



TEST REPORT

Report Reference No.....	CHTEW19100130	Report verification:	 Report No: CHTEW19100130
Project No.....	SHT1909064404EW		
FCC ID	2AJZP-G450A1		
Applicant's name	Mason America, Inc		
Address.....	2101 4th Avenue Suite 1550, Seattle WA, 98121		
Manufacturer.....	Mason America, Inc		
Address.....	2101 4th Avenue Suite 1550, Seattle WA, 98121		
Test item description	PAD		
Trade Mark	MASON/ypprime		
Model/Type reference.....	G450A1		
Listed Model(s)	-		
Standard	FCC CFR Title 47 Part 15 Subpart C Section 15.247		
Date of receipt of test sample.....	Sep 27, 2019		
Date of testing.....	Sep 28, 2019- Oct 28, 2019		
Date of issue.....	Oct 29, 2019		
Result.....	PASS		
Compiled by (Position+Printed name+Signature):	File administrators Silvia Li		
Supervised by (Position+Printed name+Signature):	Project Engineer Aaron Fang		
Approved by (Position+Printed name+Signature):	RF Manager Hans Hu		
Testing Laboratory Name	Shenzhen Huatongwei International Inspection Co., Ltd.		
Address.....	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China		
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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

[KDB 558074 D01 15.247 Meas Guidance v05r02](#): Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating under Section 15.247 of The FCC Rules

1.2. **Report version**

Revision No.	Date of issue	Description
N/A	2019-10-29	Original

2. **TEST DESCRIPTION**

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

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

3. **SUMMARY**

3.1. Client Information

Applicant:	Mason America, Inc
Address:	2101 4th Avenue Suite 1550, Seattle WA, 98121
Manufacturer:	Mason America, Inc
Address:	2101 4th Avenue Suite 1550, Seattle WA, 98121

3.2. Product Description

Name of EUT:	PAD
Trade Mark:	MASON/ypprime
Model No.:	G450A1
Listed Model(s):	-
Power supply:	DC 3.8V
Adapter information:	Model: A138A-120150U-US2 Input: 100-240V a.c., 50/60Hz, 0.5A Output: 5.0V d.c., 2.5A/9.0V d.c., 2.0A/12V d.c., 1.5A
Hardware version:	PVT2.0
Software version:	N2G48H
Bluetooth	
Version:	Supported BT4.2+EDR
Modulation:	GFSK, π/4DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	FPC Antenna
Antenna gain:	1.5dBi

3.3. Operation state

➤ Test frequency list

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

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

➤ TEST MODE

For RF test items:

The engineering test program was provided and enabled to make EUT continuous transmit

For AC power line conducted emissions:

The EUT was set to connect with the Bluetooth instrument under large package sizes transmission.

For Radiated suprious emissions test item:

The engineering test program was provided and enabled to make EUT continuous transmit. The EUT in each of three orthogonal axis emissions had been tested ,but only the worst case (X axis) data recorded in the report.

3.4. EUT configuration

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

- - supplied by the manufacturer
- - supplied by the lab

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

3.5. Modifications

No modifications were implemented to meet testing criteria.

4. TEST ENVIRONMENT

4.1. Address of the test laboratory

Laboratory: Shenzhen Huatongwei International Inspection Co., Ltd.

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

4.2. Test Facility

CNAS-Lab Code: L1225

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

A2LA-Lab Cert. No.: 3902.01

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

FCC-Registration No.: 762235

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

IC-Registration No.:5377A

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

ACA

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

4.3. Environmental conditions

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

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

4.4. Statement of the measurement uncertainty

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

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

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.51 dB	(1)
Conducted spurious emissions 9kHz~40GHz	0.51 dB	(1)
Conducted Disturbance 150kHz~30MHz	3.02 dB	(1)
Radiated Emissions below 1GHz	4.90 dB	(1)
Radiated Emissions above 1GHz	4.96 dB	(1)
Occupied Bandwidth	70 Hz	(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 Emission							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Shielded Room	Albatross projects	HTWE0114	N/A	N/A	2018/09/28	2023/09/27
●	EMI Test Receiver	R&S	HTWE0111	ESCI	101247	2019/10/26	2020/10/25
●	Artificial Mains	SCHWARZBECK	HTWE0113	NNLK 8121	573	2019/10/23	2020/10/22
●	Pulse Limiter	R&S	HTWE0033	ESH3-Z2	100499	2019/10/23	2020/10/22
●	RF Connection Cable	HUBER+SUHNER	HTWE0113-02	ENVIROFLEX_142	EF-NM-BNCM-2M	2019/10/23	2020/10/22
●	Test Software	R&S	N/A	ES-K1	N/A	N/A	N/A

● Radiated Emission-6th test site							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0127	SAC-3m-02	C11121	2018/09/30	2021/09/29
●	EMI Test Receiver	R&S	HTWE0099	ESCI	100900	2019/10/26	2020/10/25
●	Ultra-Broadband Antenna	SCHWARZBECK	HTWE0119	VULB9163	546	2017/04/05	2020/04/04
●	Pre-Amplifier	SCHWARZBECK	HTWE0295	BBV 9742	N/A	2018/11/14	2019/11/13
●	RF Connection Cable	HUBER+SUHNER	HTWE0062-01	N/A	N/A	2019/8/21	2020/8/20
●	RF Connection Cable	HUBER+SUHNER	HTWE0062-02	SUCOFLEX104	501184/4	2019/5/27	2020/5/26
●	Test Software	R&S	N/A	ES-K1	N/A	N/A	N/A

● Radiated emission-7th test site							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0122	SAC-3m-01	N/A	2018/09/30	2021/09/29
●	Spectrum Analyzer	R&S	HTWE0098	FSP40	100597	2019/10/26	2020/10/25
●	Horn Antenna	SCHWARZBECK	HTWE0126	9120D	1011	2017/04/01	2020/03/31
●	Broadband Pre-amplifier	SCHWARZBECK	HTWE0201	BBV 9718	9718-248	2019/05/23	2020/05/22
●	RF Connection Cable	HUBER+SUHNER	HTWE0121-01	RE-7-FH	N/A	2019/05/10	2020/05/09
●	Test Software	Audix	N/A	E3	N/A	N/A	N/A

● RF Conducted Method							
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)	
●	Signal and spectrum Analyzer	R&S	FSV40	100048	2019/10/26	2020/10/25	
●	Spectrum Analyzer	Agilent	N9020A	MY50510187	2019/10/26	2020/10/25	
●	Test software	Tonscend	JS1120-2(WIFI)	N/A	N/A	N/A	

5. TEST CONDITIONS AND RESULTS

5.1. Antenna requirement

Requirement

FCC CFR Title 47 Part 15 Subpart C Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of 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)

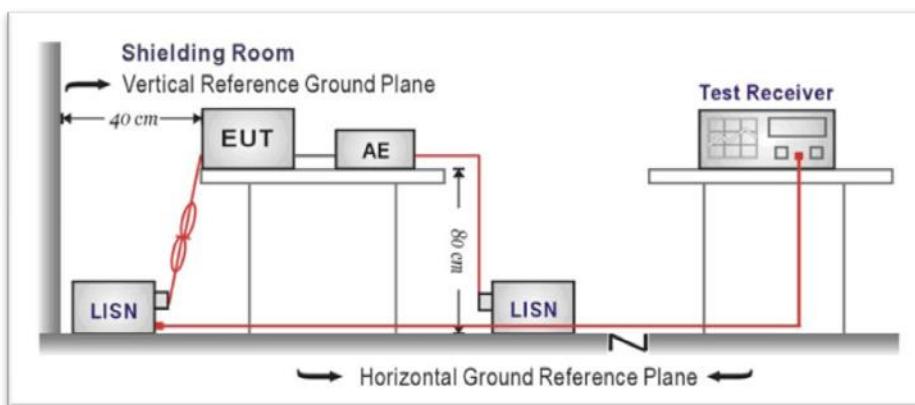
LIMIT

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

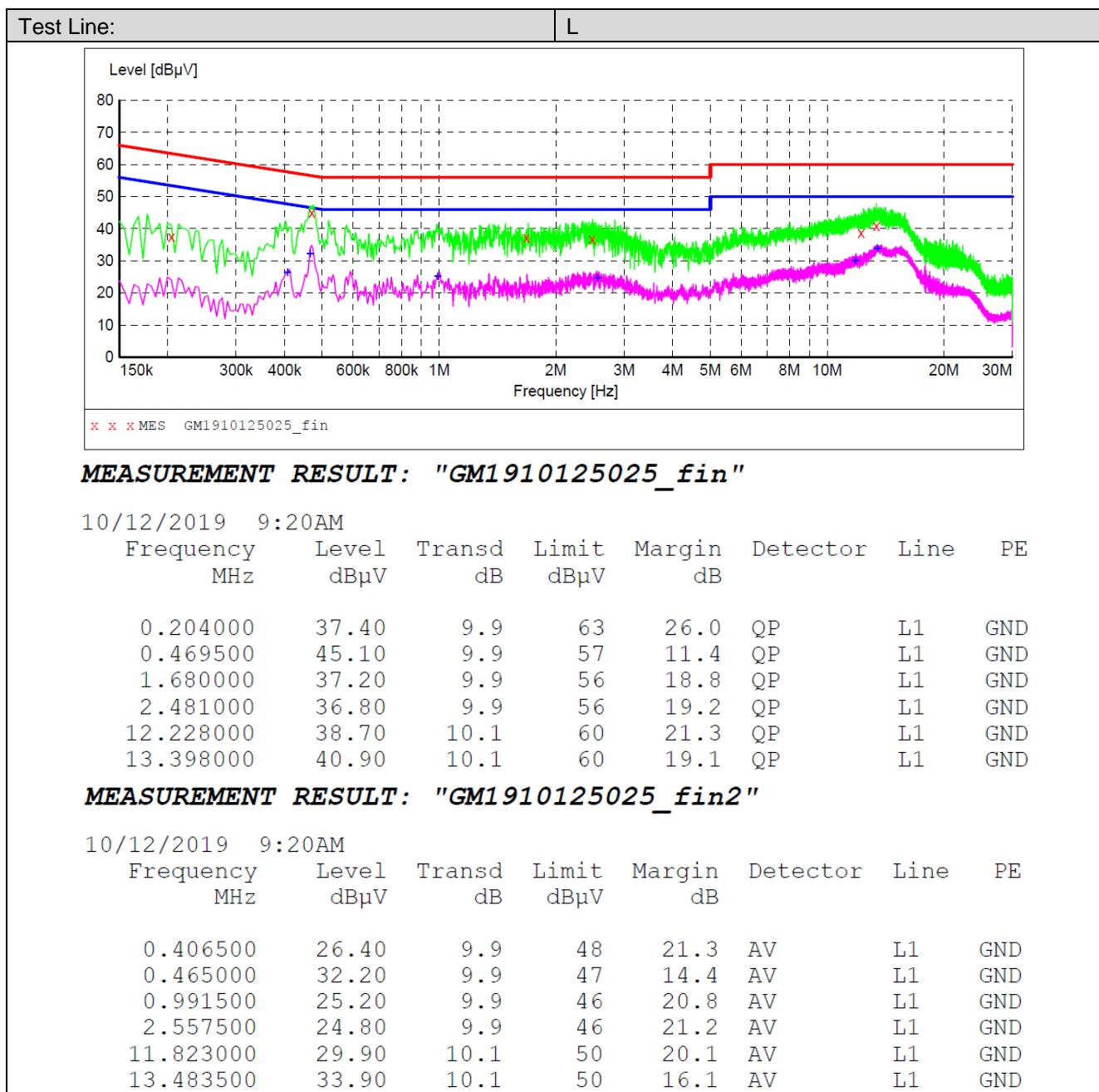
1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from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

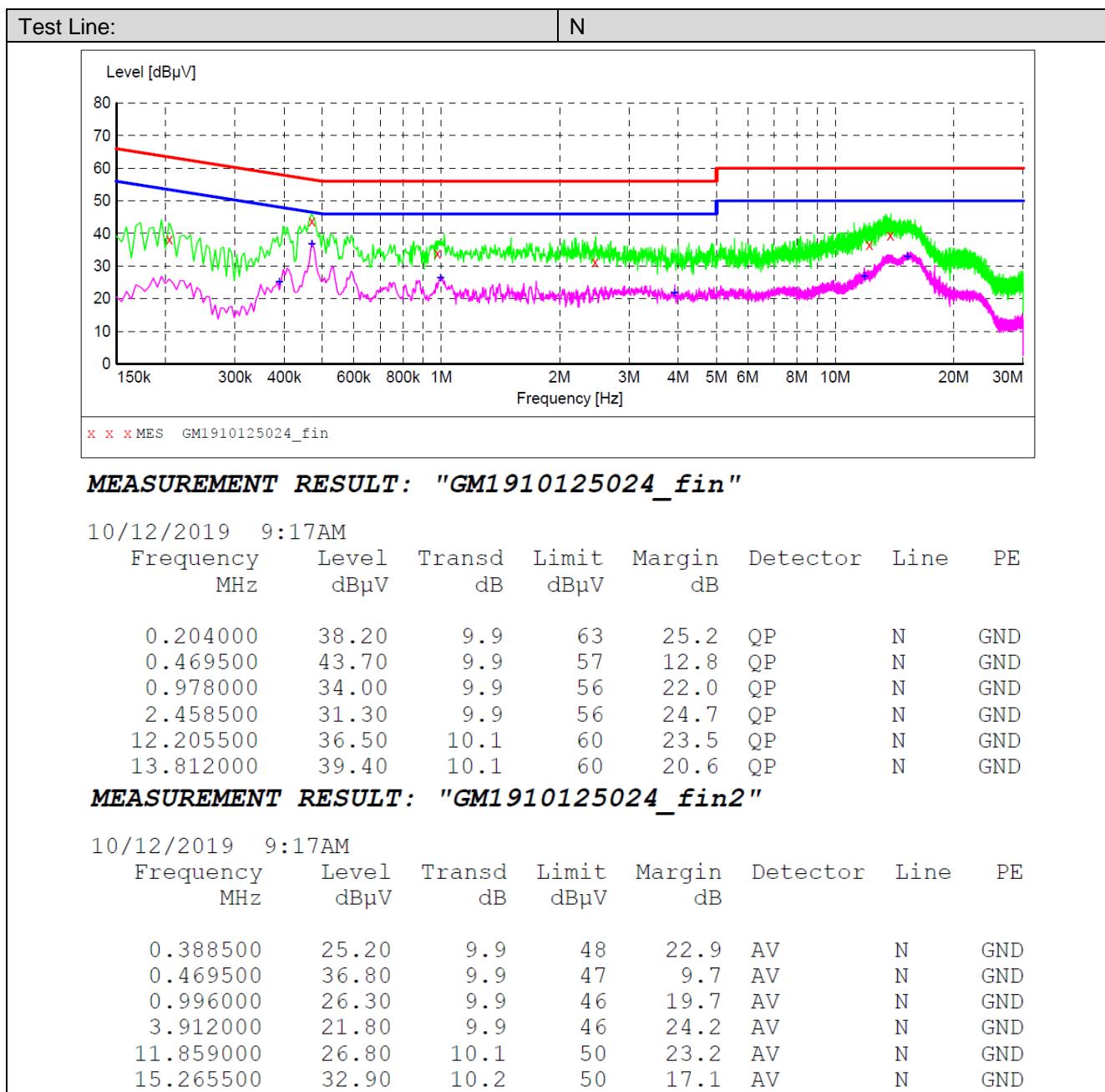
TEST RESULTS

Passed Not Applicable

Note:

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





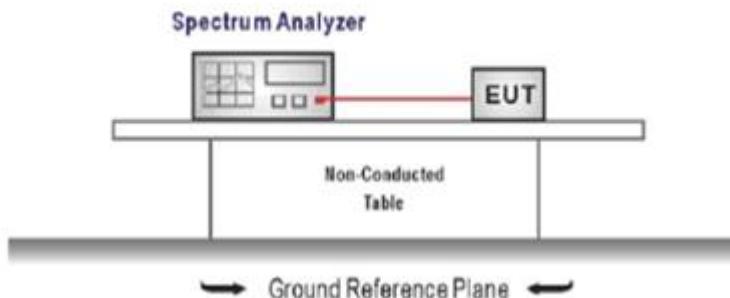
5.3. Conducted Peak Output Power

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.

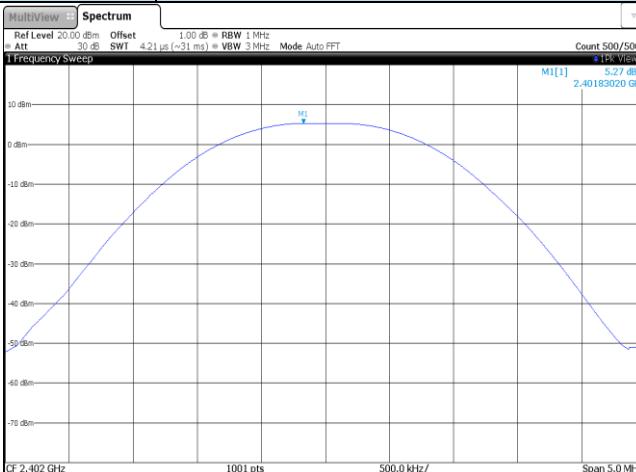
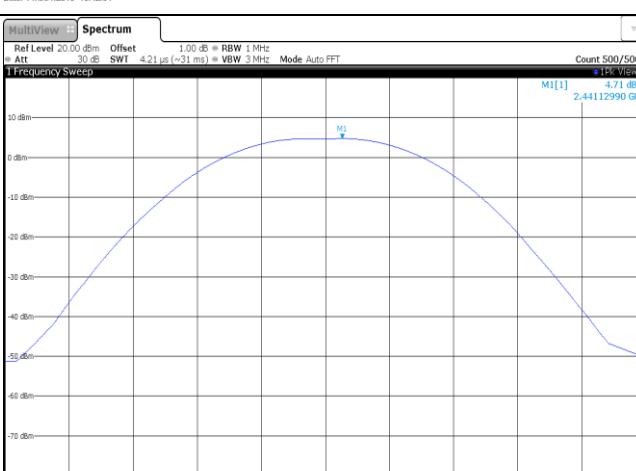
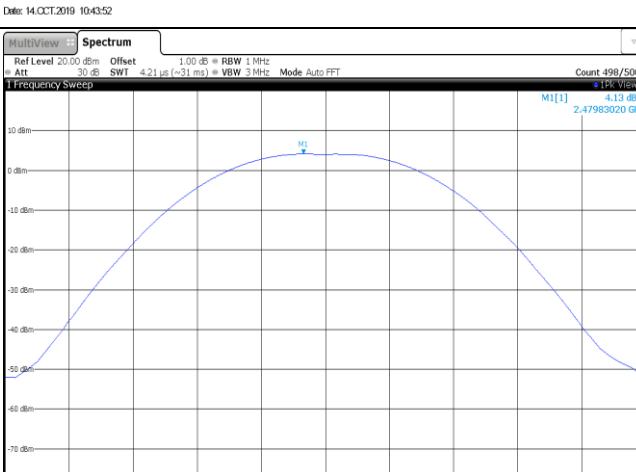
TEST MODE:

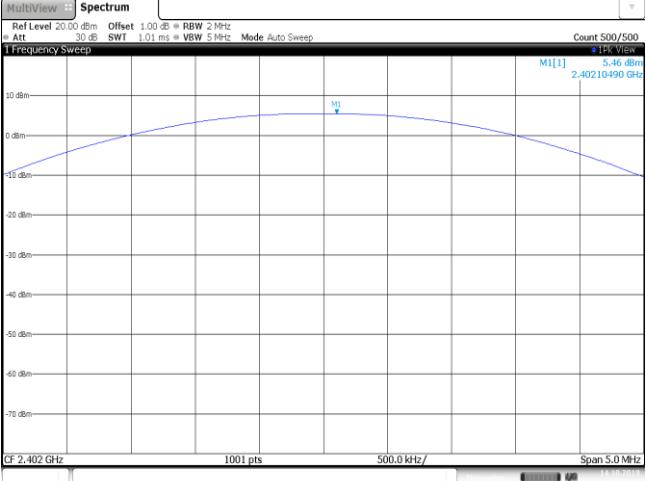
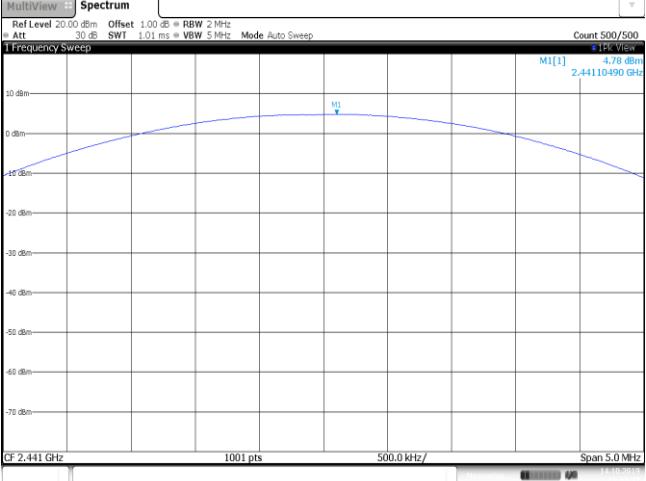
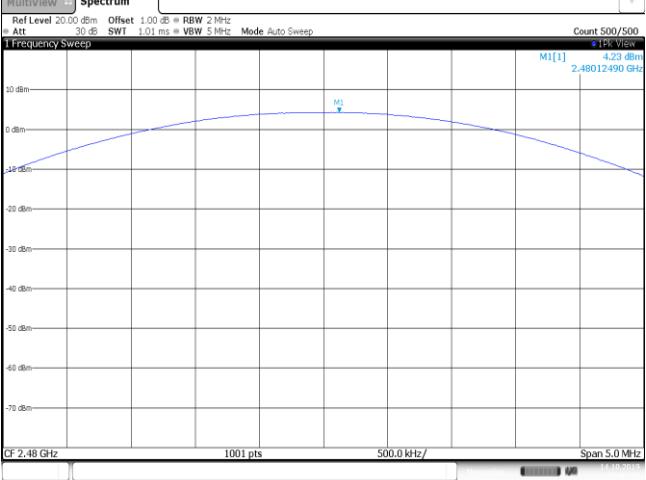
Please refer to the clause 3.3

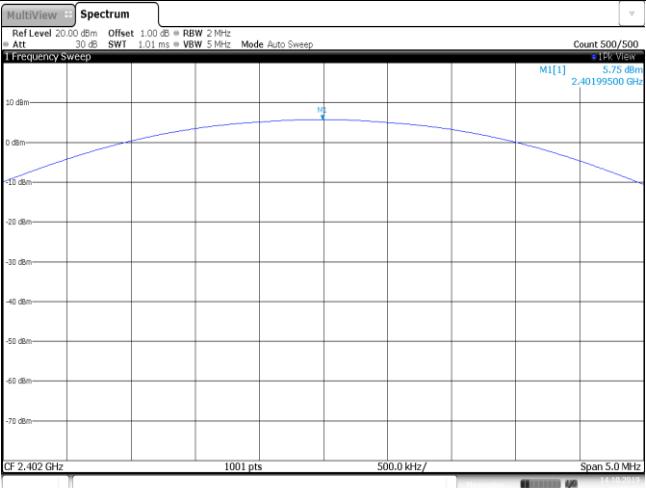
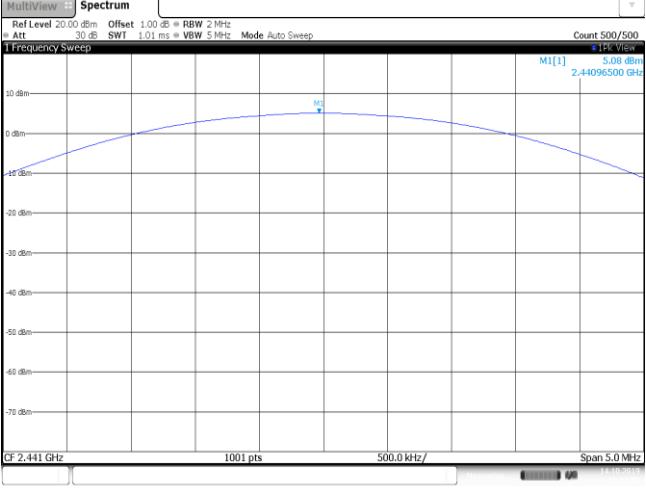
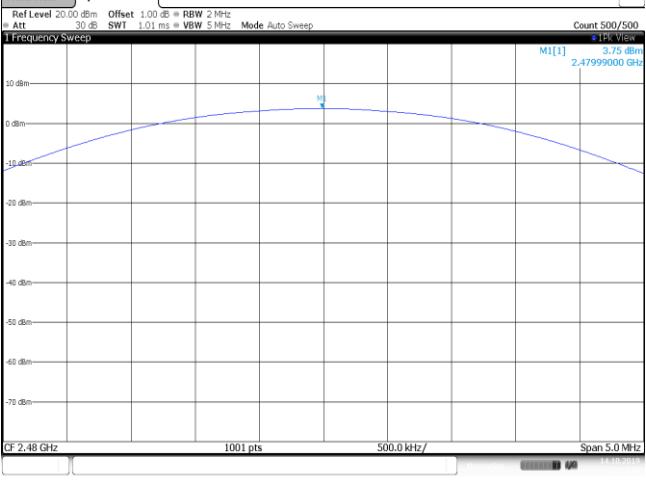
TEST RESULTS

Passed Not Applicable

Modulation type	Channel	Peak Output power (dBm)	Average Output power (dBm)	Limit (dBm)	Result
GFSK	00	5.27	5.19	≤ 30.00	Pass
	39	4.71	4.65		
	78	4.13	4.10		
$\pi/4$ DQPSK	00	5.46	4.78	≤ 21.00	Pass
	39	4.78	4.19		
	78	4.23	3.65		
8DPSK	00	5.75	5.02	≤ 21.00	Pass
	39	5.08	4.38		
	78	3.75	3.08		

Modulation Type:		GFSK
CH00		 <p>Date: 14.OCT.2019 10:42:04</p>
CH39		 <p>Date: 14.OCT.2019 10:43:52</p>
CH78		 <p>Date: 14.OCT.2019 10:45:45</p>

Modulation Type:		$\pi/4$ DQPSK
CH00		 <p>CH00</p> <p>Date: 14.OCT.2019 11:03:13</p>
CH39		 <p>CH39</p> <p>Date: 14.OCT.2019 11:05:17</p>
CH78		 <p>CH78</p> <p>Date: 14.OCT.2019 11:07:26</p>

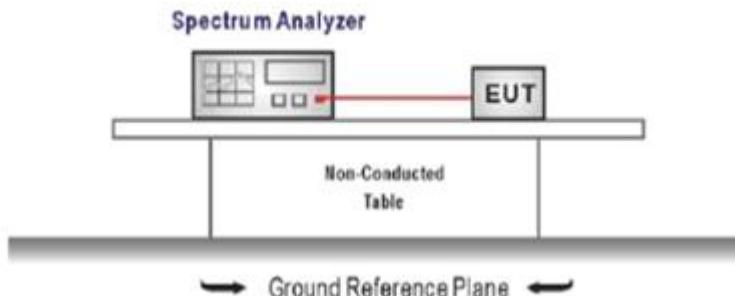
Modulation Type:	8DPSK
CH00	 <p>CH00</p> <p>Date: 14.OCT.2019 11:09:50</p>
CH39	 <p>CH39</p> <p>Date: 14.OCT.2019 11:12:04</p>
CH78	 <p>CH78</p> <p>Date: 14.OCT.2019 11:13:48</p>

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.

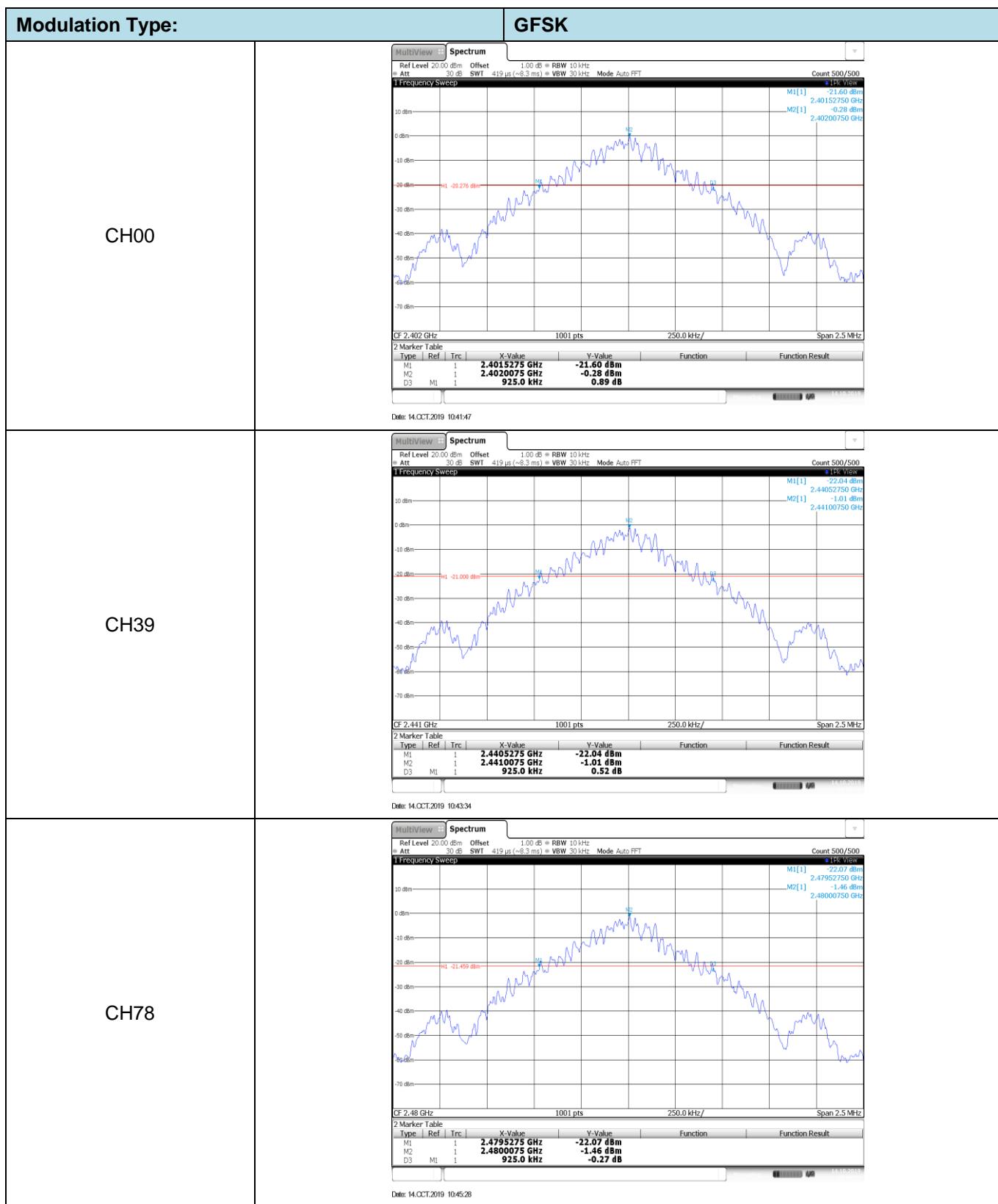
TEST MODE:

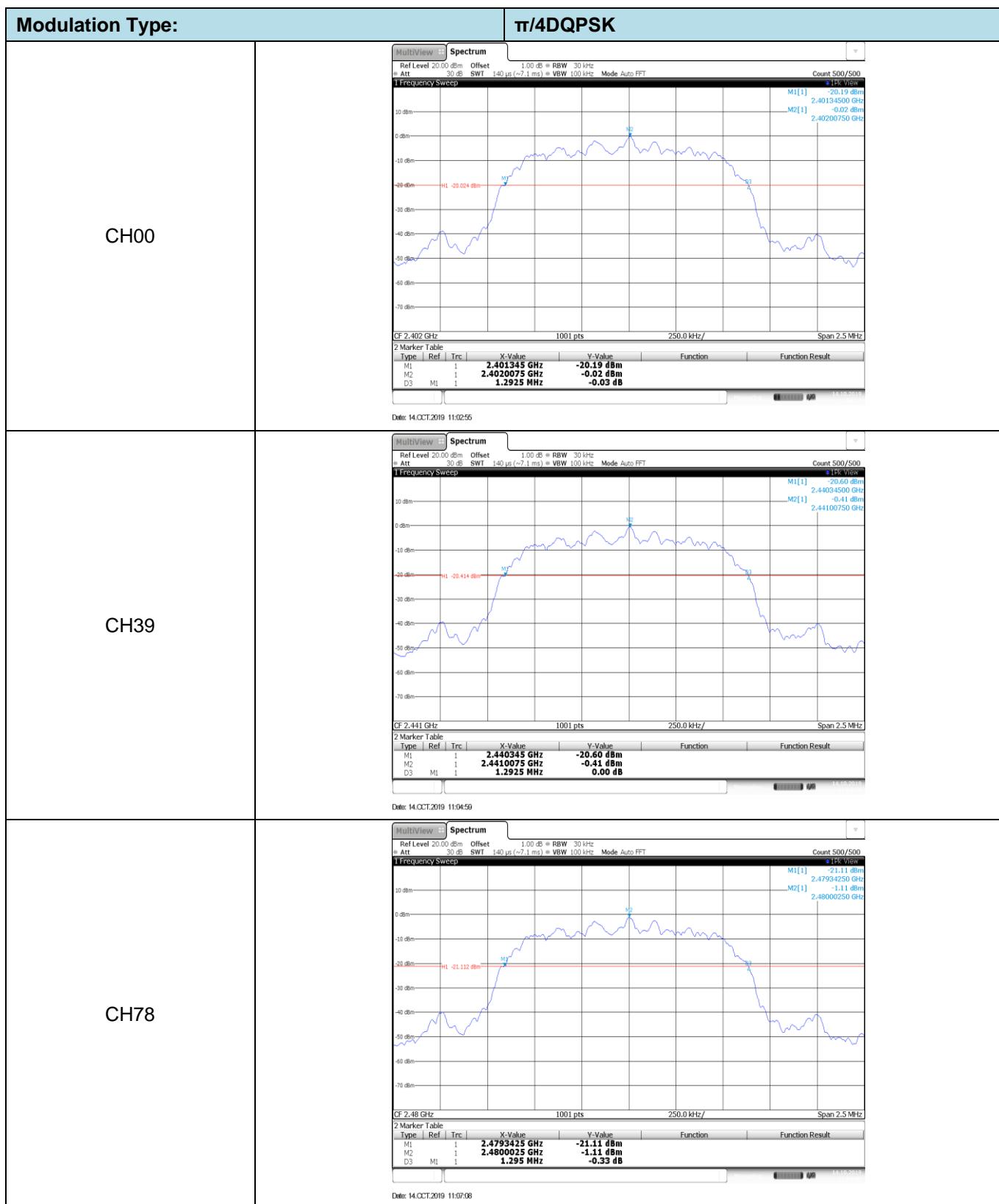
Please refer to the clause 3.3

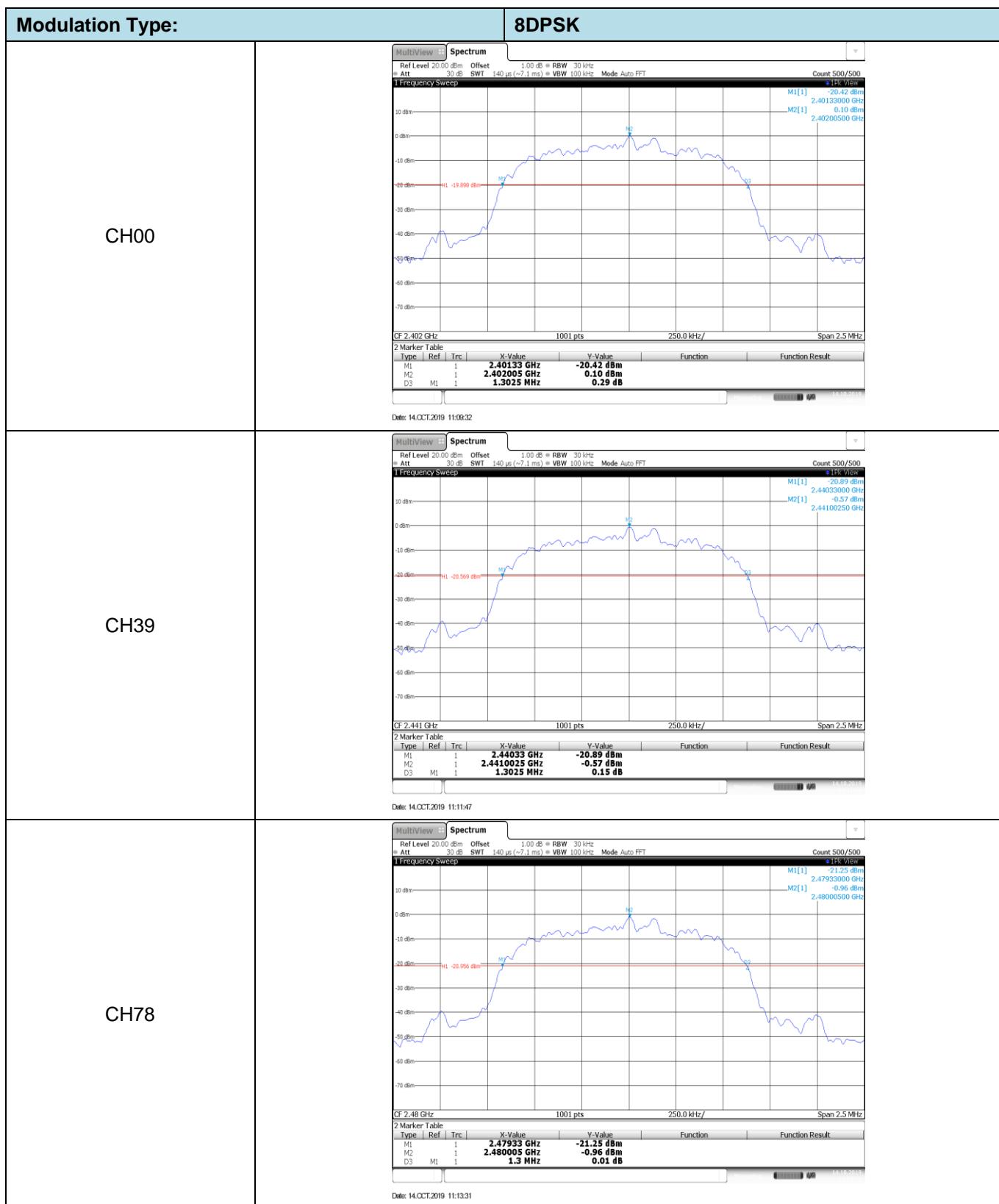
TEST RESULTS

Passed Not Applicable

Modulation type	Channel	20 dB Bandwidth (kHz)	Limit (kHz)	Result
GFSK	00	925.00	-	Pass
	39	925.00		
	78	925.00		
$\pi/4$ DQPSK	00	1293.00	-	Pass
	39	1293.00		
	78	1295.00		
8DPSK	00	1303.00	-	Pass
	39	1303.00		
	78	1300.00		







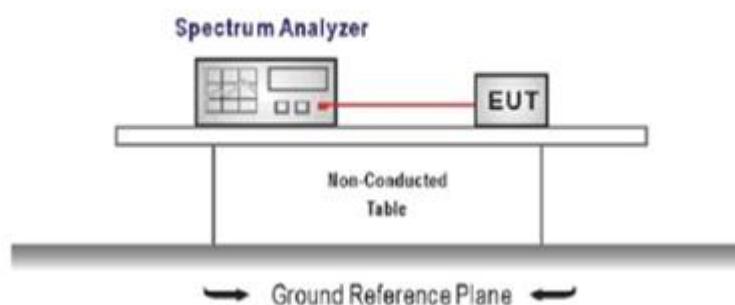
5.5. Carrier Frequencies Separation

LIMIT

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

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels
RBW \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 (kHz)	Limit (kHz) *	Result
GFSK	39	1000	\geq 925	Pass
$\pi/4$ DQPSK	39	999	\geq 863.33	Pass
8DPSK	39	1002	\geq 868.67	Pass

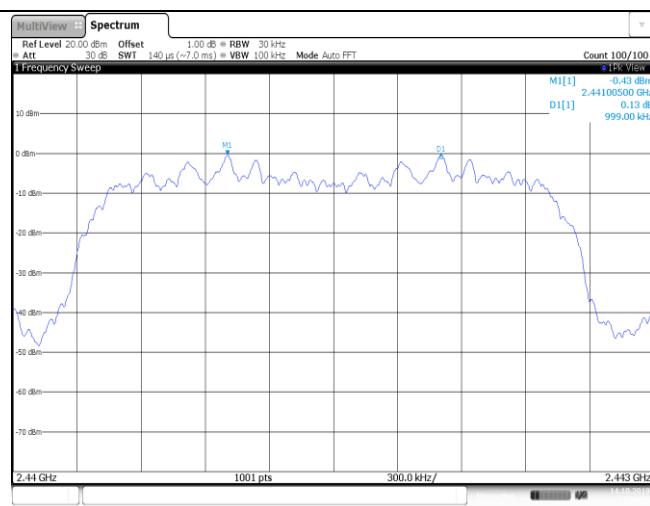
Note:

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

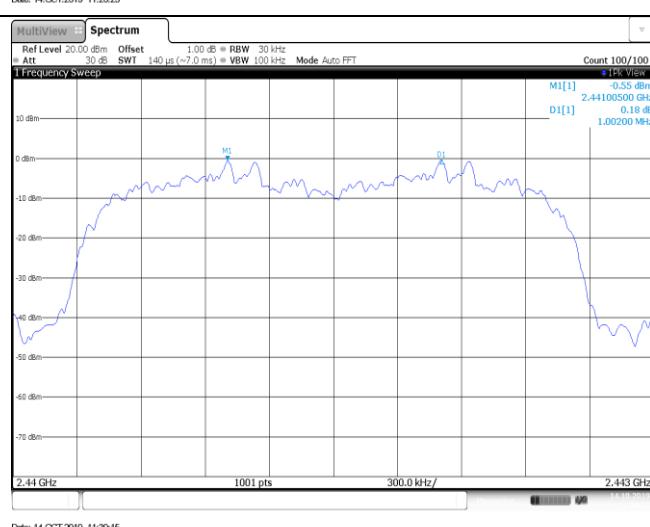
$\pi/4$ DQPSK limit = 2/3 * The maximum 20 dB Bandwidth for $\pi/4$ DQPSK modulation on the section 5.4.

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

GFSK

 $\pi/4$ DQPSK

8DPSK

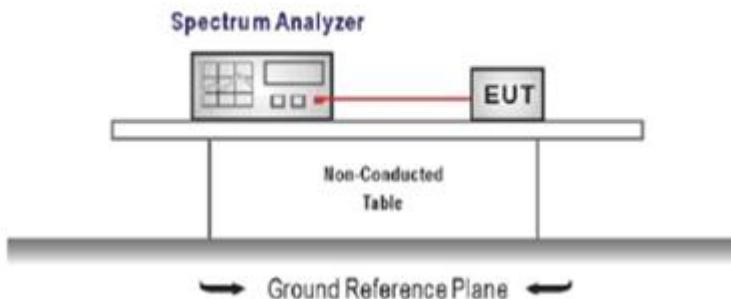


5.6. Hopping Channel Number

LIMIT

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

TEST CONFIGURATION



TEST PROCEDURE

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

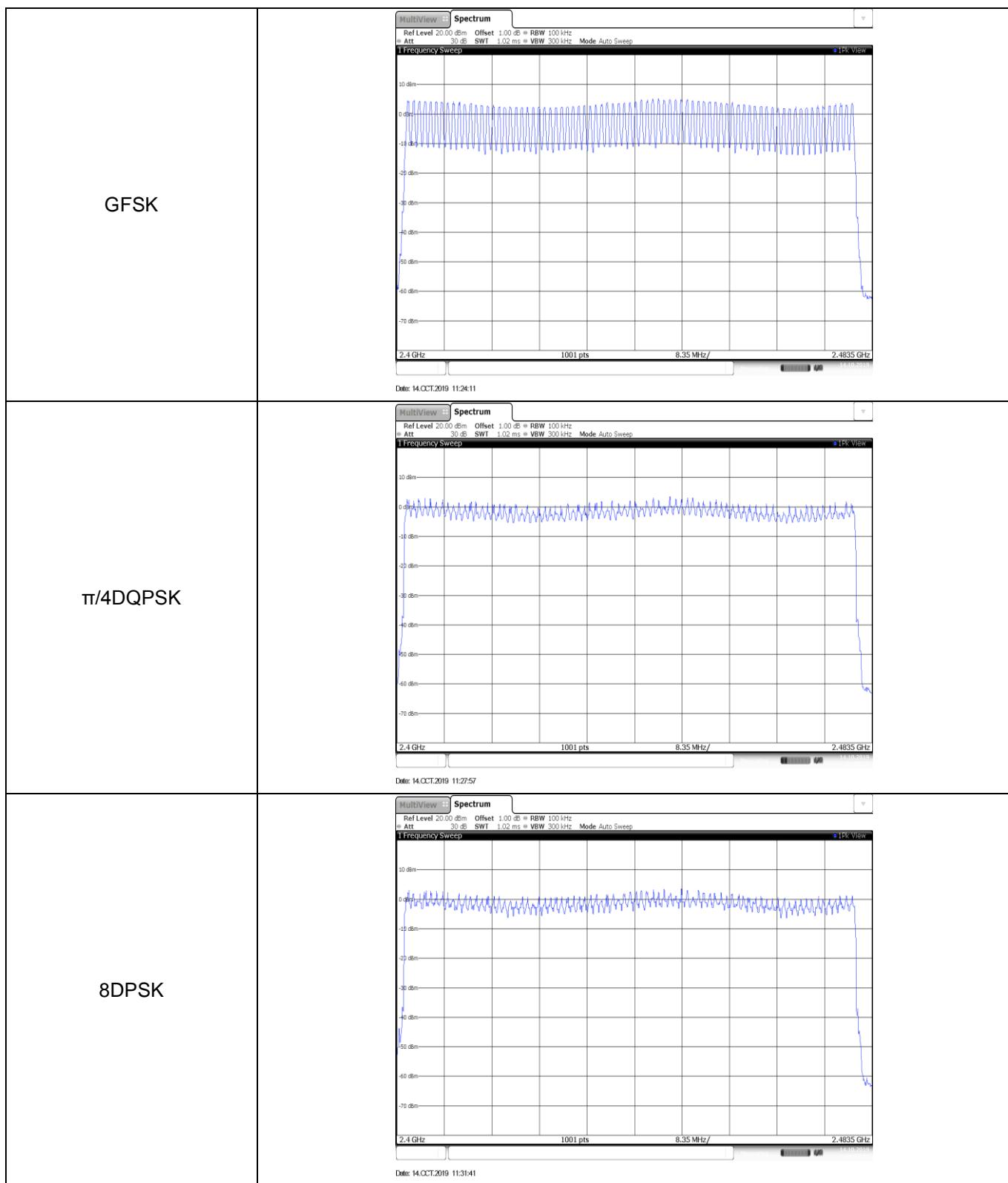
TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

Passed Not Applicable

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

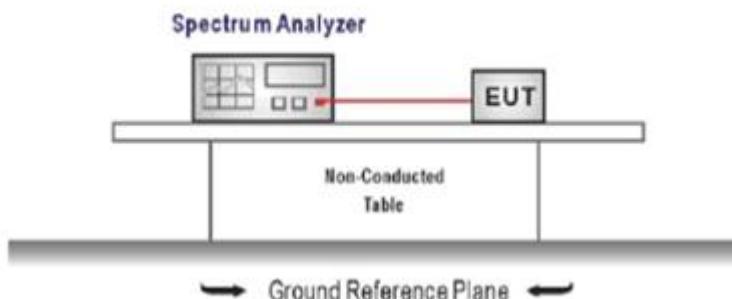


5.7. Dwell Time

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.

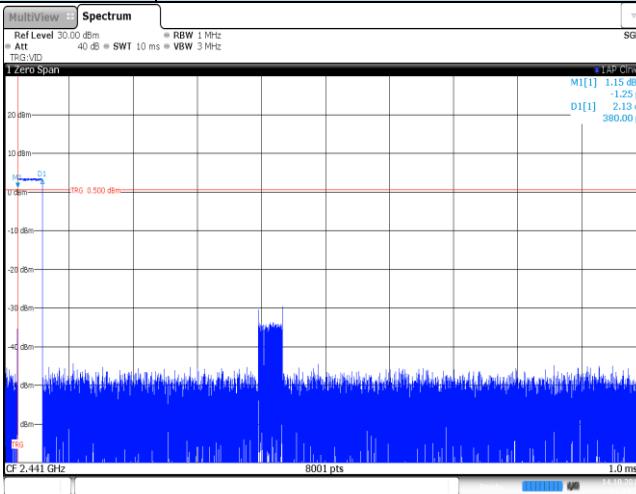
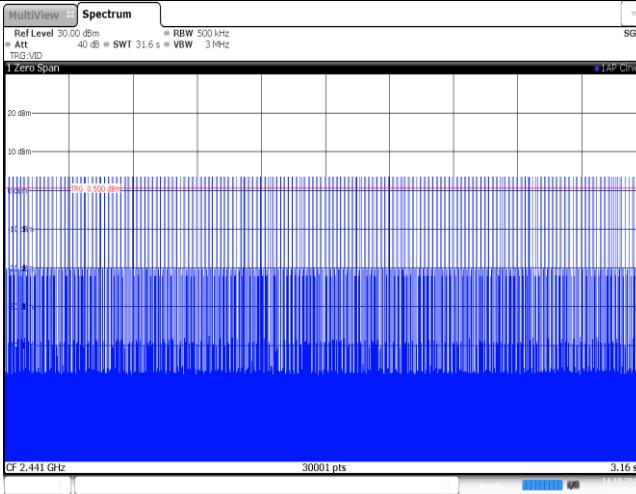
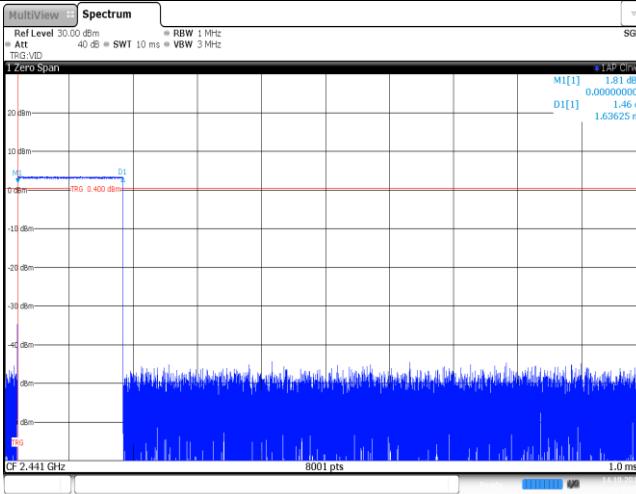
TEST MODE:

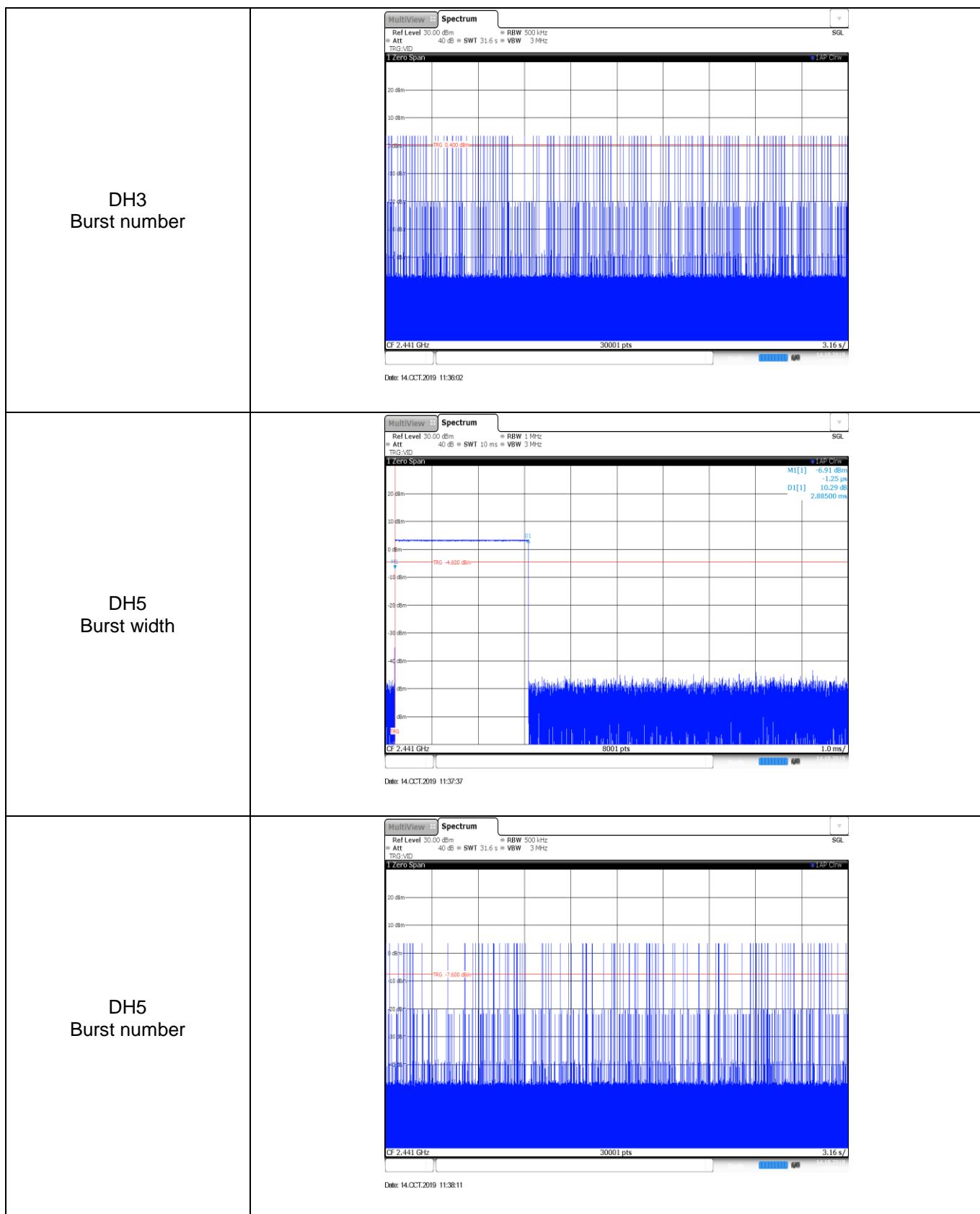
Please refer to the clause 3.3

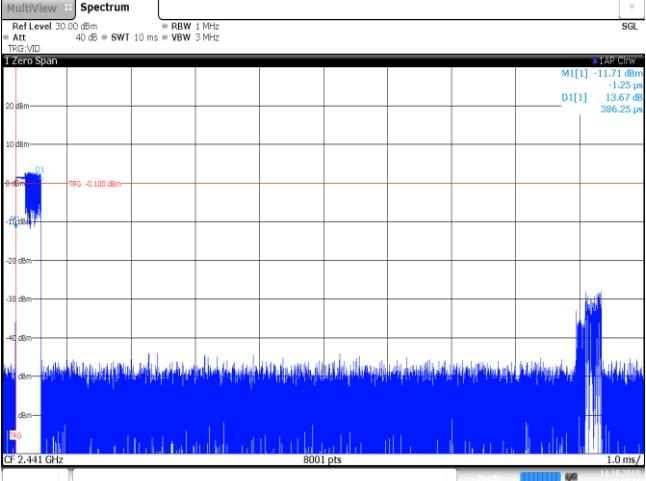
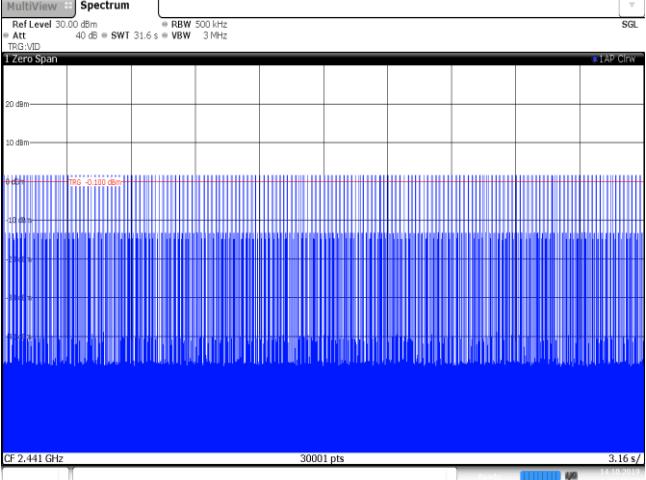
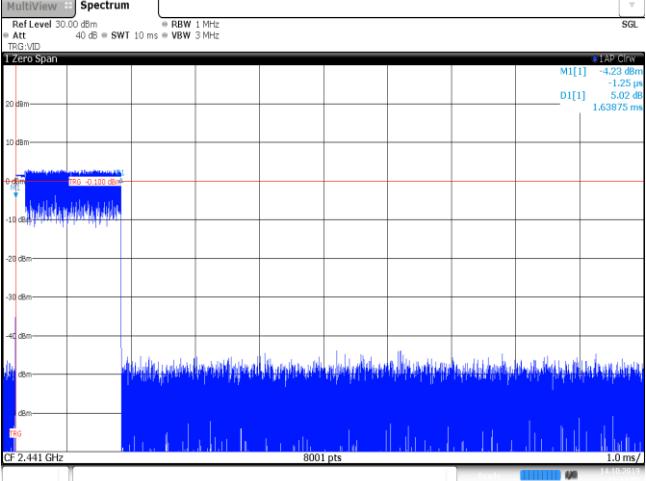
TEST RESULTS

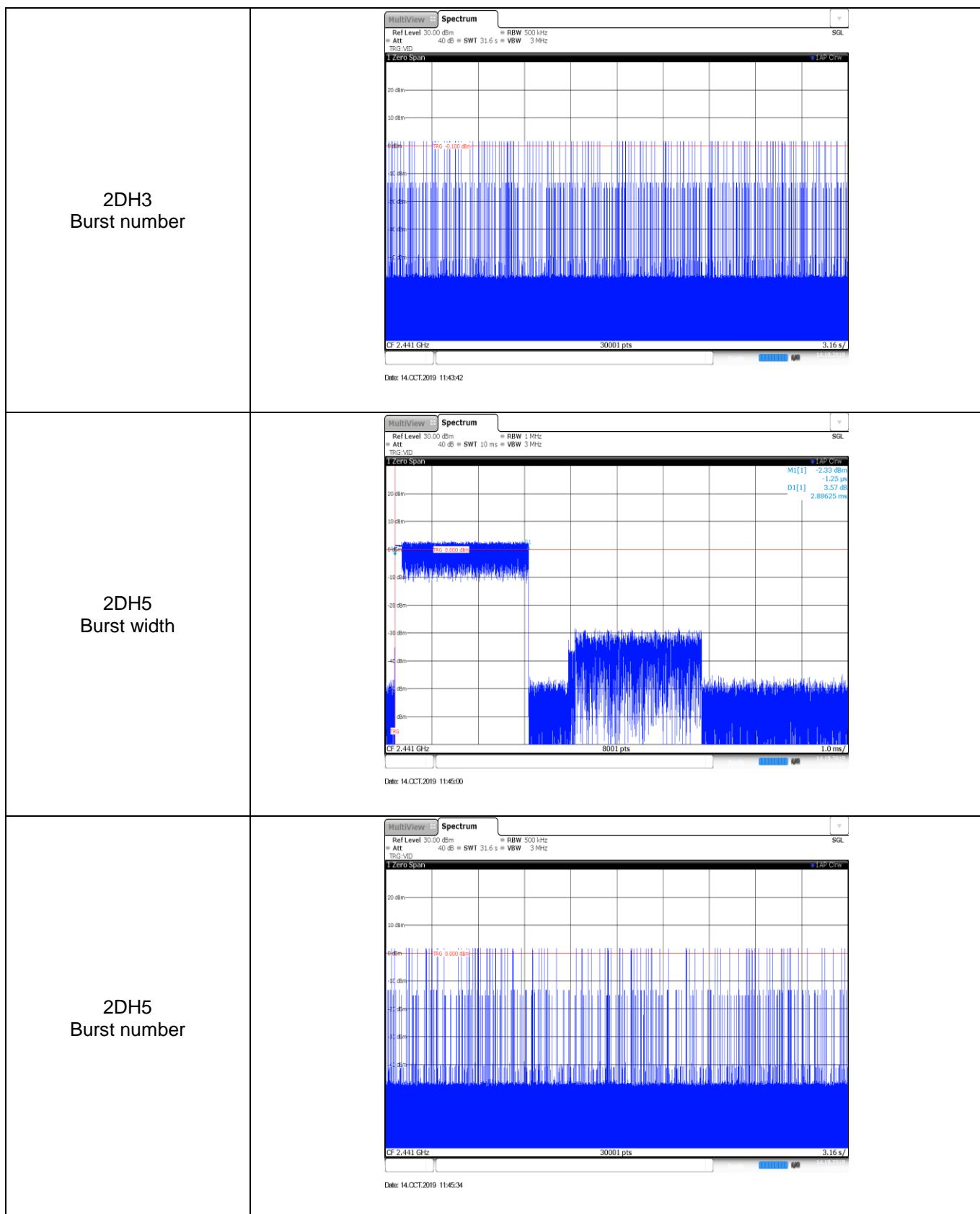
Passed Not Applicable

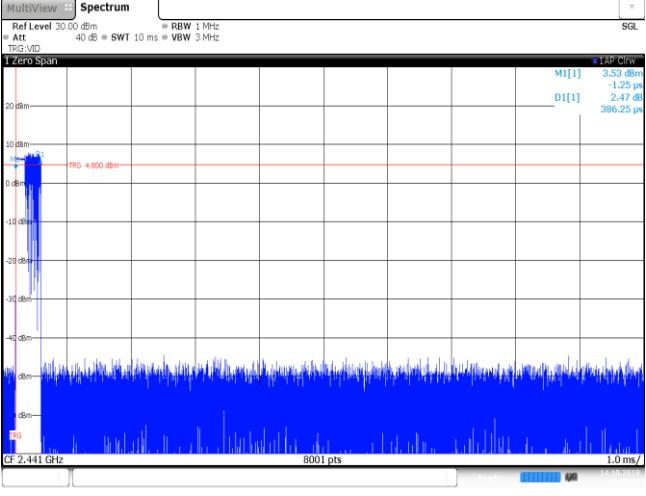
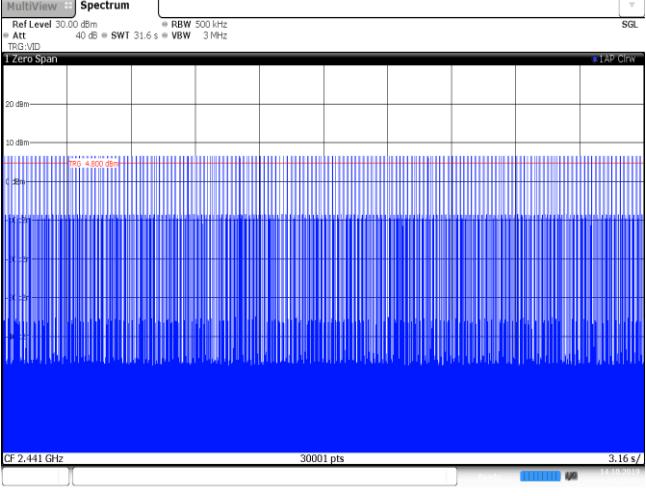
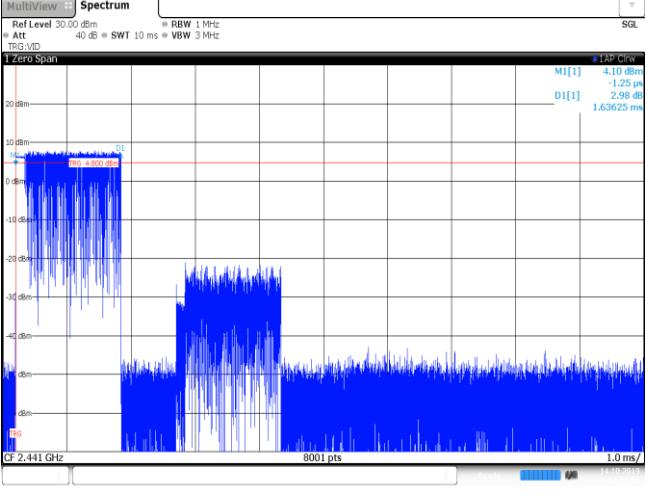
Modulation type	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell time (Second)	Limit (Second)	Result
GFSK	DH1	0.38	314.00	0.12	≤ 0.40	Pass
	DH3	1.64	158.00	0.26		
	DH5	2.89	106.00	0.31		
$\pi/4$ DQPSK	2DH1	0.39	315.00	0.12	≤ 0.40	Pass
	2DH3	1.64	154.00	0.25		
	2DH5	2.89	101.00	0.29		
8DPSK	3DH1	0.39	315.00	0.12	≤ 0.40	Pass
	3DH3	1.64	162.00	0.27		
	3DH5	2.89	112.00	0.32		

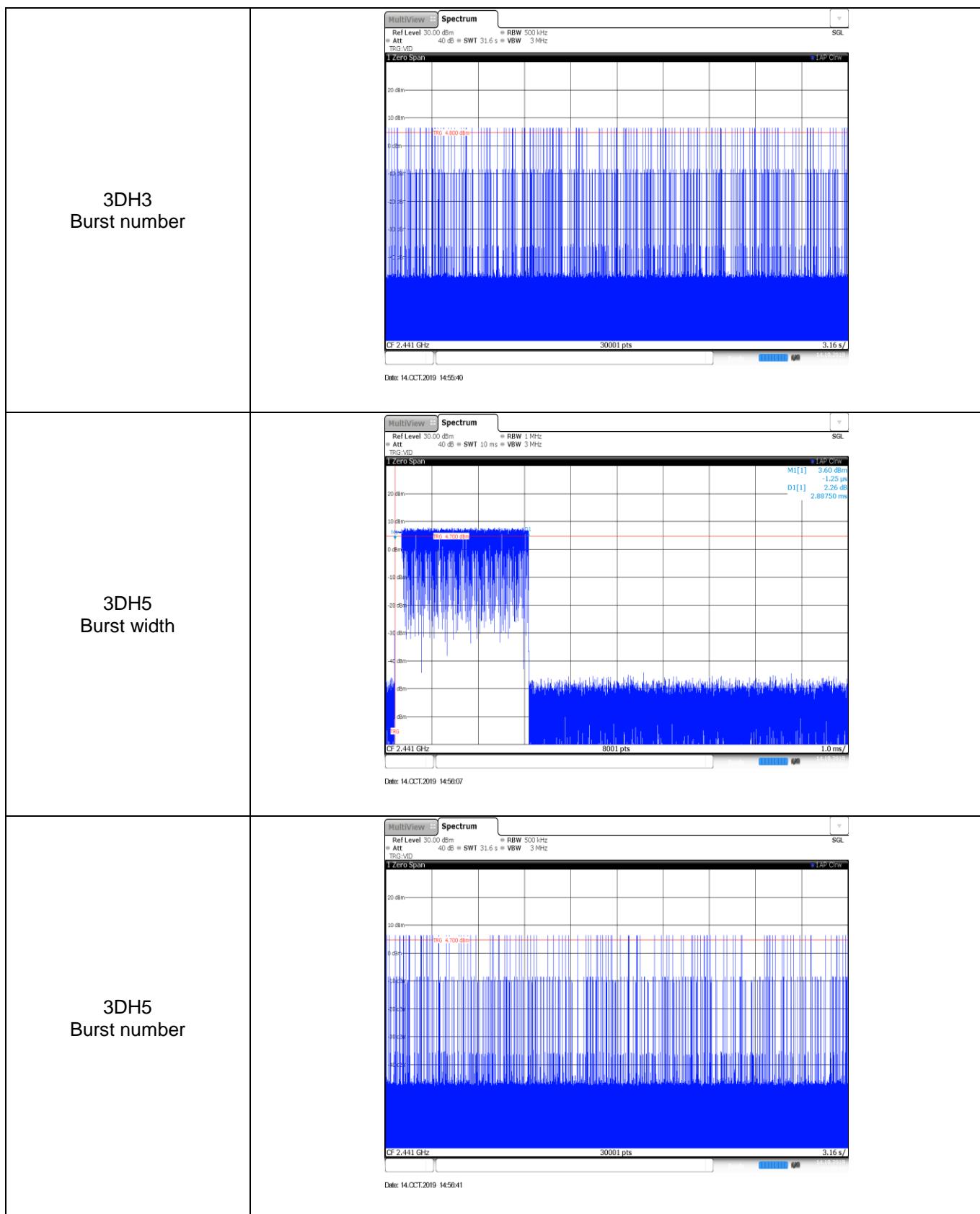
Modulation Type:		GFSK
DH1 Burst width		 <p>CF: 2.441 GHz, 80001 pts, 1.0 ms</p> <p>Ref Level: 30.00 dBm, Att: 40 dB, SW: 10 ms, VBW: 3 MHz</p> <p>TRG: 0.500 dBm</p> <p>MI[1]: 1.15 dBm, -1.25 μs</p> <p>DI[1]: 2.13 dB, 380.00 μs</p> <p>Date: 14.OCT.2019 11:34:30</p>
DH1 Burst number		 <p>CF: 2.441 GHz, 30001 pts, 3.16 s</p> <p>Ref Level: 30.00 dBm, Att: 40 dB, SW: 31.6 s, VBW: 3 MHz</p> <p>TRG: 0.500 dBm</p> <p>MI[1]: 1.15 dBm, 3.16 s</p> <p>DI[1]: 2.13 dB, 380.00 μs</p> <p>Date: 14.OCT.2019 11:35:03</p>
DH3 Burst width		 <p>CF: 2.441 GHz, 80001 pts, 1.0 ms</p> <p>Ref Level: 30.00 dBm, Att: 40 dB, SW: 10 ms, VBW: 3 MHz</p> <p>TRG: 0.400 dBm</p> <p>MI[1]: 1.81 dBm, 0.0000000 s</p> <p>DI[1]: 1.46 dB, 1.63625 ms</p> <p>Date: 14.OCT.2019 11:35:28</p>



Modulation Type:		$\pi/4$ DQPSK
2DH1 Burst width		 <p>2DH1 Burst width</p> <p>CF: 2.441 GHz</p> <p>8001 pts</p> <p>1.0 ms</p> <p>Date: 14.OCT.2019 11:40:13</p>
2DH1 Burst number		 <p>2DH1 Burst number</p> <p>CF: 2.441 GHz</p> <p>30001 pts</p> <p>3.16 s</p> <p>Date: 14.OCT.2019 11:40:47</p>
2DH3 Burst width		 <p>2DH3 Burst width</p> <p>CF: 2.441 GHz</p> <p>8001 pts</p> <p>1.0 ms</p> <p>Date: 14.OCT.2019 11:43:08</p>



Modulation Type:		$\pi/4$ DQPSK
3DH1 Burst width		 <p>3DH1 burst width spectrum analysis. The plot shows a single burst with a peak power of 4.800 dBm. The x-axis represents frequency from 2.441 GHz to 2.441 GHz, and the y-axis represents power from -20 dBm to 20 dBm. The plot is a 1.0 ms window with 8001 points. The plot includes a red line at 0 dBm and a blue line at 4.800 dBm. The plot is titled "1 Zero Span".</p>
3DH1 Burst number		 <p>3DH1 burst number spectrum analysis. The plot shows a continuous burst with a peak power of 4.800 dBm. The x-axis represents frequency from 2.441 GHz to 2.441 GHz, and the y-axis represents power from -20 dBm to 20 dBm. The plot is a 3.16 s window with 30001 points. The plot includes a red line at 0 dBm and a blue line at 4.800 dBm. The plot is titled "1 Zero Span".</p>
3DH3 Burst width		 <p>3DH3 burst width spectrum analysis. The plot shows a burst with a peak power of 4.400 dBm. The x-axis represents frequency from 2.441 GHz to 2.441 GHz, and the y-axis represents power from -20 dBm to 20 dBm. The plot is a 1.0 ms window with 8001 points. The plot includes a red line at 0 dBm and a blue line at 4.400 dBm. The plot is titled "1 Zero Span".</p>



5.8. Pseudorandom Frequency Hopping Sequence

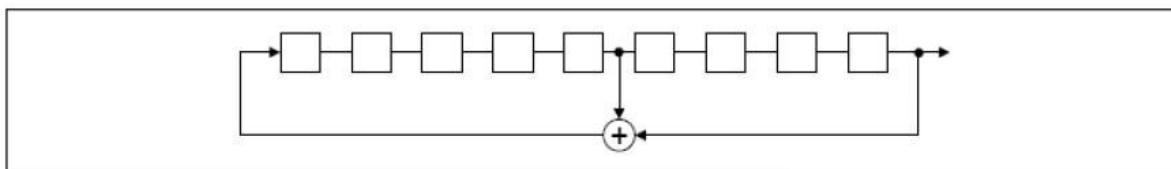
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

TEST RESULTS

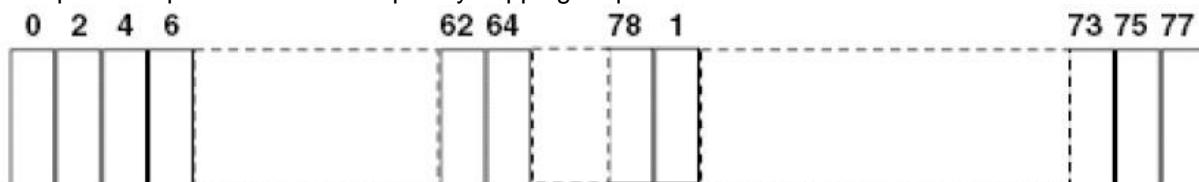
The pseudorandom frequency hopping sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones, for example: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

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



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.

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

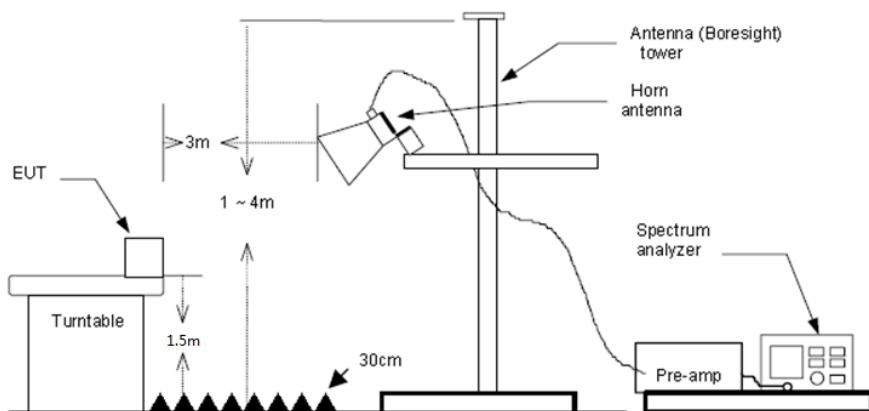
5.9. Restricted band (radiated)

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, Radiated Emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the Radiated Emissions limits specified in §15.209(a) (see §15.205(c)).

TEST CONFIGURATION



TEST PROCEDURE

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

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

Passed Not Applicable

Note:

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

Test channel:				CH00			
Freq. [MHz]	Reading [dB μ V/m]	Factor [dB]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Polarity	Detector
2310.000	43.15	-2.34	40.81	74.00	33.19	Horizontal	PK
2390.000	43.12	-2.41	40.71	74.00	33.29	Horizontal	PK
2310.000	43.15	-27.16	15.99	54.00	38.01	Horizontal	AV
2390.000	43.12	-27.23	15.89	54.00	38.11	Horizontal	AV

Freq. [MHz]	Reading [dB μ V/m]	Factor [dB]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Polarity	Detector
2310.000	43.35	-2.34	41.01	74.00	32.99	Vertical	PK
2390.000	41.21	-2.41	38.80	74.00	35.20	Vertical	PK
2310.000	43.35	-27.16	16.19	54.00	37.81	Vertical	AV
2390.000	41.21	-27.23	13.98	54.00	40.02	Vertical	AV

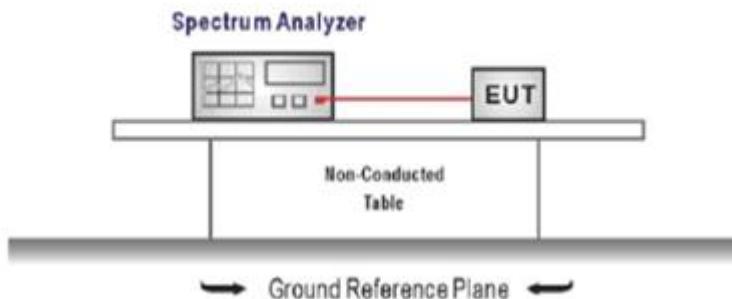
Test channel:				CH78			
Freq. [MHz]	Reading [dB μ V/m]	Factor [dB]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Polarity	Detector
2483.500	61.64	-2.15	59.49	74.00	14.51	Horizontal	PK
2500.000	42.99	-2.10	40.89	74.00	33.11	Horizontal	PK
2483.500	61.64	-26.97	34.67	54.00	19.33	Horizontal	AV
2500.000	42.99	-26.92	16.07	54.00	37.93	Horizontal	AV
Freq. [MHz]	Reading [dB μ V/m]	Factor [dB]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Polarity	Detector
2483.500	50.11	-2.15	47.96	74.00	26.04	Vertical	PK
2500.000	43.85	-2.10	41.75	74.00	32.25	Vertical	PK
2483.500	50.11	-26.97	23.14	54.00	30.86	Vertical	AV
2500.000	43.85	-26.92	16.93	54.00	37.07	Vertical	AV

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, scan up through 10th harmonic.
Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

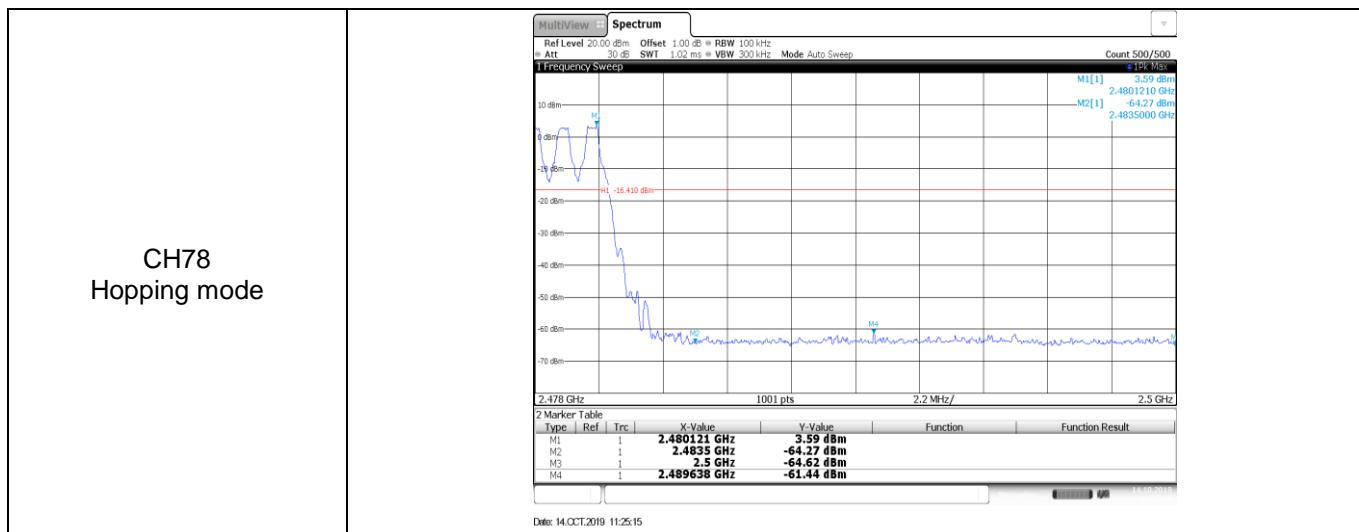
TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

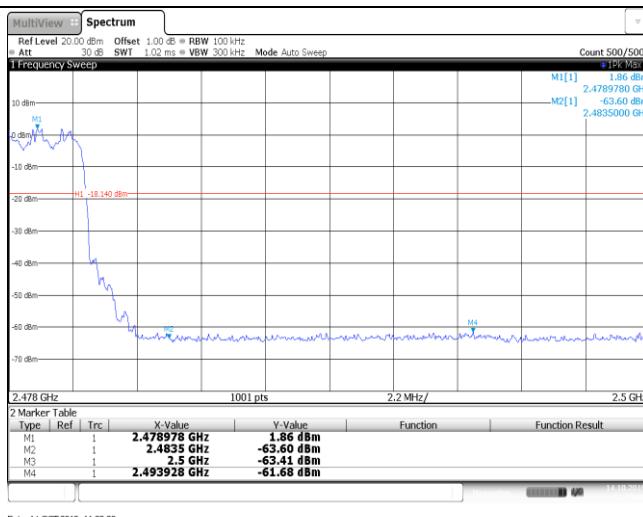
Passed Not Applicable

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

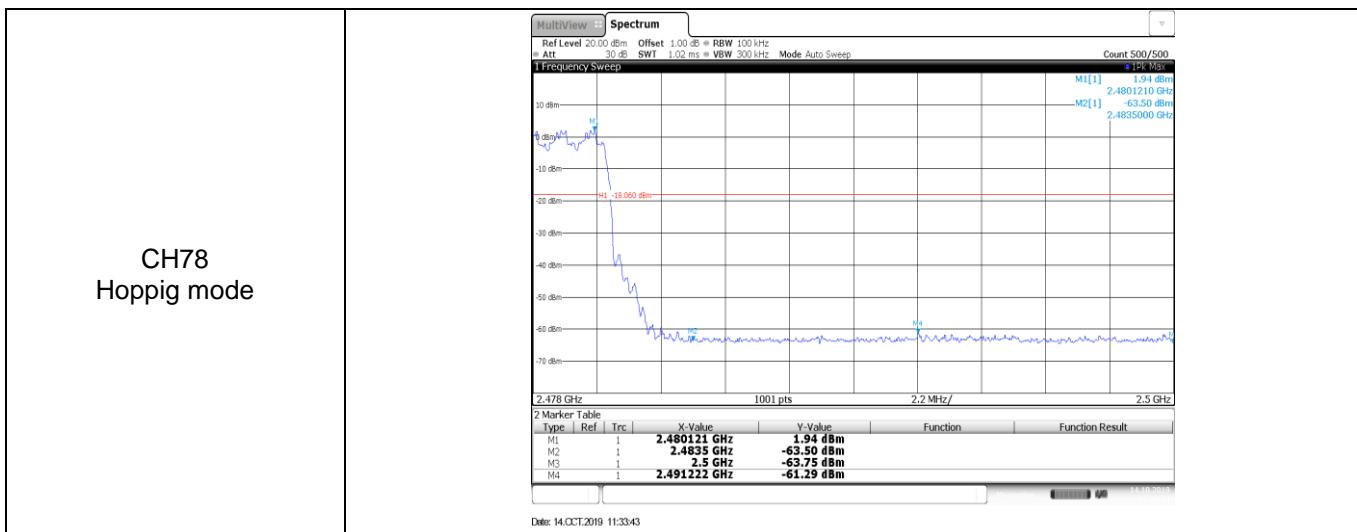


Test Item:	Band edge	Modulation type:	$\pi/4$ DQPSK
CH00 No hopping mode			
CH00 Hopping mode			
CH78 No hopping mode			

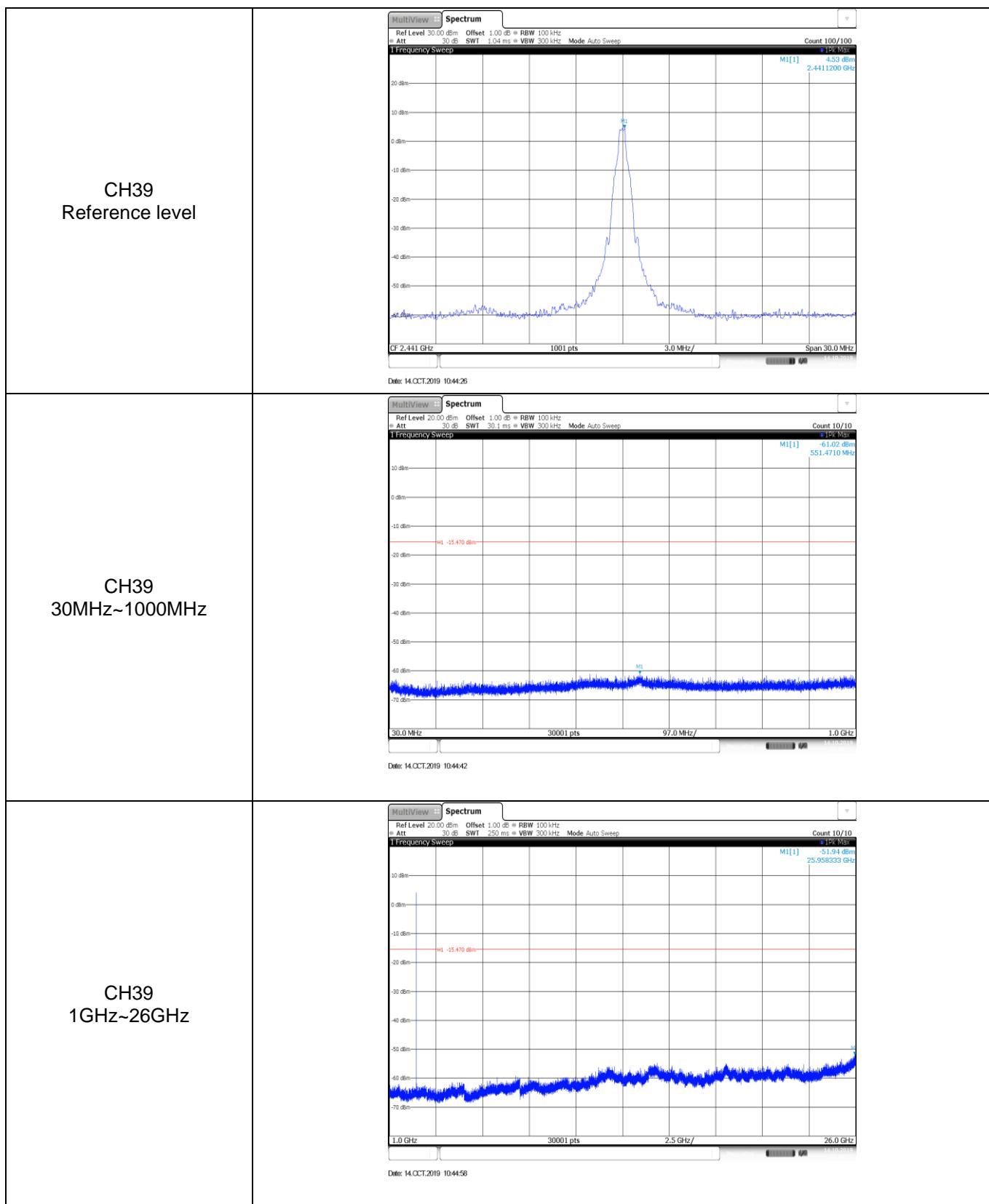
CH78
Hopping mode

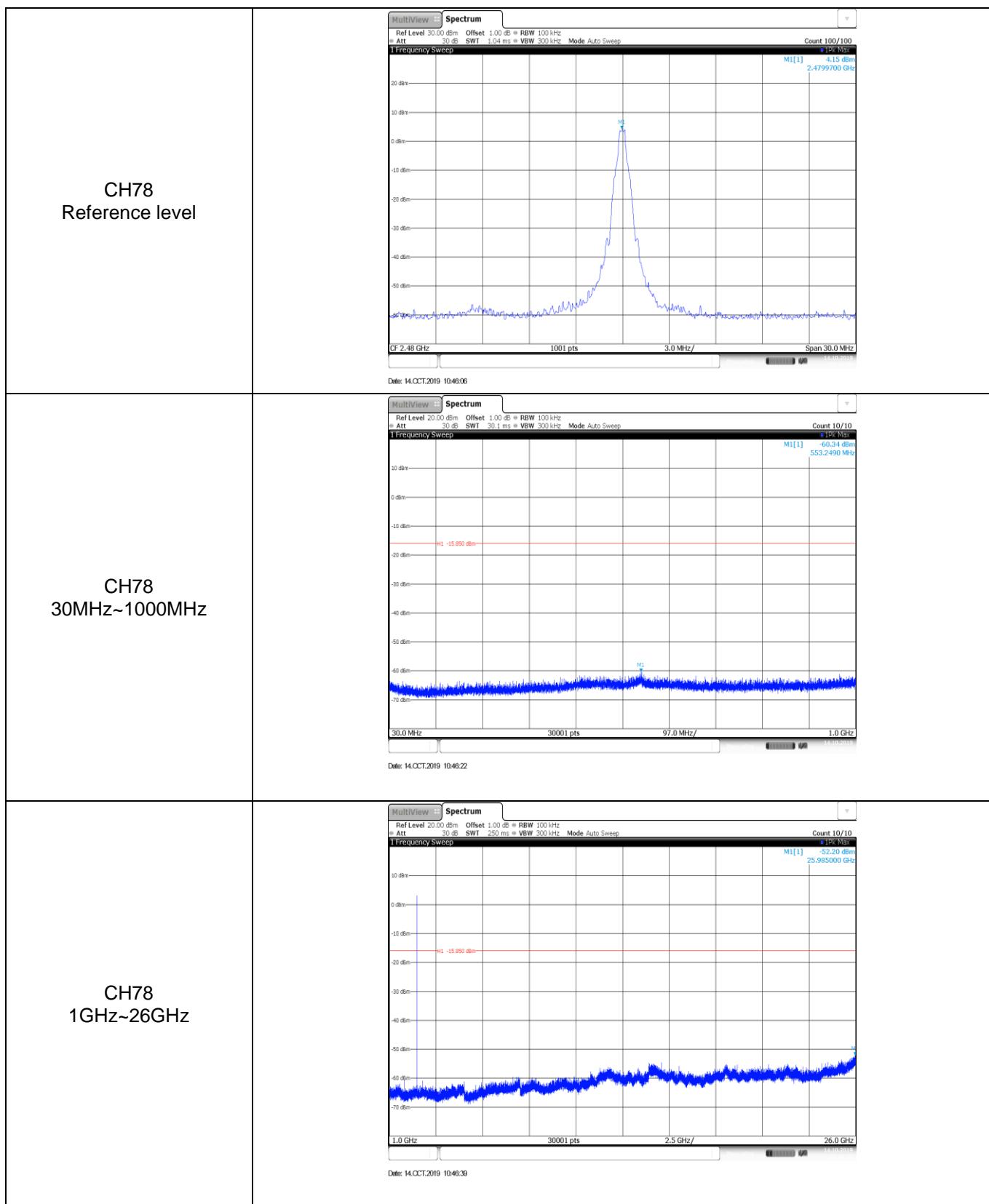


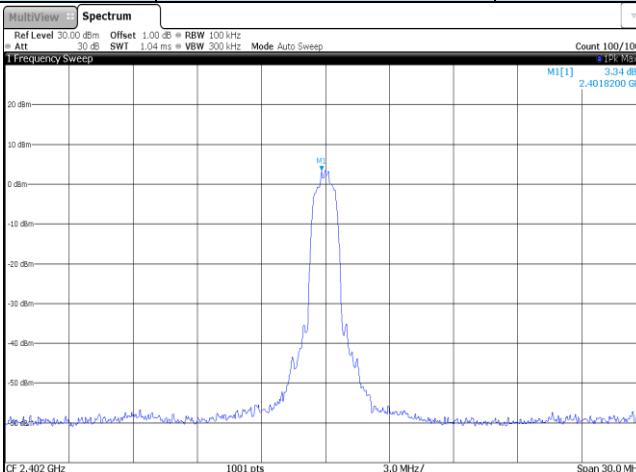
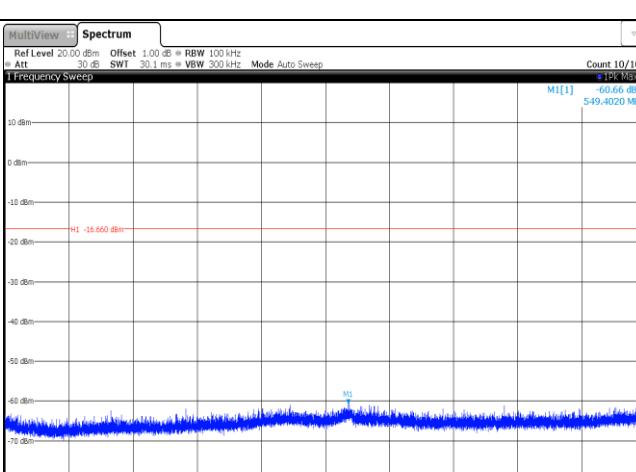
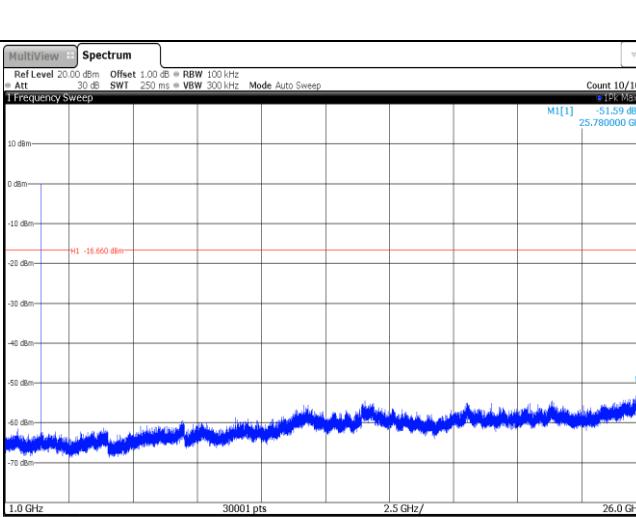
Test Item:	Band edge	Modulation type:	8DPSK
CH00 No hopping mode			
CH00 Hopping mode			
CH78 No hopping mode			

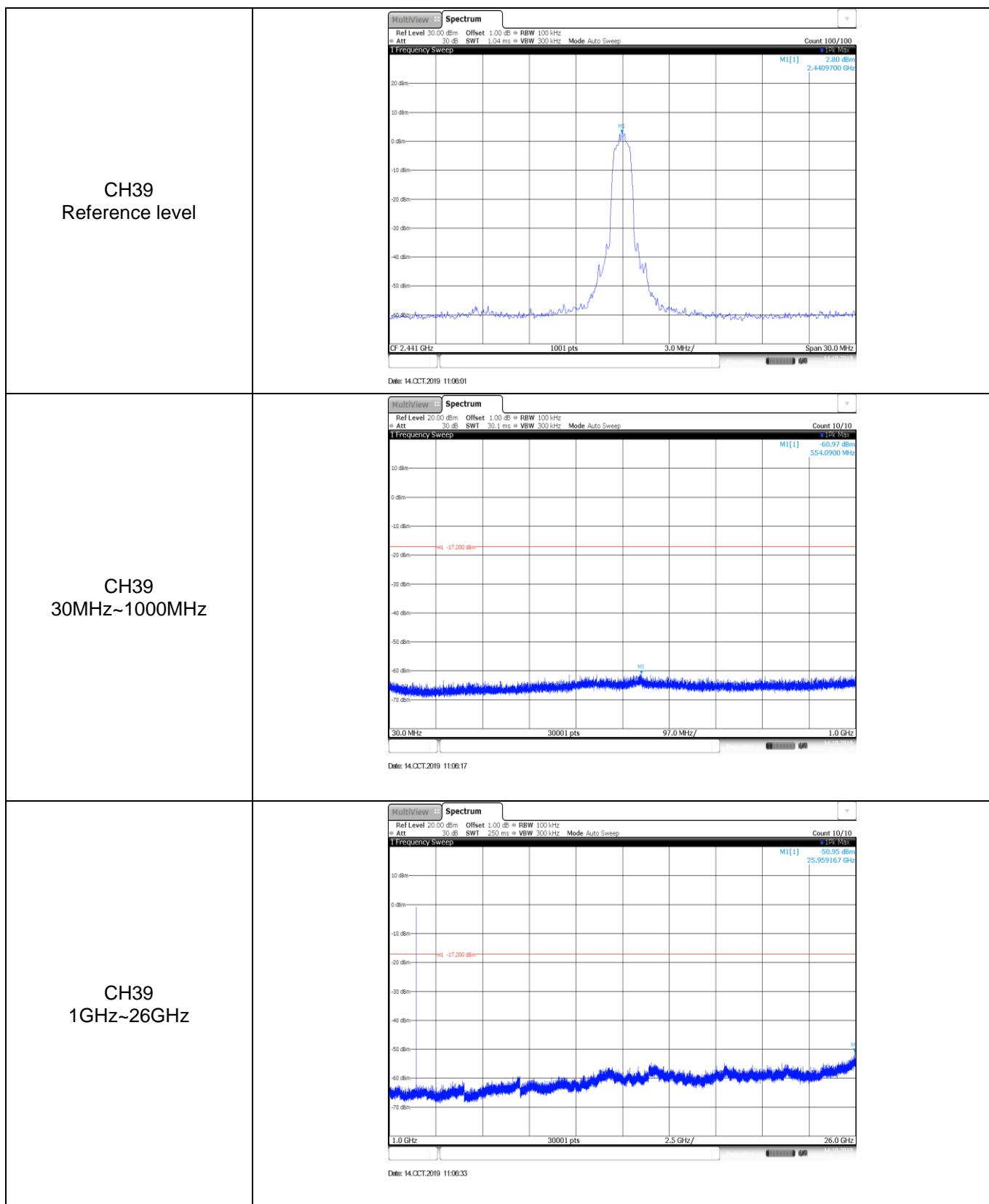


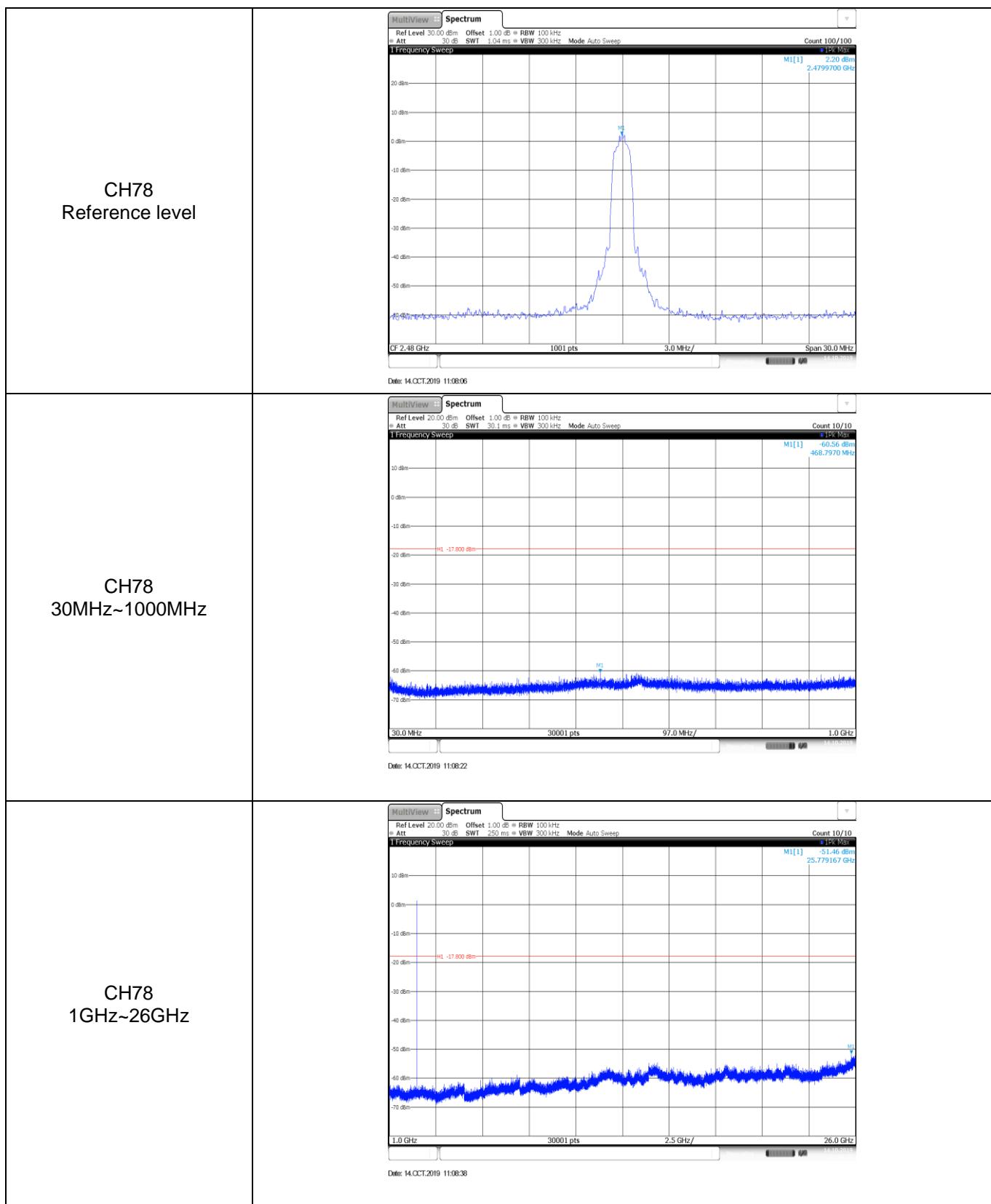
Test Item:	SE	Modulation type:	GFSK
CH00 Reference level			
CH00 30MHz~1000MHz			
CH00 1GHz~26GHz			



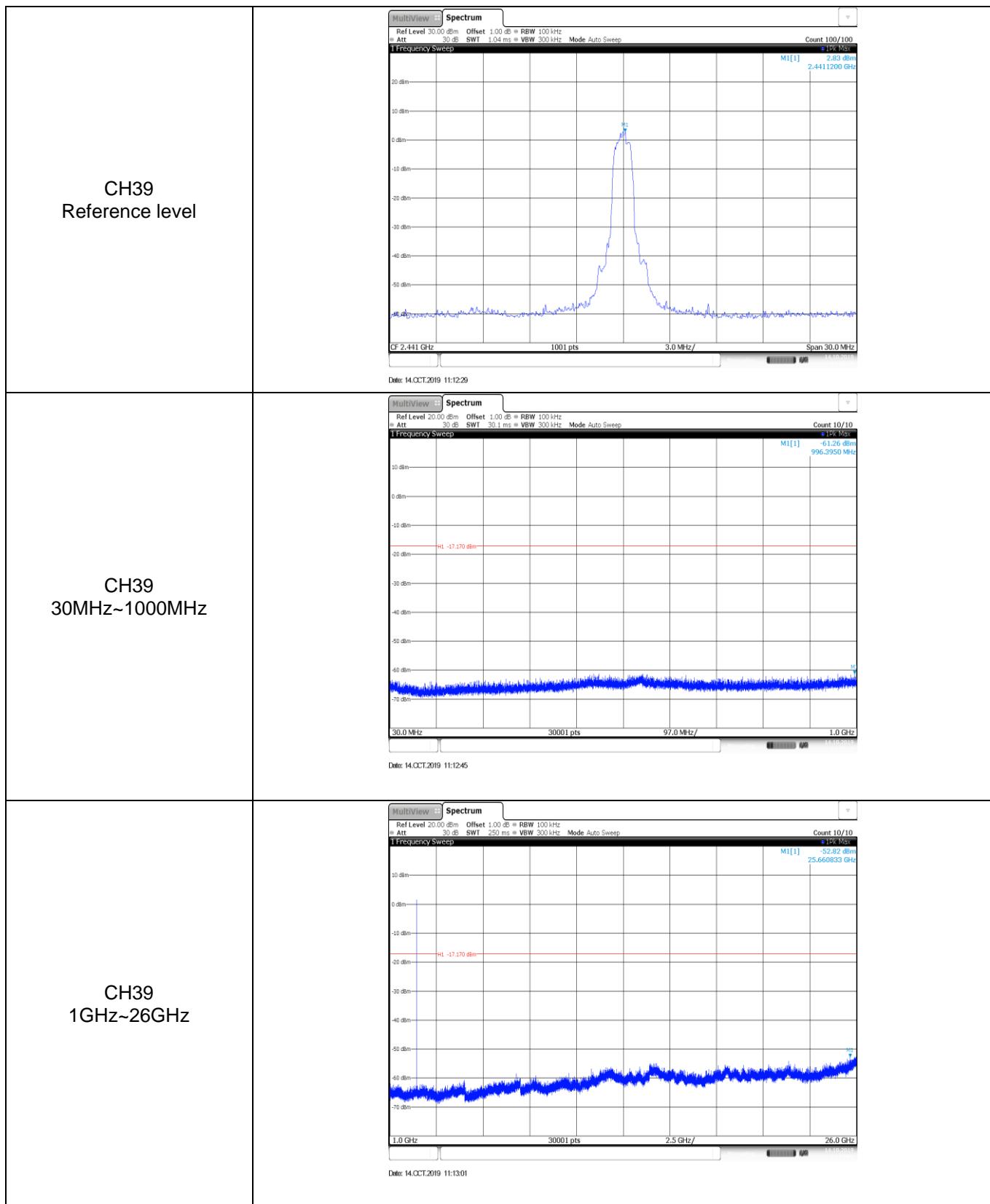


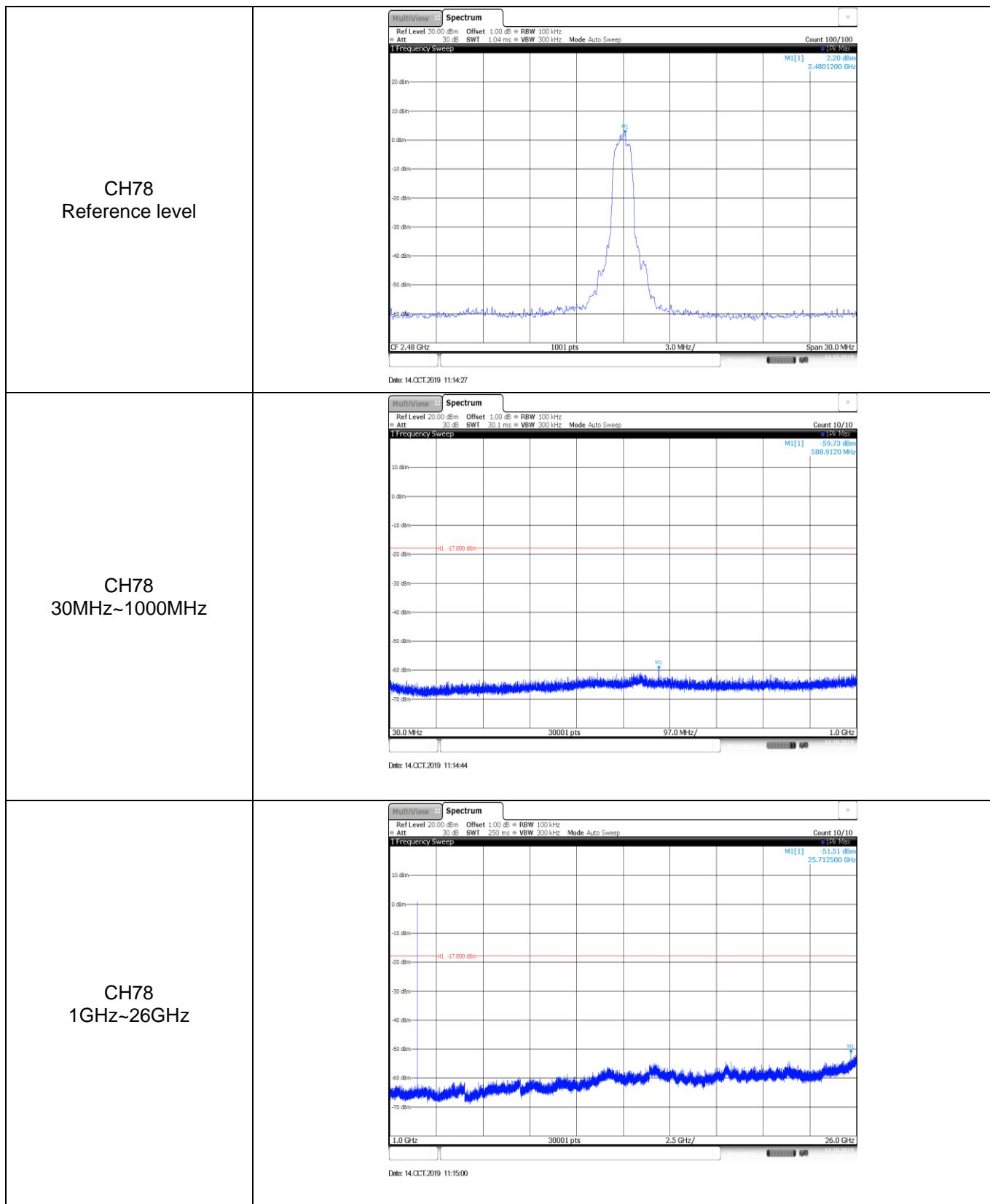
Test Item:	SE	Modulation type:	$\pi/4$ DQPSK
CH00 Reference level			 <p>Date: 14.OCT.2019 11:03:51</p>
CH00 30MHz~1000MHz			 <p>Date: 14.OCT.2019 11:04:07</p>
CH00 1GHz~26GHz			 <p>Date: 14.OCT.2019 11:04:23</p>





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





5.11. Spurious Emissions (radiated)

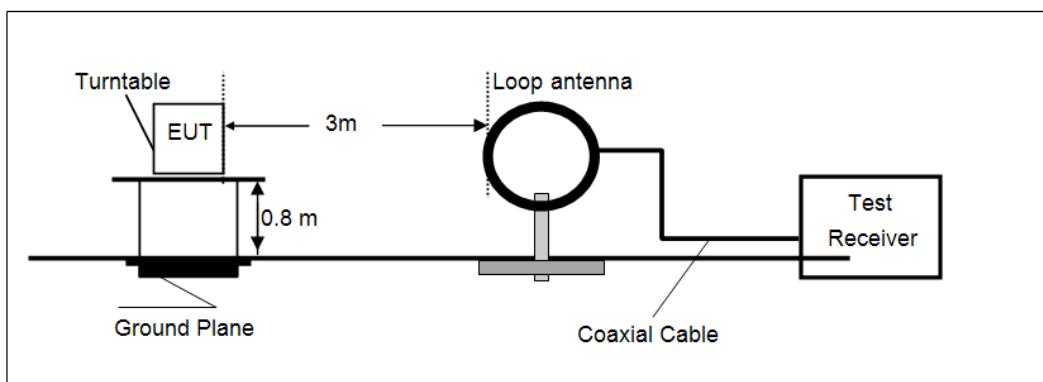
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209

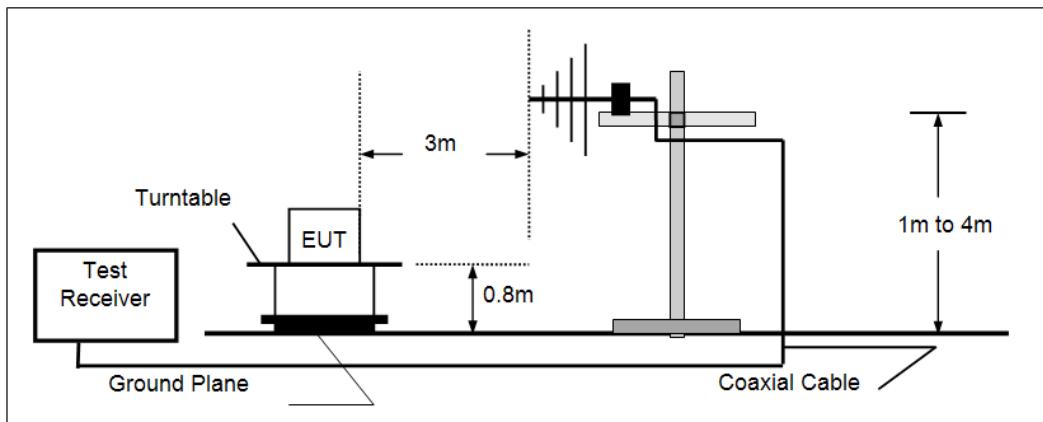
Frequency	Limit (dB _{UV} /m @ 3m)	Value
30 MHz ~ 88 MHz	40.00	Quasi-peak
88 MHz ~ 216 MHz	43.50	Quasi-peak
216 MHz ~ 960 MHz	46.00	Quasi-peak
960 MHz ~ 1 GHz	54.00	Quasi-peak
Above 1 GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

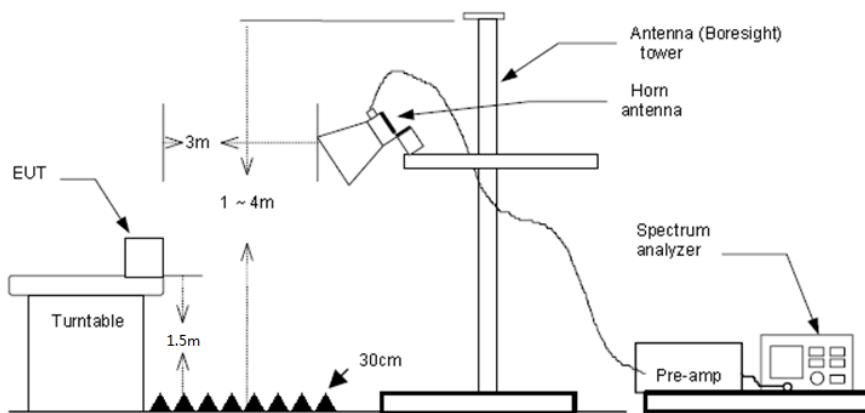
- Below 30 MHz



- 30 MHz ~1000 MHz



- Above 1 GHz



TEST PROCEDURE

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

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

Passed Not Applicable

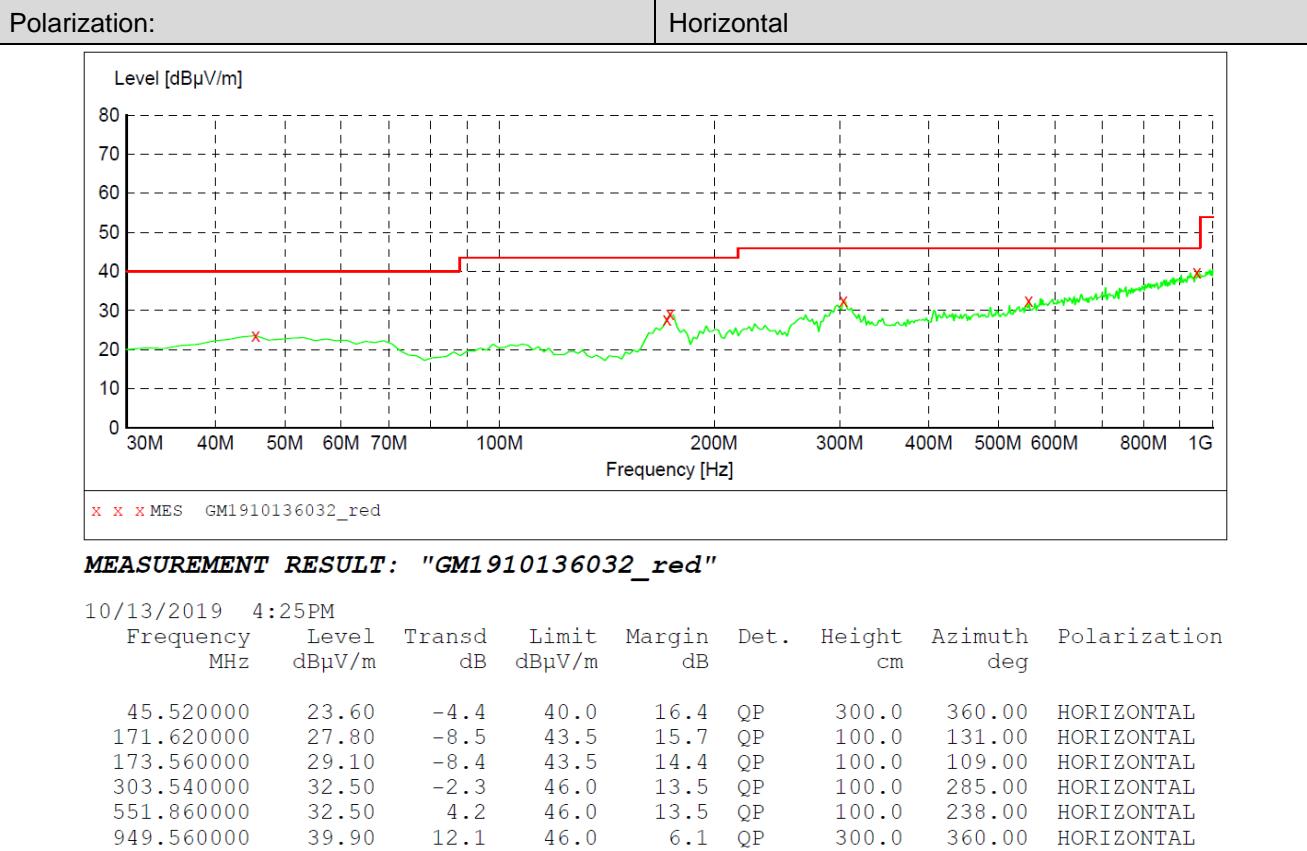
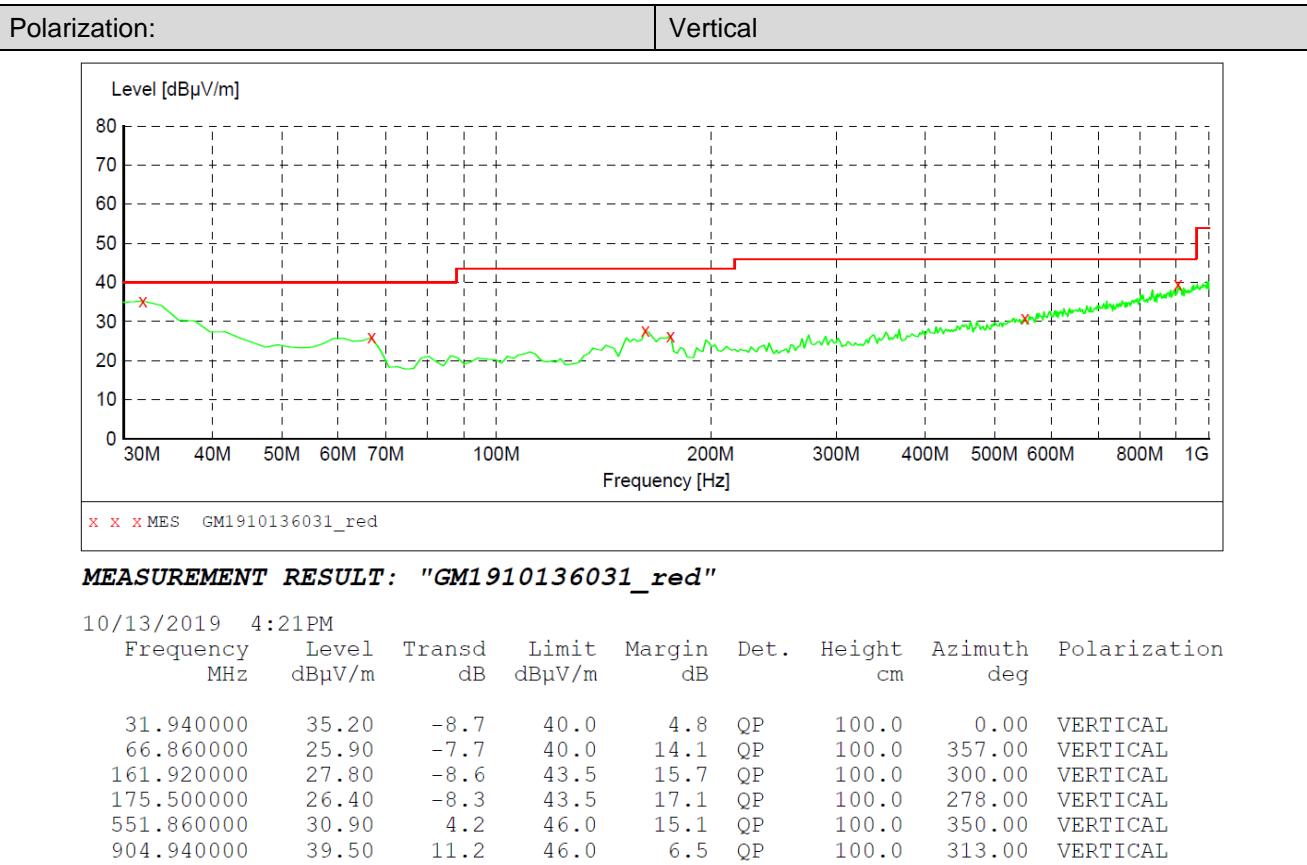
Note:

- 1) Final Level = Receiver Read level + 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							
Freq. [MHz]	Reading [dB μ V/m]	Factor [dB]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Polarity	Detector
1240.875	34.44	-5.72	28.72	74.00	45.28	Horizontal	PK
3188.437	34.23	0.78	35.01	74.00	38.99	Horizontal	PK
4713.000	31.17	6.47	37.64	74.00	36.36	Horizontal	PK
6061.312	30.77	10.62	41.39	74.00	32.61	Horizontal	PK

Freq. [MHz]	Reading [dB μ V/m]	Factor [dB]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Polarity	Detector
1220.312	35.25	-5.78	29.47	74.00	44.53	Vertical	PK
3172.281	34.26	0.70	34.96	74.00	39.04	Vertical	PK
4257.687	40.29	3.79	44.08	74.00	29.92	Vertical	PK
4981.781	34.70	7.73	42.43	74.00	31.57	Vertical	PK

CH39							
Freq. [MHz]	Reading [dB μ V/m]	Factor [dB]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Polarity	Detector
1189.468	35.22	-5.94	29.28	74.00	44.72	Horizontal	PK
3189.906	34.46	0.79	35.25	74.00	38.75	Horizontal	PK
4989.125	33.01	7.78	40.79	74.00	33.21	Horizontal	PK
6651.750	29.83	13.32	43.15	74.00	30.85	Horizontal	PK
Freq. [MHz]	Reading [dB μ V/m]	Factor [dB]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Polarity	Detector
1233.531	34.54	-5.74	28.80	74.00	45.20	Vertical	PK
3173.750	34.77	0.70	35.47	74.00	38.53	Vertical	PK
4978.843	36.48	7.71	44.19	74.00	29.81	Vertical	PK
6833.875	30.50	13.50	44.00	74.00	30.00	Vertical	PK

CH78							
Freq. [MHz]	Reading [dB μ V/m]	Factor [dB]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Polarity	Detector
1239.406	34.87	-5.73	29.14	74.00	44.86	Horizontal	PK
3173.750	34.46	0.70	35.16	74.00	38.84	Horizontal	PK
4510.312	32.02	5.39	37.41	74.00	36.59	Horizontal	PK
6654.687	30.66	13.33	43.99	74.00	30.01	Horizontal	PK
Freq. [MHz]	Reading [dB μ V/m]	Factor [dB]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Polarity	Detector
1242.343	34.51	-5.72	28.79	74.00	45.21	Vertical	PK
3148.781	33.56	0.57	34.13	74.00	39.87	Vertical	PK
4270.906	34.52	3.78	38.30	74.00	35.70	Vertical	PK
4983.250	33.71	7.74	41.45	74.00	32.55	Vertical	PK

Remark:

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

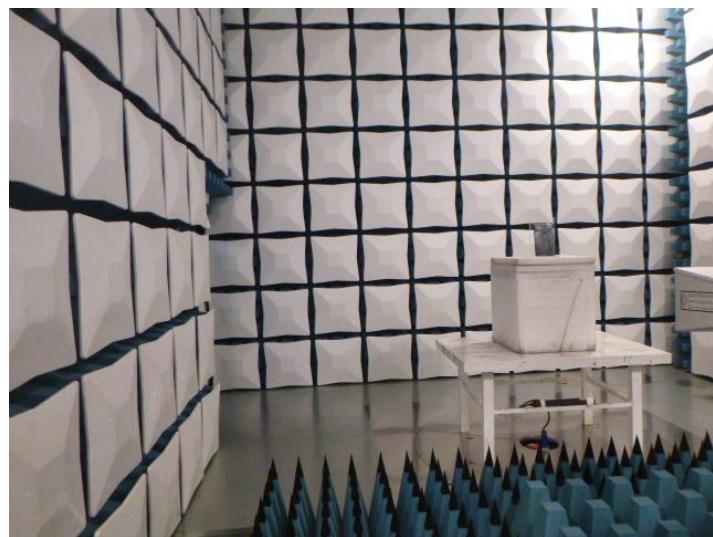
6. TEST SETUP PHOTOS

Conducted Emissions (AC Mains)



Radiated Emissions





7. EXTERANAL AND INTERNAL PHOTOS

Reference to the test report No. CHTEW19100128

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