2. Product Description

Name of EUT:	ELEMENT
Trade Mark:	Kalley
Model No.:	Element Q
Listed Model(s):	-
IMEI:	354546080152055
IME2:	354546080152063
Power supply:	DC 3.7V From exchange battery
Adapter information:	Input: 100-240Va.c., 50/60Hz, 0.2A Output: 5Vd.c., 1.0A
Hardware version:	TC65B V2.0
Software version:	Kalley_ELEMENT_Q_SW05_20170929
Bluetooth	
Version:	Supported BT4.0+EDR
Modulation:	GFSK, π/4DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	Integral Antenna
Antenna gain:	-1.2 dBi

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 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.
1	Artificial Mains	Rohde&Schwarz	ESH2-Z5	100028	2016/11/13
2	EMI Test Receiver	Rohde&Schwarz	ESCI3	100038	2016/11/13
3	Pulse Limiter	Rohde&Schwarz	ESHSZ2	100044	2016/11/13
4	EMI Test Software	Rohde&Schwarz	ES-K1 V1.71	-	-

Radiated Emissions					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	EMI test receiver	Rohde&Schwarz	ESI 26	100009	2016/11/13
2	Loop Antenna	Rohde&Schwarz	HFH2-Z2	100020	2016/11/13
3	Ultra-Broadband Antenna	ShwarzBeck	VULB9163	538	2016/11/13
4	Horn antenna	ShwarzBeck	9120D	1011	2016/11/13
5	Horn Antenna	SCHWARZBECK	BBHA9170	25841	2016/11/13
6	Amplifier	Sonoma	310N	E009-13	2016/11/13
7	JS Amplifier	Rohde&Schwarz	JS4-00101800-28-5A	F201504	2016/11/13
8	Amplifier	Compliance Direction systems	PAP1-4060	120	2016/11/13
9	High pass filter	Compliance Direction systems	BSU-6	34202	2016/11/13
10	EMI test Software	Rohde&Schwarz	ESK1	-	-
11	EMI test Software	Audix	E3	-	-
12	TURNTABLE	MATURO	TT2.0	-	-
13	ANTENNA MAST	MATURO	TAM-4.0-P	-	-

RF Conducted methods					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Spectrum Analyzer	Rohde&Schwarz	FSP	1164.4391.40	2016/11/13
2	MXA Signal Analyzer	Agilent Technologies	N9020A	MY5050187	2016/11/13

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 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.

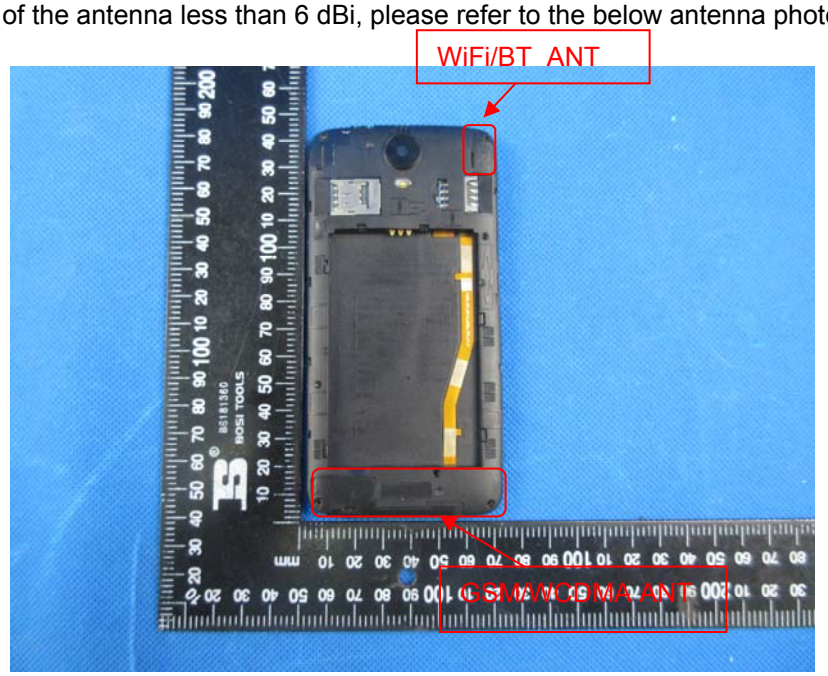
FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):

(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)

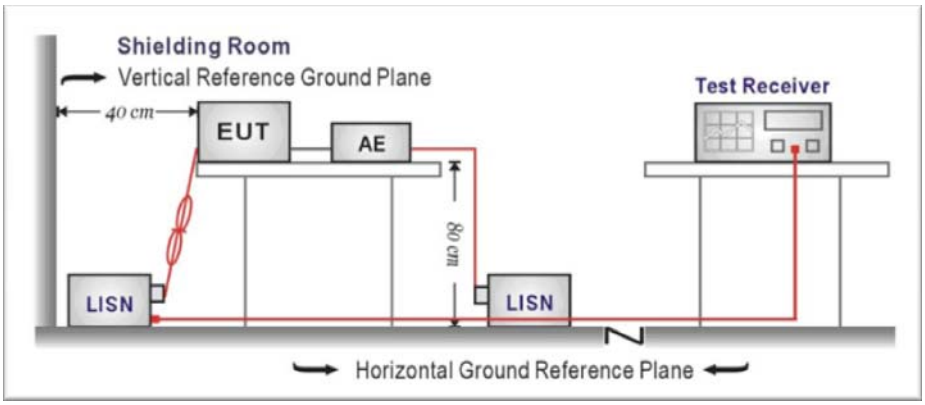
LIMIT

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

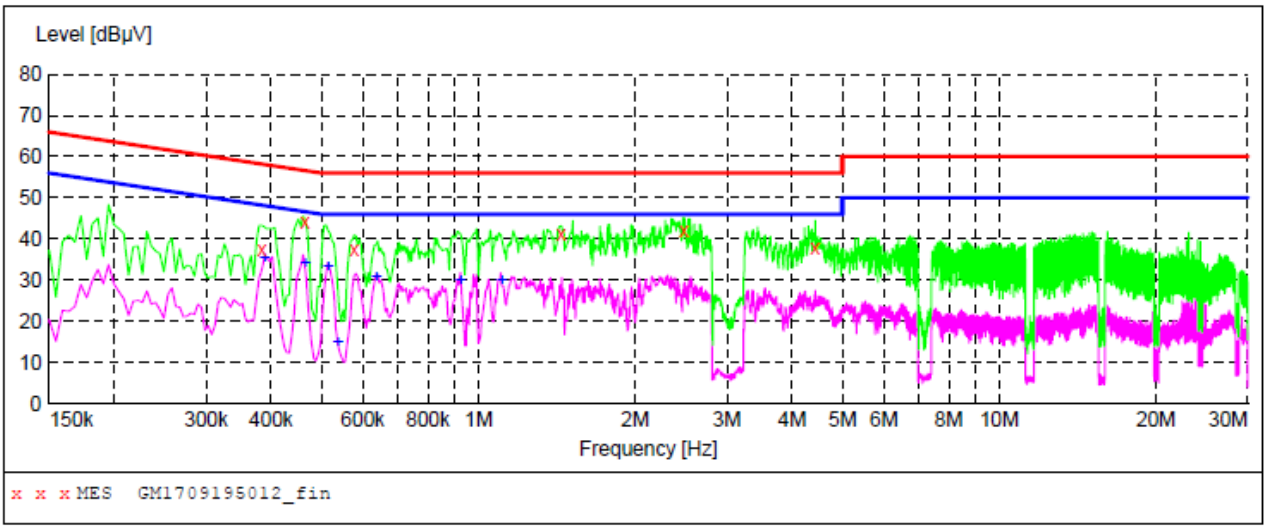
1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from 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: "GM1709195012_fin"

9/19/2017 10:24AM

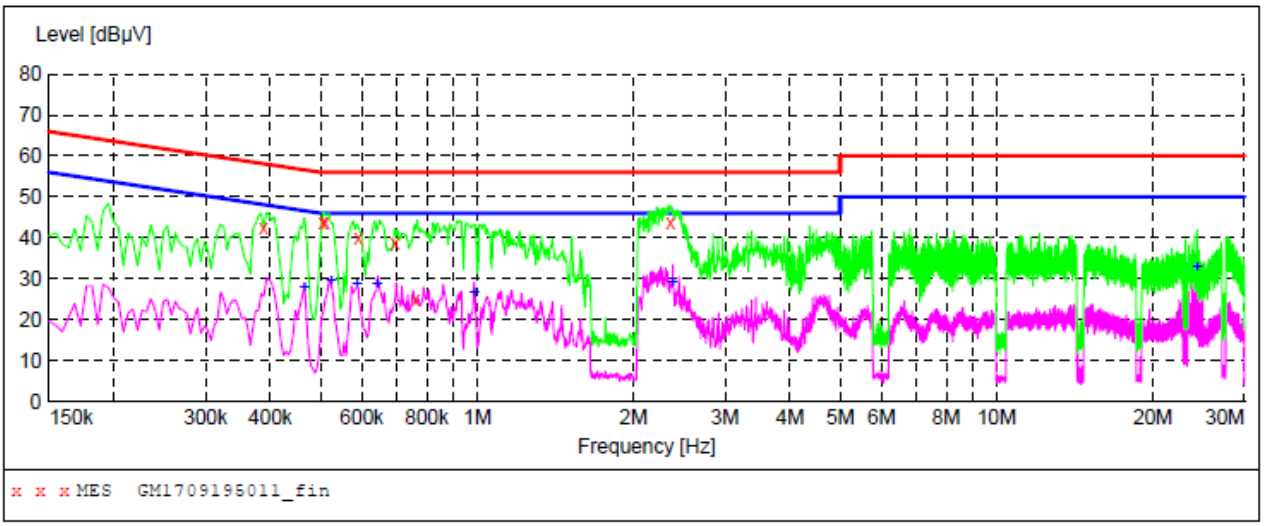
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.384000	37.40	10.2	58	20.8	QP	L1	GND
0.465000	44.20	10.2	57	12.4	QP	L1	GND
0.577500	37.30	10.2	56	18.7	QP	L1	GND
1.441500	41.40	10.2	56	14.6	QP	L1	GND
2.481000	42.10	10.2	56	13.9	QP	L1	GND
4.429500	37.90	10.3	56	18.1	QP	L1	GND

MEASUREMENT RESULT: "GM1709195012_fin2"

9/19/2017 10:24AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.388500	35.30	10.2	48	12.8	AV	L1	GND
0.465000	34.10	10.2	47	12.5	AV	L1	GND
0.514500	33.20	10.2	46	12.8	AV	L1	GND
0.537000	14.80	10.2	46	31.2	AV	L1	GND
0.636000	30.90	10.2	46	15.1	AV	L1	GND
0.924000	30.10	10.2	46	15.9	AV	L1	GND
1.108500	30.10	10.2	46	15.9	AV	L1	GND

Test Line:	N



MEASUREMENT RESULT: "GM1709195011_fin"

9/19/2017 10:21AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.388500	42.60	10.2	58	15.5	QP	N	GND
0.505500	43.90	10.2	56	12.1	QP	N	GND
0.510000	43.70	10.2	56	12.3	QP	N	GND
0.591000	39.80	10.2	56	16.2	QP	N	GND
0.694500	38.70	10.2	56	17.3	QP	N	GND
0.762000	25.00	10.2	56	31.0	QP	N	GND
2.359500	43.70	10.2	56	12.3	QP	N	GND

MEASUREMENT RESULT: "GM1709195011_fin2"

9/19/2017 10:21AM

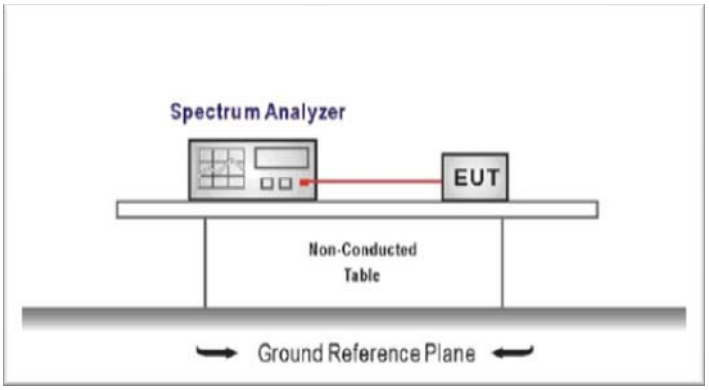
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.465000	27.90	10.2	47	18.7	AV	N	GND
0.523500	29.40	10.2	46	16.6	AV	N	GND
0.586500	28.80	10.2	46	17.2	AV	N	GND
0.640500	28.70	10.2	46	17.3	AV	N	GND
0.987000	26.60	10.2	46	19.4	AV	N	GND
2.377500	29.20	10.2	46	16.8	AV	N	GND
24.346500	32.90	10.7	50	17.1	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

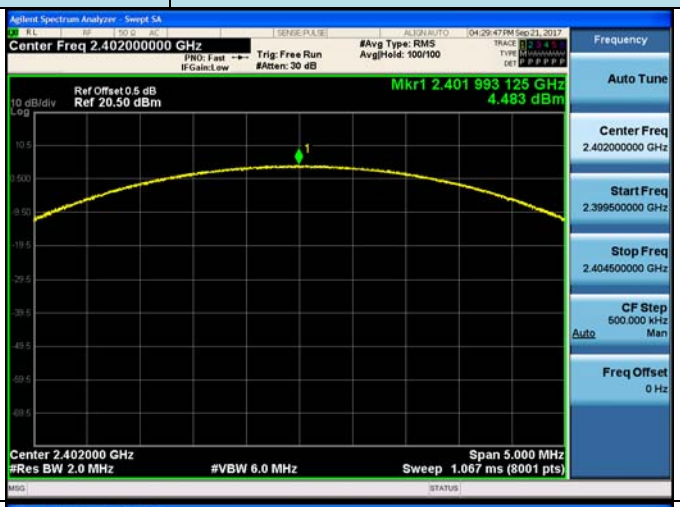
TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Modulation type	Channel	Output power (dBm)	Limit (dBm)	Result
GFSK	00	4.936	≤ 30.00	Pass
	39	6.373		
	78	5.428		
π/4DQPSK	00	3.939	≤ 21.00	Pass
	39	5.083		
	78	4.177		
8DPSK	00	4.483	≤ 21.00	Pass
	39	5.842		
	78	4.826		

Modulation Type:		GFSK	
CH00			
CH39			
CH78			

Modulation Type:		π/4DQPSK	
CH00			
CH39			
CH78			

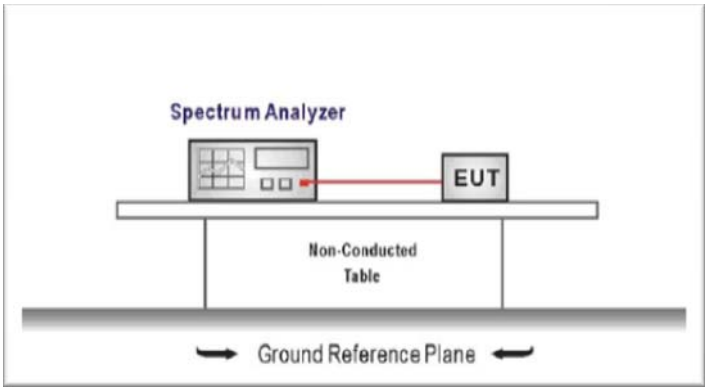
Modulation Type:		8DPSK	
CH00			
CH39			
CH78			

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	0.9181	-	Pass
	39	0.9233		
	78	0.9221		
π/4DQPSK	00	1.338	-	Pass
	39	1.323		
	78	1.309		
8DPSK	00	1.291	-	Pass
	39	1.336		
	78	1.327		

Modulation Type:		GFSK	
CH00			
CH39			
CH78			

Modulation Type:		π/4DQPSK	
CH00			
CH39			
CH78			

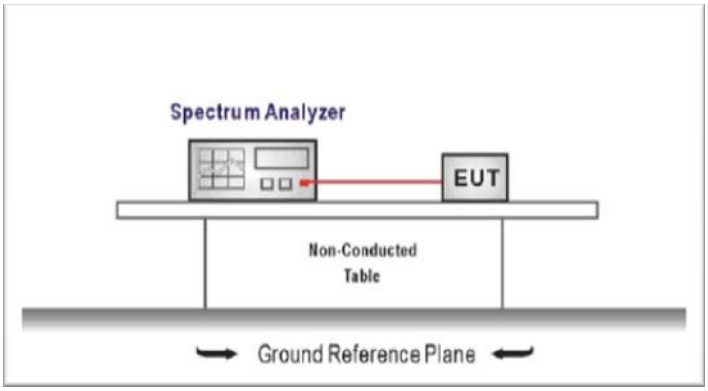
Modulation Type:		8DPSK	
CH00			
CH39			
CH78			

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 minimum of 25 kHz or the 2/3*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 ≥ 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:

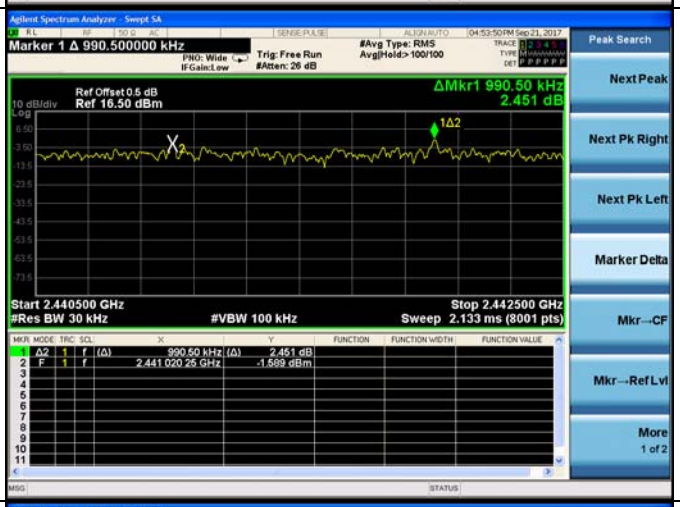
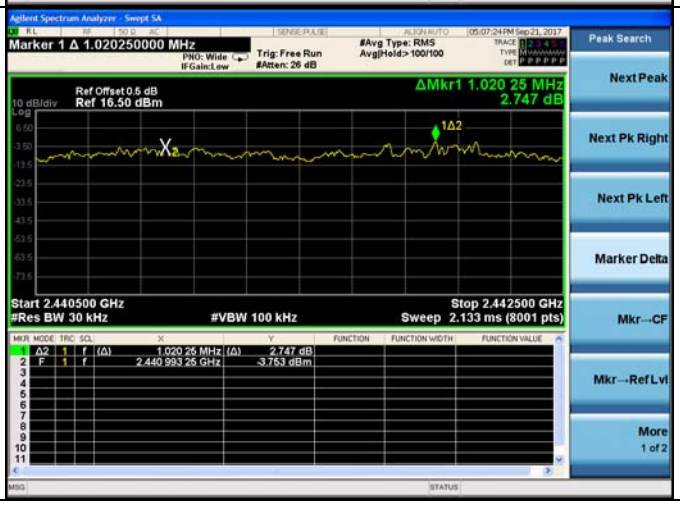
Please refer to the clause 3.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Modulation type	Channel	Carrier Frequencies Separation (MHz)	Limit (MHz) *	Result
GFSK	39	1.018	≥0.932	Pass
π/4DQPSK	39	0.990	≥0.861	Pass
8DPSK	39	1.020	≥0.854	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

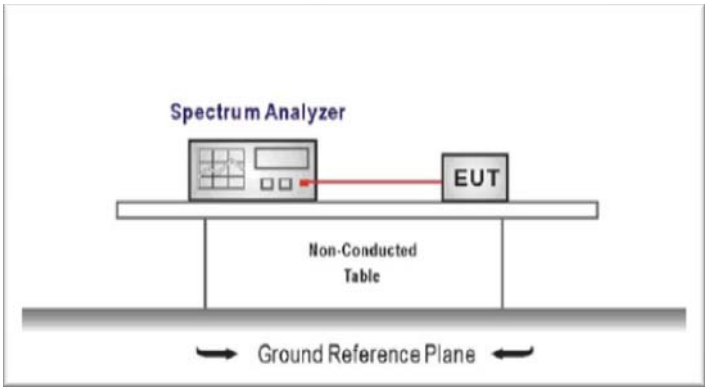
GFSK			
π/4DQPSK			
8DPSK			

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.

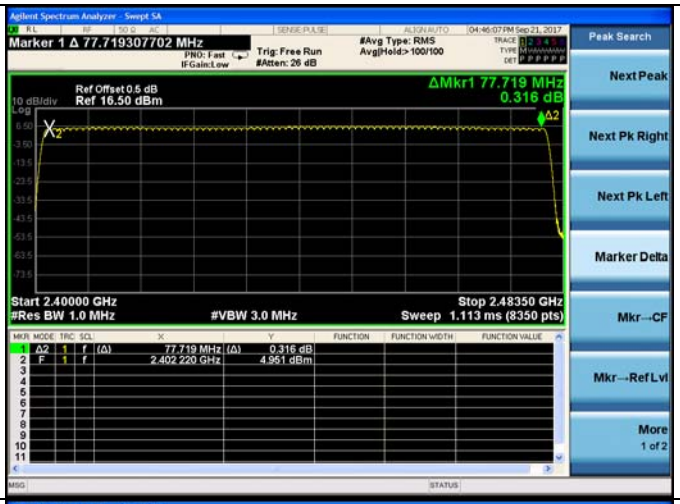
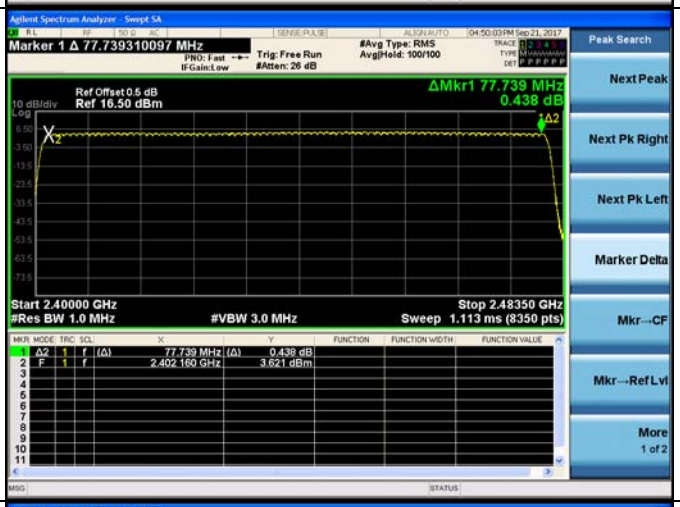
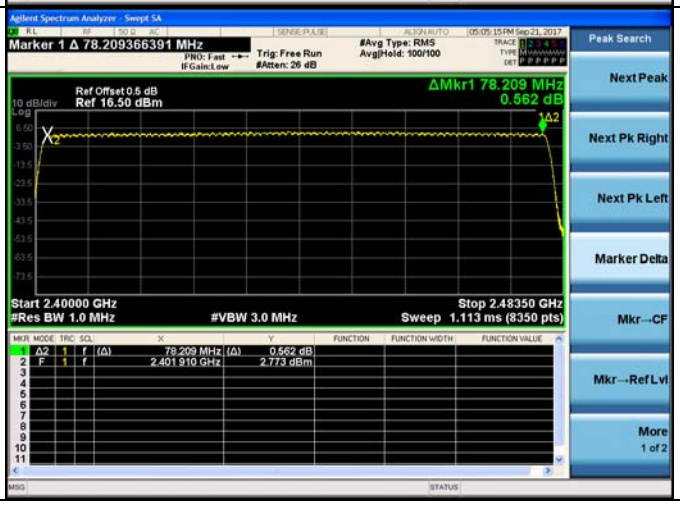
TEST MODE:

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		

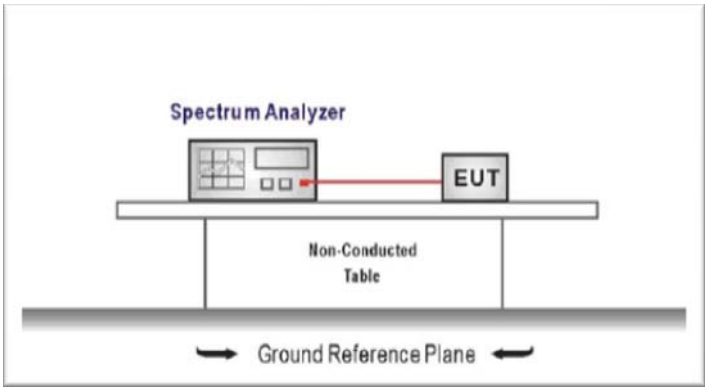
GFSK			
π/4DQPSK			
8DPSK			

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

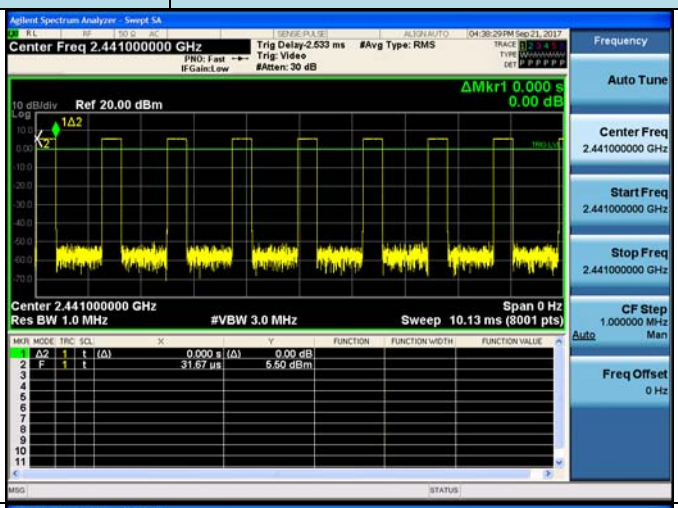
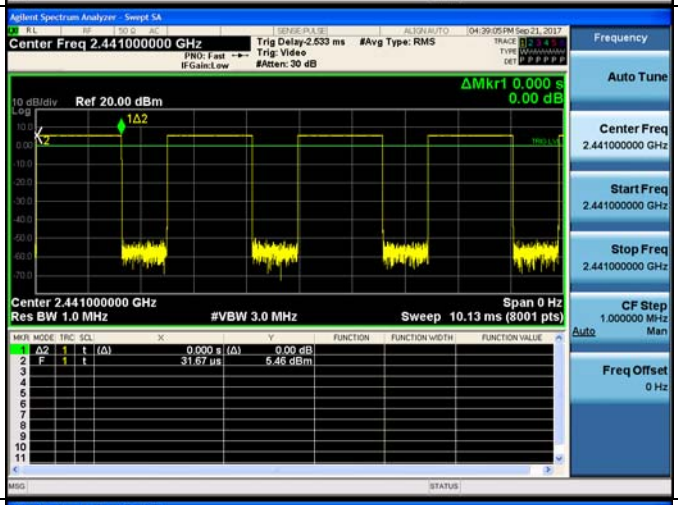
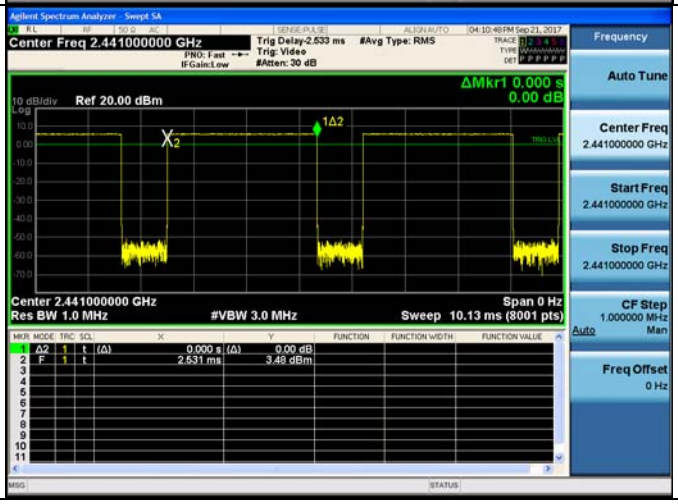
TEST RESULTS

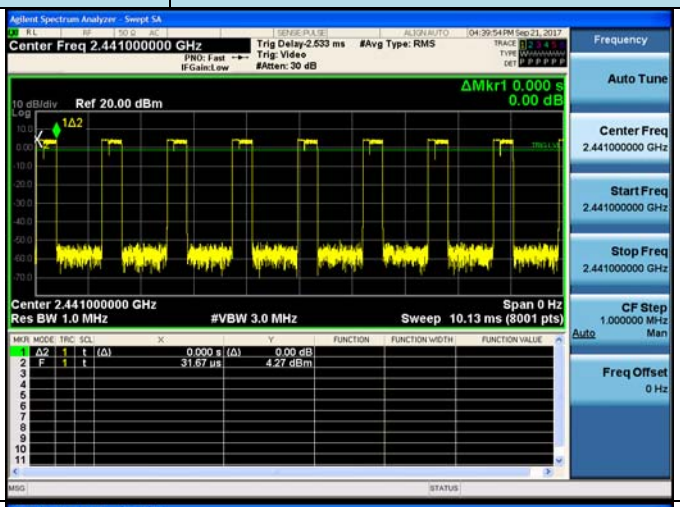
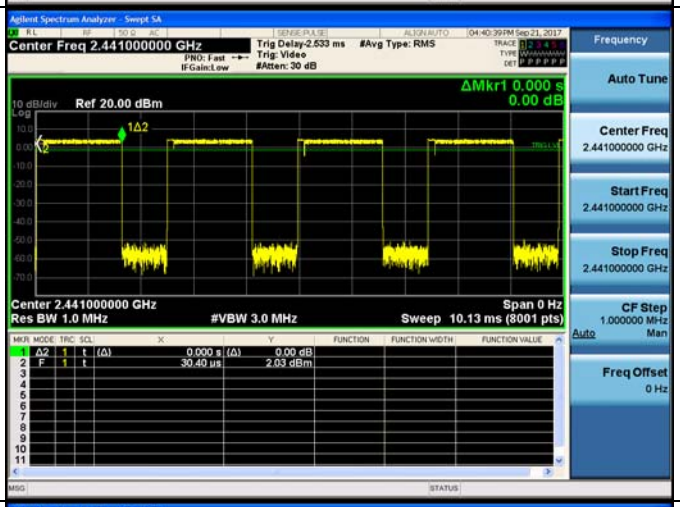
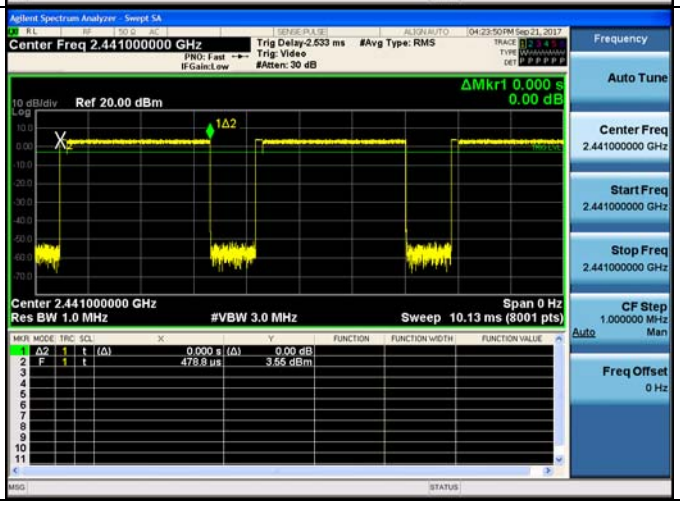
☒ **Passed** ☐ **Not Applicable**

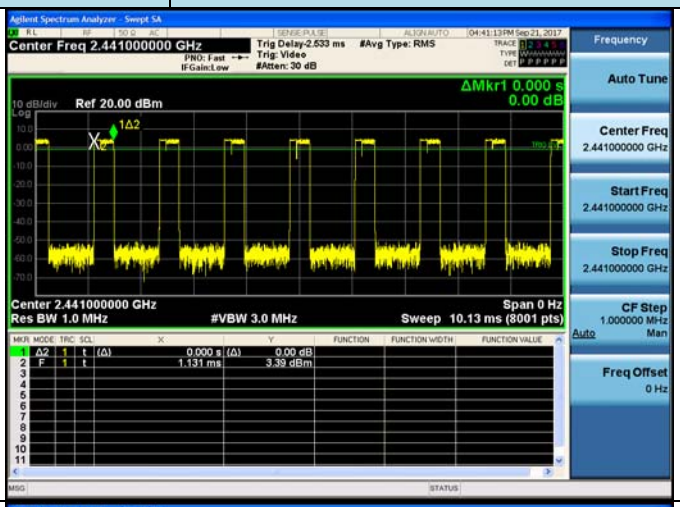
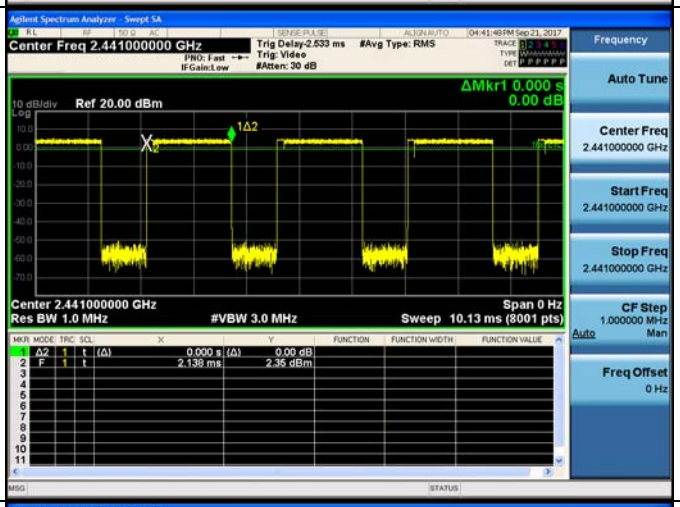
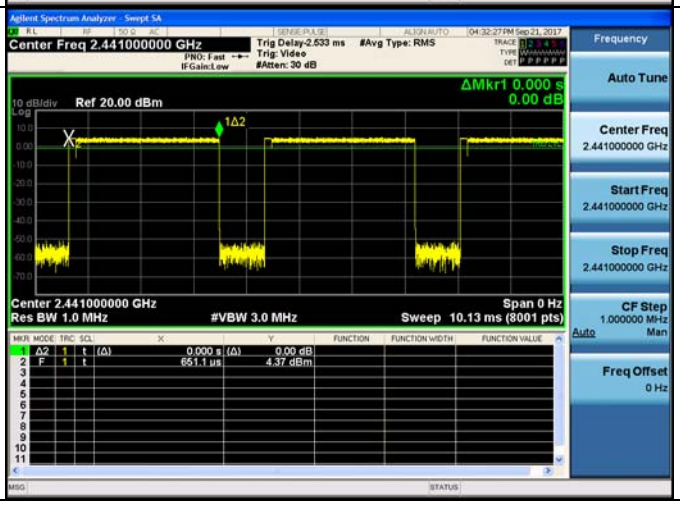
Modulation type	Channel	Dwell time (Second)	Limit (Second)	Result
GFSK	DH1	0.118	≤ 0.40	Pass
	DH3	0.261		
	DH5	0.306		
π/4DQPSK	2DH1	0.122	≤ 0.40	Pass
	2DH3	0.261		
	2DH5	0.307		
8DPSK	3DH1	0.122	≤ 0.40	Pass
	3DH3	0.261		
	3DH5	0.307		

Note:

1. We have tested all mode at high,middle and low channel,and recoreded worst case at middle channel.
2. Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second for DH1, 2DH1, 3DH1
   Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second for DH3, 2DH3, 3DH3
   Dwell time=Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second for DH5, 2DH5, 3DH5

Modulation Type:		GFSK	
DH1			
DH3			
DH5			

Modulation Type:		π/4DQPSK	
2DH1			
2DH3			
2DH5			

Modulation Type:		8DPSK	
3DH1			
3DH3			
3DH5			

5.8. Pseudorandom Frequency Hopping Sequence

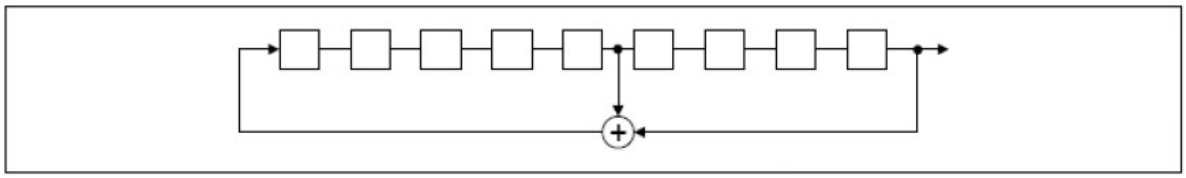
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):Frequency hopping systems shall have hopping channel carrier 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

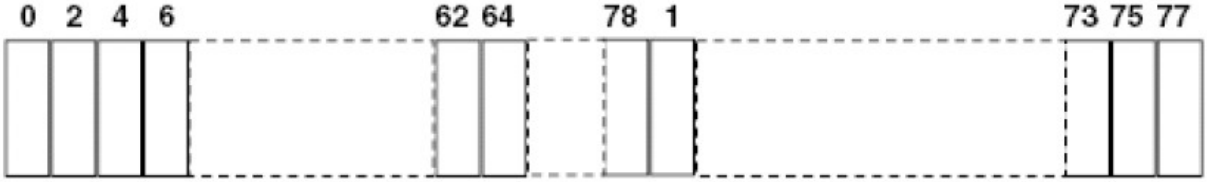
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage.And the result is fed back to the input of the friststage.The sequence begins with the frist one of 9 consecutive ones,forexample:the shift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



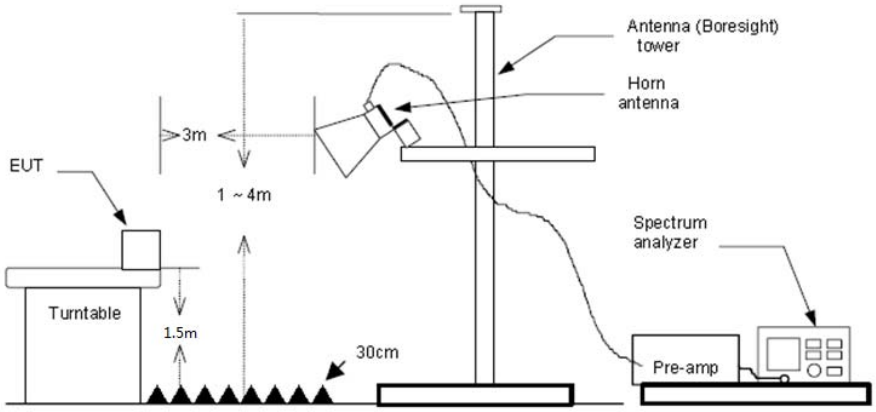
Each frequency used equally one the average by each transmitter.
The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

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

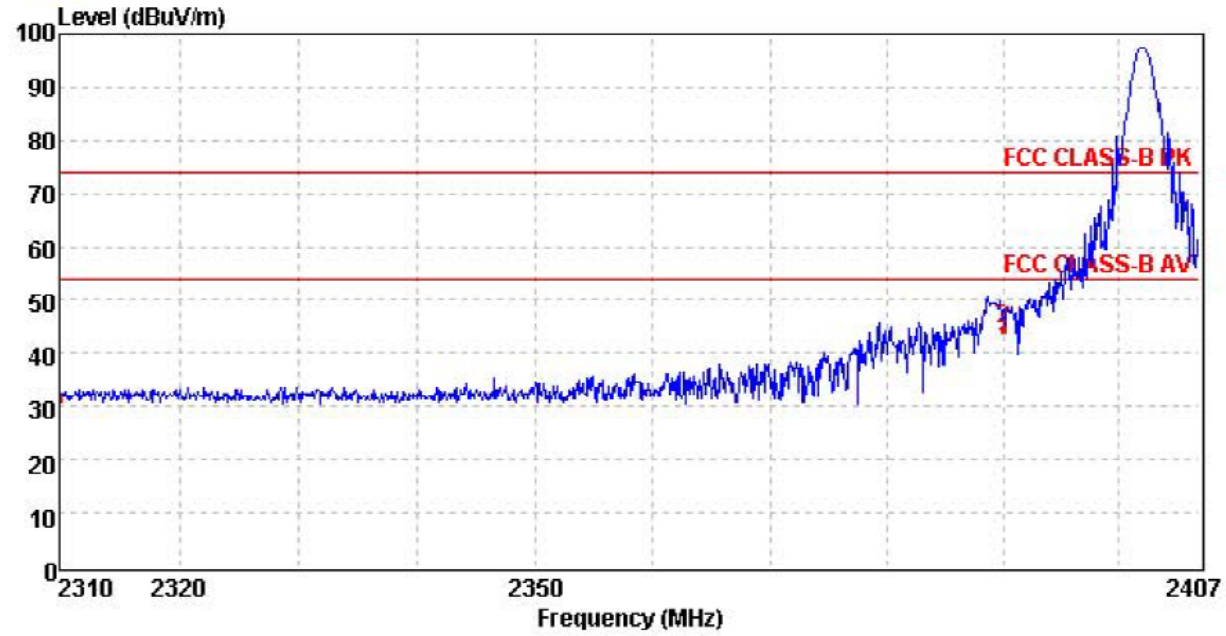
☒ **Passed** ☐ **Not Applicable**

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.

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	36.00	28.05	6.62	37.65	33.02	74.00	-40.98	Vertical	Peak
2390.03	53.38	27.65	6.75	37.87	49.91	74.00	-24.09	Vertical	Peak
2310.00	34.76	28.05	6.62	37.65	31.78	74.00	-42.22	Horizontal	Peak
2390.03	48.26	27.65	6.75	37.87	44.79	74.00	-29.21	Horizontal	Peak

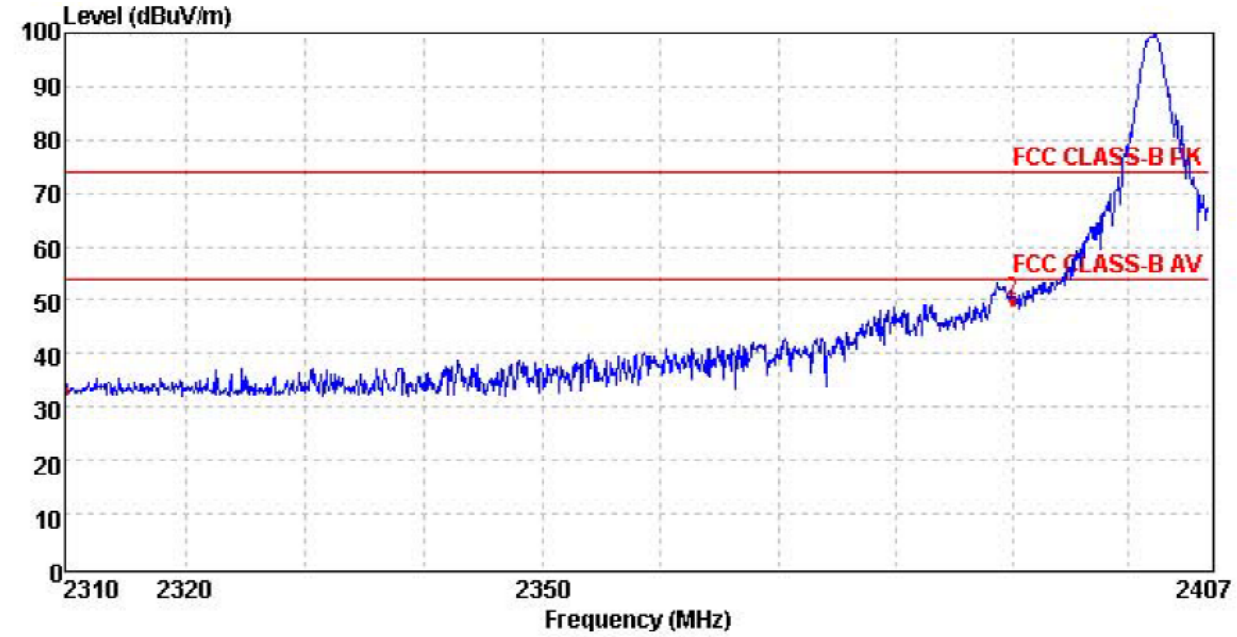
CH78									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2483.45	76.27	27.27	6.83	37.87	72.50	74.00	-1.50	Vertical	Peak
2500.00	46.53	27.20	6.84	37.87	42.70	74.00	-31.30	Vertical	Peak
2483.50	76.05	27.26	6.83	37.87	72.27	74.00	-1.73	Horizontal	Peak
2500.00	48.09	27.20	6.84	37.87	44.26	74.00	-29.74	Horizontal	Peak
2483.50	36.45	27.26	6.83	37.87	32.67	54.00	-21.33	Vertical	Average
2492.77	33.68	27.23	6.83	37.87	29.87	54.00	-24.13	Vertical	Average
2500.00	24.66	27.20	6.84	37.87	20.83	54.00	-33.17	Vertical	Average
2483.50	32.84	27.26	6.83	37.87	29.06	54.00	-24.94	Horizontal	Average
2492.90	28.75	27.23	6.84	37.87	24.95	54.00	-29.05	Horizontal	Average
2500.00	23.43	27.20	6.84	37.87	19.60	54.00	-34.40	Horizontal	Average

CH00(Peak)	
Polarization:	Vertical



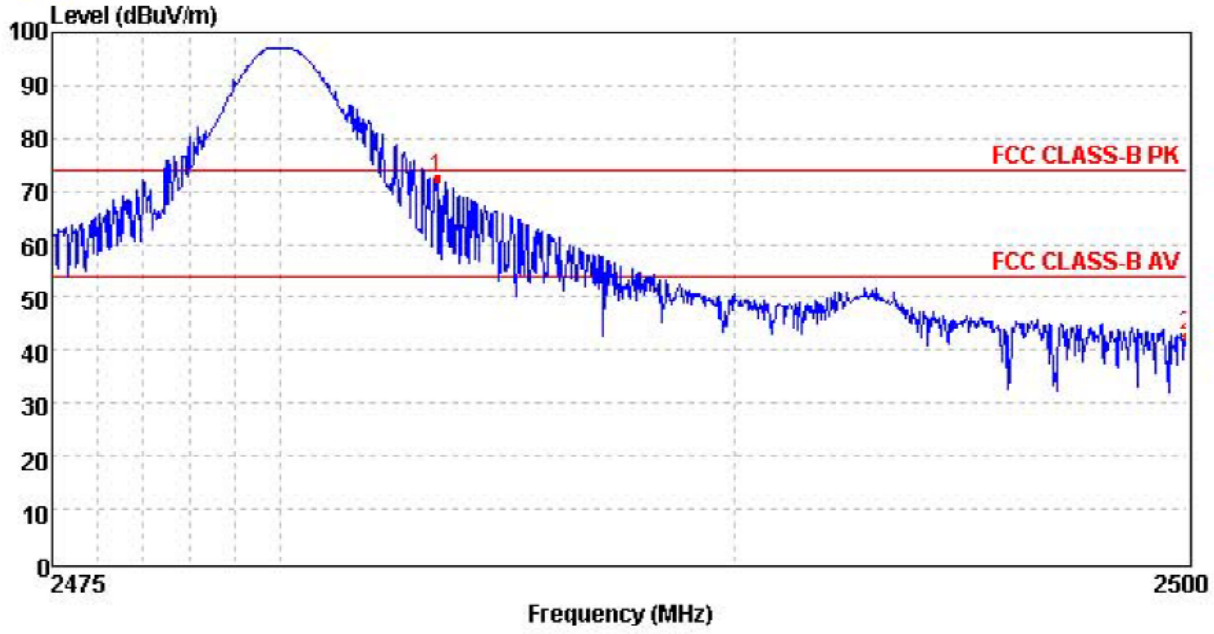
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	2310.00	34.76	28.05	6.62	37.65	31.78	74.00	-42.22	Peak
2	2390.03	48.26	27.65	6.75	37.87	44.79	74.00	-29.21	Peak

Polarization:	Horizontal



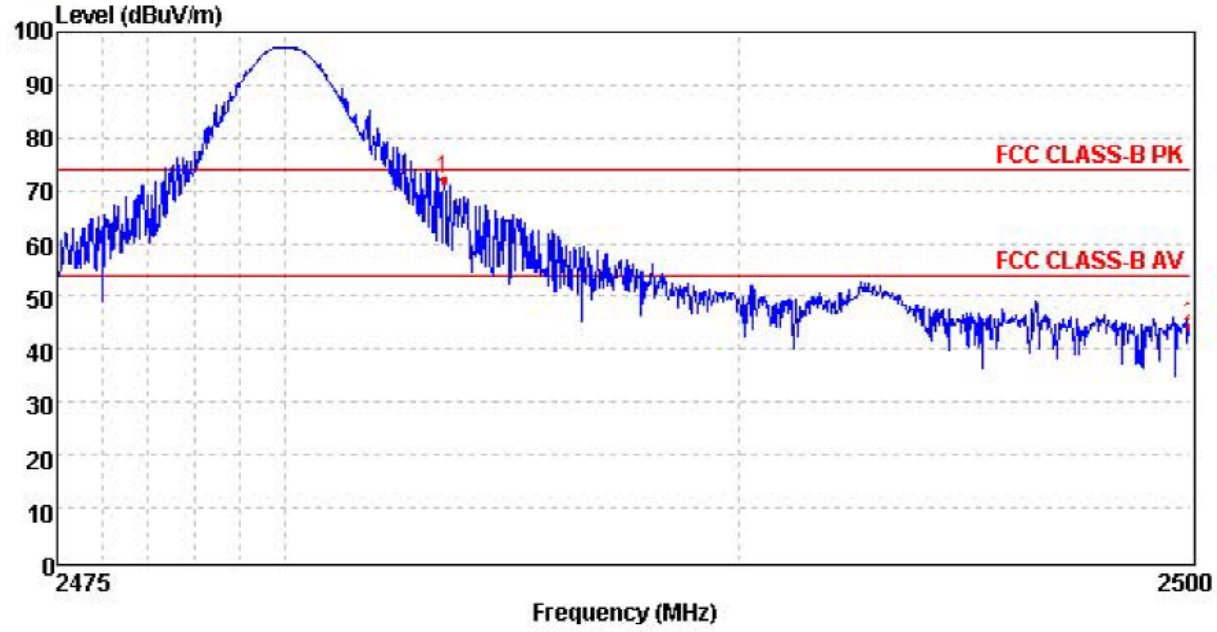
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	2310.00	36.00	28.05	6.62	37.65	33.02	74.00	-40.98	Peak
2	2390.03	53.38	27.65	6.75	37.87	49.91	74.00	-24.09	Peak

CH78(Peak)	
Polarization:	Vertical



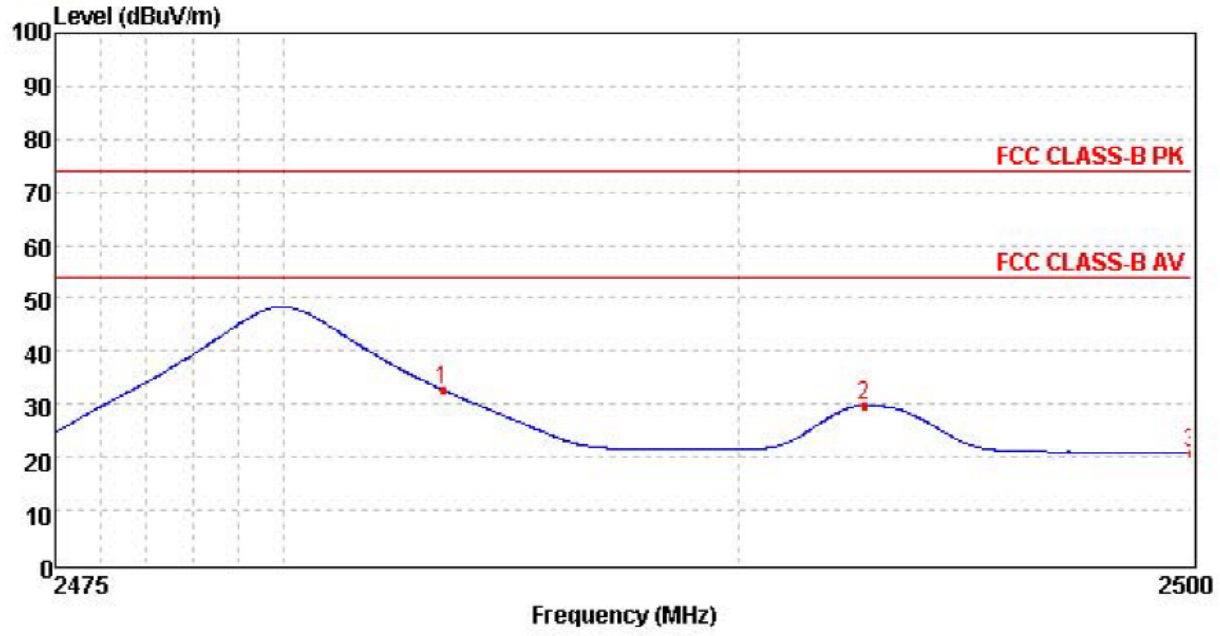
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	2483.45	76.27	27.27	6.83	37.87	72.50	74.00	-1.50	Peak
2	2500.00	46.53	27.20	6.84	37.87	42.70	74.00	-31.30	Peak

Polarization:	Horizontal



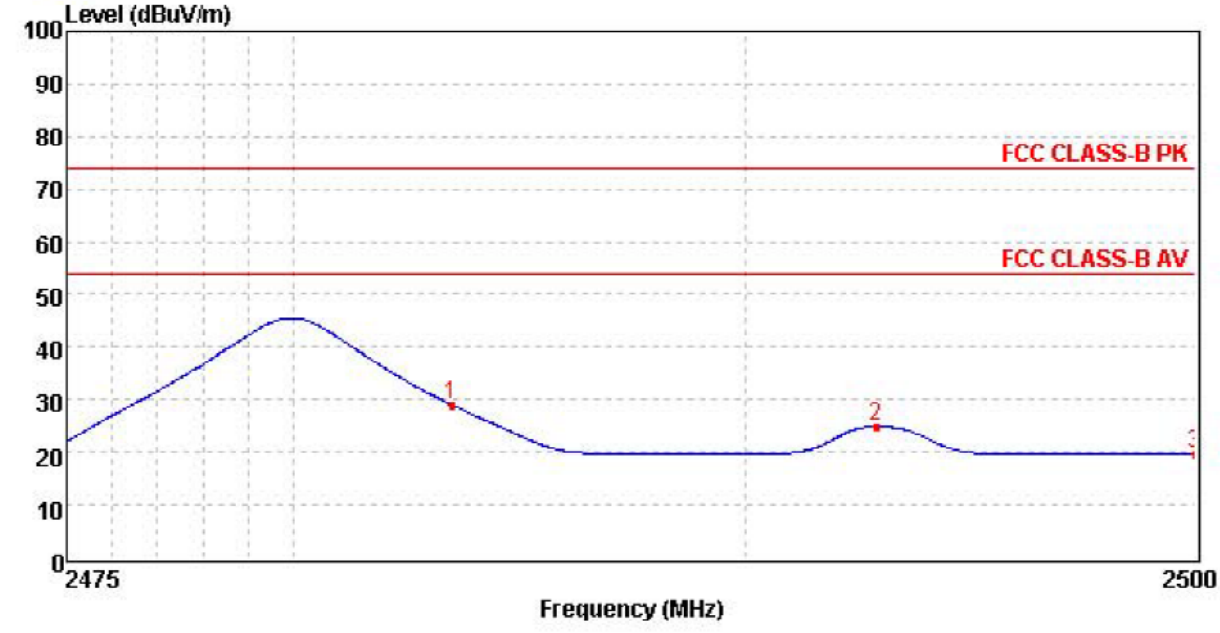
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	2483.50	76.05	27.26	6.83	37.87	72.27	74.00	-1.73	Peak
2	2500.00	48.09	27.20	6.84	37.87	44.26	74.00	-29.74	Peak

CH78(Average)	
Polarization:	Vertical



Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	2483.50	36.45	27.26	6.83	37.87	32.67	54.00	-21.33	Average
2	2492.77	33.68	27.23	6.83	37.87	29.87	54.00	-24.13	Average
3	2500.00	24.66	27.20	6.84	37.87	20.83	54.00	-33.17	Average

Polarization:	Horizontal



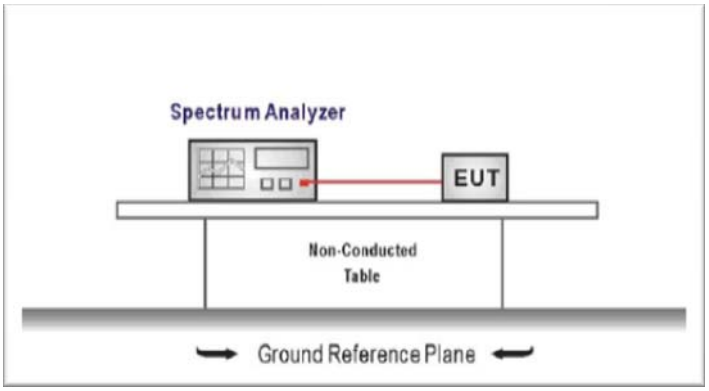
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	2483.50	32.84	27.26	6.83	37.87	29.06	54.00	-24.94	Average
2	2492.90	28.75	27.23	6.84	37.87	24.95	54.00	-29.05	Average
3	2500.00	23.43	27.20	6.84	37.87	19.60	54.00	-34.40	Average

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

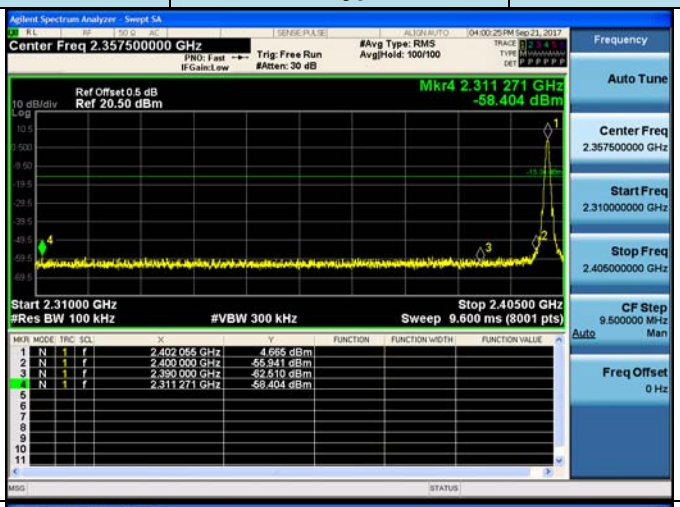
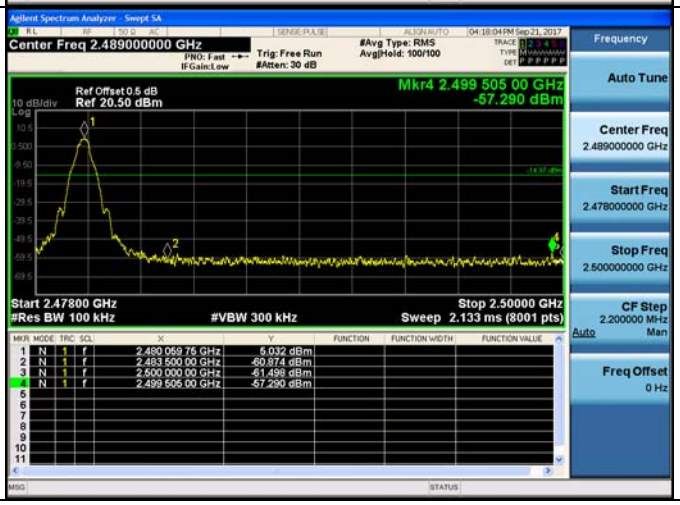
1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   RBW = 100 kHz, VBW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

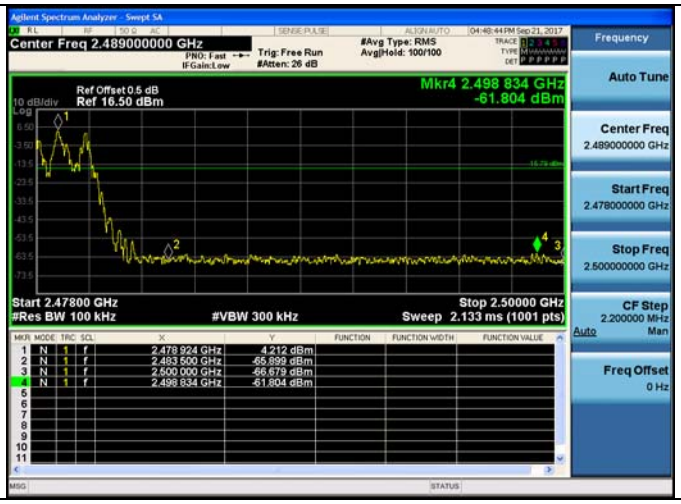
TEST MODE:

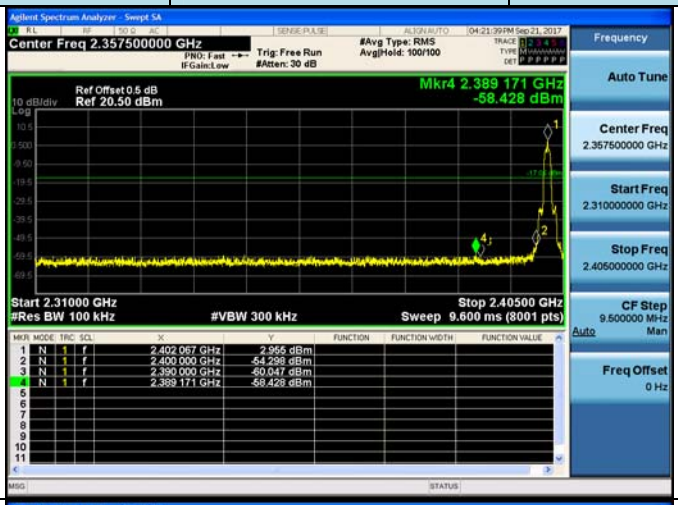
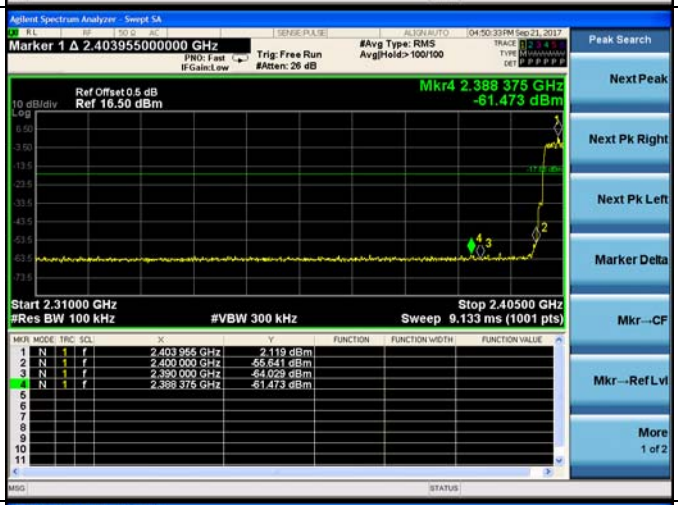
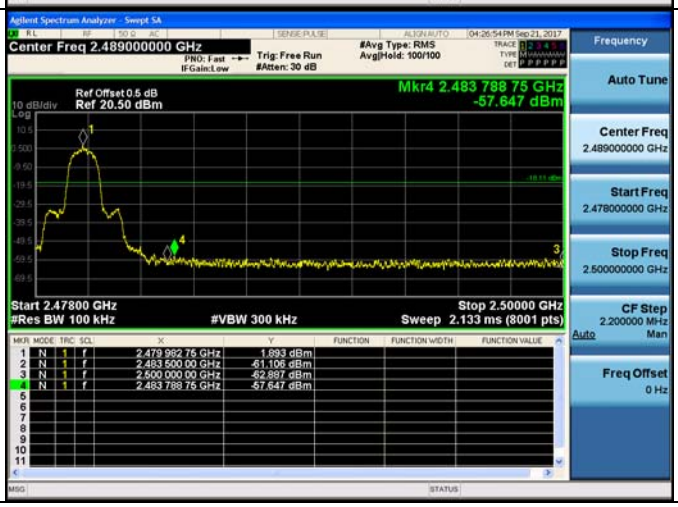
Please refer to the clause 3.3

TEST RESULTS

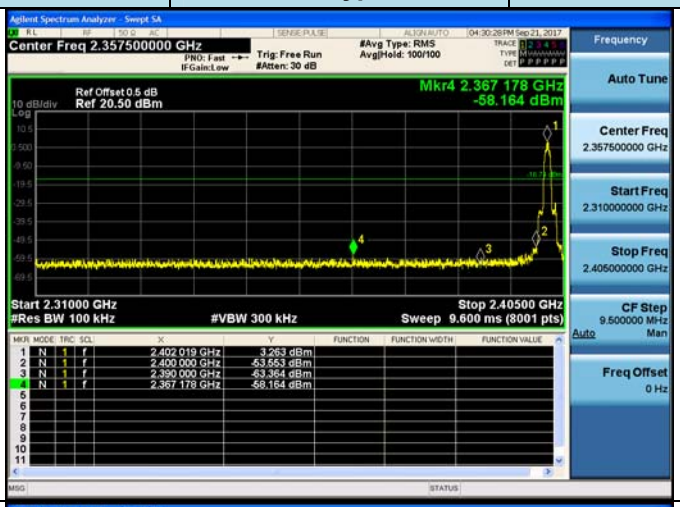
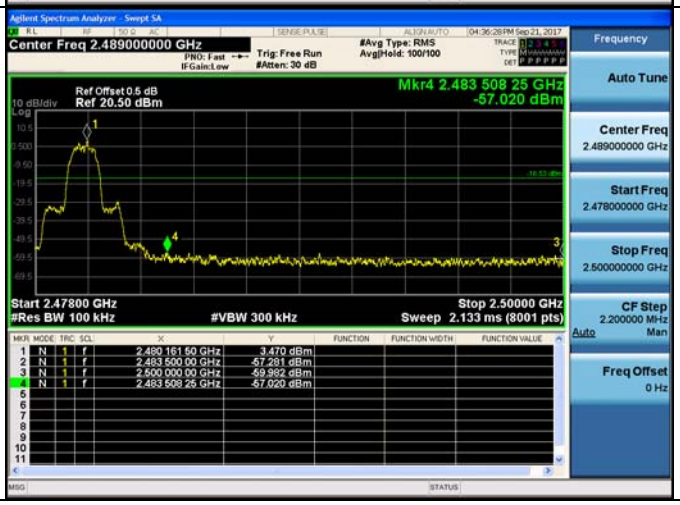
☒ **Passed** ☐ **Not Applicable**

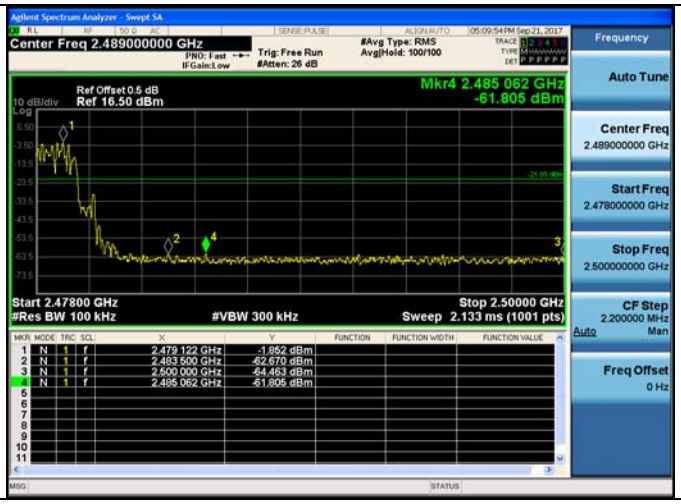
Test Item:	Band edge	Modulation type:	GFSK
CH00 No hopping mode		
CH00 Hopping mode		
CH78 No hopping mode		

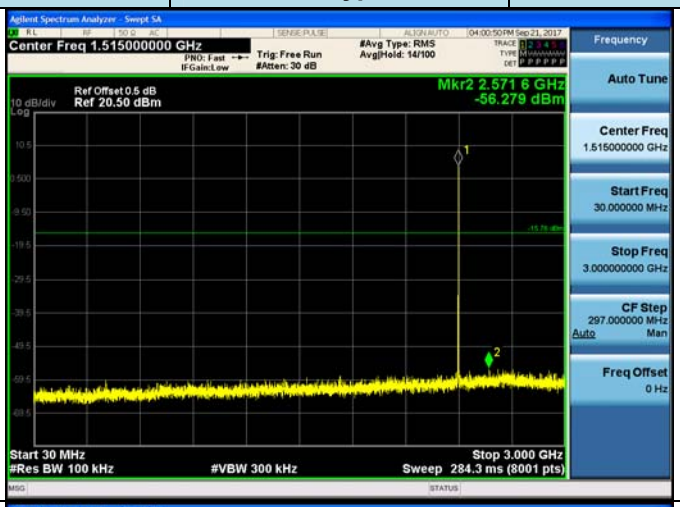
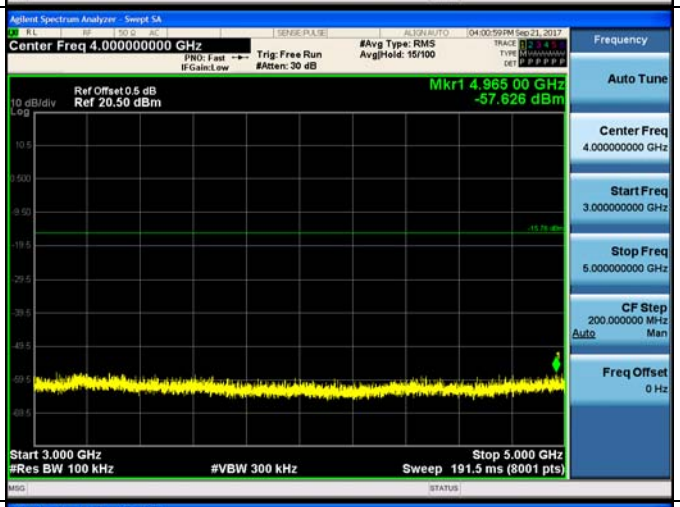
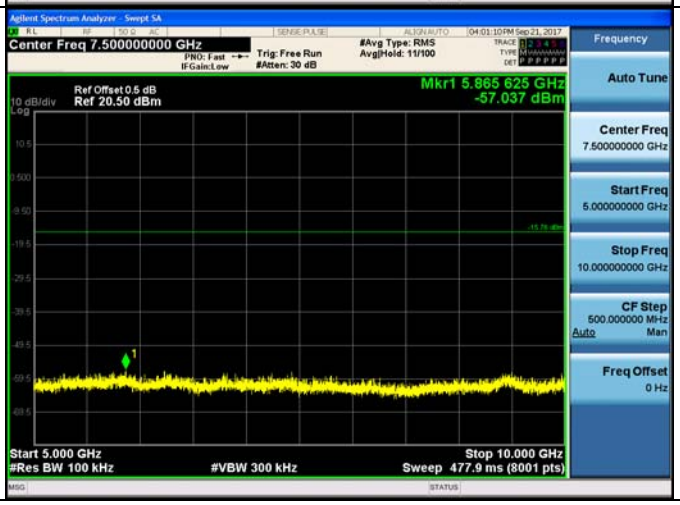
CH78 Hopping mode		

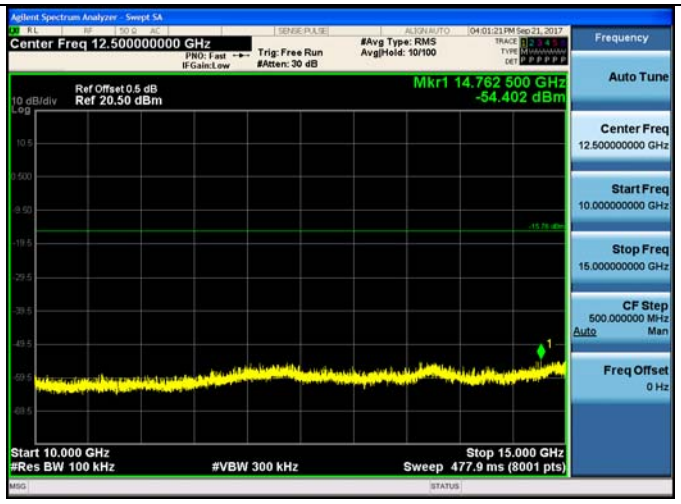
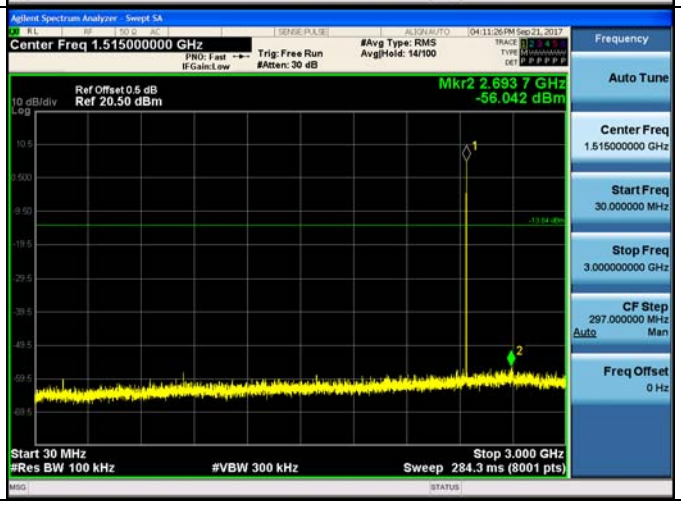
Test Item:	Band edge	Modulation type:	π/4DQPSK
CH00 No hopping mode			
CH00 Hopping mode			
CH78 No hopping mode			

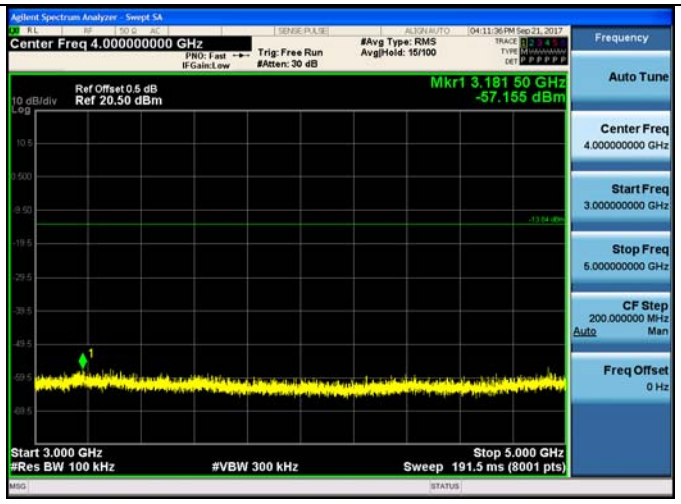
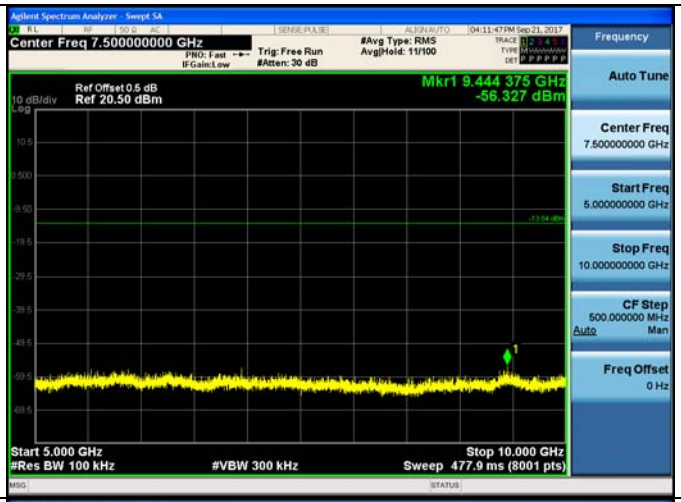
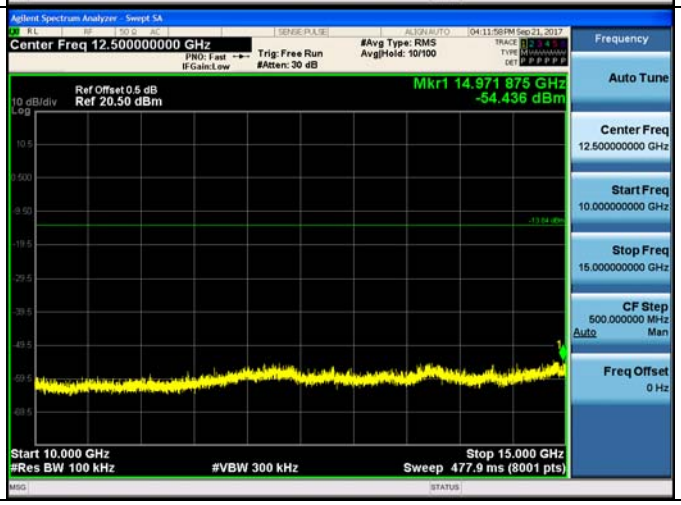
CH78 Hopping mode		

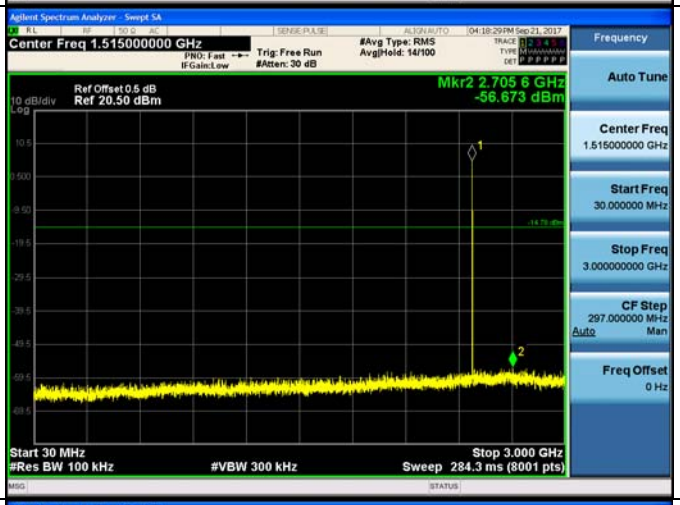
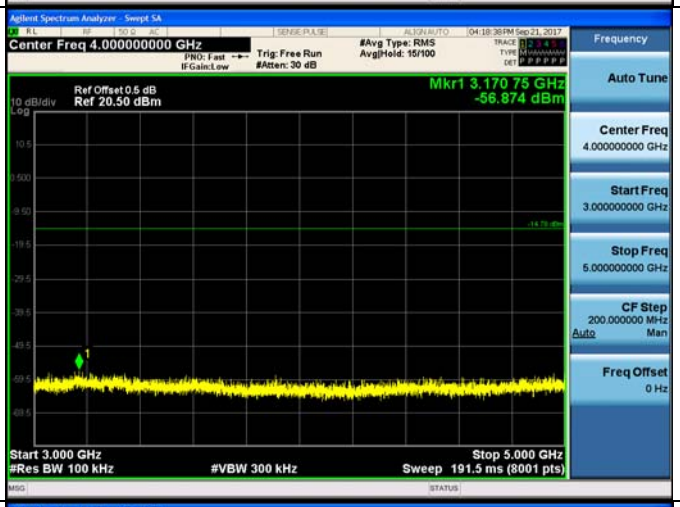
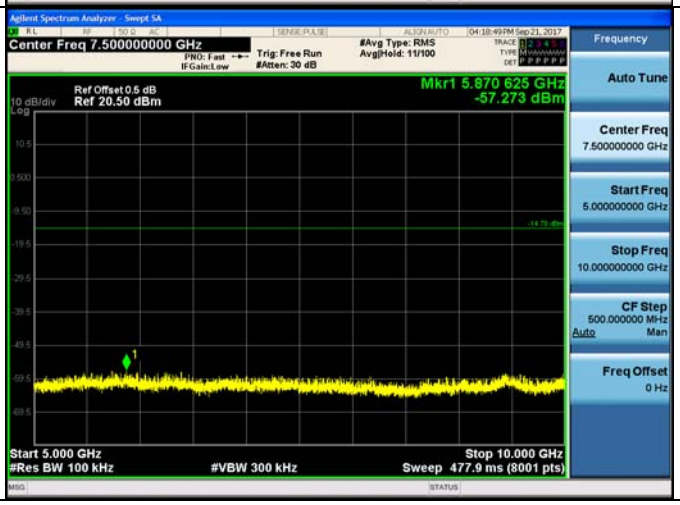
Test Item:	Band edge	Modulation type:	8DPSK
CH00 No hopping mode		
CH00 Hopping mode		
CH78 No hopping mode		

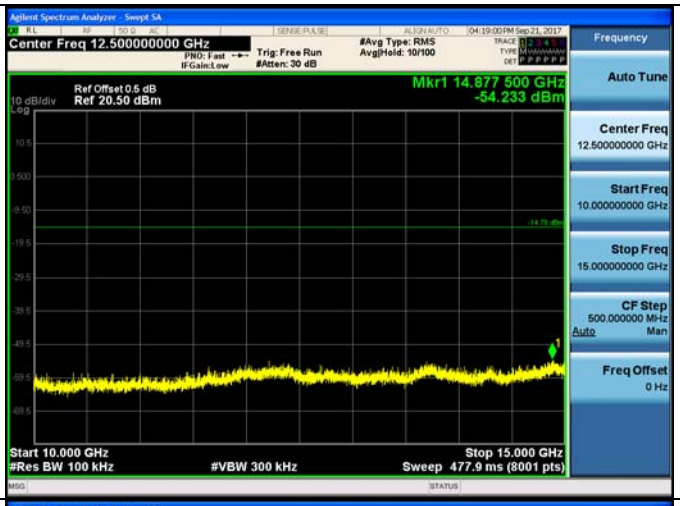
CH78 Hoppig mode			

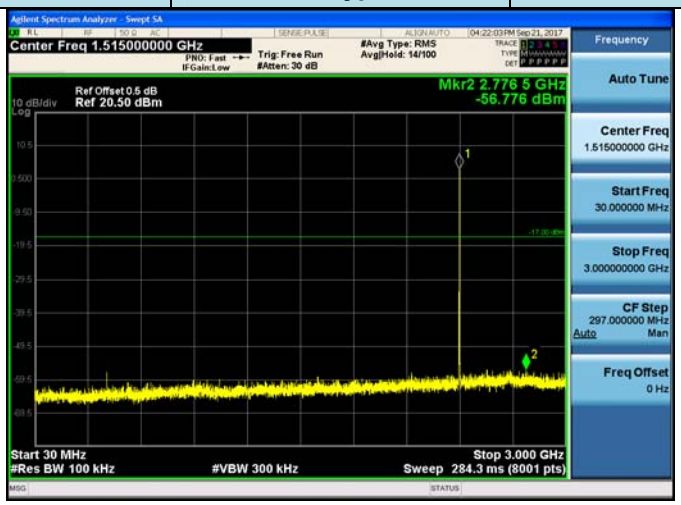
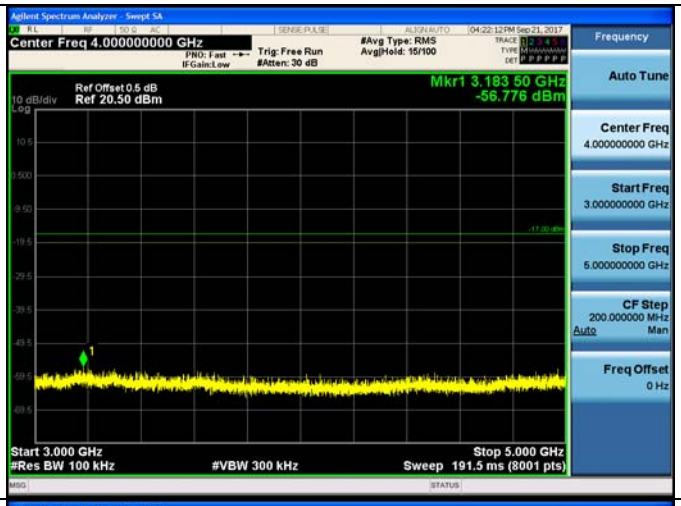
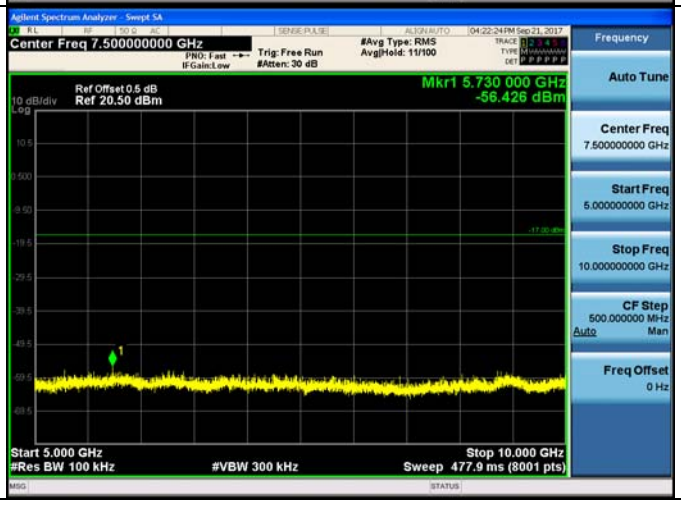
Test Item:	SE	Modulation type:	GFSK
CH00 30MHz~3GHz		
CH00 3GHz~5GHz		
CH00 5GHz~10GHz		

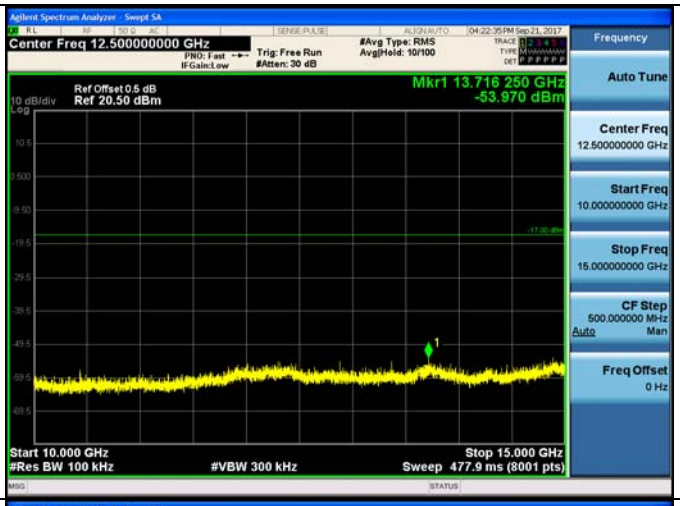
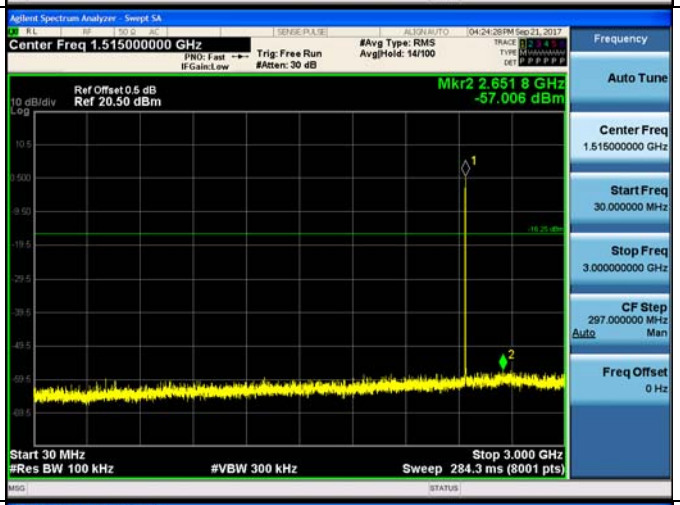
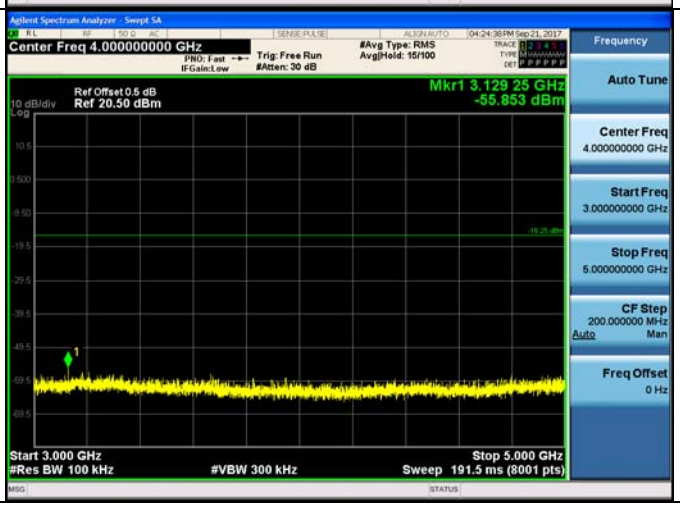
CH00 10GHz~15GHz		
CH00 15GHz~25GHz		
CH39 30MHz~3GHz		

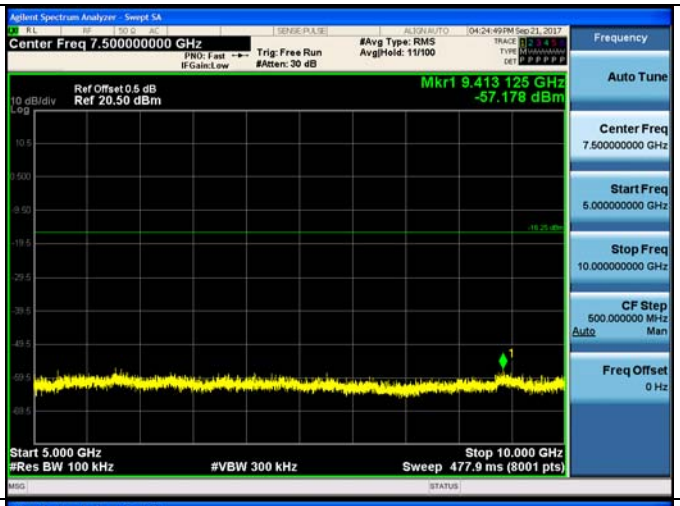
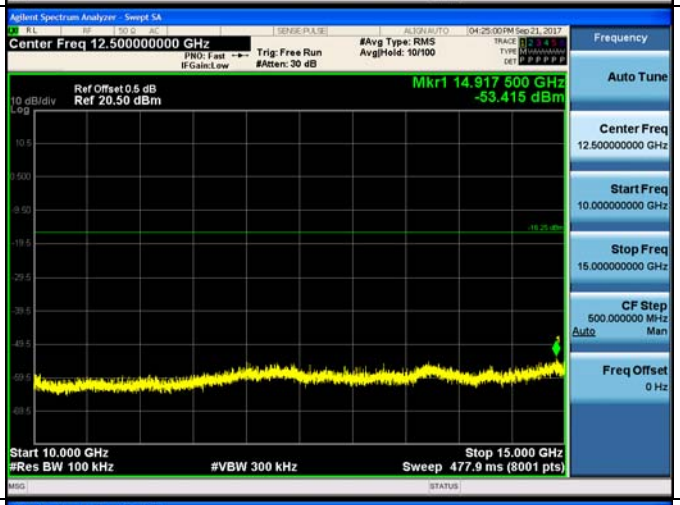
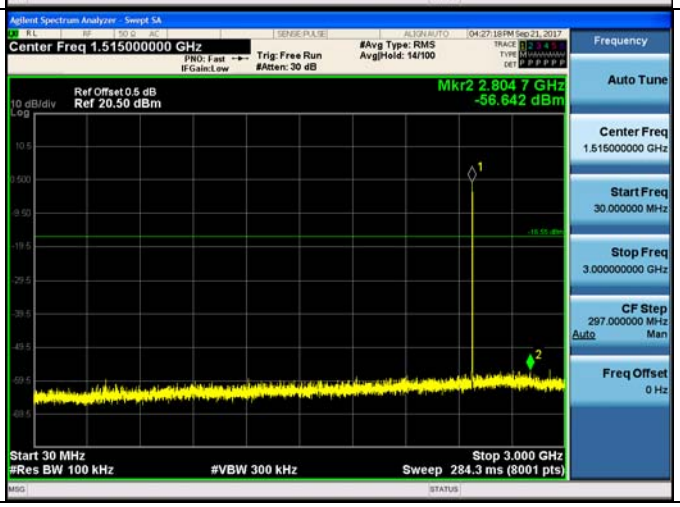
CH39 3GHz~5GHz		
CH39 5GHz~10GHz		
CH39 10GHz~15GHz		

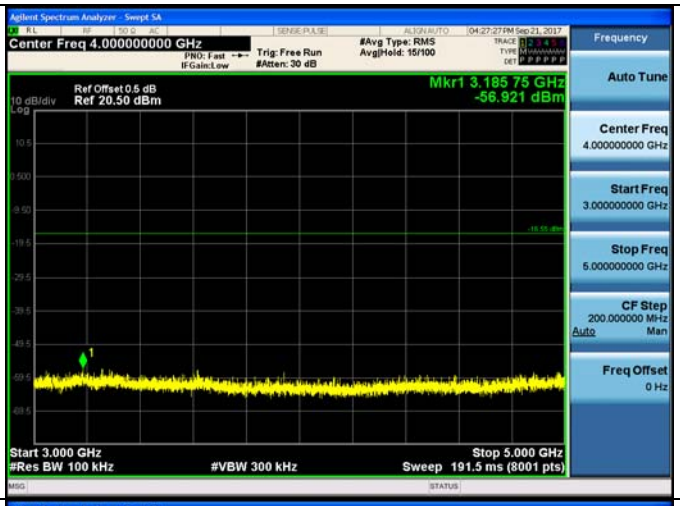
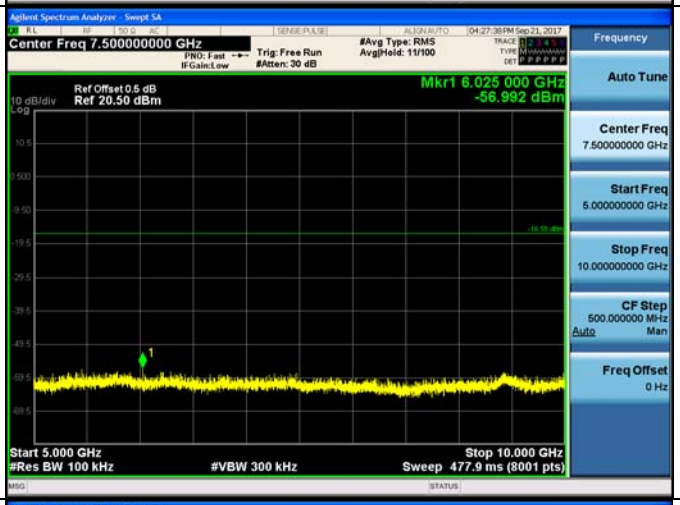
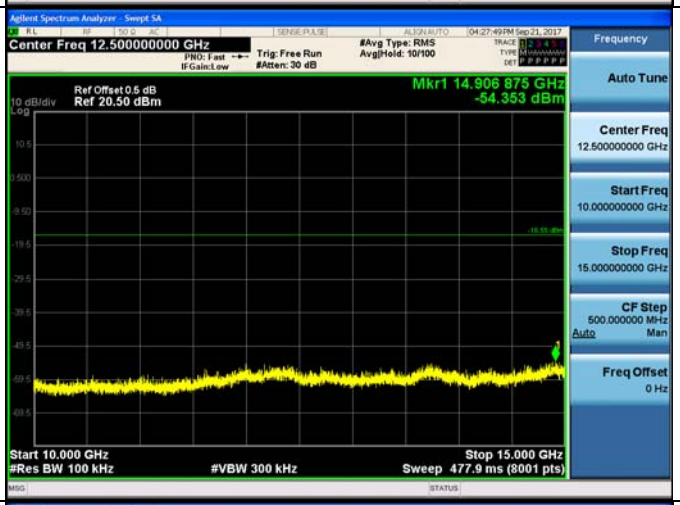
CH39 15GHz~25GHz		
CH78 30MHz~3GHz		
CH78 3GHz~5GHz		
CH78 5GHz~10GHz		

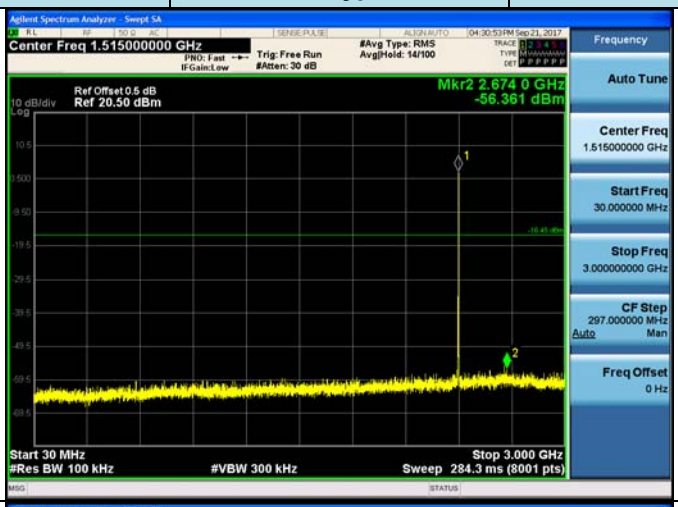
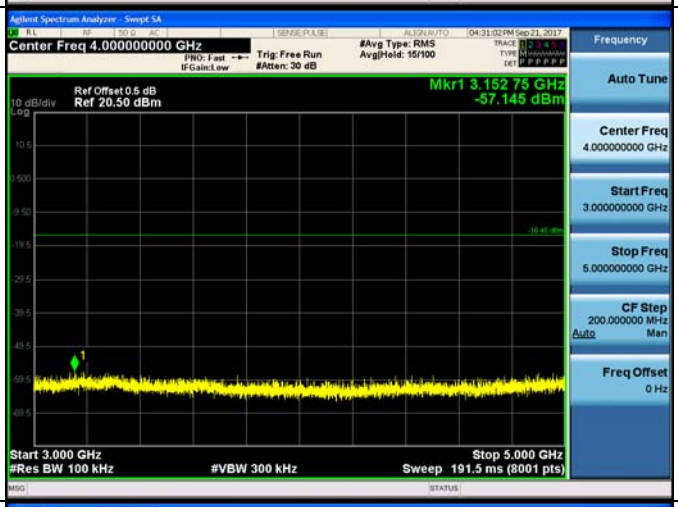
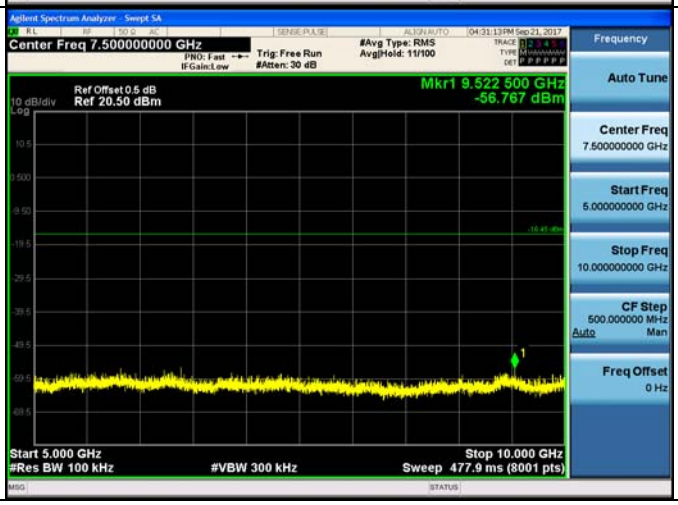
CH78 10GHz~15GHz			
CH78 15GHz~25GHz			

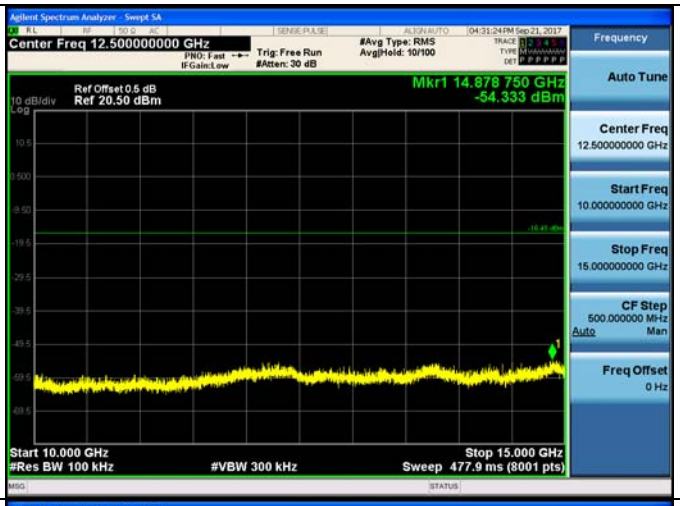
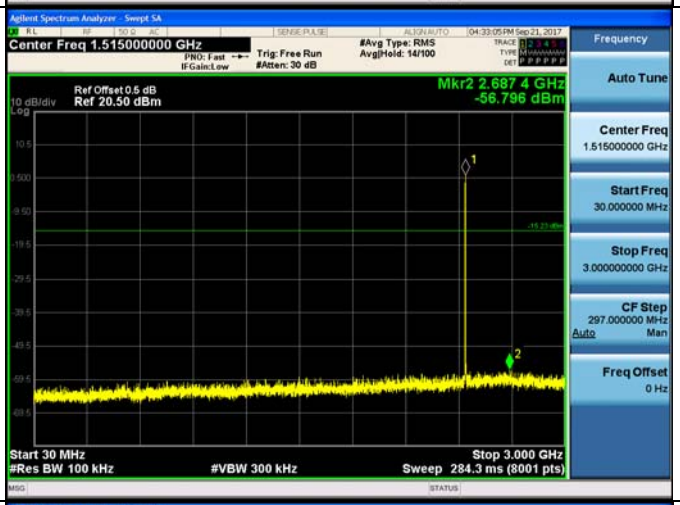
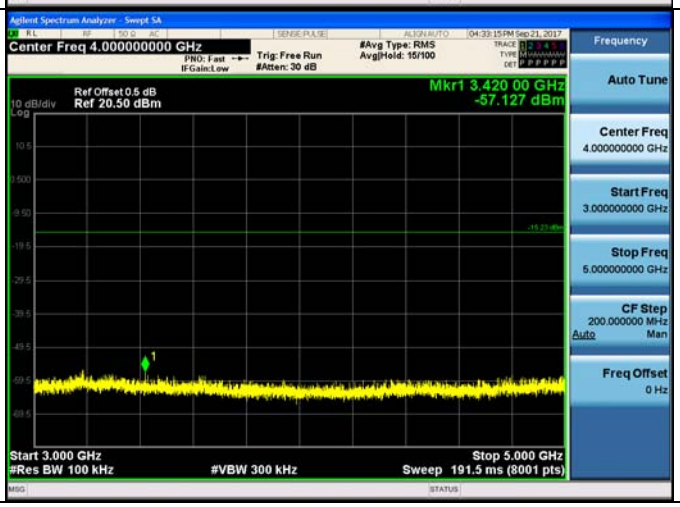
Test Item:	SE	Modulation type:	π/4DQPSK
CH00 30MHz~3GHz			
CH00 3GHz~5GHz			
CH00 5GHz~10GHz			

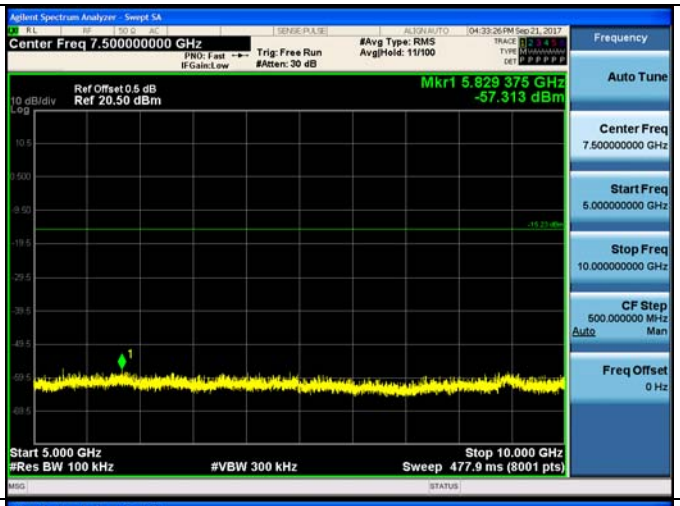
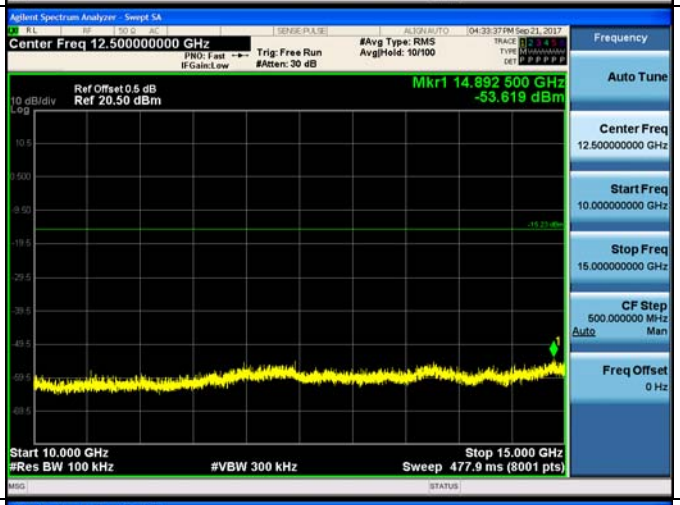
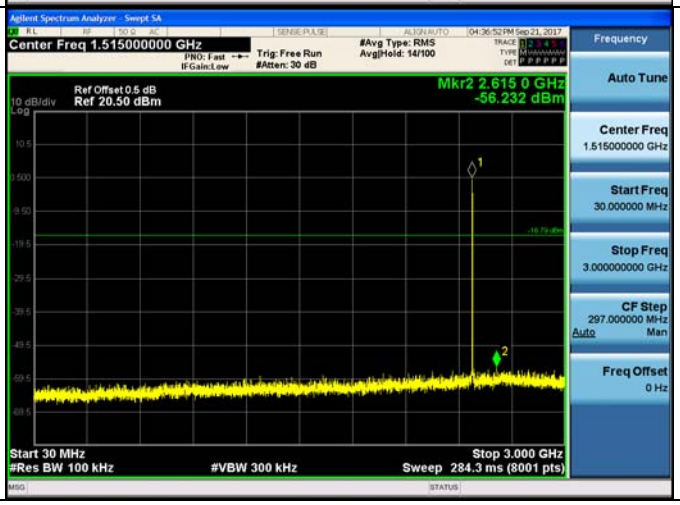
CH00 10GHz~15GHz		
CH00 15GHz~25GHz		
CH39 30MHz~3GHz		
CH39 3GHz~5GHz		

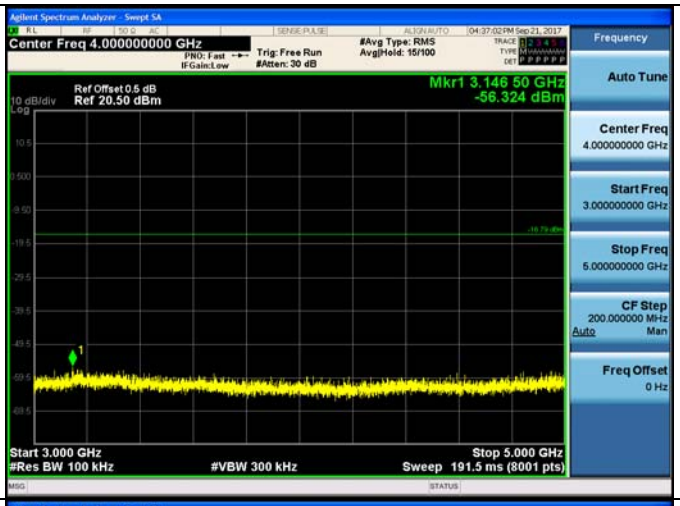
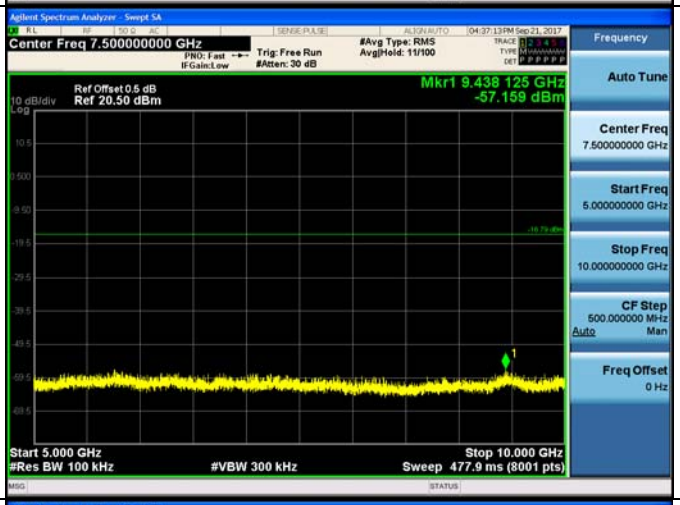
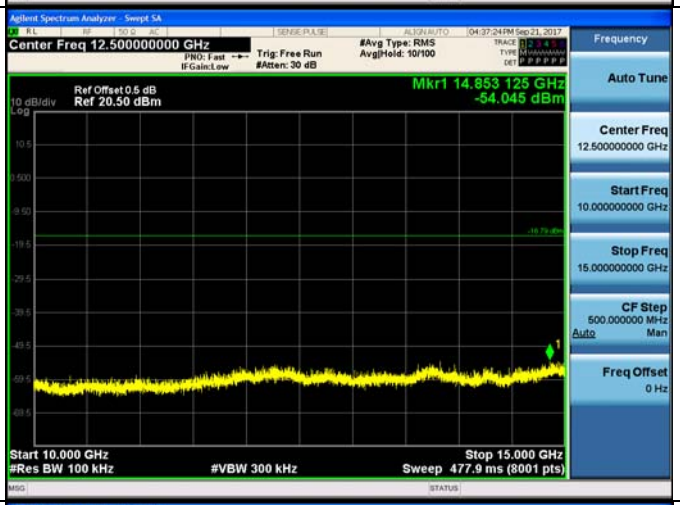
CH39 5GHz~10GHz		
CH39 10GHz~15GHz		
CH39 15GHz~25GHz		
CH78 30MHz~3GHz		

CH78 3GHz~5GHz		
CH78 5GHz~10GHz		
CH78 10GHz~15GHz		
CH78 15GHz~25GHz		

Test Item:	SE	Modulation type:	8DPSK
CH00 30MHz~3GHz		
CH00 3GHz~5GHz		
CH00 5GHz~10GHz		

CH00 10GHz~15GHz		
CH00 15GHz~25GHz		
CH39 30MHz~3GHz		
CH39 3GHz~5GHz		

CH39 5GHz~10GHz		
CH39 10GHz~15GHz		
CH39 15GHz~25GHz		
CH78 30MHz~3GHz		

CH78 3GHz~5GHz		
CH78 5GHz~10GHz		
CH78 10GHz~15GHz		
CH78 15GHz~25GHz		

5.11. Spurious Emissions (radiated)

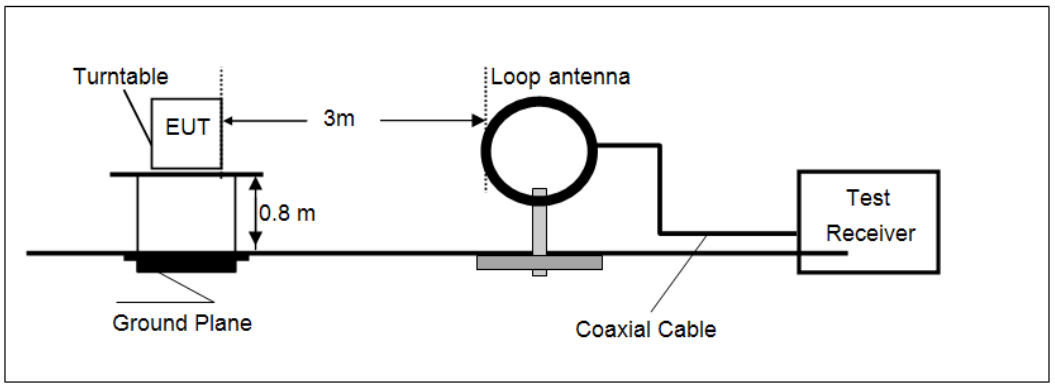
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209

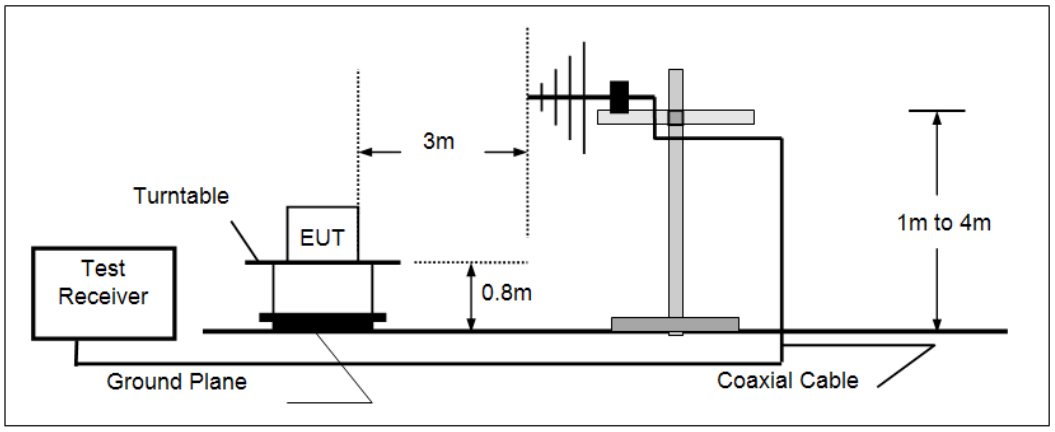
Frequency	Limit (dBuV/m @3m)	Value
30 MHz ~ 88 MHz	40.00	Quasi-peak
88 MHz ~ 216 MHz	43.50	Quasi-peak
216 MHz ~ 960 MHz	46.00	Quasi-peak
960 MHz ~ 1 GHz	54.00	Quasi-peak
Above 1 GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

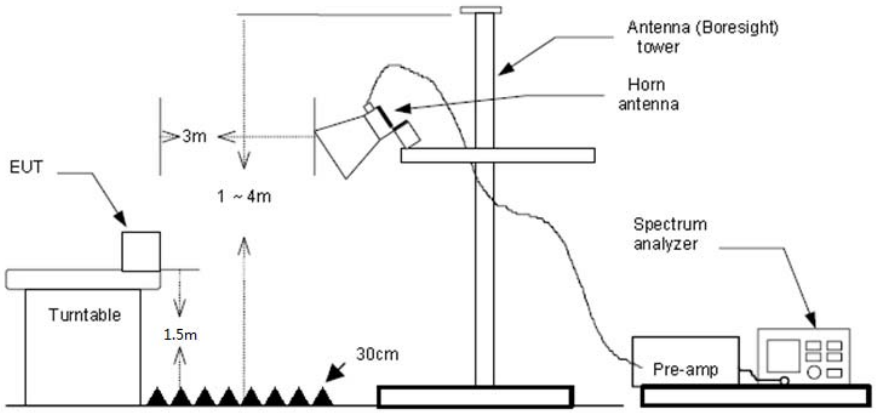
- Below 30 MHz



- 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 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) 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:

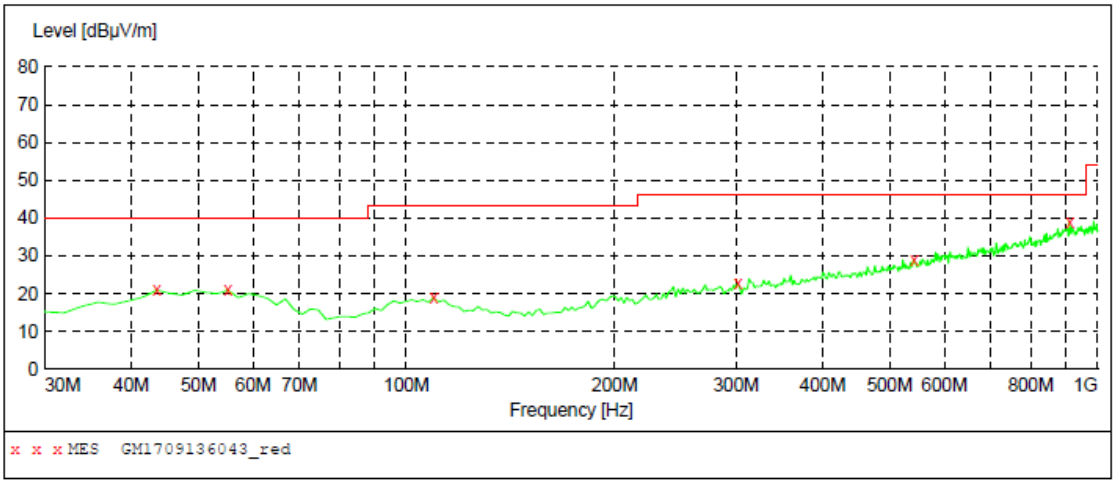
1) Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2) The emission levels of other frequencies are very lower than the limit and not show in test report.
3) Below 1 GHz,Have pre-scan all modulation mode, found the GFSK modulation High channel which it was worst case, 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

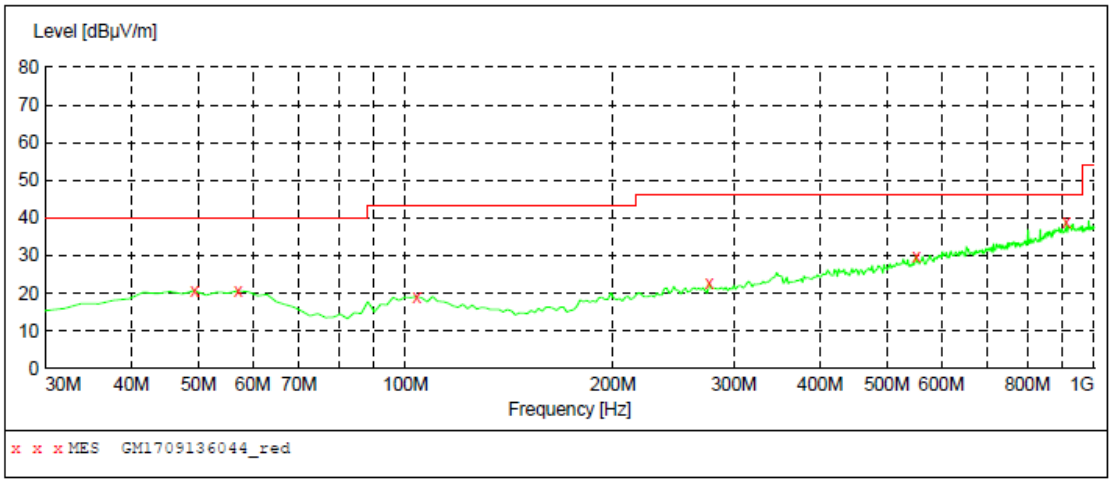


MEASUREMENT RESULT: "GM1709136043_red"

9/13/2017 4:26PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
43.580000	21.00	-9.1	40.0	19.0	QP	100.0	266.00	VERTICAL
55.220000	21.00	-9.2	40.0	19.0	QP	100.0	210.00	VERTICAL
109.540000	18.90	-10.8	43.5	24.6	QP	100.0	186.00	VERTICAL
301.600000	22.70	-7.2	46.0	23.3	QP	100.0	346.00	VERTICAL
542.160000	29.00	-0.9	46.0	17.0	QP	100.0	355.00	VERTICAL
910.760000	38.90	6.9	46.0	7.1	QP	100.0	35.00	VERTICAL

Polarization:	Horizontal



MEASUREMENT RESULT: "GM1709136044_red"

9/13/2017 4:29PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
49.400000	20.80	-8.7	40.0	19.2	QP	300.0	327.00	HORIZONTAL
57.160000	20.70	-9.4	40.0	19.3	QP	300.0	154.00	HORIZONTAL
103.720000	19.20	-10.5	43.5	24.3	QP	300.0	207.00	HORIZONTAL
276.380000	22.60	-7.9	46.0	23.4	QP	300.0	299.00	HORIZONTAL
551.860000	29.90	-0.7	46.0	16.1	QP	100.0	153.00	HORIZONTAL
910.760000	38.80	6.9	46.0	7.2	QP	100.0	153.00	HORIZONTAL

➢ **Above 1 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
1617.86	38.24	24.95	5.60	36.76	32.03	74.00	-41.97	Vertical	Peak
3192.37	38.92	28.80	7.71	38.20	37.23	74.00	-36.77	Vertical	Peak
4809.50	41.06	31.58	9.55	36.93	45.26	74.00	-28.74	Vertical	Peak
7209.02	37.35	36.21	11.87	35.07	50.36	74.00	-23.64	Vertical	Peak
1746.25	37.86	25.29	5.86	37.03	31.98	74.00	-42.02	Horizontal	Peak
3192.37	38.92	28.80	7.71	38.20	37.23	74.00	-36.77	Horizontal	Peak
4809.50	40.91	31.58	9.55	36.93	45.11	74.00	-28.89	Horizontal	Peak
7209.02	36.55	36.21	11.87	35.07	49.56	74.00	-24.44	Horizontal	Peak

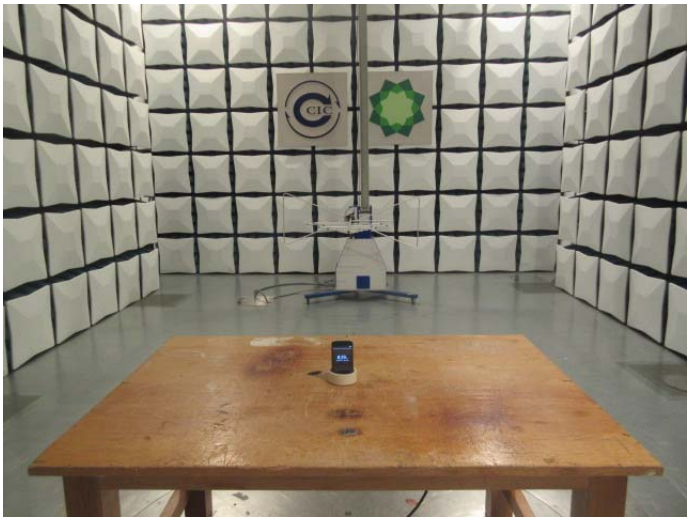
CH39									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
1741.81	37.58	25.29	5.85	37.02	31.70	74.00	-42.30	Vertical	Peak
3258.04	38.75	28.45	7.79	38.30	36.69	74.00	-37.31	Vertical	Peak
4883.52	38.79	31.43	9.59	36.73	43.08	74.00	-30.92	Vertical	Peak
7319.96	34.54	36.30	11.99	34.92	47.91	74.00	-26.09	Vertical	Peak
1746.25	48.51	25.29	5.86	37.03	42.63	74.00	-31.37	Horizontal	Peak
3258.04	38.07	28.45	7.79	38.30	36.01	74.00	-37.99	Horizontal	Peak
4883.52	40.03	31.43	9.59	36.73	44.32	74.00	-29.68	Horizontal	Peak
7190.69	32.96	36.14	11.86	35.07	45.89	74.00	-28.11	Horizontal	Peak

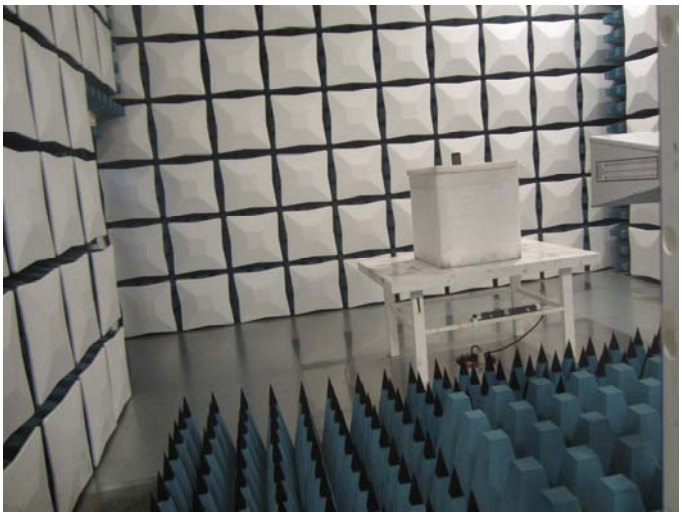
CH78									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
1746.25	49.39	25.29	5.86	37.03	43.51	74.00	-30.49	Vertical	Peak
3308.19	38.43	28.20	7.85	38.39	36.09	74.00	-37.91	Vertical	Peak
4958.68	44.41	31.46	9.64	36.52	48.99	74.00	-25.01	Vertical	Peak
7413.73	33.41	36.27	12.11	34.83	46.96	74.00	-27.04	Vertical	Peak
1746.25	47.48	25.29	5.86	37.03	41.60	74.00	-32.40	Horizontal	Peak
3143.98	36.58	28.80	7.65	38.21	34.82	74.00	-39.18	Horizontal	Peak
4958.68	36.80	31.46	9.64	36.52	41.38	74.00	-32.62	Horizontal	Peak
7451.57	33.04	36.20	12.24	34.86	46.62	74.00	-27.38	Horizontal	Peak

6. TEST SETUP PHOTOS

Conducted Emissions

Radiated Emissions





7. EXTERANAL AND INTERNAL PHOTOS

Reference to Test Report No.: TRE1709004201.

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