FCC TEST REPORT(Bluetooth)

for

Swalle Technology CO.,Ltd

Selfie Remote Shutter

Model Number: 631000

FCC ID: 2AFF9-631000

Prepared for	:	Swalle Technology CO.,Ltd
Address	:	F-G,20th Floor,Pacific Trade Building B,Jia Bin Road,Luo Hu District,Shenzhen,China
Prepared by	:	Keyway Testing Technology Co., Ltd.
Address	:	Building 1, Baishun Industrial Zone, Zhangmutou Town, Dongguan, Guangdong, China
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Report No.	:	15KWE072817F
Date of Test	:	Jul. 13~20, 2015
Date of Report	:	Jul 20, 2015

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Keyway Testing Technology Co., Ltd.

Applicant: **Address:**	Swalle Technology CO.,Ltd F-G,20th Floor,Pacific Trade Building B,Jia Bin Road,Luo Hu District,Shenzhen,China		
Manufacturer: **Address:**	Swalle Technology CO.,Ltd F-G,20th Floor,Pacific Trade Building B,Jia Bin Road,Luo Hu District,Shenzhen,China		
E.U.T:	Selfie Remote Shutter		
Model Number:	631000		
Trade Name:	N/A	**Serial No.:**	------
Date of Receipt:	Jul 10, 2015	**Date of Test:**	Jul.13~20, 2015
Test Specification:	FCC Part 15, Subpart C Section 15.247: 2014 ANSI C63.10:2013		
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied. **Issue Date: Jul. 21, 2015**		

Tested by:	Reviewed by:	Approved by:
Daisy Chen / Engineer	Andy Gao / Supervisor	Jade Yang / Supervisor

Other Aspects:

None.

Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested

1. TEST SUMMARY

Test Items	Test Requirement	Result
Conducted Emissions	15.207	N/A
Radiated Emissions	15.205(a)/15.209	PASS
20dB Bandwidth	15.247(a)(1)	PASS
Frequency Separation	15.247(a)(1)	PASS
Maximum Peak Output Power	15.247(b)(1)	PASS
Number of Hopping Frequency	15.247(a)(1)(iii)	PASS
Dwell time	15.247(a)(1)(iii)	PASS
Emissions from out of band	15.247(d)	PASS
Antenna Requirement	15.203	PASS

2.GENERAL PRODUCT INFORMATION

2.1. Product Function

Refer to Technical Construction Form and User Manual.

2.2. Description of Device (EUT)

Product Name:	Selfie Remote Shutter
Model No.:	631000
Operation Frequency:	2402MHz ~2480MHz
Channel numbers:	79 Channels
Channel spacing	1MHz
Modulation technology:	BT(1Mbps): GFSK BT EDR(2Mbps): π/4-DQPSK BT EDR(3Mbps): 8-DPSK
Bit Rate of Transmitter	1Mbps/2Mbps/3Mbps
Antenna Type:	PCB
Antenna gain:	1.0dBi
Power supply:	DC 3V

2.3. Difference between Model Numbers

None.

2.4. Independent Operation Modes

The basic operation modes are:

2.4.1. EUT work continues TX mode and frequency as below:

Channel	Frequency
Low	2402MHz
Middle	2441MHz
High	2480MHz

2.5. Test Supporting System

None.

2.6. Test Facilities

Lab Qualifications : 944 Shielded Room built by ETS-Lindgren, USA
Date of completion: March 28, 2011

966 Chamber built by ETS-Lindgren, USA
Date of completion: March 28, 2011

Certificated by TUV Rheinland, Germany.
Registration No.: UA 50207153
Date of registration: July 13, 2011

Certificated by UL, USA
Registration No.: 100567-237
Date of registration: September 1, 2011

Certificated by Intertek
Registration No.: 2011-RTL-L1-31
Date of registration: October 11, 2011

Certificated by Industry Canada
Registration No.: 9868A
Date of registration: December 8, 2011

Certificated by FCC, USA
Registration No.: 370994
Date of registration: February 21, 2012

Certificated by CNAS China
Registration No.: CNAS L5783
Date of registration: August 8, 2012

Name of Firm : Keyway Testing Technology Co., Ltd.

Site Location : Building 1, Baishun Industrial Zone, Zhangmutou Town, Dongguan, Guangdong, China

2.7. List of Test and Measurement Instruments

2.7.1. For conducted emission at the mains terminals test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 27,15	Apr. 27,16
Artificial Mains Network	Rohde&Schwarz	ENV216	101315	Apr. 27,15	Apr. 27,16
Artificial Mains Network (AUX)	Rohde&Schwarz	ENV216	101314	Apr. 27,15	Apr. 27,16
RF Cable	FUJIKURA	3D-2W	944 Cable	Apr. 27,15	Apr. 27,16

2.7.2. For radiated emission test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 27,15	Apr. 27,16
System Simulator	Agilent	E5515C	GB43130245	Apr. 27,15	Apr. 27,16
Power Splitter	Weinschel	1506A	NW425	Apr. 27,15	Apr. 27,16
Bilog Antenna	ETS-LINDGREEN	3142D	135452	Apr. 27,15	Apr. 27,16
Spectrum Analyzer	Agilent	E4411B	MY4511304	Apr. 27,15	Apr. 27,16
3m Semi-anechoic Chamber	ETS-LINDGREEN	966	KW01	Apr. 27,15	Apr. 27,16
Signal Amplifier	SONOMA	310	187016	Apr. 27,15	Apr. 27,16
Signal Amplifier	Agilent	8449B	3008A00251	Apr. 27,15	Apr. 27,16
RF Cable	IMRO	IMRO-400	966 Cable 1#	N/A	N/A
MULTI-DEVICE Controller	ETS-LINDGREEN	2090	126913	N/A	N/A
Horn Antenna	DAZE	ZN30701	11003	Apr. 27,15	Apr. 27,16
Horn Antenna	SCHWARZBECK	BBHA9170	9170-068	Apr. 27,15	Apr. 27,16
Spectrum Analyzer	Agilent	8593E	3911A04271	Apr. 27,15	Apr. 27,16
Spectrum Analyzer	Agilent	E4408B	MY44211125	Apr. 27,15	Apr. 27,16
Signal Amplifier	DAZE	ZN3380C	11001	Apr. 27,15	Apr. 27,16
High Pass filter	Micro	HPM50111	324216	Apr. 27,15	Apr. 27,16
Filter	COM-MW	ZBSF-C836.5-25-X	KW032	Apr. 27,15	Apr. 27,16
Filter	COM-MW	ZBSF-C1747.5-75-X2	KW035	Apr. 27,15	Apr. 27,16
Filter	COM-MW	ZBSF-C1880-60-X2	KW037	Apr. 27,15	Apr. 27,16
DC Power Supply	LongWei	PS-305D	010964729	Apr. 27,15	Apr. 27,16
Constant temperature and humidity box	GF	GTH-800-40-1P	MAA9906-005	Apr. 27,15	Apr. 27,16
Universal radio communication tester	Rohde&Schwarz	CMU200	3215420	Apr. 27,15	Apr. 27,16
Splitter	Agilent	11636B	0025164	Apr. 27,15	Apr. 27,16
Attenuation	MCE	24-10-34	BN9258	Apr. 27,15	Apr. 27,16

3. TEST SET-UP AND OPERATION MODES

3.1. Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the Operating Instructions.

3.2. Block Diagram of Test Set-up

System Diagram of Connections between EUT and Simulators

EUT

(EUT: Selfie Remote Shutter)

3.3. Test Operation Mode and Test Software

None.

3.4. Special Accessories and Auxiliary Equipment

None.

3.5. Countermeasures to Achieve EMC Compliance

None.

3.6. Test Environment:

Ambient conditions in the test laboratory:

Items	Actual
Temperature (℃)	21~23
Humidity (%RH)	50~65

4. MAXIMUM PEAK OUTPUT POWER

4.1. Limits

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247 (b)(i)	Peak Output Power	0.125 w or 20.96dBm	2400-2483.5	PASS

4.2. Test Procedure

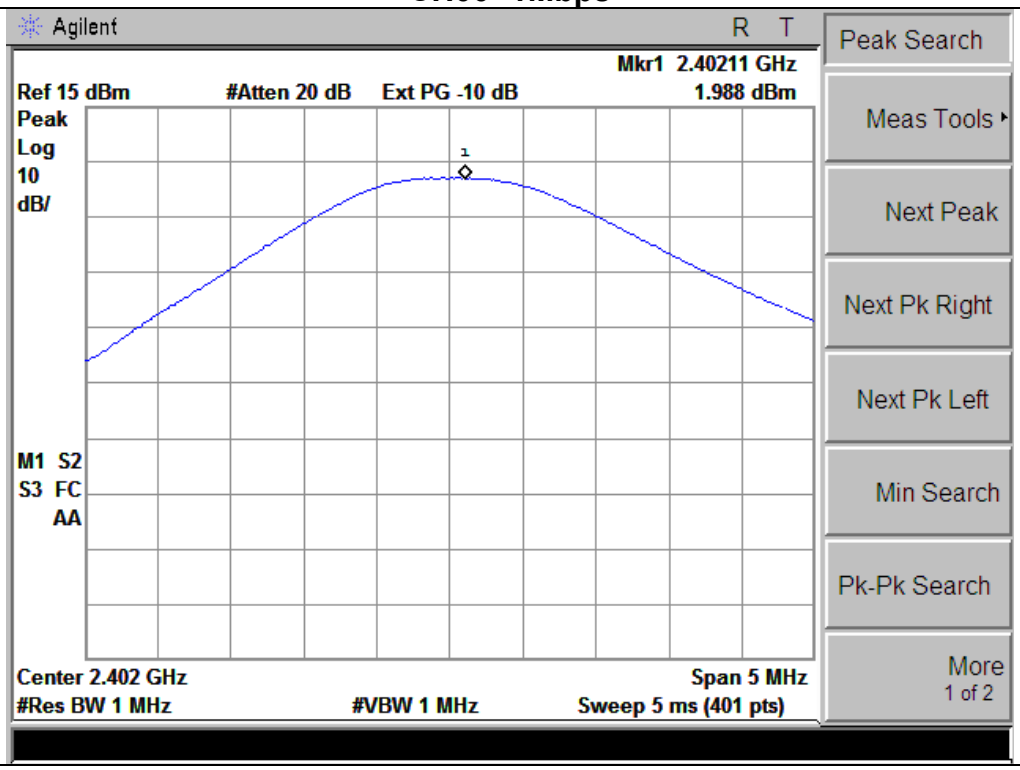
a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,

b. Spectrum Setting : RBW > the 20 dB bandwidth of the emission being measured
Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

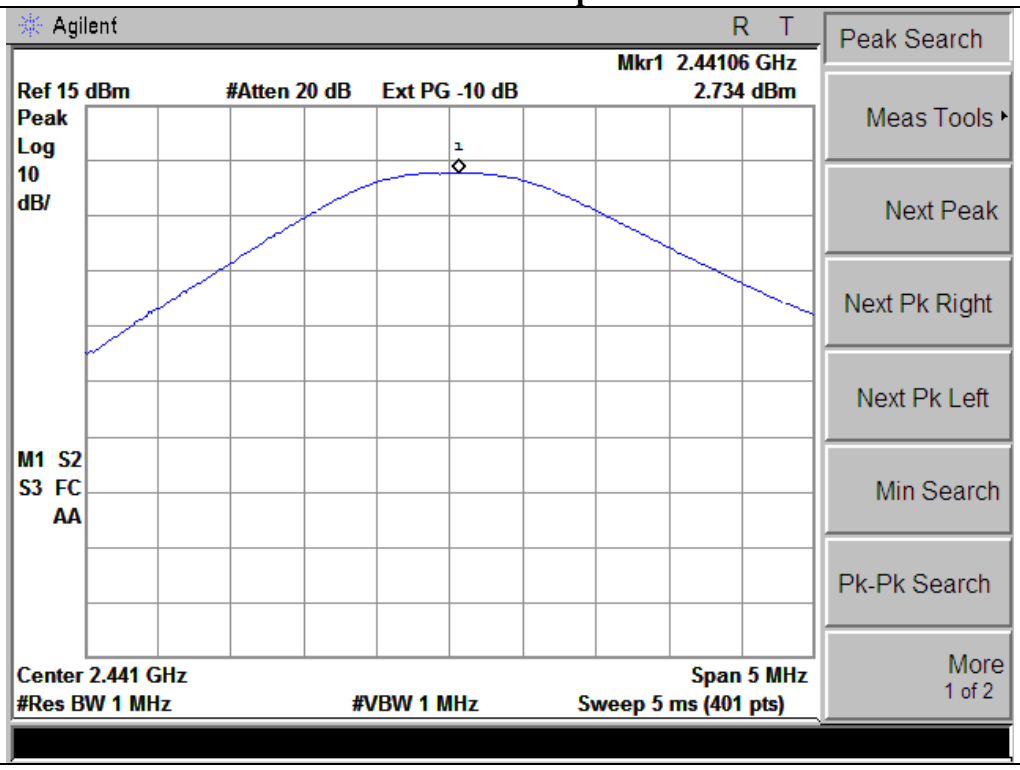
Test data:

1Mbps			
Test Channel	Frequency (MHz)	Peak Output Power (dBm)	LIMIT (dBm)
CH00	2402	1.988	30
CH39	2441	2.734	30
CH78	2480	2.461	30
2Mbps			
CH00	2402	1.625	20.96
CH39	2441	2.165	20.96
CH78	2480	2.282	20.96
3Mbps			
CH00	2402	2.163	20.96
CH39	2441	2.616	20.96
CH78	2480	2.631	20.96

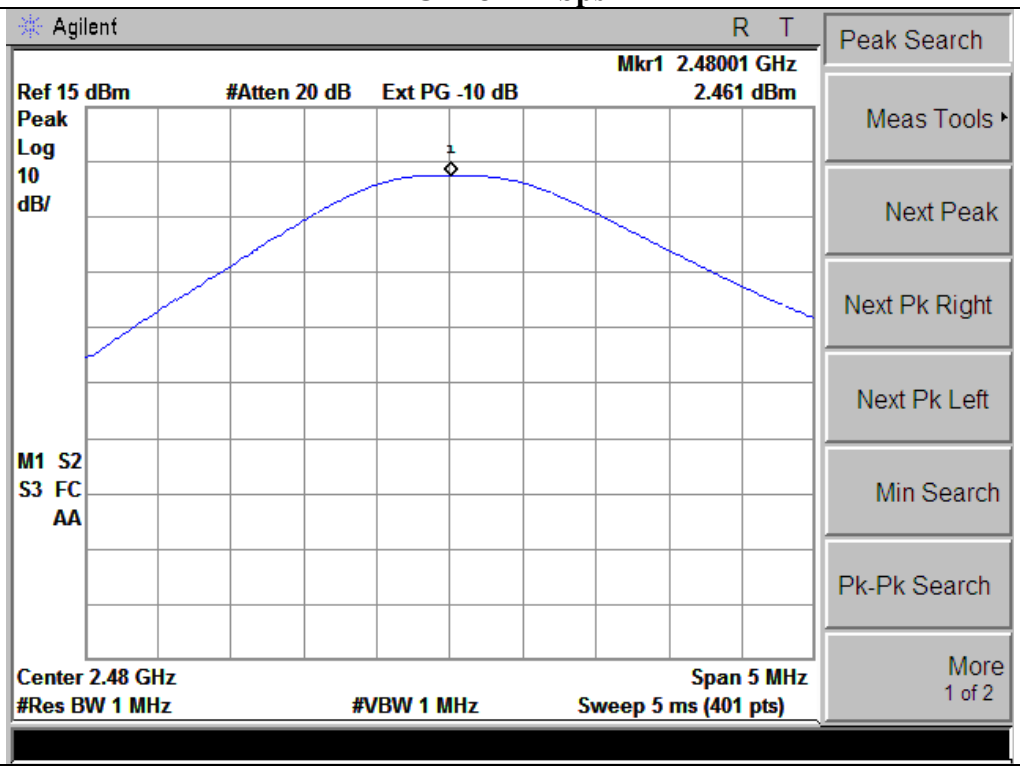
CH00 -1Mbps



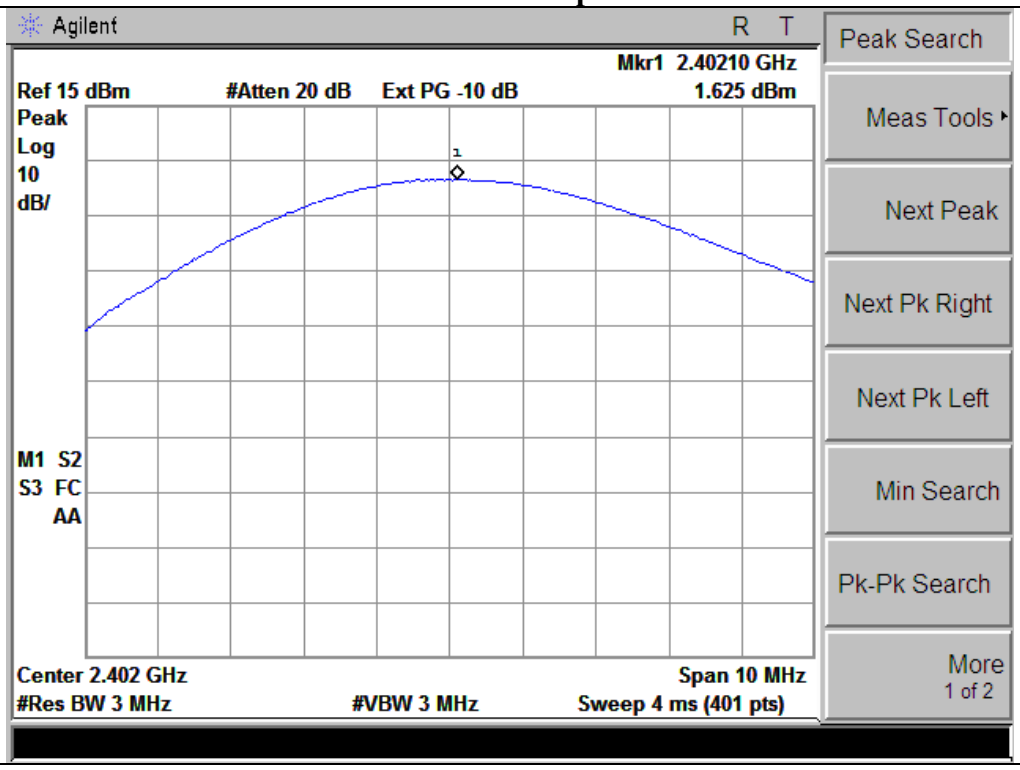
CH39 -1Mbps



CH78 -1Mbps



CH00 -2Mbps



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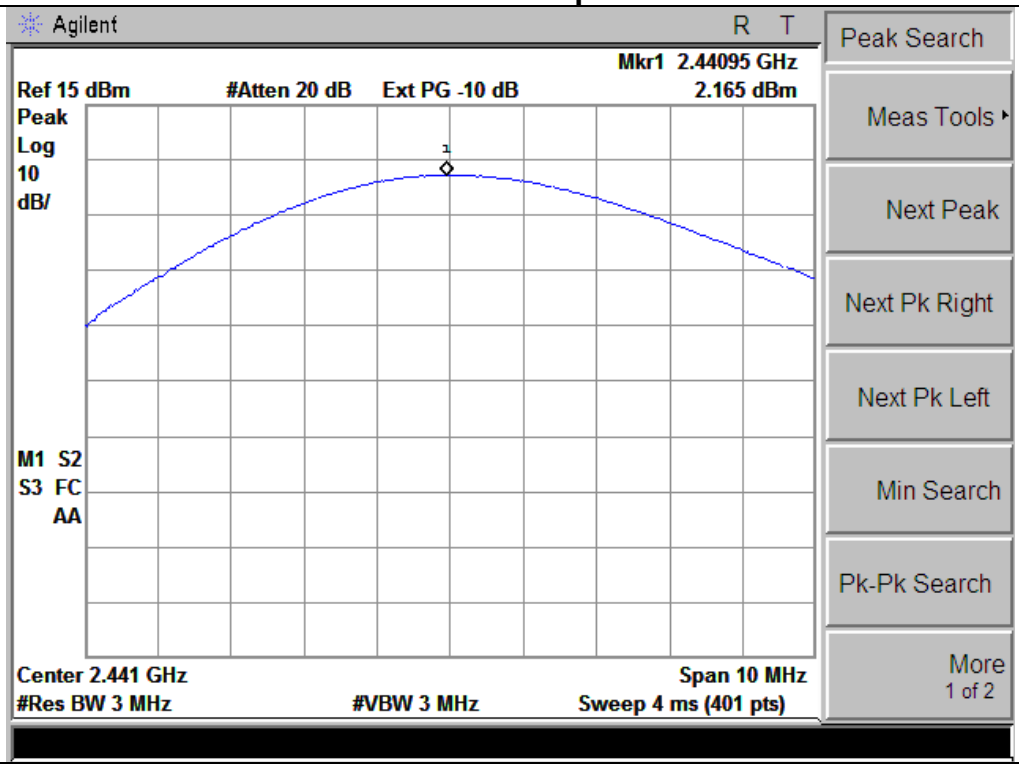
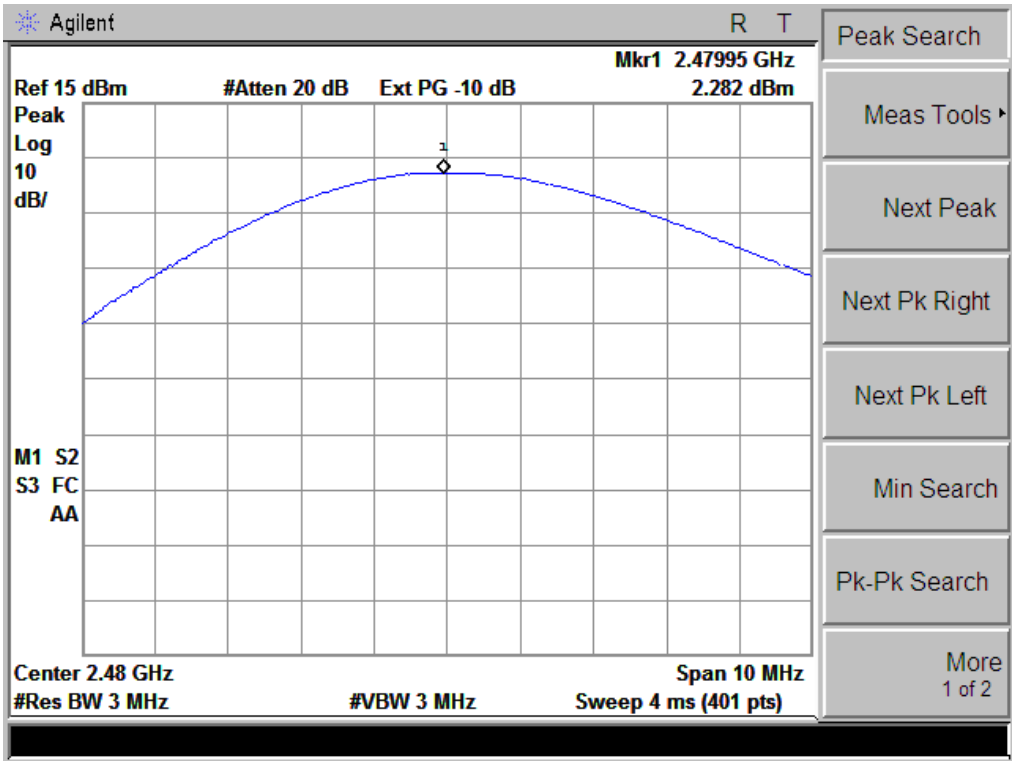
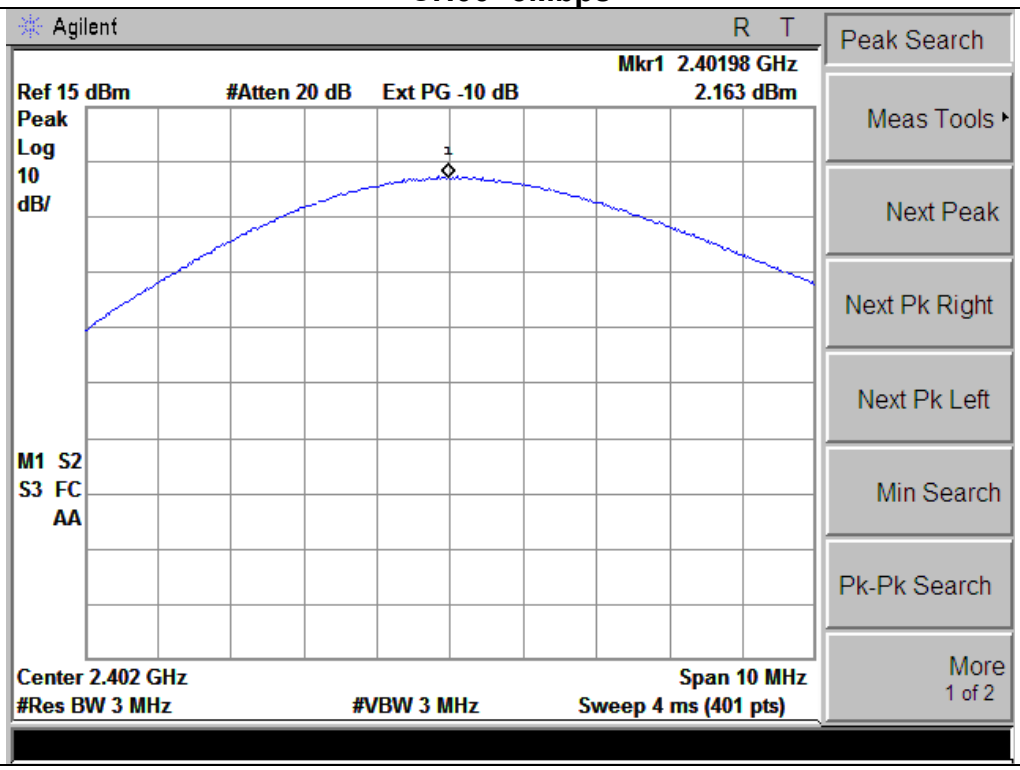


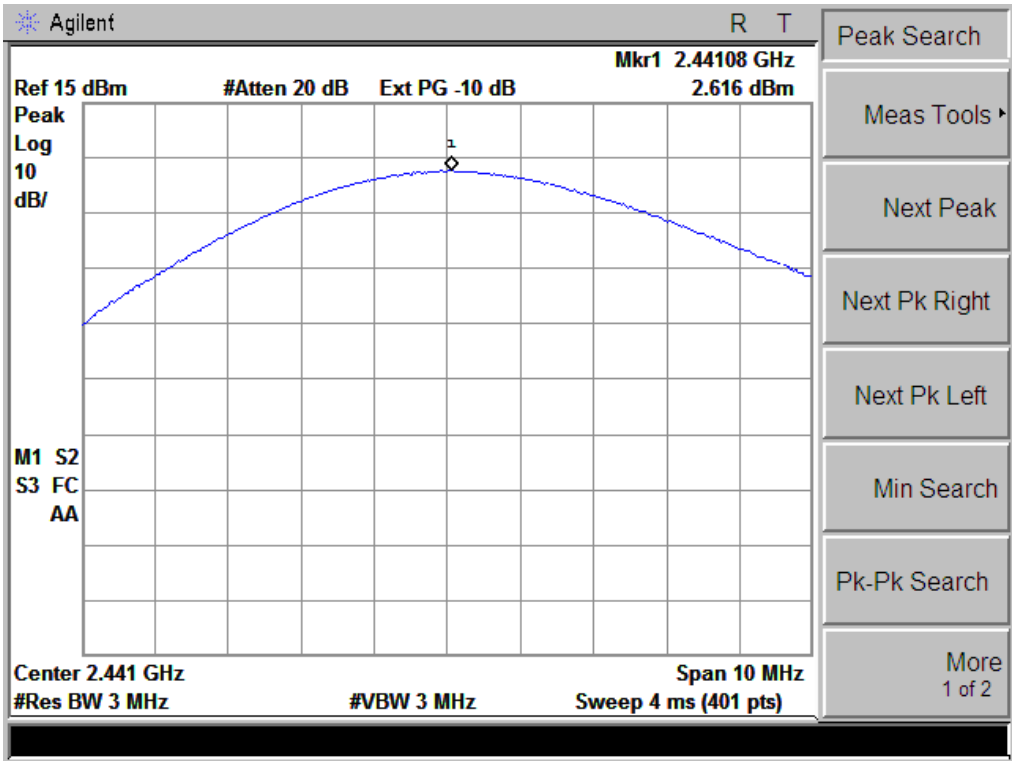
CH78 -2Mbps



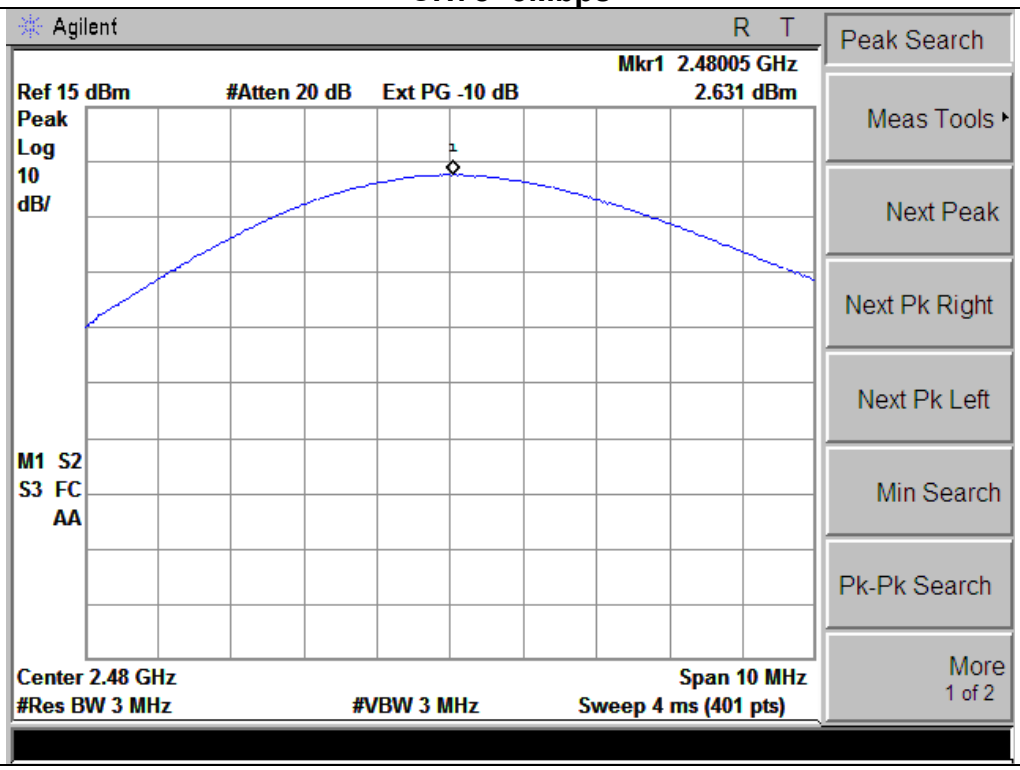
CH00 -3Mbps



CH39 -3Mbps



CH78 -3Mbps


Agilent
R T
Mkr1 2.48005 GHz
Ref 15 dBm
#Atten 20 dB
Ext PG -10 dB
2.631 dBm
Peak
Log
10
dB/
M1 S2
S3 FC
AA
Center 2.48 GHz
#Res BW 3 MHz
#VBW 3 MHz
Span 10 MHz
Sweep 4 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

5. EMISSION TEST RESULTS

5.1. Conducted Emission at the Mains Terminals Test

5.1.1. Limit 15.207 limits

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBμV)	
	Quasi-peak	Average
0.15-0.5 0.5-5 5-30	66 to 56 56 60	56 to 46 46 50

5.1.2. Test Setup

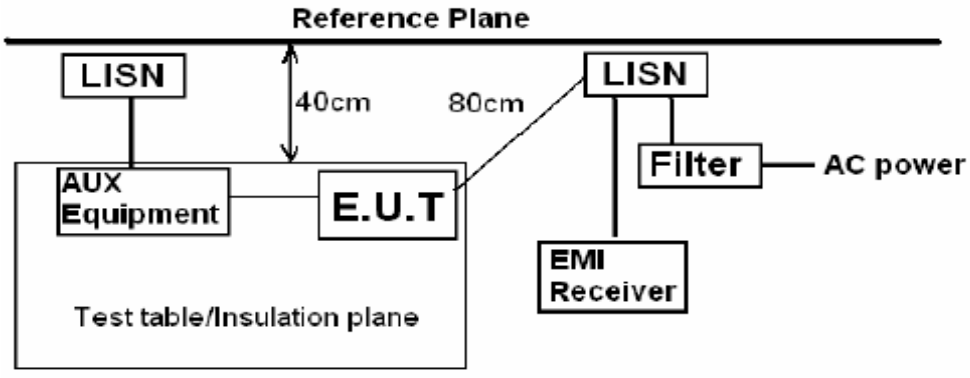
The EUT was put on a wooden table which was 0.8 m high above the ground and connected to the AC mains through the Artificial Mains Network (AMN). Where the mains cable supplied by the manufacture was longer than 0.8 m, the excess was folded back and forth parallel to the cable at the center so as to form a bundle no longer than 0.4 m.

The EUT was kept 0.4 m from any other earthed conducting surface. Both sides of AC line were checked to find out the maximum conducted emission levels according to the test procedure during the conducted emission test.

The frequency range from 150 kHz to 30 MHz was investigated.

The bandwidth of the test receiver was set at 9 kHz.

Pretest for all mode, The test data of the worst case condition(s) was reported on the following page.



Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m

5.1.3. Test result

N/A.

5.2. Radiated Emission Test

5.2.1. Limit 15.209 limits

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

5.2.2. Restricted bands of operation

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

5.2.3. Test setup

The EUT was placed on a turn table which was 0.8 m above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The EUT was tested in the Chamber Site. It was pre-scanned with a Peak detector from the spectrum, and all the final readings from the test receiver were measured with the Quasi-Peak detector.

The bandwidth of the EMI test receiver is set at 120kHz for frequency range from 30MHz to 1000 MHz.

The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz, the EUT was placed on a turn table which was 1.5 m above the ground, for all test, used peak detector.

The frequency range from 30MHz to 10^{th} harmonic (25GHz) are checked. and no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

Notes: 1. Emission Level = Antenna Factor + Cable Loss + Meter Reading-Preamp Factor.

2. Measurement Uncertainty: ±3.2 dB at a level of confidence of 95%.

3. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.

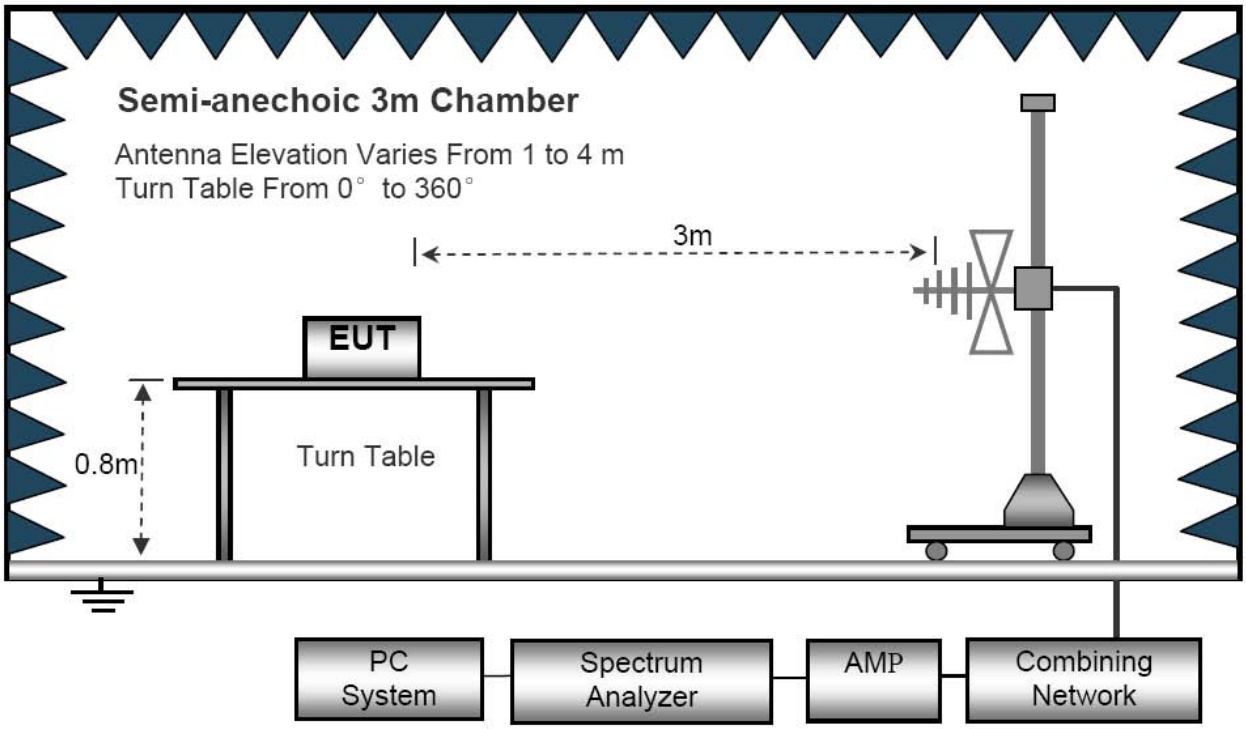
4. For emissions below 1GHz, pretest for all mode, The test data of the worst case condition(s) was reported on the following pages.

5: we pretest 3 packages DH1, DH3, DH5, package DH5 is largest; we are testing DH5 in the report.

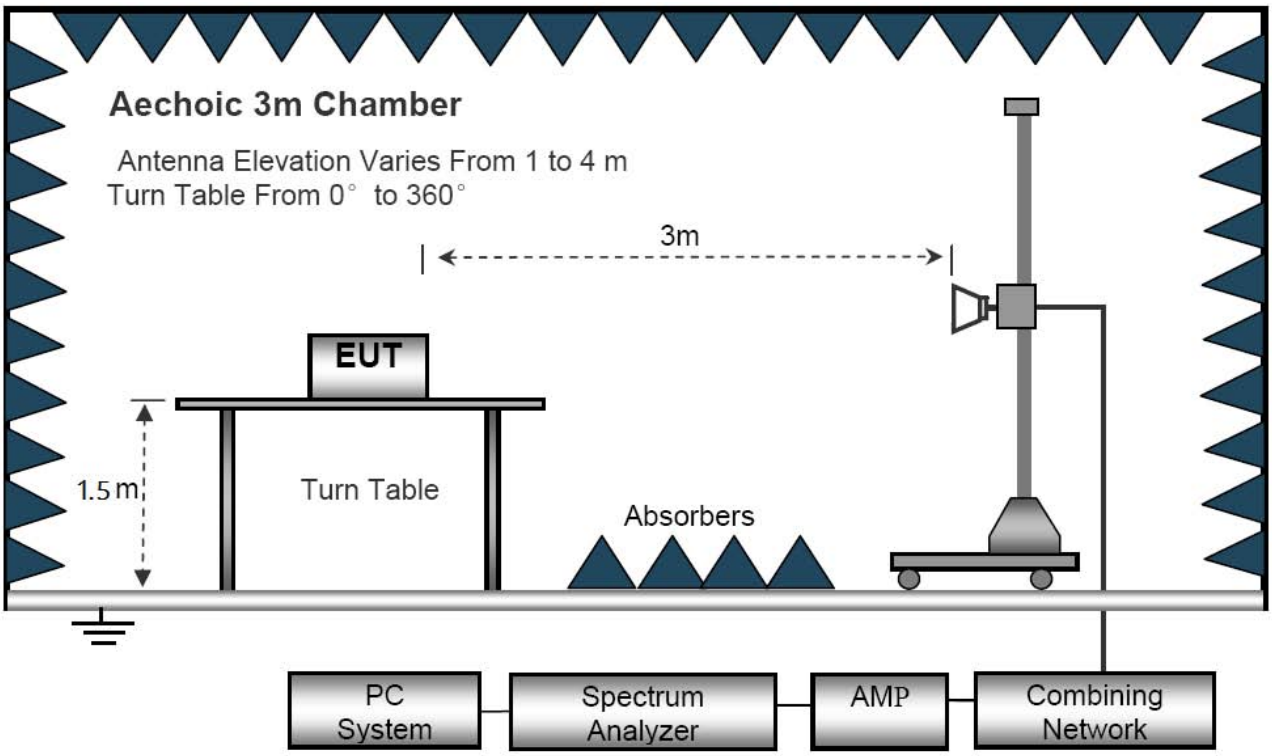
6:Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.

7：We pretest all modulation, The worst was 8-DPSK, the worst data was show in the report.

Below 1GHz

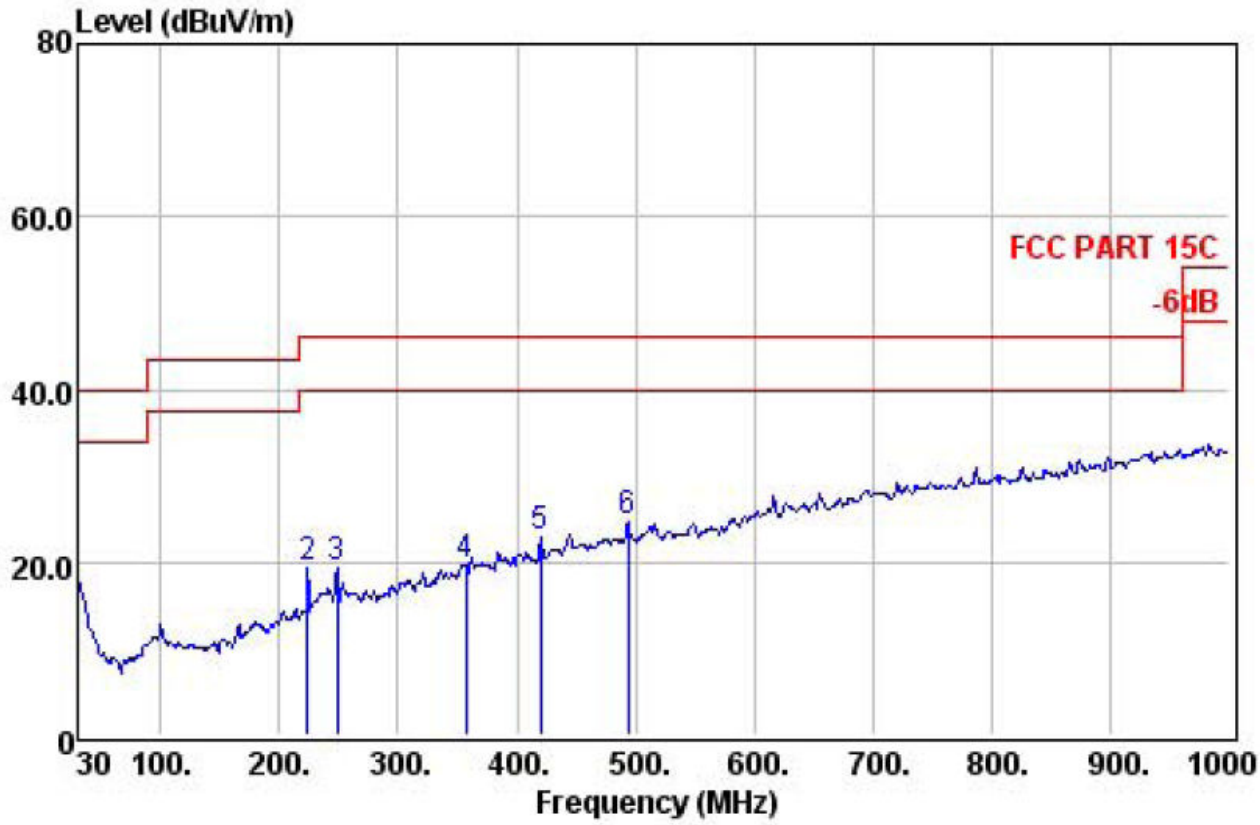


Above 1GHz



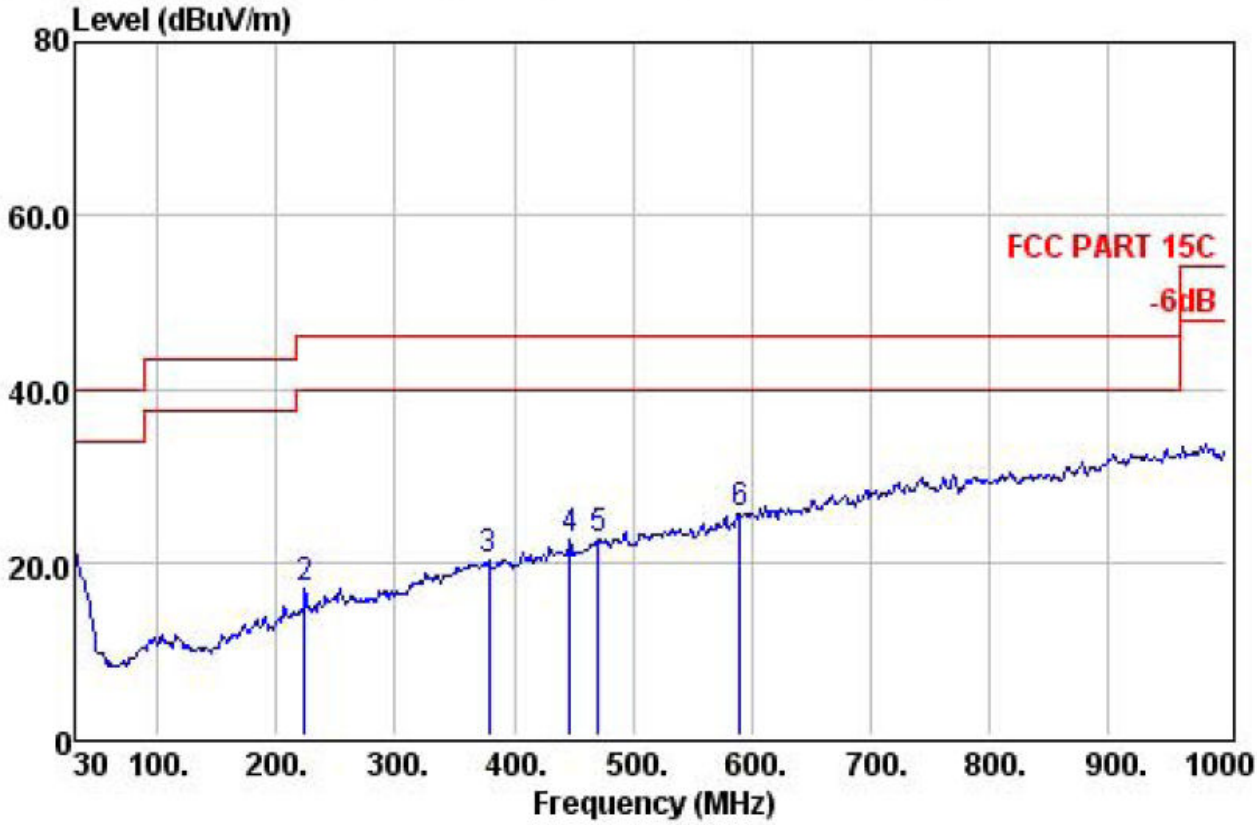
Below 1GHz

Horizontal



	Freq	Preamp Factor	Read Level	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dBuV/m	dBuV/m	dB	
1	30.00	31.41	31.20	0.56	19.15	40.00	-20.85	QP
2	224.00	30.95	36.64	1.53	19.37	46.00	-26.63	QP
3	248.25	30.96	35.79	1.70	19.38	46.00	-26.62	QP
4	356.89	30.63	32.11	2.18	19.75	46.00	-26.25	QP
5	419.94	30.63	33.99	2.48	22.78	46.00	-23.22	QP
6	493.66	30.59	34.01	2.77	24.79	46.00	-21.21	QP

Vertical



	Freq	Preamp Factor	Read Level	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dBuV/m	dBuV/m	dB	
1	30.00	31.41	34.35	0.56	22.30	40.00	-17.70	QP
2	224.00	30.95	34.26	1.53	16.99	46.00	-29.01	QP
3	379.20	30.62	32.45	2.27	20.30	46.00	-25.70	QP
4	447.10	30.61	33.03	2.62	22.58	46.00	-23.42	QP
5	471.35	30.60	32.34	2.69	22.63	46.00	-23.37	QP
6	590.66	30.69	32.68	3.29	25.58	46.00	-20.42	QP

ABOVE 1G

Frequency (MHz)	Reading (dB μ V)	Factor (dB)	Corrected Amplitude (dB μ V/m)	Limit(dB μ V/m)	Margin (dB)	Remark	Polar (H/V)
low channel(2402MHz)							
4804.000	47.14	10.12	57.26	74	-16.74	Pk	Vertical
4804.000	37.52	10.12	47.64	54	-6.36	AV	Vertical
7206.000	42.45	12.05	54.5	74	-19.5	Pk	Vertical
7206.000	32.52	12.05	44.57	54	-9.43	AV	Vertical
4804.000	44.14	10.12	54.26	74	-19.74	Pk	Horizontal
4804.000	35.62	10.12	45.74	54	-8.26	AV	Horizontal
7206.000	46.55	12.05	58.6	74	-15.4	Pk	Horizontal
7206.000	34.21	12.05	46.26	54	-7.74	AV	Horizontal
Middle channel(2441MHz)							
4882.000	52.21	10.42	62.63	74	-11.37	Pk	Vertical
4882.000	33.15	10.42	43.57	54	-10.43	AV	Vertical
7323.000	42.32	12.81	55.13	74	-18.87	Pk	Vertical
7323.000	32.14	12.81	44.95	54	-9.05	AV	Vertical
4882.0002	56.22	10.42	66.64	74	-7.36	Pk	Horizontal
4882.000	33.62	10.42	44.04	54	-9.96	AV	Horizontal
7323.000	47.24	12.81	60.05	74	-13.95	Pk	Horizontal
7323.000	32.14	12.81	44.95	54	-9.05	AV	Horizontal
High channel(2480MHz)							
4960.000	47.32	10.48	57.8	74	-16.2	Pk	Vertical
4960.000	34.14	10.48	44.62	54	-9.38	AV	Vertical
7440.000	43.54	12.87	56.41	74	-17.59	Pk	Vertical
7440.000	35.32	12.87	48.19	54	-5.81	AV	Vertical
4960.000	46.42	10.48	56.9	74	-17.1	Pk	Horizontal
4960.000	34.24	10.48	44.72	54	-9.28	AV	Horizontal
7440.000	45.18	12.87	58.05	74	-15.95	Pk	Horizontal
7440.000	37.41	12.87	50.28	54	-3.72	AV	Horizontal

Note: Mode 1Mbps is the worst mode.

6. 20DB BANDWIDTH

6.1. Limits

According to FCC Section 15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth(10*log1%=20dB)taking the RF output power

6.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

2. Set the spectrum analyzer:

Span: approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel

RBW ≥1% of the 20dB bandwidth

VBW ≥ RBW

Sweep=auto

Detector function=peak

Trace=max hold

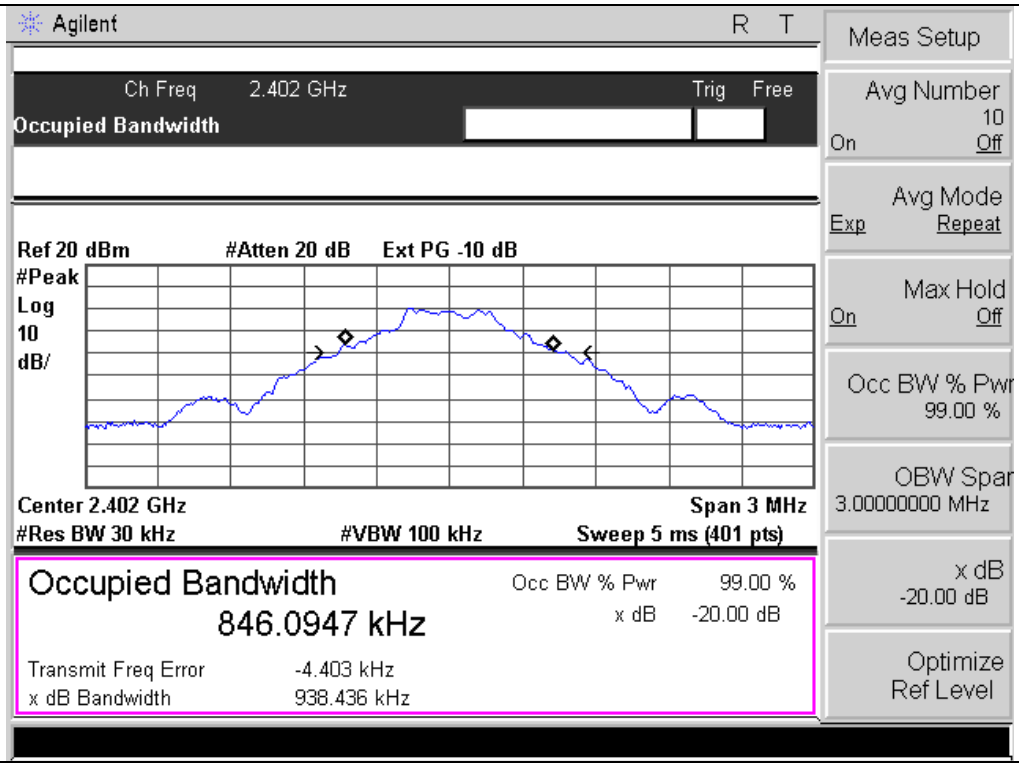
Test data:

EUT：	Selfie Remote Shutter	Model Name ：	631000
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1012 hPa	Test Voltage ：	DC 3.0V
Test Mode ：	CH00 / CH39 /C78**(1Mbps)**		

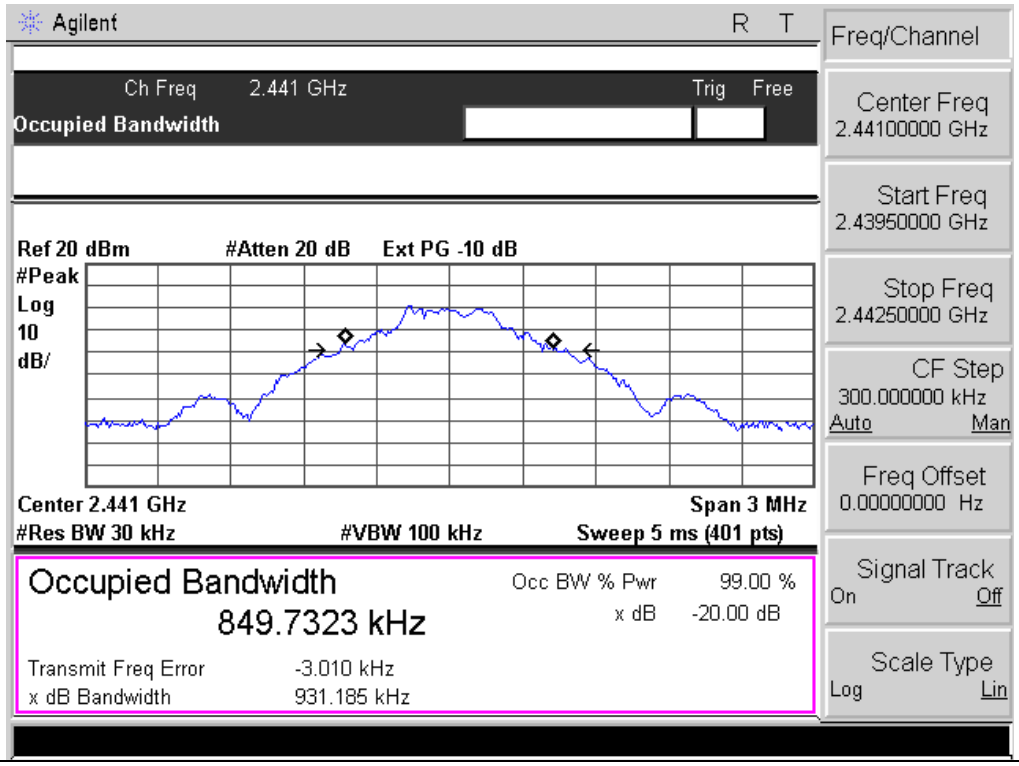
Frequency	20dB Bandwidth (kHz)	Result
2402 MHz	938.436	**PASS**
2441 MHz	931.185	**PASS**
2480 MHz	874.037	**PASS**

Test plot as follows:

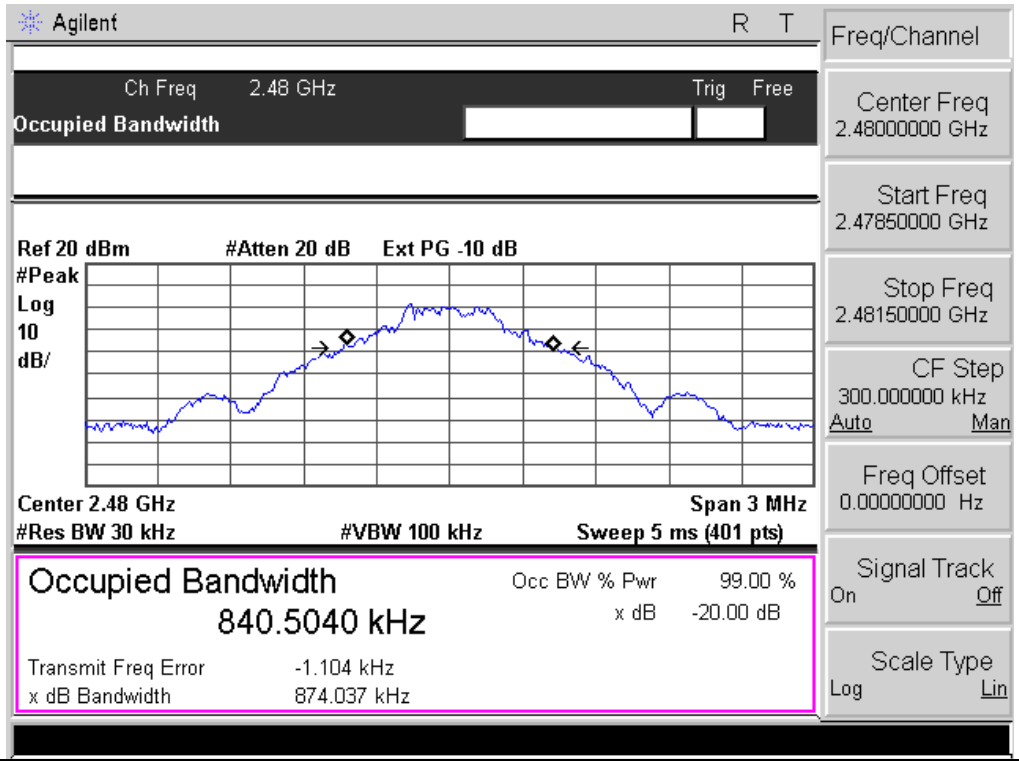
CH00



CH39 -1Mbps



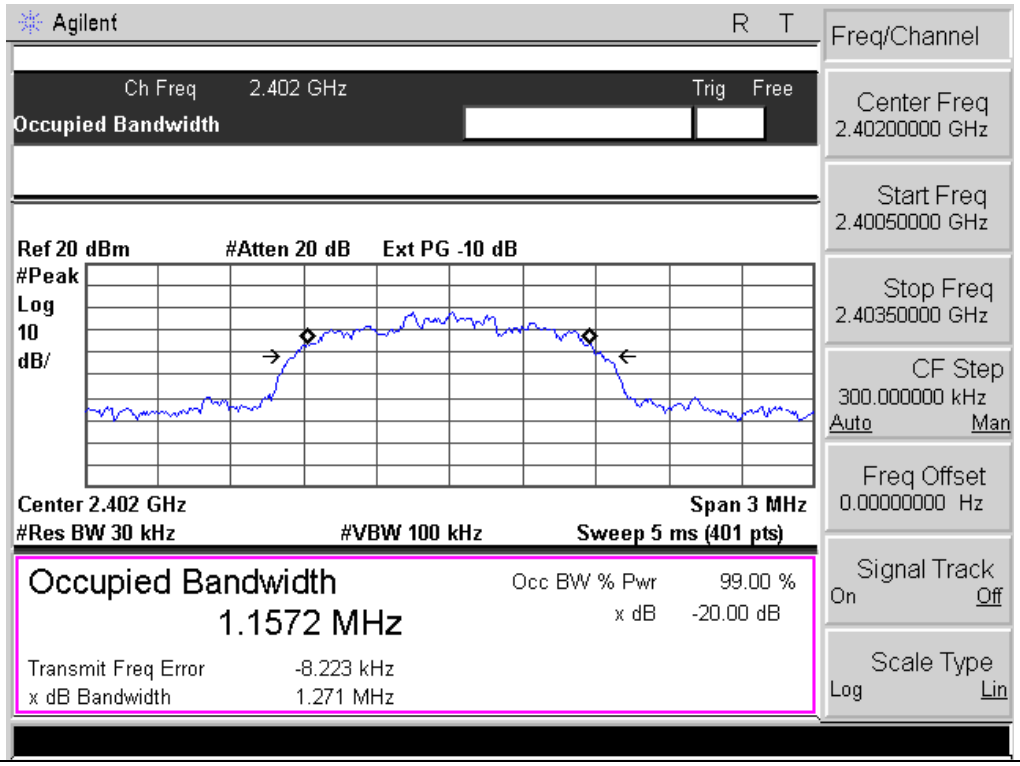
CH78 -1Mbps



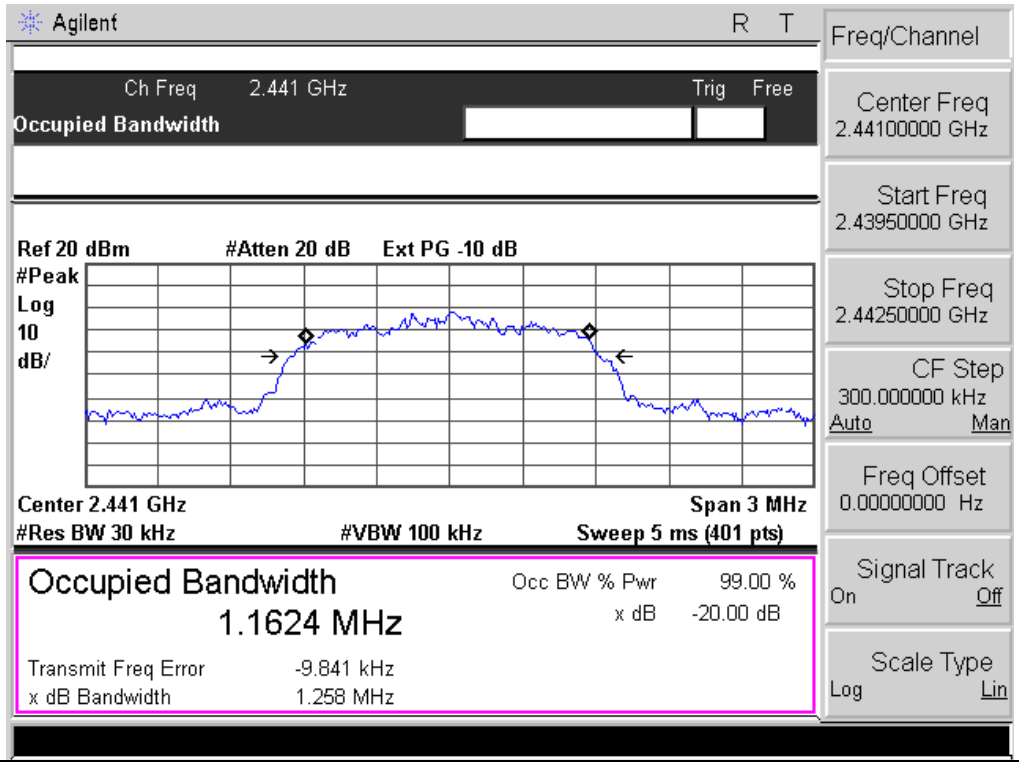
EUT：	Selfie Remote Shutter	Model Name ：	631000
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1012 hPa	Test Voltage ：	DC 3.0V
Test Mode ：	CH00 / CH39 /C78**(2Mbps)**		

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.271	**PASS**
2441 MHz	1.258	**PASS**
2480 MHz	1.258	**PASS**

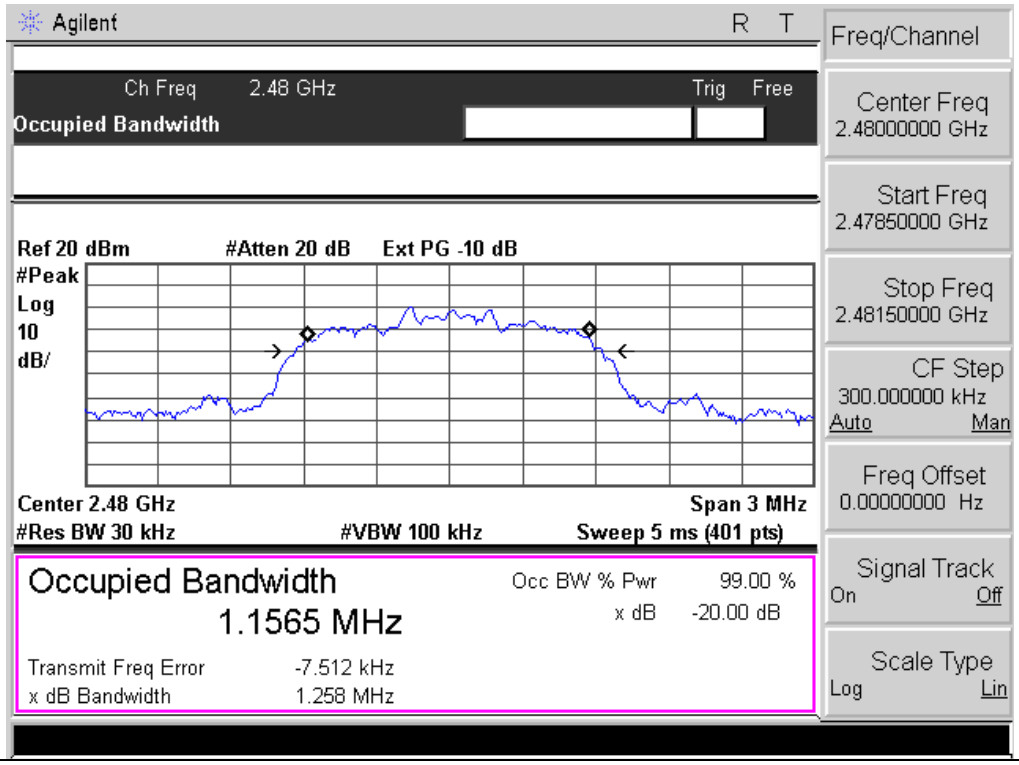
CH00



CH39


Agilent
R T
Freq/Channel
Ch Freq 2.441 GHz
Trig Free
Occupied Bandwidth
Center Freq
2.44100000 GHz
Start Freq
2.43950000 GHz
Stop Freq
2.44250000 GHz
CF Step
300.000000 kHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin
Ref 20 dBm
#Atten 20 dB
Ext PG -10 dB
#Peak
Log
10
dB/
Center 2.441 GHz
Span 3 MHz
#Res BW 30 kHz
#VBW 100 kHz
Sweep 5 ms (401 pts)
Occupied Bandwidth
1.1624 MHz
Occ BW % Pwr 99.00 %
x dB -20.00 dB
Transmit Freq Error -9.841 kHz
x dB Bandwidth 1.258 MHz

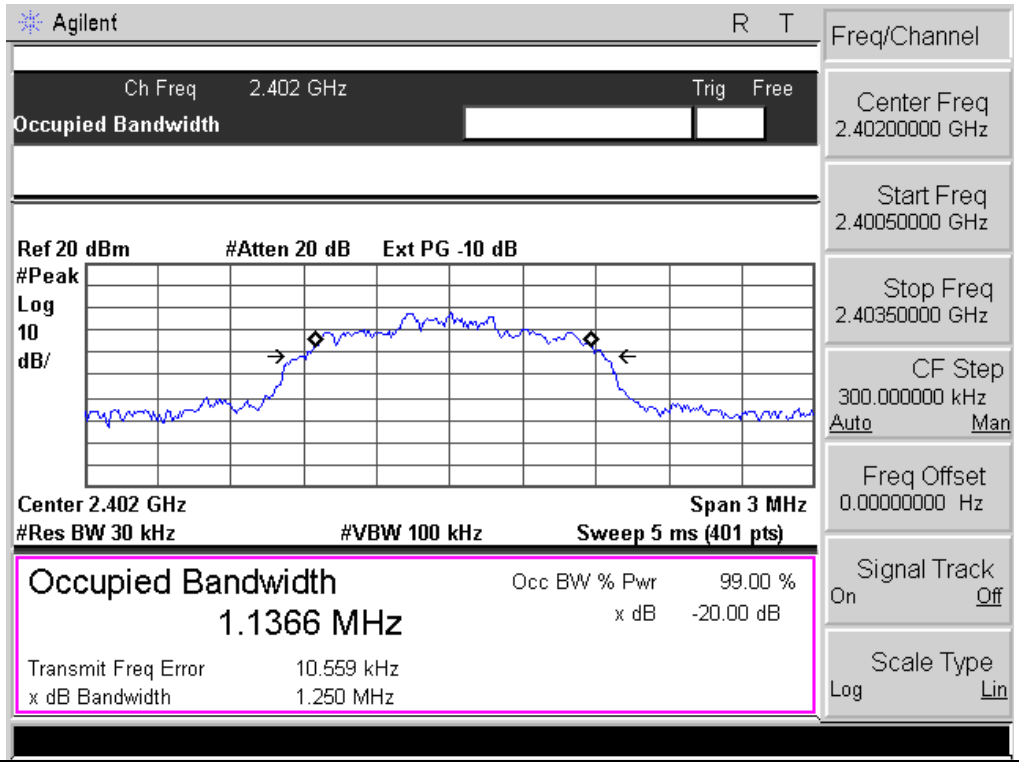
CH78


Agilent
R T
Freq/Channel
Ch Freq 2.48 GHz
Trig Free
Occupied Bandwidth
Center Freq
2.48000000 GHz
Start Freq
2.47850000 GHz
Stop Freq
2.48150000 GHz
CF Step
300.000000 kHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin
Ref 20 dBm
#Atten 20 dB
Ext PG -10 dB
#Peak
Log
10
dB/
Center 2.48 GHz
Span 3 MHz
#Res BW 30 kHz
#VBW 100 kHz
Sweep 5 ms (401 pts)
Occupied Bandwidth
1.1565 MHz
Occ BW % Pwr 99.00 %
x dB -20.00 dB
Transmit Freq Error -7.512 kHz
x dB Bandwidth 1.258 MHz

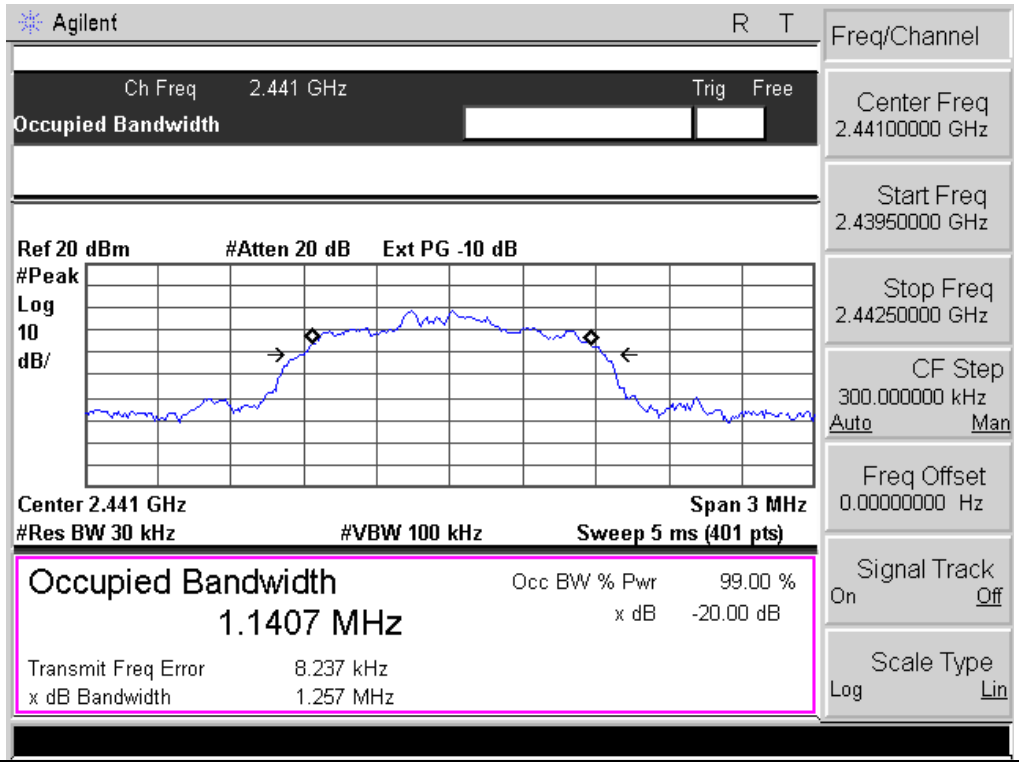
EUT：	Selfie Remote Shutter	Model Name ：	631000
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1012 hPa	Test Voltage ：	DC 3.0V
Test Mode ：	CH00 / CH39 /CH78**(3Mbps)**		

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.250	**PASS**
2441 MHz	1.257	**PASS**
2480 MHz	1.246	**PASS**

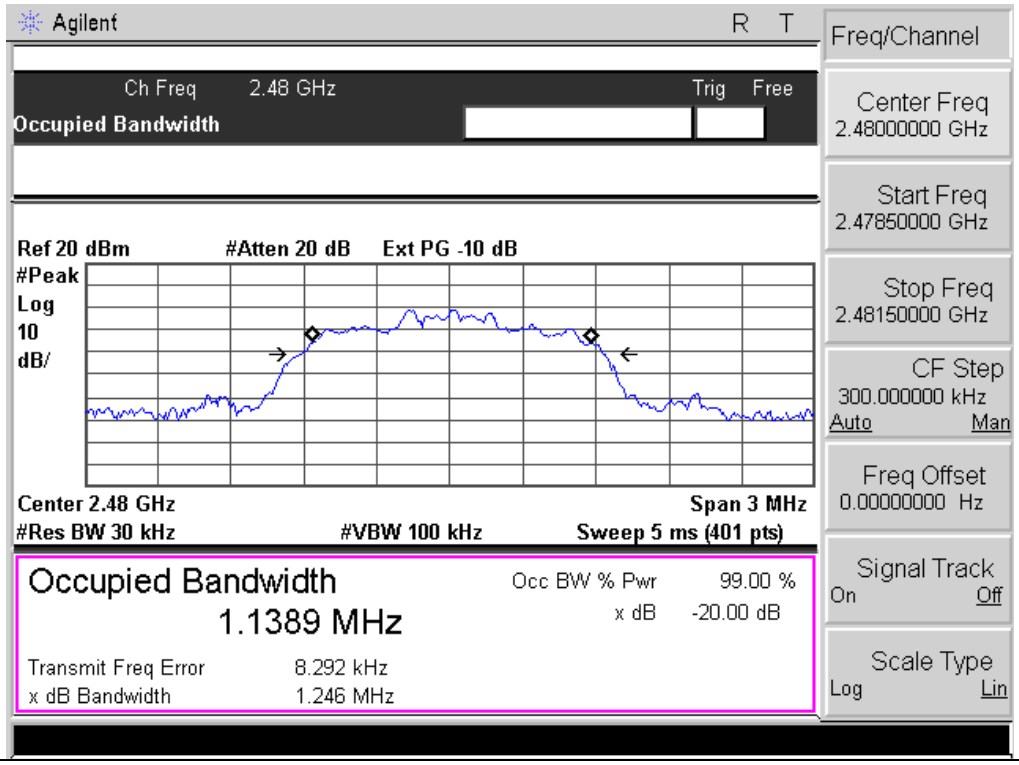
CH00



CH39


Agilent
R T
Ch Freq 2.441 GHz
Trig Free
Occupied Bandwidth
Ref 20 dBm
#Atten 20 dB
Ext PG -10 dB
#Peak
Log
10
dB/
Center 2.441 GHz
Span 3 MHz
#Res BW 30 kHz
#VBW 100 kHz
Sweep 5 ms (401 pts)
Occupied Bandwidth
1.1407 MHz
Occ BW % Pwr 99.00 %
x dB -20.00 dB
Transmit Freq Error 8.237 kHz
x dB Bandwidth 1.257 MHz
Freq/Channel
Center Freq
2.44100000 GHz
Start Freq
2.43950000 GHz
Stop Freq
2.44250000 GHz
CF Step
300.000000 kHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin

CH78


Agilent
R T
Ch Freq 2.48 GHz
Trig Free
Occupied Bandwidth
Ref 20 dBm
#Atten 20 dB
Ext PG -10 dB
#Peak
Log
10
dB/
Center 2.48 GHz
Span 3 MHz
#Res BW 30 kHz
#VBW 100 kHz
Sweep 5 ms (401 pts)
Occupied Bandwidth
1.1389 MHz
Occ BW % Pwr 99.00 %
x dB -20.00 dB
Transmit Freq Error 8.292 kHz
x dB Bandwidth 1.246 MHz
Freq/Channel
Center Freq
2.48000000 GHz
Start Freq
2.47850000 GHz
Stop Freq
2.48150000 GHz
CF Step
300.000000 kHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin

7. FREQUENCY SEPARATION

7.1. Limits

According to FCC Section 15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

7.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode .

2. Set the spectrum analyzer:

Span: wide enough to capture the peaks of two adjacent channels

RBW ≥1% of the span(30KHz)

VBW ≥ RBW(100KHz)

Sweep=auto

Detector function=peak

Trace=max hold

Test data:

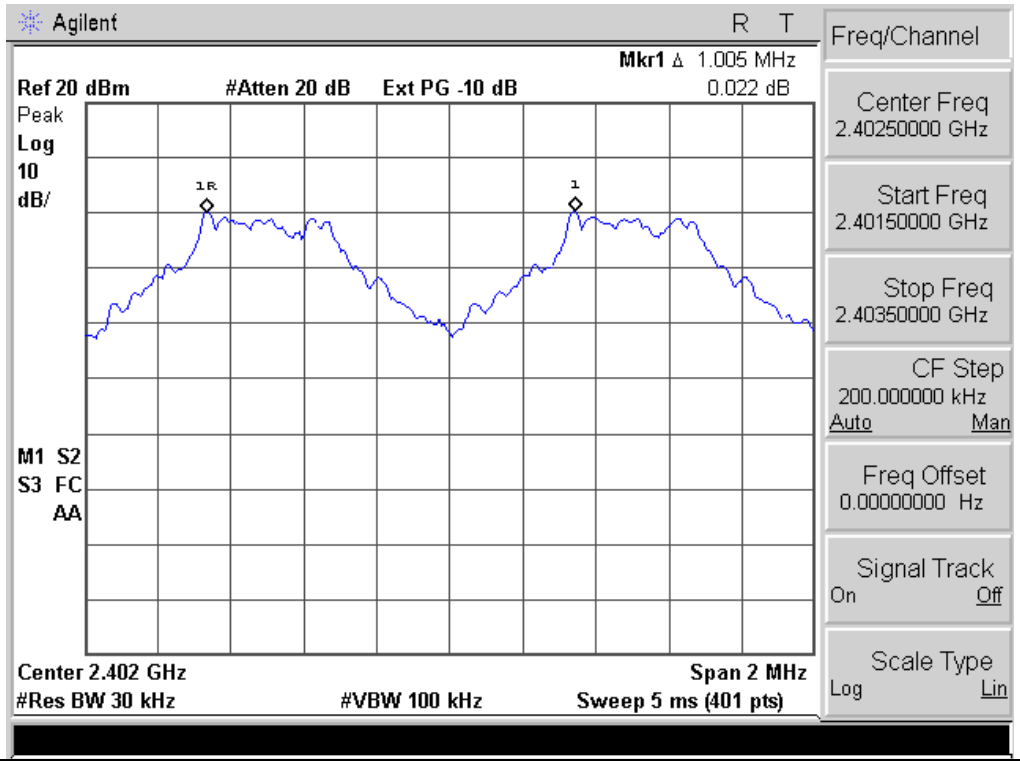
EUT：	Selfie Remote Shutter	Model Name ：	631000
Temperature：	24 ℃	Relative Humidity：	58%
Pressure：	1010hPa	Test Voltage ：	DC 3.0V
Test Mode ：	CH00 / CH39 /CH78**(1Mbps)**		

Frequency	Ch. Separation (MHz)	Result
2402 MHz	1.005	**Complies**
2441 MHz	1.010	**Complies**
2480 MHz	1.000	**Complies**

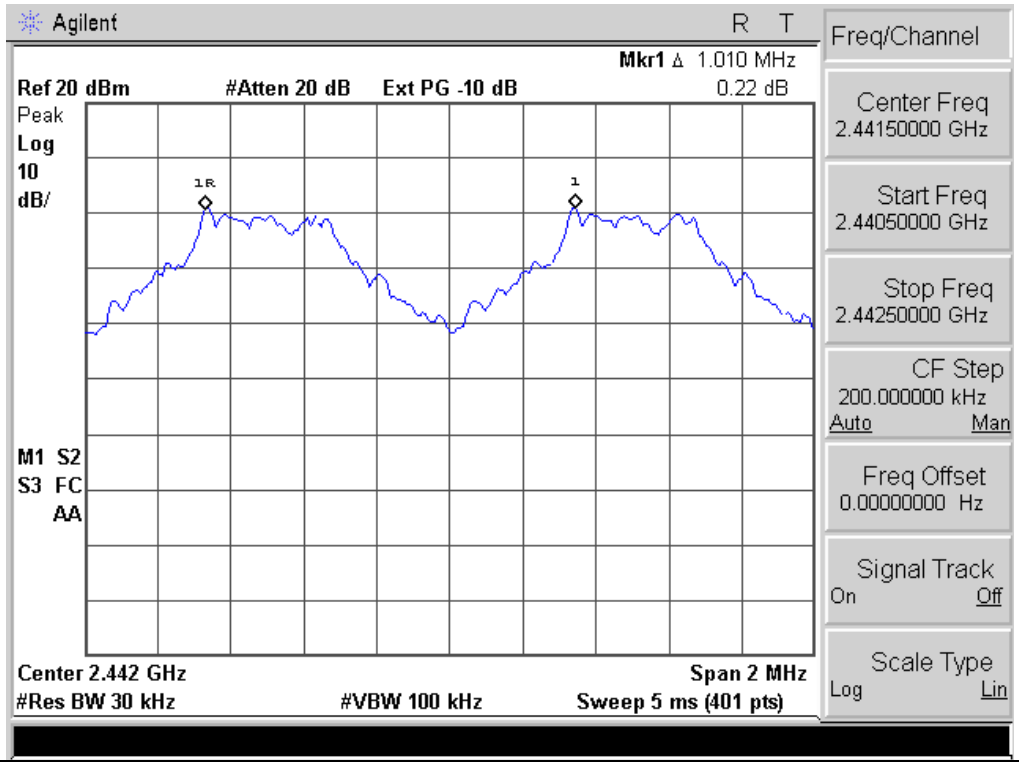
Ch. Separation Limits: > 20dB bandwidth

Test plot as follows:

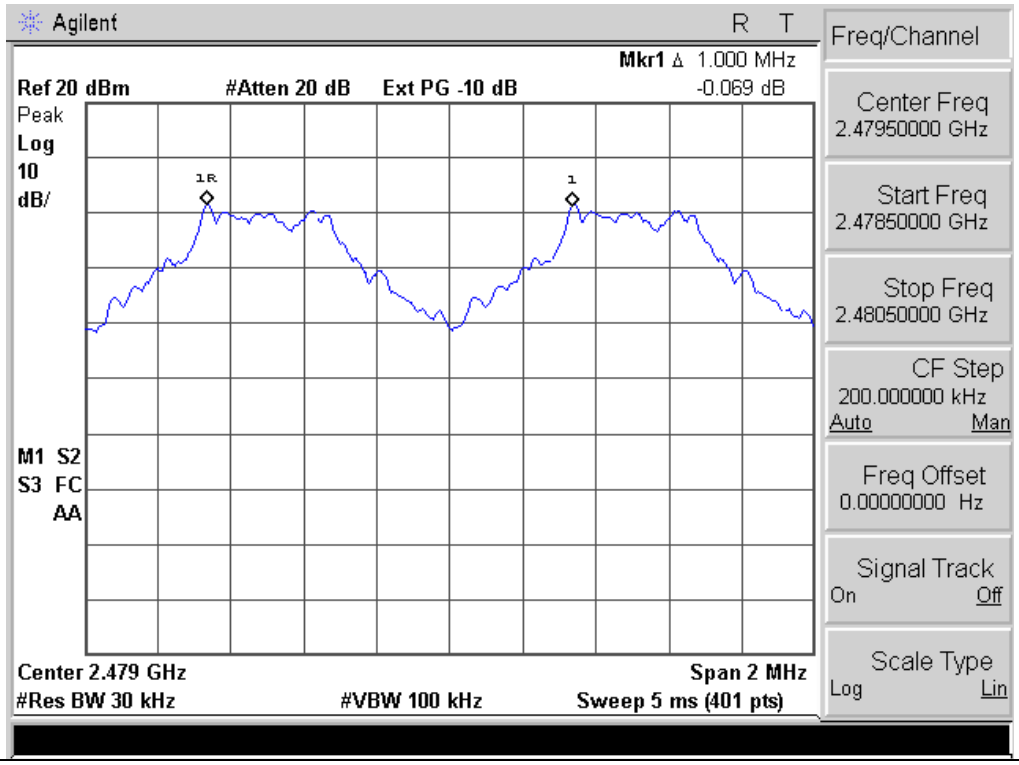
CH00



CH39


Agilent
R T
Mkr1 Δ 1.010 MHz
0.22 dB
Ref 20 dBm
#Atten 20 dB
Ext PG -10 dB
Peak
Log
10
dB/
1R
1
M1 S2
S3 FC
AA
Center 2.442 GHz
Span 2 MHz
#Res BW 30 kHz
#VBW 100 kHz
Sweep 5 ms (401 pts)
Freq/Channel
Center Freq
2.44150000 GHz
Start Freq
2.44050000 GHz
Stop Freq
2.44250000 GHz
CF Step
200.000000 kHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin

CH78

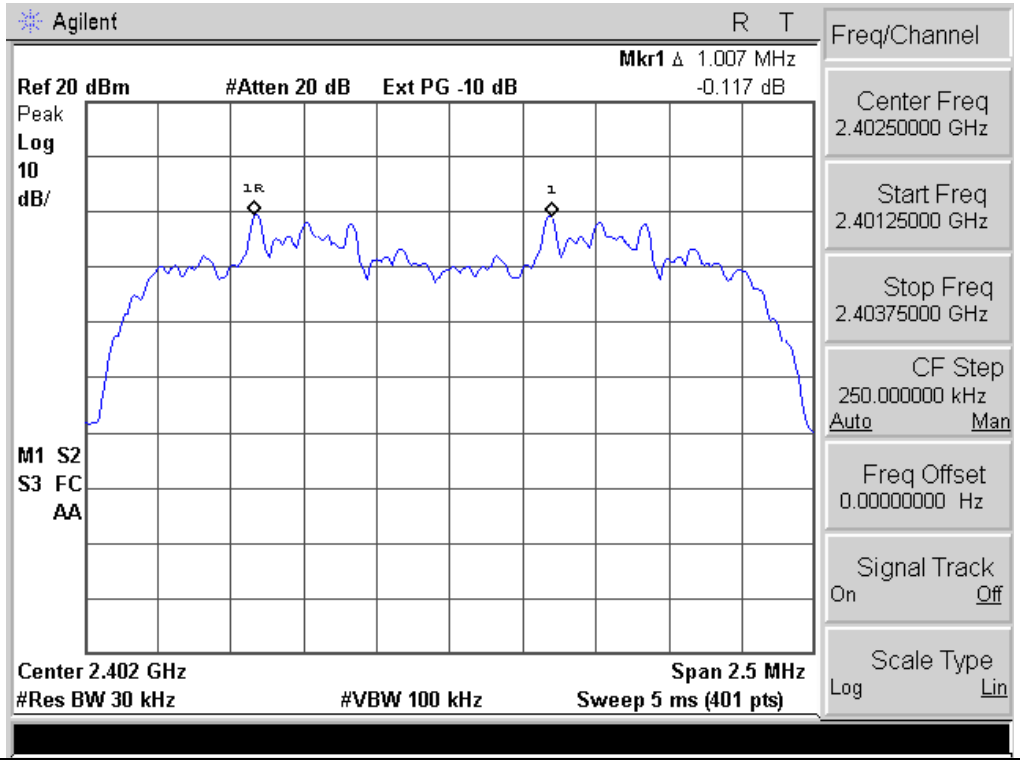

Agilent
R T
Mkr1 Δ 1.000 MHz
-0.069 dB
Ref 20 dBm
#Atten 20 dB
Ext PG -10 dB
Peak
Log
10
dB/
1R
1
M1 S2
S3 FC
AA
Center 2.479 GHz
Span 2 MHz
#Res BW 30 kHz
#VBW 100 kHz
Sweep 5 ms (401 pts)
Freq/Channel
Center Freq
2.47950000 GHz
Start Freq
2.47850000 GHz
Stop Freq
2.48050000 GHz
CF Step
200.000000 kHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin

EUT：	Selfie Remote Shutter	Model Name ：	631000
Temperature：	24 ℃	Relative Humidity：	58%
Pressure：	1010 hPa	Test Voltage ：	DC 3.0V
Test Mode ：	CH00 / CH39 /CH78**(2Mbps)**		

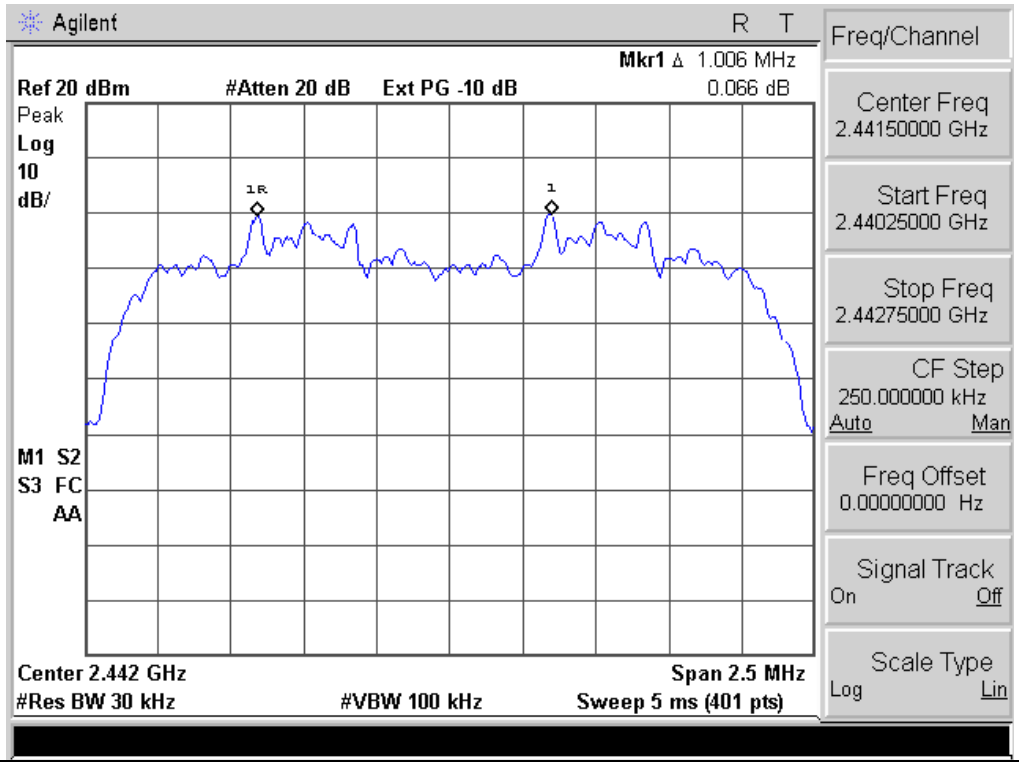
Frequency	Ch. Separation (MHz)	Result
2402 MHz	1.007	**Complies**
2441 MHz	1.006	**Complies**
2480 MHz	1.006	**Complies**

Ch. Separation Limits: >2/3 of 20dB bandwidth

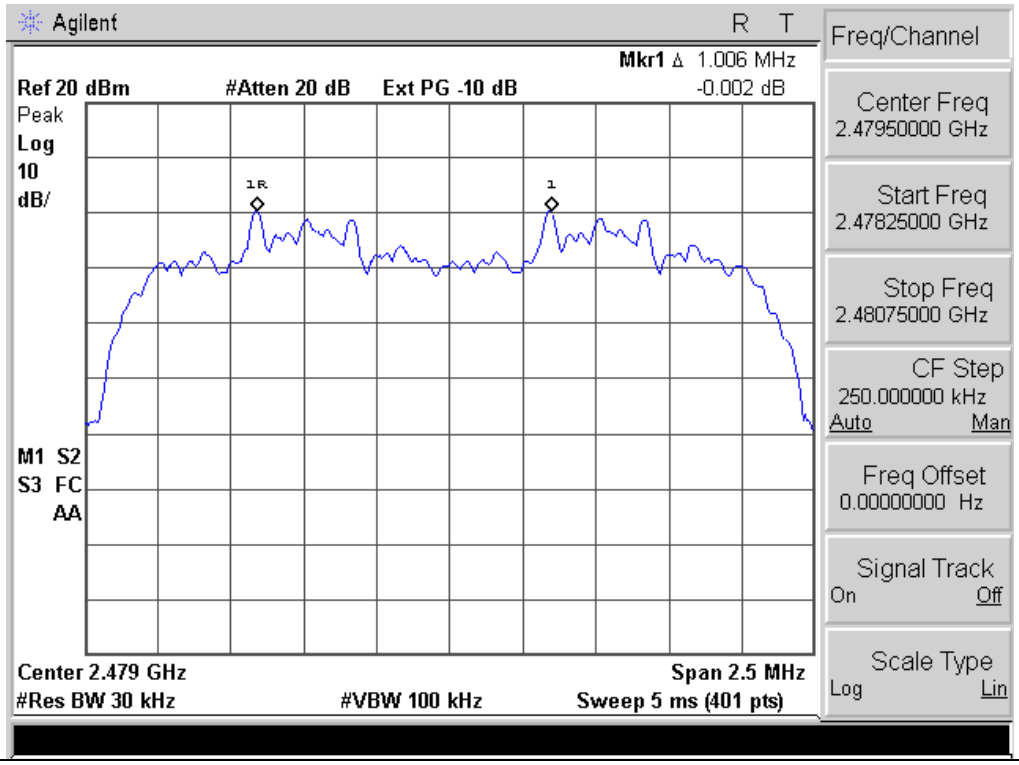
CH00 -2Mbps



CH39 -2Mbps



CH78 -2Mbps

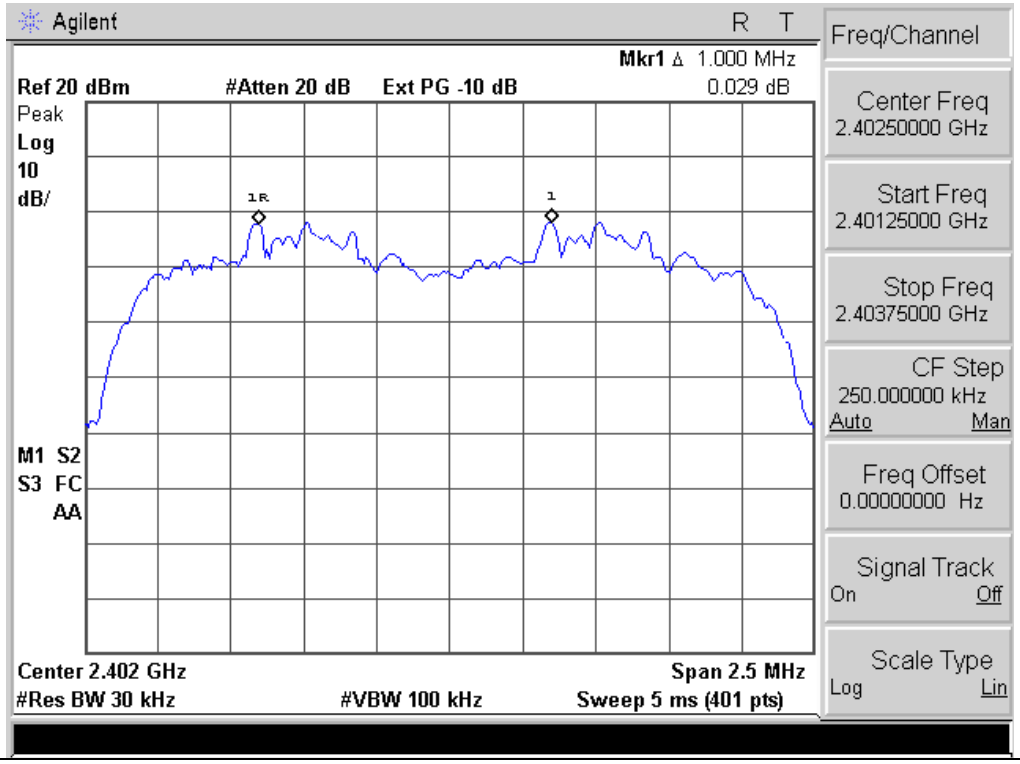


EUT：	Selfie Remote Shutter	Model Name ：	631000
Temperature：	24 ℃	Relative Humidity：	58%
Pressure：	1010 hPa	Test Voltage ：	DC 3.0V
Test Mode ：	CH00 / CH39 /CH78**(3Mbps)**		

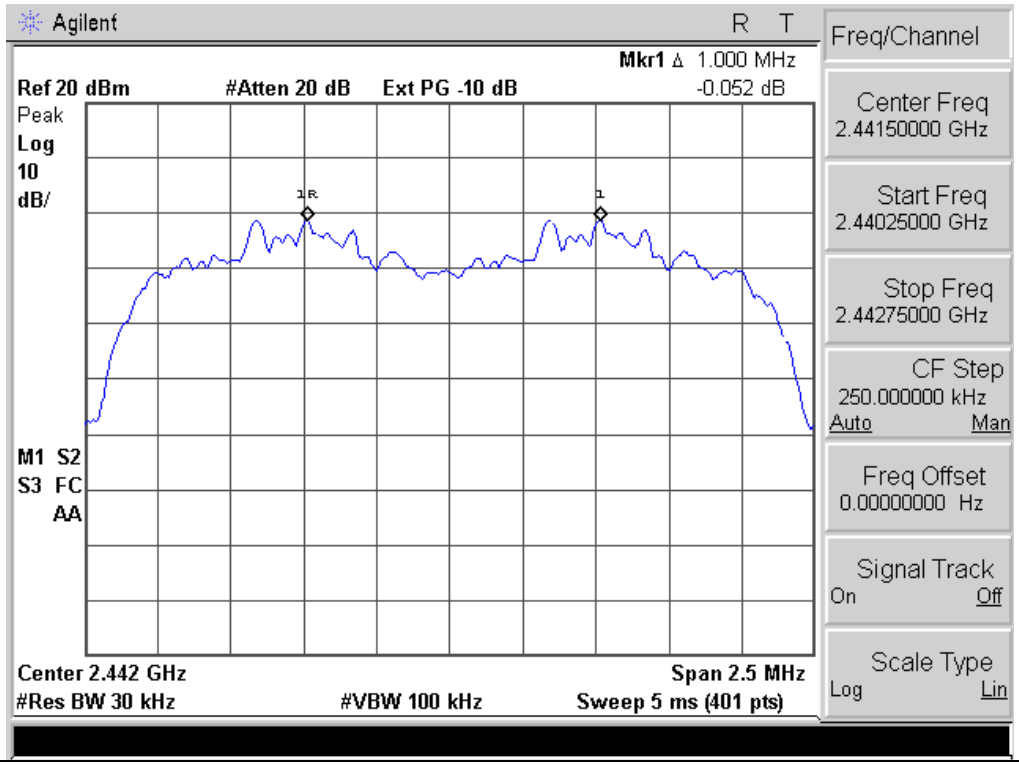
Frequency	Ch. Separation (MHz)	Result
2402 MHz	1.000	**Complies**
2441 MHz	1.000	**Complies**
2480 MHz	1.000	**Complies**

Ch. Separation Limits: >2/3 of 20dB bandwidth

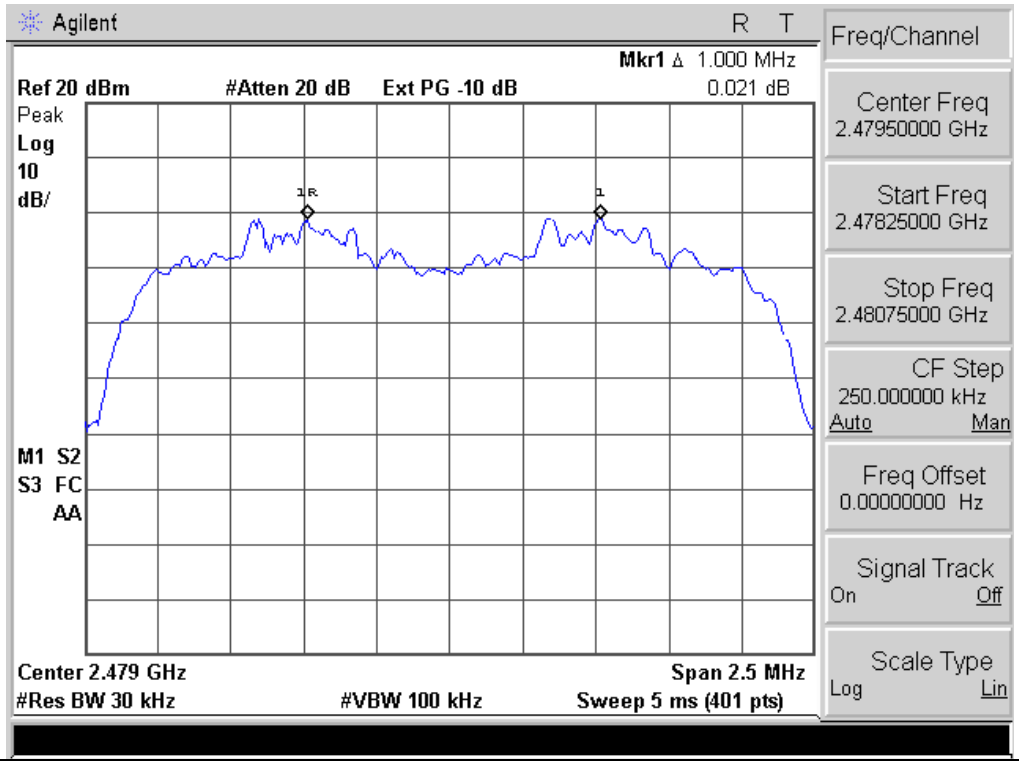
CH00 -3Mbps



CH39 -3Mbps



CH78 -3Mbps



8. NUMBER OF HOPPING FREQUENCY

8.1. Limits

According to FCC Section 15.247(a)(1)(iii), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

8.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode .

2. Set the spectrum analyzer:

Span: the frequency band of operation

RBW =100KHz

VBW=300KHz

Sweep=auto

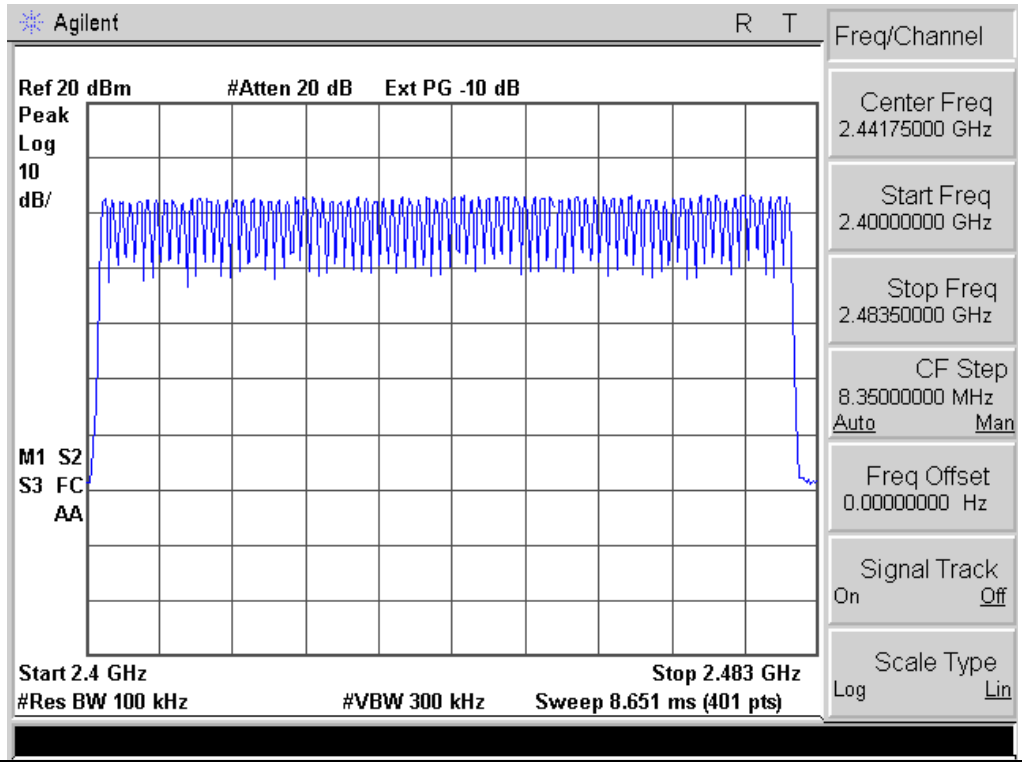
Detector function=peak

Trace=max hold

Test data:

Measured channel numbers	Limit	Result
79	>15	PASS

Test plot as follows:


Agilent
R T
Ref 20 dBm
#Atten 20 dB
Ext PG -10 dB
Peak
Log
10
dB/
M1 S2
S3 FC
AA
Start 2.4 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.483 GHz
Sweep 8.651 ms (401 pts)
Freq/Channel
Center Freq
2.44175000 GHz
Start Freq
2.40000000 GHz
Stop Freq
2.48350000 GHz
CF Step
8.35000000 MHz
Auto
Man
Freq Offset
0.00000000 Hz
Signal Track
On
Off
Scale Type
Log
Lin

9. DWELL TIME

9.1. Limits

According to FCC Section 15.247(a)(1)(iii), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

9.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode power.

2. Set the spectrum analyzer:

Span= 0Hz,RBW =1000 kHz,VBW = 3000 kHz

Use a video trigger with the trigger level set to enable triggering only on full pulses.

Detector function=peak, Sweep Time is more than once pulse time.

Set the EUT for DH5, DH3 and DH1 packet transmitting

Measure the maximum time duration of one single pulse.

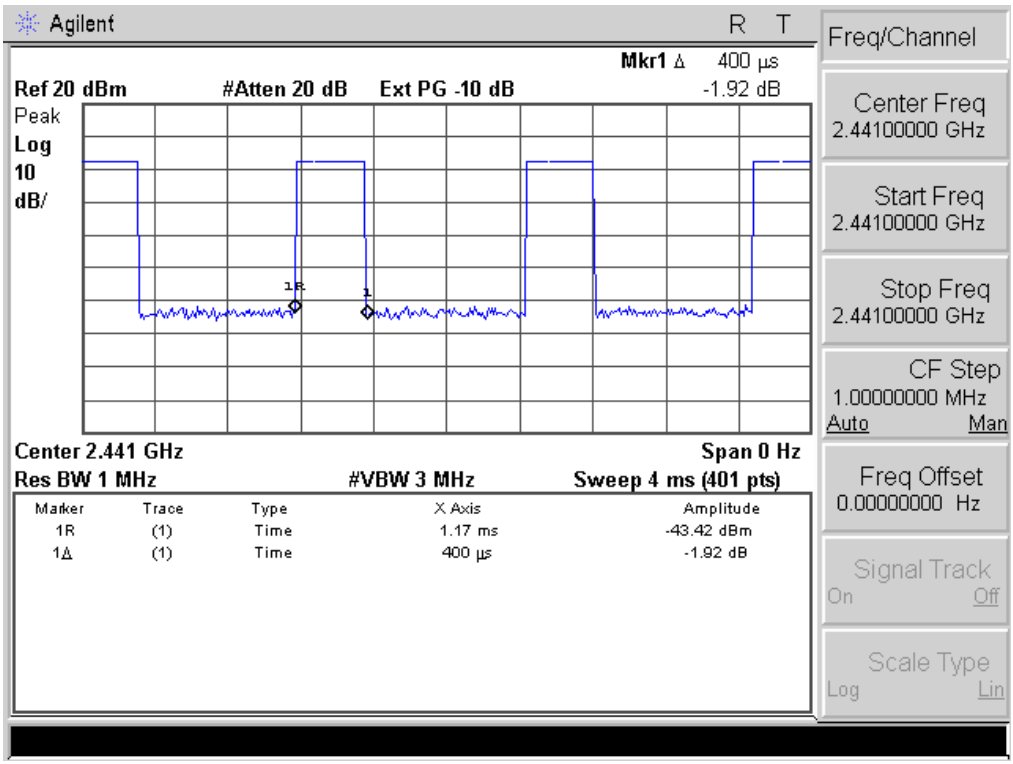
A Period Time = (channel number)*0.4
DH1 Time Slot: Reading * (1600/2)*31.6/(channel number)
DH3 Time Slot: Reading * (1600/4)*31.6/(channel number)
DH5 Time Slot: Reading * (1600/6)*31.6/(channel number)

Test data:

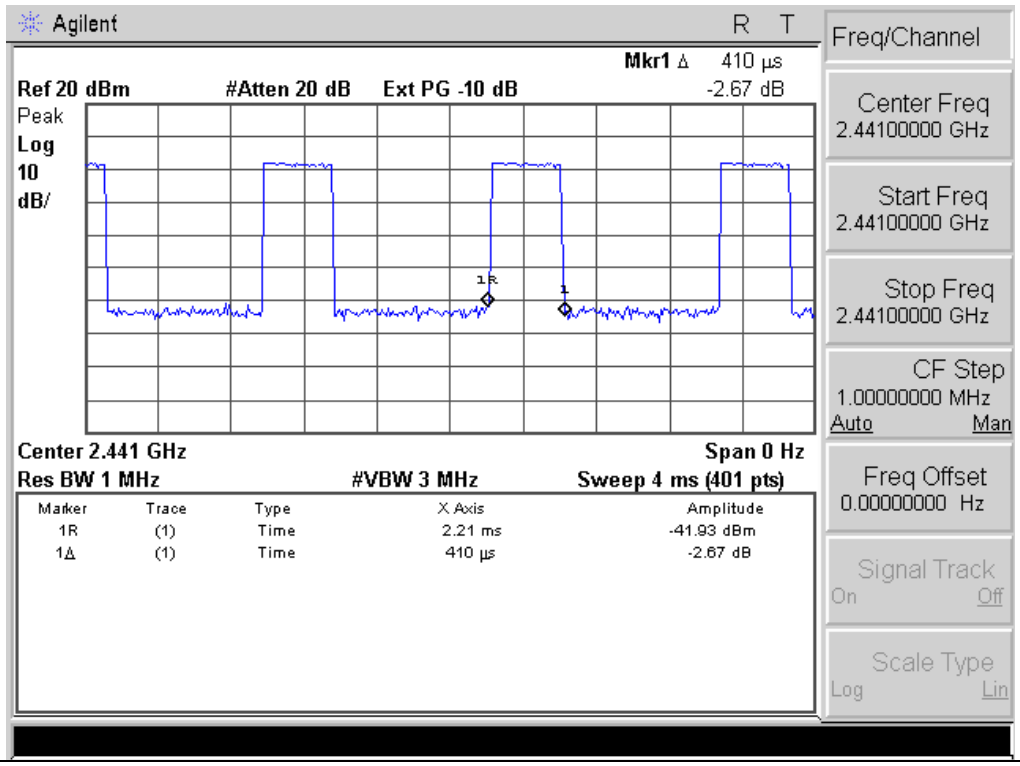
Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(s)	(s)
DH1	2441 MHz	0.40	0.13	0.4
2DH1	2441 MHz	0.41	0.13	0.4
3DH1	2441 MHz	0.41	0.13	0.4

Test plot as follows as below:

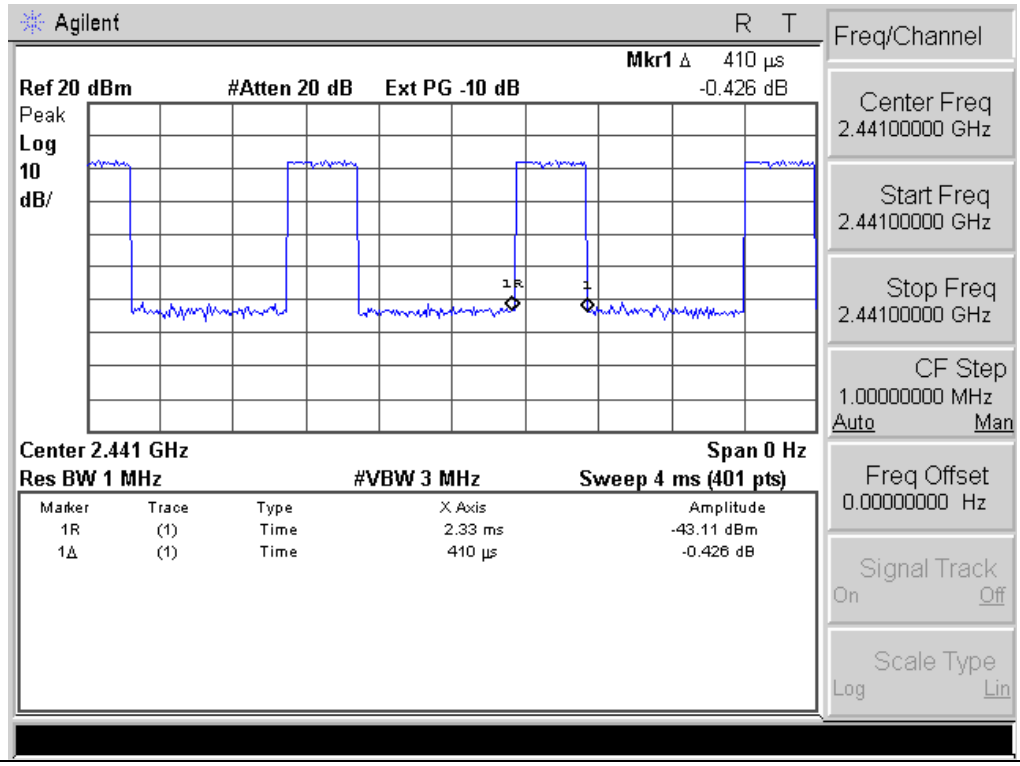
CH39-DH1



CH39-2DH1

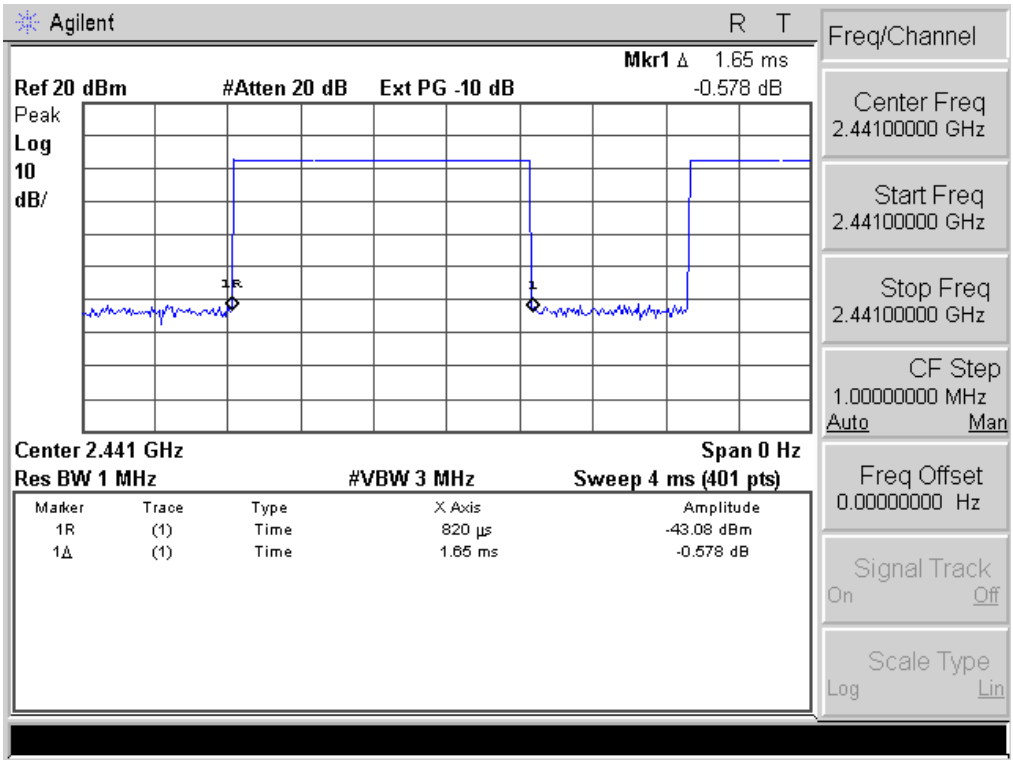


CH39-3DH1

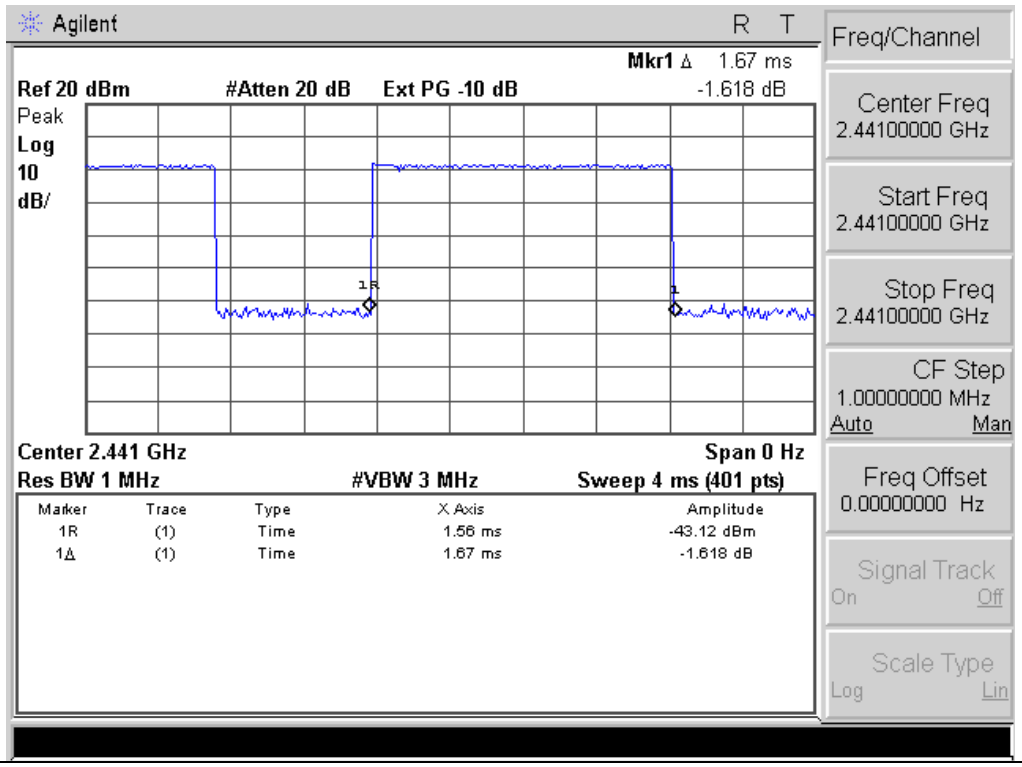


Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(s)	(s)
DH3	2441 MHz	1.65	0.26	0.4
2DH3	2441 MHz	1.67	0.27	0.4
3DH3	2441 MHz	1.66	0.27	0.4

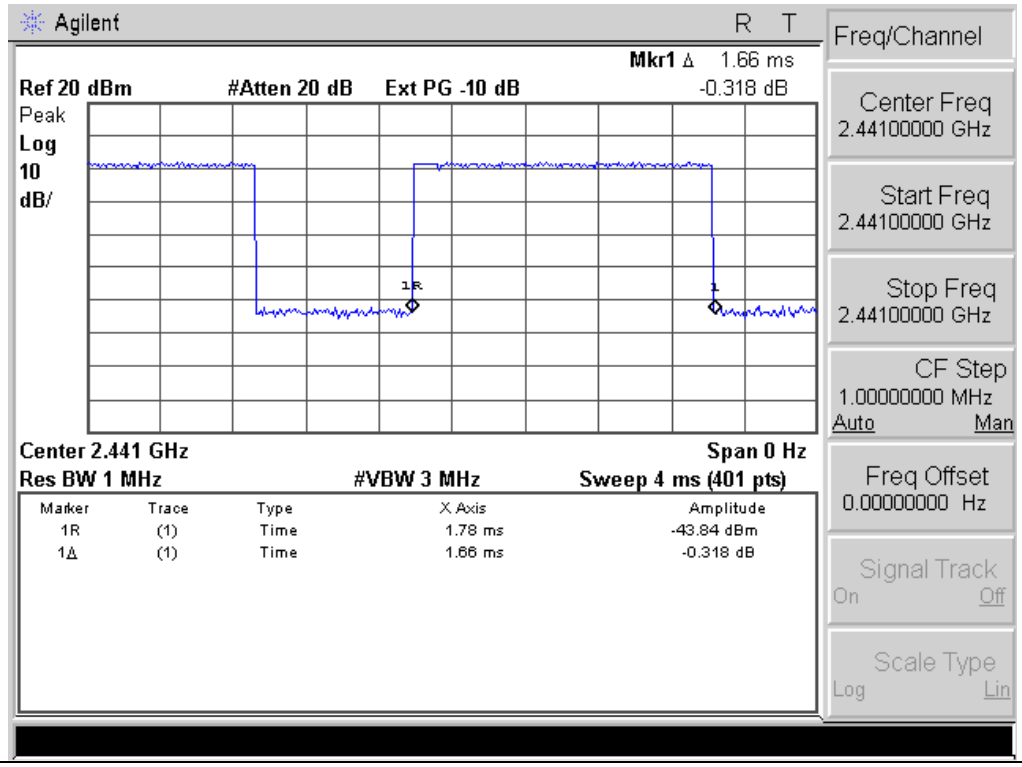
CH39-DH3



CH39-2DH3

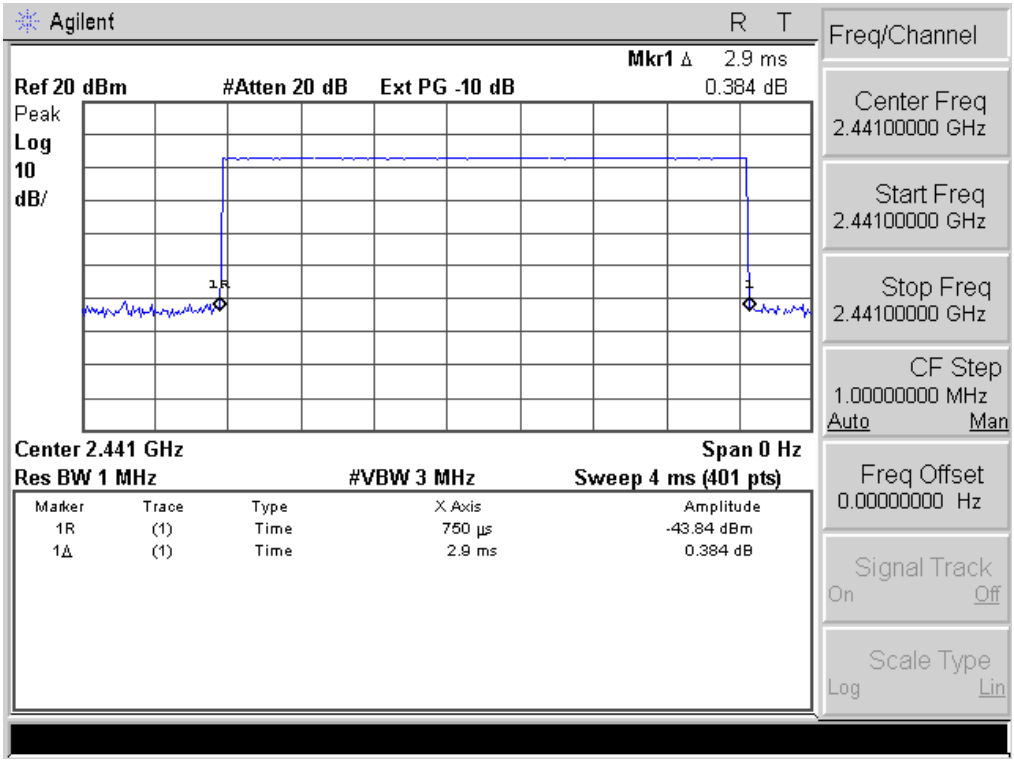


CH39-3DH3

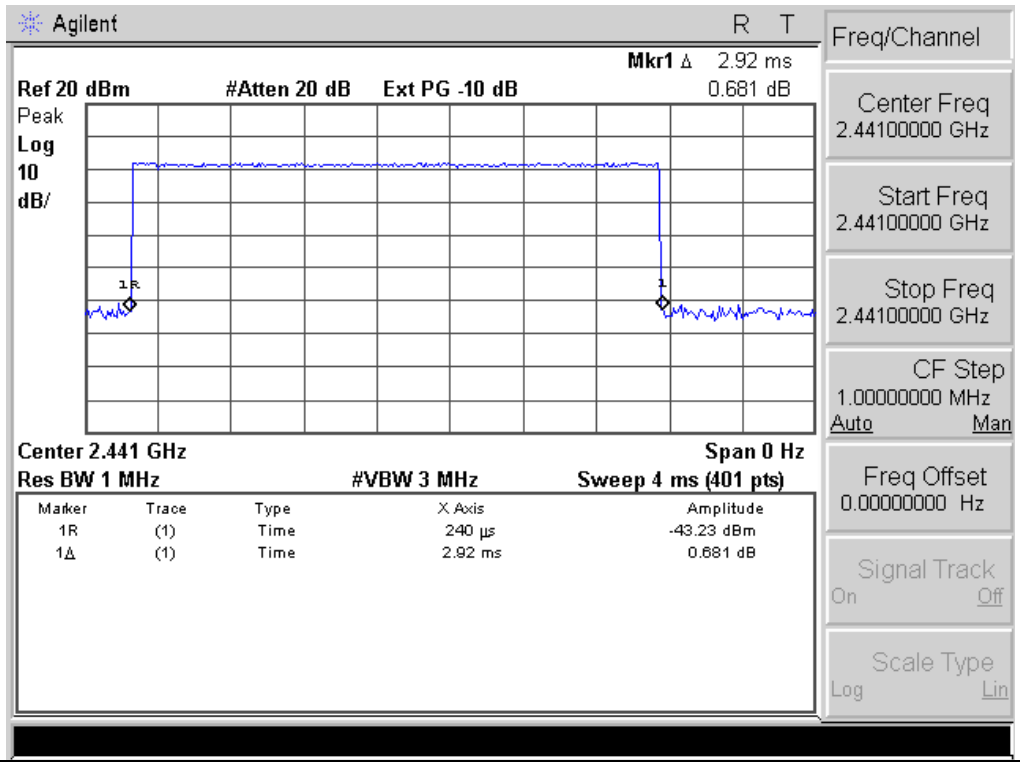


Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(s)	(s)
DH5	2441 MHz	2.90	0.31	0.4
2DH5	2441 MHz	2.92	0.31	0.4
3DH5	2441 MHz	2.92	0.31	0.4

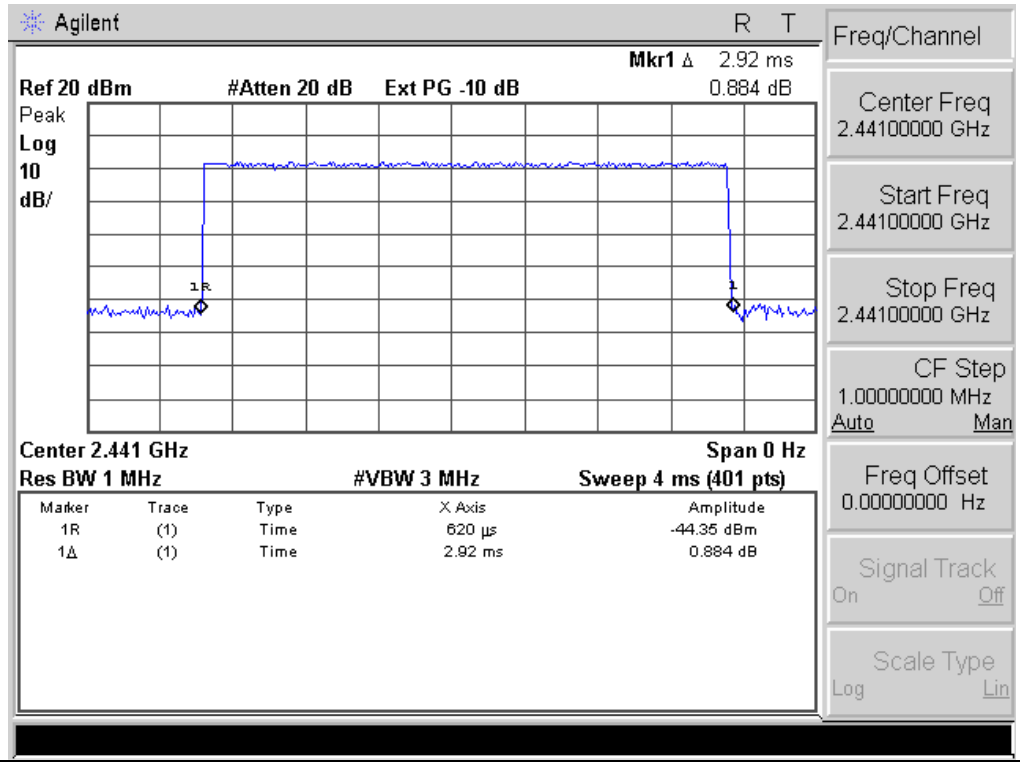
CH39-DH5



CH39-2DH5



CH39-3DH5



10. BAND EDGE COMPLIANCE TEST

10.1. Limits

According to FCC 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, 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 con-ducted or a radiated measurement

10.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set to span from the lowest frequency generated in the device up to and including the tenth harmonic of the highest fundamental frequency

The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure. For all test, used peak detector.

Note: If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

Test plot as follows:

For radiated test as follows:

	Frequency (MHz)	Antenna polarization (H/V)	Emission (dBuV/m)	Band edge Limit (dBuV/m)		Result
			PK	PK	AV	Pass
Hopping	<2400	H	51.22	74.00	54.00	Pass
	<2400	V	51.53	74.00	54.00	Pass
	>2483.5	H	51.31	74.00	54.00	Pass
	>2483.5	V	50.15	74.00	54.00	Pass
Unhopping	<2400	H	52.15	74.00	54.00	Pass
	<2400	V	53.23	74.00	54.00	Pass
	>2483.5	H	51.41	74.00	54.00	Pass
	>2483.5	V	52.13	74.00	54.00	Pass

If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

11. ANTENNA REQUIREMENTS

11.1. Limits

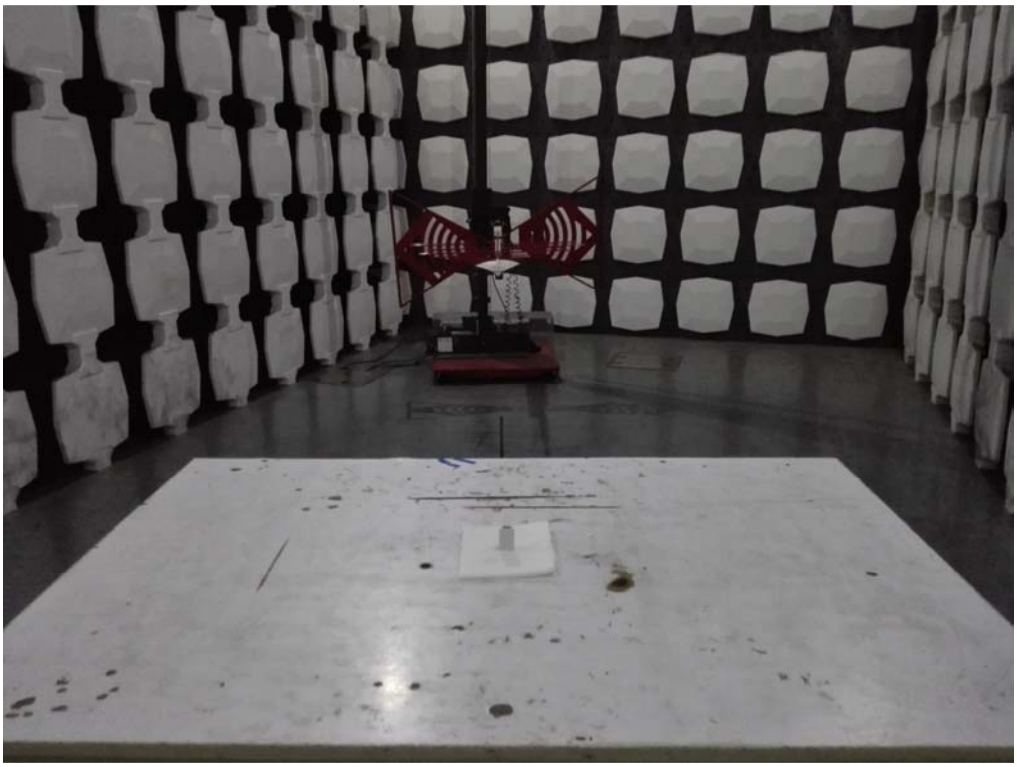
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

11.2. Result

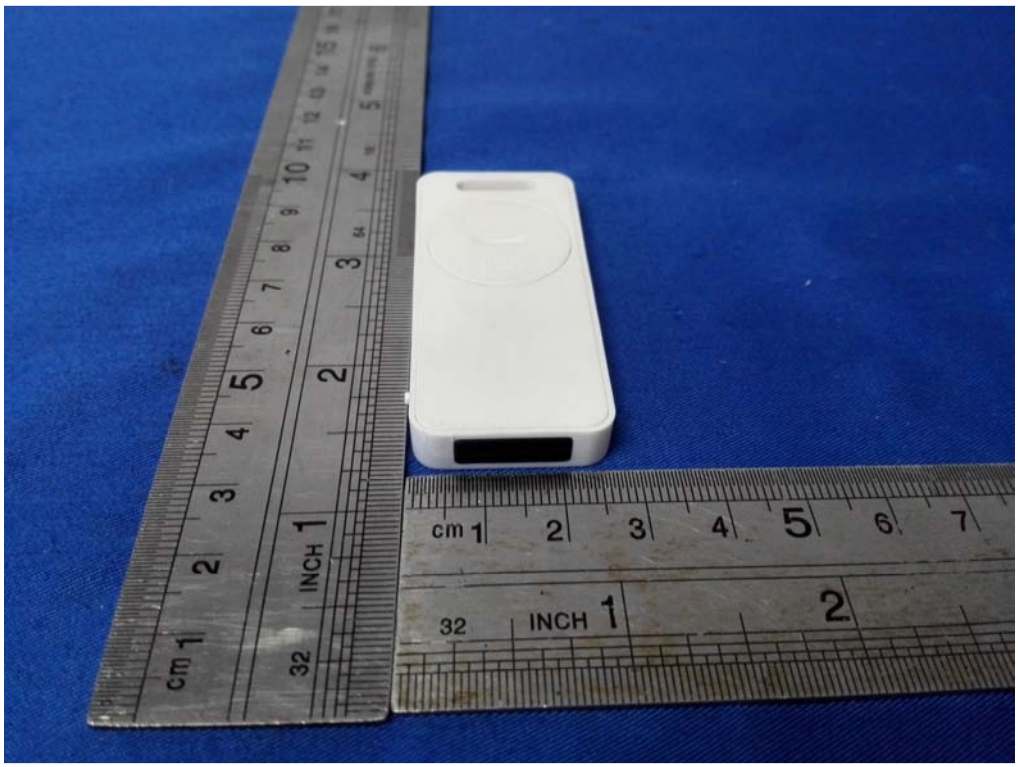
The antennas used for this product are Permanently fixed antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 1.0dBi.

12. PHOTOGRAPHS OF TEST SET-UP

Radiated Emission Test



13. PHOTOGRAPHS OF THE EUT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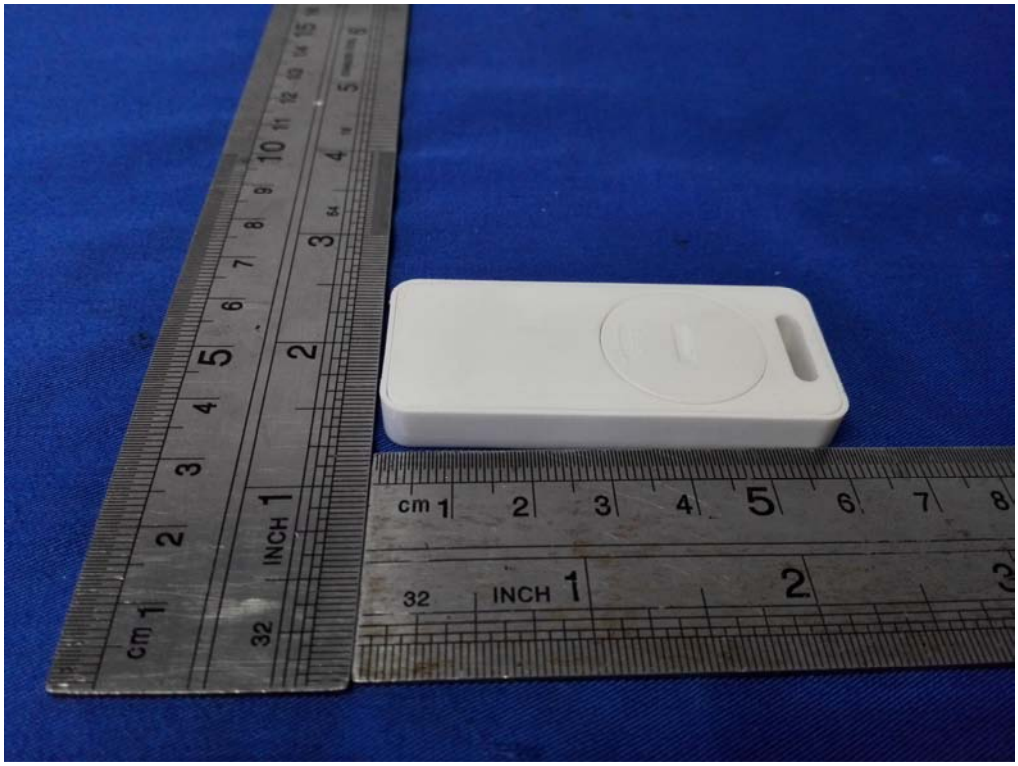
32 INCH 1 2
INCH 1
cm 1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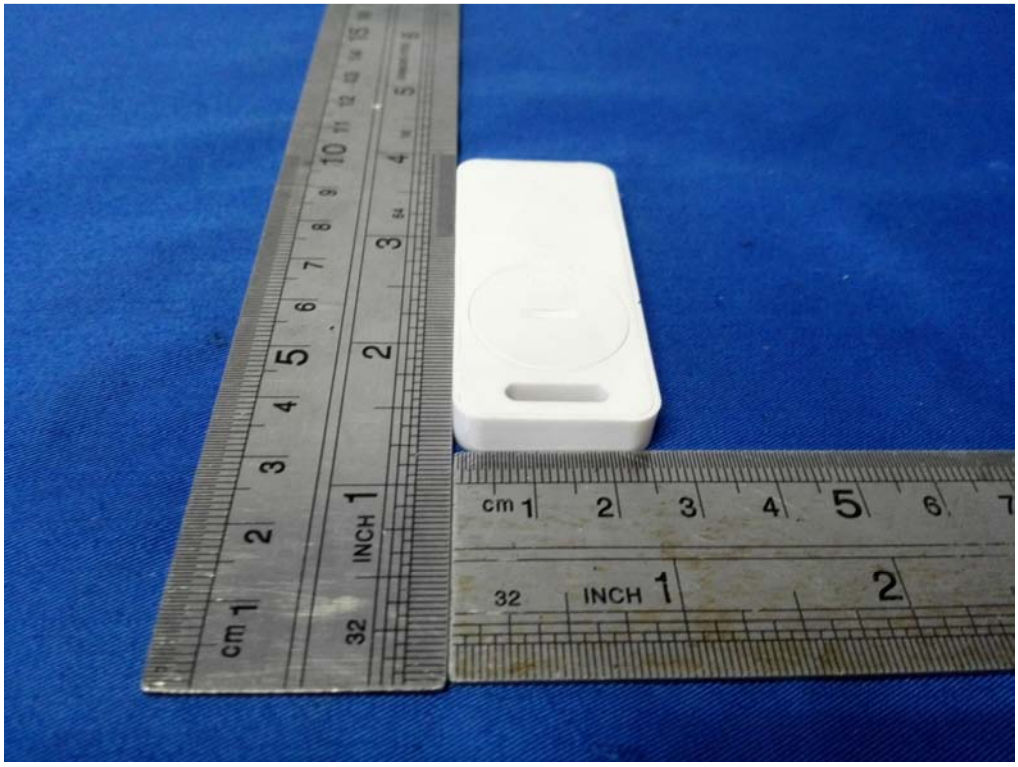
INCH 1
cm 1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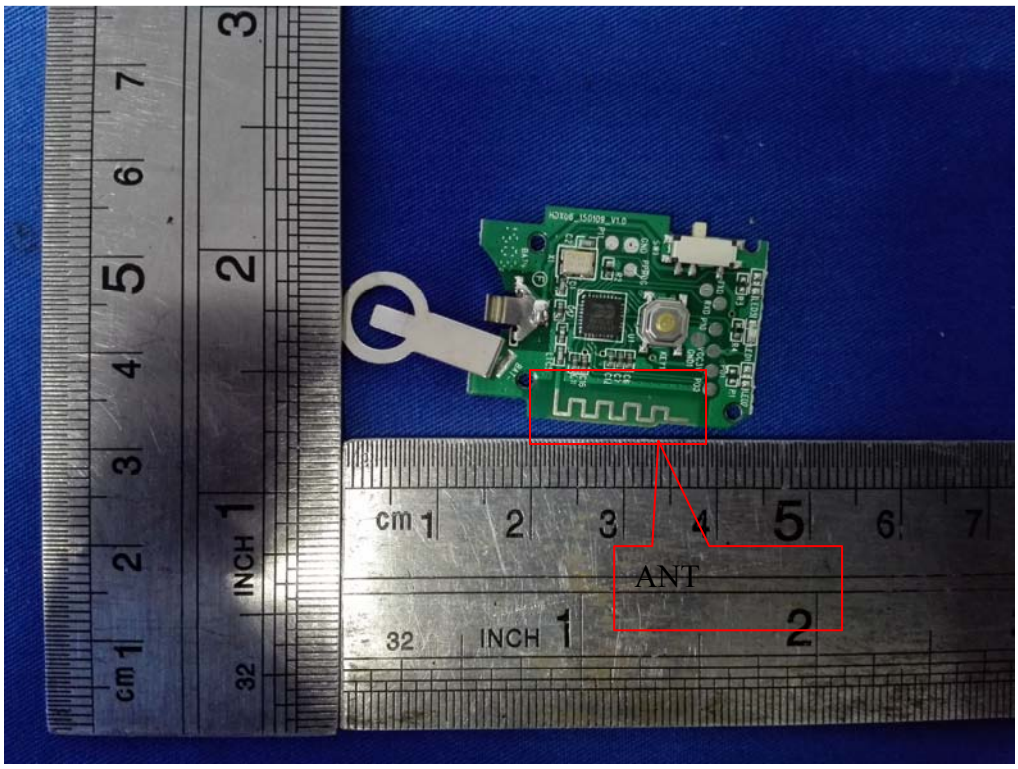
INCH 1 2
32


cm 1 2 3 4 5 6 7 8 9
INCH 1 2 3
32 64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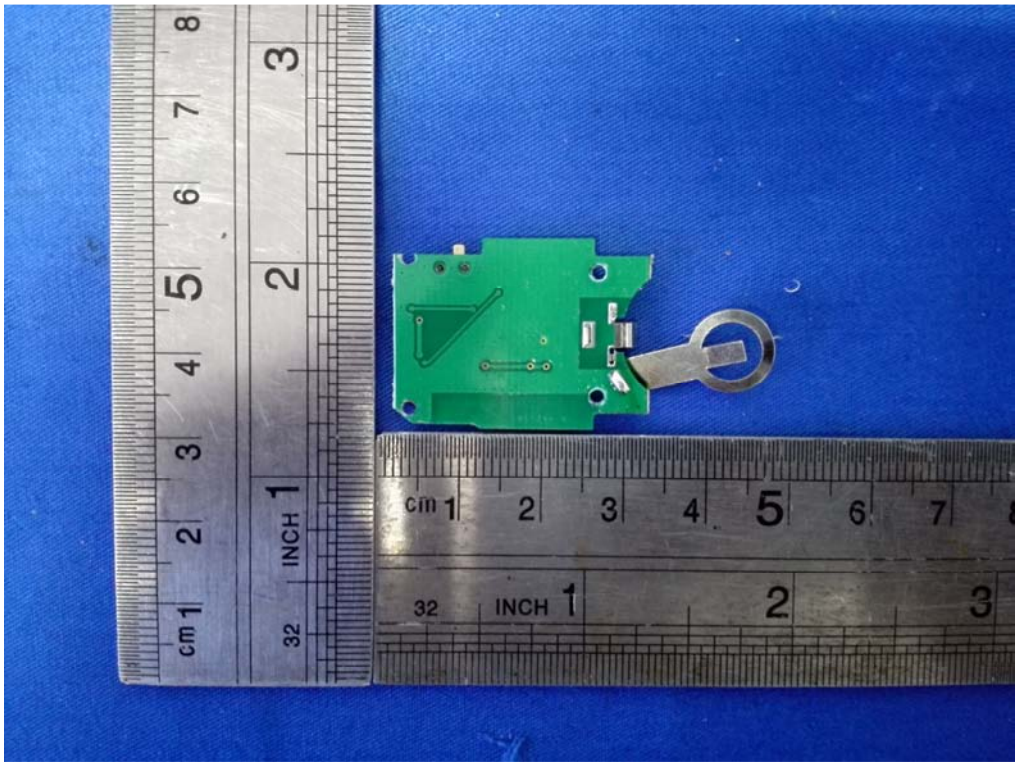

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