FCC RF Test Report

For

SHENZHEN GIEC DIGITAL CO., LTD

Test Standards:	Part 15C Subpart C §15.247
Product Description:	all in one
Tested Model:	GK-MWZE501
Additional Model No.:	WGC22T324S, TLGC22T324S
Brand Name:	N/A
FCC ID:	2AHYK09586AIO
Classification	Digital Spread Spectrum (DSS)
Report No.:	GTS201901000080F02
Tested Date:	2019-02-14 to 2019-03-24
Issued Date:	2019-03-24
Prepared By:	
Approved By:	

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Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	2019.03.24	Valid	Original Report

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Summary of Test Result

FCC Rule	Description	Limit	Result	Remark
15.247(a)(1)	20dB Bandwidth	NA	Pass	-
-	99% Bandwidth	-	Pass	-
15.247(a)(1)	Hopping Channel Separation	≥ 2/3 of 20dB BW	Pass	-
15.247(a)(1)	Number of Channels	≥ 15Chs	Pass	-
15.247(a)(1)	Average Time of Occupancy	≤ 0.4sec in 31.6sec period	Pass	-
15.247(b)(1)	Peak Output Power	≤ 125 mW	Pass	-
15.247(d)	Conducted Band Edges	≤ 20dBc	Pass	-
15.247(d)	Conducted Spurious Emission	≤ 20dBc	Pass	-
15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 2.64 dB at 158.1 MHz
15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 5.05 dB at 4.926 MHz
15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-

1 Test Laboratory

1.1 Test facility

The test facility is recognized, certified, or accredited by the following organizations:

● **FCC —Registration No.: 381383**

Global United Technology Services Co., Ltd., Shenzhen 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 files. Registration 381383.

● **Industry Canada (IC) —Registration No.: 9079A-2**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2.

● **NVLAP (LAB CODE:600179-0)**

Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). LAB CODE:600179-0

2 General Description

2.1 Applicant

SHENZHEN GIEC DIGITAL CO., LTD
1st&3rd Building，No.26 Puzai Road，Pingdi，Longgang District, Shenzhen, China

2.2 Manufacturer

SHENZHEN GIEC DIGITAL CO., LTD
1st&3rd Building，No.26 Puzai Road，Pingdi，Longgang District, Shenzhen, China

2.3 General Description Of EUT

Product	all in one
Model No.	GK-MWZE501
Additional No.	WGC22T324S, TLGC22T324S
Difference Description	All above models are identical in the same PCB layout, interior structure and electrical circuits. The only differences are the colour and trade mark for commercial purpose.
FCC ID	2AHYK09586AIO
Power Supply	120Vdc (adapter or host equipment)
Modulation Technology	FHSS
Modulation Type	GFSK, 8DPSK, π/4 DQPSK
Operating Frequency	2402MHz~2480MHz
Number Of Channel	79
Max. Output Power	Bluetooth BR(1Mbps) : 5.831 dBm (0.00383 W) Bluetooth EDR (2Mbps) : 2.085 dBm (0.00162 W) Bluetooth EDR (3Mbps) : 2.290 dBm (0.00170 W)
Antenna Type	FPC Antenna with 2.0±0.5dBi gain
I/O Ports	Refer to user's manual

NOTE:

1. The EUT was powered by the following adapters:

ADAPTER 1	
BRAND:	N/A
MODEL:	TAA0361200300HU
INPUT:	AC 100-240V, 50/60Hz,1A
OUTPUT:	DC 12V, 3000mA
DC LINE:	N/A

2. For a more detailed features description, please refer to the manufacturer's specifications or the user's

manual.

3. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

2.4 Modification of EUT

No modifications are made to the EUT during all test items.

2.5 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- ANSI C63.10-2013
- KDB 558074 D01 15.247 Meas Guidance v05r01

Remark:

1. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

3 Test Configuration of Equipment Under Test

3.1 Descriptions of Test Mode

The transmitter has a maximum peak conducted output power as follows:

Channel	Frequency	Mode	Bluetooth RF Output Power
Ch00	2402MHz	GFSK	4.903
		4π -DQPSK	1.028
		8PSK	1.216
Ch39	2441MHz	GFSK	5.831
		4π -DQPSK	2.085
		8PSK	2.290
Ch78	2480MHz	GFSK	5.303
		4π -DQPSK	1.569
		8PSK	1.732

Remark:

1. All the test data for each data rate were verified, but only the worst case was reported.
2. The data rate was set in 1Mbps for all the test items due to the highest RF output power.

a. Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

b. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

3.2 Test Mode

3.2.1 Antenna Port Conducted Measurement

Summary table of Test Cases			
Test Item	Data Rate / Modulation		
	Bluetooth BR 1Mbps GFSK	Bluetooth EDR 2Mbps π/4-DQPSK	Bluetooth EDR 3Mbps 8-DPSK
Conducted Test Cases	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz	Mode 4: CH00_2402 MHz Mode 5: CH39_2441 MHz Mode 6: CH78_2480 MHz	Mode 7: CH00_2402 MHz Mode 8: CH39_2441 MHz Mode 9: CH78_2480 MHz

3.2.2 Radiated Emission Test (Below 1GHz)

Radiated Test Cases	Bluetooth BR 1Mbps GFSK
	Mode 1: CH00_2441 MHz

Note : 1. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.

2. Following channel(s) was (were) selected for the final test as listed above

3.2.3 Radiated Emission Test (Above 1GHz)

Radiated Test Cases	Bluetooth BR 1Mbps GFSK
	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz

Note : 1. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.

2. Following channel(s) was (were) selected for the final test as listed above

3.2.4 Power Line Conducted Emission Test:

AC Conducted Emission	
	Mode 1 : Bluetooth Idel + WLAN Idel+ Earphone + Cable (Charging from Adapter) + SD Card+USB flash disk

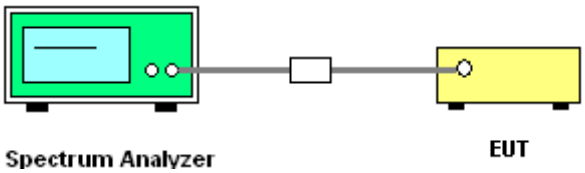
3.3 Support Equipment

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
2.	Bluetooth Base Station	R&S	CBT	N/A	N/A	Unshielded, 1.8 m
3.	Bluetooth Earphone	Nokia	BH-108	PYAHS-107W	N/A	N/A
4.	WLAN AP	D-link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
5.	Micro SD Card	SanDisk	HC I	N/A	N/A	N/A
6.	USB flash disk	kingston	N/A	N/A	N/A	N/A
7.	displayer	DELL	P2317H	N/A	N/A	Unshielded, 1.8 m
8.	HDMI	UGREEN	N/A	N/A	Unshielded,1.5 m	N/A
9.	Notebook	Lenovo	Xiao xin cao 5000	N/A	N/A	shielded cable DC O/P 1.8 m unshielded AC I/P cable1.2 m

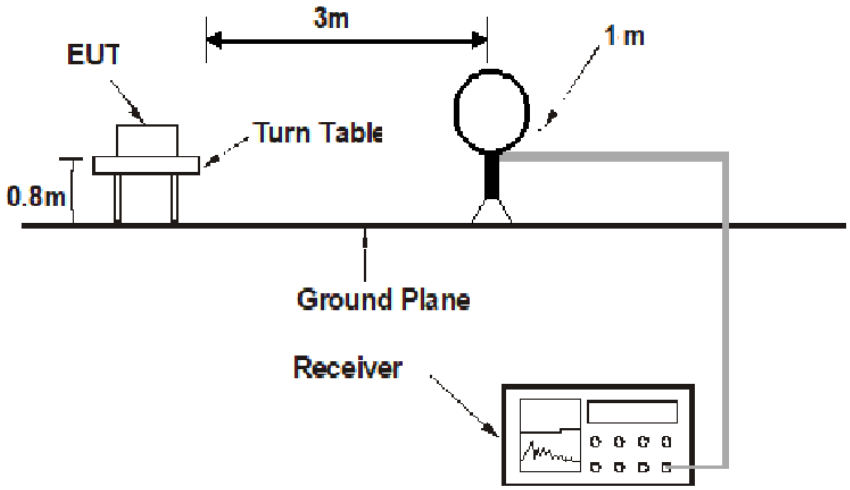
3.4 Test Setup

The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

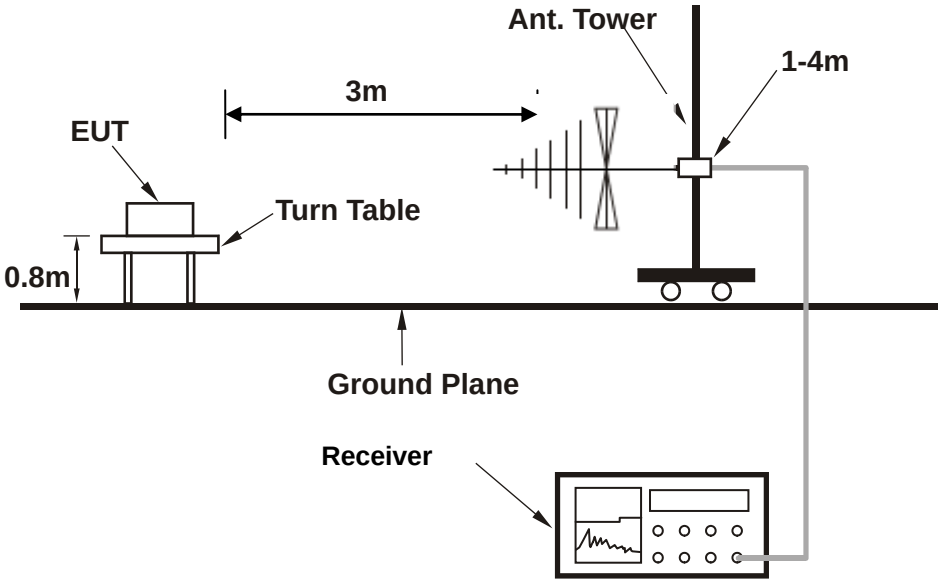
Setup diagram for Conducted Test



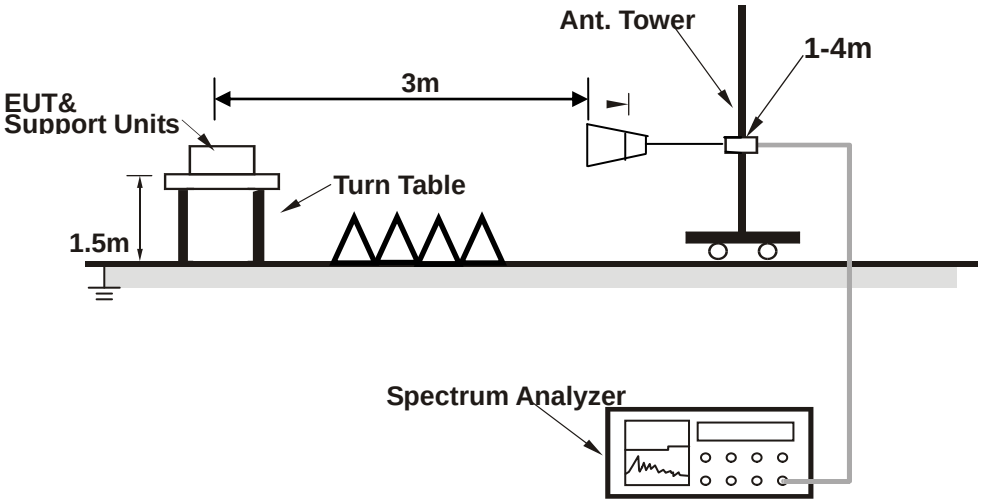
Setup diagram for Raidation(9KHz~30MHz) Test



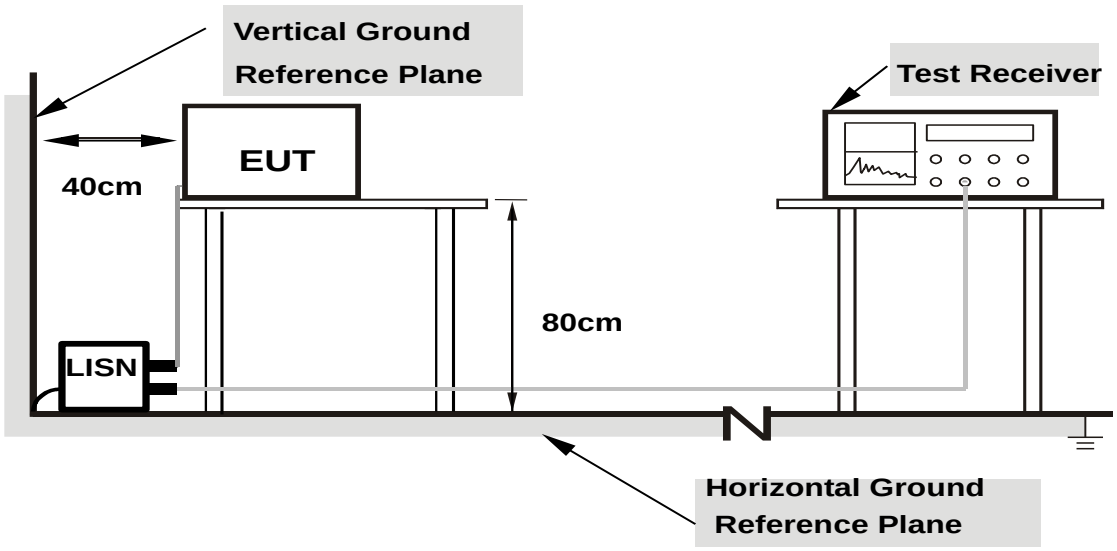
Setup diagram for Raidation(Below 1G) Test



Setup diagram for Raidation(Above1G) Test



Setup diagram for AC Conducted Emission Test



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

3.5 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 5 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 5 + 10 = 15 (dB)

4 Test Result

4.1 20dB and 99% Bandwidth Measurement

4.1.1 Limit of 20dB and 99% Bandwidth

None; for reporting purposes only.

4.1.2 Test Procedures

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument.
3. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.

   Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel; RBW ≥ 1% of the 20 dB bandwidth; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
4. Use the following spectrum analyzer settings for 99 % Bandwidth measurement.

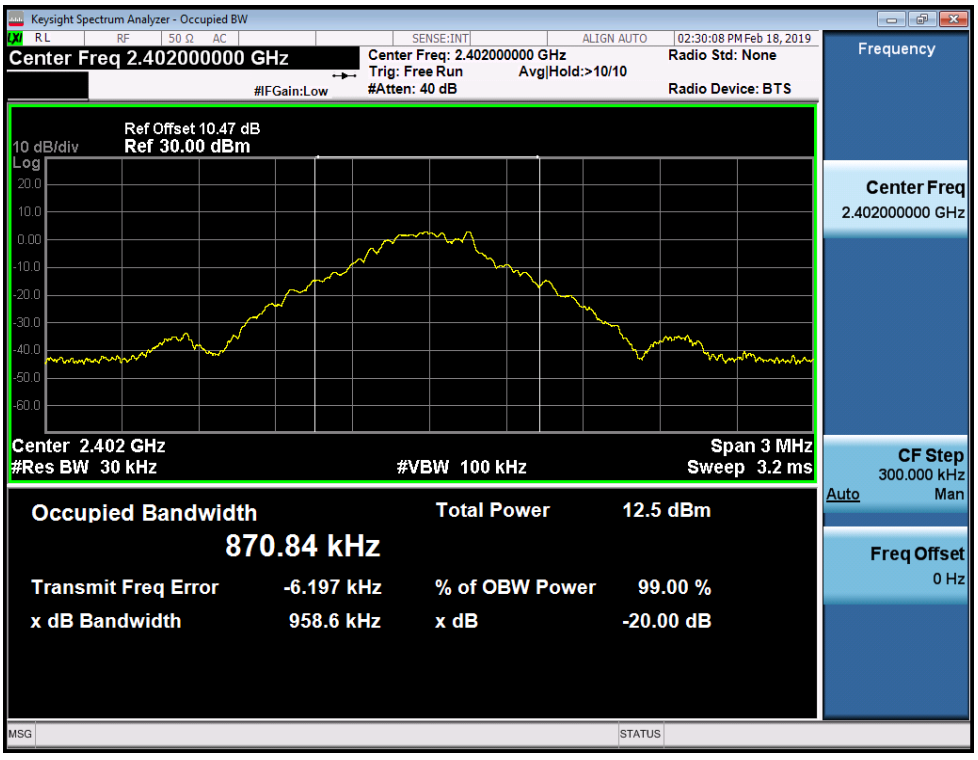
   Span = approximately 1.5 to 5 times the 99% bandwidth, centered on a hopping channel; RBW ≥ 1% of the 99% bandwidth; VBW ≥ RBW; Sweep = auto; Detector function = sample; Trace = max hold.

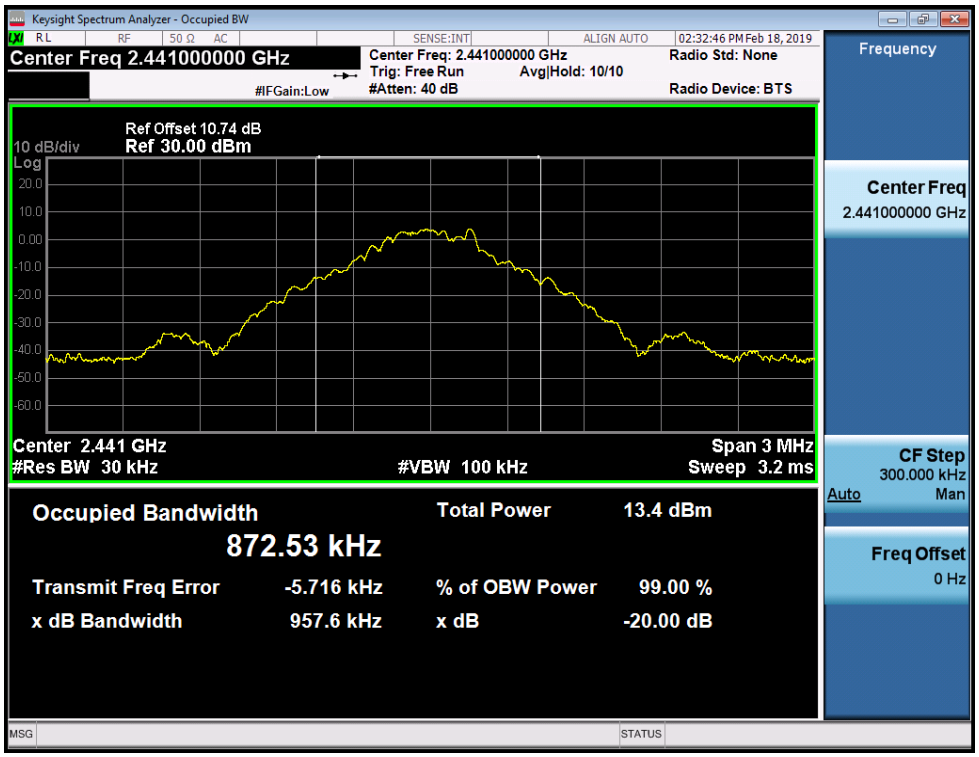
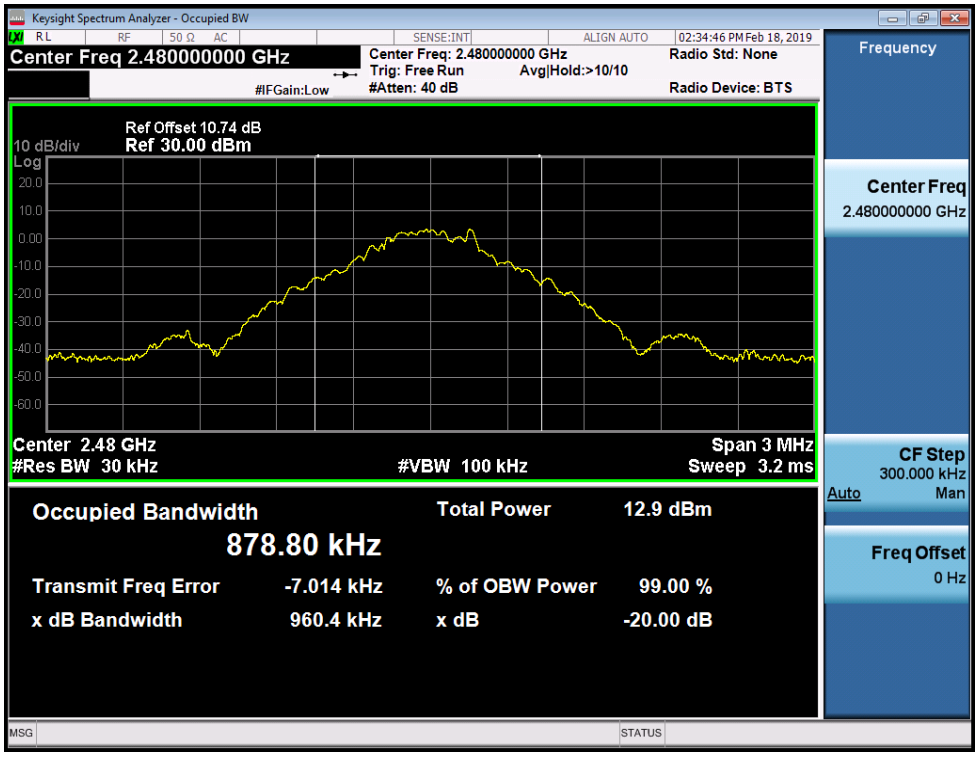
4.1.3 Test Result of 20dB Bandwidth and 99% Bandwidth

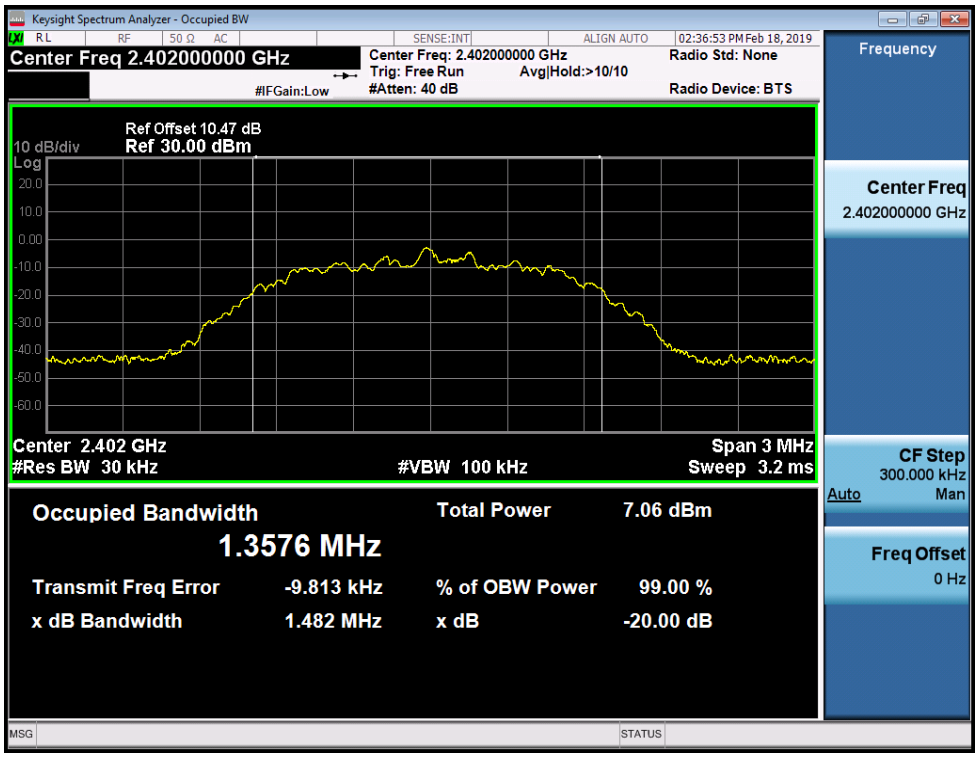
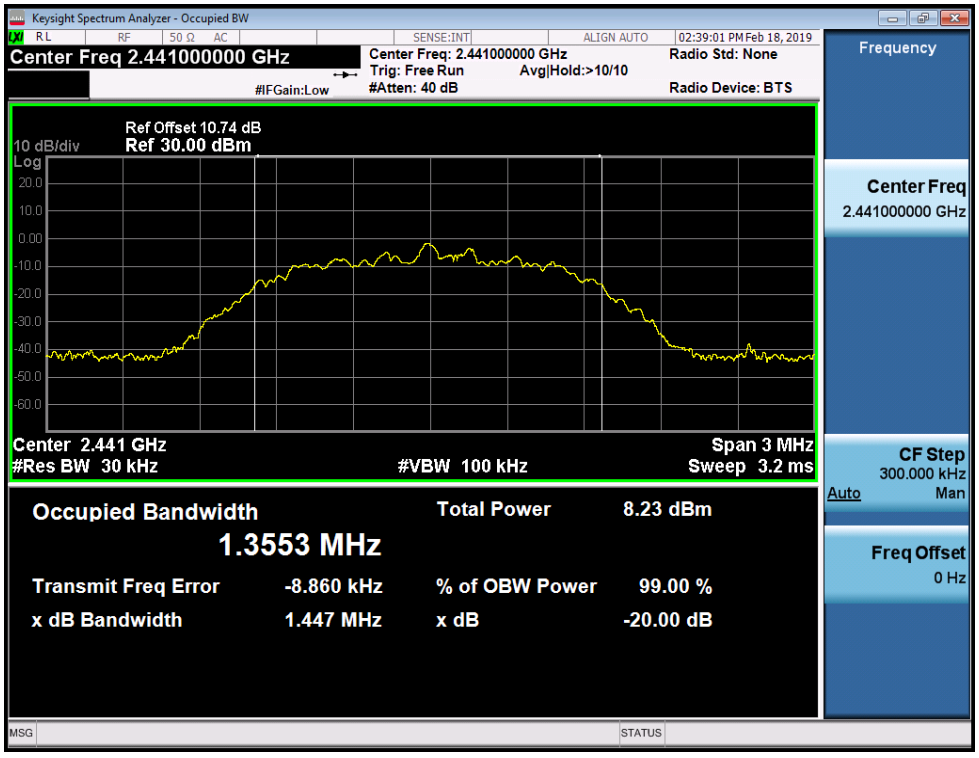
Test Mode :	1Mbps	Temperature :	24~26℃
Test Engineer :	Damon Zhang	Relative Humidity :	50~53%

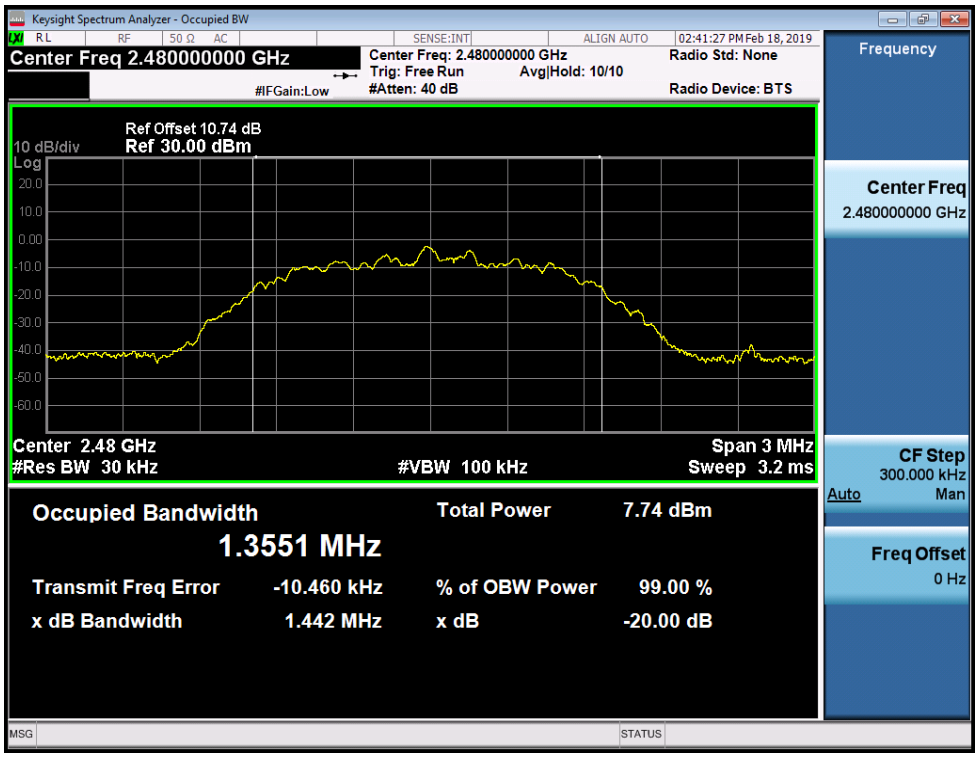
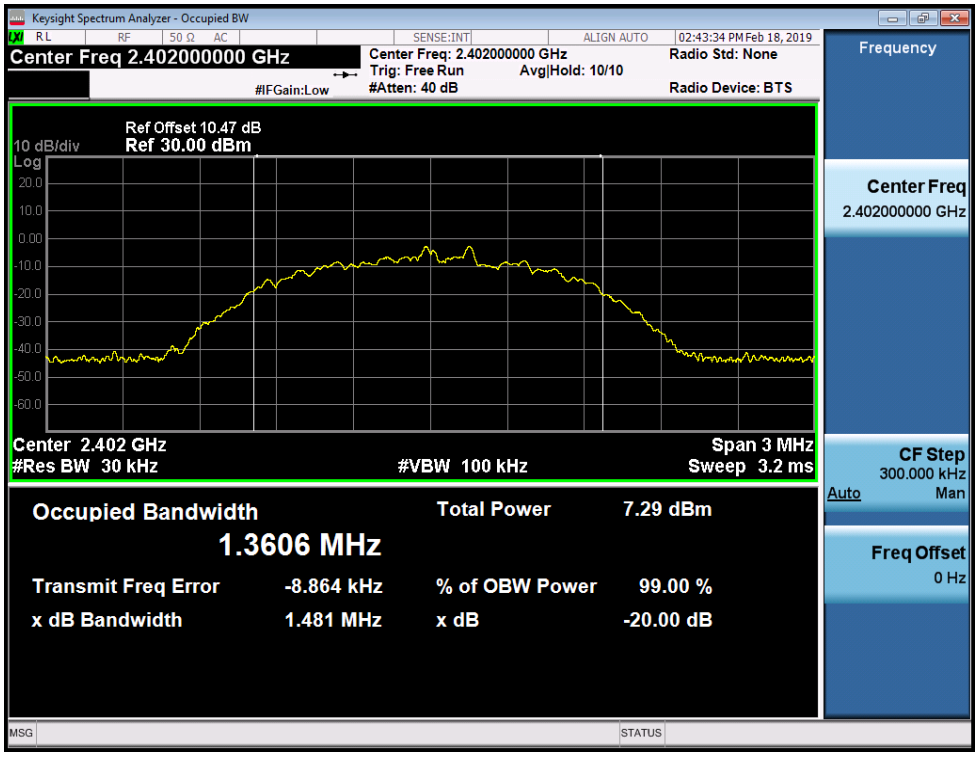
Mode	Channel.	20dB Bandwidth [MHz]	99% OBW [MHz]	Verdict
GFSK	LCH	0.9586	0.87084	PASS
GFSK	MCH	0.9576	0.87253	PASS
GFSK	HCH	0.9604	0.87880	PASS
π/4DQPSK	LCH	1.482	1.3576	PASS
π/4DQPSK	MCH	1.447	1.3553	PASS
π/4DQPSK	HCH	1.442	1.3551	PASS
8DPSK	LCH	1.481	1.3606	PASS
8DPSK	MCH	1.481	1.3575	PASS
8DPSK	HCH	1.481	1.3594	PASS

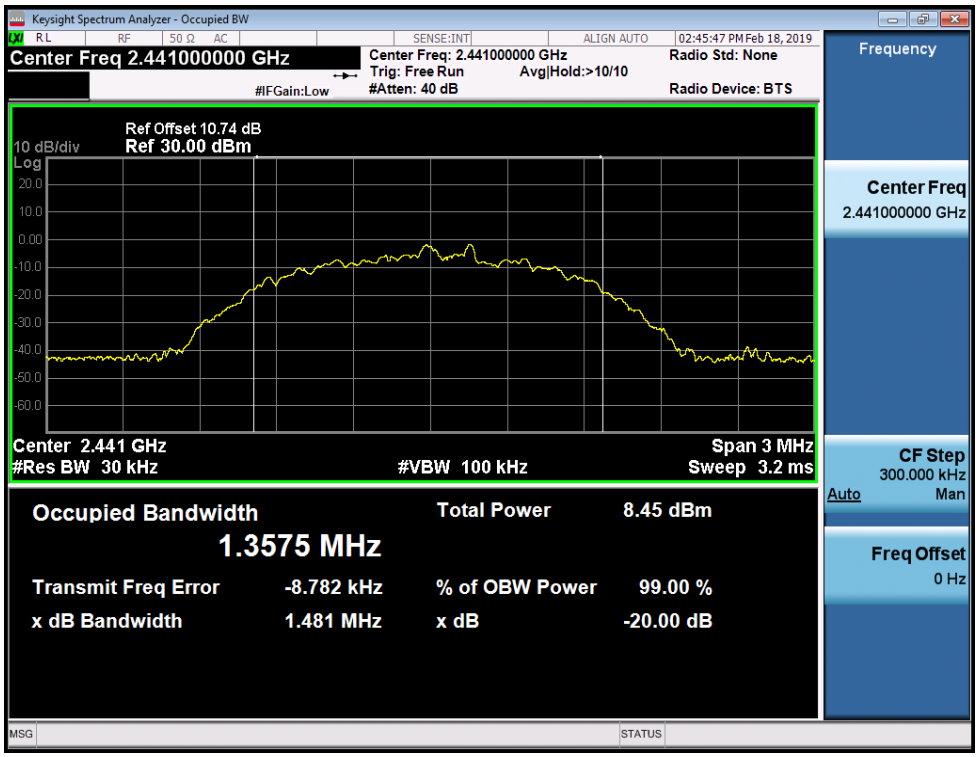
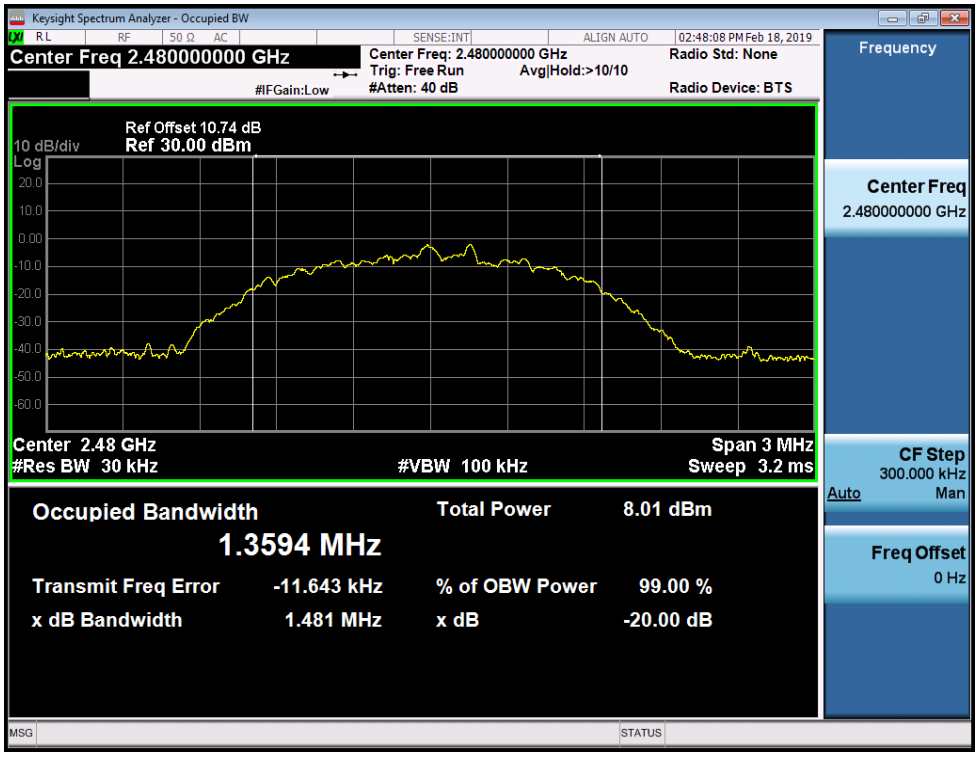
20dB and 99% Plot

Graphs	
GFSK/LCH	

GFSK/MCH	
GFSK/HCH	

π/4DQPSK/LCH	
π/4DQPSK/MCH	

π/4DQPSK/HCH	
8DPSK/LCH	

8DPSK/MCH	
8DPSK/HCH	

4.2 Hopping Channel Separation Measurement

4.2.1 Limit of Hopping Channel Separation

FCC §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 hoping 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.

4.2.2 Test Procedures

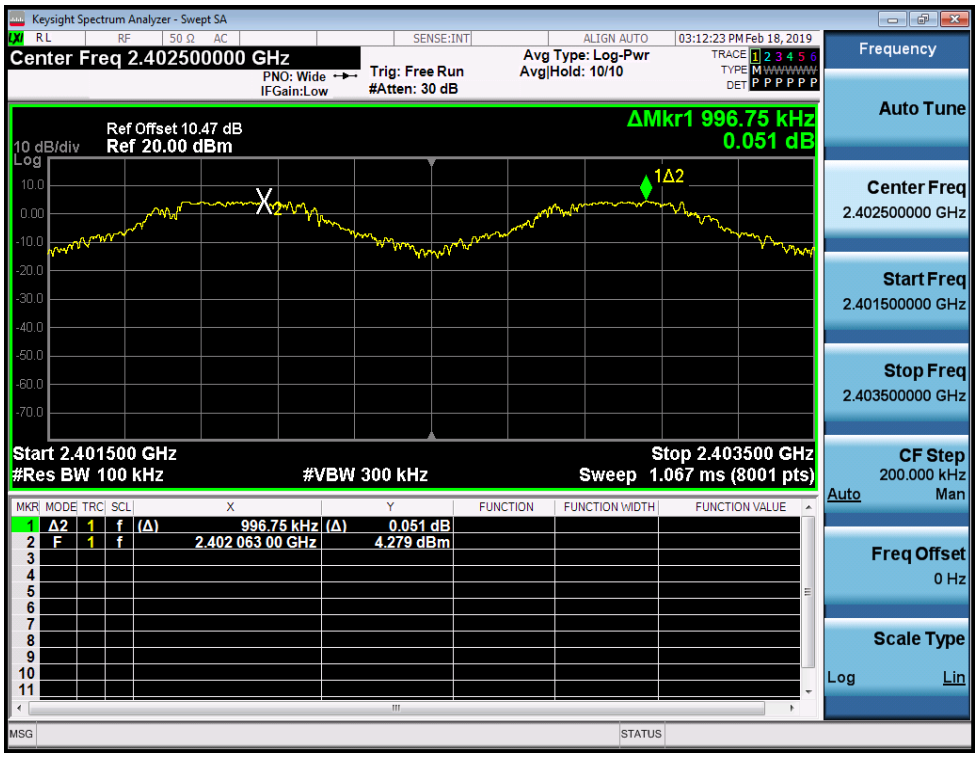
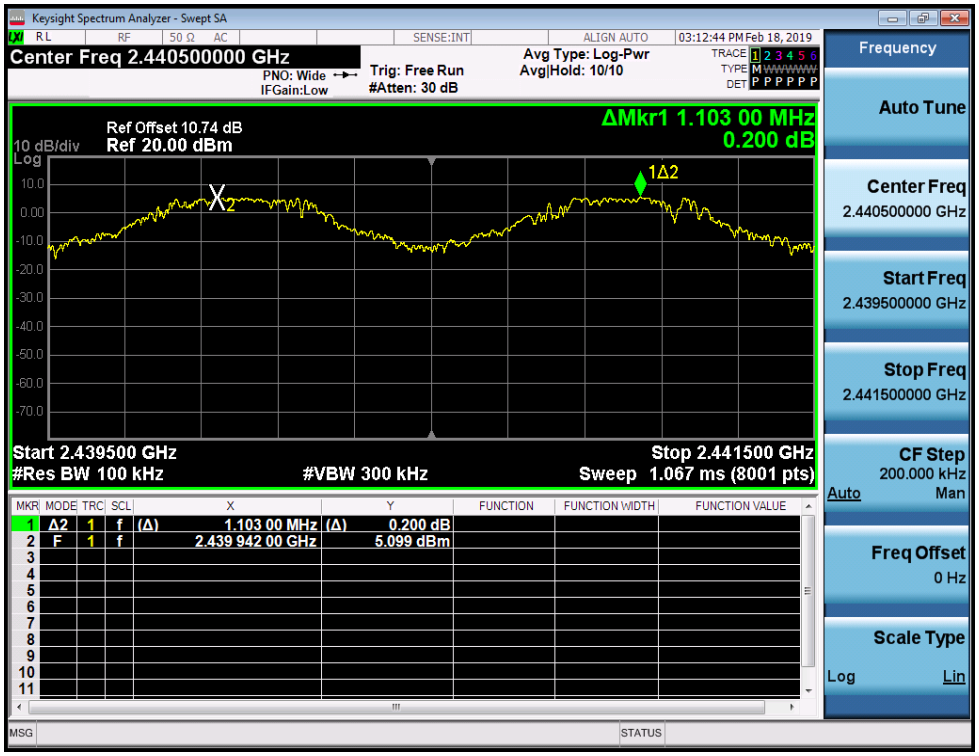
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument.
3. The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

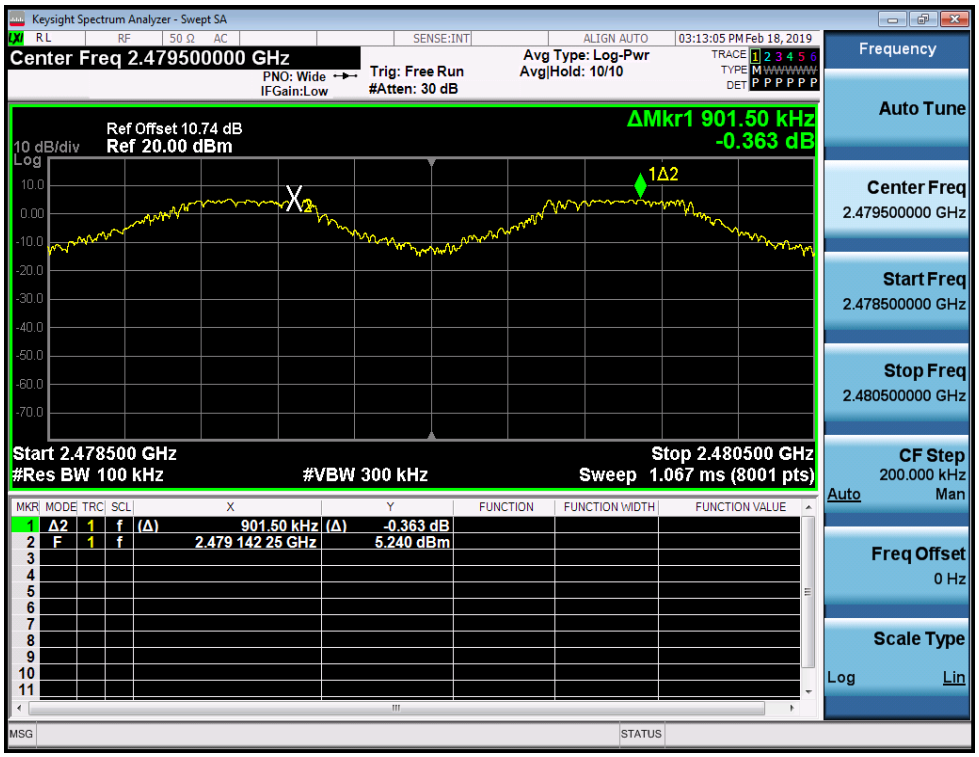
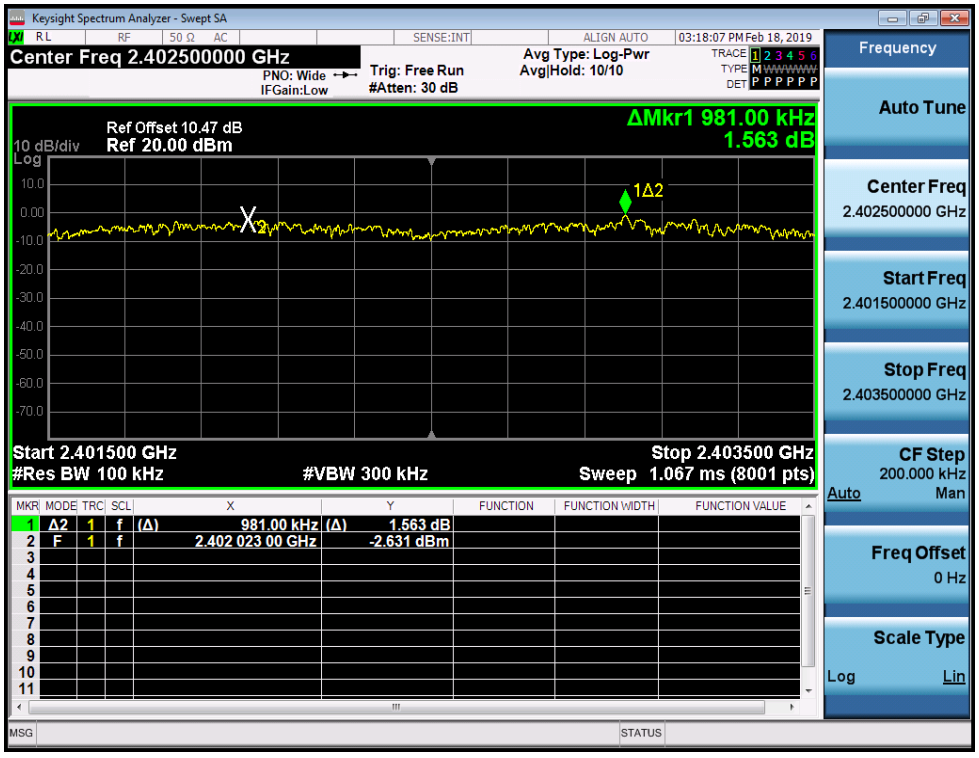
4.2.3 Test Result of Hopping Channel Separation

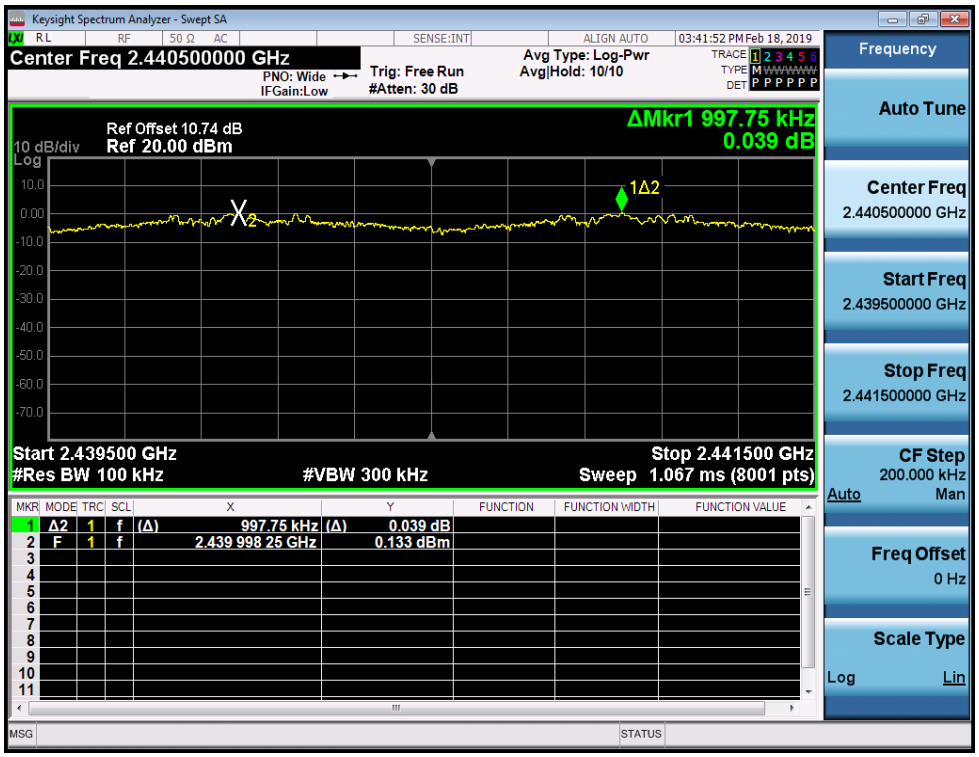
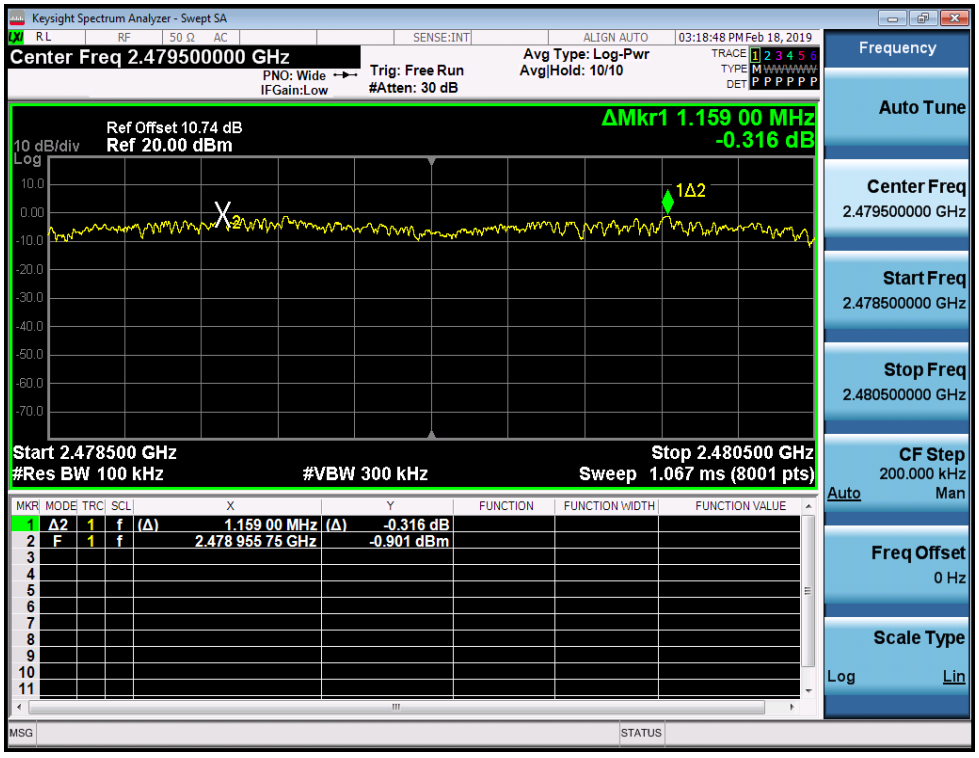
Test Mode :	1Mbps,2Mbps, 3Mbps	**Temperature :**	24~26℃
Test Engineer :	Damon Zhang	**Relative Humidity :**	50~53%

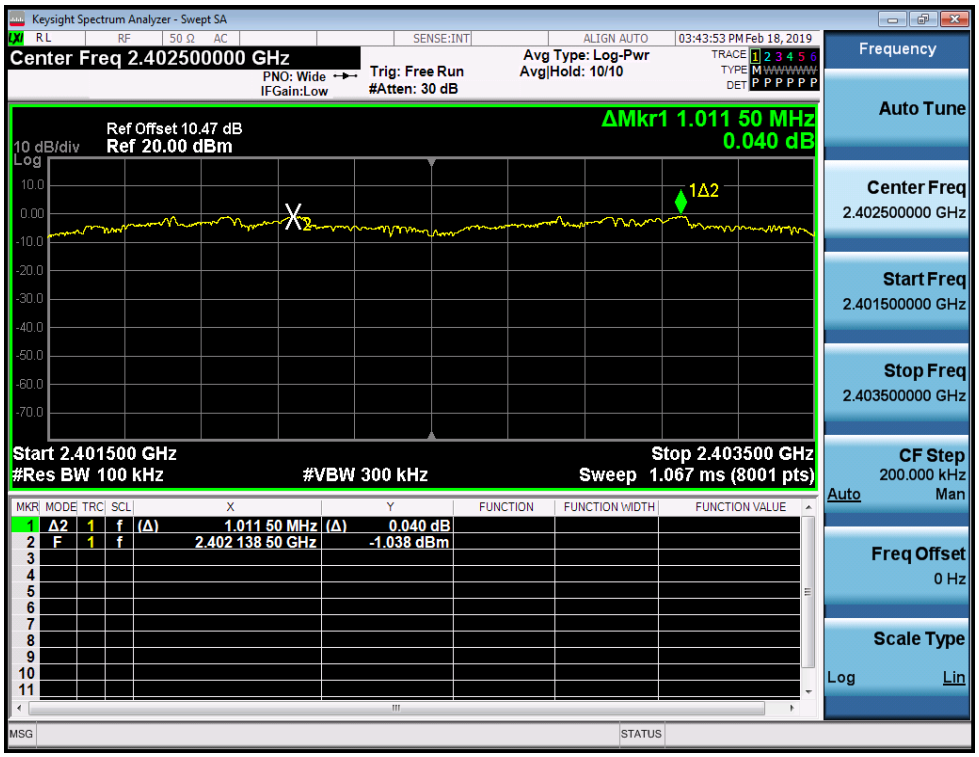
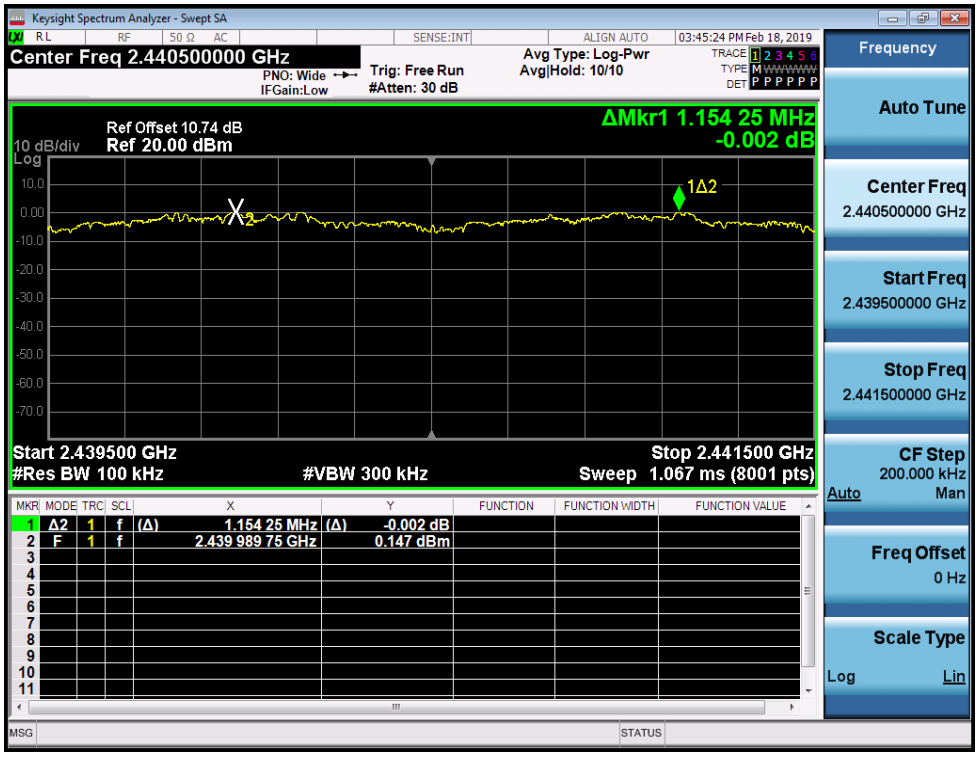
Mode	Channel.	Carrier Frequency Separation [MHz]	Verdict
GFSK	LCH	0.997	PASS
GFSK	MCH	1.103	PASS
GFSK	HCH	0.901	PASS
π/4DQPSK	LCH	0.981	PASS
π/4DQPSK	MCH	0.998	PASS
π/4DQPSK	HCH	1.159	PASS
8DPSK	LCH	1.012	PASS
8DPSK	MCH	1.154	PASS
8DPSK	HCH	1.008	PASS

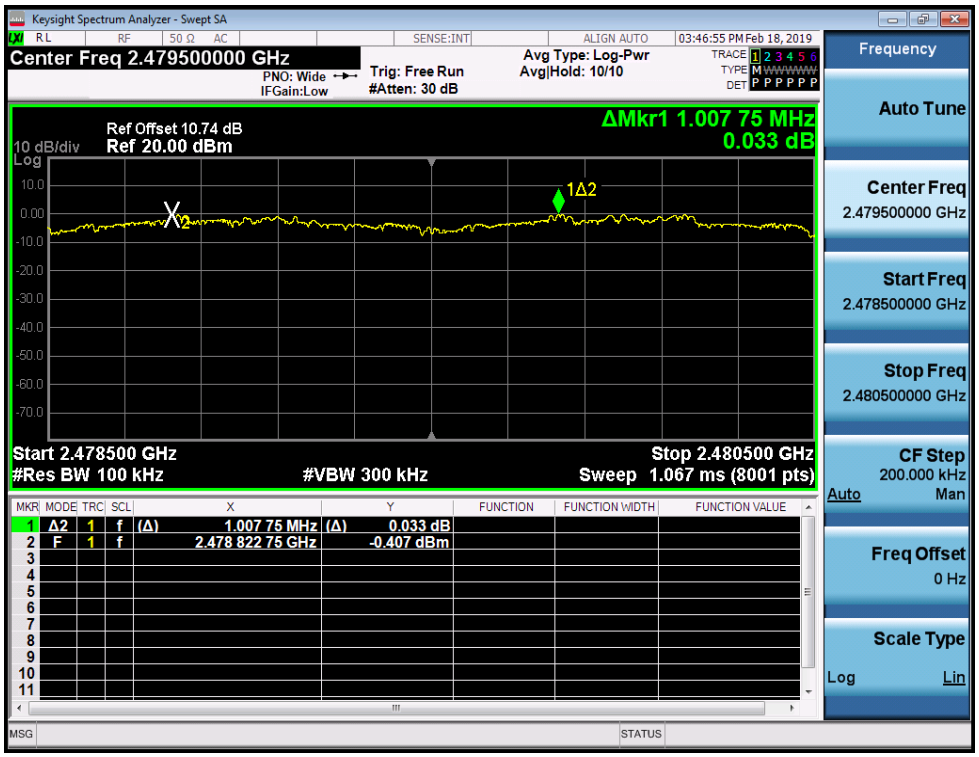
Hopping Frequency Separation Plot

Graphs	
GFSK/LCH	
GFSK/MCH	

GFSK/HCH	
π/4DQPSK/LCH	

π/4DQPSK/MCH	
π/4DQPSK/HCH	

8DPSK/LCH	
8DPSK/MCH	

8DPSK/HCH	

Keysight Spectrum Analyzer - Swept SA
Center Freq 2.479500000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
03:46:55 PM Feb 18, 2019
Ref Offset 10.74 dB
10 dB/div
Log
Ref 20.00 dBm
ΔMkr1 1.007 75 MHz
0.033 dB
Start 2.478500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.480500 GHz
Sweep 1.067 ms (8001 pts)
1 Δ2 1 f (Δ) 1.007 75 MHz (Δ) 0.033 dB
2 F 1 f 2.478 822 75 GHz -0.407 dBm
Frequency
Auto Tune
Center Freq
2.479500000 GHz
Start Freq
2.478500000 GHz
Stop Freq
2.480500000 GHz
CF Step
200.000 kHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin

4.3 Number of Channel Measurement

4.3.1 Limits of Number of Hopping Frequency

FCC § 15.247(a)(1)(iii)

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

4.3.2 Test Procedure

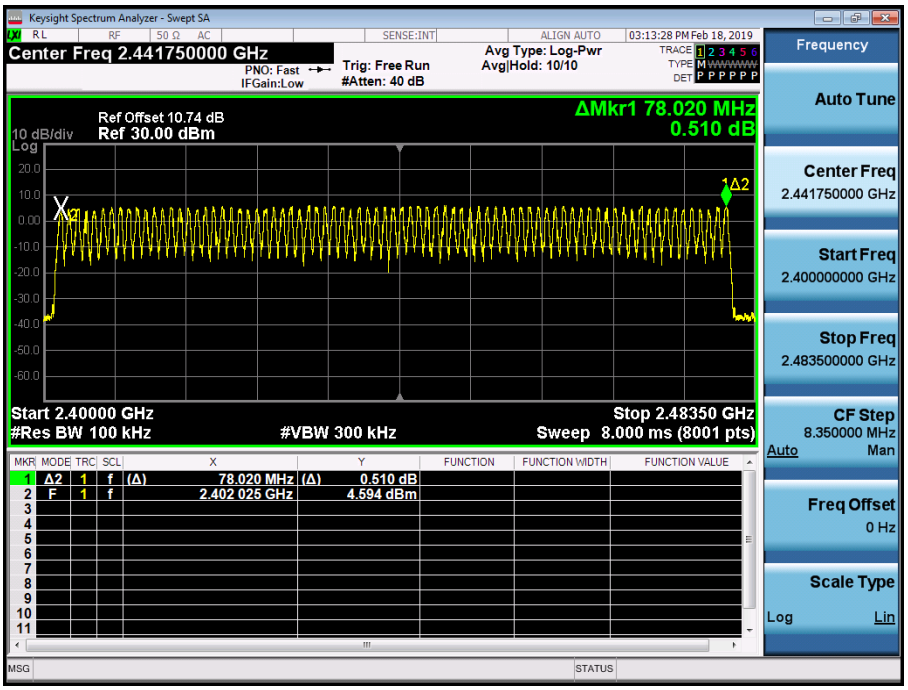
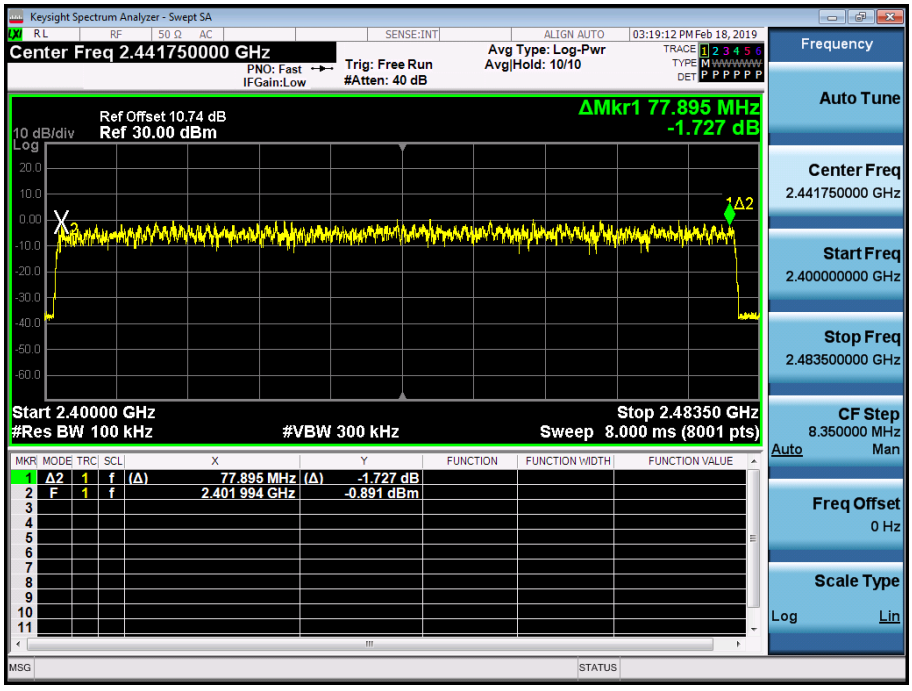
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument.
3. The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

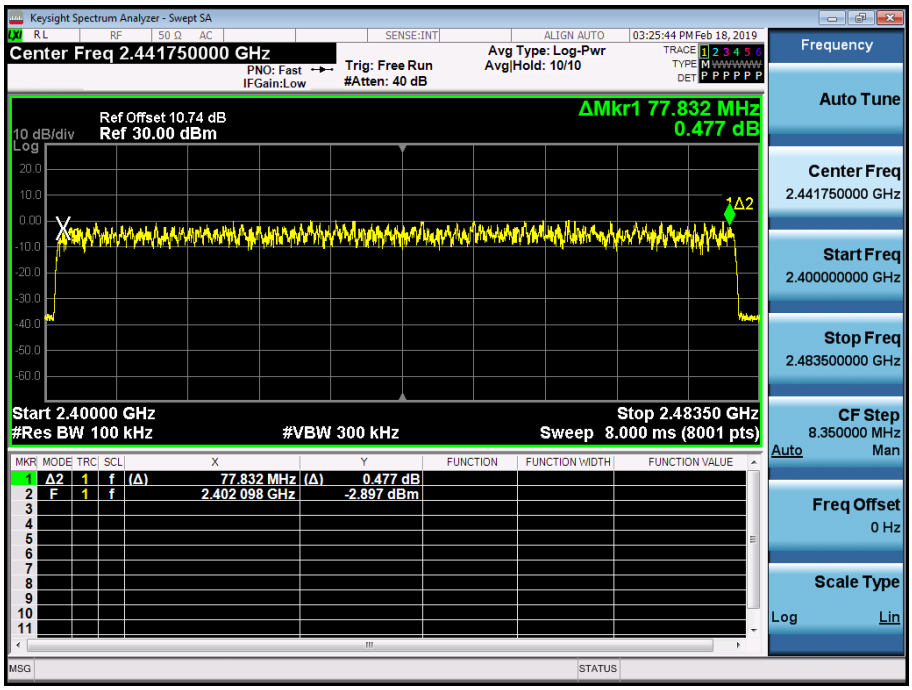
4.3.3 Test Result of Number of Hopping Frequency

Test Mode :	1Mbps,2Mbps, 3Mbps	**Temperature :**	24~26℃
Test Engineer :	Damon Zhang	**Relative Humidity :**	50~53%

Mode	Channel.	Number of Hopping Channel	Verdict
GFSK	Hop	79	PASS
π/4DQPSK	Hop	79	PASS
8DPSK	Hop	79	PASS

Number of Hopping Channels

Graphs	
GFSK/Hop	
π/4DQPSK/Hop	

8DPSK/Hop	

Keysight Spectrum Analyzer - Swept SA
Center Freq 2.441750000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
03:25:44 PM Feb 18, 2019
Ref Offset 10.74 dB
10 dB/div
Log
Ref 30.00 dBm
ΔMkr1 77.832 MHz
0.477 dB
Start 2.40000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.48350 GHz
Sweep 8.000 ms (8001 pts)
1 Δ2 1 f (Δ) 77.832 MHz (Δ) 0.477 dB
2 F 1 f 2.402 098 GHz -2.897 dBm
Frequency
Auto Tune
Center Freq
2.441750000 GHz
Start Freq
2.400000000 GHz
Stop Freq
2.483500000 GHz
CF Step
8.350000 MHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin

4.4 Average Time of Occupancy Measurement

4.4.1 Limit of Average Time of Occupancy

FCC §15.247 (a) (1) (iii)

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.

4.4.2 Test Procedures

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument.
3. The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.
4. The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements.

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

Test channel: 2441MHz as blow：

DH1 time slot= Burst Width (ms)*(1600/ (2*79))*31.6

DH3 time slot= Burst Width (ms)*(1600/ (4*79))*31.6

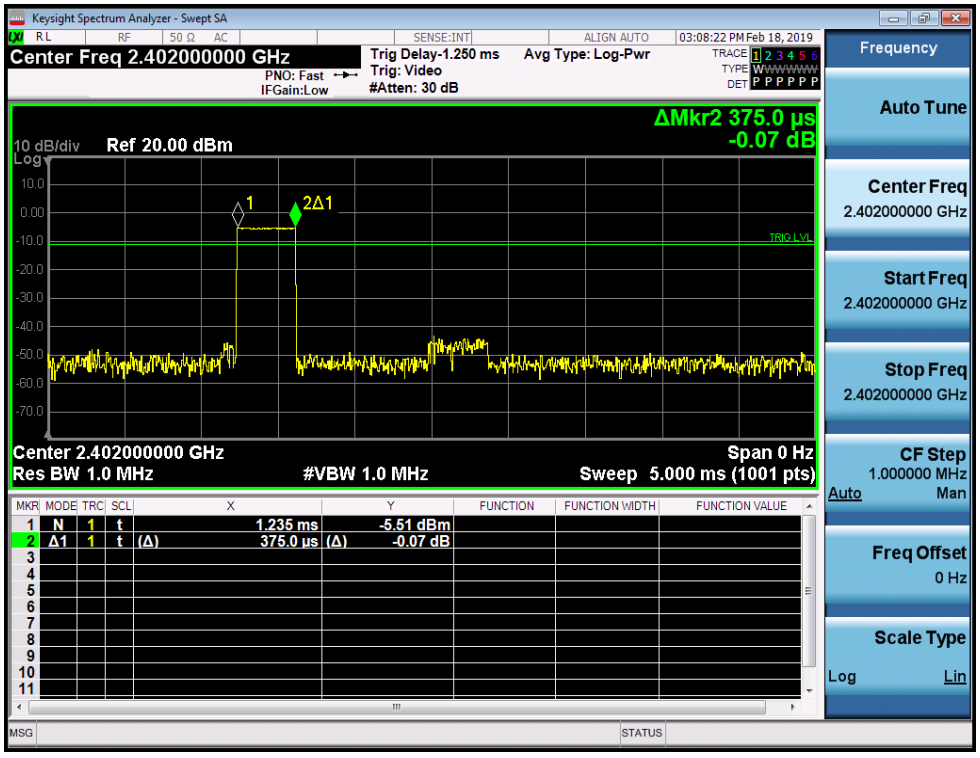
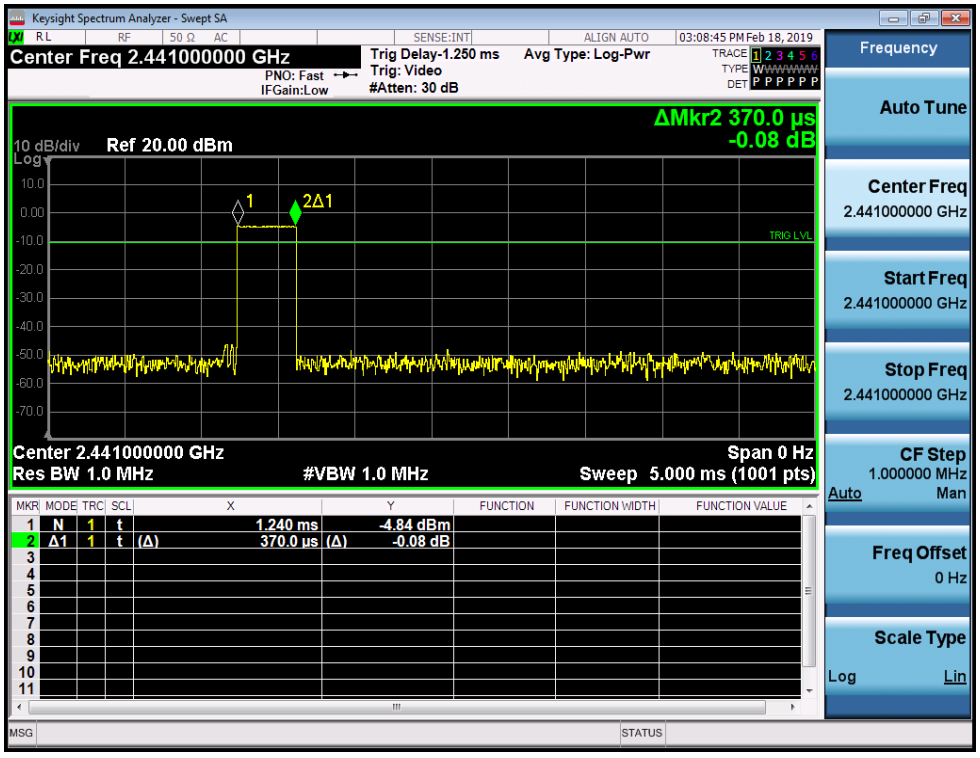
DH5 time slot= Burst Width (ms)*(1600/ (6*79))*31.6

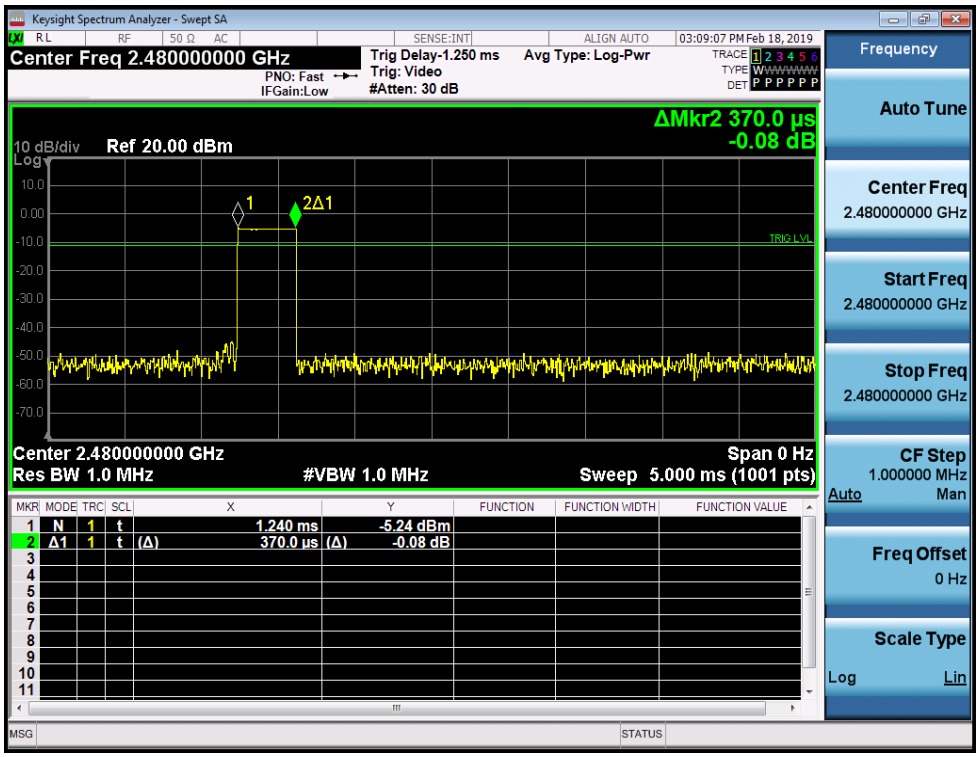
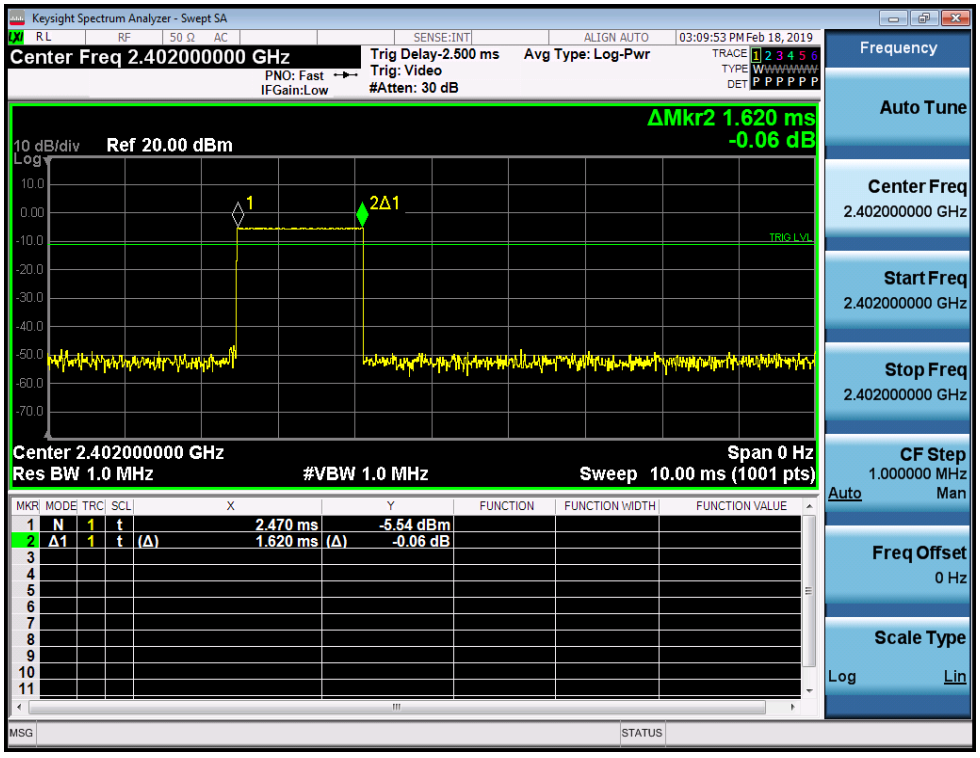
4.4.3 Test Result of Dwell Time

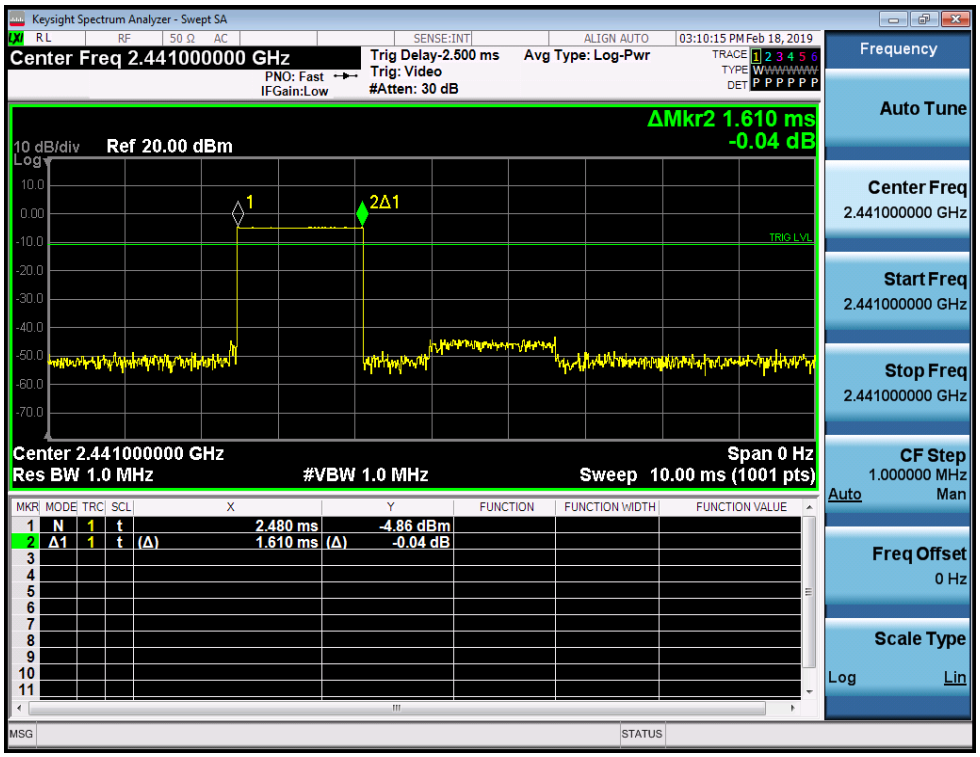
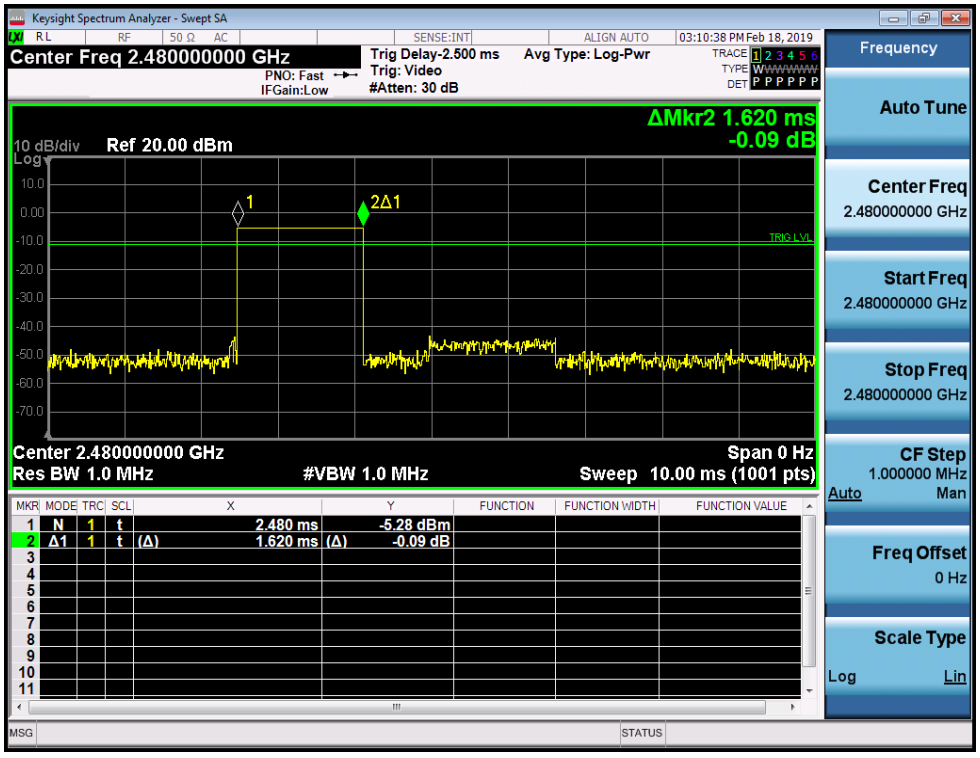
Test Mode :	1Mbps	Temperature :	24~26℃
Test Engineer :	Damon Zhang	Relative Humidity :	50~53%

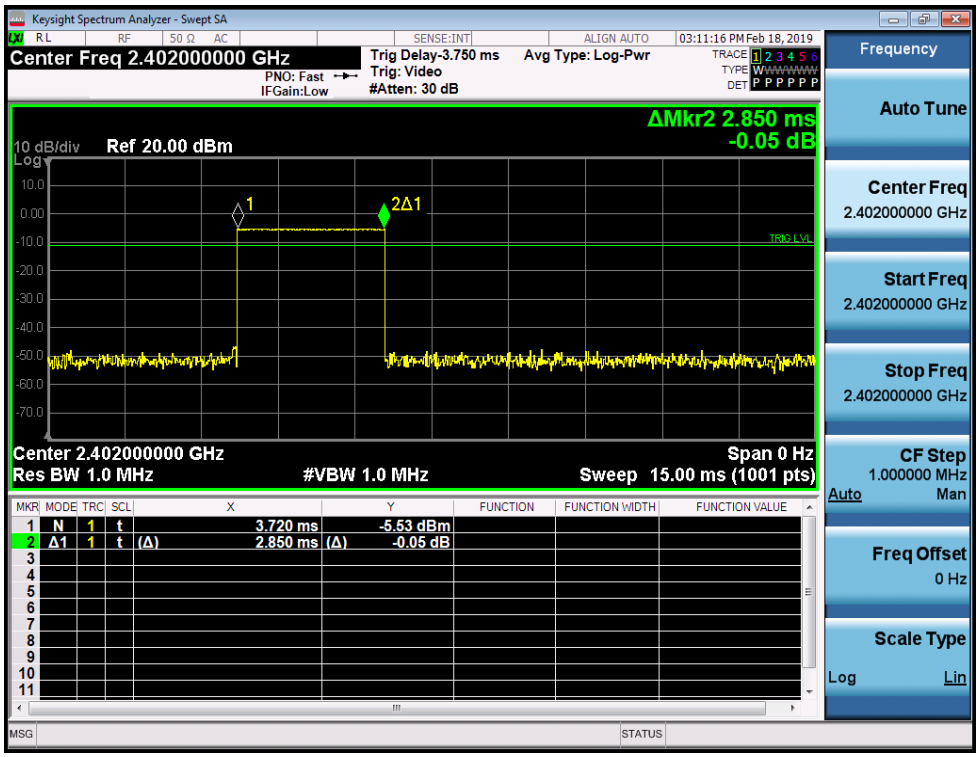
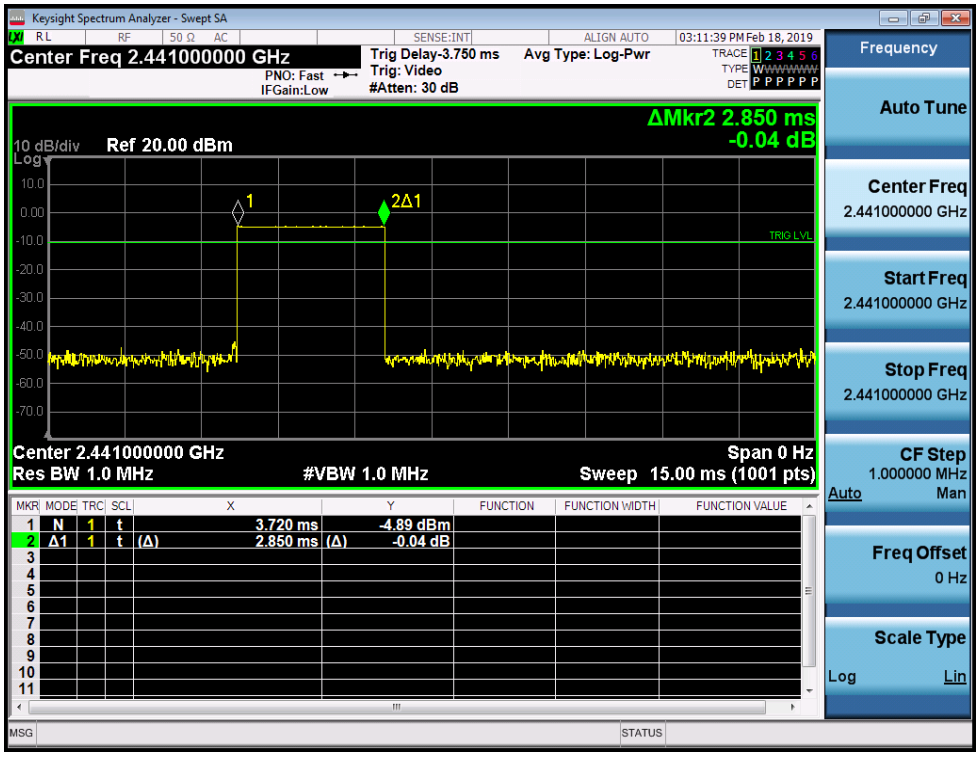
Data Rate	Mode	Packet	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell Time[s]	Verdict
1Mbps	GFSK	DH1	LCH	0.38	320	0.122	PASS
1Mbps	GFSK	DH1	MCH	0.37	320	0.118	PASS
1Mbps	GFSK	DH1	HCH	0.37	320	0.118	PASS
1Mbps	GFSK	DH3	LCH	1.62	160	0.259	PASS
1Mbps	GFSK	DH3	MCH	1.61	160	0.258	PASS
1Mbps	GFSK	DH3	HCH	1.62	160	0.259	PASS
1Mbps	GFSK	DH5	LCH	2.85	106.7	0.304	PASS
1Mbps	GFSK	DH5	MCH	2.85	106.7	0.304	PASS
1Mbps	GFSK	DH5	HCH	2.87	106.7	0.306	PASS

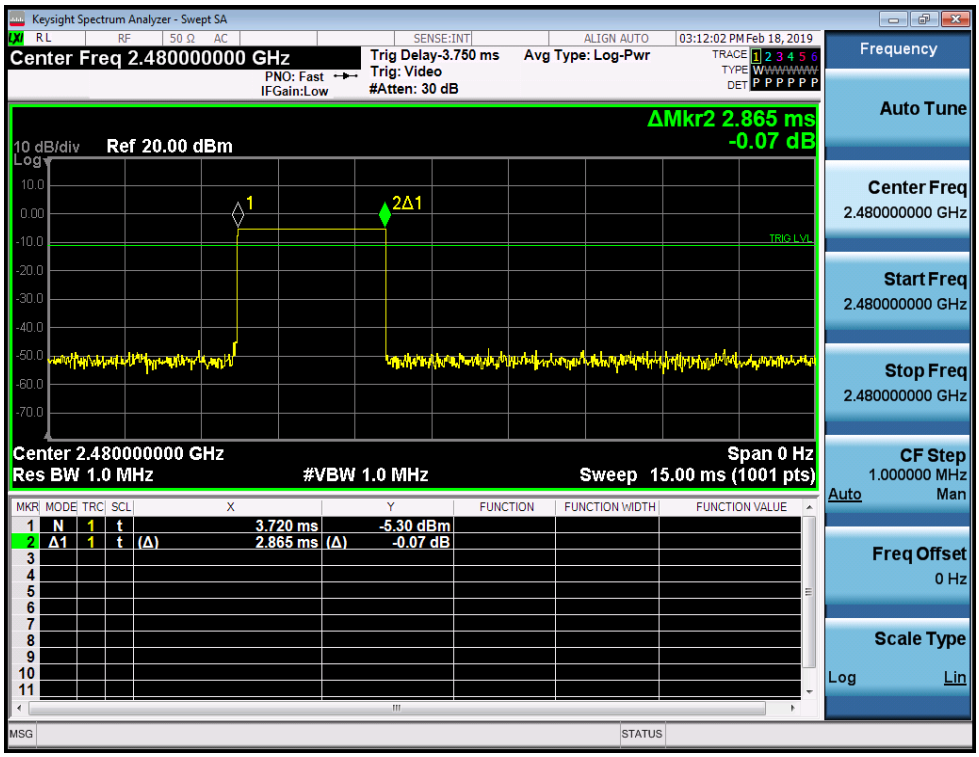
The Average Time of Occupancy Plot

Graphs	
GFSK_DH1/LCH	
GFSK_DH1/MCH	

GFSK_DH1/HCH	
GFSK_DH3/LCH	

GFSK_DH3/MCH	
GFSK_DH3/HCH	

GFSK_DH5/LCH	
GFSK_DH5/MCH	

GFSK_DH5/HCH	

Keysight Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Fast
IFGain:Low
Trig Delay-3.750 ms
Trig: Video
#Atten: 30 dB
Avg Type: Log-Pwr
03:12:02 PM Feb 18, 2019
ΔMkr2 2.865 ms
-0.07 dB
10 dB/div
Log
Ref 20.00 dBm
TRIG LVL
Center 2.480000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 15.00 ms (1001 pts)
1 N 1 t 3.720 ms -5.30 dBm
2 Δ1 1 t (Δ) 2.865 ms (Δ) -0.07 dB
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.480000000 GHz
Stop Freq
2.480000000 GHz
CF Step
1.000000 MHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin
MSG
STATUS

4.5 Peak Output Power Measurement

4.5.1 Limit of Peak Output Power

Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (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.

4.5.2 Test Procedures

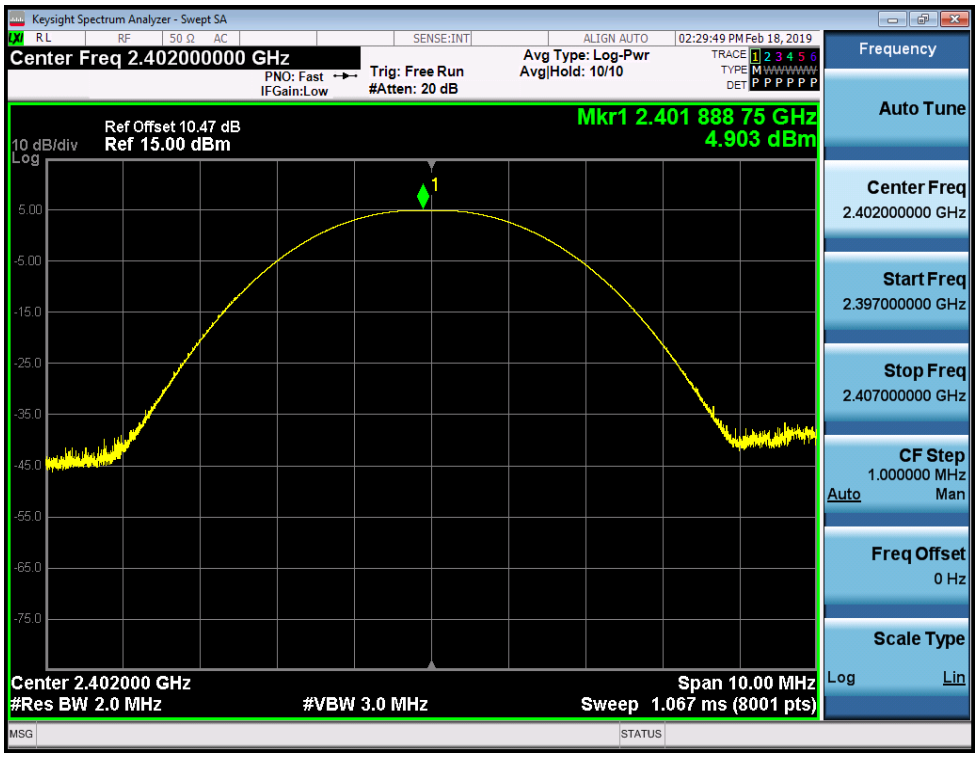
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument.
3. The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

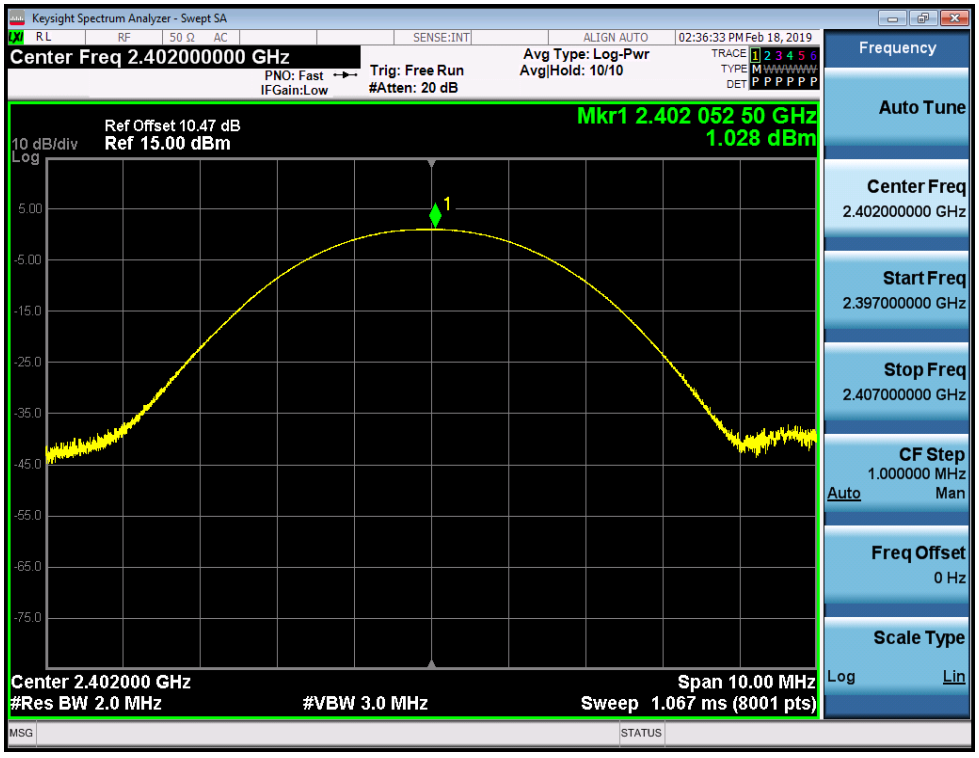
4.5.3 Test Result of Peak Output Power

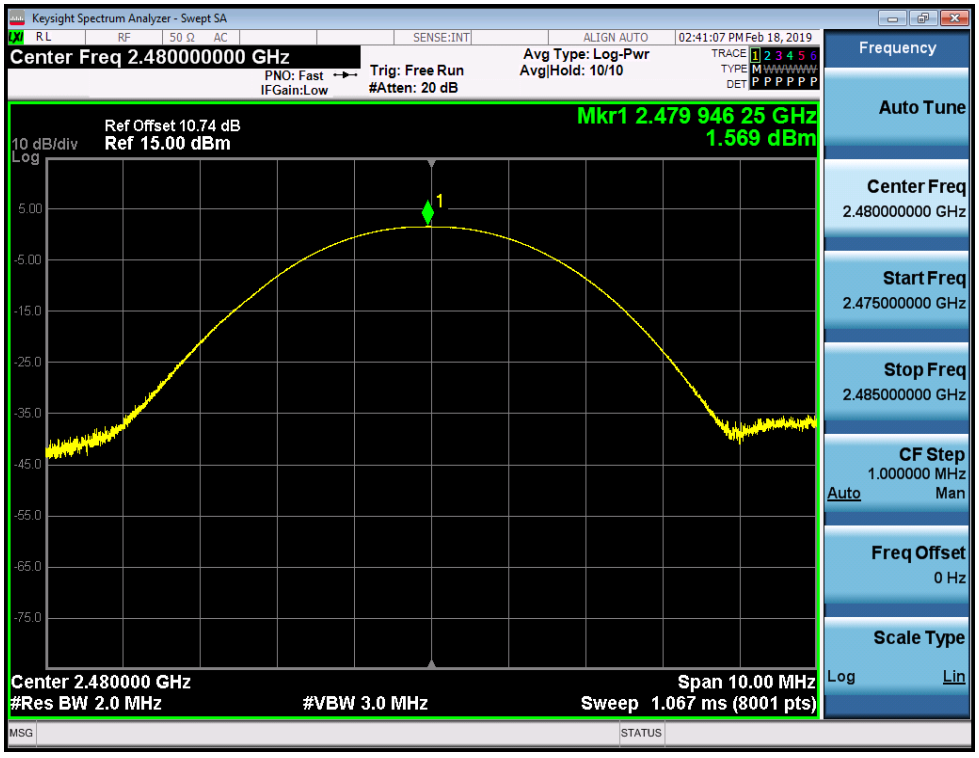
Test Mode :	1Mbps,2Mbps, 3Mbps	**Temperature :**	24~26℃
Test Engineer :	Damon Zhang	**Relative Humidity :**	50~53%

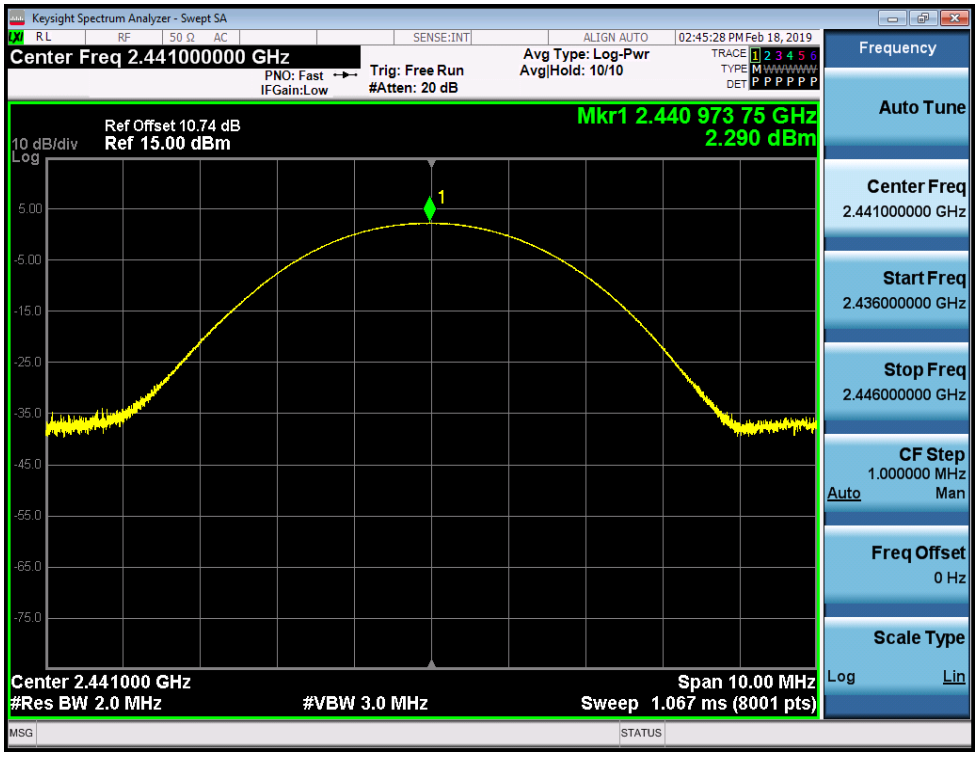
Mode	**Channel.**	**Maximum Peak Output Power [dBm]**	**Verdict**
GFSK	LCH	4.903	PASS
GFSK	MCH	5.831	PASS
GFSK	HCH	5.303	PASS
π/4DQPSK	LCH	1.028	PASS
π/4DQPSK	MCH	2.085	PASS
π/4DQPSK	HCH	1.569	PASS
8DPSK	LCH	1.216	PASS
8DPSK	MCH	2.290	PASS
8DPSK	HCH	1.732	PASS

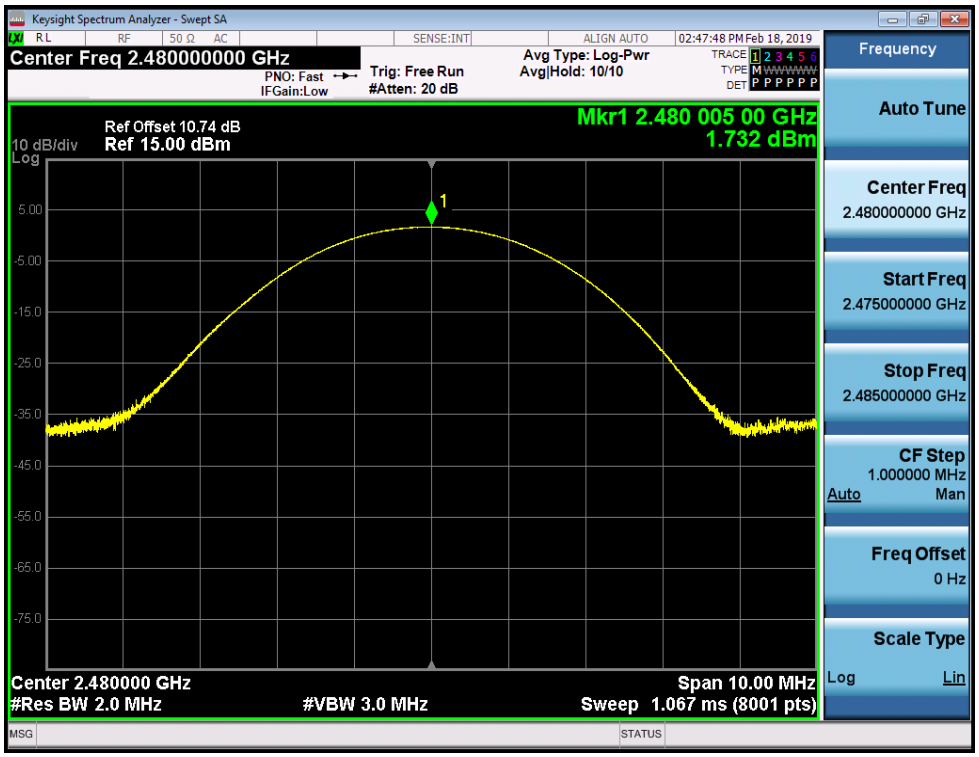
Peak Output Power Polt

Graphs	
GFSK/LCH	
GFSK/MCH	

GFSK/HCH	
π/4DQPSK/LCH	

π/4DQPSK/MCH	
π/4DQPSK/HCH	

8DPSK/LCH	
8DPSK/MCH	

8DPSK/HCH	

Keysight Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
02:47:48 PM Feb 18, 2019
Center Freq 2.480000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P P P P P
Ref Offset 10.74 dB
10 dB/div
Log
Ref 15.00 dBm
Mkr1 2.480 005 00 GHz
1.732 dBm
5.00
-5.00
-15.0
-25.0
-35.0
-45.0
-55.0
-65.0
-75.0
Center 2.480000 GHz
#Res BW 2.0 MHz
#VBW 3.0 MHz
Span 10.00 MHz
Sweep 1.067 ms (8001 pts)
MSG
STATUS
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.475000000 GHz
Stop Freq
2.485000000 GHz
CF Step
1.000000 MHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin

4.6 Conducted Band Edges Measurement

4.6.1 Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

4.6.2 Test Procedures

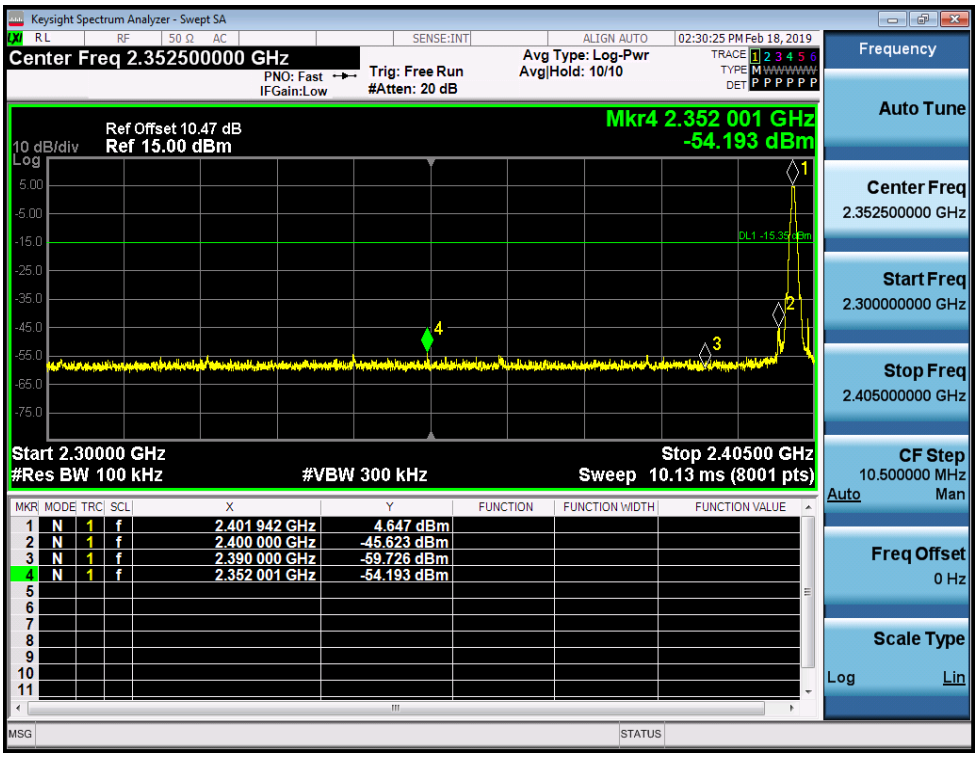
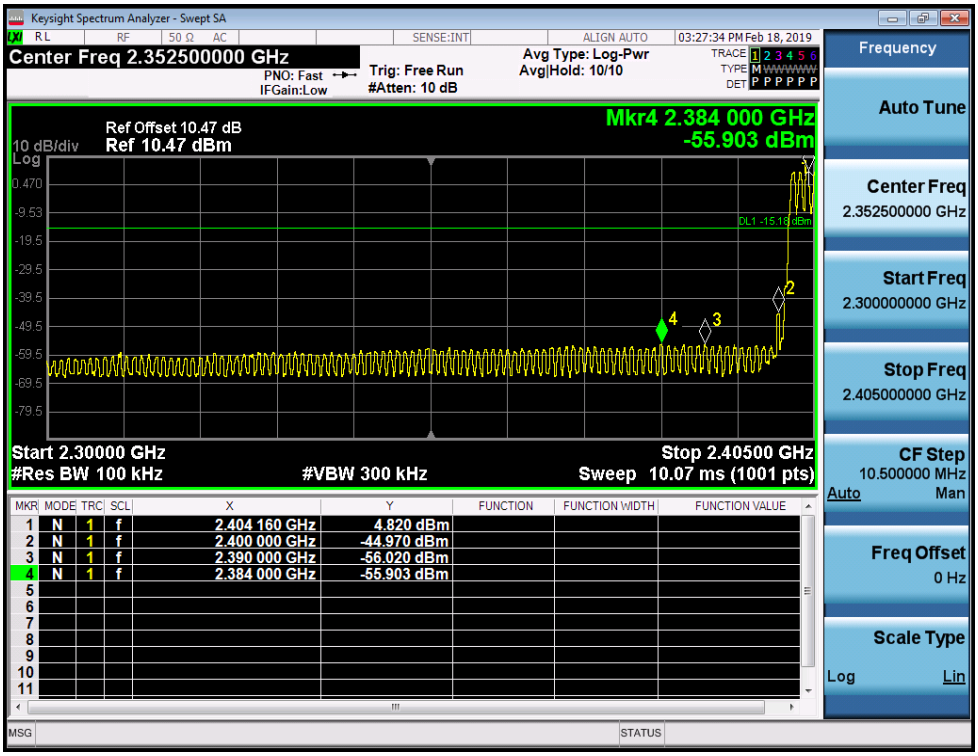
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument.
3. Set RBW = 100kHz, VBW = 300kHz. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
4. Enable hopping function of the EUT and then repeat step 1~3.

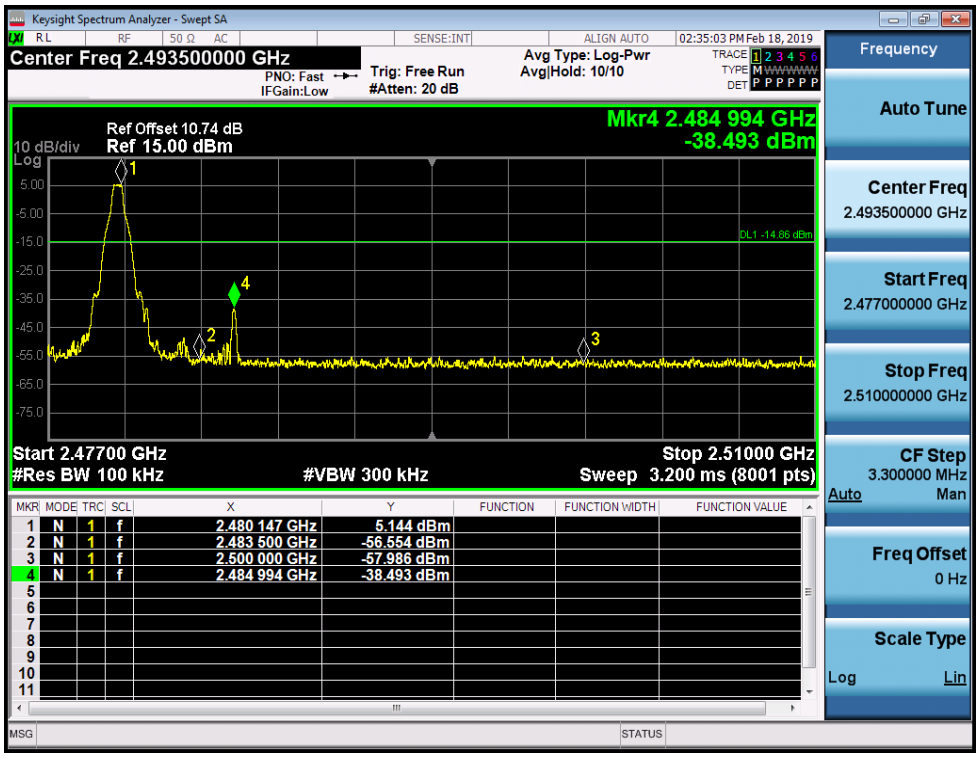
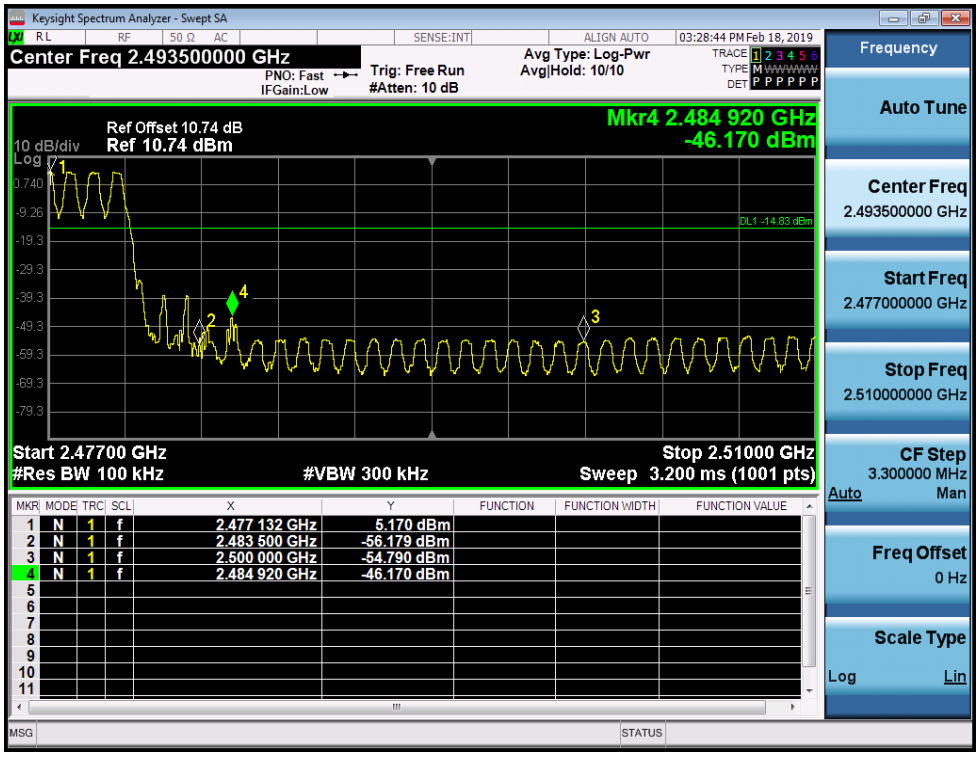
4.6.3 Test Result of Conducted Band Edges

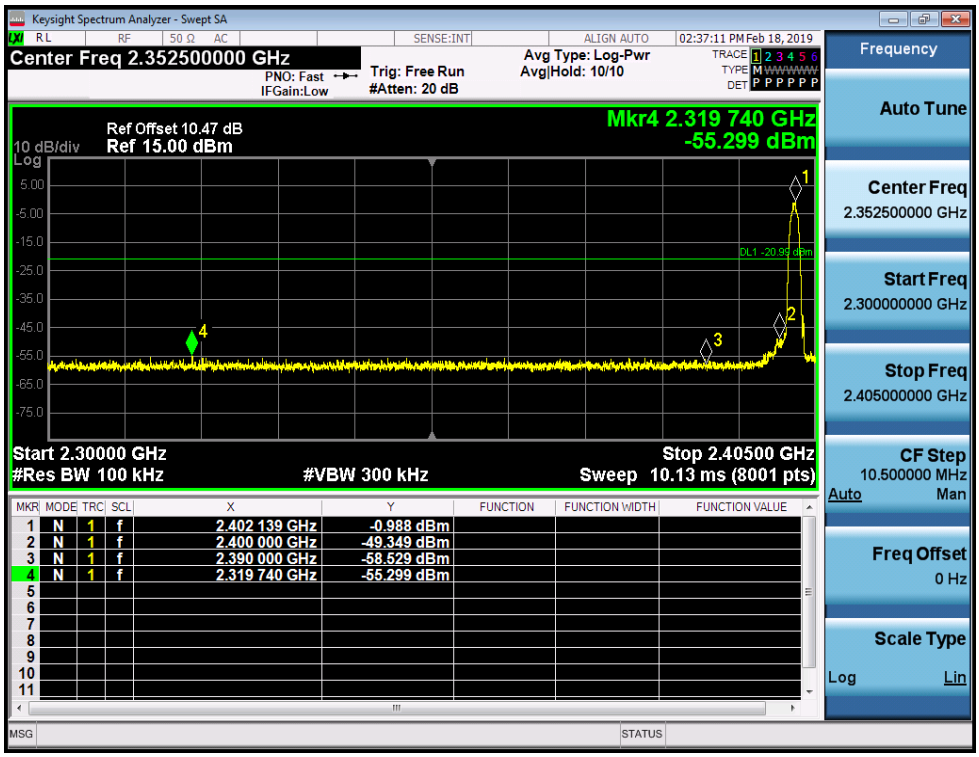
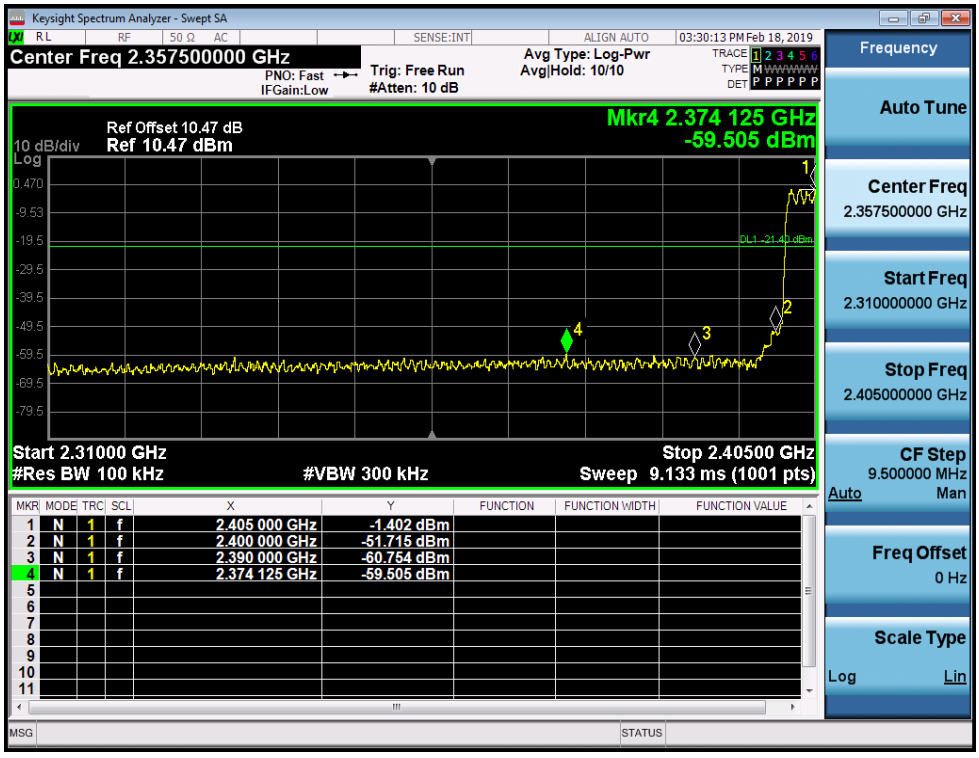
Test Mode :	1Mbps,2Mbps, 3Mbps	Temperature :	24~26℃
Test Engineer :	Damon Zhang	Relative Humidity :	50~53%

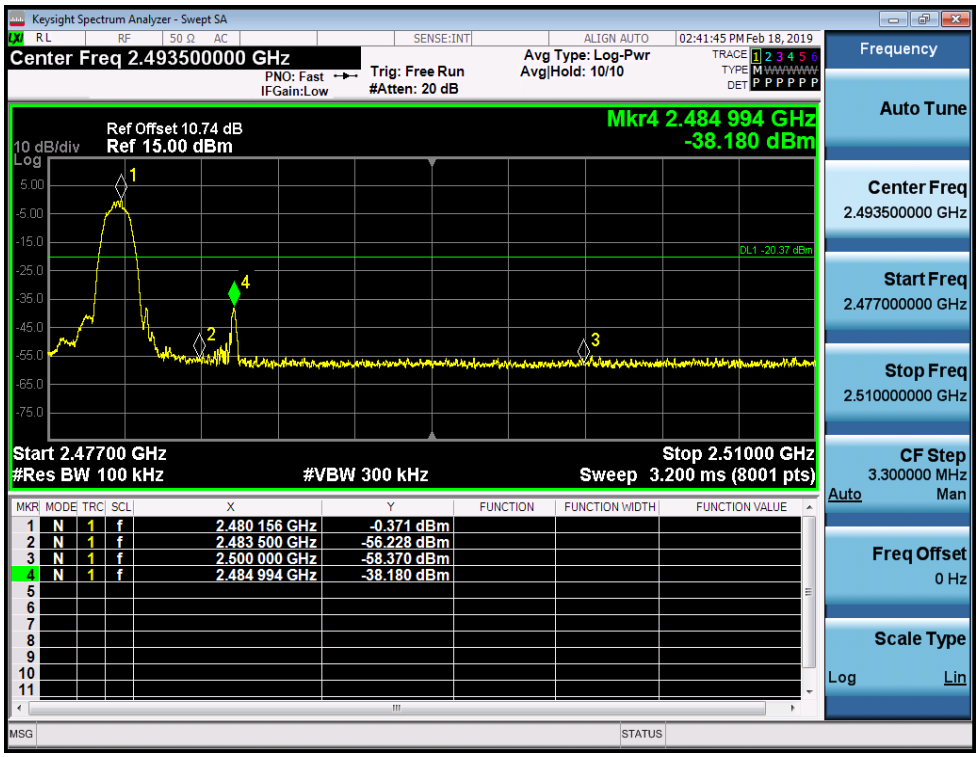
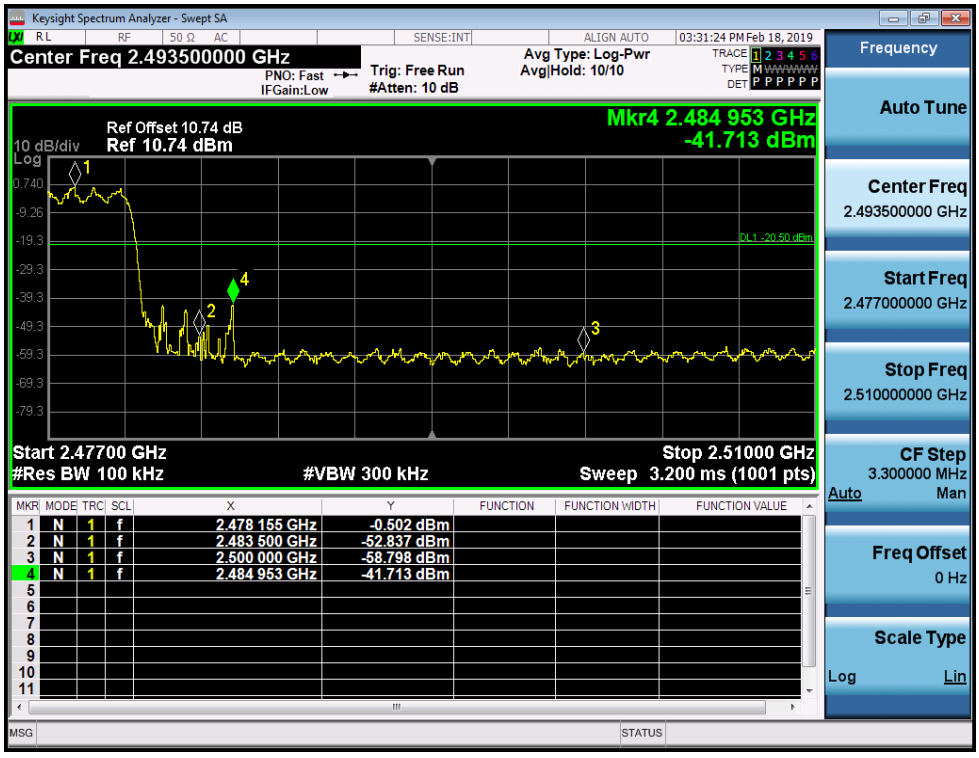
Mode	Channel	Carrier Frequency [MHz]	Carrier Power [dBm]	Frequency Hopping	Max Spurious Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	2402	4.647	Off	-45.623	-15.35	PASS
			4.820	On	-44.970	-15.18	PASS
GFSK	HCH	2480	5.144	Off	-38.493	-14.86	PASS
			5.170	On	-46.170	-14.83	PASS
π/4DQPSK	LCH	2402	-0.988	Off	-49.349	-20.99	PASS
			-1.402	On	-51.715	-21.4	PASS
π/4DQPSK	HCH	2480	-0.371	Off	-38.180	-20.37	PASS
			-0.502	On	-41.713	-20.5	PASS
8DPSK	LCH	2402	-1.092	Off	-50.686	-21.09	PASS
			-1.121	On	-52.284	-21.12	PASS
8DPSK	HCH	2480	-0.310	Off	-38.063	-20.31	PASS
			-0.391	On	-38.520	-20.39	PASS

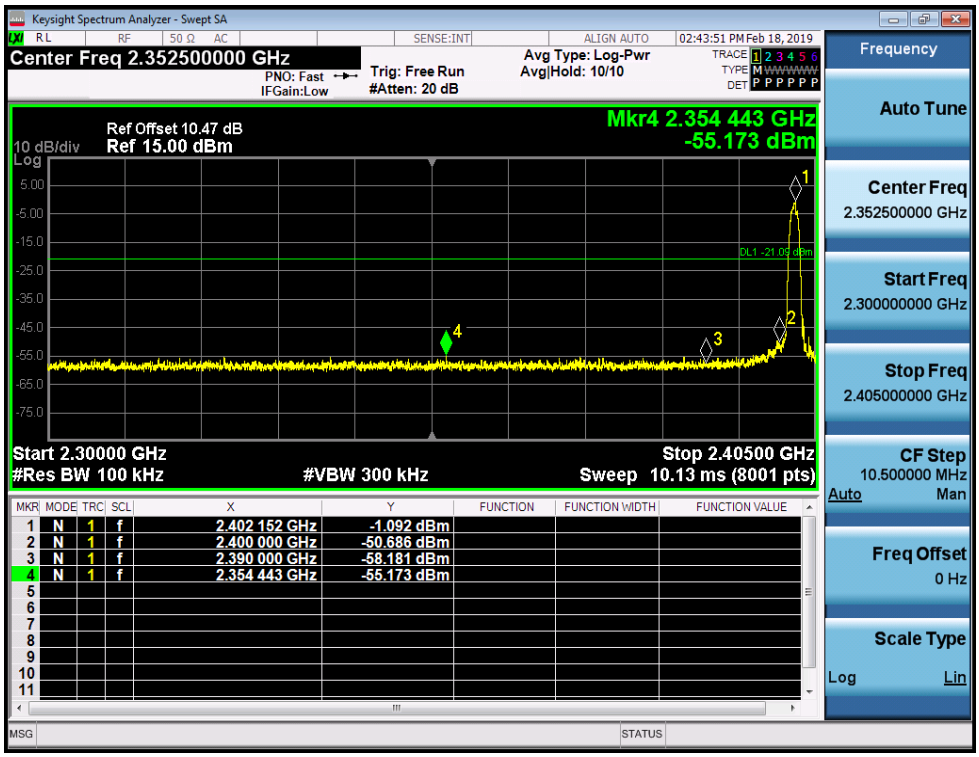
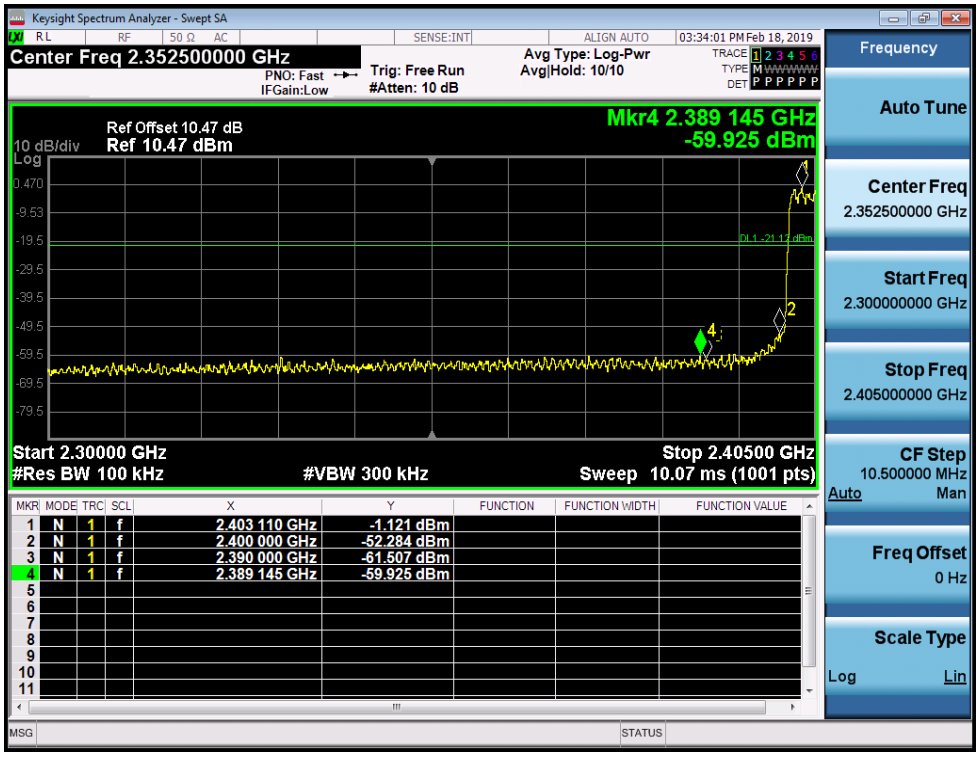
Conducted Band Edge Polt

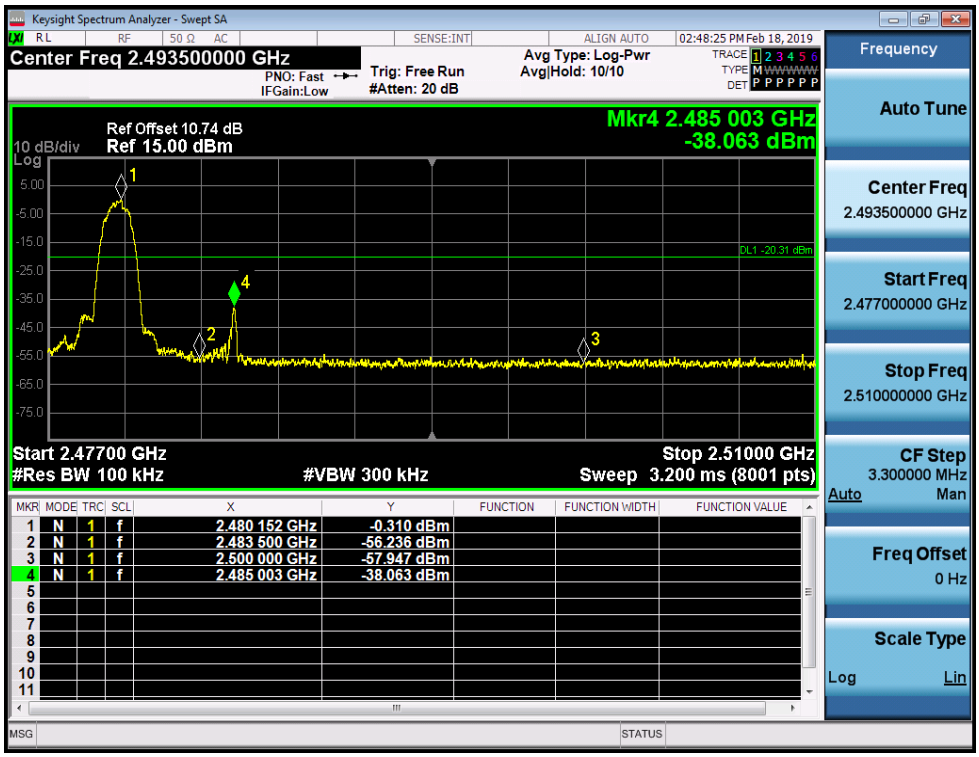
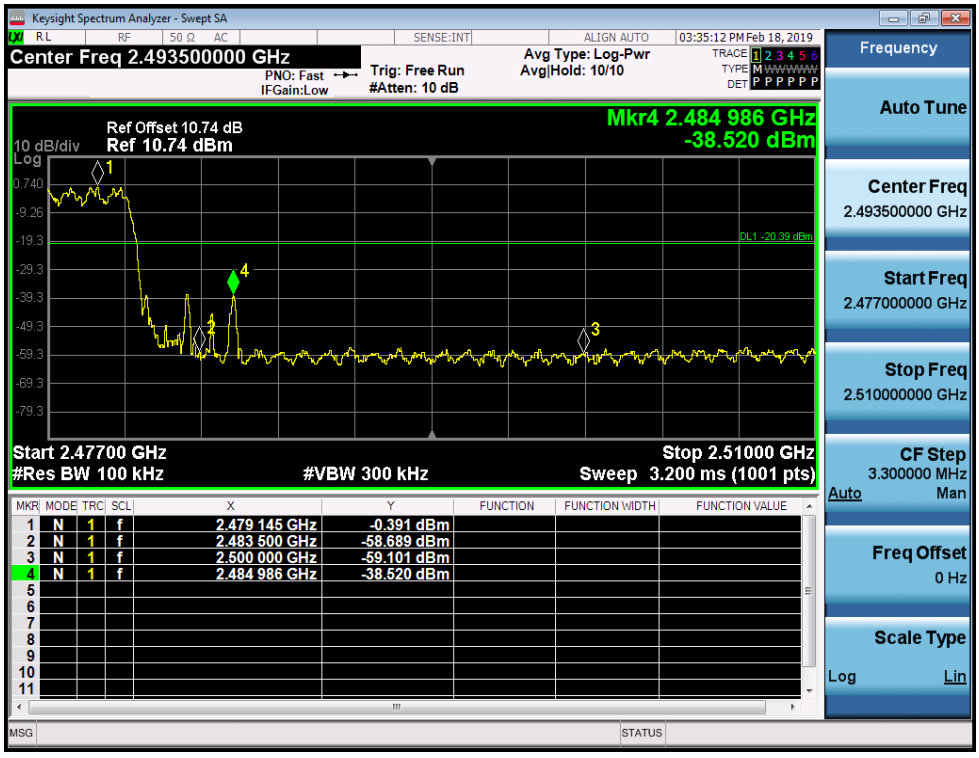
Graphs	
GFSK/LCH/No Hop	
GFSK/LCH/Hop	

GFSK/HCH/No Hop	
GFSK/HCH/Hop	

π/4DQPSK/LCH/No Hop	
π/4DQPSK/LCH/Hop	

π/4DQPSK/HCH/No Hop	
π/4DQPSK/HCH/Hop	

8DPSK/LCH/No Hop	
8DPSK/LCH/Hop	

8DPSK/HCH/No Hop	
8DPSK/HCH/Hop	

4.7 Conducted Spurious Emission Measurement

4.7.1 Limit of Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

4.7.2 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

4.7.3 Test Result of Conducted Spurious Emission

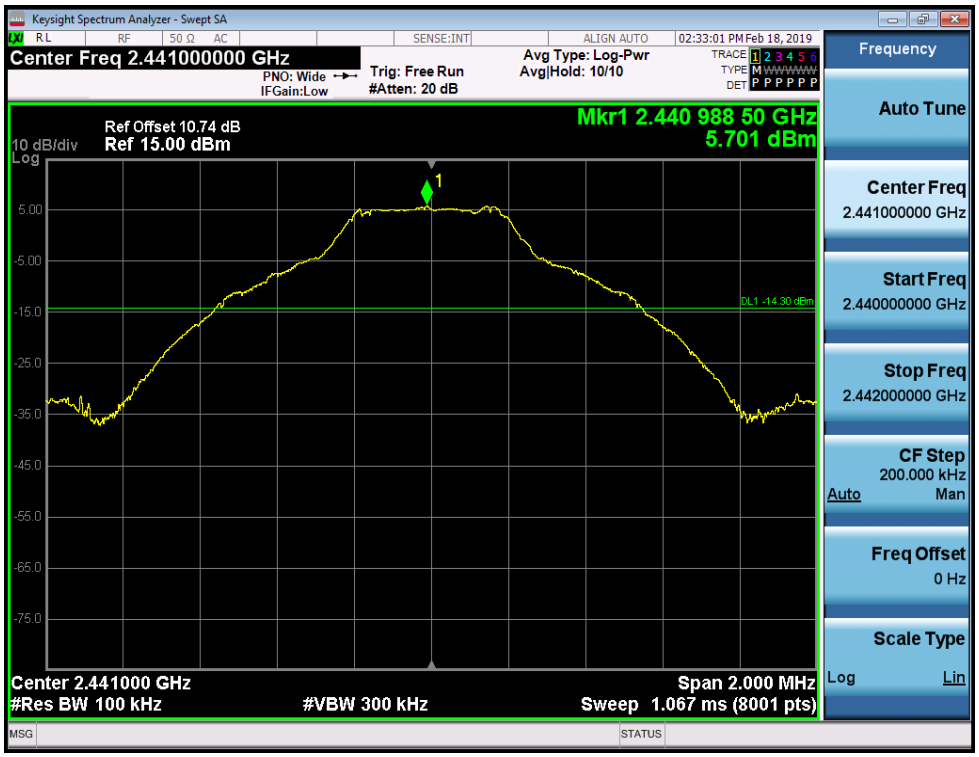
Test Mode :	1Mbps,2Mbps, 3Mbps	**Temperature :**	24~26℃
Test Engineer :	Damon Zhang	**Relative Humidity :**	50~53%

Mode	Channel	Pref [dBm]	Puw[dBm]	Verdict
GFSK	LCH	4.833	<Limit	PASS
GFSK	MCH	5.701	<Limit	PASS
GFSK	HCH	5.206	<Limit	PASS
π/4DQPSK	LCH	-1.065	<Limit	PASS
π/4DQPSK	MCH	0.103	<Limit	PASS
π/4DQPSK	HCH	-0.457	<Limit	PASS
8DPSK	LCH	-0.969	<Limit	PASS
8DPSK	MCH	0.122	<Limit	PASS
8DPSK	HCH	-0.405	<Limit	PASS

Conducted Spurious Emission Polt

GFSK_LCH_Graphs	
Pref	
Puw	

GFSK_MCH_Graphs

Pref	
Puw	

GFSK_HCH_Graphs

Pref	
Puw	

π/4DQPSK_LCH_Graphs

Pref	
Puw	

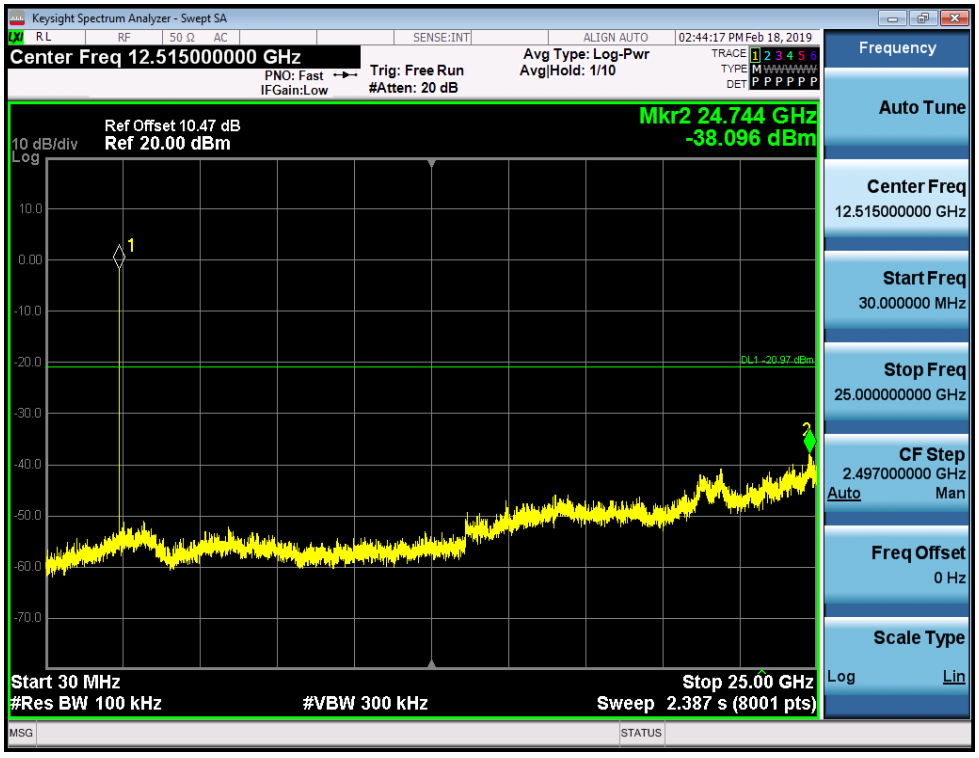
π/4DQPSK_MCH_Graphs

Pref	
Puw	

π/4DQPSK_HCH_Graphs

Pref	
Puw	

8DPSK_LCH_Graphs

Pref	
Puw	

8DPSK_MCH_Graphs

Pref	
Puw	

8DPSK_HCH_Graphs

Pref	 Keysight Spectrum Analyzer - Swept SA Center Freq 2.480000000 GHz PNO: Wide IFGain:Low Trig: Free Run #Atten: 20 dB Avg Type: Log-Pwr Avg|Hold: 10/10 02:48:39 PM Feb 18, 2019 Ref Offset 10.74 dB 10 dB/div Ref 15.00 dBm Log Mkr1 2.480 149 75 GHz -0.405 dBm DL1 -20.41 dBm Center 2.480000 GHz #Res BW 100 kHz #VBW 300 kHz Span 2.000 MHz Sweep 1.067 ms (8001 pts) Frequency Auto Tune Center Freq 2.480000000 GHz Start Freq 2.479000000 GHz Stop Freq 2.481000000 GHz CF Step 200.000 kHz Auto Man Freq Offset 0 Hz Scale Type Log Lin MSG STATUS
Puw	 Keysight Spectrum Analyzer - Swept SA Center Freq 12.515000000 GHz PNO: Fast IFGain:Low Trig: Free Run #Atten: 20 dB Avg Type: Log-Pwr Avg|Hold: 1/10 02:48:50 PM Feb 18, 2019 Ref Offset 10.74 dB 10 dB/div Ref 20.00 dBm Log Mkr2 24.803 GHz -37.933 dBm DL1 -20.41 dBm Start 30 MHz #Res BW 100 kHz #VBW 300 kHz Stop 25.00 GHz Sweep 2.387 s (8001 pts) Frequency Auto Tune Center Freq 12.515000000 GHz Start Freq 30.000000 MHz Stop Freq 25.000000000 GHz CF Step 2.497000000 GHz Auto Man Freq Offset 0 Hz Scale Type Log Lin MSG STATUS

4.8 Radiated Band Edges and Spurious Emission Measurement

4.8.1 Limit of Radiated Band Edges and Spurious Emission

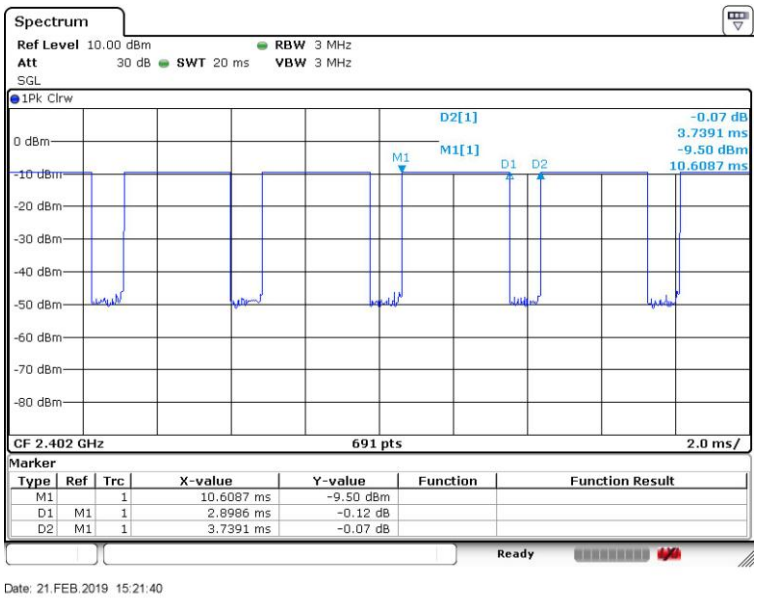
In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

4.8.2 Test Procedures

1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The measurement distance is 3 meter.
3. 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.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=120 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
   (3) For average measurement:
   VBW = 10 Hz, when duty cycle is no less than 98 percent.
   VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
1Mbps	77.52	2.8986	0.34	1kHz



6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

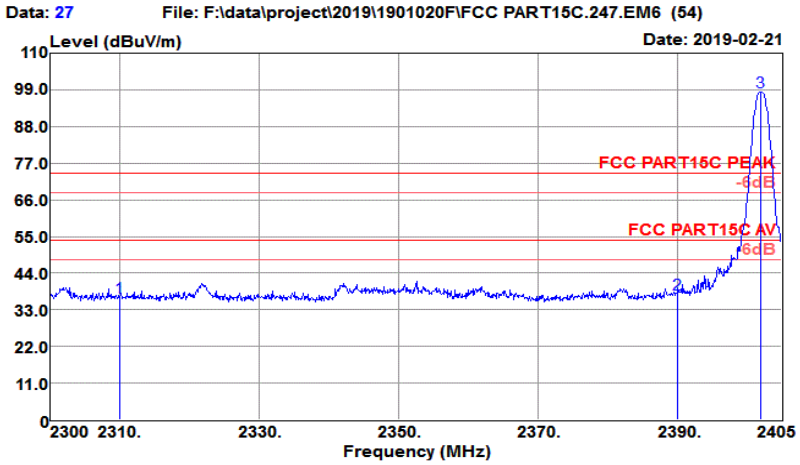
4.8.3 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

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

4.8.4 Test Result of Radiated Spurious at Band Edges

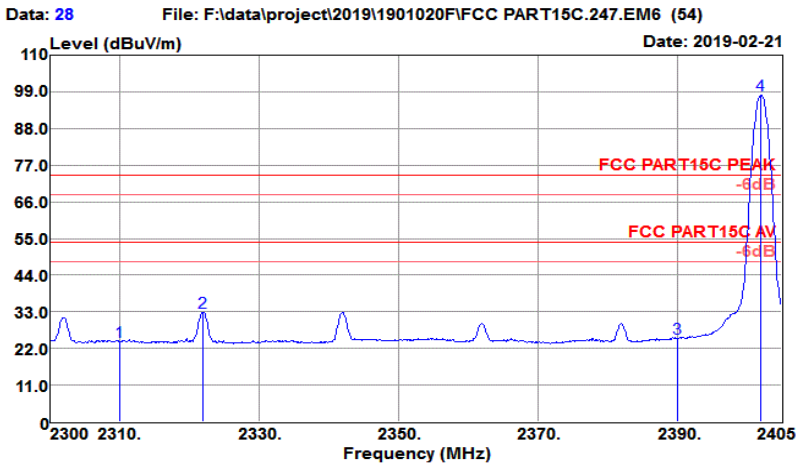
Low Channel Horizontal:

Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: HORIZONTAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH00(2402MHz)		



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
2310.000	42.21	26.91	3.56	35.87	36.81	74.00	-37.19	Peak
2390.000	43.09	27.11	3.64	36.08	37.76	74.00	-36.24	Peak
2402.000	103.57	27.15	3.65	36.11	98.26	74.00	24.26	Peak

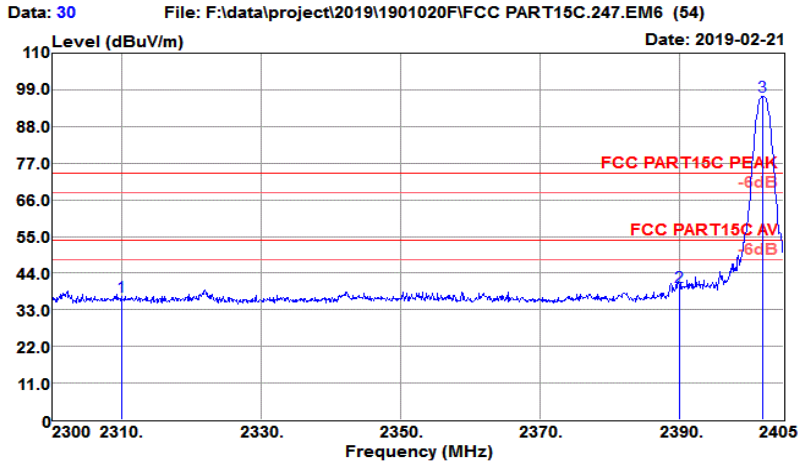
Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: HORIZONTAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH00(2402MHz)		



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
2310.000	29.45	26.91	3.56	35.87	24.05	54.00	-29.95	Average
2321.945	38.31	26.94	3.57	35.90	32.92	54.00	-21.08	Average
2390.000	30.28	27.11	3.64	36.08	24.95	54.00	-29.05	Average
2402.000	103.39	27.15	3.65	36.11	98.08	54.00	44.08	Average

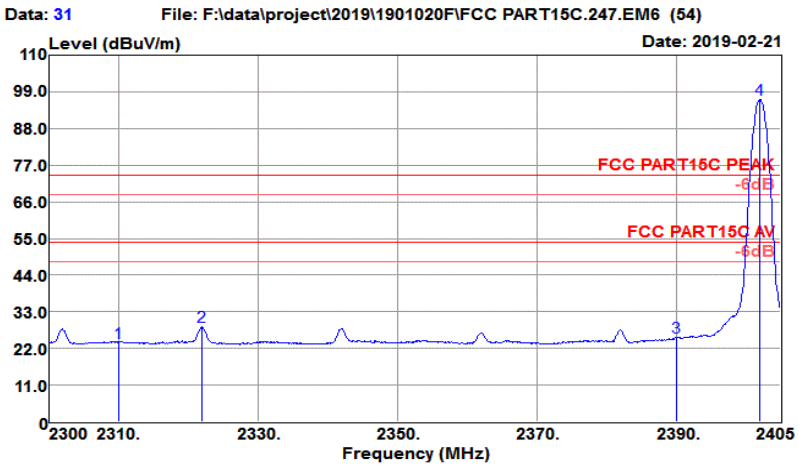
Low Channel Vertical:

Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: VERTICAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH00(2402MHz)		



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
2310.000	42.32	26.91	3.56	35.87	36.92	74.00	-37.08	Peak
2390.000	45.14	27.11	3.64	36.08	39.81	74.00	-34.19	Peak
2402.000	102.28	27.15	3.65	36.11	96.97	74.00	22.97	Peak

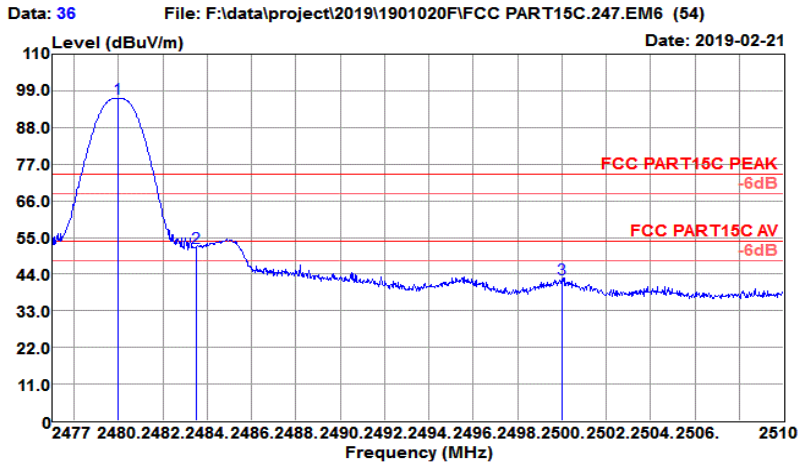
Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: VERTICAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH00(2402MHz)		



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
2310.000	29.20	26.91	3.56	35.87	23.80	54.00	-30.20	Average
2321.945	33.80	26.94	3.57	35.90	28.41	54.00	-25.59	Average
2390.000	30.65	27.11	3.64	36.08	25.32	54.00	-28.68	Average
2402.000	102.08	27.15	3.65	36.11	96.77	54.00	42.77	Average

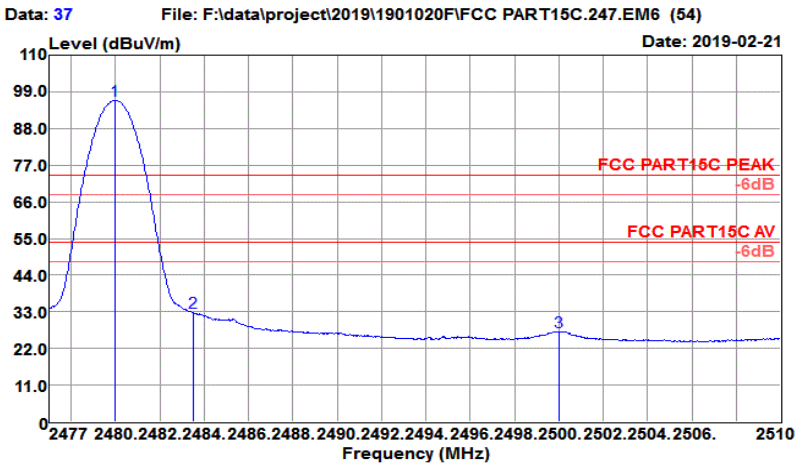
High Channel Horizontal:

Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: HORIZONTAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH78(2480MHz)		



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
2480.000	101.97	27.35	3.68	36.32	96.68	74.00	22.68	Peak
2483.500	57.35	27.36	3.68	36.33	52.06	74.00	-21.94	Peak
2500.000	47.81	27.40	3.68	36.37	42.52	74.00	-31.48	Peak

Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: HORIZONTAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH78(2480MHz)		

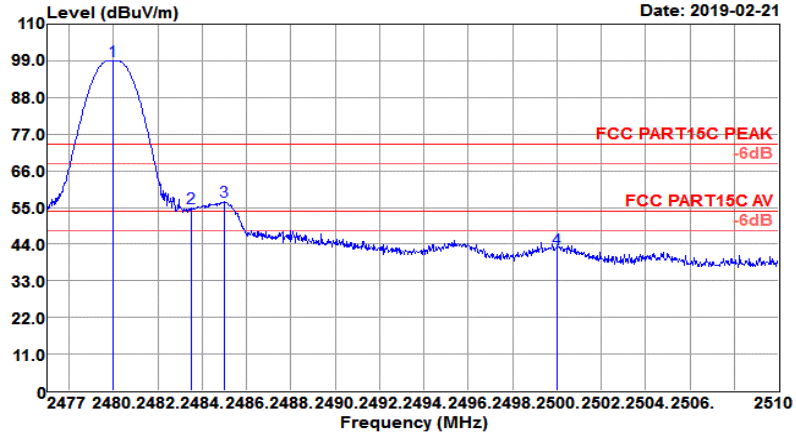


Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
2480.000	101.70	27.35	3.68	36.32	96.41	54.00	42.41	Average
2483.500	38.07	27.36	3.68	36.33	32.78	54.00	-21.22	Average
2500.000	32.36	27.40	3.68	36.37	27.07	54.00	-26.93	Average

High Channel Vertical:

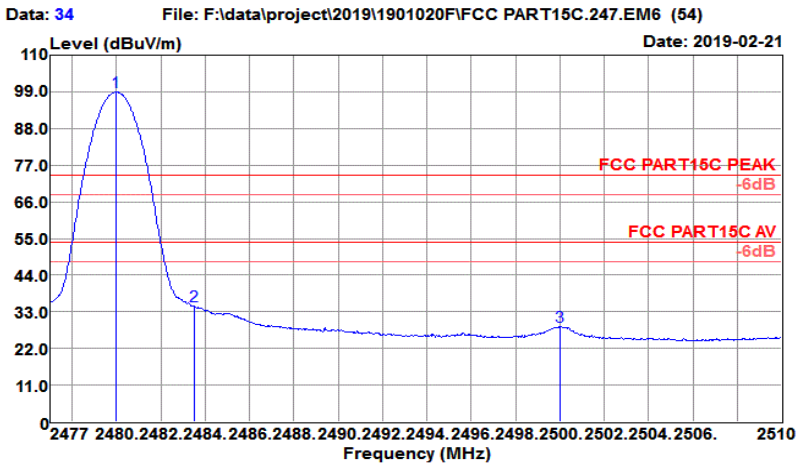
Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: VERTICAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH78(2480MHz)		

Data: 33 File: F:\data\project\2019\1901020F\FCC PART15C.247.EM6 (54)



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
2480.000	104.37	27.35	3.68	36.32	99.08	74.00	25.08	Peak
2483.500	59.99	27.36	3.68	36.33	54.70	74.00	-19.30	Peak
2485.019	61.96	27.36	3.68	36.33	56.67	74.00	-17.33	Peak
2500.000	47.83	27.40	3.68	36.37	42.54	74.00	-31.46	Peak

Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: VERTICAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH78(2480MHz)		

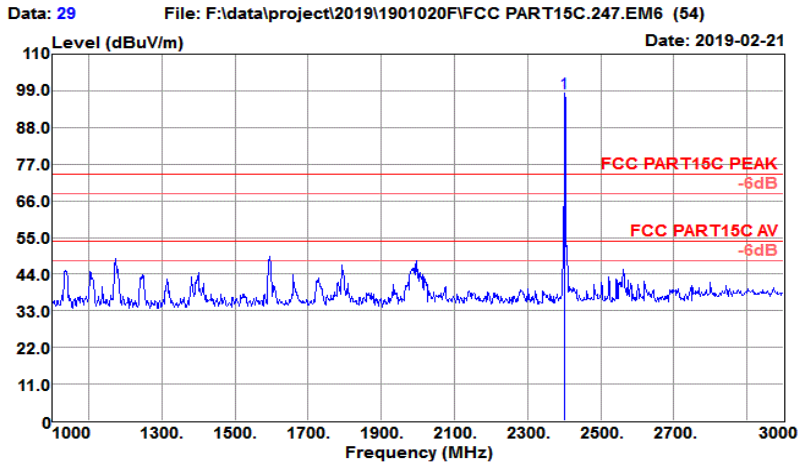


Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
2480.000	104.16	27.35	3.68	36.32	98.87	54.00	44.87	Average
2483.500	39.94	27.36	3.68	36.33	34.65	54.00	-19.35	Average
2500.000	33.81	27.40	3.68	36.37	28.52	54.00	-25.48	Average

4.8.5 Test Result of Radiated Spurious Emission (1GHz ~ 10th Harmonic)

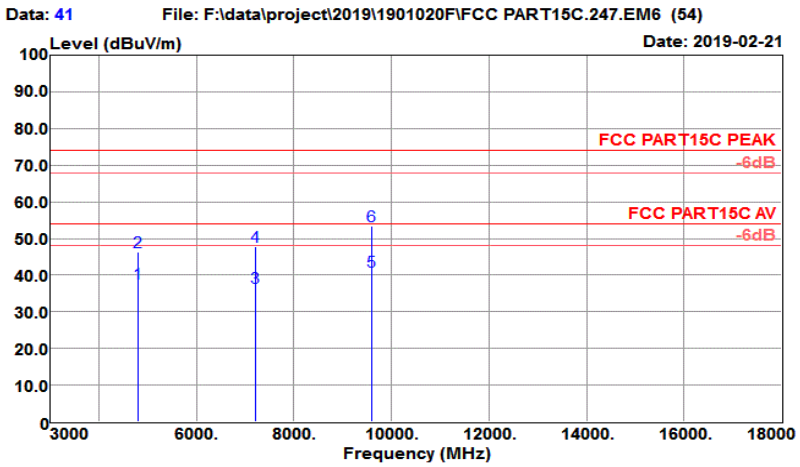
Low Channel Horizontal:

Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: HORIZONTAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH00(2402MHz)		



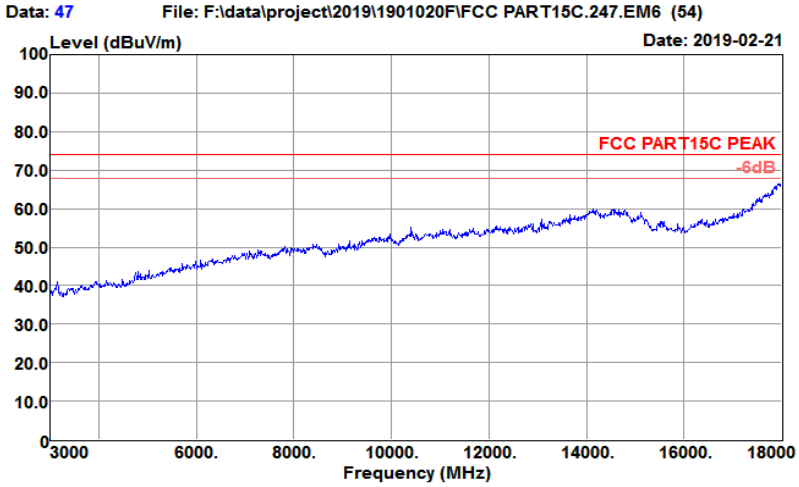
Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
2402.000	103.54	27.15	3.65	36.11	98.23	74.00	24.23	Peak

Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: HORIZONTAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH00(2402MHz)		



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
4804.000	37.31	31.23	5.45	36.27	37.72	54.00	-16.28	Average
4804.000	45.84	31.23	5.45	36.27	46.25	74.00	-27.75	Peak
7206.000	28.09	35.87	6.94	34.25	36.65	54.00	-17.35	Average
7206.000	39.16	35.87	6.94	34.25	47.72	74.00	-26.28	Peak
9608.000	29.61	37.79	7.77	34.13	41.04	54.00	-12.96	Average
9608.000	41.89	37.79	7.77	34.13	53.32	74.00	-20.68	Peak

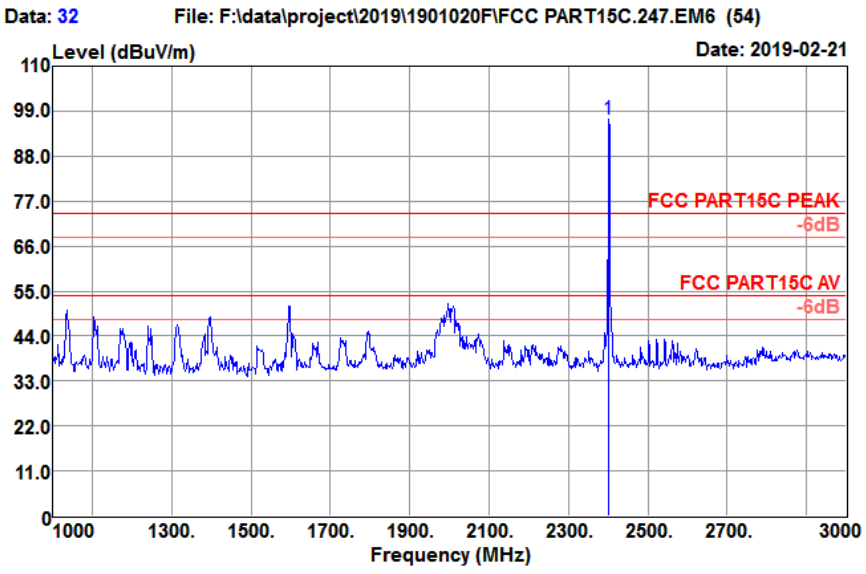
Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: HORIZONTAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH00(2402MHz)		



Note: Emission was scanned up to 25GHz,there is only a base noise above 18GHz, so it is not recorded in the report

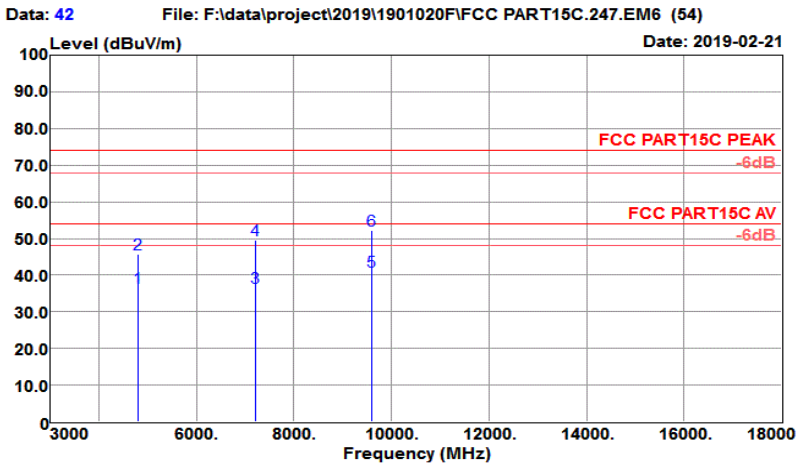
Low Channel Vertical:

Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: VERTICAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH00(2402MHz)		



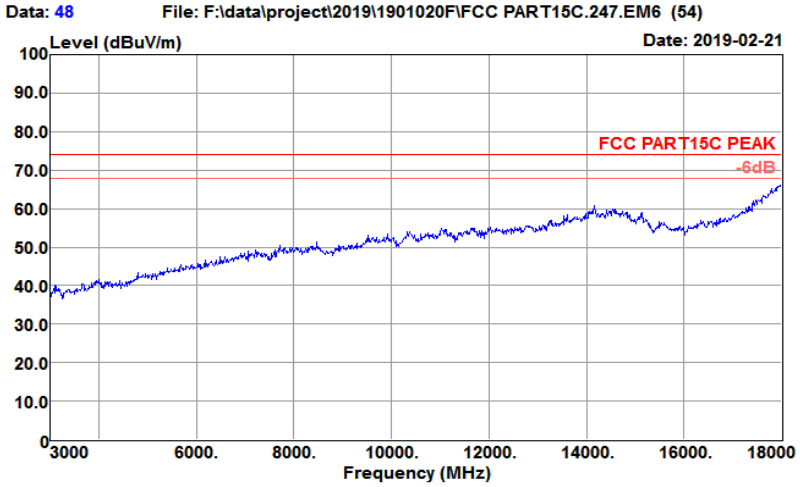
Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
2402.000	102.24	27.15	3.65	36.11	96.93	74.00	22.93	Peak

Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: VERTICAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH00(2402MHz)		



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
4804.000	36.22	31.23	5.45	36.27	36.63	54.00	-17.37	Average
4804.000	45.40	31.23	5.45	36.27	45.81	74.00	-28.19	Peak
7206.000	27.95	35.87	6.94	34.25	36.51	54.00	-17.49	Average
7206.000	41.14	35.87	6.94	34.25	49.70	74.00	-24.30	Peak
9608.000	29.65	37.79	7.77	34.13	41.08	54.00	-12.92	Average
9608.000	40.78	37.79	7.77	34.13	52.21	74.00	-21.79	Peak

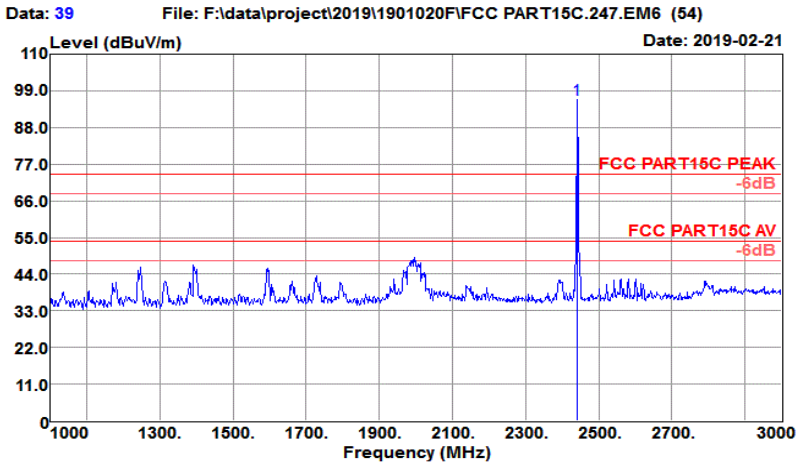
Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: VERTICAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH00(2402MHz)		



Note: Emission was scanned up to 25GHz,there is only a base noise above 18GHz, so it is not recorded in the report

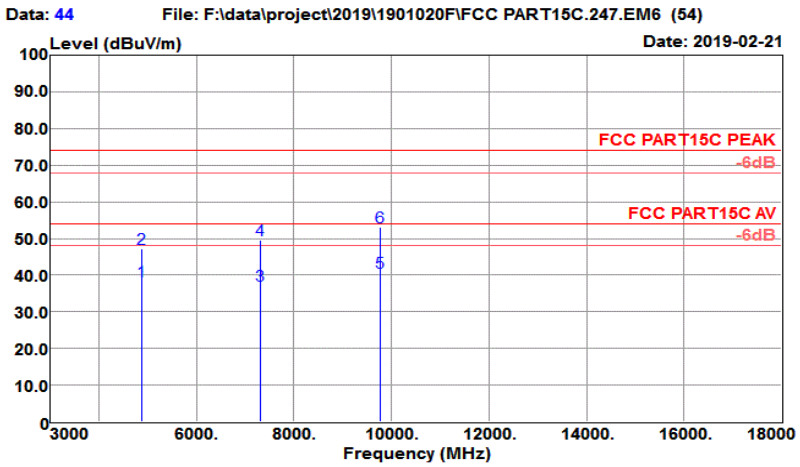
Middle Channel Horizontal:

Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: HORIZONTAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH39(2441MHz)		



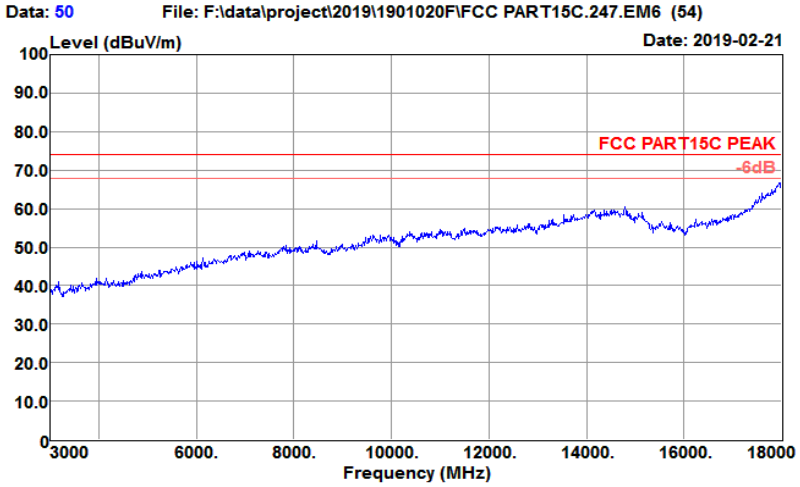
Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
2441.000	101.56	27.25	3.66	36.21	96.26	74.00	22.26	Peak

Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: HORIZONTAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH39(2441MHz)		



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
4882.000	37.92	31.42	5.40	36.24	38.50	54.00	-15.50	Average
4882.000	46.53	31.42	5.40	36.24	47.11	74.00	-26.89	Peak
7323.000	28.12	36.14	7.28	34.36	37.18	54.00	-16.82	Average
7323.000	40.43	36.14	7.28	34.36	49.49	74.00	-24.51	Peak
9764.000	28.84	38.08	7.98	34.20	40.70	54.00	-13.30	Average
9764.000	41.23	38.08	7.98	34.20	53.09	74.00	-20.91	Peak

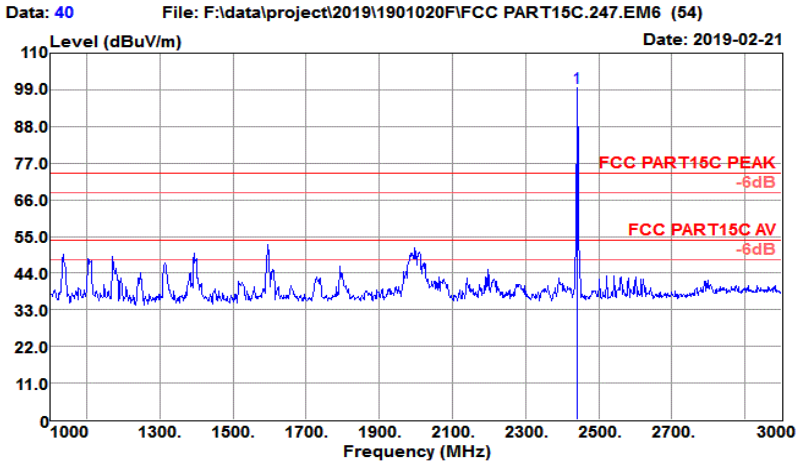
Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: HORIZONTAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH39(2441MHz)		



Note: Emission was scanned up to 25GHz,there is only a base noise above 18GHz, so it is not recorded in the report

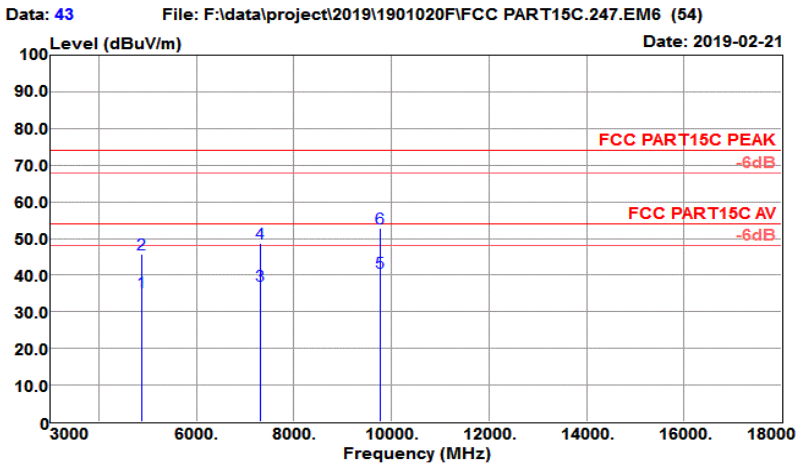
Middle Channel Vertical:

Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: VERTICAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH39(2441MHz)		



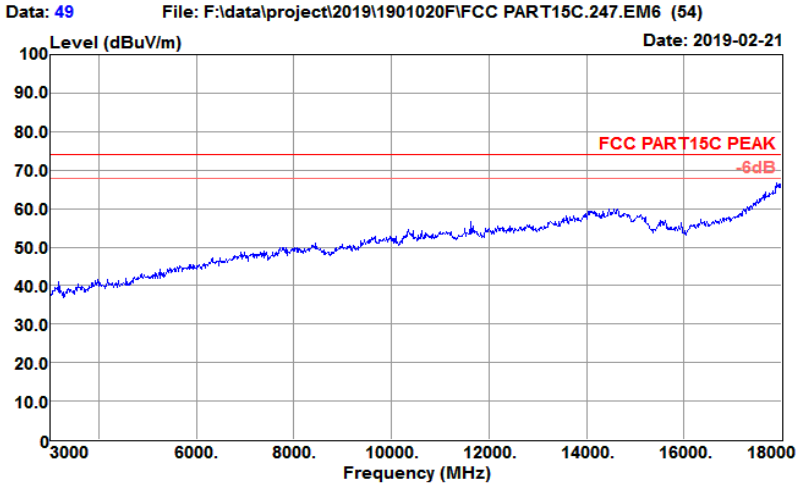
Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
2441.000	104.89	27.25	3.66	36.21	99.59	74.00	25.59	Peak

Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: VERTICAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH39(2441MHz)		



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
4882.000	34.73	31.42	5.40	36.24	35.31	54.00	-18.69	Average
4882.000	45.11	31.42	5.40	36.24	45.69	74.00	-28.31	Peak
7323.000	27.98	36.14	7.28	34.36	37.04	54.00	-16.96	Average
7323.000	39.52	36.14	7.28	34.36	48.58	74.00	-25.42	Peak
9764.000	28.97	38.08	7.98	34.20	40.83	54.00	-13.17	Average
9764.000	41.05	38.08	7.98	34.20	52.91	74.00	-21.09	Peak

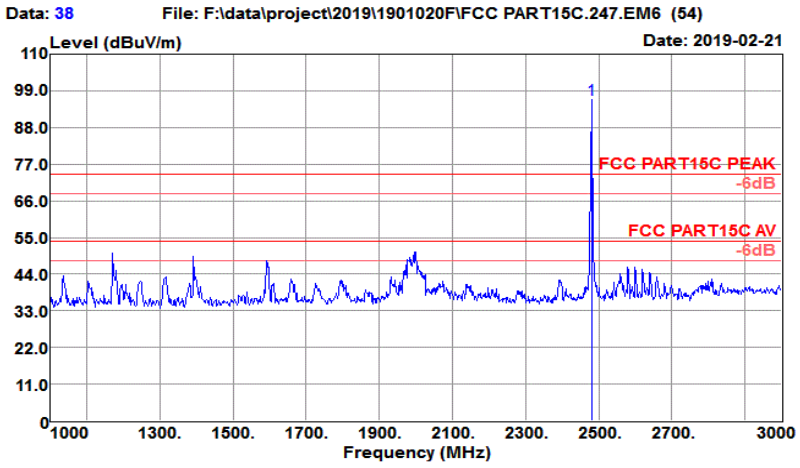
Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: VERTICAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH39(2441MHz)		



Note: Emission was scanned up to 25GHz,there is only a base noise above 18GHz, so it is not recorded in the report

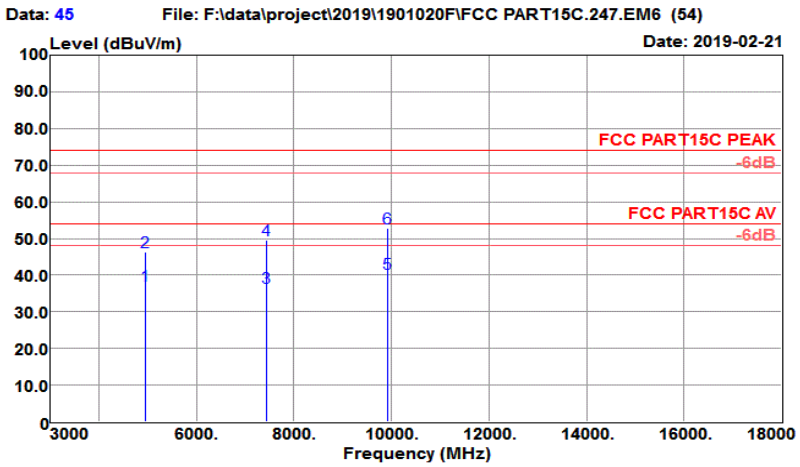
High Channel Horizontal:

Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: HORIZONTAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH78(2480MHz)		



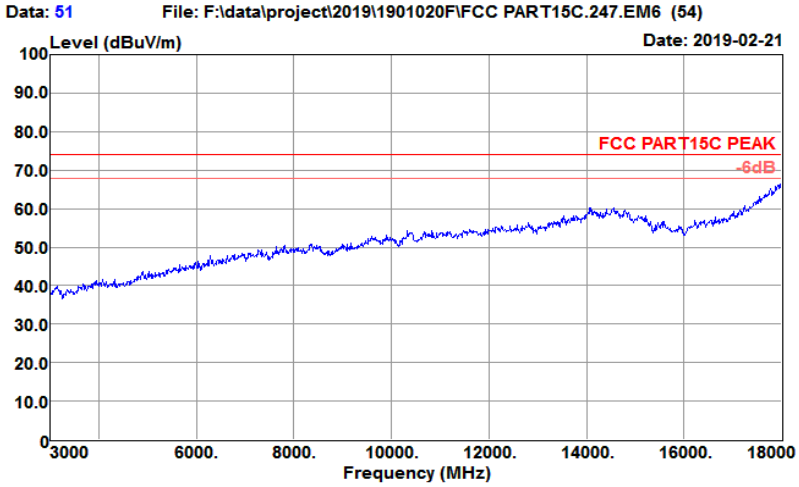
Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
2480.000	101.71	27.35	3.68	36.32	96.42	74.00	22.42	Peak

Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: HORIZONTAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH78(2480MHz)		



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
4960.000	36.43	31.60	5.36	36.21	37.18	54.00	-16.82	Average
4960.000	45.57	31.60	5.36	36.21	46.32	74.00	-27.68	Peak
7440.000	27.16	36.41	7.44	34.47	36.54	54.00	-17.46	Average
7440.000	40.20	36.41	7.44	34.47	49.58	74.00	-24.42	Peak
9920.000	28.39	38.36	8.05	34.26	40.54	54.00	-13.46	Average
9920.000	40.70	38.36	8.05	34.26	52.85	74.00	-21.15	Peak

Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: HORIZONTAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH78(2480MHz)		

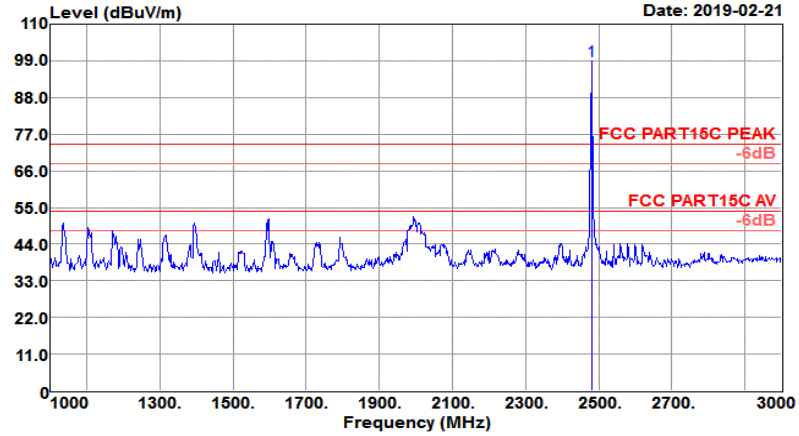


Note: Emission was scanned up to 25GHz,there is only a base noise above 18GHz, so it is not recorded in the report

High Channel Vertical:

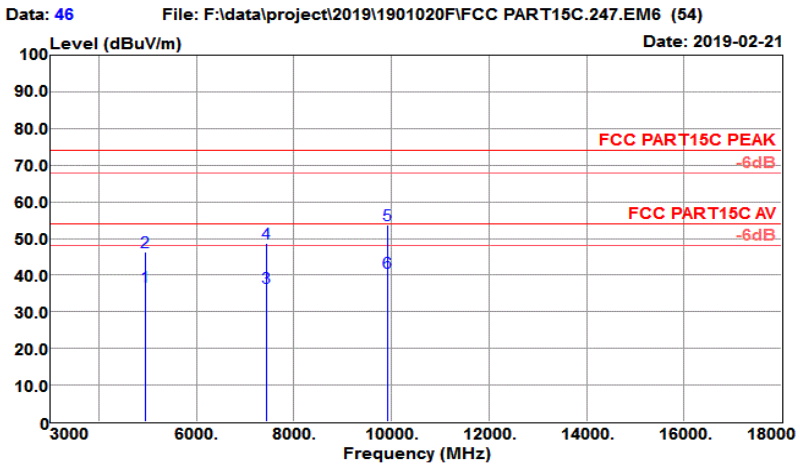
Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: VERTICAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH78(2480MHz)		

Data: 35 File: F:\data\project\2019\1901020F\FCC PART15C.247.EM6 (54)



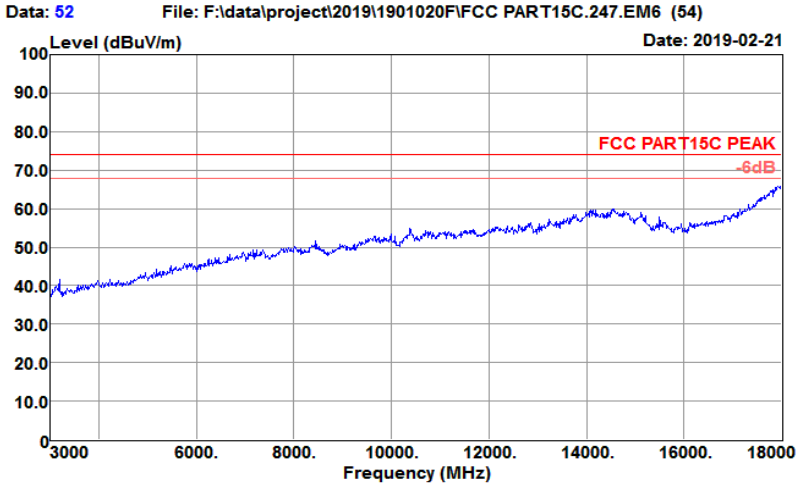
Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
2480.000	104.37	27.35	3.68	36.32	99.08	74.00	25.08	Peak

Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: VERTICAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH78(2480MHz)		



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
4960.000	36.10	31.60	5.36	36.21	36.85	54.00	-17.15	Average
4960.000	45.58	31.60	5.36	36.21	46.33	74.00	-27.67	Peak
7440.000	27.32	36.41	7.44	34.47	36.70	54.00	-17.30	Average
7440.000	39.23	36.41	7.44	34.47	48.61	74.00	-25.39	Peak
9920.000	41.61	38.36	8.05	34.26	53.76	74.00	-20.24	Peak
9920.000	28.55	38.36	8.05	34.26	40.70	74.00	-33.30	Peak

Test Site	: 3m Chamber	Temp/Humi	: 17℃/56%
Tested by	: Damon	Power rating	: AC120V/60Hz
Model No.	: GK-MWZE501	Pol/Phase	: VERTICAL
EUT	: all in one		
Test Mode	: Bluetooth(1Mbps) CH78(2480MHz)		

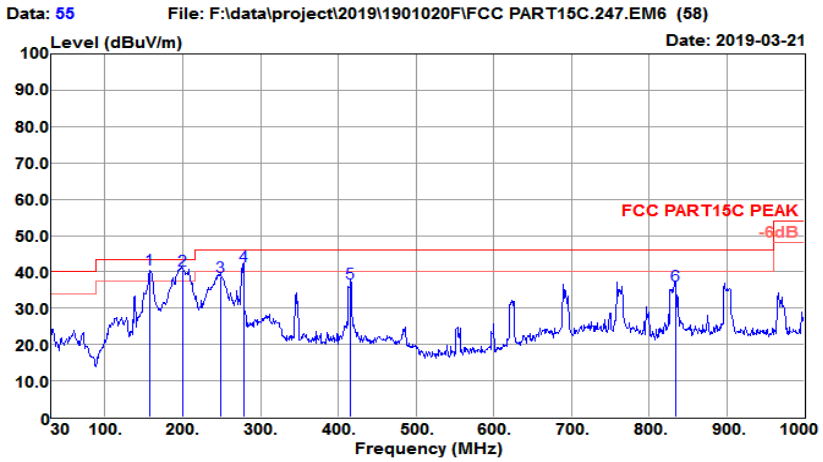


Note: Emission was scanned up to 25GHz,there is only a base noise above 18GHz, so it is not recorded in the report

4.8.6 Test Result of Radiated Spurious Emission (30MHz ~ 1GHz)

Horizontal:

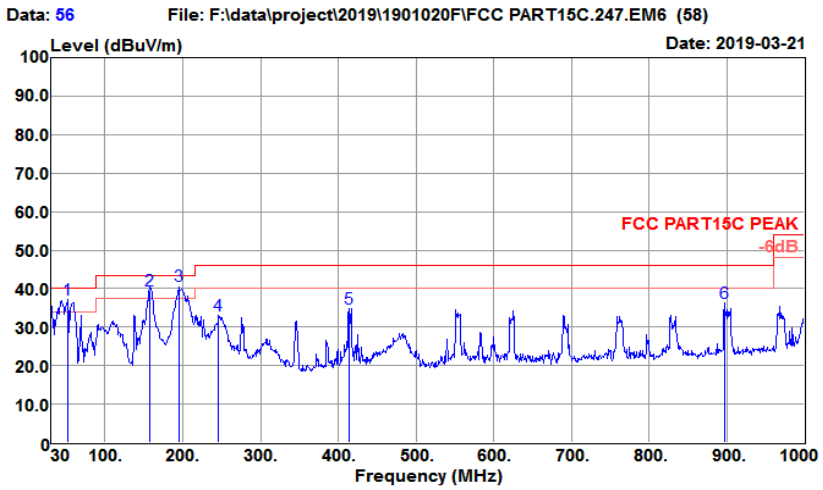
Test Site	: 3m Chamber	Temp/Humi	: 19℃/60%
Tested by	: Damon	Power rating	: AC120V/60Hz
EUT	: all in one	Pol/Phase	: HORIZONTAL
Model No.	: GK-MWZE501		
Test Mode	: Bluetooth(1Mbps) CH39(2441MHz)		



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
158.100	56.70	14.20	2.47	32.51	40.86	43.50	-2.64	QP
199.700	60.20	9.92	2.81	32.55	40.38	43.50	-3.12	QP
249.220	56.56	11.38	3.20	32.53	38.61	46.00	-7.39	QP
278.320	58.45	12.25	3.31	32.53	41.48	46.00	-4.52	QP
416.060	50.07	15.07	4.09	32.48	36.75	46.00	-9.25	QP
834.130	41.65	21.11	6.02	32.45	36.33	46.00	-9.67	QP

Vertical:

Test Site	: 3m Chamber	Temp/Humi	: 19℃/60%
Tested by	: Damon	Power rating	: AC120V/60Hz
EUT	: all in one	Pol/Phase	: VERTICAL
Model No.	: GK-MWZE501		
Test Mode	: Bluetooth(1Mbps) CH39(2441MHz)		



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
51.340	54.85	13.39	1.41	32.58	37.07	40.00	-2.93	QP
158.040	55.41	14.20	2.47	32.51	39.57	43.50	-3.93	QP
194.900	60.30	10.21	2.79	32.55	40.75	43.50	-2.75	QP
246.310	51.27	11.29	3.16	32.53	33.19	46.00	-12.81	QP
414.120	48.32	15.04	4.08	32.48	34.96	46.00	-11.04	QP
897.180	40.22	21.67	6.43	32.10	36.22	46.00	-9.78	QP

4.9 AC Conducted Emission Measurement

4.9.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

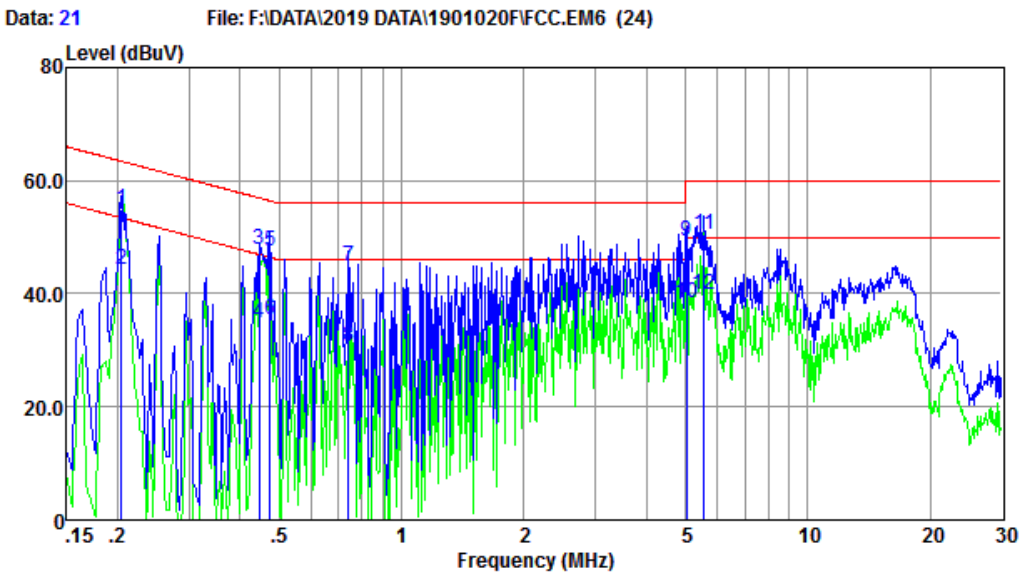
*Decreases with the logarithm of the frequency.

4.9.2 Test Procedures

7. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
8. Connect EUT to the power mains through a line impedance stabilization network (LISN).
9. All the support units are connecting to the other LISN.
10. The LISN provides 50 ohm coupling impedance for the measuring instrument.
11. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
12. Both sides of AC line were checked for maximum conducted interference.
13. The frequency range from 150 kHz to 30 MHz was searched.
14. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

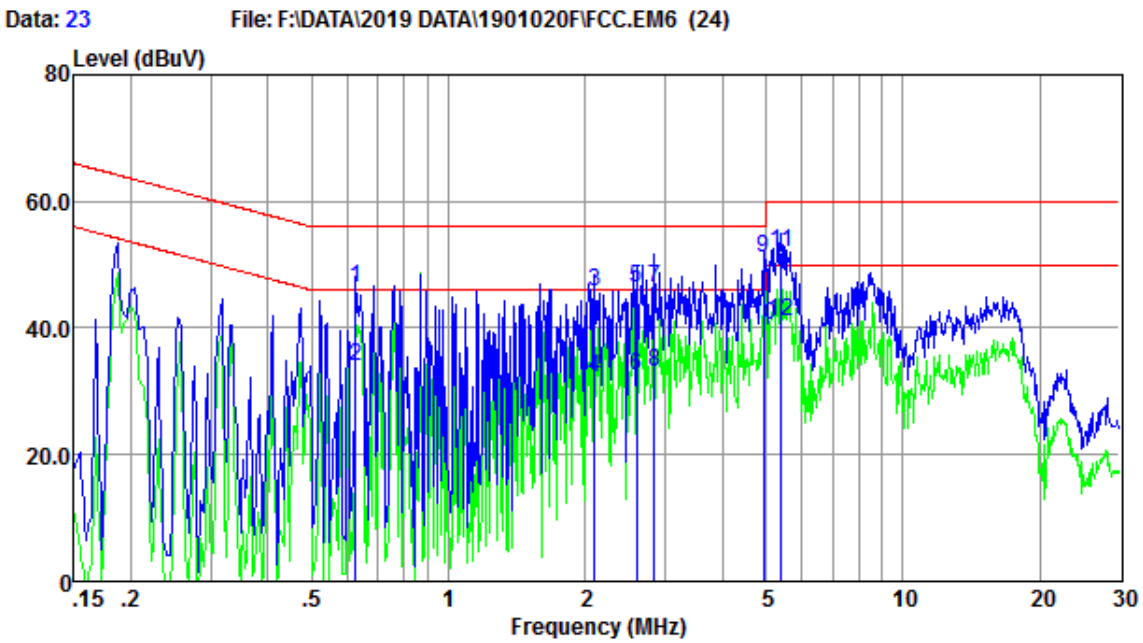
4.9.3 Test Result of AC Conducted Emission

Test Mode :	Mode 1	Temperature :	21~23℃
Test Engineer :	Damon Zhang	Relative Humidity :	41~43%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	Mode 1		



Freq	Reading level	LISN/ISN factor	Cable loss		Limit level	Over limit	Remark
MHz	dBuV	dB	dB	level dBuV	dBuV	dB	
0.204	45.20	9.56	0.01	54.77	63.45	-8.68	QP
0.204	34.60	9.56	0.01	44.17	53.45	-9.28	Average
0.447	38.10	9.58	0.02	47.70	56.93	-9.23	QP
0.447	25.10	9.58	0.02	34.70	46.93	-12.23	Average
0.474	38.00	9.58	0.02	47.60	56.45	-8.85	QP
0.474	25.70	9.58	0.02	35.30	46.45	-11.15	Average
0.739	35.21	9.59	0.03	44.83	56.00	-11.17	QP
0.739	21.00	9.59	0.03	30.62	46.00	-15.38	Average
5.031	39.60	9.67	0.03	49.30	60.00	-10.70	QP
5.031	28.70	9.67	0.03	38.40	50.00	-11.60	Average
5.564	40.70	9.68	0.03	50.41	60.00	-9.59	QP
5.564	30.10	9.68	0.03	39.81	50.00	-10.19	Average

Test Mode :	Mode 1	Temperature :	21~23℃
Test Engineer :	Damon Zhang	Relative Humidity :	41~43%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	Mode1		



Freq	Reading level	LISN/ISN factor	Cable loss	Limit level	Limit level	Over limit	Remark
MHz	dBuV	dB	dB	dBuV	dBuV	dB	
0.624	36.60	9.63	0.03	46.26	56.00	-9.74	QP
0.624	24.20	9.63	0.03	33.86	46.00	-12.14	Average
2.099	36.10	9.65	0.03	45.78	56.00	-10.22	QP
2.099	22.40	9.65	0.03	32.08	46.00	-13.92	Average
2.594	36.60	9.66	0.03	46.29	56.00	-9.71	QP
2.594	22.80	9.66	0.03	32.49	46.00	-13.51	Average
2.839	36.70	9.67	0.03	46.40	56.00	-9.60	QP
2.839	23.30	9.67	0.03	33.00	46.00	-13.00	Average
4.926	41.20	9.72	0.03	50.95	56.00	-5.05	QP
4.926	30.60	9.72	0.03	40.35	46.00	-5.65	Average
5.390	42.20	9.73	0.03	51.96	60.00	-8.04	QP
5.390	31.30	9.73	0.03	41.06	50.00	-8.94	Average

4.10 Antenna Requirements

4.10.1 Standard Applicable

According to antenna requirement of §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 shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded..

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

4.10.2 Antenna Connected Construction

An embedded-in antenna design is used.

4.10.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

5 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Due Date	Remark
Spectrum Analyzer	Keysight	N9010A	MY56070788	2019/1/23	2020/1/22	Conducted
Power Sensor	Keysight	U2021XA	MY56510025	2019/1/23	2020/1/22	Conducted
Power Sensor	Keysight	U2021XA	MY57030005	2019/1/23	2020/1/22	Conducted
Power Sensor	Keysight	U2021XA	MY56510018	2019/1/23	2020/1/22	Conducted
Power Sensor	Keysight	U2021XA	MY56480002	2019/1/23	2020/1/22	Conducted
Thermal Chamber	Sanmtest	SMC-408-CD	2435	2018/7/5	2019/7/4	Conducted
Base Station	R&S	CMW 270	101231	2019/1/23	2020/1/22	Conducted
Signal Generator (Blocker)	Keysight	N5171B	MY56200661	2019/1/23	2020/1/22	Conducted

Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Due Date**	**Remark**
Spectrum Analyzer	R&S	FSV 40	101433	2019/2/18	2020/2/17	Radiation
Amplifier	Sonoma	310	363917	2019/1/22	2020/1/21	Radiation
Amplifier	Schwarzbeck	BBV 9718	327	2019/1/22	2020/1/21	Radiation
Amplifier	Narda	TTA1840-35-HG	2034380	2018/7/18	2019/7/17	Radiation
Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-051	2017/3/3	2020/3/2	Radiation
Broadband Antenna	Schwarzbeck	VULB 9168	9168-757	2017-03-03	2020-03-02	Radiation
Horn Antenna	Schwarzbeck	BBHA 9120 D	1677	2017-03-03	2020-03-02	Radiation
Horn Antenna	COM-POWER	AH-1840	101117	2018-06-20	2021-06-19	Radiation
Test Software	Auidx	E3	6.111221a	N/A	N/A	Radiation
Filter	Micro-Tronics	BRM 50702	G266	N/A	N/A	Radiation

N/A: No Calibration Required

6 Uncertainty of Evaluation

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.64dB
Radiated emission	30MHz ~ 1GMHz	5.05dB
	1GHz ~ 18GHz	5.06 dB
	18GHz ~ 40GHz	3.65dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

----------End of the report----------