



TEST REPORT

Report Reference No. : TRE1710008301 R/C.....: 62200
FCC ID : 2AN7Q-BT-90D
Applicant's name : Dongguan kangbo Garment Co.,Ltd
Address : Jiuwei,8Hao,Xiapengcun,Libeiling,Dalang,Dongguan, Guangdong,China
Manufacturer : Shenzhen Smart Technology Co.,Ltd
Address : 3F B1 YuetongshitoulingIndusrial Park Sanlian Village LonghuaDistrice Shenzhen Guangdong China 518109
Test item description : Bluetooth Hat
Trade Mark : NINE BULL
Model/Type reference : BT-90D
Listed Model(s) : -
Standard : FCC CFR Title 47 Part 15 Subpart C Section 15.247
Date of receipt of test sample : Oct.18,2017
Date of testing : Oct.19,2017-Nov.08,2017
Date of issue : Nov.09,2017
Result : PASS

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Testing Laboratory Name : Shenzhen Huatongwei International Inspection Co., Ltd.

Address : 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

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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	Nov.09,2017	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)	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:	Dongguan kangbo Garment Co.,Ltd
Address:	Jiuwei,8Hao,Xiapengcun,Libeiling,Dalang,Dongguan, Guangdong,China
Manufacturer:	Shenzhen Smart Technology Co.,Ltd
Address:	3F B1 YuetongshitoulingIndusrial Park Sanlian Village LonghuaDistrice Shenzhen Guangdong China 518109

3.2. Product Description

Name of EUT:	Bluetooth Hat
Trade Mark:	NINE BULL
Model No.:	BT-90D
Listed Model(s):	-
Power supply:	DC 3.7V From internal battery
Adapter information:	-
Hardware version:	1.0
Software version:	2.0
Bluetooth	
Version:	Supported BT4.2+EDR
Modulation:	GFSK, π/4DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	Integral Antenna
Antenna gain:	-0.3 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

○	AC Adapter	Model No.:	GTM46101-1005-USB
		Input:	100-240V a.c., 50-60Hz, 0.3A
		Output:	5V d.c., 2.0A
	/	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 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.

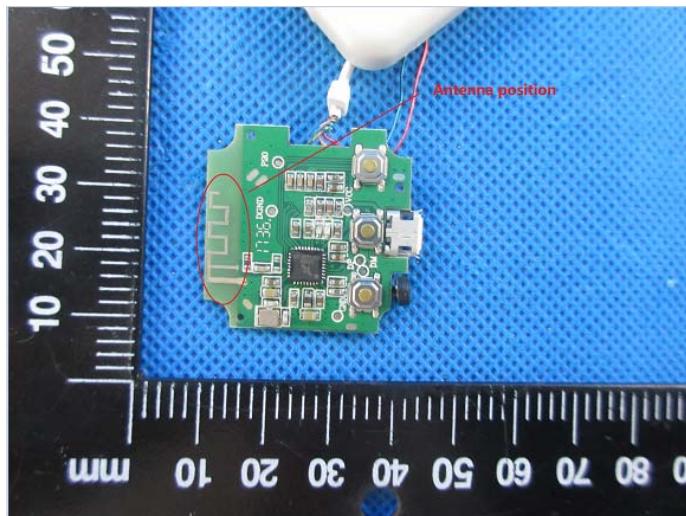
FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):

(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)

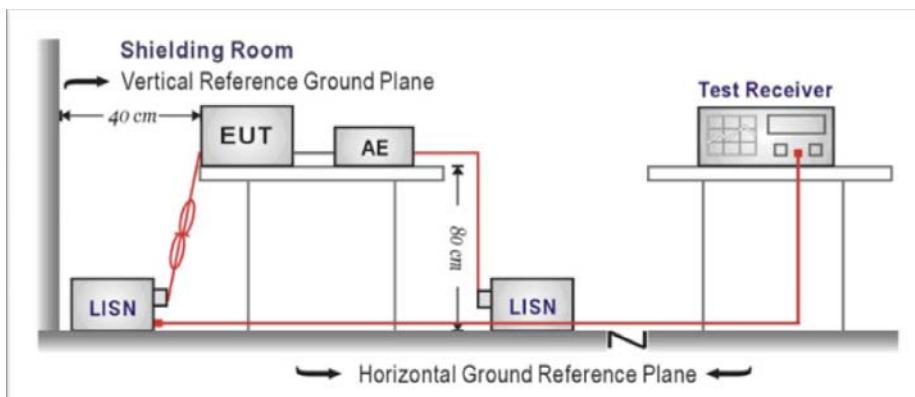
LIMIT

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

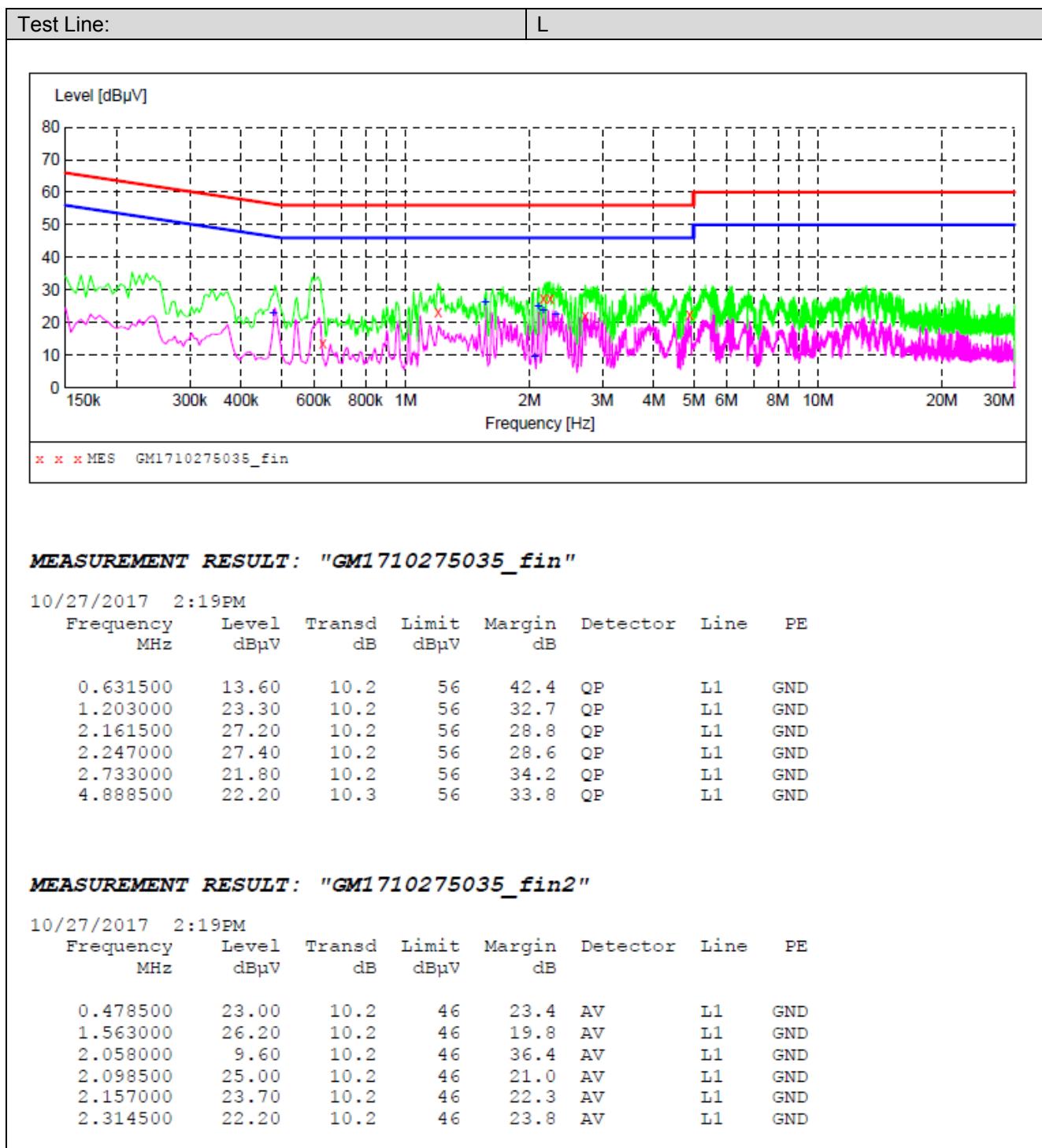
1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from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

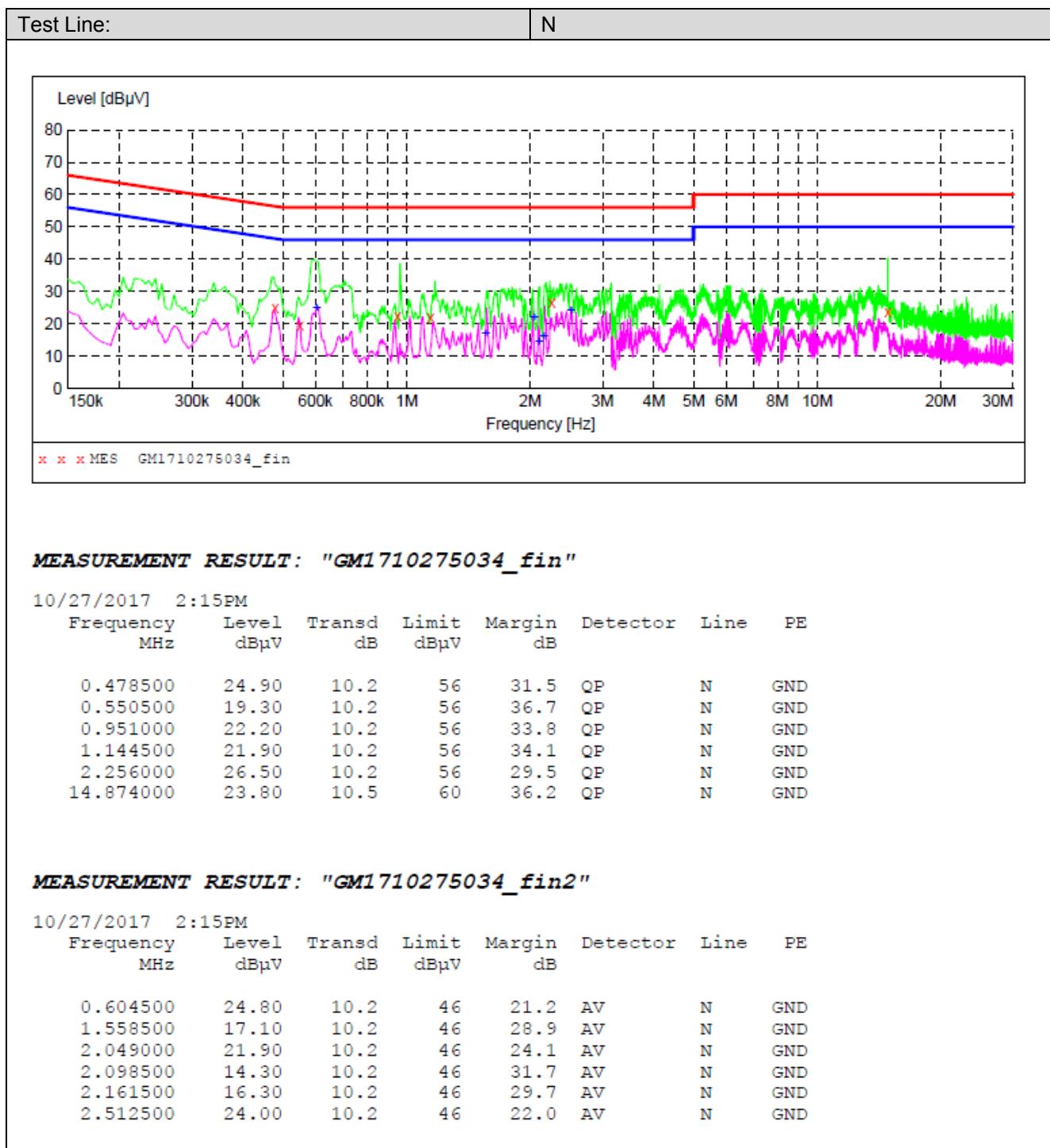
TEST RESULTS

Passed Not Applicable

Note:

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



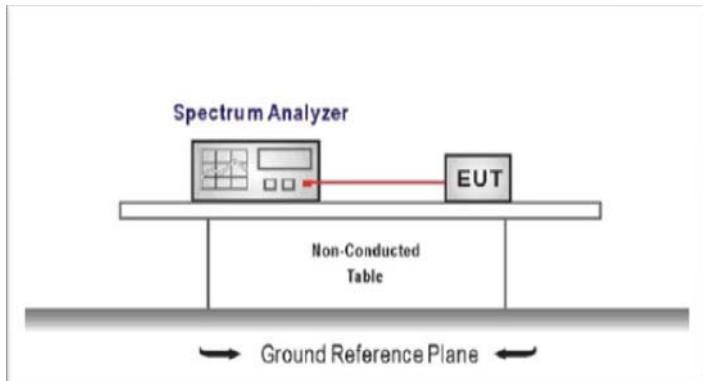


5.3. Conducted Peak Output Power

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.

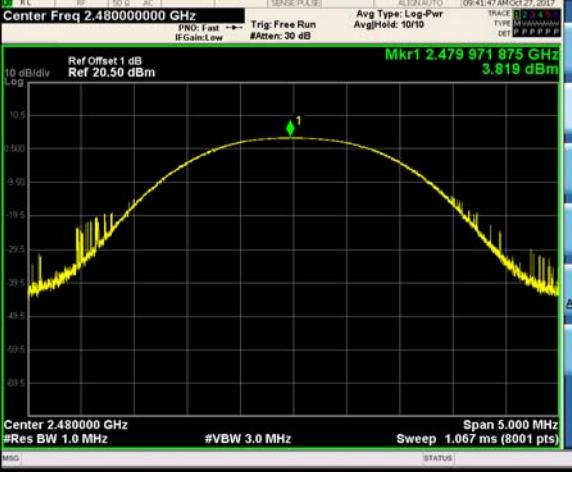
TEST MODE:

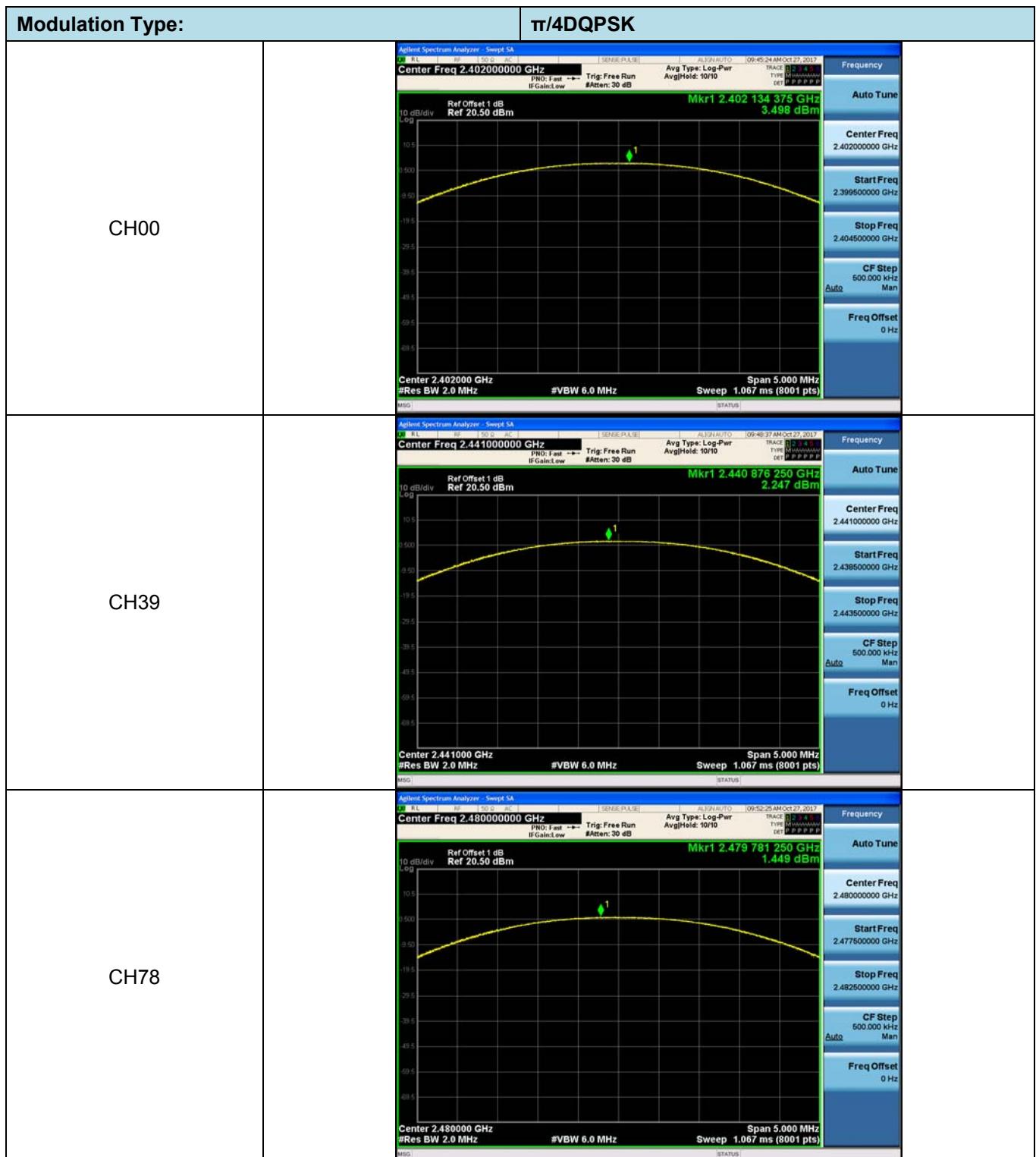
Please refer to the clause 3.3

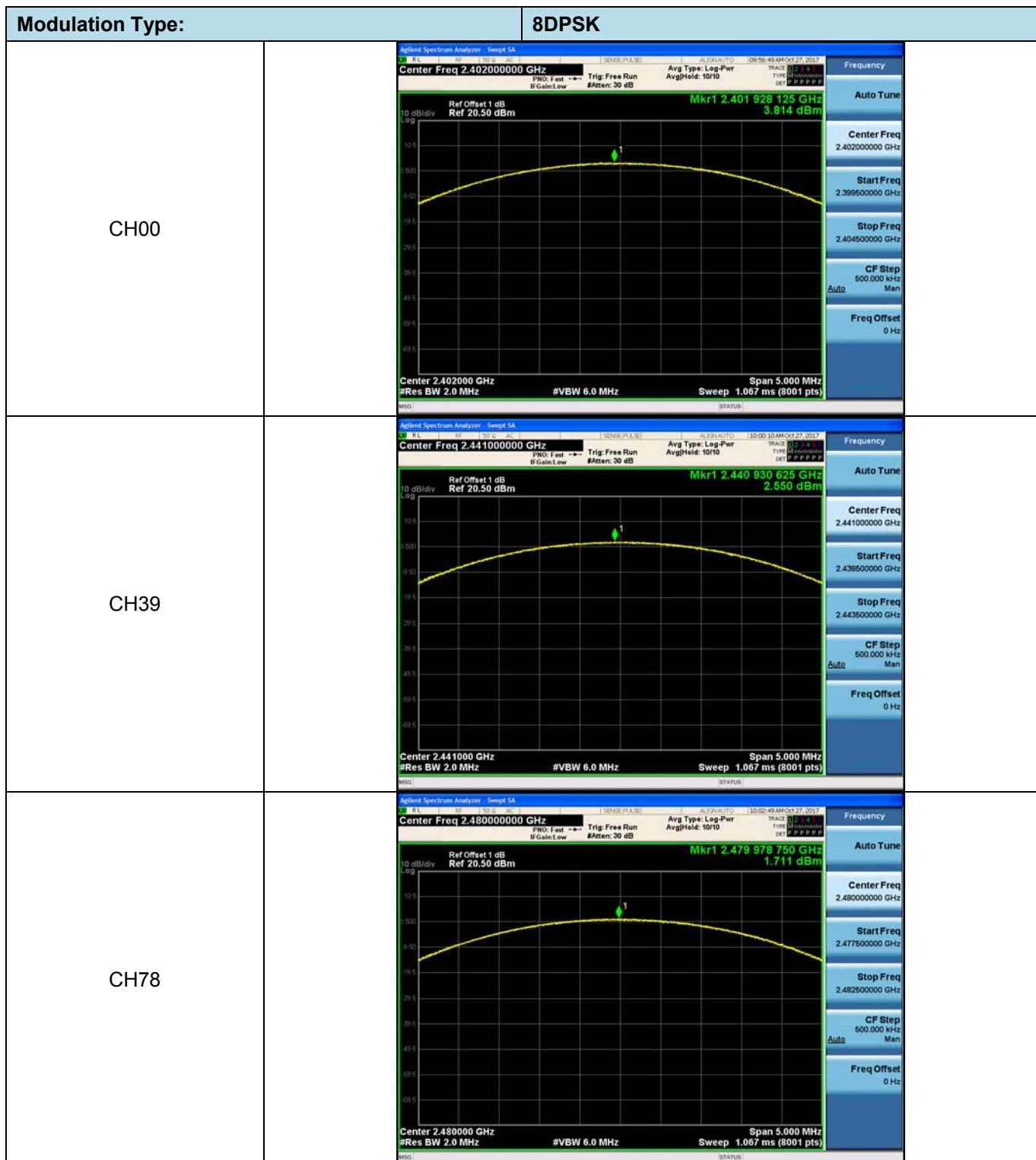
TEST RESULTS

Passed Not Applicable

Modulation type	Channel	Output power (dBm)	Limit (dBm)	Result
GFSK	00	5.465	≤ 30.00	Pass
	39	4.500		
	78	3.819		
$\pi/4$ DQPSK	00	3.498	≤ 21.00	Pass
	39	2.247		
	78	1.449		
8DPSK	00	3.814	≤ 21.00	Pass
	39	2.550		
	78	1.711		

Modulation Type:		GFSK
CH00	 <p>Agilent Spectrum Analyzer - Sweep SA Center Freq 2.402000000 GHz PWD: Fast --> Trig: Free Run IF Gain:Low #Atten: 30 dB Avg Type: Log-Pwr AvgHold: 10/10 Ref Offset 1 dB Mkr1 2.401 981 875 GHz 5.465 dBm Log 10 dB/div Ref 20.50 dBm Center 2.402000 GHz #VBW 3.0 MHz Span 5.000 MHz Sweep 1.067 ms (8001 pts) MSG STATUS</p>	Frequency Auto Tune Center Freq 2.402000000 GHz Start Freq 2.399500000 GHz Stop Freq 2.404500000 GHz CF Step 500.000 kHz Auto Freq Offset 0 Hz
CH39	 <p>Agilent Spectrum Analyzer - Sweep SA Center Freq 2.441000000 GHz PWD: Fast --> Trig: Free Run IF Gain:Low #Atten: 30 dB Avg Type: Log-Pwr AvgHold: 10/10 Ref Offset 1 dB Mkr1 2.441 008 750 GHz 4.500 dBm Log 10 dB/div Ref 20.50 dBm Center 2.441000 GHz #VBW 3.0 MHz Span 5.000 MHz Sweep 1.067 ms (8001 pts) MSG STATUS</p>	Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.438500000 GHz Stop Freq 2.443500000 GHz CF Step 500.000 kHz Auto Freq Offset 0 Hz
CH78	 <p>Agilent Spectrum Analyzer - Sweep SA Center Freq 2.480000000 GHz PWD: Fast --> Trig: Free Run IF Gain:Low #Atten: 30 dB Avg Type: Log-Pwr AvgHold: 10/10 Ref Offset 1 dB Mkr1 2.479 971 875 GHz 3.819 dBm Log 10 dB/div Ref 20.50 dBm Center 2.480000 GHz #VBW 3.0 MHz Span 5.000 MHz Sweep 1.067 ms (8001 pts) MSG STATUS</p>	Frequency Auto Tune Center Freq 2.480000000 GHz Start Freq 2.477500000 GHz Stop Freq 2.482500000 GHz CF Step 500.000 kHz Auto Freq Offset 0 Hz



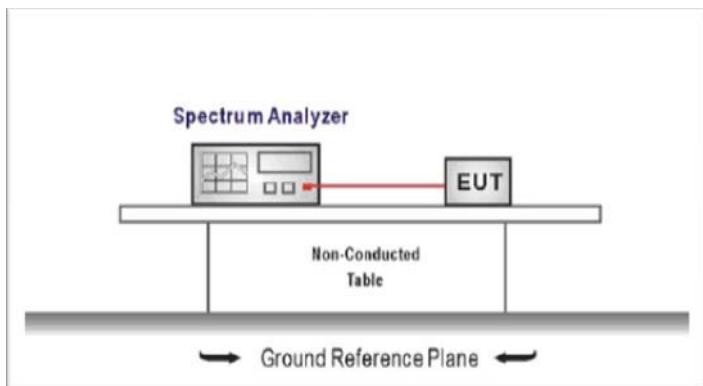


5.4. 20 dB Bandwidth

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	0.7847	-	Pass
	39	0.7892		
	78	1.004		
$\pi/4$ DQPSK	00	1.234	-	Pass
	39	1.264		
	78	1.266		
8DPSK	00	1.260	-	Pass
	39	1.257		
	78	1.270		

Modulation Type:	GFSK
CH00	 <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.402000000 GHz</p> <p>Ref Offset 1 dB Ref 10.50 dBm</p> <p>Mkr1 2.402 GHz 3.6030 dBm</p> <p>10 dB/div</p> <p>Log</p> <p>Center 2.402 GHz #Res BW 10 kHz #VBW 30 kHz Span 2 MHz Sweep 19.13 ms</p> <p>Occupied Bandwidth Total Power 12.2 dBm 912.07 kHz</p> <p>Transmit Freq Error 381 Hz OBW Power 99.00 % x dB Bandwidth 784.7 kHz x dB -20.00 dB</p> <p>MSG STATUS</p>
CH39	 <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.441000000 GHz</p> <p>Ref Offset 1 dB Ref 10.50 dBm</p> <p>Mkr1 2.441 GHz 2.9814 dBm</p> <p>10 dB/div</p> <p>Log</p> <p>Center 2.441 GHz #Res BW 10 kHz #VBW 30 kHz Span 2 MHz Sweep 19.13 ms</p> <p>Occupied Bandwidth Total Power 11.7 dBm 949.67 kHz</p> <p>Transmit Freq Error -3.525 kHz OBW Power 99.00 % x dB Bandwidth 789.2 kHz x dB -20.00 dB</p> <p>MSG STATUS</p>
CH78	 <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.480000000 GHz</p> <p>Ref Offset 1 dB Ref 10.50 dBm</p> <p>Mkr1 2.48 GHz 1.6477 dBm</p> <p>10 dB/div</p> <p>Log</p> <p>Center 2.48 GHz #Res BW 10 kHz #VBW 30 kHz Span 2 MHz Sweep 19.13 ms</p> <p>Occupied Bandwidth Total Power 10.4 dBm 968.10 kHz</p> <p>Transmit Freq Error 1.017 kHz OBW Power 99.00 % x dB Bandwidth 1.004 MHz x dB -20.00 dB</p> <p>MSG STATUS</p>

Modulation Type:		$\pi/4$ DQPSK
CH00		<p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.402000000 GHz</p> <p>Ref Offset 1 dB Ref 10.50 dBm</p> <p>Mkr1 2.4019925 GHz 1.9760 dBm</p> <p>10 dB/div</p> <p>Log</p> <p>Span 2.5 MHz</p> <p>Sweep 2.667 ms</p> <p>Occupied Bandwidth 1.1693 MHz</p> <p>Total Power 9.94 dBm</p> <p>Transmit Freq Error -1.179 kHz</p> <p>x dB Bandwidth 1.234 MHz</p> <p>OBW Power x dB</p> <p>-20.00 dB</p> <p>MSG STATUS</p>
CH39		<p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.441000000 GHz</p> <p>Ref Offset 1 dB Ref 10.50 dBm</p> <p>Mkr1 2.4409975 GHz 0.49350 dBm</p> <p>10 dB/div</p> <p>Log</p> <p>Span 2.5 MHz</p> <p>Sweep 2.667 ms</p> <p>Occupied Bandwidth 1.1704 MHz</p> <p>Total Power 8.67 dBm</p> <p>Transmit Freq Error -748 Hz</p> <p>x dB Bandwidth 1.264 MHz</p> <p>OBW Power x dB</p> <p>-20.00 dB</p> <p>MSG STATUS</p>
CH78		<p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.480000000 GHz</p> <p>Ref Offset 1 dB Ref 10.50 dBm</p> <p>Mkr1 2.48 GHz -0.56228 dBm</p> <p>10 dB/div</p> <p>Log</p> <p>Span 2.5 MHz</p> <p>Sweep 2.667 ms</p> <p>Occupied Bandwidth 1.1683 MHz</p> <p>Total Power 7.53 dBm</p> <p>Transmit Freq Error 525 Hz</p> <p>x dB Bandwidth 1.266 MHz</p> <p>OBW Power x dB</p> <p>-20.00 dB</p> <p>MSG STATUS</p>

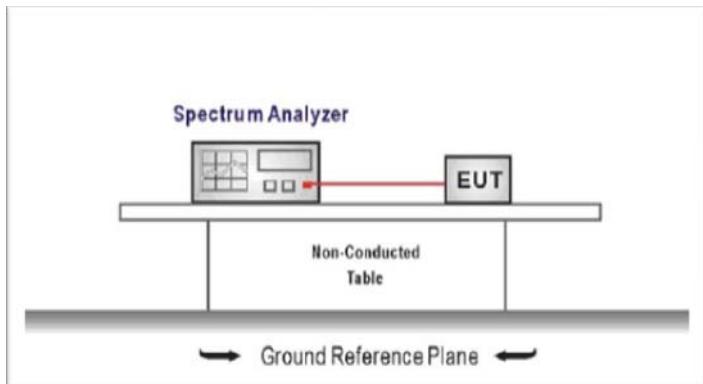
Modulation Type:		8DPSK
CH00		<p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.402000000 GHz</p> <p>Ref Offset 1 dB Ref 10.50 dBm</p> <p>Mkr1 2.4019925 GHz 1.8770 dBm</p> <p>10 dB/div</p> <p>Center 2.402 GHz #Res BW 30 kHz #VBW 100 kHz Span 2.5 MHz Sweep 2.667 ms</p> <p>Occupied Bandwidth Total Power 10.1 dBm 1.1595 MHz</p> <p>Transmit Freq Error 2.056 kHz OBW Power 99.00 % x dB Bandwidth 1.260 MHz x dB -20.00 dB</p> <p>MSG STATUS</p>
CH39		<p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.441000000 GHz</p> <p>Ref Offset 1 dB Ref 10.50 dBm</p> <p>Mkr1 2.4409925 GHz 0.59148 dBm</p> <p>10 dB/div</p> <p>Center 2.441 GHz #Res BW 30 kHz #VBW 100 kHz Span 2.5 MHz Sweep 2.667 ms</p> <p>Occupied Bandwidth Total Power 8.84 dBm 1.1619 MHz</p> <p>Transmit Freq Error 828 Hz OBW Power 99.00 % x dB Bandwidth 1.257 MHz x dB -20.00 dB</p> <p>MSG STATUS</p>
CH78		<p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.480000000 GHz</p> <p>Ref Offset 1 dB Ref 10.50 dBm</p> <p>Mkr1 2.4800025 GHz -0.57267 dBm</p> <p>10 dB/div</p> <p>Center 2.48 GHz #Res BW 30 kHz #VBW 100 kHz Span 2.5 MHz Sweep 2.667 ms</p> <p>Occupied Bandwidth Total Power 7.72 dBm 1.1671 MHz</p> <p>Transmit Freq Error 2.114 kHz OBW Power 99.00 % x dB Bandwidth 1.270 MHz x dB -20.00 dB</p> <p>MSG STATUS</p>

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 \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

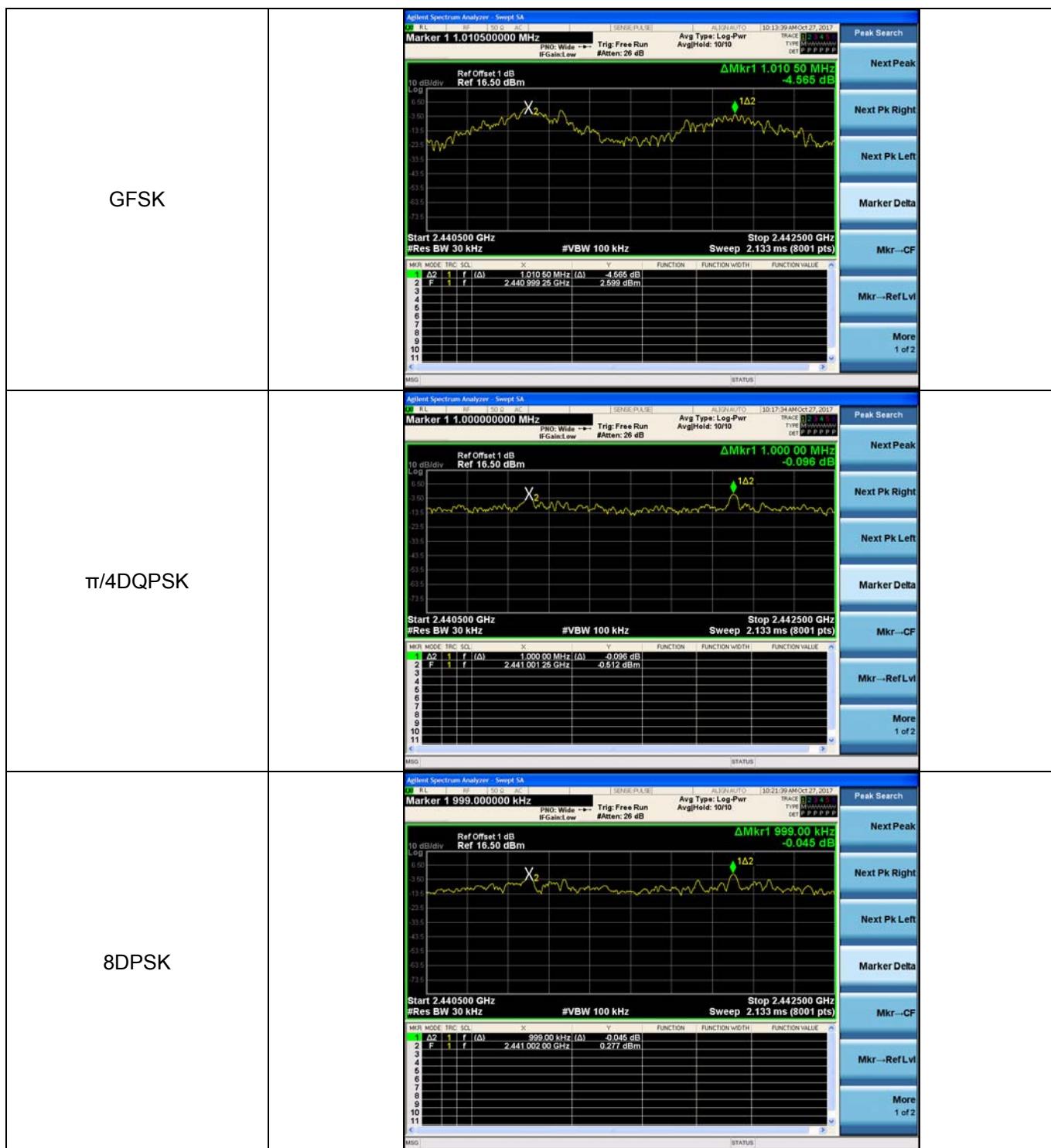
Modulation type	Channel	Carrier Frequencies Separation (MHz)	Limit (MHz) *	Result
GFSK	39	1.011	\geq 1.004	Pass
$\pi/4$ DQPSK	39	1.000	\geq 0.844	Pass
8DPSK	39	0.999	\geq 0.847	Pass

Note:

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

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

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

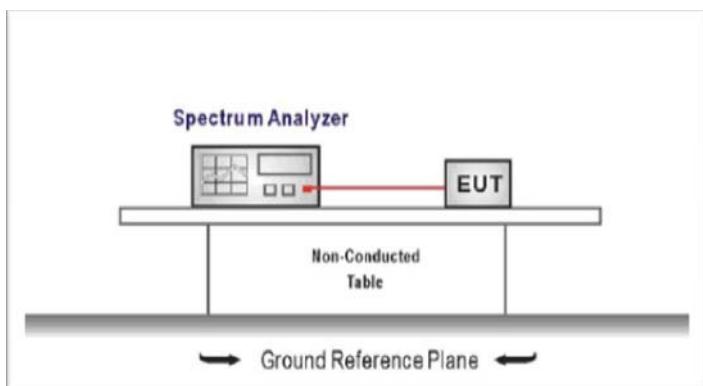


5.6. Hopping Channel Number

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:

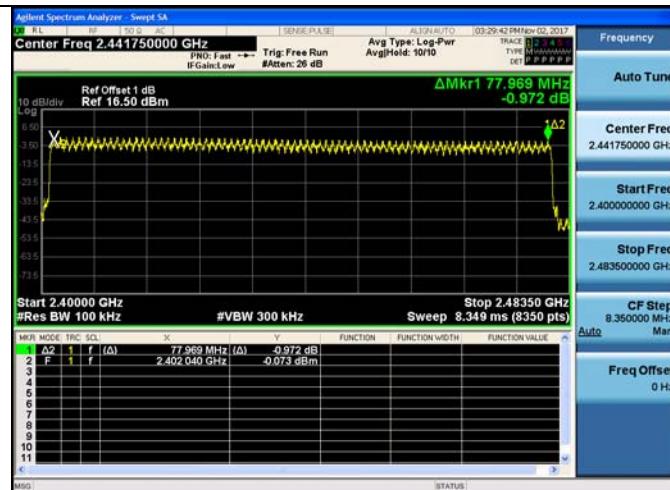
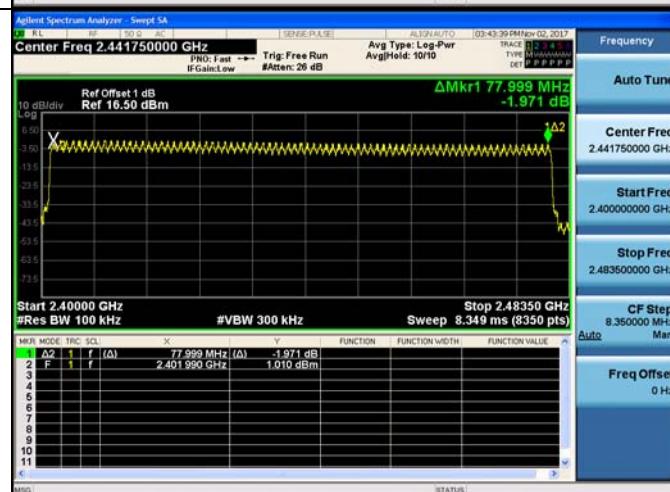
Please refer to the clause 3.3

TEST RESULTS

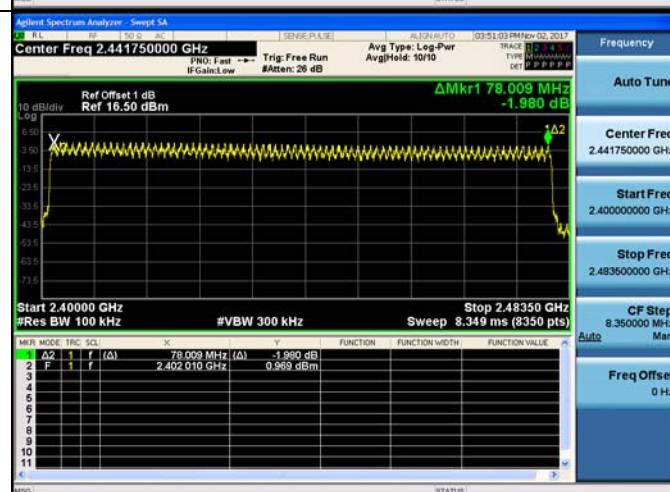
Passed Not Applicable

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

GFSK

 $\pi/4$ DQPSK

8DPSK

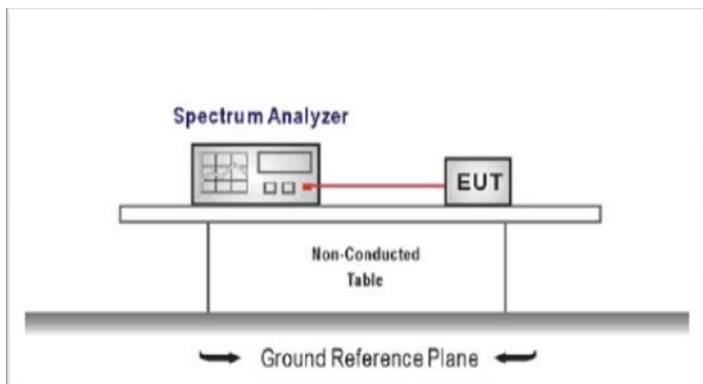


5.7. Dwell Time

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 period 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

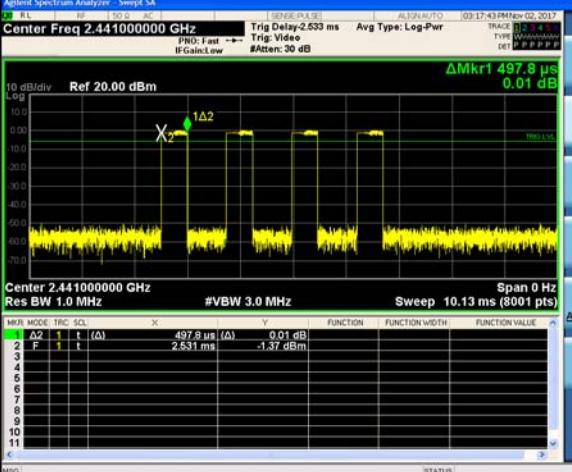
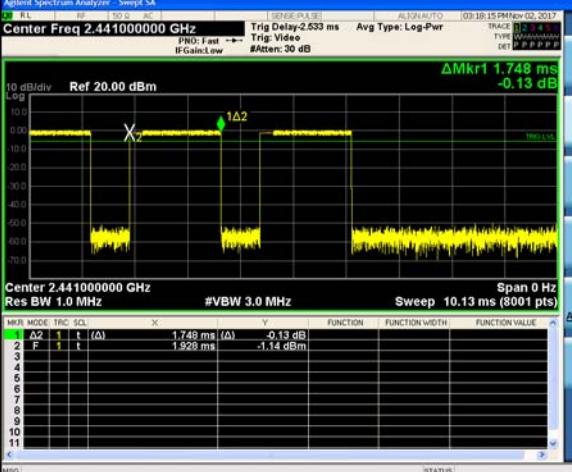
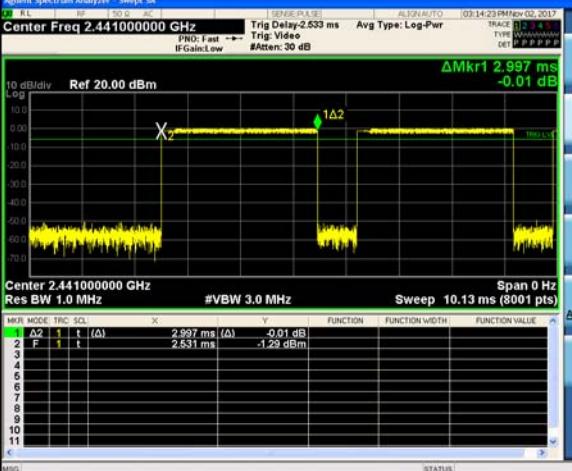
Passed Not Applicable

Modulation type	Channel	Dwell time (Second)	Limit (Second)	Result
GFSK	DH1	0.157	≤ 0.40	Pass
	DH3	0.278		
	DH5	0.319		
$\pi/4$ DQPSK	2DH1	0.16	≤ 0.40	Pass
	2DH3	0.28		
	2DH5	0.32		
8DPSK	3DH1	0.16	≤ 0.40	Pass
	3DH3	0.28		
	3DH5	0.32		

Note:

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

Modulation Type:		GFSK																																																																		
DH1		<p>Agilent Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.441000000 GHz</p> <p>Ref 20.00 dBm</p> <p>Span 0 Hz</p> <p>Res BW 1.0 MHz</p> <p>#VBW 3.0 MHz</p> <p>Sweep 10.13 ms (8001 pts)</p> <p>MIX MODE: TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE</p> <table border="1"> <tr> <td>1</td> <td>A2</td> <td>1</td> <td>t (Δ)</td> <td>495.1 us (Δ)</td> <td>-0.04 dB</td> </tr> <tr> <td>2</td> <td>F</td> <td>1</td> <td>t</td> <td>2.531 ms</td> <td>0.94 dB</td> </tr> <tr> <td>3</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>5</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>6</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>7</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>8</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>9</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>10</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>11</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <p>MSG [] STATUS []</p> <p>Frequency Auto Tune</p> <p>Center Freq 2.441000000 GHz</p> <p>Start Freq 2.441000000 GHz</p> <p>Stop Freq 2.441000000 GHz</p> <p>CF Step 1.000000 MHz Man</p> <p>Freq Offset 0 Hz</p>	1	A2	1	t (Δ)	495.1 us (Δ)	-0.04 dB	2	F	1	t	2.531 ms	0.94 dB	3						4						5						6						7						8						9						10						11					
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DH3		<p>Agilent Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.441000000 GHz</p> <p>Ref 20.00 dBm</p> <p>Span 0 Hz</p> <p>Res BW 1.0 MHz</p> <p>#VBW 3.0 MHz</p> <p>Sweep 10.13 ms (8001 pts)</p> <p>MIX MODE: TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE</p> <table border="1"> <tr> <td>1</td> <td>A2</td> <td>1</td> <td>t (Δ)</td> <td>1.740 ms (Δ)</td> <td>0.89 dB</td> </tr> <tr> <td>2</td> <td>F</td> <td>1</td> <td>t</td> <td>2.532 ms</td> <td>1.63 dBm</td> </tr> <tr> <td>3</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>5</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>6</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>7</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>8</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>9</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>10</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>11</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <p>MSG [] STATUS []</p> <p>Frequency Auto Tune</p> <p>Center Freq 2.441000000 GHz</p> <p>Start Freq 2.441000000 GHz</p> <p>Stop Freq 2.441000000 GHz</p> <p>CF Step 1.000000 MHz Man</p> <p>Freq Offset 0 Hz</p>	1	A2	1	t (Δ)	1.740 ms (Δ)	0.89 dB	2	F	1	t	2.532 ms	1.63 dBm	3						4						5						6						7						8						9						10						11					
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Modulation Type:		$\pi/4$ DQPSK										
2DH1			Frequency	Auto Tune	Center Freq	2.44100000 GHz	Start Freq	2.44100000 GHz	Stop Freq	2.44100000 GHz	CF Step	1.000000 MHz
2DH3			Frequency	Auto Tune	Center Freq	2.44100000 GHz	Start Freq	2.44100000 GHz	Stop Freq	2.44100000 GHz	CF Step	1.000000 MHz
2DH5			Frequency	Auto Tune	Center Freq	2.44100000 GHz	Start Freq	2.44100000 GHz	Stop Freq	2.44100000 GHz	CF Step	1.000000 MHz

Modulation Type:		8DPSK																																																																																																
3DH1		<p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.441000000 GHz Trig Delay:2.533 ms Avg Type: Log-Pwr</p> <p>PND: Fast --> Trig: Video #Atten: 30 dB</p> <p>ΔMkr1 495.3 μs -0.32 dB</p> <p>10 dB/div Ref 20.00 dBm</p> <p>Center 2.441000000 GHz Res BW 1.0 MHz #VBW 3.0 MHz Sweep 10.13 ms (8001 pts)</p> <table border="1"> <tr><td>MKR MODE</td><td>TRIG</td><td>SCL</td><td>X</td><td>Y</td><td>FUNCTION</td><td>FUNCTION WIDTH</td><td>FUNCTION VALUE</td></tr> <tr><td>1</td><td>A2</td><td>1</td><td>t</td><td>(Δ)</td><td>495.3 μs (Δ)</td><td>-0.32 dB</td><td></td></tr> <tr><td>2</td><td>F</td><td>1</td><td>t</td><td></td><td>2.532 ms</td><td>-1.07 dBm</td><td></td></tr> <tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>8</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>9</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>10</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>11</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table> <p>MSG STATUS</p>	MKR MODE	TRIG	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	A2	1	t	(Δ)	495.3 μs (Δ)	-0.32 dB		2	F	1	t		2.532 ms	-1.07 dBm		3								4								5								6								7								8								9								10								11							
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3DH3		<p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.441000000 GHz Trig Delay:2.533 ms Avg Type: Log-Pwr</p> <p>PND: Fast --> Trig: Video #Atten: 30 dB</p> <p>ΔMkr1 1.747 ms -0.09 dB</p> <p>10 dB/div Ref 20.00 dBm</p> <p>Center 2.441000000 GHz Res BW 1.0 MHz #VBW 3.0 MHz Sweep 10.13 ms (8001 pts)</p> <table border="1"> <tr><td>MKR MODE</td><td>TRIG</td><td>SCL</td><td>X</td><td>Y</td><td>FUNCTION</td><td>FUNCTION WIDTH</td><td>FUNCTION VALUE</td></tr> <tr><td>1</td><td>A2</td><td>1</td><td>t</td><td>(Δ)</td><td>1.747 ms (Δ)</td><td>-0.09 dB</td><td></td></tr> <tr><td>2</td><td>F</td><td>1</td><td>t</td><td></td><td>2.532 ms</td><td>-1.14 dBm</td><td></td></tr> <tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>8</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>9</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>10</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>11</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table> <p>MSG STATUS</p>	MKR MODE	TRIG	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	A2	1	t	(Δ)	1.747 ms (Δ)	-0.09 dB		2	F	1	t		2.532 ms	-1.14 dBm		3								4								5								6								7								8								9								10								11							
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3DH5		<p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.441000000 GHz Trig Delay:2.533 ms Avg Type: Log-Pwr</p> <p>PND: Fast --> Trig: Video #Atten: 30 dB</p> <p>ΔMkr1 2.997 ms -0.32 dB</p> <p>10 dB/div Ref 20.00 dBm</p> <p>Center 2.441000000 GHz Res BW 1.0 MHz #VBW 3.0 MHz Sweep 10.13 ms (8001 pts)</p> <table border="1"> <tr><td>MKR MODE</td><td>TRIG</td><td>SCL</td><td>X</td><td>Y</td><td>FUNCTION</td><td>FUNCTION WIDTH</td><td>FUNCTION VALUE</td></tr> <tr><td>1</td><td>A2</td><td>1</td><td>t</td><td>(Δ)</td><td>2.997 ms (Δ)</td><td>-0.32 dB</td><td></td></tr> <tr><td>2</td><td>F</td><td>1</td><td>t</td><td></td><td>2.532 ms</td><td>-1.27 dBm</td><td></td></tr> <tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>8</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>9</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>10</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>11</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table> <p>MSG STATUS</p>	MKR MODE	TRIG	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	A2	1	t	(Δ)	2.997 ms (Δ)	-0.32 dB		2	F	1	t		2.532 ms	-1.27 dBm		3								4								5								6								7								8								9								10								11							
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5.8. Pseudorandom Frequency Hopping Sequence

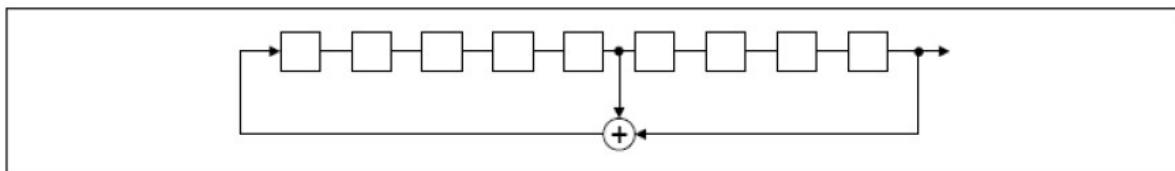
LIMIT

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

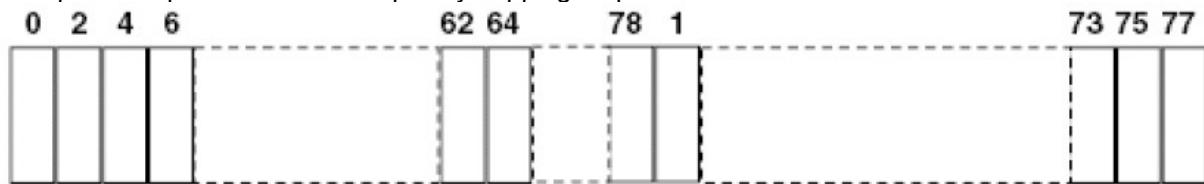
The pseudorandom frequency hopping sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones, for example: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

The system receiver has input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shifts frequencies in synchronization with the transmitted signals.

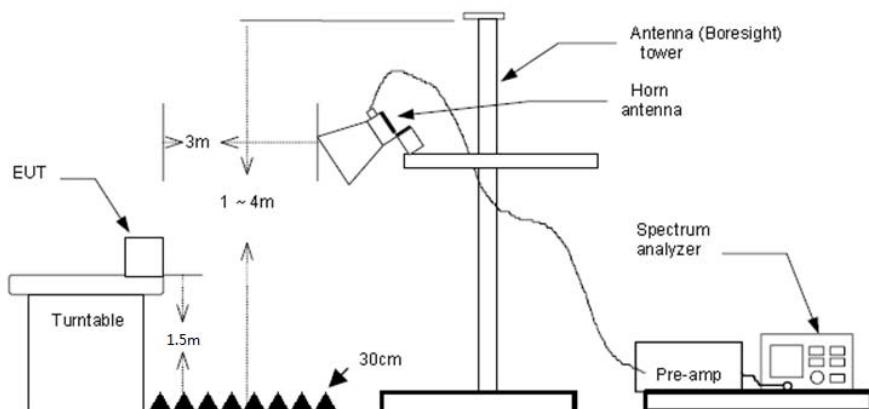
5.9. Restricted band (radiated)

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. 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.

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
2483.50	35.04	27.26	6.83	37.87	31.26	74.00	-42.74	Vertical	Peak
2498.47	51.58	27.21	6.84	37.87	47.76	74.00	-26.24	Vertical	Peak
2500.00	33.17	27.20	6.84	37.87	29.34	74.00	-44.66	Vertical	Peak
2483.50	34.33	27.26	6.83	37.87	30.55	74.00	-43.45	Horizontal	Peak
2500.00	34.49	27.20	6.84	37.87	30.66	74.00	-43.34	Horizontal	Peak
2310.00	21.96	28.05	6.62	37.65	18.98	54.00	-35.02	Vertical	Average
2390.03	22.28	27.65	6.75	37.87	18.81	54.00	-35.19	Vertical	Average
2310.00	22.38	28.05	6.62	37.65	19.40	54.00	-34.60	Horizontal	Average
2390.03	22.15	27.65	6.75	37.87	18.68	54.00	-35.32	Horizontal	Average

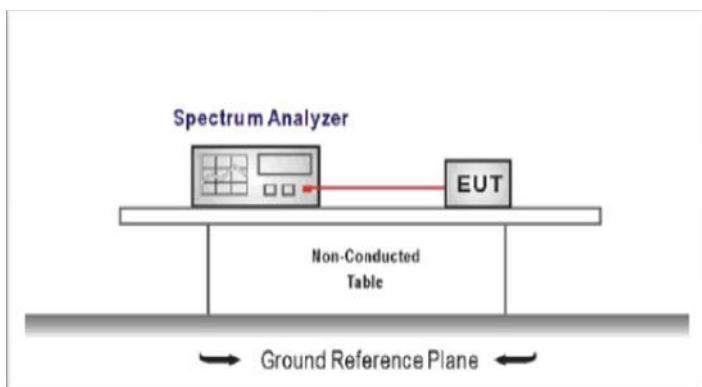
CH78									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2310.00	33.99	28.05	6.62	37.65	31.01	74.00	-42.99	Vertical	Peak
2390.03	49.43	27.65	6.75	37.87	45.96	74.00	-28.04	Vertical	Peak
2310.00	34.03	28.05	6.62	37.65	31.05	74.00	-42.95	Horizontal	Peak
2389.93	41.47	27.65	6.75	37.87	38.00	74.00	-36.00	Horizontal	Peak
2483.50	21.66	27.26	6.83	37.87	17.88	54.00	-36.12	Vertical	Average
2500.00	21.55	27.20	6.84	37.87	17.72	54.00	-36.28	Vertical	Average
2483.50	22.10	27.26	6.83	37.87	18.32	54.00	-35.68	Horizontal	Average
2500.00	23.13	27.20	6.84	37.87	19.30	54.00	-34.70	Horizontal	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

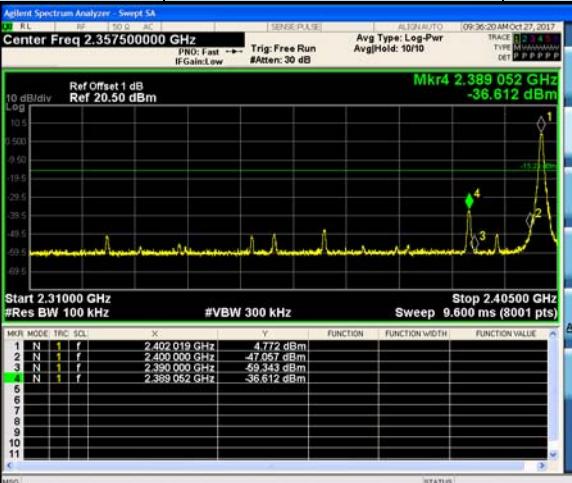
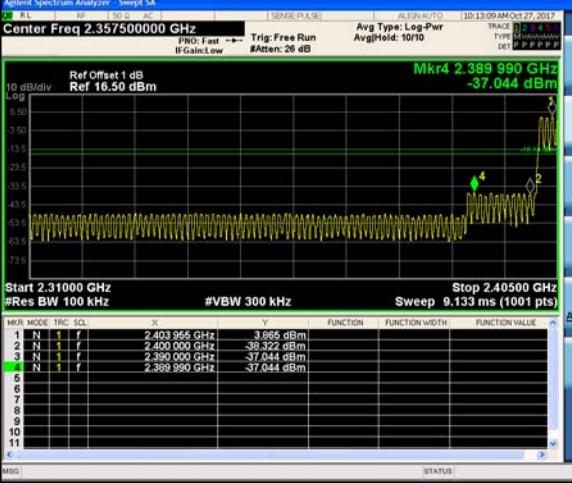
1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
RBW = 100 kHz, VBW \geq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

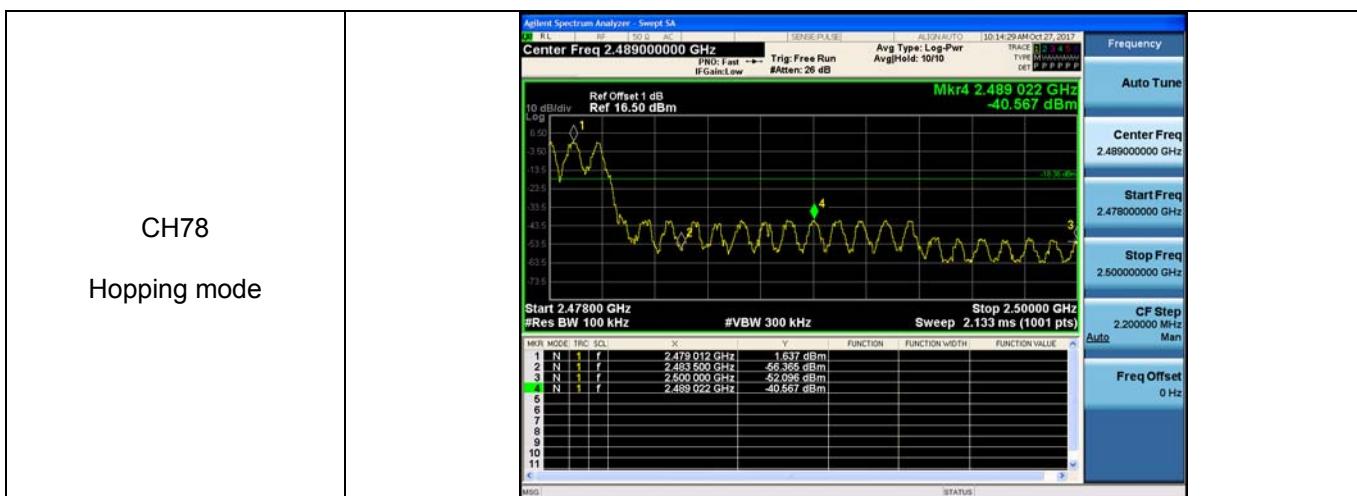
TEST MODE:

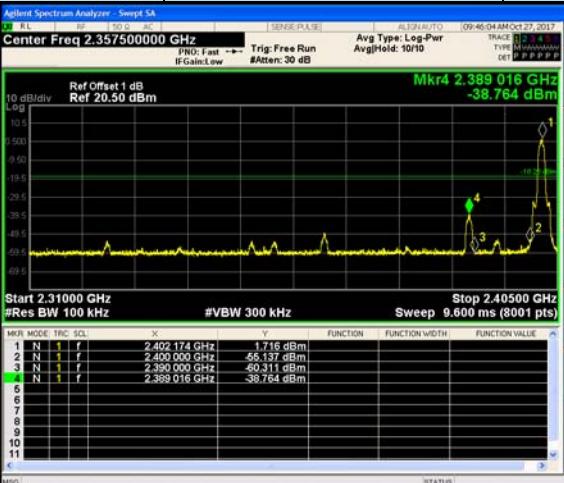
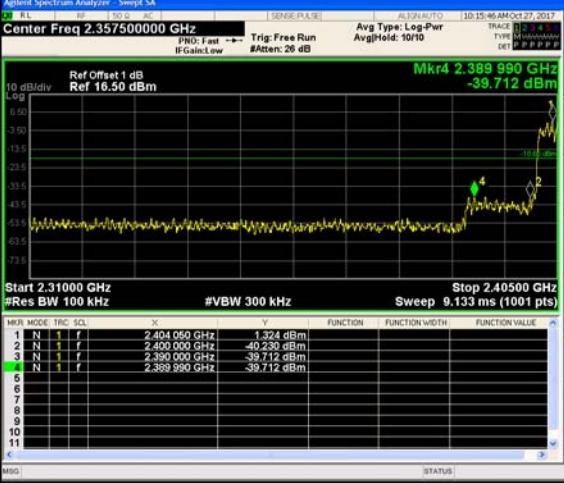
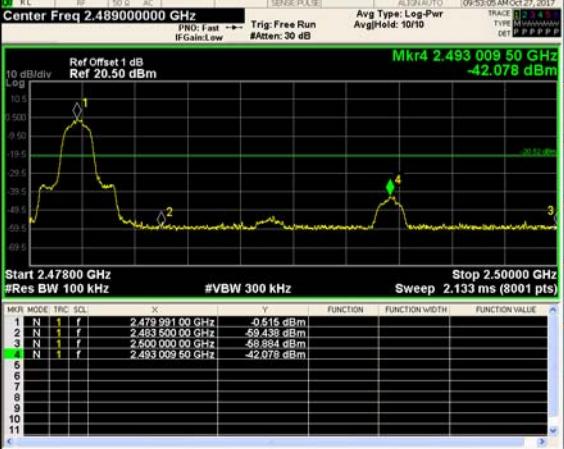
Please refer to the clause 3.3

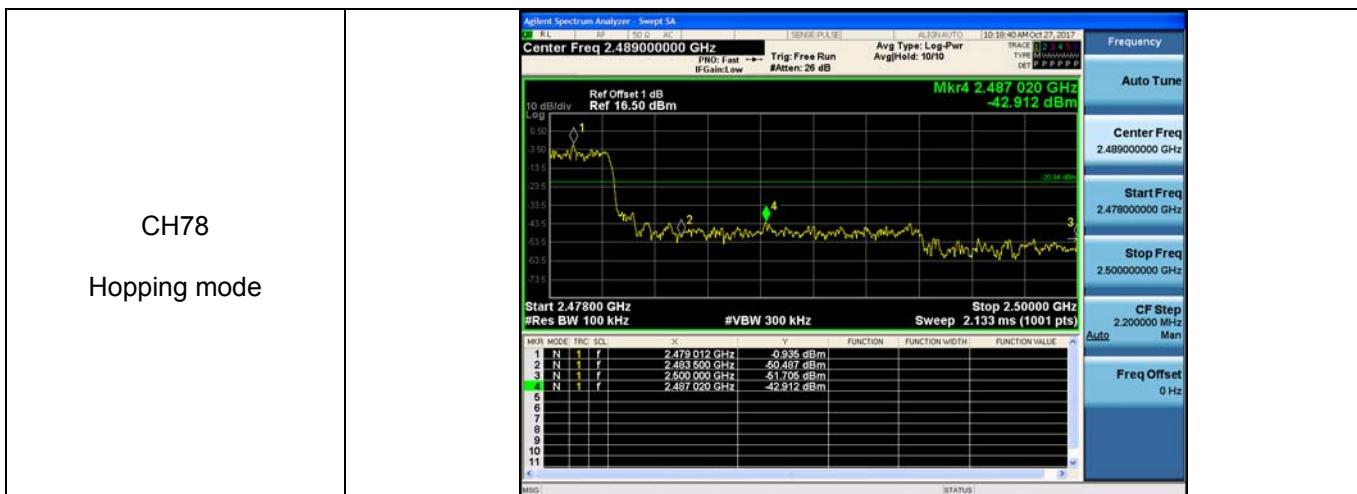
TEST RESULTS

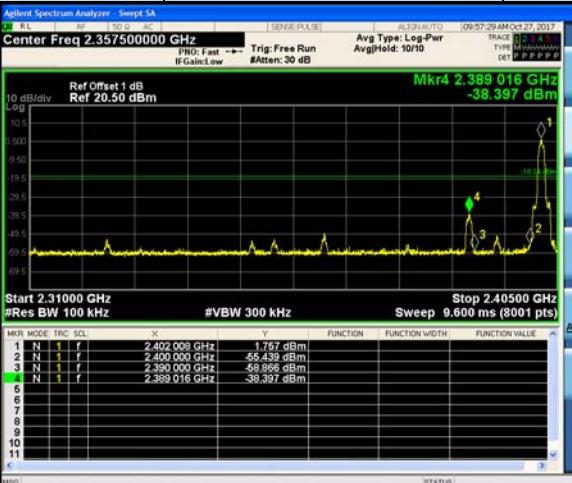
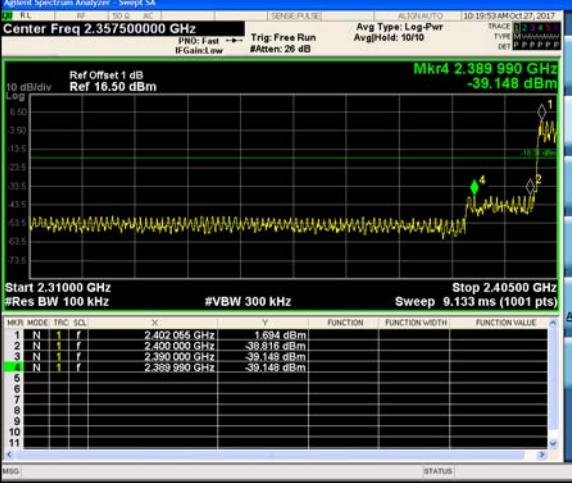
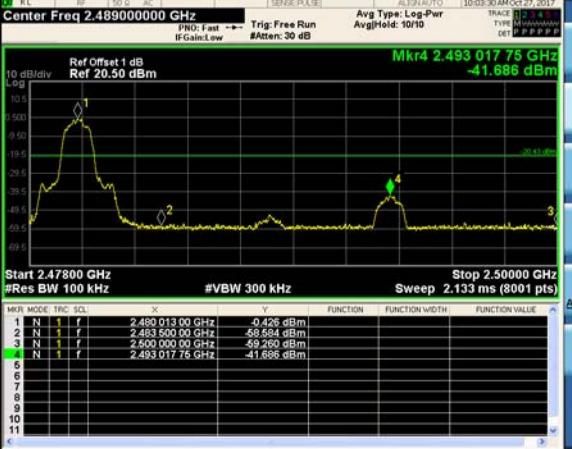
Passed Not Applicable

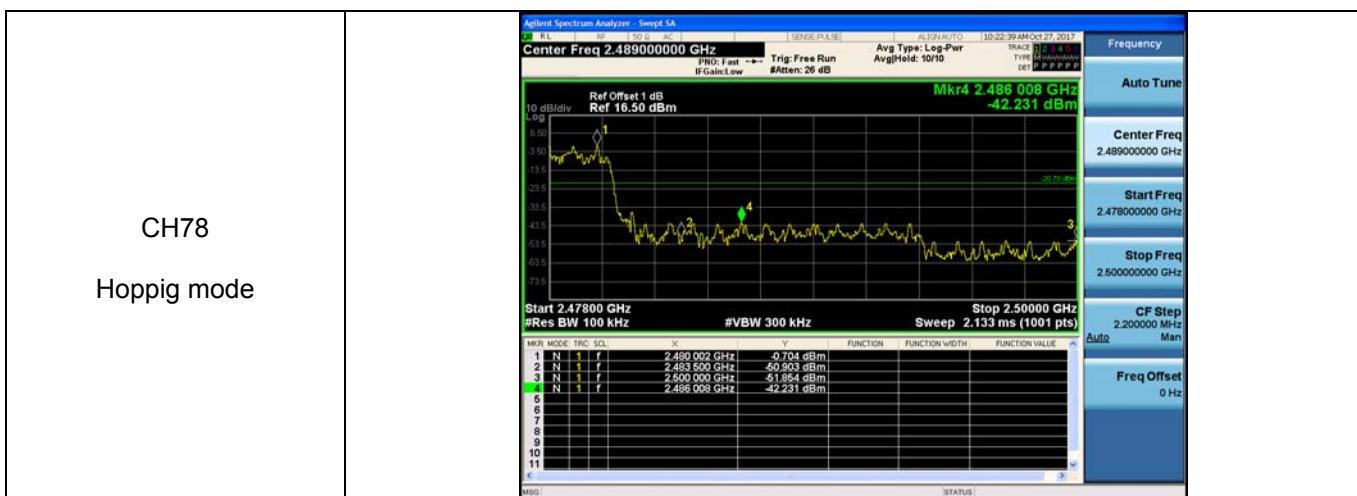
Test Item:	Band edge	Modulation type:	GFSK																				
CH00	No hopping mode	 <p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.357500000 GHz</p> <p>Start 2.31000 GHz Stop 2.40500 GHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 9.600 ms (8001 pts)</p> <table border="1"> <thead> <tr> <th>MARKER</th> <th>FUNCTION</th> <th>FUNCTION WIDTH</th> <th>FUNCTION VALUE</th> </tr> </thead> <tbody> <tr><td>1</td><td>N</td><td>f</td><td>2.402 019 GHz</td></tr> <tr><td>2</td><td>N</td><td>f</td><td>2.400 000 GHz</td></tr> <tr><td>3</td><td>N</td><td>f</td><td>2.399 000 GHz</td></tr> <tr><td>4</td><td>N</td><td>f</td><td>2.389 052 GHz</td></tr> </tbody> </table>	MARKER	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	f	2.402 019 GHz	2	N	f	2.400 000 GHz	3	N	f	2.399 000 GHz	4	N	f	2.389 052 GHz	Frequency Auto Tune Center Freq 2.357500000 GHz Start Freq 2.310000000 GHz Stop Freq 2.405000000 GHz CF Step 9.500000 MHz Auto Freq Offset 0 Hz
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CH78	No hopping mode	 <p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.489000000 GHz</p> <p>Start 2.47800 GHz Stop 2.50000 GHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 2.133 ms (8001 pts)</p> <table border="1"> <thead> <tr> <th>MARKER</th> <th>FUNCTION</th> <th>FUNCTION WIDTH</th> <th>FUNCTION VALUE</th> </tr> </thead> <tbody> <tr><td>1</td><td>N</td><td>f</td><td>2.480 037.76 GHz</td></tr> <tr><td>2</td><td>N</td><td>f</td><td>2.483 500.00 GHz</td></tr> <tr><td>3</td><td>N</td><td>f</td><td>2.500 000.00 GHz</td></tr> <tr><td>4</td><td>N</td><td>f</td><td>2.493 174.50 GHz</td></tr> </tbody> </table>	MARKER	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	f	2.480 037.76 GHz	2	N	f	2.483 500.00 GHz	3	N	f	2.500 000.00 GHz	4	N	f	2.493 174.50 GHz	Frequency Auto Tune Center Freq 2.489000000 GHz Start Freq 2.478000000 GHz Stop Freq 2.500000000 GHz CF Step 2.200000 MHz Auto Freq Offset 0 Hz
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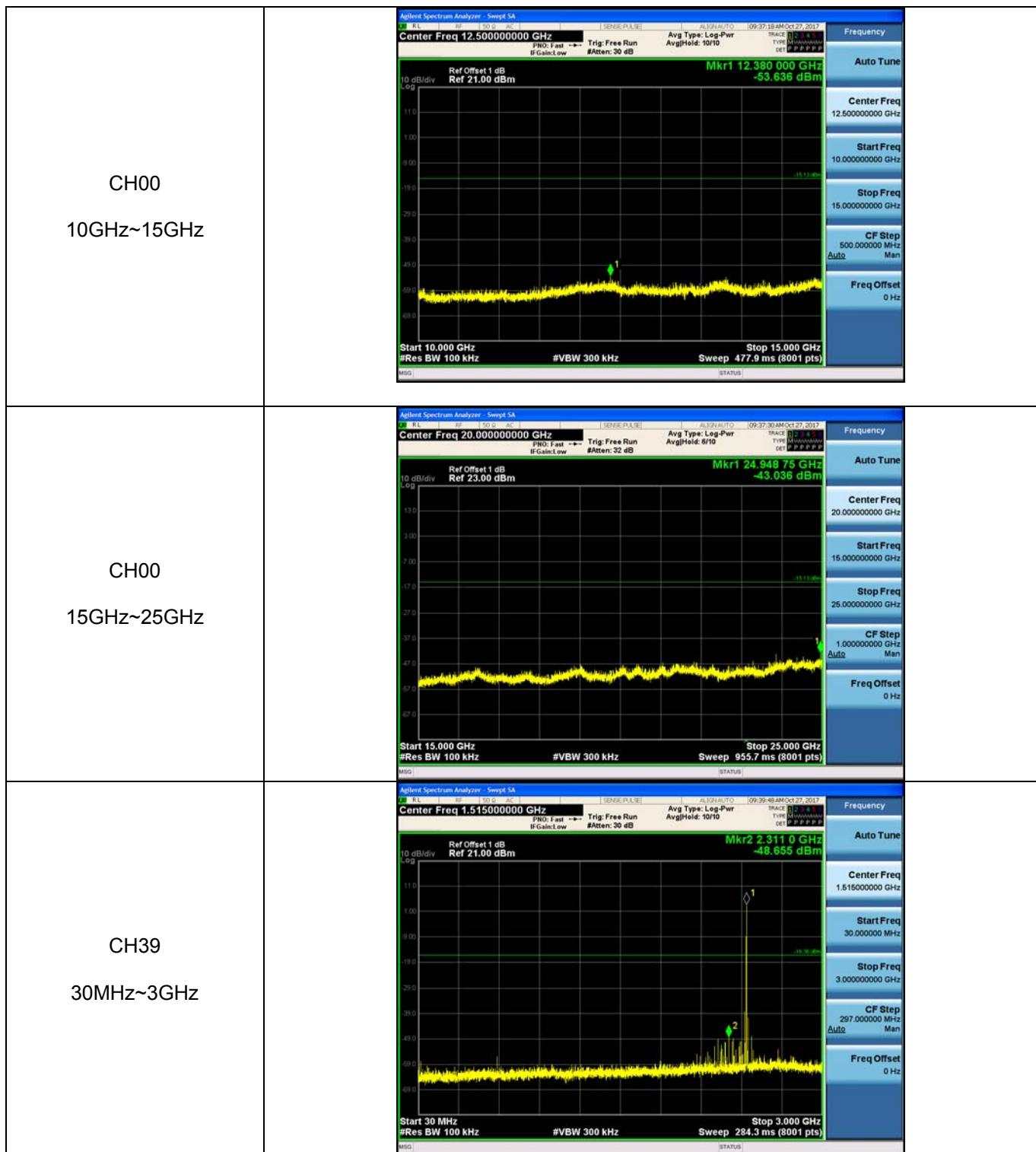
Test Item:	Band edge	Modulation type:	$\pi/4$ DQPSK																																																																		
CH00	No hopping mode	 <p>Agilent Spectrum Analyzer - Sweep SA Center Freq 2.357500000 GHz PND: Fast --> Trig: Free Run #Atten: 30 dB Avg Type: Log-Pwr Avg Hold: 10/10 Ref Offset 1 dB Ref 20.50 dBm Start 2.31000 GHz #Res BW 100 kHz Stop 2.40500 GHz Sweep 9.600 ms (8001 pts) Mkr4 2.389 016 GHz -38.764 dBm</p> <table border="1"> <tr><td>1</td><td>N</td><td>1</td><td>f</td><td>2.402 174 GHz</td><td>1.716 dBm</td></tr> <tr><td>2</td><td>N</td><td>1</td><td>f</td><td>2.400 000 GHz</td><td>-65.137 dBm</td></tr> <tr><td>3</td><td>N</td><td>1</td><td>f</td><td>2.399 000 GHz</td><td>-60.311 dBm</td></tr> <tr><td>4</td><td>N</td><td>1</td><td>f</td><td>2.389 016 GHz</td><td>-38.764 dBm</td></tr> <tr><td>5</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>6</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>8</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>9</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>10</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>11</td><td></td><td></td><td></td><td></td><td></td></tr> </table>	1	N	1	f	2.402 174 GHz	1.716 dBm	2	N	1	f	2.400 000 GHz	-65.137 dBm	3	N	1	f	2.399 000 GHz	-60.311 dBm	4	N	1	f	2.389 016 GHz	-38.764 dBm	5						6						7						8						9						10						11						Frequency Auto Tune Center Freq 2.357500000 GHz Start Freq 2.310000000 GHz Stop Freq 2.405000000 GHz CF Step 9.500000 MHz Auto Freq Offset 0 Hz
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CH00	Hopping mode	 <p>Agilent Spectrum Analyzer - Sweep SA Center Freq 2.357500000 GHz PND: Fast --> Trig: Free Run #Atten: 26 dB Avg Type: Log-Pwr Avg Hold: 10/10 Ref Offset 1 dB Ref 16.50 dBm Start 2.31000 GHz #Res BW 100 kHz Stop 2.40500 GHz Sweep 9.133 ms (1001 pts) Mkr4 2.389 990 GHz -39.712 dBm</p> <table border="1"> <tr><td>1</td><td>N</td><td>1</td><td>f</td><td>2.404 050 GHz</td><td>1.324 dBm</td></tr> <tr><td>2</td><td>N</td><td>1</td><td>f</td><td>2.400 000 GHz</td><td>-40.230 dBm</td></tr> <tr><td>3</td><td>N</td><td>1</td><td>f</td><td>2.399 000 GHz</td><td>-39.712 dBm</td></tr> <tr><td>4</td><td>N</td><td>1</td><td>f</td><td>2.389 990 GHz</td><td>-39.712 dBm</td></tr> <tr><td>5</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>6</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>8</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>9</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>10</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>11</td><td></td><td></td><td></td><td></td><td></td></tr> </table>	1	N	1	f	2.404 050 GHz	1.324 dBm	2	N	1	f	2.400 000 GHz	-40.230 dBm	3	N	1	f	2.399 000 GHz	-39.712 dBm	4	N	1	f	2.389 990 GHz	-39.712 dBm	5						6						7						8						9						10						11						Frequency Auto Tune Center Freq 2.357500000 GHz Start Freq 2.310000000 GHz Stop Freq 2.405000000 GHz CF Step 9.500000 MHz Auto Freq Offset 0 Hz
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CH78	No hopping mode	 <p>Agilent Spectrum Analyzer - Sweep SA Center Freq 2.489000000 GHz PND: Fast --> Trig: Free Run #Atten: 30 dB Avg Type: Log-Pwr Avg Hold: 10/10 Ref Offset 1 dB Ref 20.50 dBm Start 2.47800 GHz #Res BW 100 kHz Stop 2.50000 GHz Sweep 2.133 ms (8001 pts) Mkr4 2.493 009 50 GHz -42.078 dBm</p> <table border="1"> <tr><td>1</td><td>N</td><td>1</td><td>f</td><td>2.479 991 00 GHz</td><td>-0.515 dBm</td></tr> <tr><td>2</td><td>N</td><td>1</td><td>f</td><td>2.483 500 00 GHz</td><td>-69.439 dBm</td></tr> <tr><td>3</td><td>N</td><td>1</td><td>f</td><td>2.500 000 00 GHz</td><td>-68.884 dBm</td></tr> <tr><td>4</td><td>N</td><td>1</td><td>f</td><td>2.493 009 50 GHz</td><td>-42.078 dBm</td></tr> <tr><td>5</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>6</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>8</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>9</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>10</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>11</td><td></td><td></td><td></td><td></td><td></td></tr> </table>	1	N	1	f	2.479 991 00 GHz	-0.515 dBm	2	N	1	f	2.483 500 00 GHz	-69.439 dBm	3	N	1	f	2.500 000 00 GHz	-68.884 dBm	4	N	1	f	2.493 009 50 GHz	-42.078 dBm	5						6						7						8						9						10						11						Frequency Auto Tune Center Freq 2.489000000 GHz Start Freq 2.478000000 GHz Stop Freq 2.500000000 GHz CF Step 2.200000 MHz Auto Freq Offset 0 Hz
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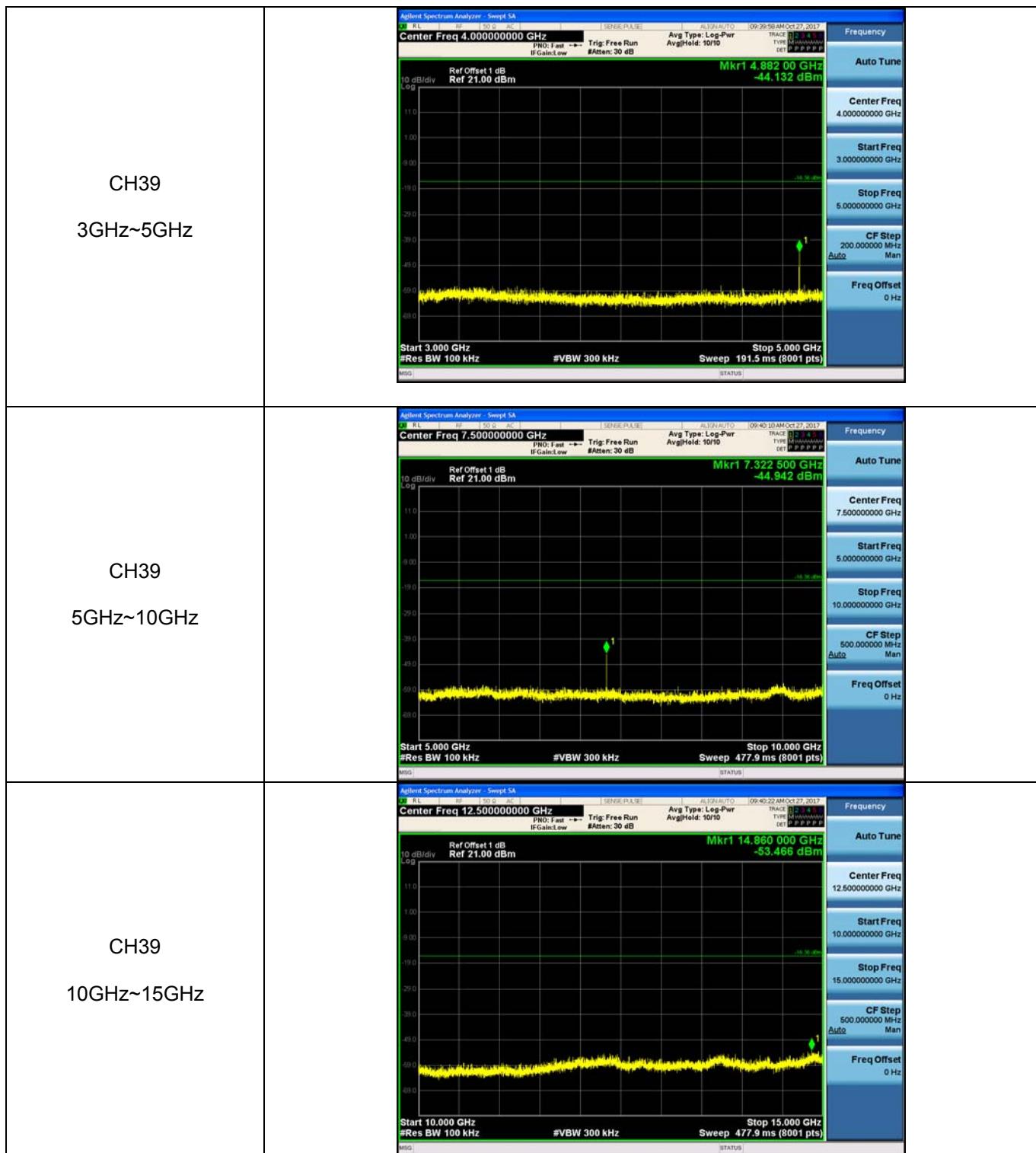


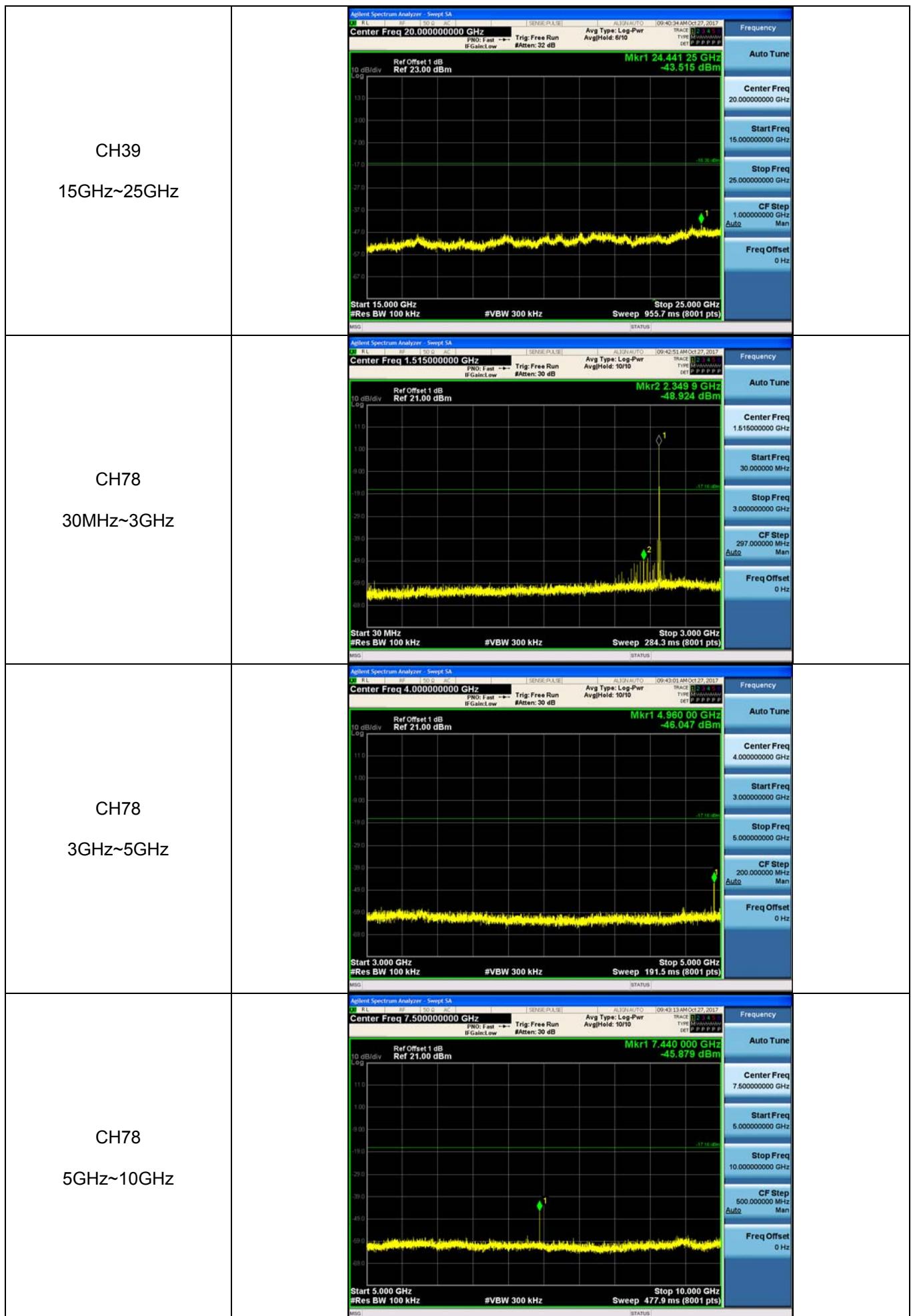
Test Item:	Band edge	Modulation type:	8DPSK																																																																																																
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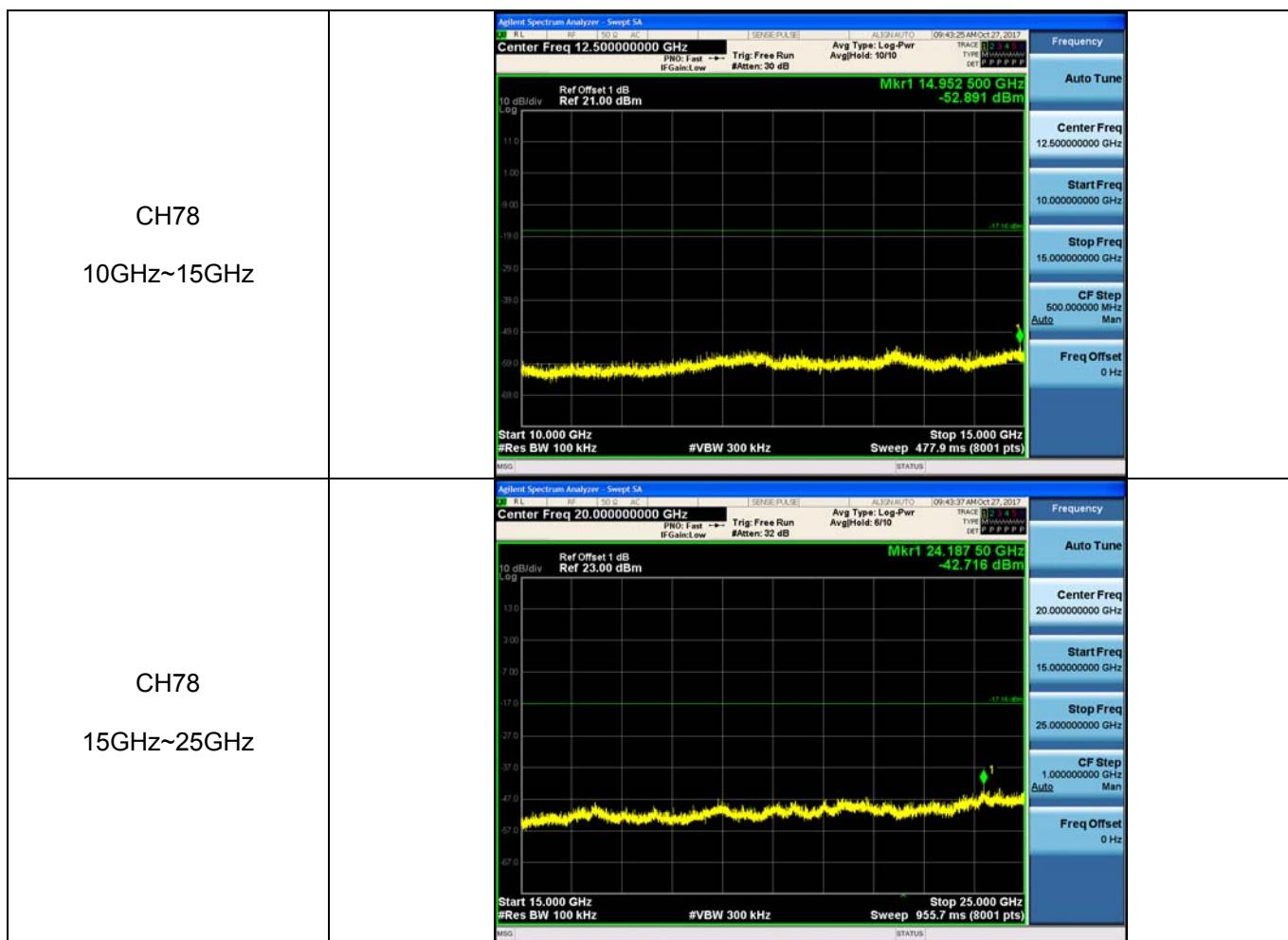


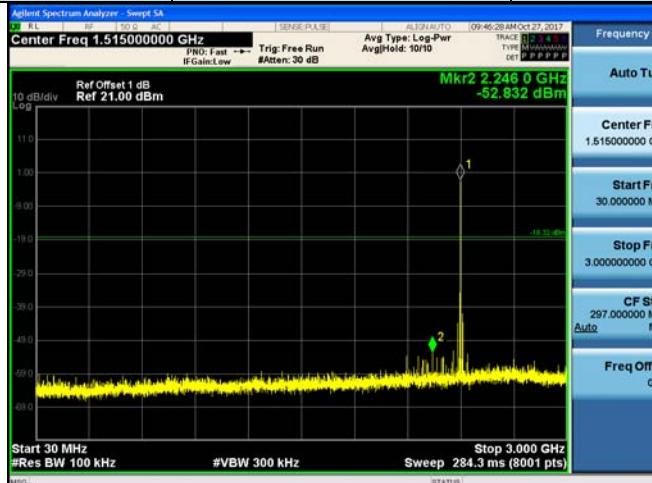
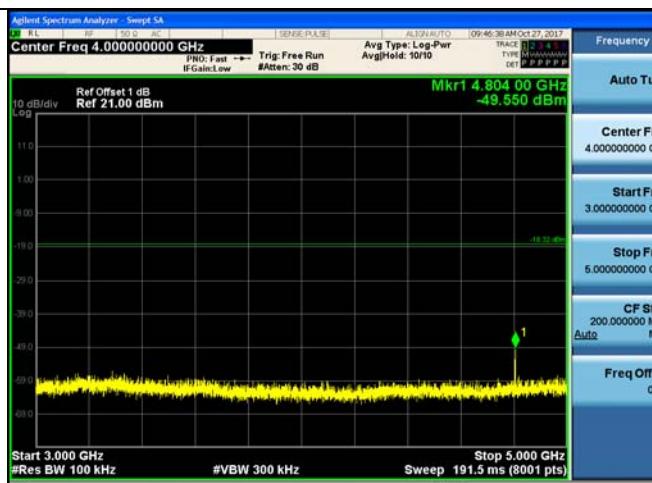
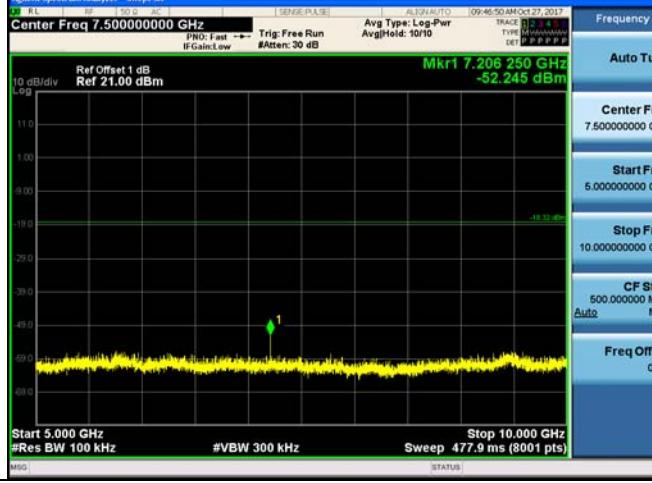
Test Item:	SE	Modulation type:	GFSK
CH00 30MHz~3GHz		<p>Agilent Spectrum Analyzer - Sweep SA Center Freq 1.515000000 GHz PND: Fast --> Trig: Free Run IFGain:Low #Atten: 30 dB Avg Type: Log-Pwr AvgHold: 10/10 TRACE 1 2 3 4 TYPE M:MMAMMAM DET P:PPPPPP Ref Offset 1 dB Ref 21.00 dBm Mkr2 2.1680 GHz -49.743 dBm 10 dB/div Log Start 30 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 284.3 ms (8001 pts) Stop 3.000 GHz MSG STATUS</p>	Frequency Auto Tune Center Freq 1.515000000 GHz Start Freq 30.000000 MHz Stop Freq 3.000000000 GHz CF Step 297.000000 MHz Auto Man Freq Offset 0 Hz
CH00 3GHz~5GHz		<p>Agilent Spectrum Analyzer - Sweep SA Center Freq 4.000000000 GHz PND: Fast --> Trig: Free Run IFGain:Low #Atten: 30 dB Avg Type: Log-Pwr AvgHold: 10/10 TRACE 1 2 3 4 TYPE M:MMAMMAM DET P:PPPPPP Ref Offset 1 dB Ref 21.00 dBm Mkr1 4.80425 GHz -45.295 dBm 10 dB/div Log Start 3.000 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 191.5 ms (8001 pts) Stop 5.000 GHz MSG STATUS</p>	Frequency Auto Tune Center Freq 4.000000000 GHz Start Freq 3.000000000 GHz Stop Freq 6.000000000 GHz CF Step 200.000000 MHz Auto Man Freq Offset 0 Hz
CH00 5GHz~10GHz		<p>Agilent Spectrum Analyzer - Sweep SA Center Freq 7.500000000 GHz PND: Fast --> Trig: Free Run IFGain:Low #Atten: 30 dB Avg Type: Log-Pwr AvgHold: 10/10 TRACE 1 2 3 4 TYPE M:MMAMMAM DET P:PPPPPP Ref Offset 1 dB Ref 21.00 dBm Mkr1 7.206250 GHz -41.018 dBm 10 dB/div Log Start 5.000 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 477.9 ms (8001 pts) Stop 10.000 GHz MSG STATUS</p>	Frequency Auto Tune Center Freq 7.500000000 GHz Start Freq 5.000000000 GHz Stop Freq 10.000000000 GHz CF Step 500.000000 MHz Auto Man Freq Offset 0 Hz

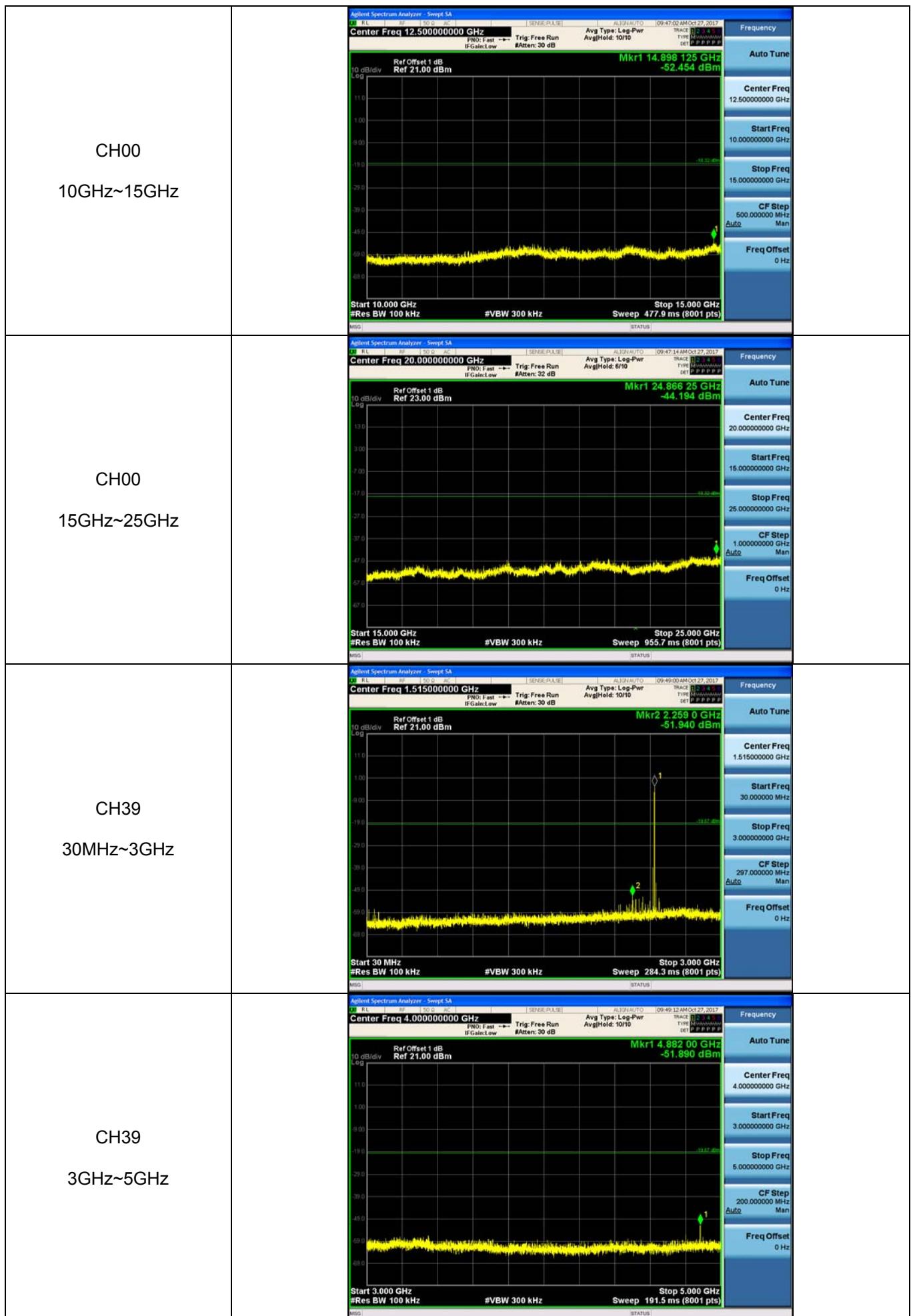


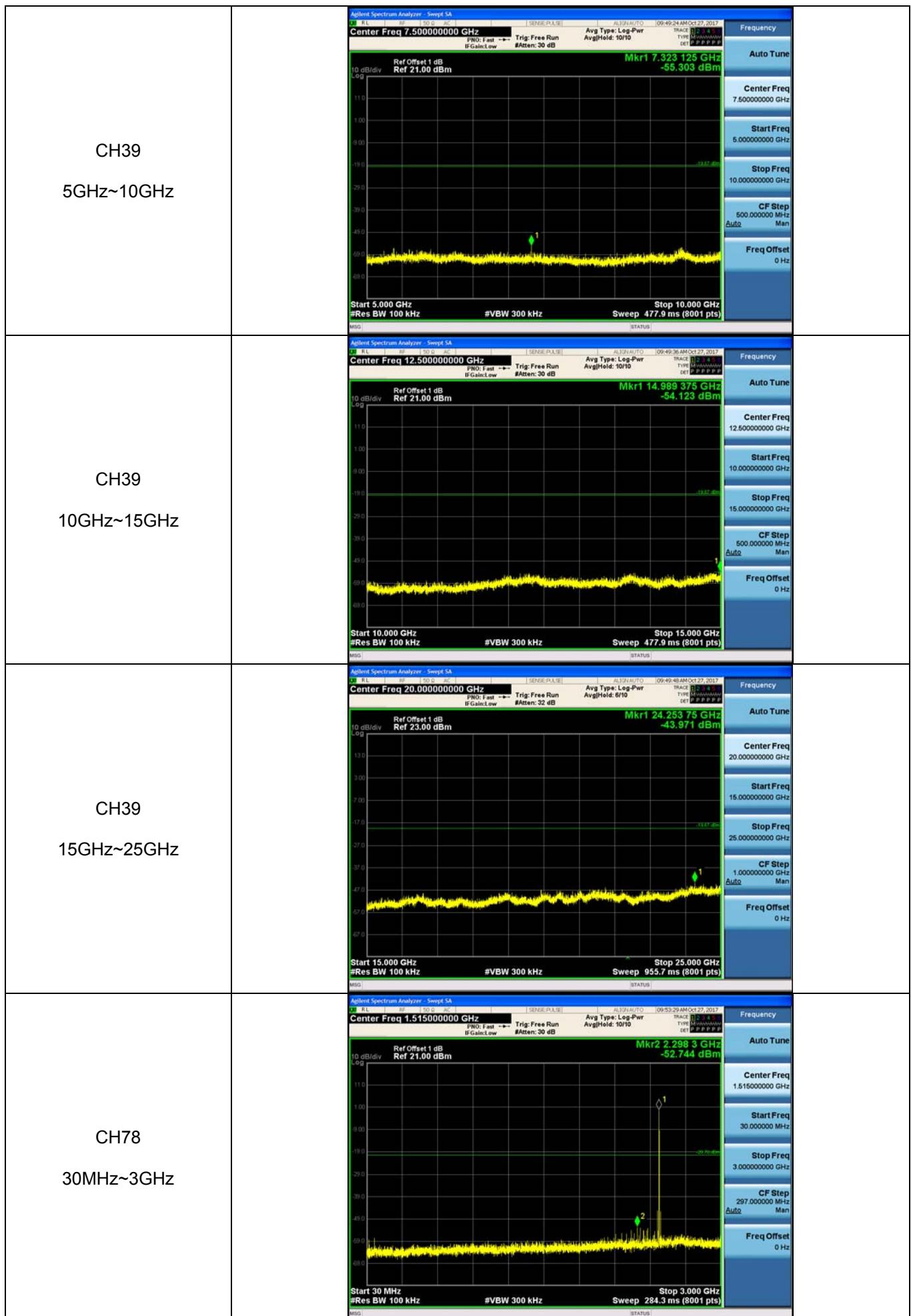


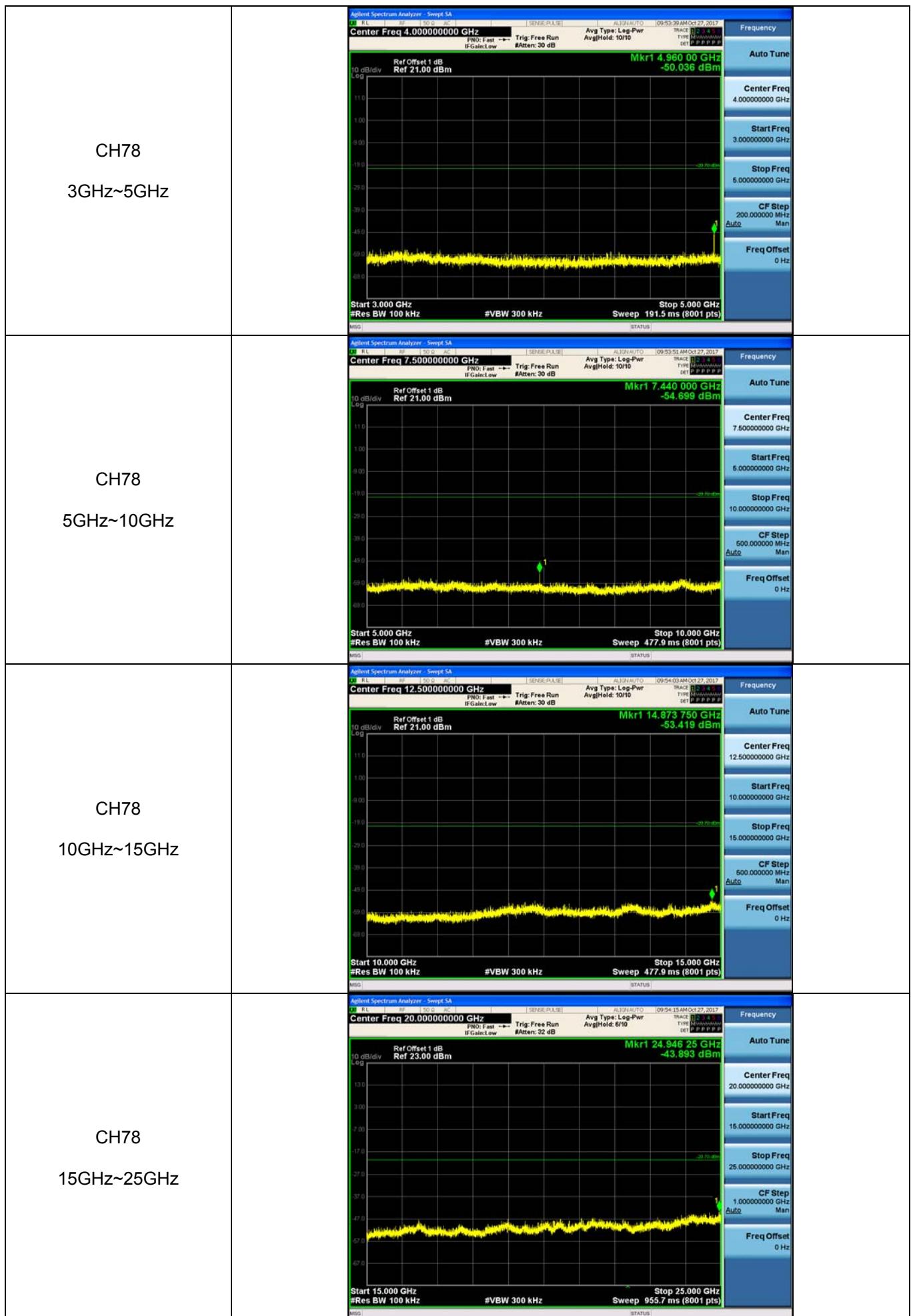


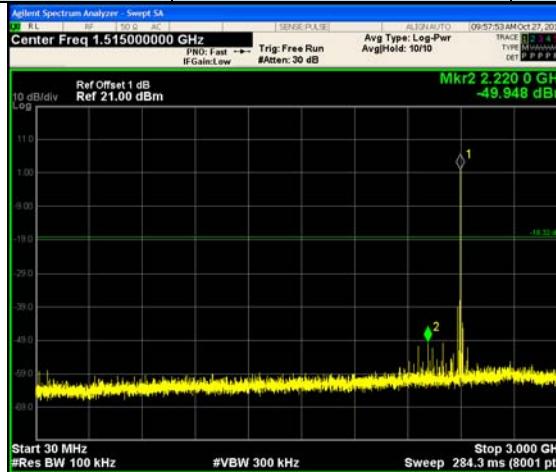
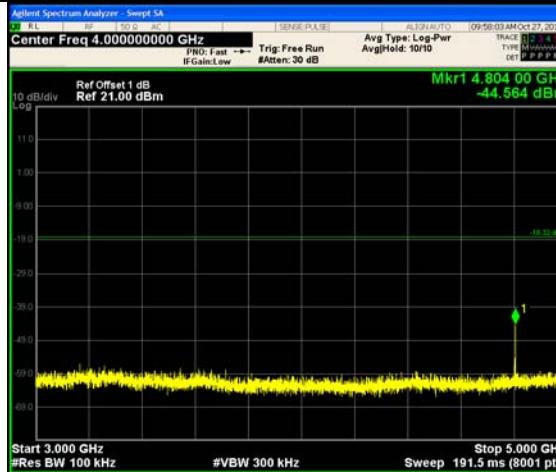
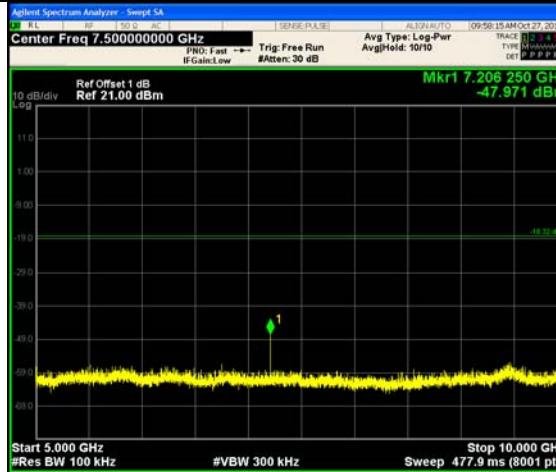


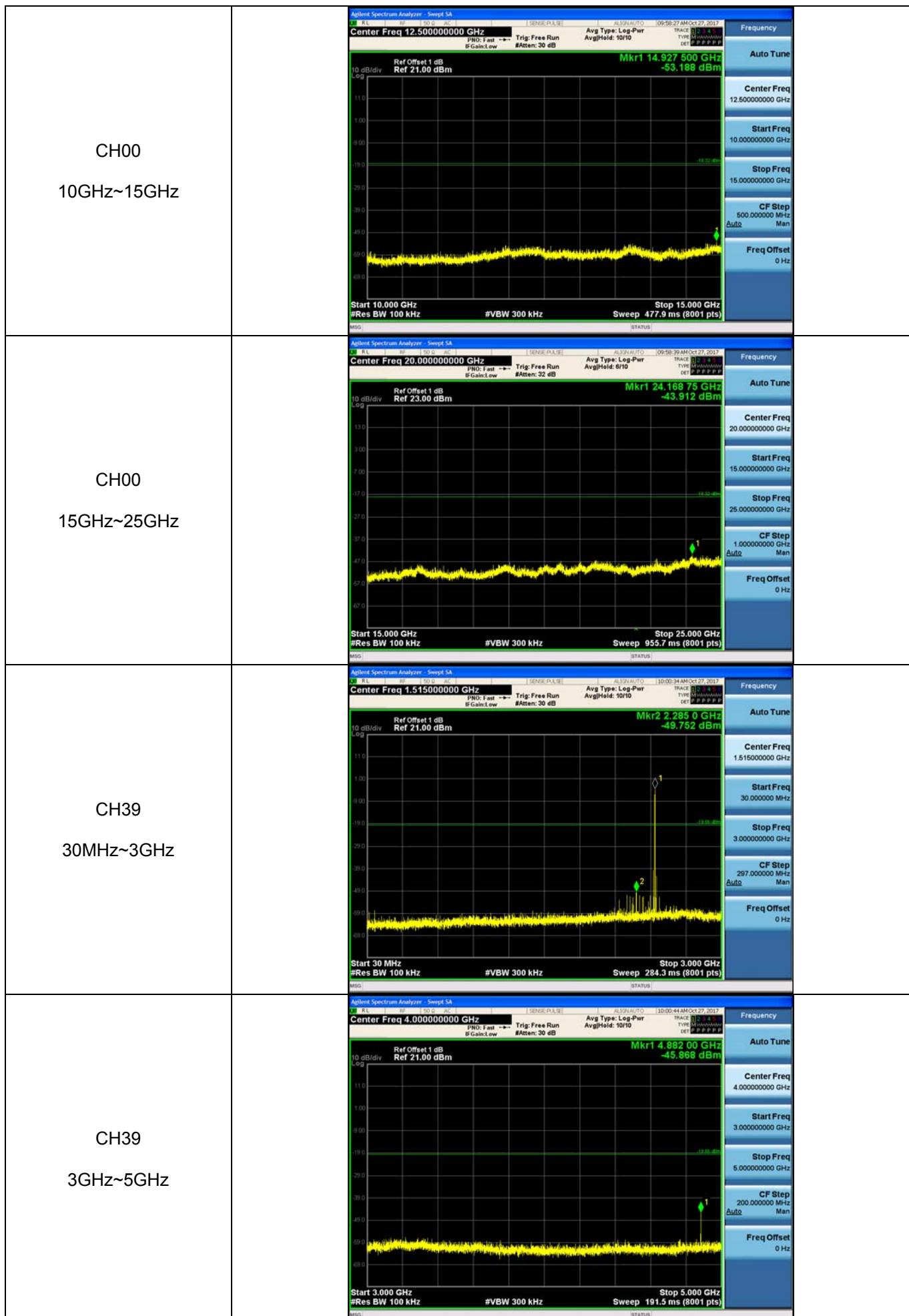
Test Item:	SE	Modulation type:	$\pi/4$ DQPSK
CH00 30MHz~3GHz			Frequency Auto Tune Center Freq 1.51500000 GHz Start Freq 30.000000 MHz Stop Freq 3.00000000 GHz CF Step 297.000000 MHz Auto Freq Offset 0 Hz
CH00 3GHz~5GHz			Frequency Auto Tune Center Freq 4.00000000 GHz Start Freq 3.00000000 GHz Stop Freq 5.00000000 GHz CF Step 200.000000 MHz Auto Freq Offset 0 Hz
CH00 5GHz~10GHz			Frequency Auto Tune Center Freq 7.50000000 GHz Start Freq 5.00000000 GHz Stop Freq 10.00000000 GHz CF Step 500.000000 MHz Auto Freq Offset 0 Hz

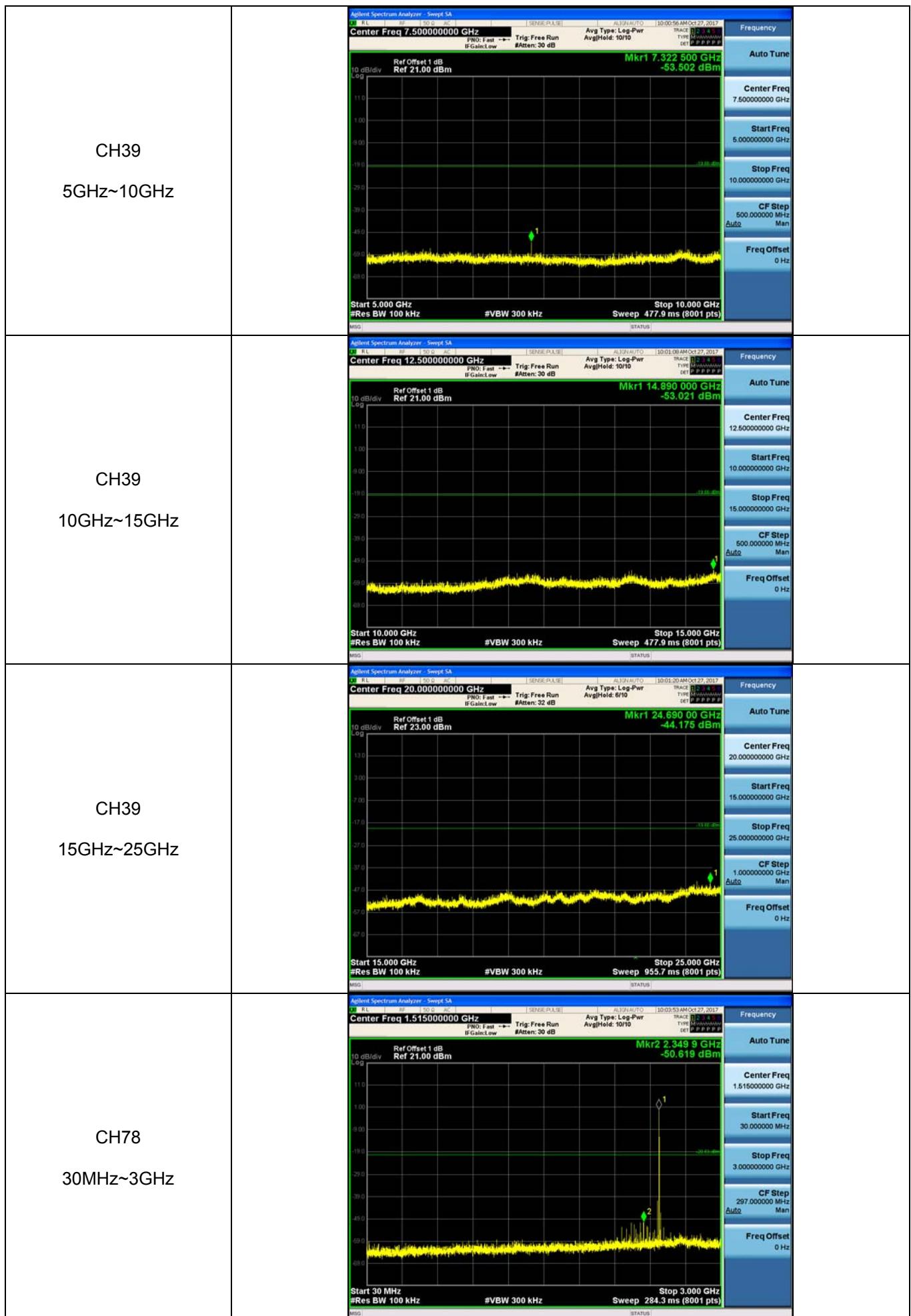


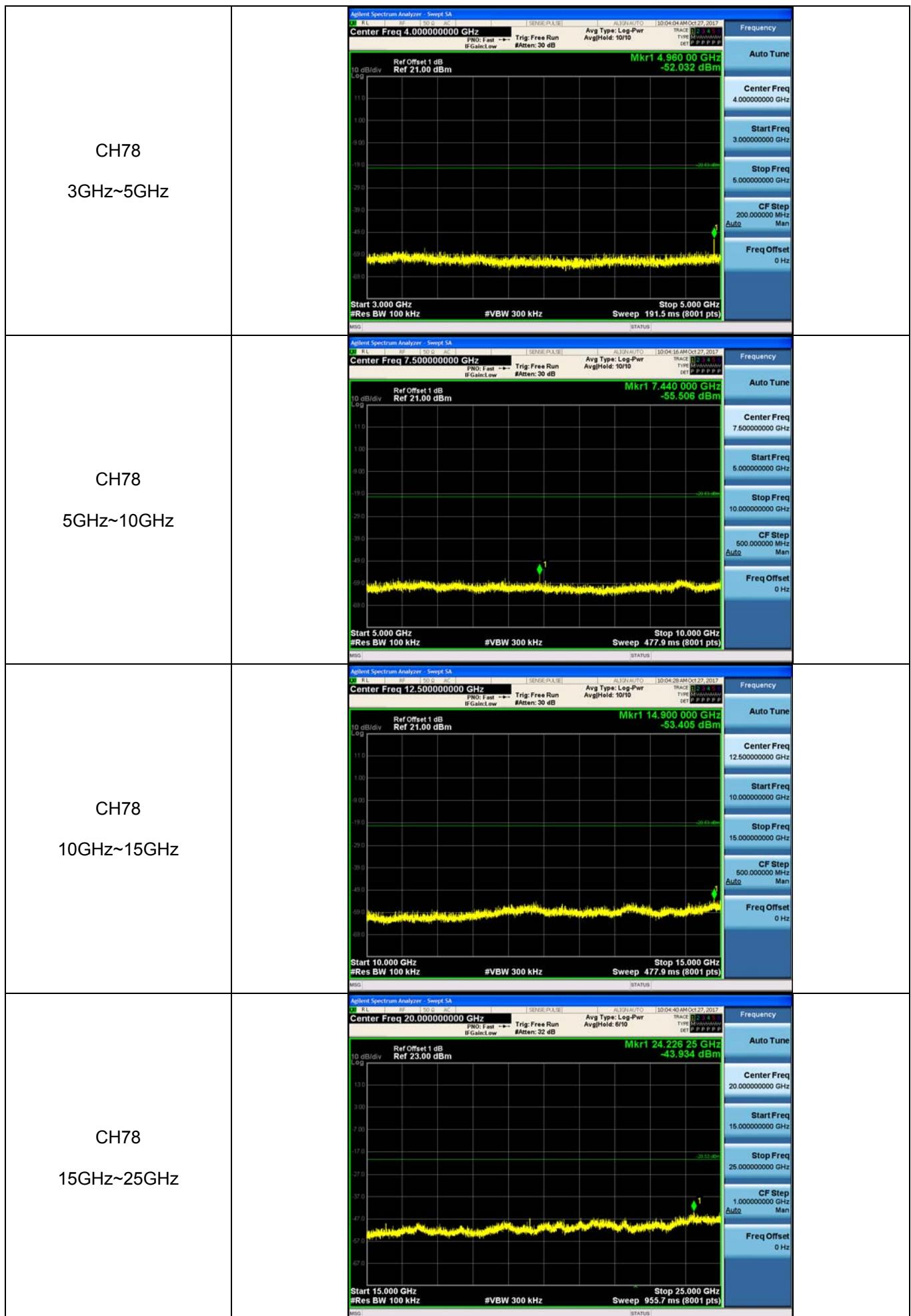




Test Item:	SE	Modulation type:	8DPSK
CH00 30MHz~3GHz		 <p>Agilent Spectrum Analyzer - Sweep SA Center Freq 1.515000000 GHz PWD: Fast --> Trig: Free Run IFGain:Low #Atten: 30 dB Avg Type: Log-Pwr AvgHold: 10/10 Mkr2 2.220 0 GHz -49.948 dBm Ref Offset 1 dB Ref 21.00 dBm 10 dB/div Log Start 30 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 284.3 ms (8001 pts) Stop 3.000000000 GHz</p>	Frequency Auto Tune Center Freq 1.515000000 GHz Start Freq 30.000000 MHz Stop Freq 3.000000000 GHz CF Step 297.000000 MHz Auto Man Freq Offset 0 Hz
CH00 3GHz~5GHz		 <p>Agilent Spectrum Analyzer - Sweep SA Center Freq 4.000000000 GHz PWD: Fast --> Trig: Free Run IFGain:Low #Atten: 30 dB Avg Type: Log-Pwr AvgHold: 10/10 Mkr1 4.804 00 GHz -44.564 dBm Ref Offset 1 dB Ref 21.00 dBm 10 dB/div Log Start 3.000 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 191.5 ms (8001 pts) Stop 5.000000000 GHz</p>	Frequency Auto Tune Center Freq 4.000000000 GHz Start Freq 3.000000000 GHz Stop Freq 6.000000000 GHz CF Step 200.000000 MHz Auto Man Freq Offset 0 Hz
CH00 5GHz~10GHz		 <p>Agilent Spectrum Analyzer - Sweep SA Center Freq 7.500000000 GHz PWD: Fast --> Trig: Free Run IFGain:Low #Atten: 30 dB Avg Type: Log-Pwr AvgHold: 10/10 Mkr1 7.206 250 GHz -47.971 dBm Ref Offset 1 dB Ref 21.00 dBm 10 dB/div Log Start 5.000 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 477.9 ms (8001 pts) Stop 10.000000000 GHz</p>	Frequency Auto Tune Center Freq 7.500000000 GHz Start Freq 5.000000000 GHz Stop Freq 10.000000000 GHz CF Step 500.000000 MHz Auto Man Freq Offset 0 Hz







5.11. Spurious Emissions (radiated)

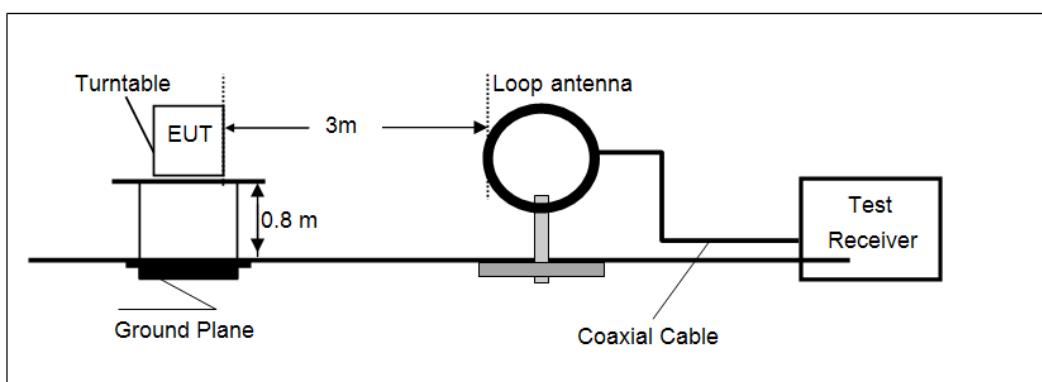
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209

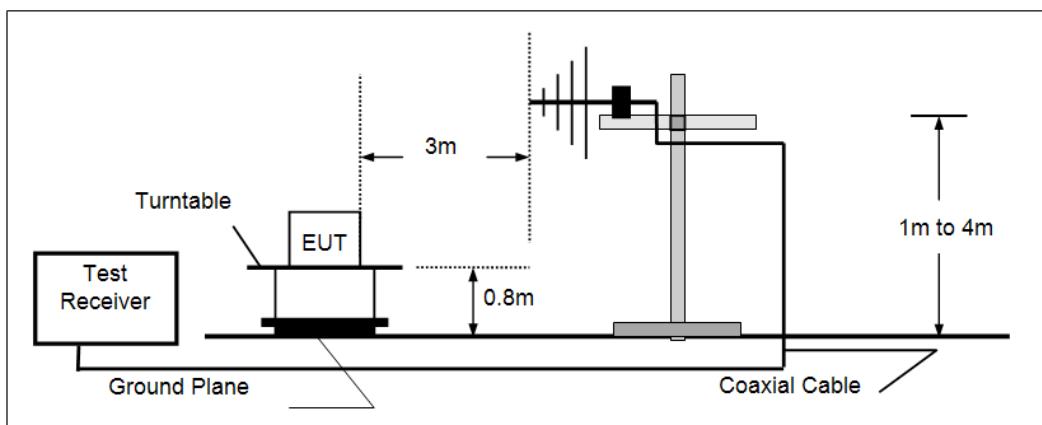
Frequency	Limit (dB _V /m @3m)	Value
30 MHz ~ 88 MHz	40.00	Quasi-peak
88 MHz ~ 216 MHz	43.50	Quasi-peak
216 MHz ~ 960 MHz	46.00	Quasi-peak
960 MHz ~ 1 GHz	54.00	Quasi-peak
Above 1 GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

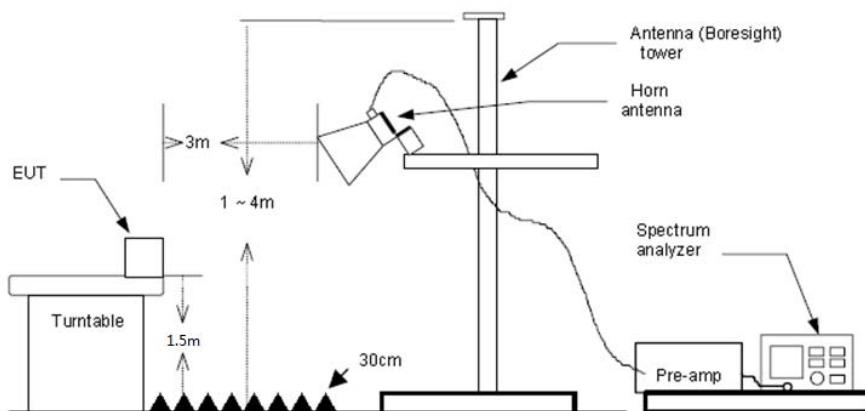
- Below 30 MHz



- 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

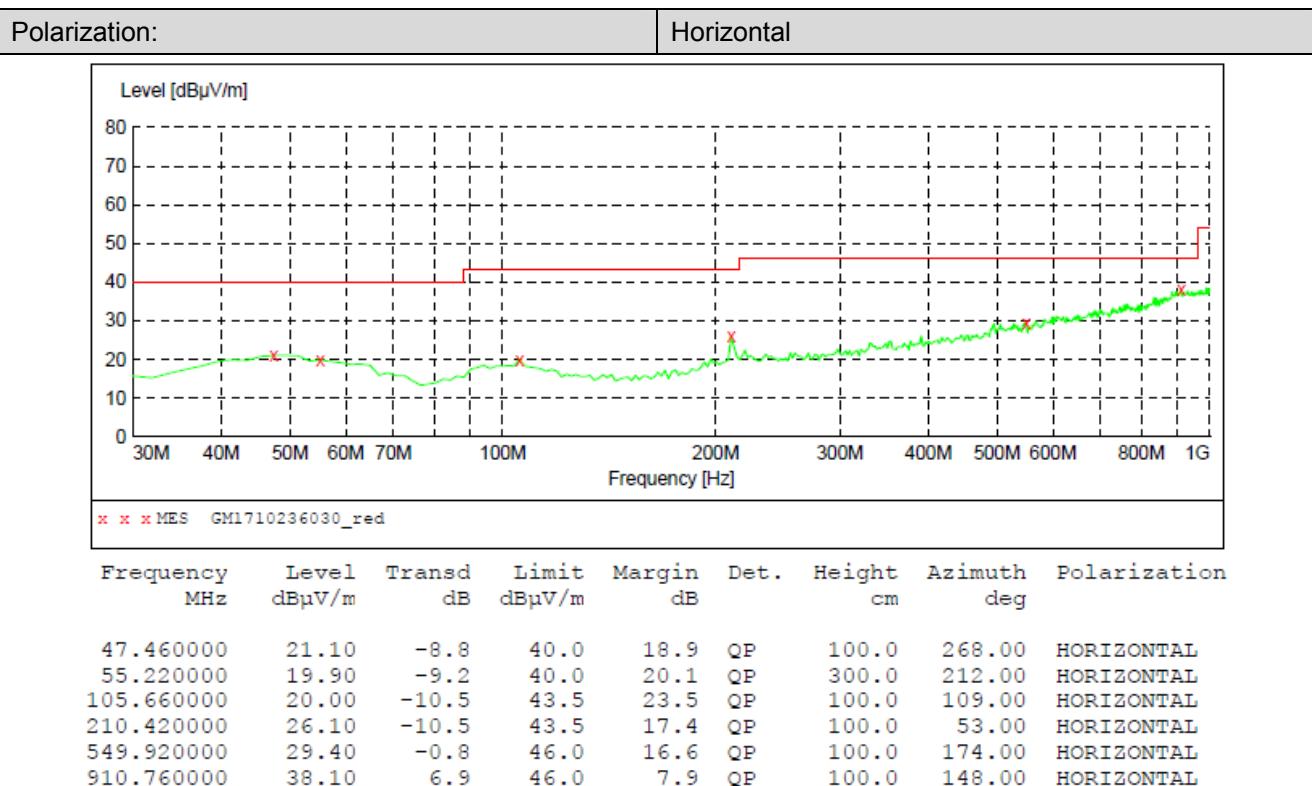
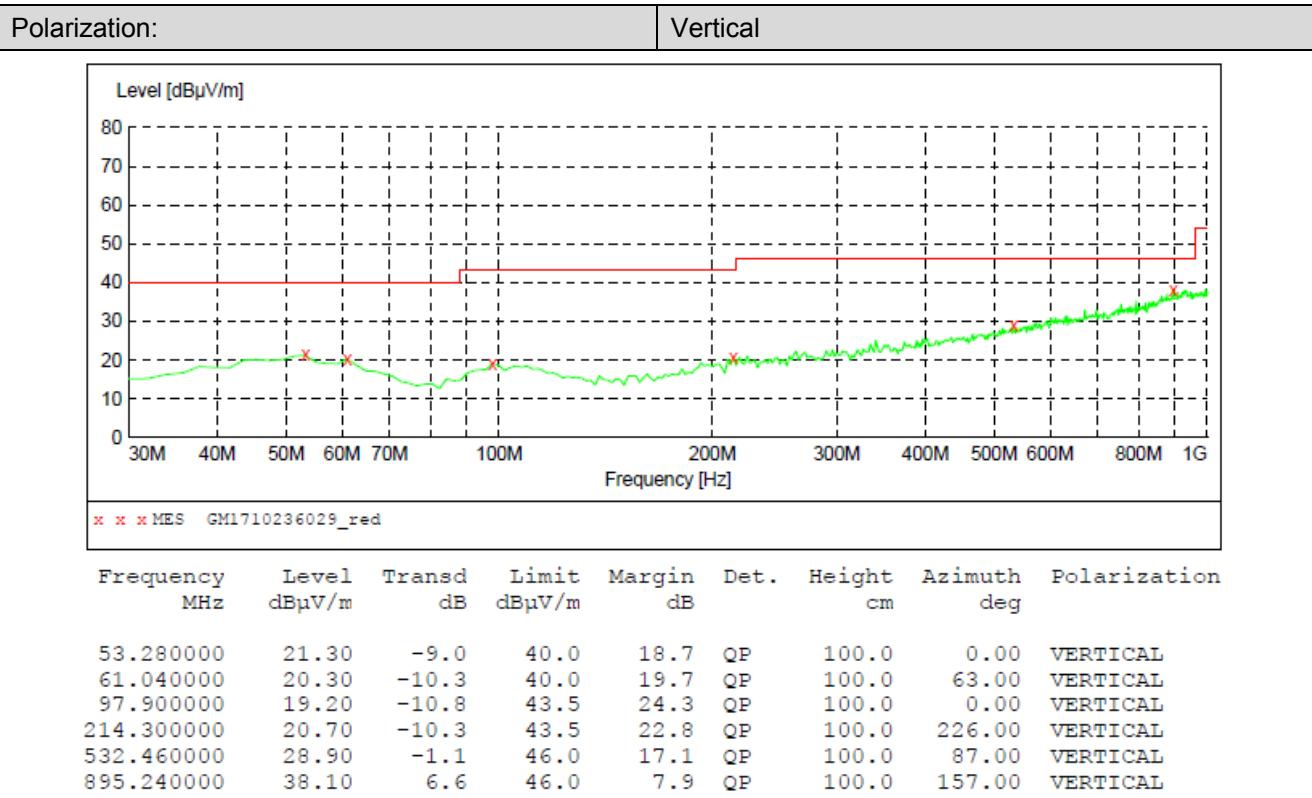
Note:

- 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



> 1 GHz ~ 25 GHz

CH00									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2086.86	45.93	26.65	6.34	37.32	41.60	74.00	-32.40	Vertical	Peak
2691.80	48.76	28.08	7.12	38.08	45.88	74.00	-28.12	Vertical	Peak
3738.13	36.74	29.42	8.43	38.24	36.35	74.00	-37.65	Vertical	Peak
6251.26	32.43	33.00	11.00	35.30	41.13	74.00	-32.87	Vertical	Peak
1786.72	40.77	25.37	5.93	37.11	34.96	74.00	-39.04	Horizontal	Peak
3299.78	38.33	28.20	7.84	38.37	36.00	74.00	-38.00	Horizontal	Peak
4410.75	34.03	30.52	9.15	37.54	36.16	74.00	-37.84	Horizontal	Peak
6125.24	31.73	32.60	10.88	35.35	39.86	74.00	-34.14	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
1676.56	38.50	25.13	5.72	36.88	32.47	74.00	-41.53	Vertical	Peak
3653.46	35.46	29.30	8.33	38.26	34.83	74.00	-39.17	Vertical	Peak
5151.68	32.58	31.69	9.79	36.25	37.81	74.00	-36.19	Vertical	Peak
8002.06	31.78	37.10	12.30	34.53	46.65	74.00	-27.35	Vertical	Peak
1782.18	44.70	25.37	5.93	37.10	38.90	74.00	-35.10	Horizontal	Peak
3283.02	42.15	28.30	7.82	38.35	39.92	74.00	-34.08	Horizontal	Peak
5009.43	32.70	31.54	9.68	36.39	37.53	74.00	-36.47	Horizontal	Peak
6662.01	32.36	34.20	11.43	35.25	42.74	74.00	-31.26	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
2081.55	44.55	26.63	6.34	37.32	40.20	74.00	-33.80	Vertical	Peak
2691.80	48.45	28.08	7.12	38.08	45.57	74.00	-28.43	Vertical	Peak
2980.33	41.16	28.58	7.47	38.24	38.97	74.00	-35.03	Vertical	Peak
5821.21	33.19	32.14	10.60	35.33	40.60	74.00	-33.40	Vertical	Peak
2081.55	36.45	26.63	6.34	37.32	32.10	74.00	-41.90	Horizontal	Peak
3088.45	36.09	28.78	7.59	38.22	34.24	74.00	-39.76	Horizontal	Peak
4377.20	33.39	30.43	9.11	37.57	35.36	74.00	-38.64	Horizontal	Peak
6315.23	32.32	33.13	11.00	35.30	41.15	74.00	-32.85	Horizontal	Peak

Remark:

- Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
- The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.
- 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.

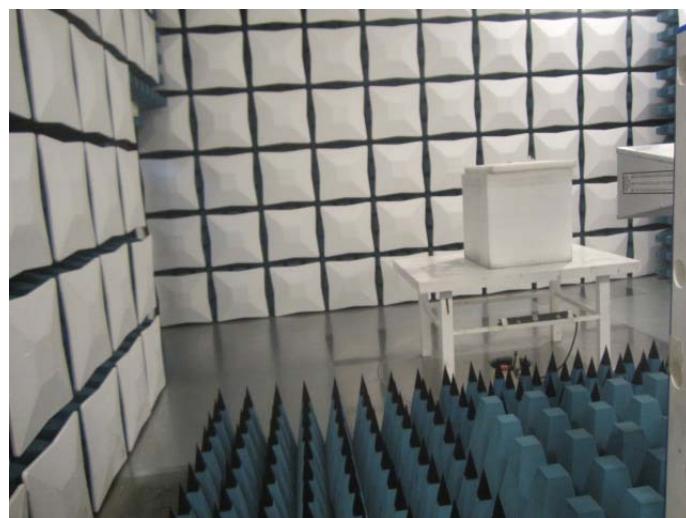
6. TEST SETUP PHOTOS

Conducted Emissions (AC Mains)



Radiated Emissions



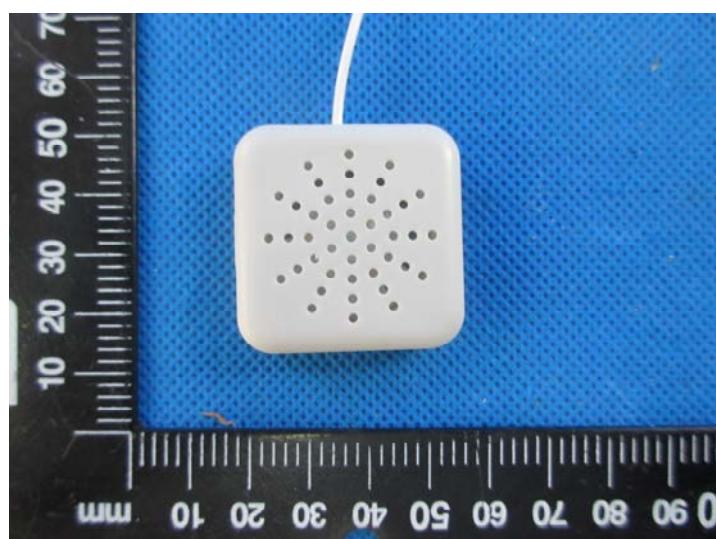
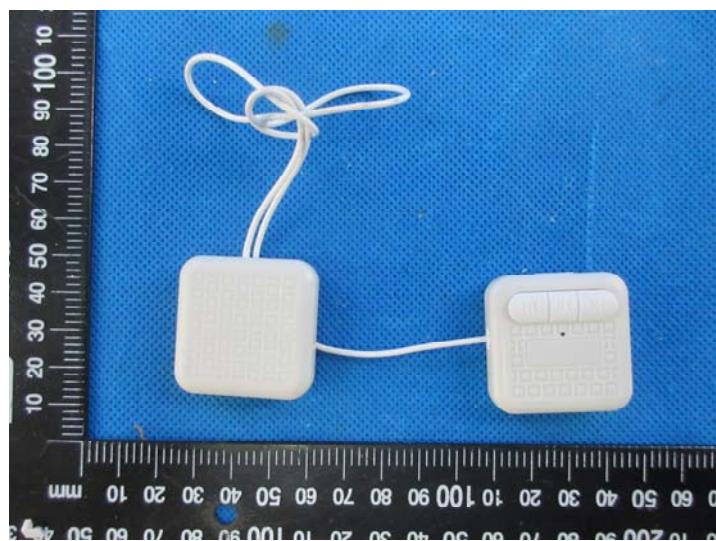


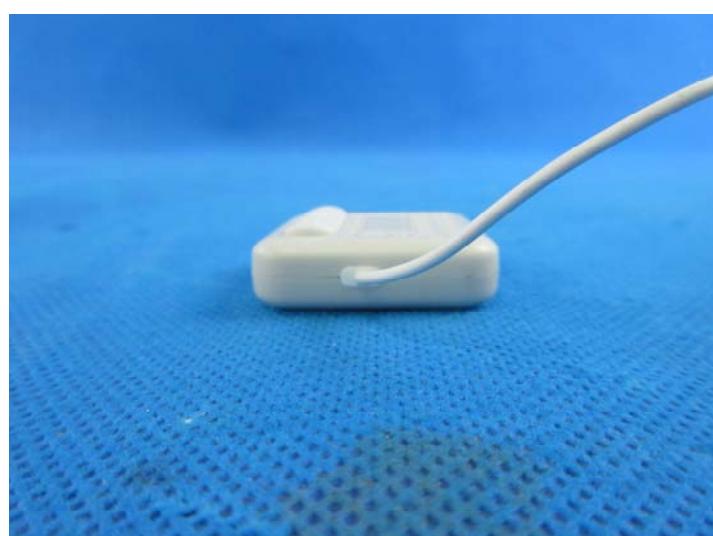
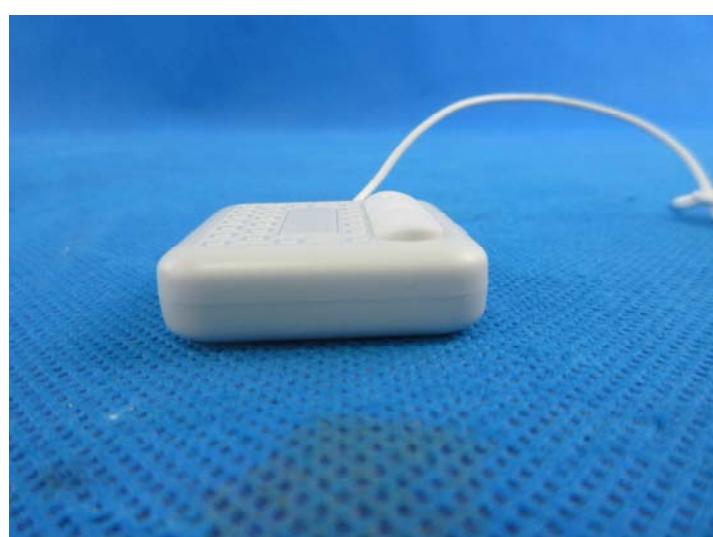
7. EXTERANAL AND INTERNAL PHOTOS

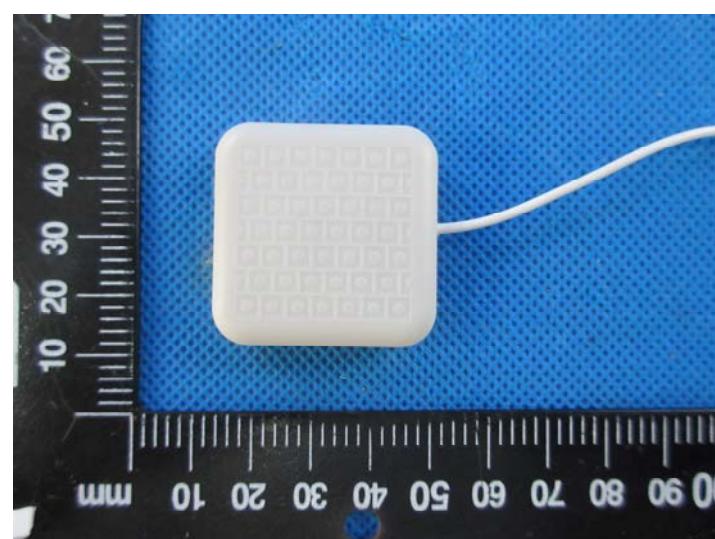
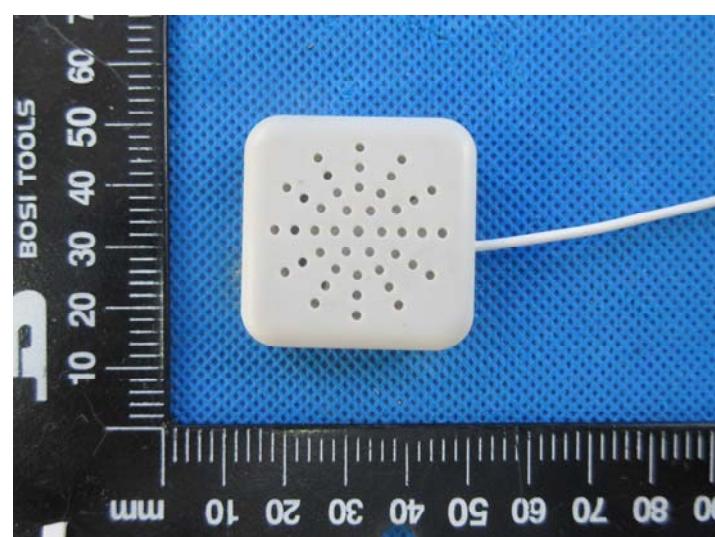
External photos of the EUT



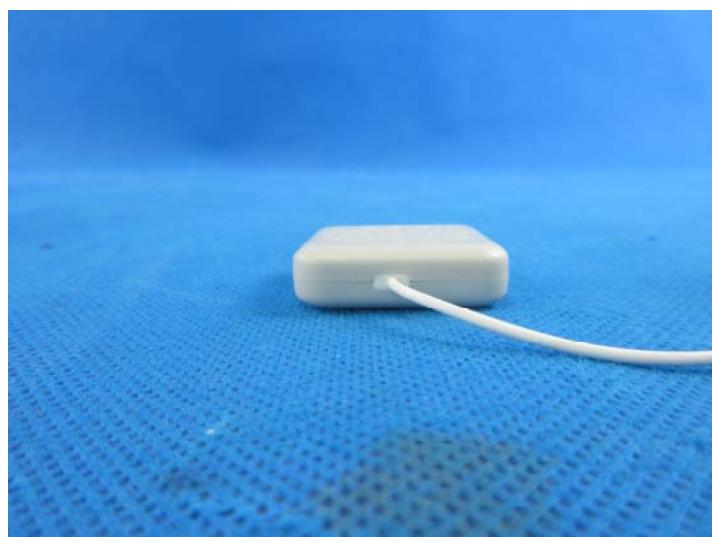


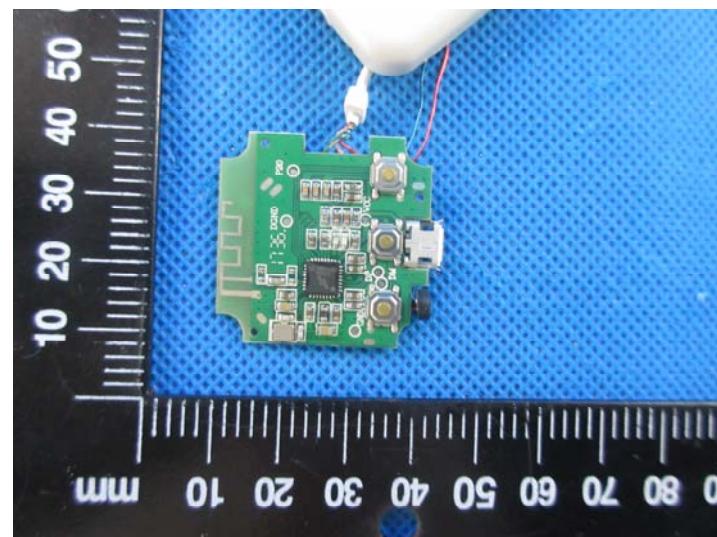
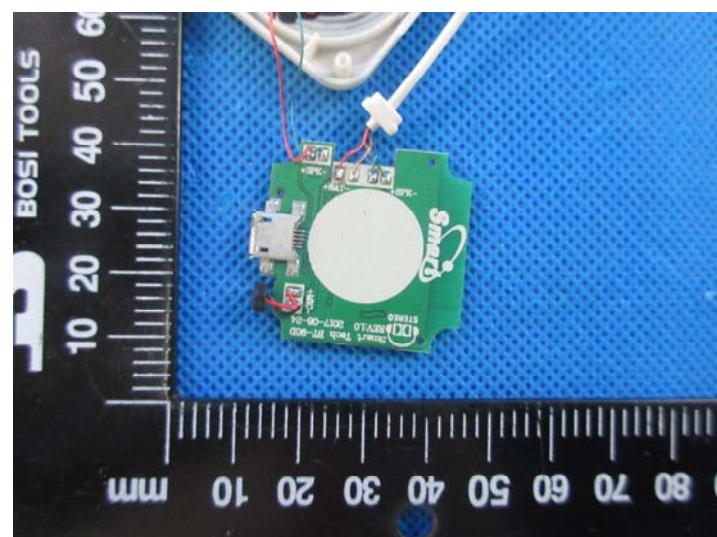
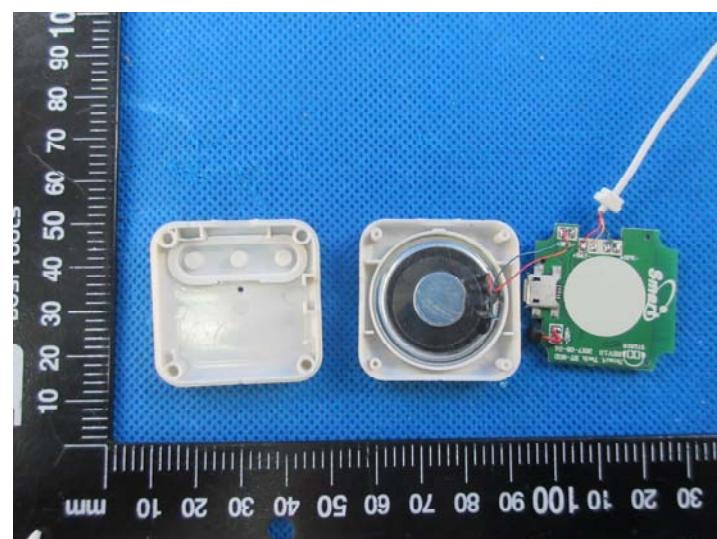


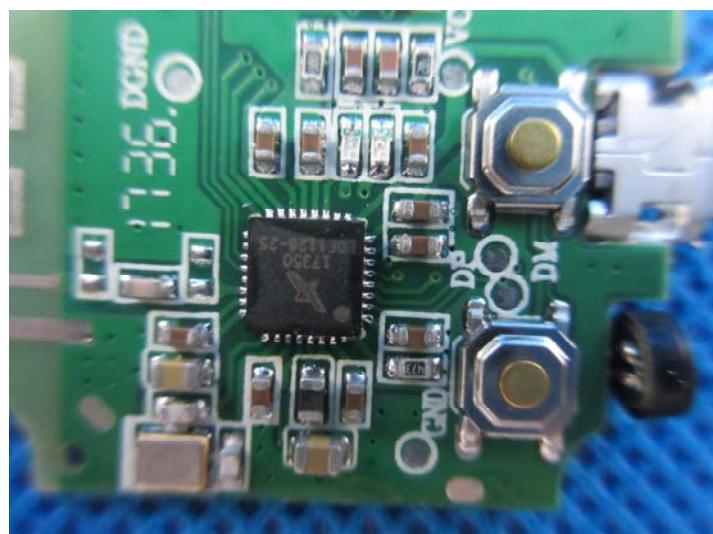








Internal photos of the EUT



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