FCC TEST REPORT(Bluetooth)

for

Guoguang Electric Co.,Ltd.

2.1 Sound Bar System（wireless）

Model Number: ESB206

FCC ID: 2AAP8ESB206

Prepared for : Guoguang Electric Co.,Ltd.
Address : No.8 Jinghu Road, Xinhua Street, Huadu Reg, Guanzhou, 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. : 15KWE103123F
Date of Test : Oct. 19~22, 2015
Date of Report : Oct. 23, 2015

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Keyway Testing Technology Co., Ltd.

Applicant: **Address:**	Guoguang Electric Co.,Ltd. No.8 Jinghu Road, Xinhua Street, Huadu Reg, Guanzhou, China		
Manufacturer: **Address:**	Guoguang Electric Co.,Ltd. No.8 Jinghu Road, Xinhua Street, Huadu Reg, Guanzhou, China		
E.U.T:	2.1 Sound Bar System（wireless）		
Model Number:	ESB206		
Trade Name:	element	**Serial No.:**	------
Date of Receipt:	Oct. 19, 2015	**Date of Test:**	Oct.19~22, 2015
Test Specification:	FCC Part 15, Subpart C Section 15.247: 2015 ANSI C63.10:2013		
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied. **Issue Date: Oct. 23, 2015**		

Tested by:	Reviewed by:	Approved by:
Keven Wu / Engineer	Mike Xu / Supervisor	Andy Gao / 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	PASS
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:	2.1 Sound Bar System（wireless）
Model No.:	ESB206
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:	0dBi
Power supply:	AC 120V/60Hz
BT Version:	V3.0
HW:	M2-SB206-MAIN902051A0
SW:	M2-SB206-MAIN902051A0

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
temporary antenna connector	ATM	R-00	3567	Oct. 08,15	Nov. 07,15

Note：The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

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
Bilog Antenna	ETS-LINDGREN	3142D	00135452	Apr. 27,15	Apr. 27,16
Loop Antenna	ARA	PLA-1030/B	1029	Apr. 22,15	Apr. 22,16
Spectrum Analyzer	Agilent	8593E	3911A04271	Apr. 27,15	Apr. 27,16
3m Semi-anechoic Chamber	ETS-LINDGREN	966	KW01	Apr. 27,15	Apr. 27,16
Signal Amplifier	SONOMA	310	187303	Apr. 27,15	Apr. 27,16
RF Cable below 1G	IMRO	IMRO-400	966 Cable 1#	Apr. 27,15	Apr. 27,16
MULTI-DEVICE Controller	ETS-LINDGREN	2090	126913	Apr. 27,15	Apr. 27,16
Antenna Holder	ETS-LINDGREN	2070B	00109601	Apr. 27,15	Apr. 27,16
Horn Antenna	DAZE	ZN30701	11003	N/A	N/A
Signal Amplifier	DAZE	ZN3380C	11001	Apr. 27,15	Apr. 27,16
RF Cable above 1G	IMRO	IMRO-401	966 Cable 1#	Apr. 27,15	Apr. 27,16
MULTI-DEVICE Controller	ETS-LINDGREN	2090	126913	Apr. 27,15	Apr. 27,16
Antenna Holder	ETS-LINDGREN	2070B	00109601	Apr. 27,15	Apr. 27,16

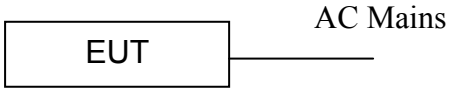
3. TEST SET-UP AND OPERATION MODES

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: 2.1 Sound Bar System（wireless）)

3.3. Test Operation Mode and Test Software

We can use a Test Software on PC control the EUT working on different channel and packet size by burning plate.

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

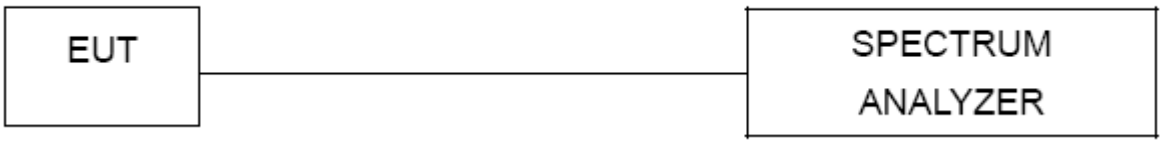
FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247 (b)(i)	Peak Output Power	0.125 w or 20.96dBm	2400-2483.5	PASS

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

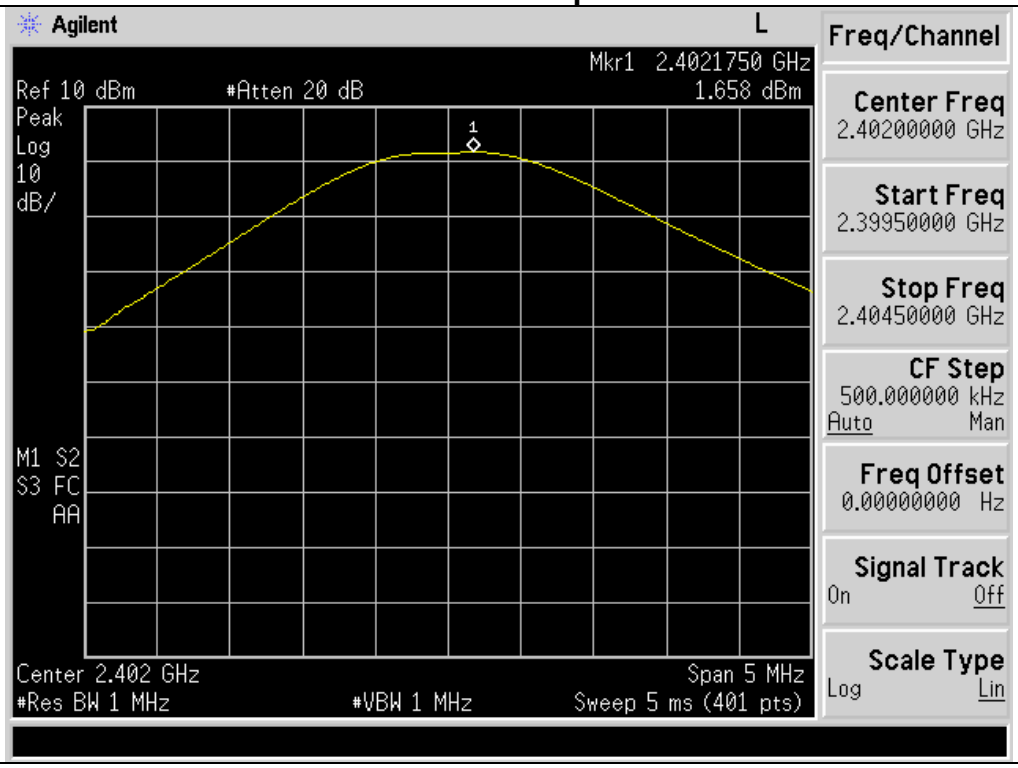
4.3. Test setup



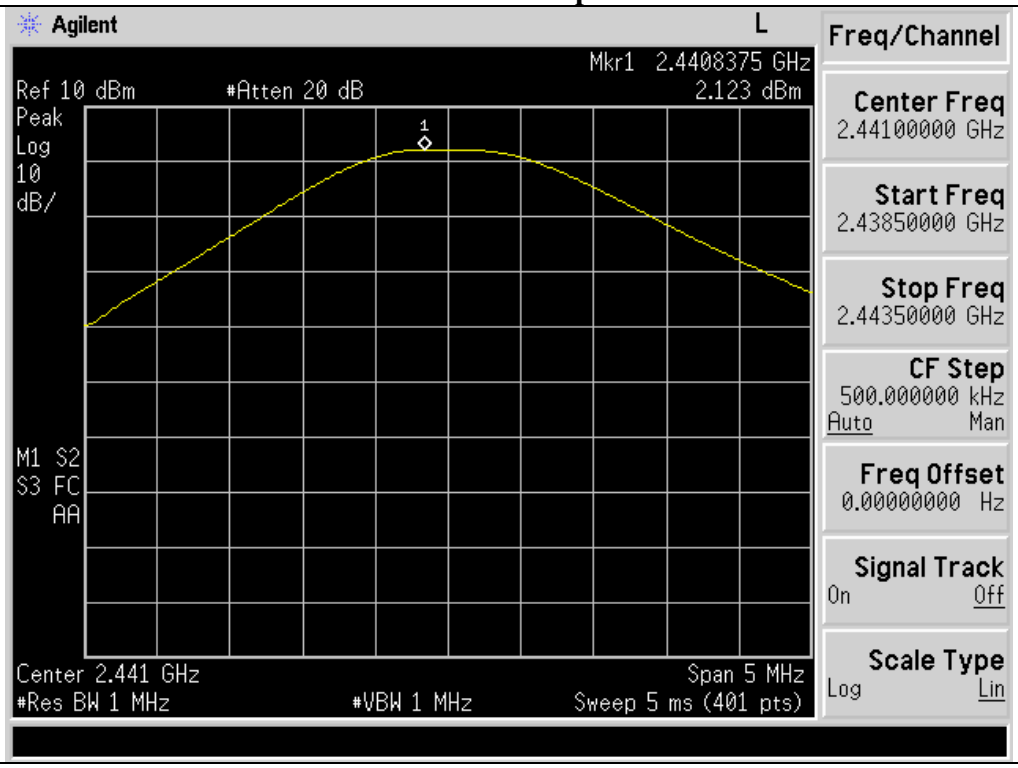
Test data:

1Mbps			
Test Channel	Frequency (MHz)	Peak Output Power (dBm)	LIMIT (dBm)
CH00	2402	1.658	30
CH39	2441	2.123	30
CH78	2480	1.722	30
2Mbps			
CH00	2402	-0.393	20.96
CH39	2441	0.456	20.96
CH78	2480	1.237	20.96
3Mbps			
CH00	2402	0.374	20.96
CH39	2441	0.522	20.96
CH78	2480	0.662	20.96

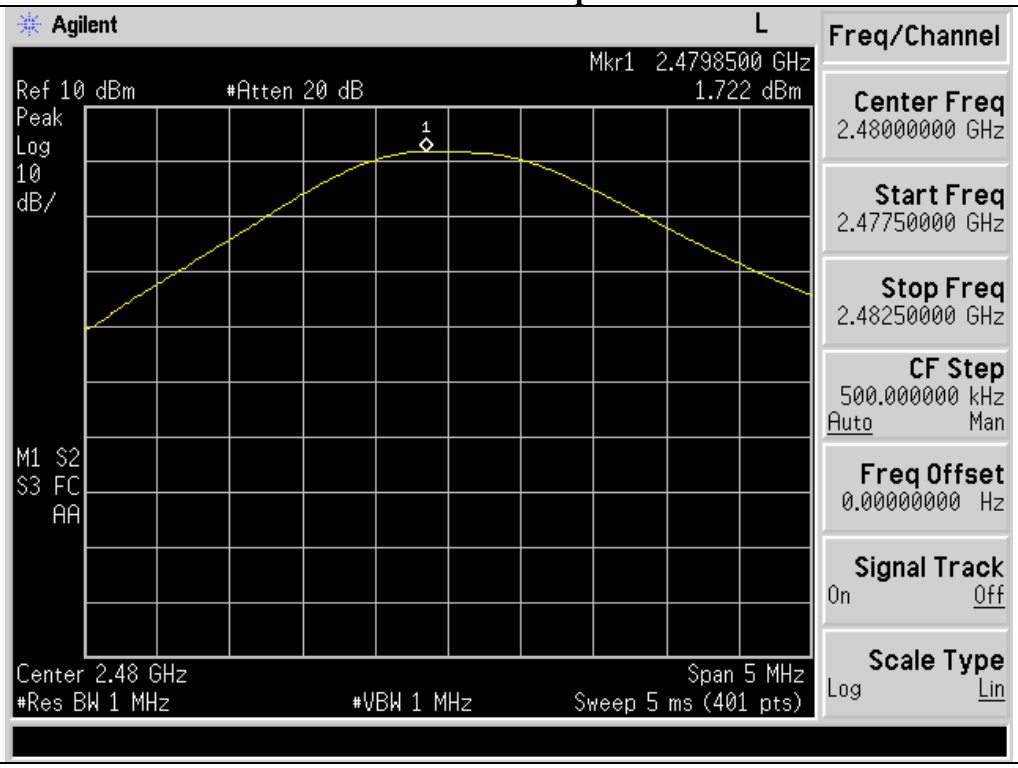
CH00 -1Mbps



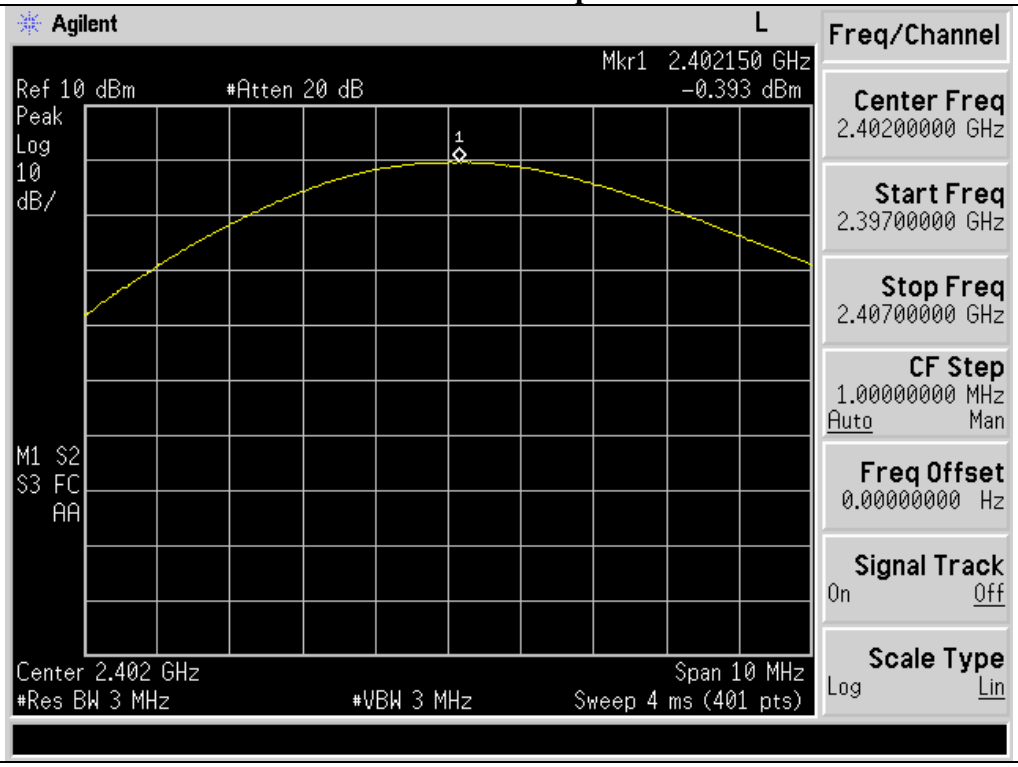
CH39 -1Mbps



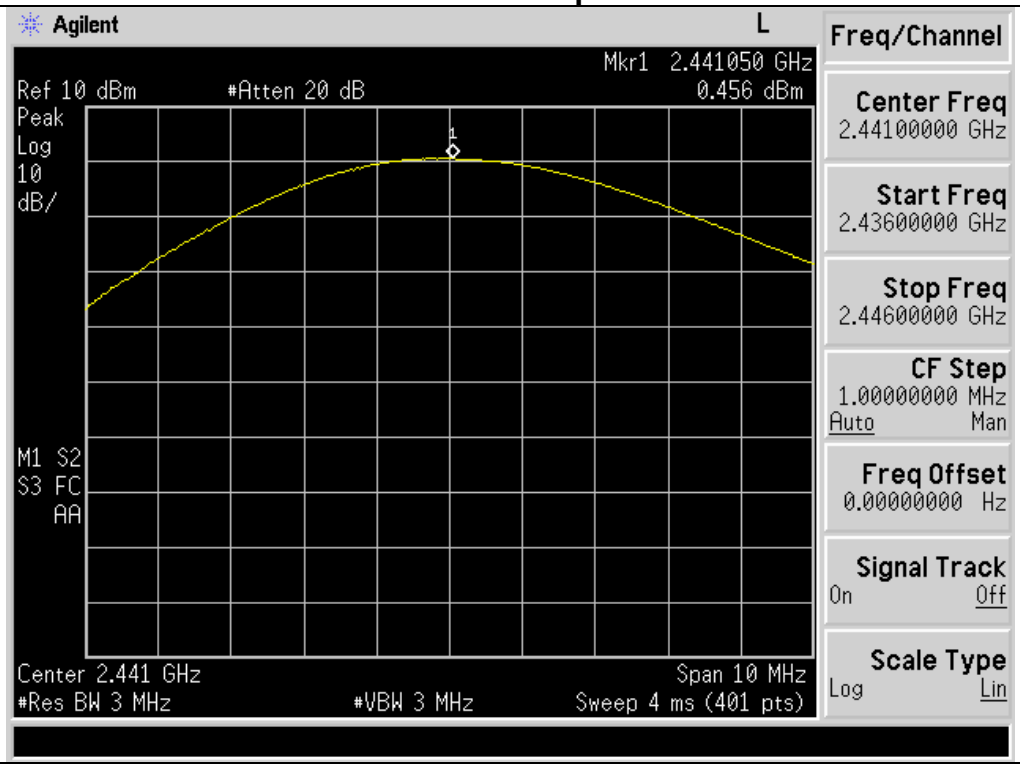
CH78 -1Mbps



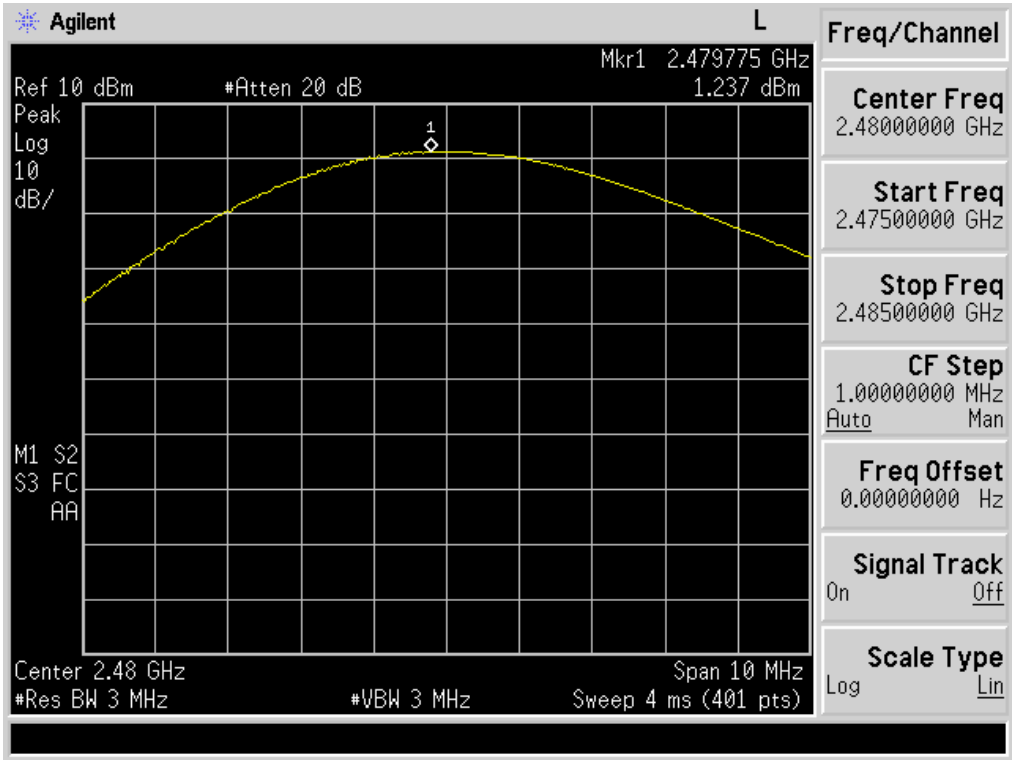
CH00 -2Mbps



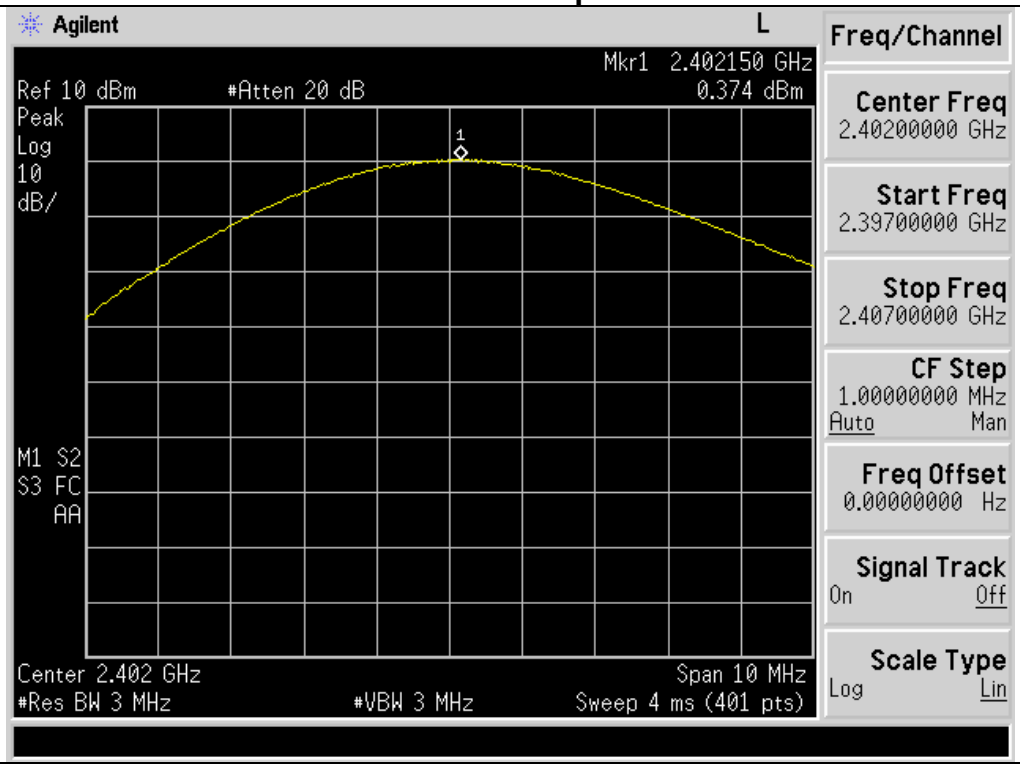
CH39 -2Mbps



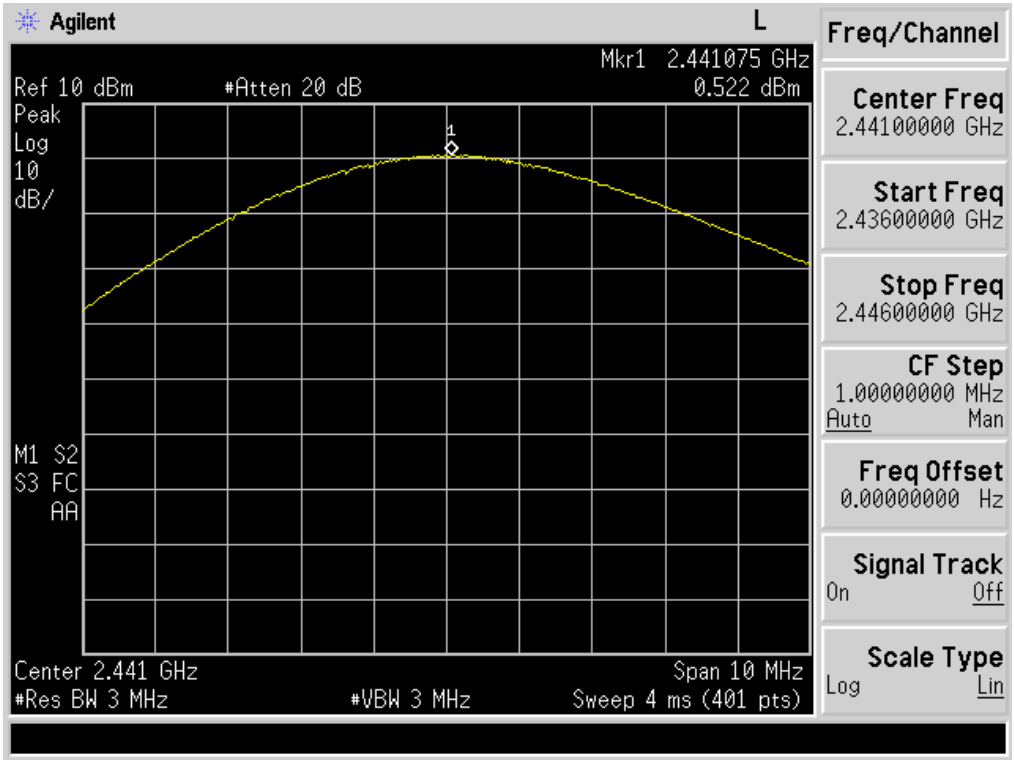
CH78 -2Mbps



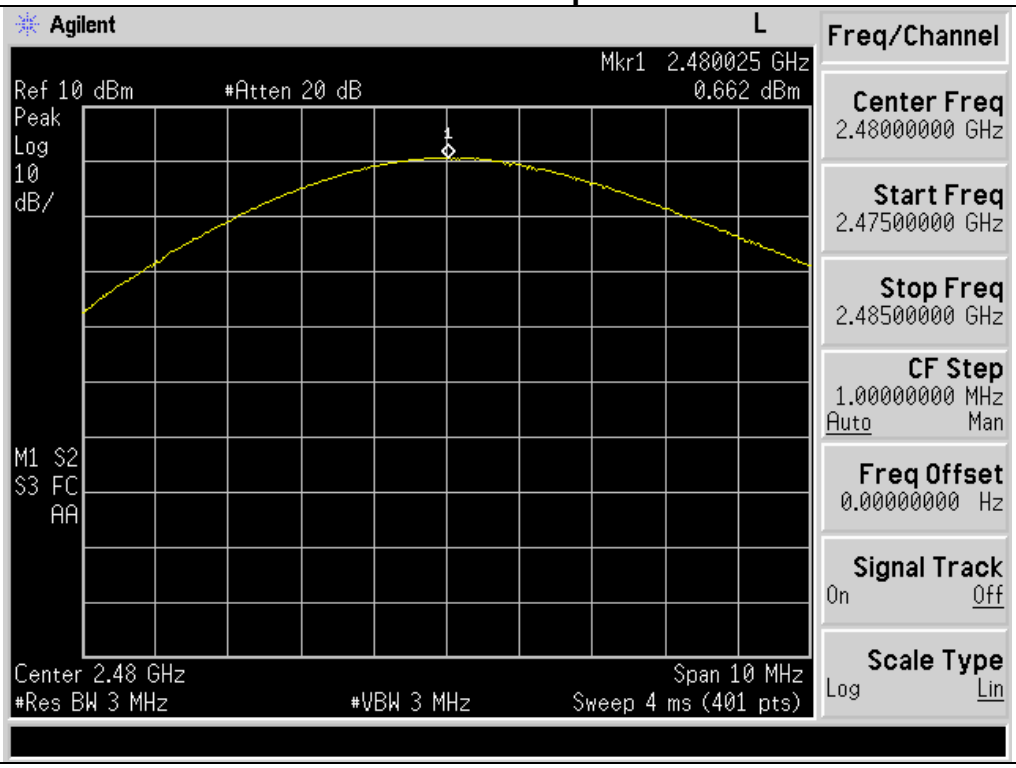
CH00 -3Mbps



CH39 -3Mbps



CH78 -3Mbps


Agilent
L
Mkr1 2.480025 GHz
Ref 10 dBm
#Atten 20 dB
0.662 dBm
Peak
Log
10
dB/
M1 S2
S3 FC
AA
Center 2.48 GHz
Span 10 MHz
#Res BW 3 MHz
#VBW 3 MHz
Sweep 4 ms (401 pts)
Freq/Channel
Center Freq
2.48000000 GHz
Start Freq
2.47500000 GHz
Stop Freq
2.48500000 GHz
CF Step
1.00000000 MHz
Auto
Man
Freq Offset
0.00000000 Hz
Signal Track
On
Off
Scale Type
Log
Lin

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	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

5.1.2. Test Setup

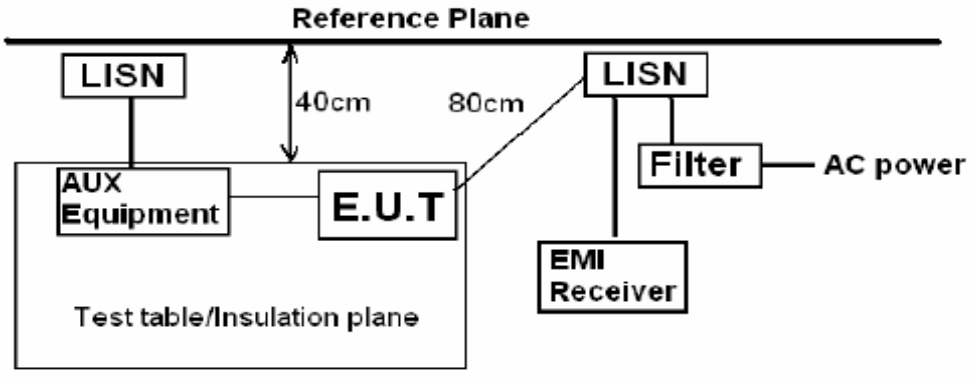
The EUT was put on a wooden table which was 0.8 m high above the ground and connected to the AC mains through the Artificial Mains Network (AMN). Where the mains cable supplied by the manufacture was longer than 0.8 m, the excess was folded back and forth parallel to the cable at the center so as to 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.

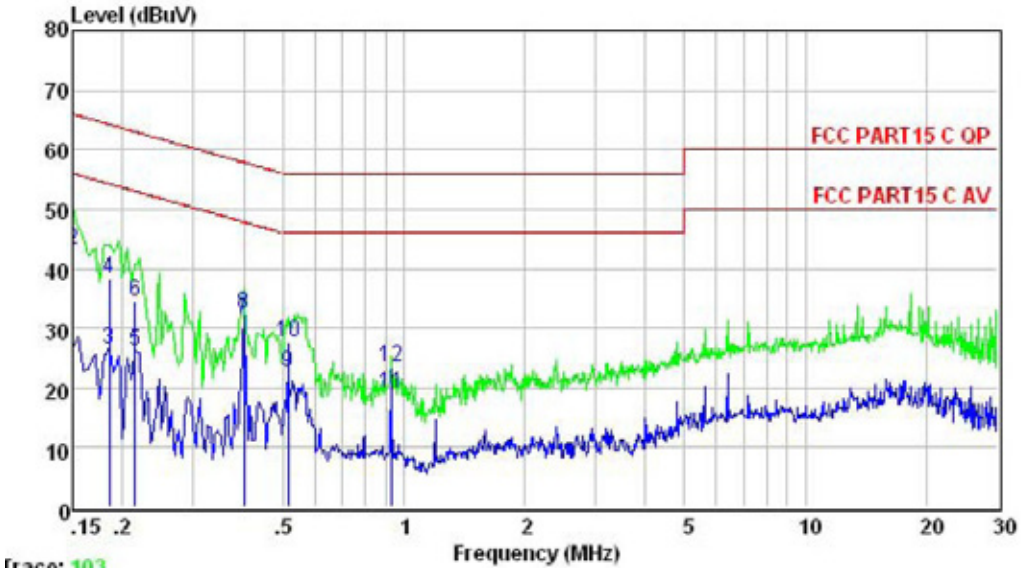
Pretest for all mode, The test data of the worst case condition(s) was reported on the following page.



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

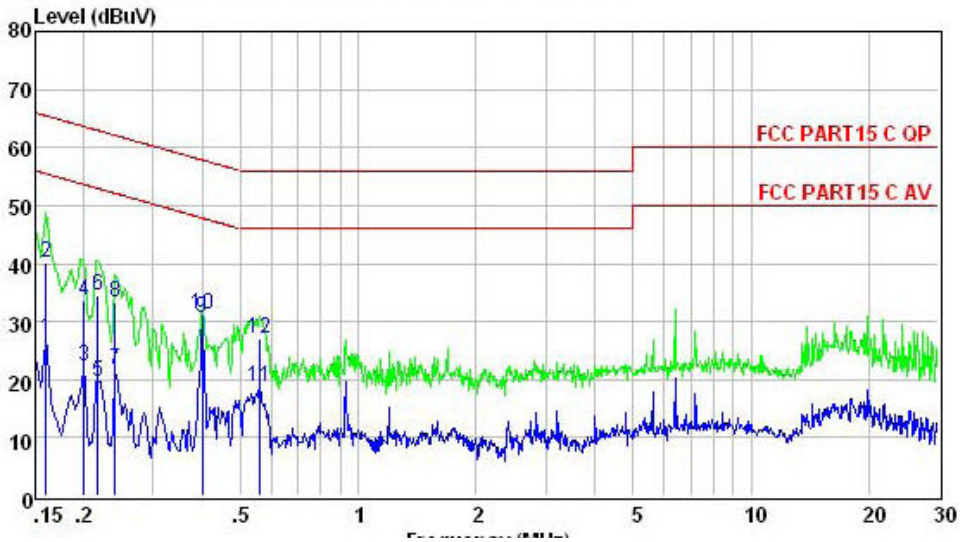
5.1.3. Test result

LINE



	Freq	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	
1	0.150	26.75	56.00	-29.25	Average
2	0.150	43.20	66.00	-22.80	QP
3	0.185	26.57	54.24	-27.67	Average
4	0.185	38.50	64.24	-25.74	QP
5	0.215	26.20	53.01	-26.81	Average
6	0.215	34.60	63.01	-28.41	QP
7	0.400	31.40	47.86	-16.46	Average
8	0.400	32.40	57.86	-25.46	QP
9	0.516	22.64	46.00	-23.36	Average
10	0.516	27.80	56.00	-28.20	QP
11	0.928	19.09	46.00	-26.91	Average
12	0.928	23.50	56.00	-32.50	QP

NEUTRAL



	Freq	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	
1	0.160	27.19	55.47	-28.28	Average
2	0.160	40.10	65.47	-25.37	QP
3	0.200	22.21	53.62	-31.41	Average
4	0.200	33.70	63.62	-29.92	QP
5	0.216	19.65	52.96	-33.31	Average
6	0.216	34.60	62.96	-28.36	QP
7	0.240	21.71	52.08	-30.37	Average
8	0.240	33.20	62.08	-28.88	QP
9	0.400	30.54	47.86	-17.32	Average
10	0.400	31.20	57.86	-26.66	QP
11	0.561	18.82	46.00	-27.18	Average
12	0.561	27.10	56.00	-28.90	QP

Note: Mode 1Mbps middle channel is the worst mode. the worst data was show in the report.

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 for below 1GHz above the ground and 1.5m for above 1GHz. 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.

For the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissionsat the specified measurement distance, while keeping the measurement antenna aimed at the source ofemissions at each frequency of significant emissions, with polarization oriented for maximum response.The measurement antenna may have to be higher or lower than the EUT, depending on the radiationpattern of the emission and staying aimed at the emission source for receiving the maximum signal. Thefinal measurement antenna elevation shall be that which maximizes the emissions. The measurementantenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 mabove the ground or reference ground plane.

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%.

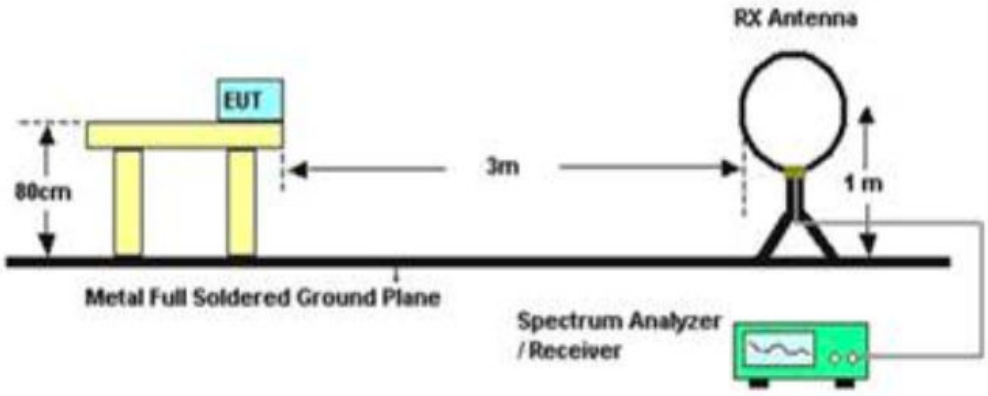
3. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.

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

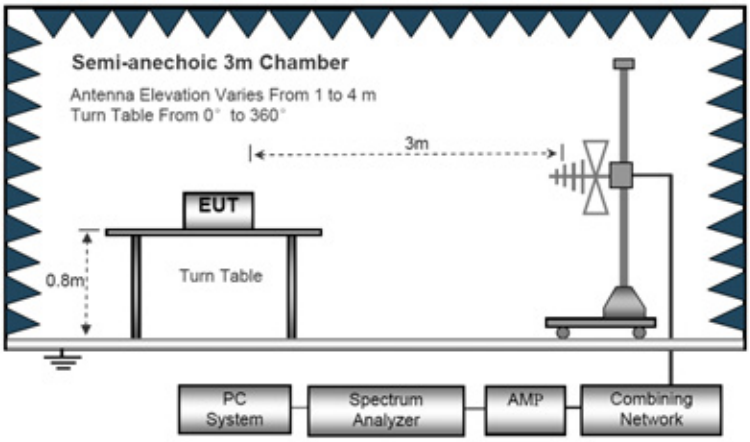
5:Pre-scan the place mode X-axis.

6：We pretest all modulation, The worst was GFSK, the worst data was show in the report.

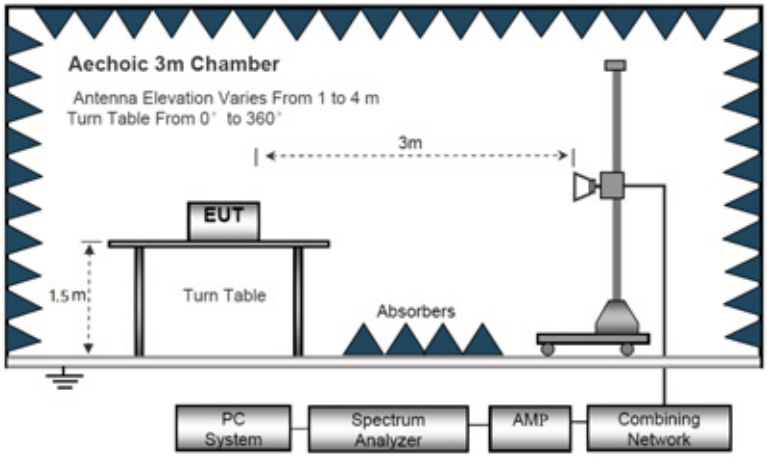
Radiated Emission Test-Up Frequency Below 30MHz



Below 1GHz



Above 1GHz



Below 30MHz

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	P
--	--	--	--	P

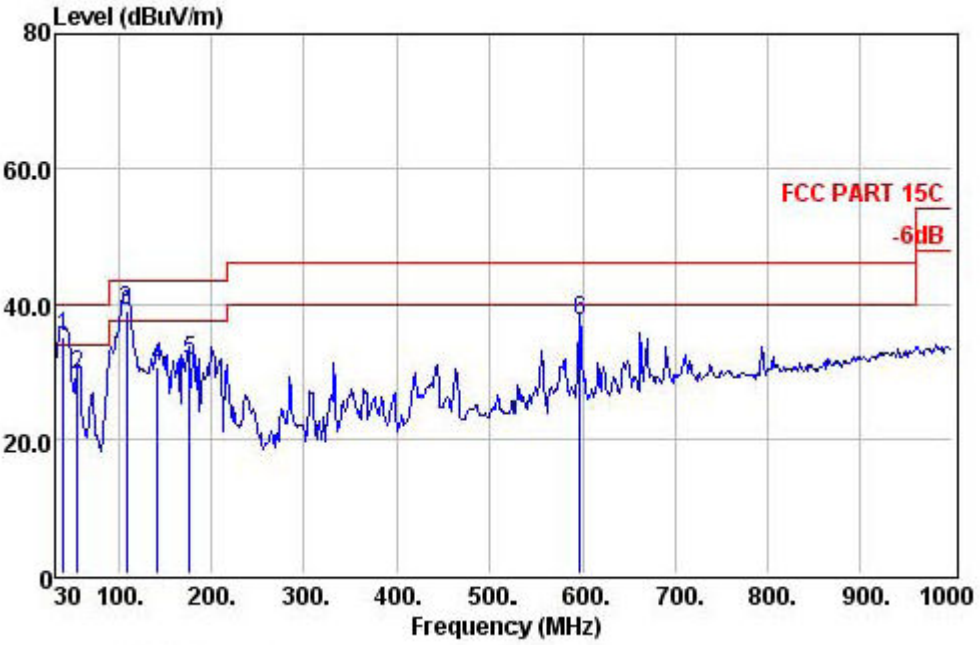
Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =40 log (specific distance/test distance)(dB);

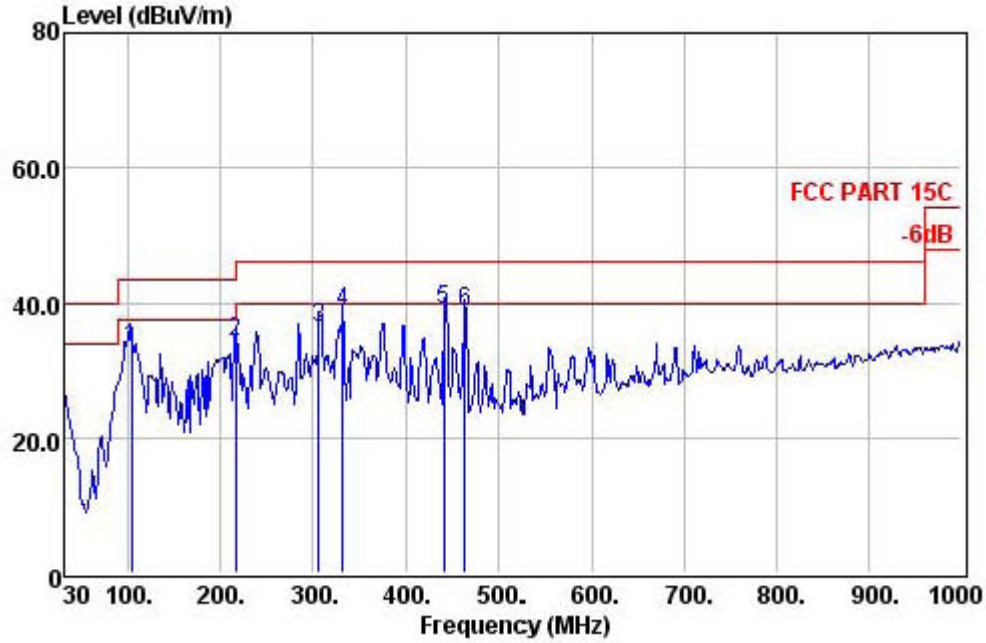
Limit line = specific limits(dBuv) + distance extrapolation factor.

Below 1GHz
Vertical



		Freq	Preamp Factor	Read Level	Cable Loss	Level	Limit Line	Over Limit	Remark
		MHz	dB	dBuV	dB	dBuV/m	dBuV/m	dB	
1	!	39.70	31.37	52.80	0.56	35.07	40.00	-4.93	QP
2		54.25	31.37	51.79	0.75	29.33	40.00	-10.67	QP
3	!	107.60	31.32	59.95	1.03	39.03	43.50	-4.47	QP
4		141.55	31.22	52.03	1.22	30.52	43.50	-12.98	QP
5		175.50	31.17	51.07	1.39	31.56	43.50	-11.94	QP
6		597.45	30.64	44.29	3.29	37.46	46.00	-8.54	QP

Horizontal



	Freq	Preamp Factor	Read Level	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dBuV/m	dBuV/m	dB	
1	102.75	31.35	54.03	1.03	33.23	43.50	-10.27	QP
2	216.24	31.02	51.88	1.53	34.17	46.00	-11.83	QP
3	306.45	30.92	51.26	1.94	36.26	46.00	-9.74	QP
4	332.64	30.76	52.61	2.02	38.68	46.00	-7.32	QP
5	442.25	30.62	49.49	2.55	38.86	46.00	-7.14	QP
6	464.56	30.60	48.47	2.69	38.57	46.00	-7.43	QP

Note：Mode 1Mbps(low CH) is the worst mode.

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	45.21	10.12	55.33	74	-18.67	Pk	Vertical
4804.000	34.34	10.12	44.46	54	-9.54	AV	Vertical
7206.000	43.61	12.05	55.66	74	-18.34	Pk	Vertical
7206.000	32.23	12.05	44.28	54	-9.72	AV	Vertical
4804.000	46.27	10.12	56.39	74	-17.61	Pk	Horizontal
4804.000	34.32	10.12	44.44	54	-9.56	AV	Horizontal
7206.000	46.26	12.05	58.31	74	-15.69	Pk	Horizontal
7206.000	33.43	12.05	45.48	54	-8.52	AV	Horizontal
Middle channel(2441MHz)							
4882.000	52.41	10.42	62.83	74	-11.17	Pk	Vertical
4882.000	36.15	10.42	46.57	54	-7.43	AV	Vertical
7323.000	45.36	12.81	58.17	74	-15.83	Pk	Vertical
7323.000	33.24	12.81	46.05	54	-7.95	AV	Vertical
4882.000	54.67	10.42	65.09	74	-8.91	Pk	Horizontal
4882.000	35.62	10.42	46.04	54	-7.96	AV	Horizontal
7323.000	48.56	12.81	61.37	74	-12.63	Pk	Horizontal
7323.000	34.24	12.81	47.05	54	-6.95	AV	Horizontal
High channel(2480MHz)							
4960.000	46.14	10.48	56.62	74	-17.38	Pk	Vertical
4960.000	35.41	10.48	45.89	54	-8.11	AV	Vertical
7440.000	46.55	12.87	59.42	74	-14.58	Pk	Vertical
7440.000	35.36	12.87	48.23	54	-5.77	AV	Vertical
4960.000	45.21	10.48	55.69	74	-18.31	Pk	Horizontal
4960.000	36.25	10.48	46.73	54	-7.27	AV	Horizontal
7440.000	43.16	12.87	56.03	74	-17.97	Pk	Horizontal
7440.000	35.47	12.87	48.34	54	-5.66	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.

2. Set the spectrum analyzer:

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

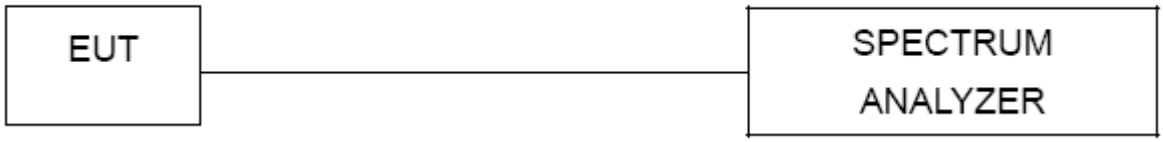
RBW ≥1% of the 20dB bandwidth

VBW ≥ RBW

Sweep=auto

Detector function=peak

Trace=max hold



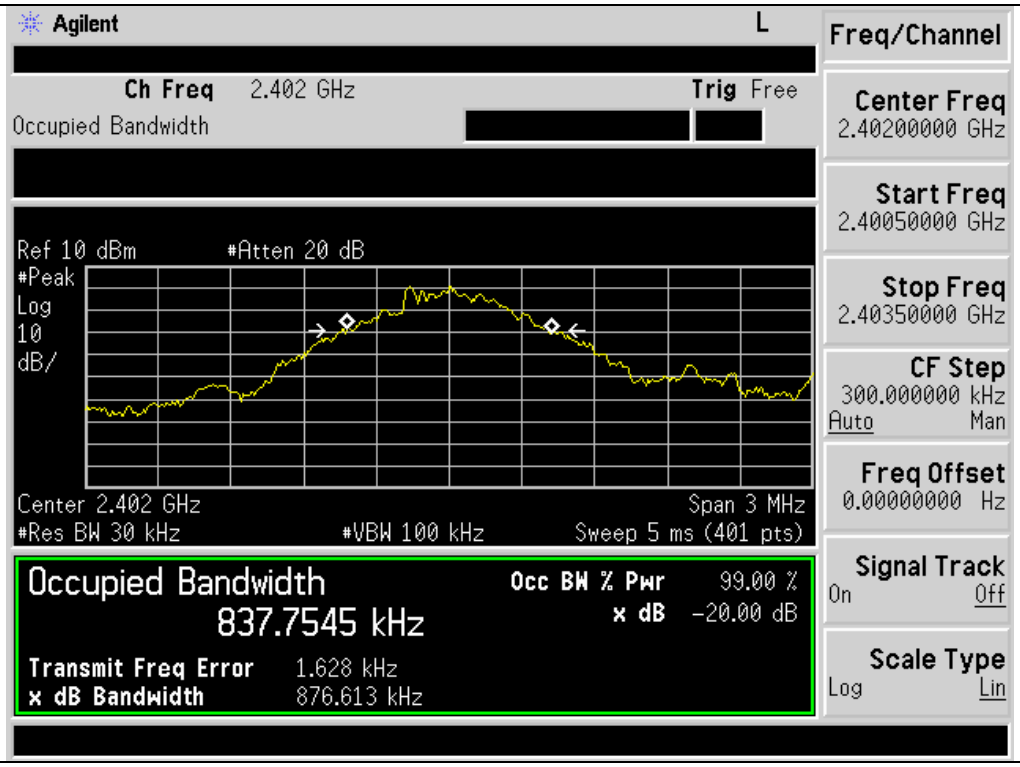
Test data:

EUT：	2.1 Sound Bar System （wireless）	Model Name ：	ESB206
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1012 hPa	Test Voltage ：	AC 120V
Test Mode ：	CH00 / CH39 /C78**(1Mbps)**		

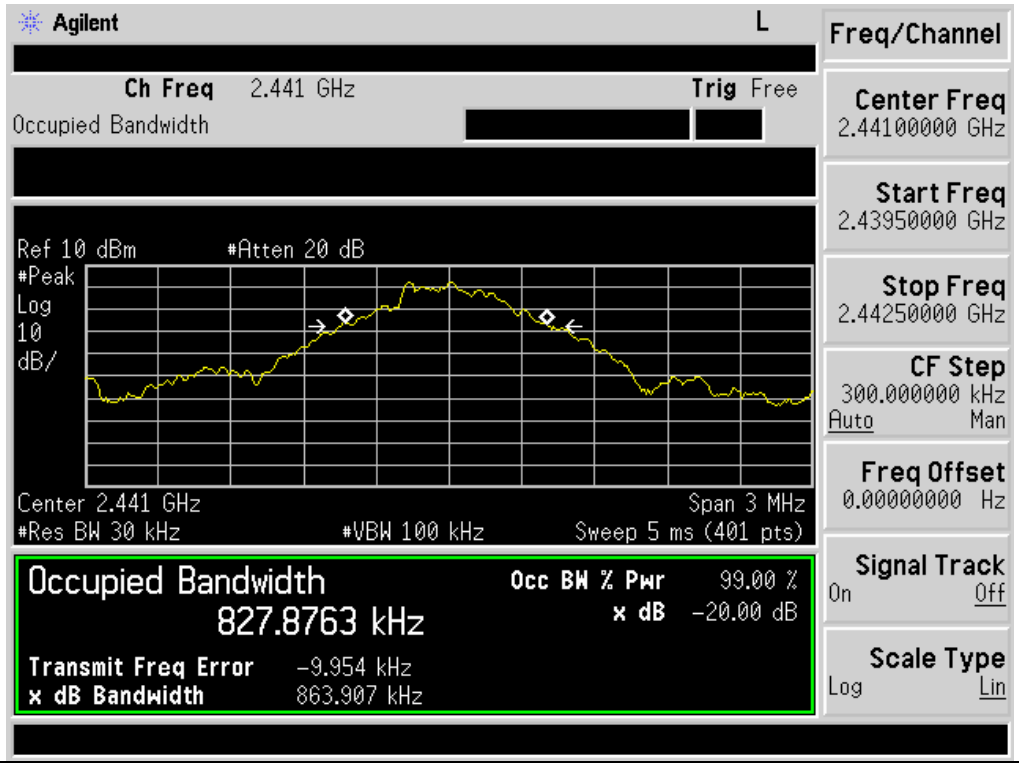
Frequency	20dB Bandwidth (kHz)	Result
2402 MHz	876.613	**PASS**
2441 MHz	863.907	**PASS**
2480 MHz	834.801	**PASS**

Test plot as follows:

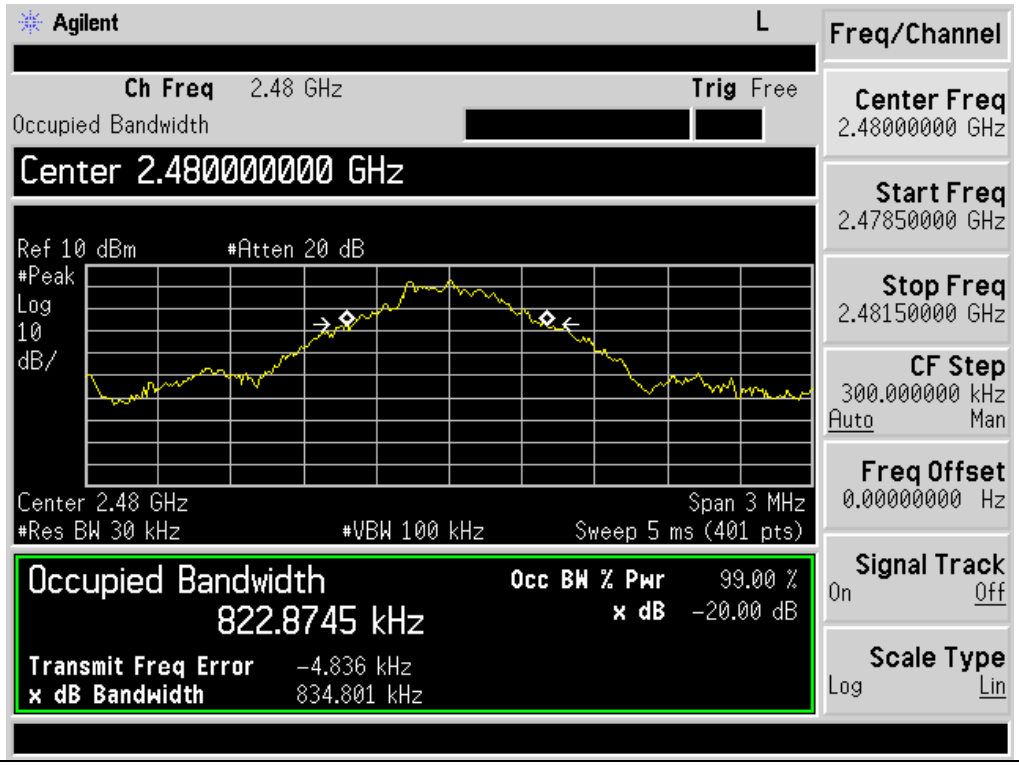
CH00



CH39 -1Mbps



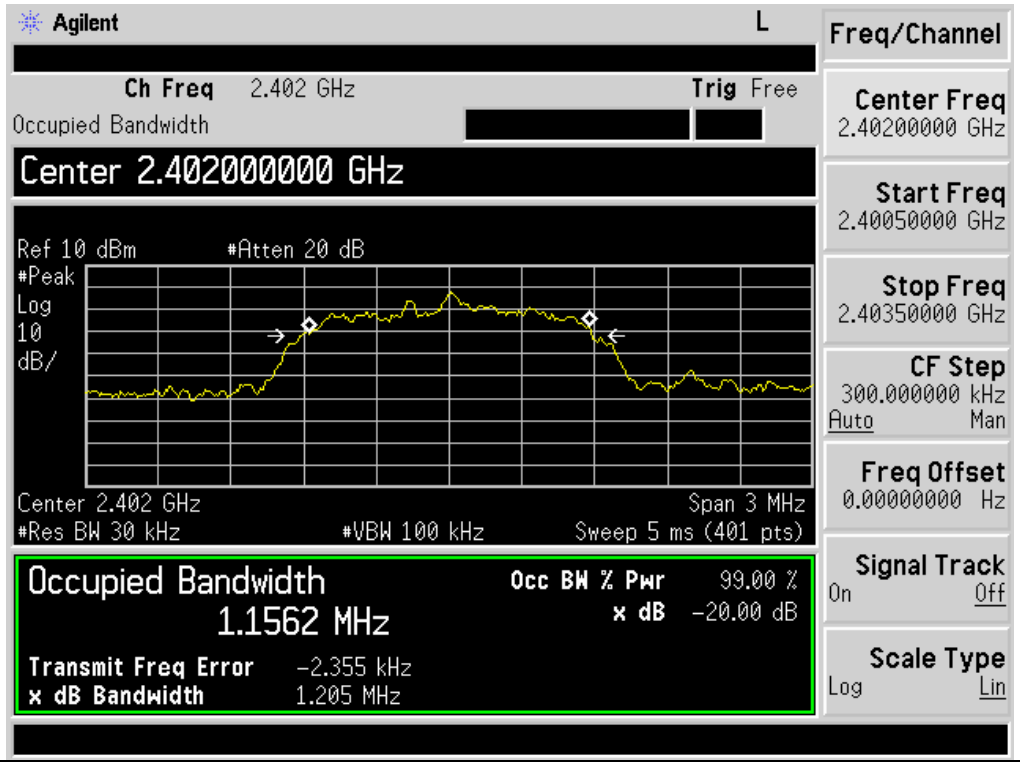
CH78 -1Mbps



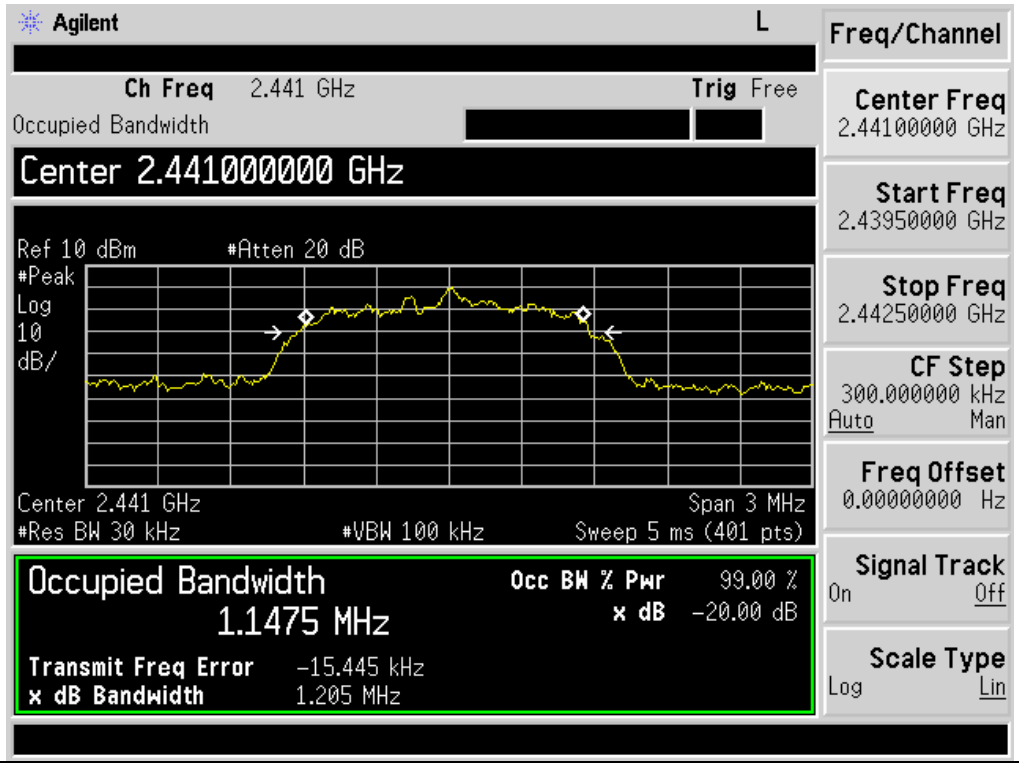
EUT：	2.1 Sound Bar System （wireless）	Model Name ：	ESB206
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1012 hPa	Test Voltage ：	AC 120V
Test Mode ：	CH00 / CH39 /C78**(2Mbps)**		

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.205	**PASS**
2441 MHz	1.205	**PASS**
2480 MHz	1.219	**PASS**

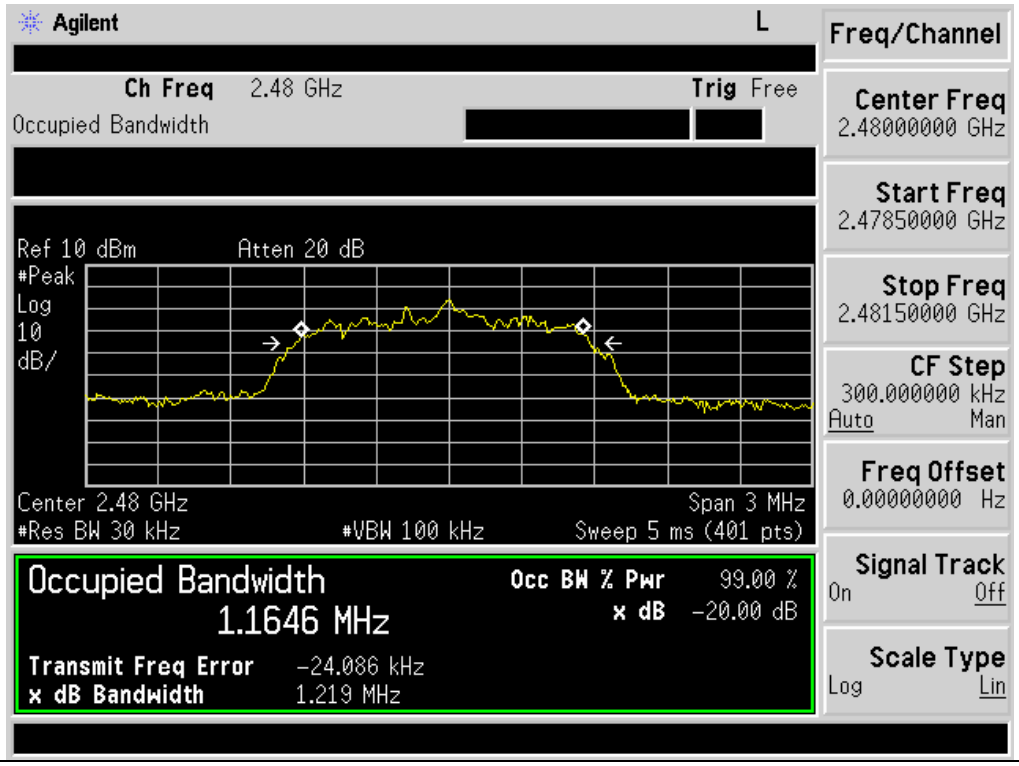
CH00



CH39


Agilent
L
Freq/Channel
Ch Freq 2.441 GHz
Trig Free
Occupied Bandwidth
Center 2.441000000 GHz
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 10 dBm
#Atten 20 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
1.1475 MHz
Occ BW % Pwr 99.00 %
x dB -20.00 dB
Transmit Freq Error -15.445 kHz
x dB Bandwidth 1.205 MHz

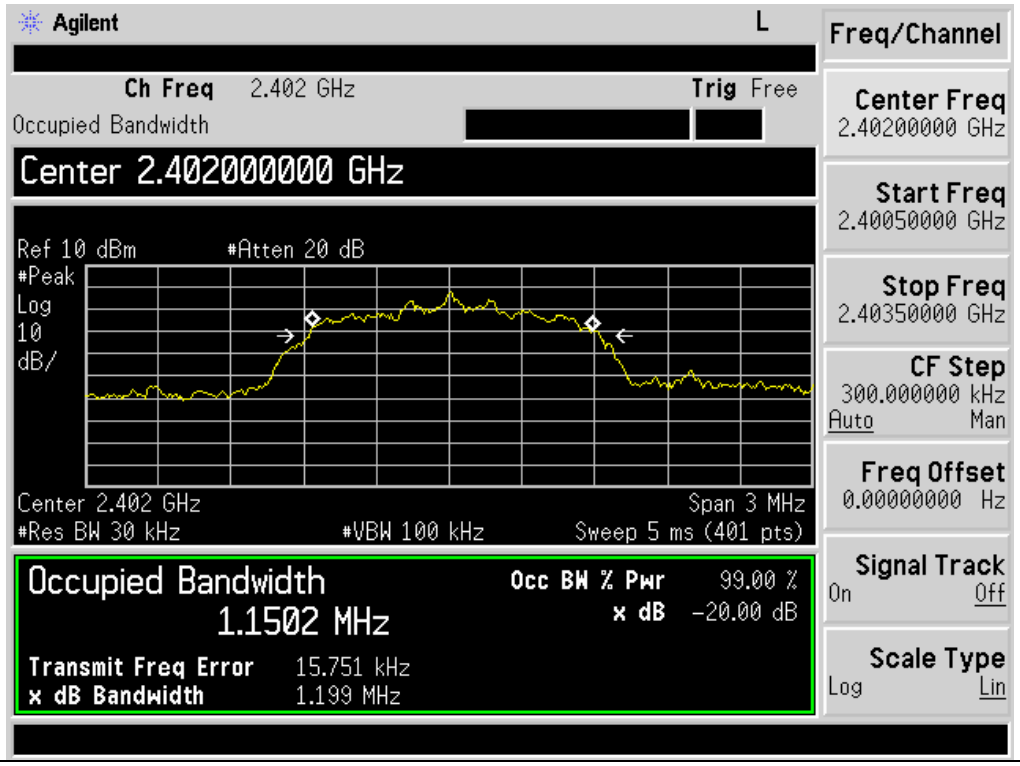
CH78


Agilent
L
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 10 dBm
Atten 20 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
1.1646 MHz
Occ BW % Pwr 99.00 %
x dB -20.00 dB
Transmit Freq Error -24.086 kHz
x dB Bandwidth 1.219 MHz

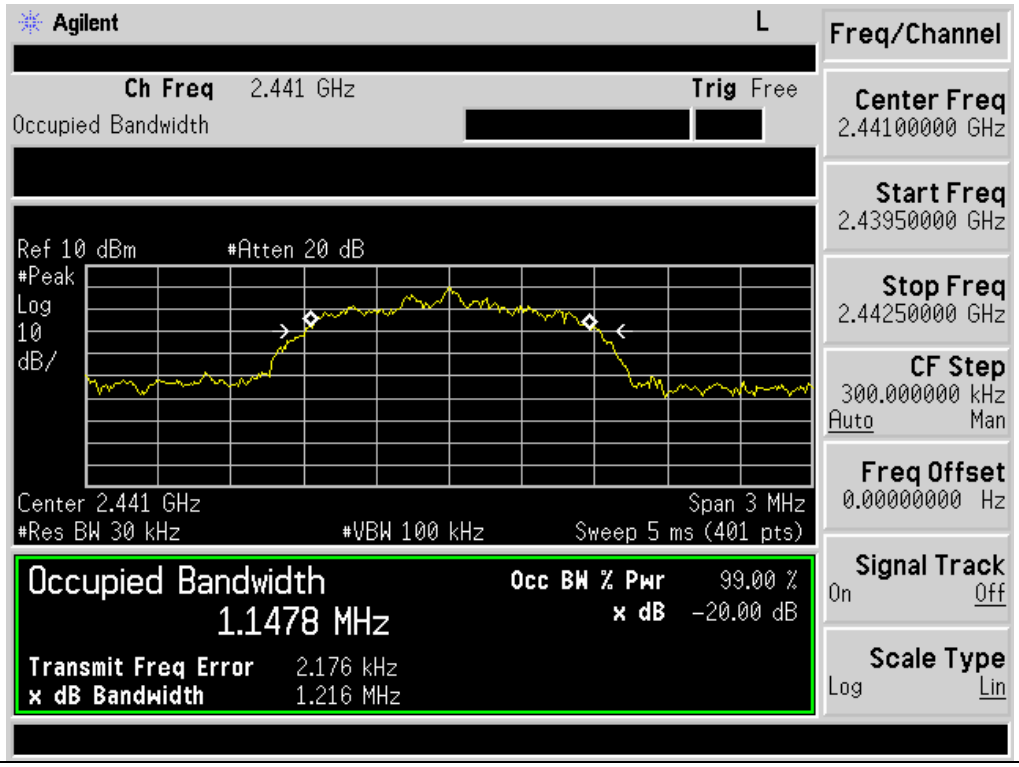
EUT：	2.1 Sound Bar System （wireless）	Model Name ：	ESB206
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1012 hPa	Test Voltage ：	AC 120V
Test Mode ：	CH00 / CH39 /CH78**(3Mbps)**		

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.199	**PASS**
2441 MHz	1.216	**PASS**
2480 MHz	1.220	**PASS**

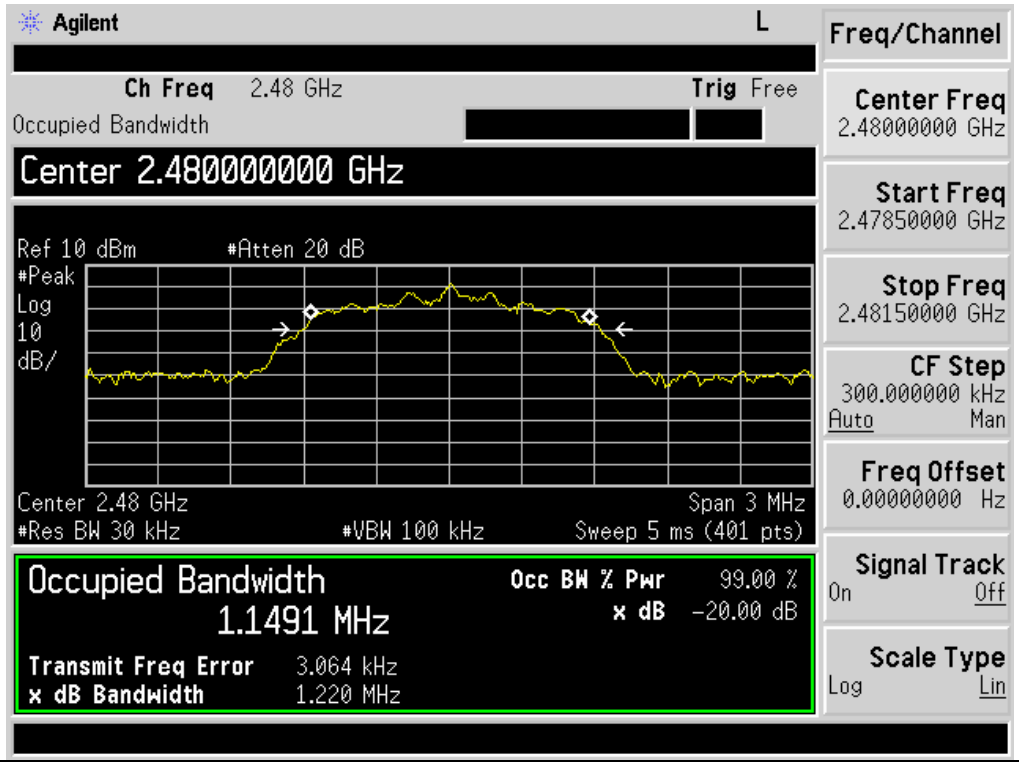
CH00



CH39


Agilent
L
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 10 dBm
#Atten 20 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
1.1478 MHz
Occ BW % Pwr 99.00 %
x dB -20.00 dB
Transmit Freq Error 2.176 kHz
x dB Bandwidth 1.216 MHz

CH78


Agilent
L
Freq/Channel
Ch Freq 2.48 GHz
Trig Free
Occupied Bandwidth
Center 2.480000000 GHz
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 10 dBm
#Atten 20 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
1.1491 MHz
Occ BW % Pwr 99.00 %
x dB -20.00 dB
Transmit Freq Error 3.064 kHz
x dB Bandwidth 1.220 MHz

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

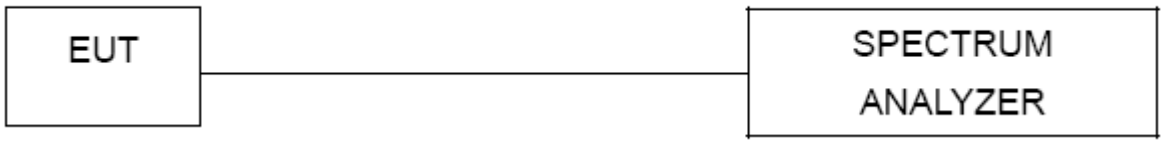
RBW ≥1% of the span(30KHz)

VBW ≥ RBW(100KHz)

Sweep=auto

Detector function=peak

Trace=max hold



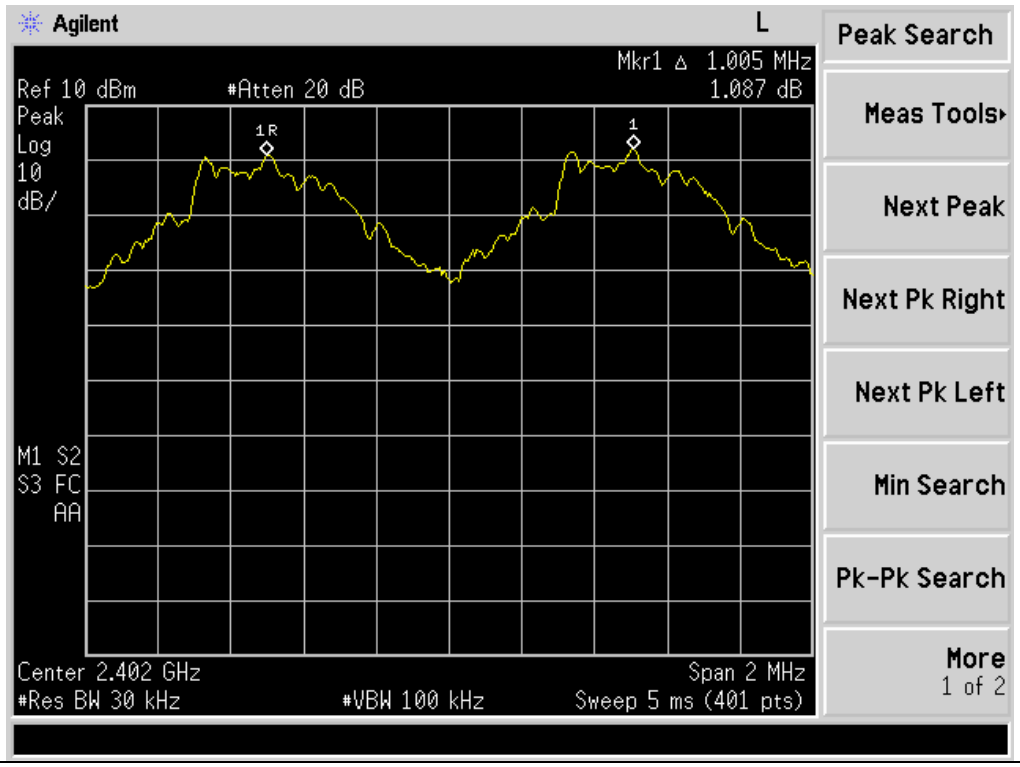
Test data:

EUT：	2.1 Sound Bar System （wireless）	Model Name ：	ESB206
Temperature：	24 ℃	Relative Humidity：	58%
Pressure：	1010hPa	Test Voltage ：	AC 120V
Test Mode ：	CH00 / CH39 /CH78**(1Mbps)**		

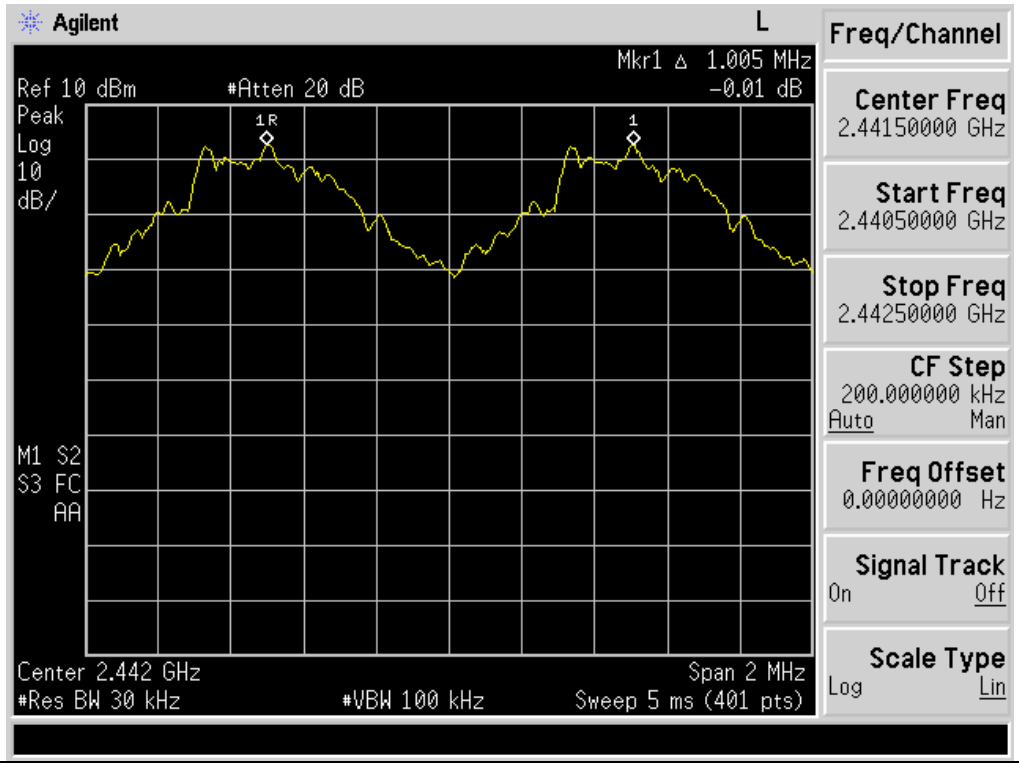
Frequency	Ch. Separation (MHz)	Result
2402 MHz	1.005	**Complies**
2441 MHz	1.005	**Complies**
2480 MHz	1.005	**Complies**

Ch. Separation Limits: > 20dB bandwidth
Test plot as follows:

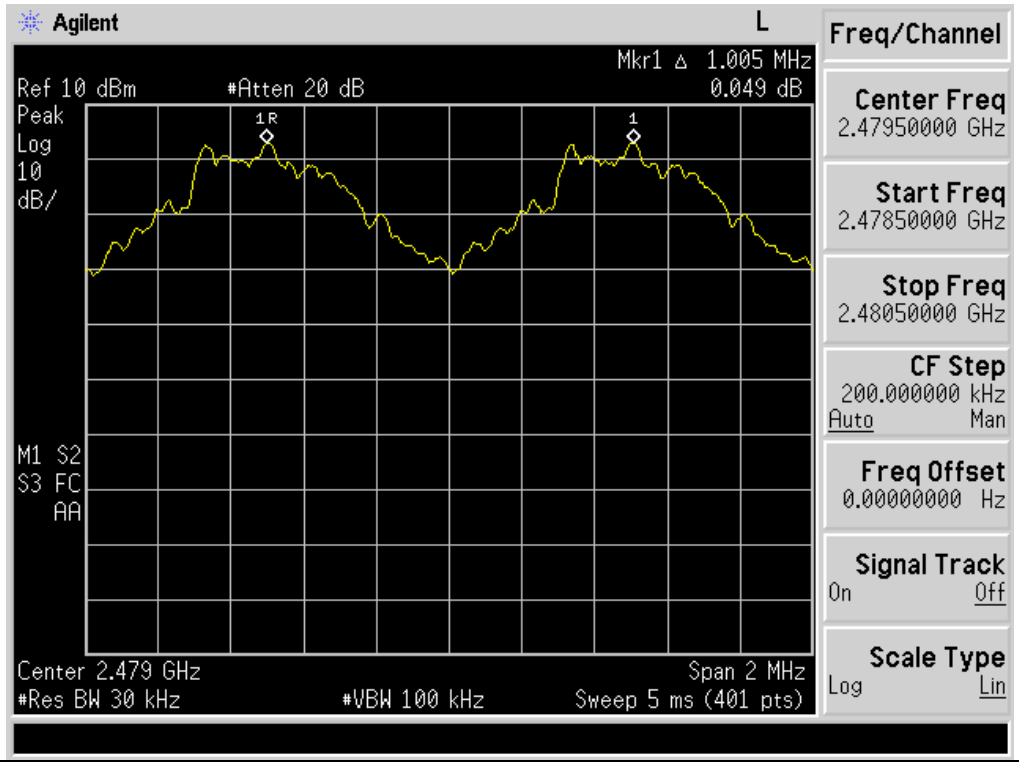
CH00



CH39


Agilent
L
Mkr1 Δ 1.005 MHz
Ref 10 dBm
#Atten 20 dB
-0.01 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

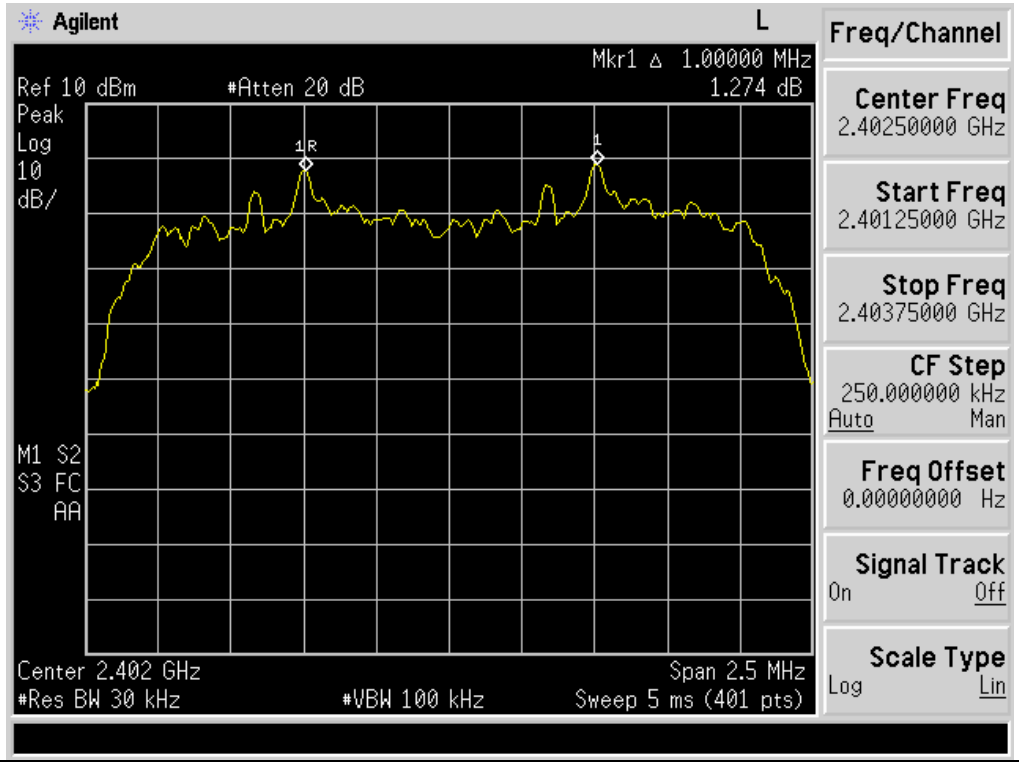

Agilent
L
Mkr1 Δ 1.005 MHz
Ref 10 dBm
#Atten 20 dB
0.049 dB
Peak
Log
10
dB/
1R
1
M1 S2
S3 FC
AA
Center 2.479 GHz
Span 2 MHz
#Res BW 30 kHz
#VBW 100 kHz
Sweep 5 ms (401 pts)
Freq/Channel
Center Freq
2.47950000 GHz
Start Freq
2.47850000 GHz
Stop Freq
2.48050000 GHz
CF Step
200.000000 kHz
Auto
Man
Freq Offset
0.00000000 Hz
Signal Track
On
Off
Scale Type
Log
Lin

EUT：	2.1 Sound Bar System （wireless）	Model Name ：	ESB206
Temperature：	24 ℃	Relative Humidity：	58%
Pressure：	1010 hPa	Test Voltage ：	AC 120V
Test Mode ：	CH00 / CH39 /CH78**(2Mbps)**		

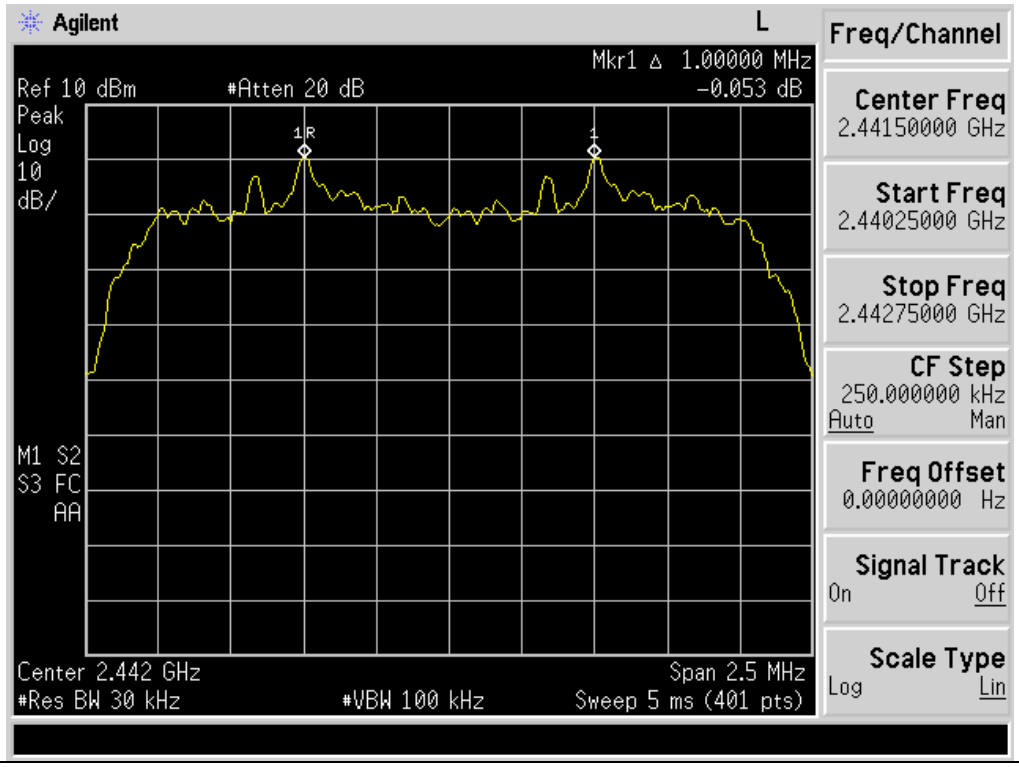
Frequency	Ch. Separation (MHz)	Result
2402 MHz	1.000	**Complies**
2441 MHz	1.000	**Complies**
2480 MHz	1.000	**Complies**

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

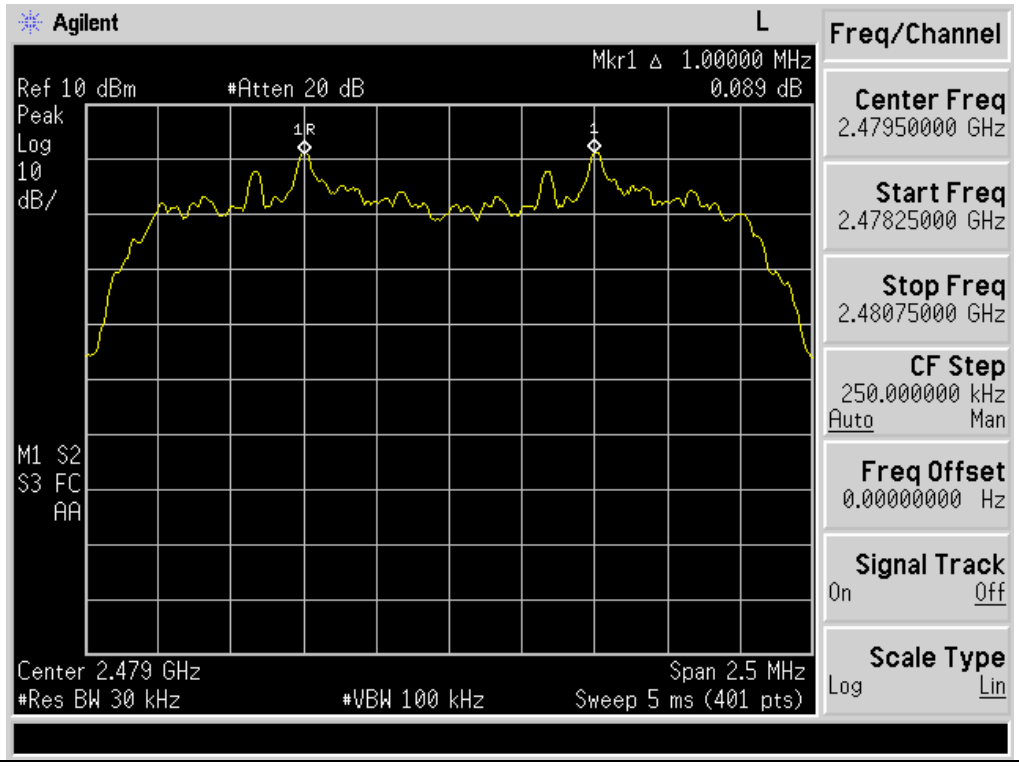
CH00 -2Mbps



CH39 -2Mbps



CH78 -2Mbps

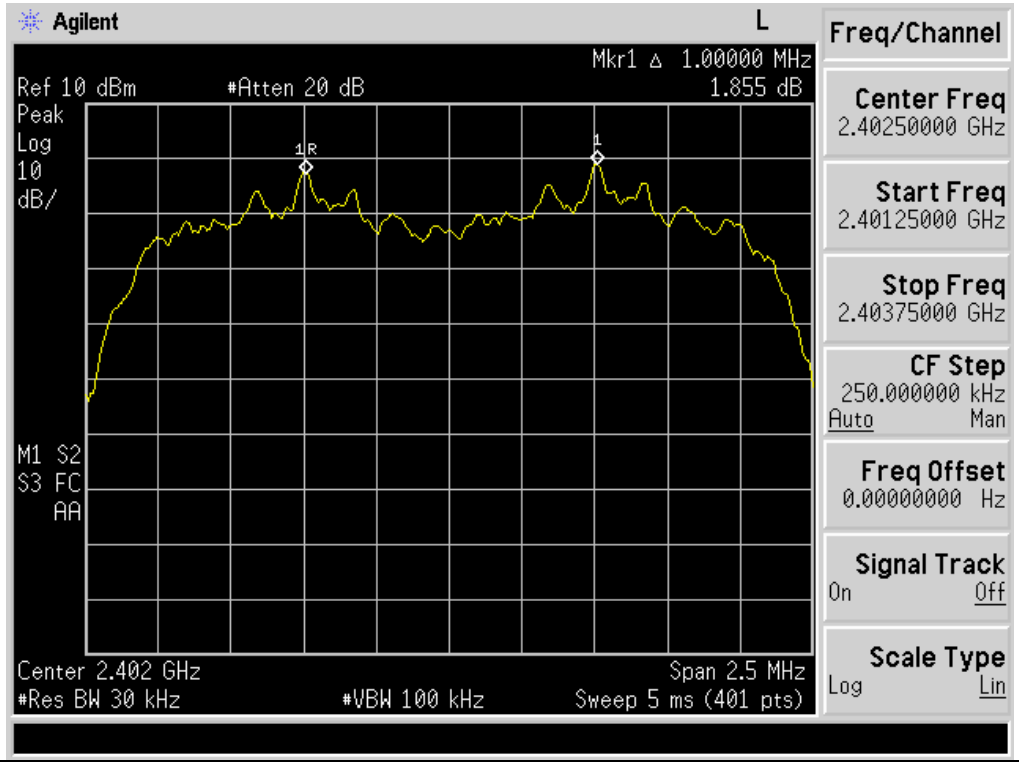


EUT：	2.1 Sound Bar System （wireless）	Model Name ：	ESB206
Temperature：	24 ℃	Relative Humidity：	58%
Pressure：	1010 hPa	Test Voltage ：	AC 120V
Test Mode ：	CH00 / CH39 /CH78**(3Mbps)**		

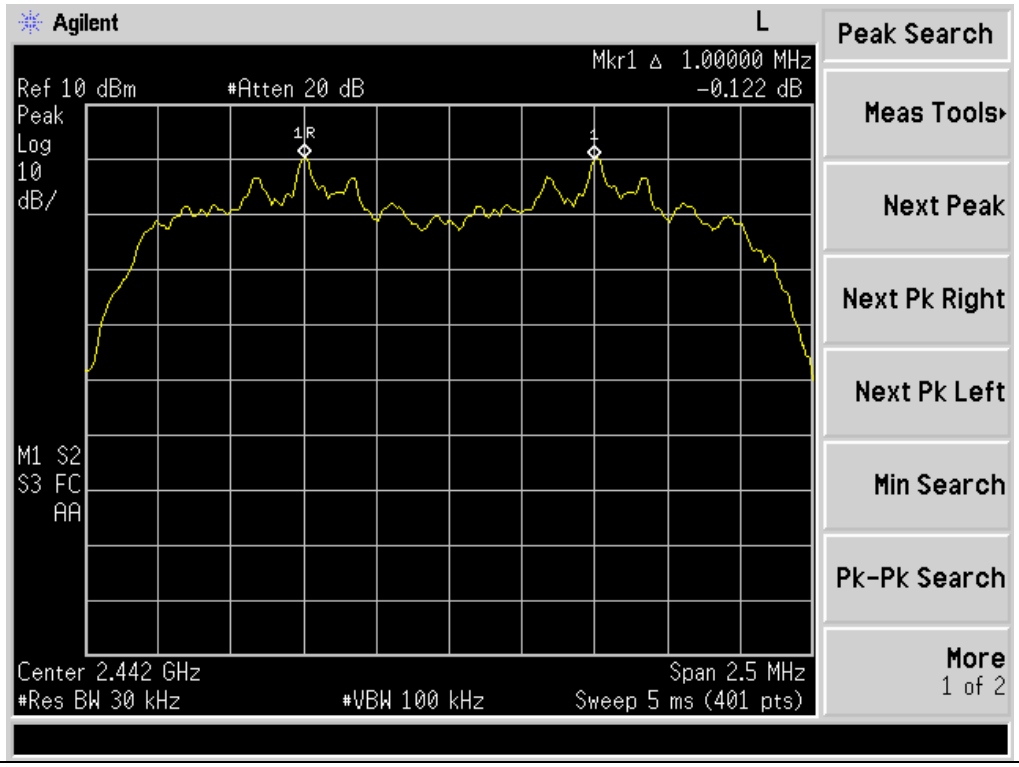
Frequency	Ch. Separation (MHz)	Result
2402 MHz	1.000	**Complies**
2441 MHz	1.000	**Complies**
2480 MHz	1.000	**Complies**

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

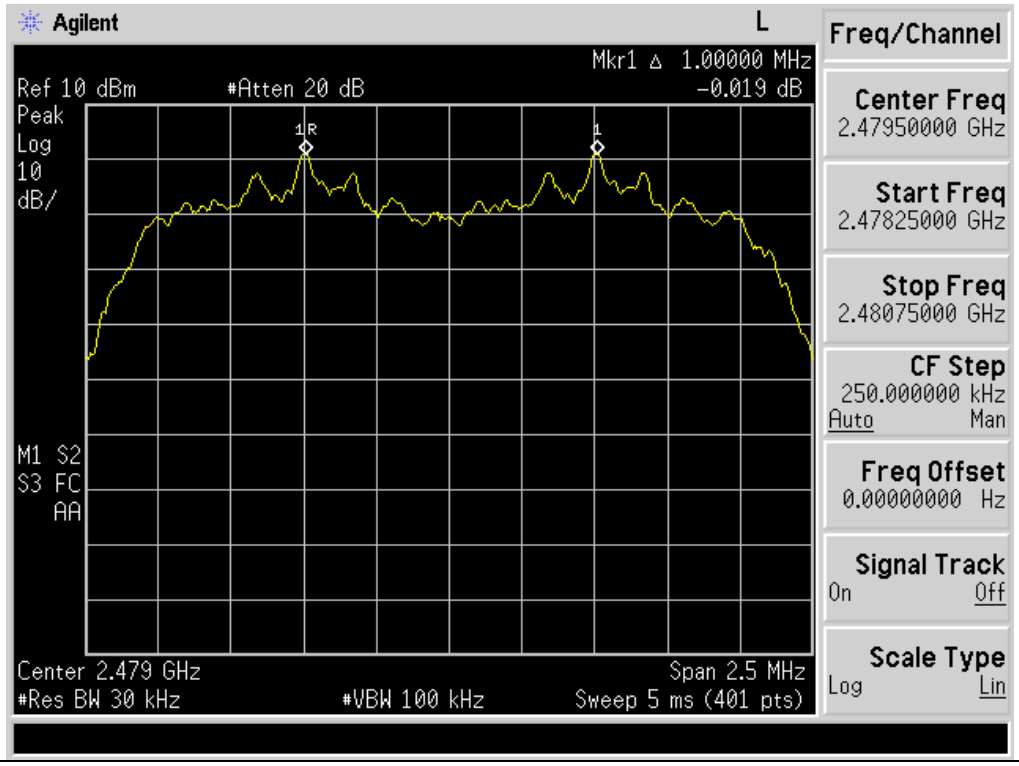
CH00 -3Mbps



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

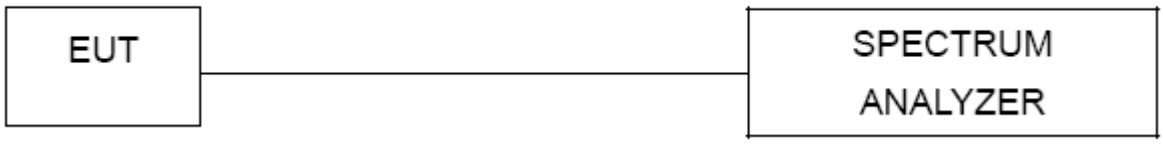
RBW =100KHz

VBW=300KHz

Sweep=auto

Detector function=peak

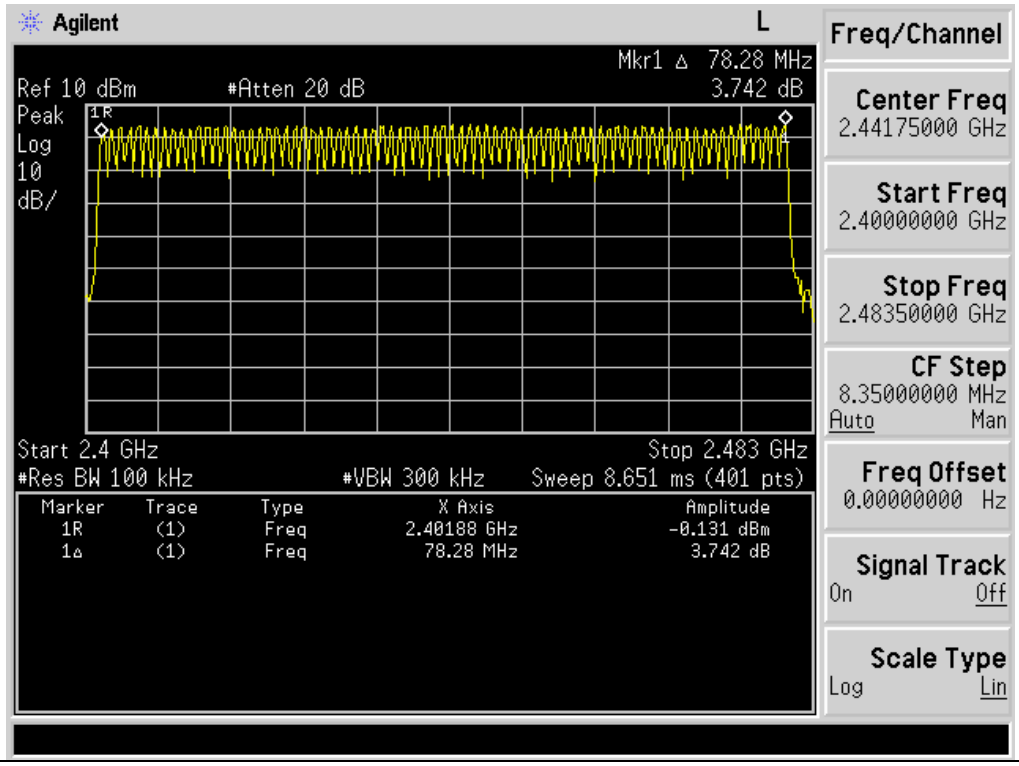
Trace=max hold



Test data:

Measured channel numbers	Limit	Result
79	⩾15	PASS

Test plot as follows:



NOTE: GFSK is the worst. the worst data was show in the report.

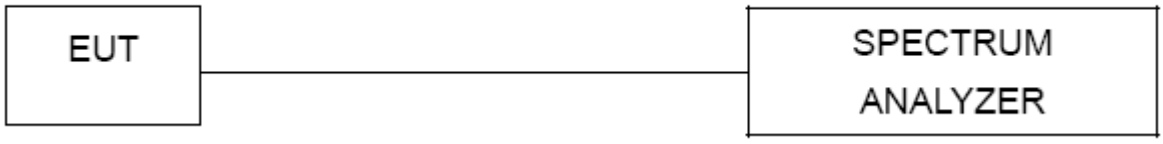
9. DWELL TIME

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.

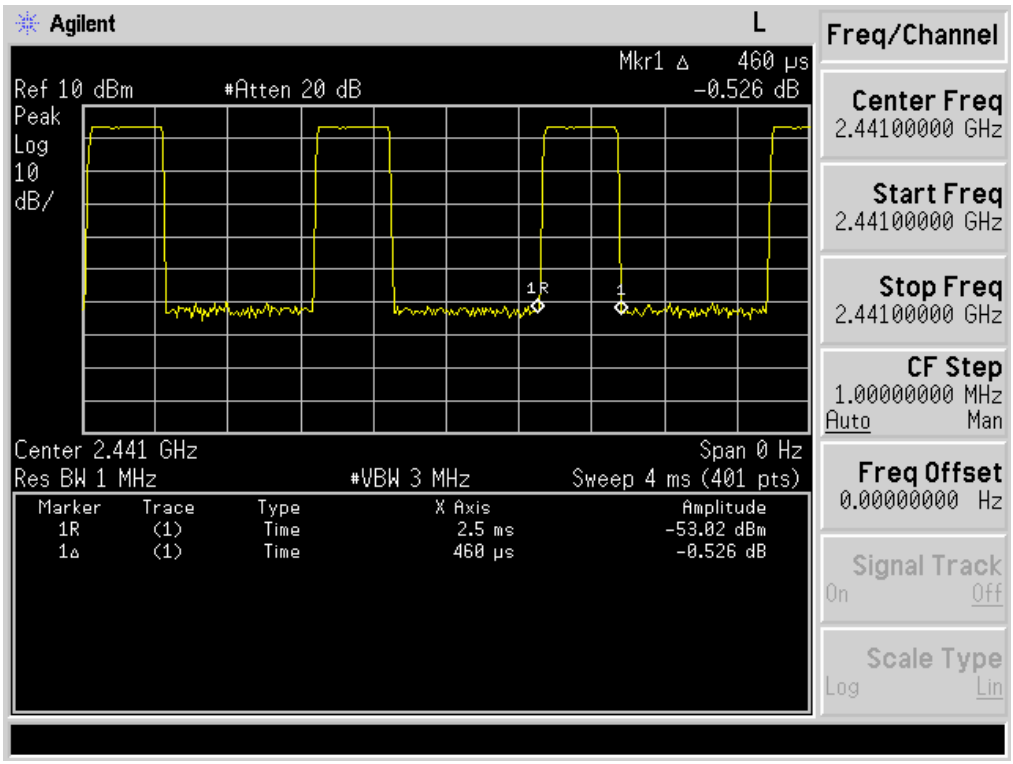
A Period Time = (channel number)*0.4
DH1 Time Slot: Reading * (1600/2)*31.6/(channel number)
DH3 Time Slot: Reading * (1600/4)*31.6/(channel number)
DH5 Time Slot: Reading * (1600/6)*31.6/(channel number)

Test data:

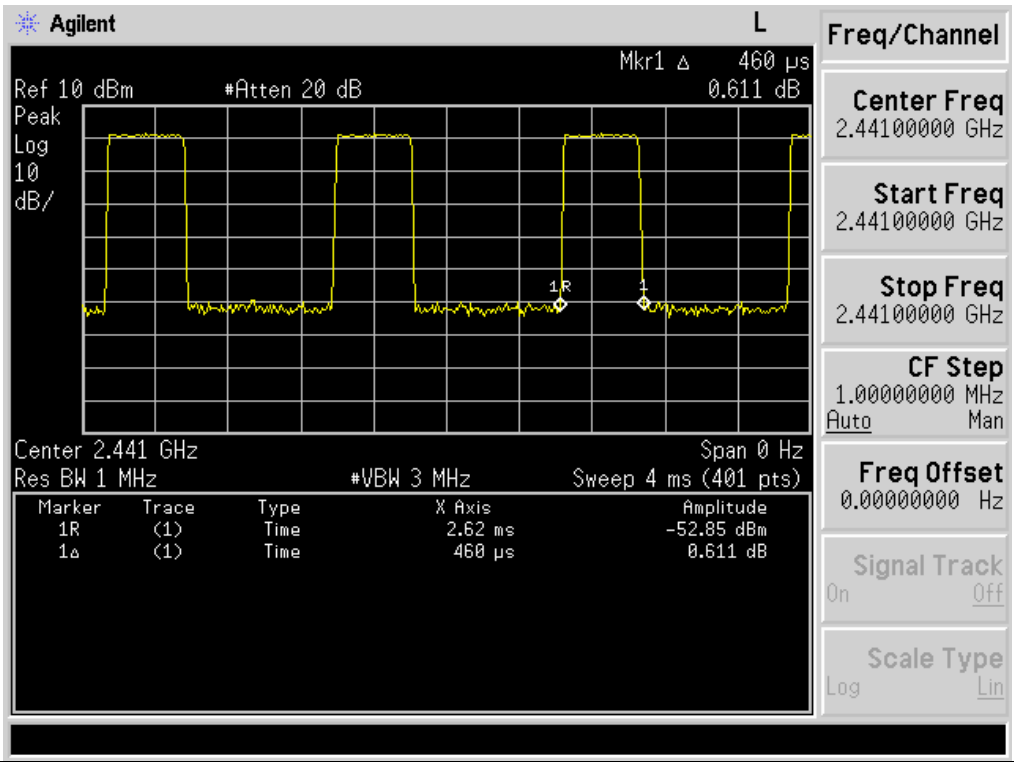
Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(s)	(s)
DH1	2441 MHz	0.46	0.15	0.4
2DH1	2441 MHz	0.46	0.15	0.4
3DH1	2441 MHz	0.46	0.15	0.4

Test plot as follows as below:

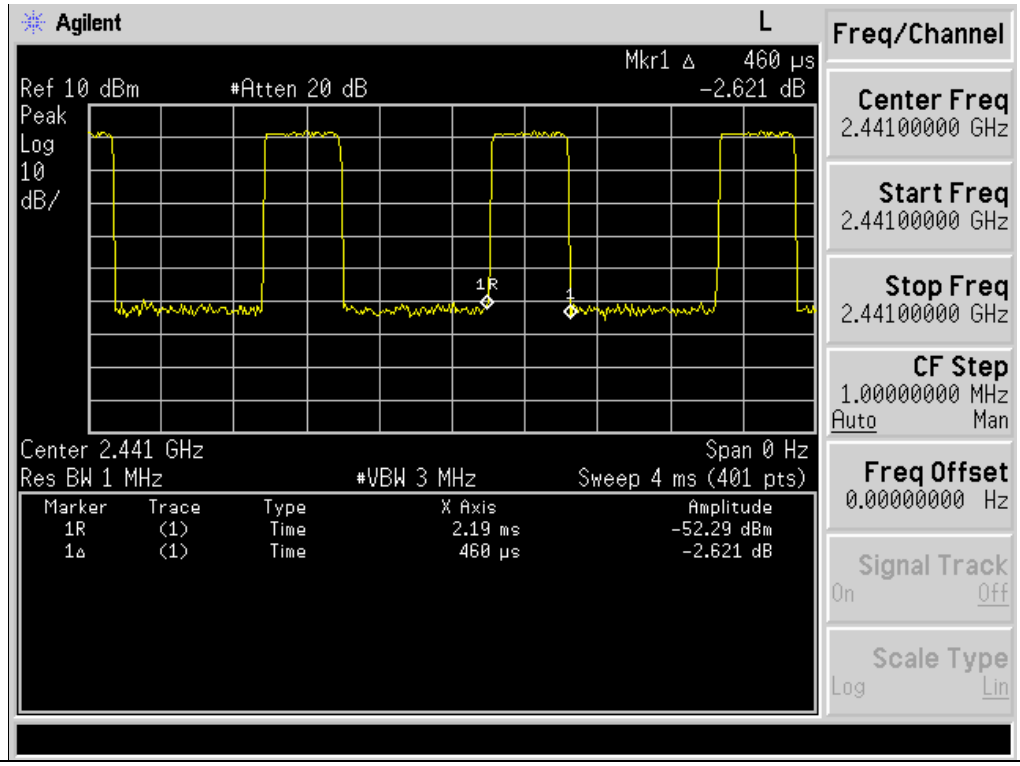
CH39-DH1



CH39-2DH1

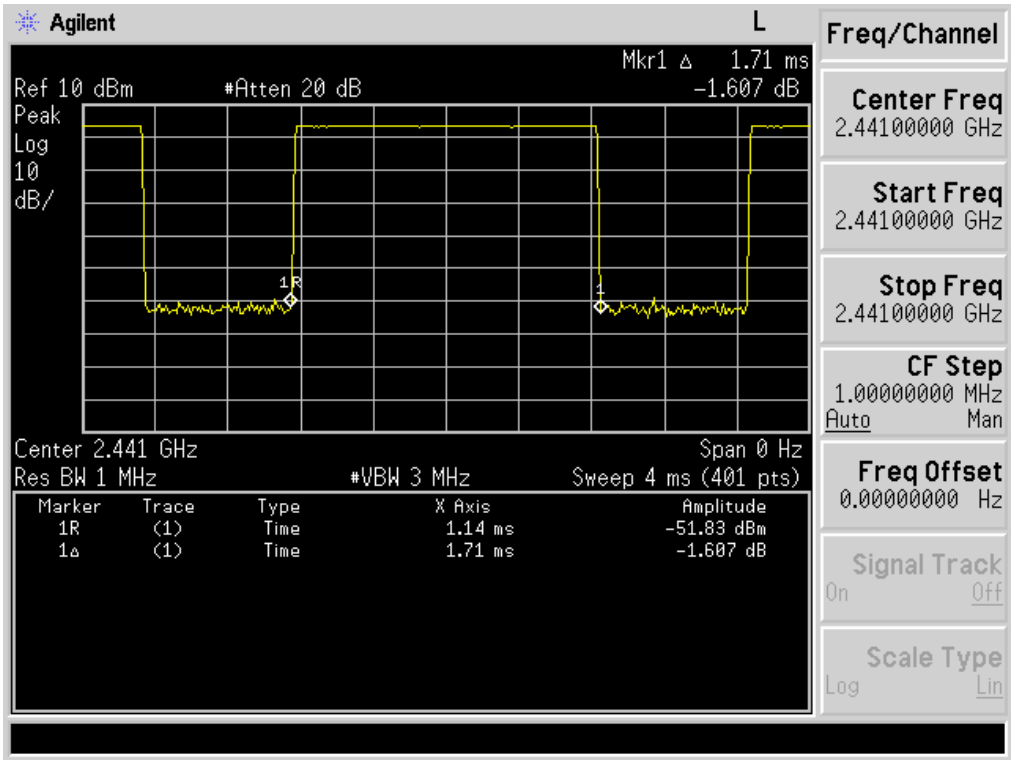


CH39-3DH1

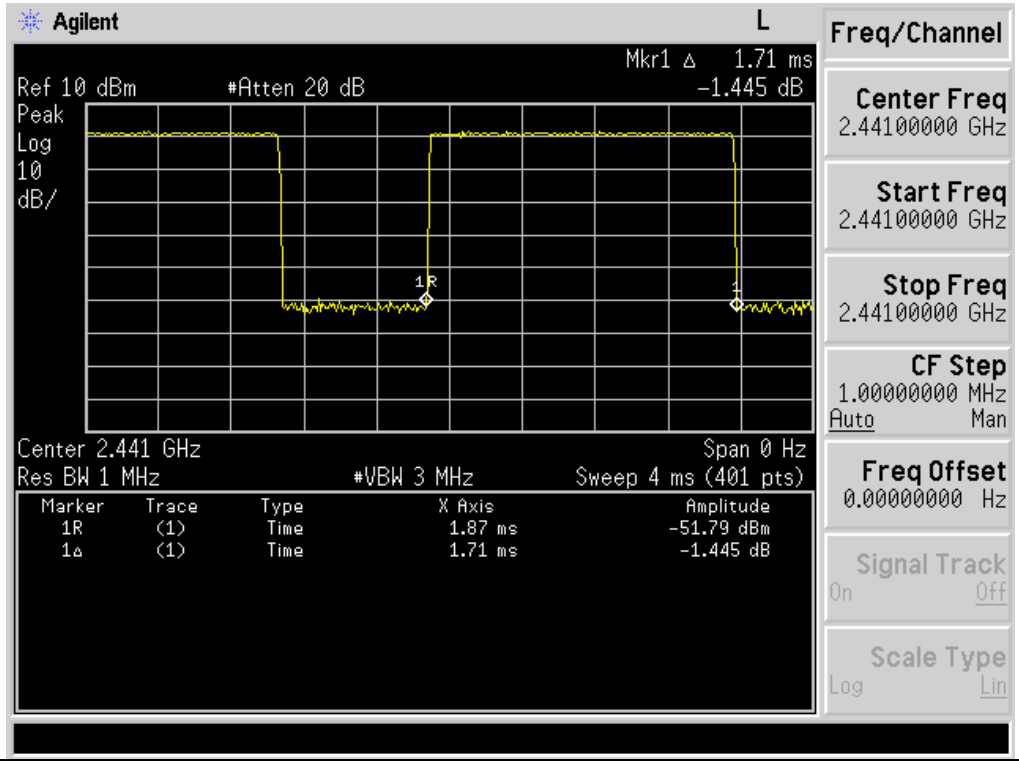


Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(s)	(s)
DH3	2441 MHz	1.71	0.27	0.4
2DH3	2441 MHz	1.71	0.27	0.4
3DH3	2441 MHz	1.71	0.27	0.4

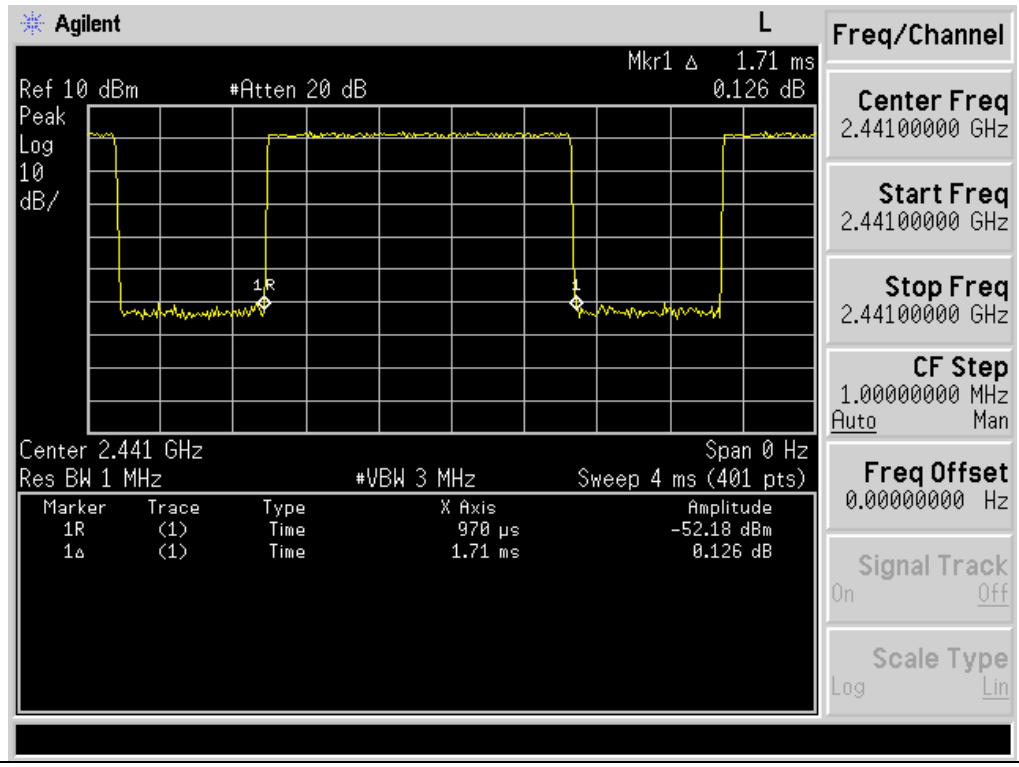
CH39-DH3



CH39-2DH3

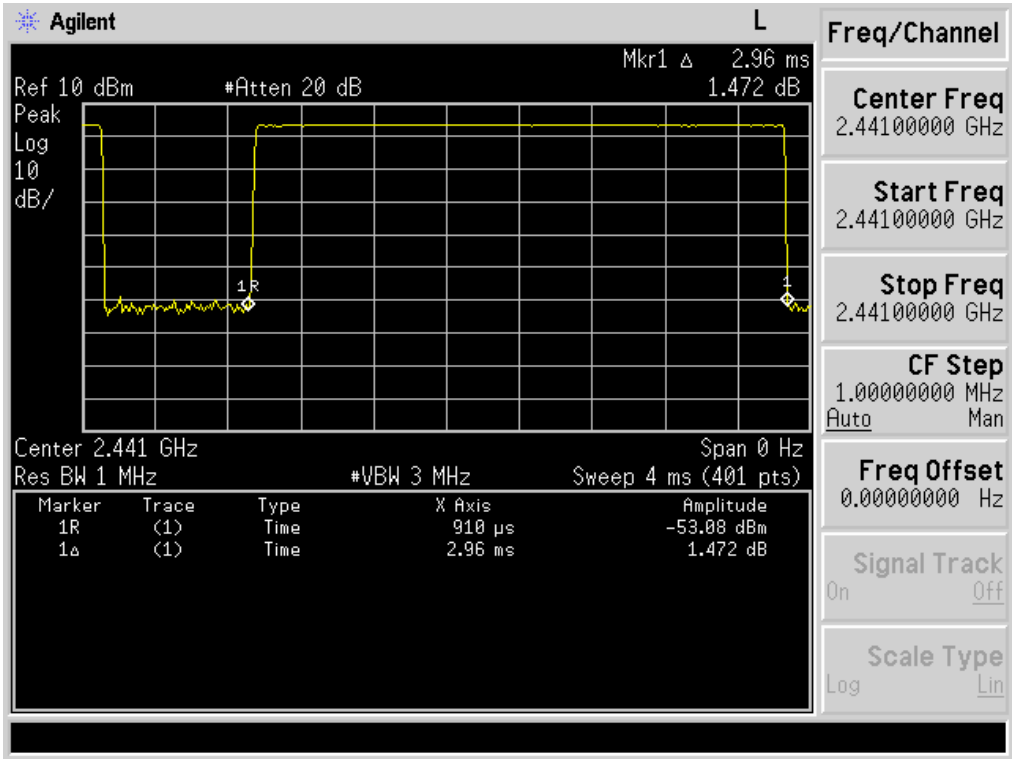


CH39-3DH3

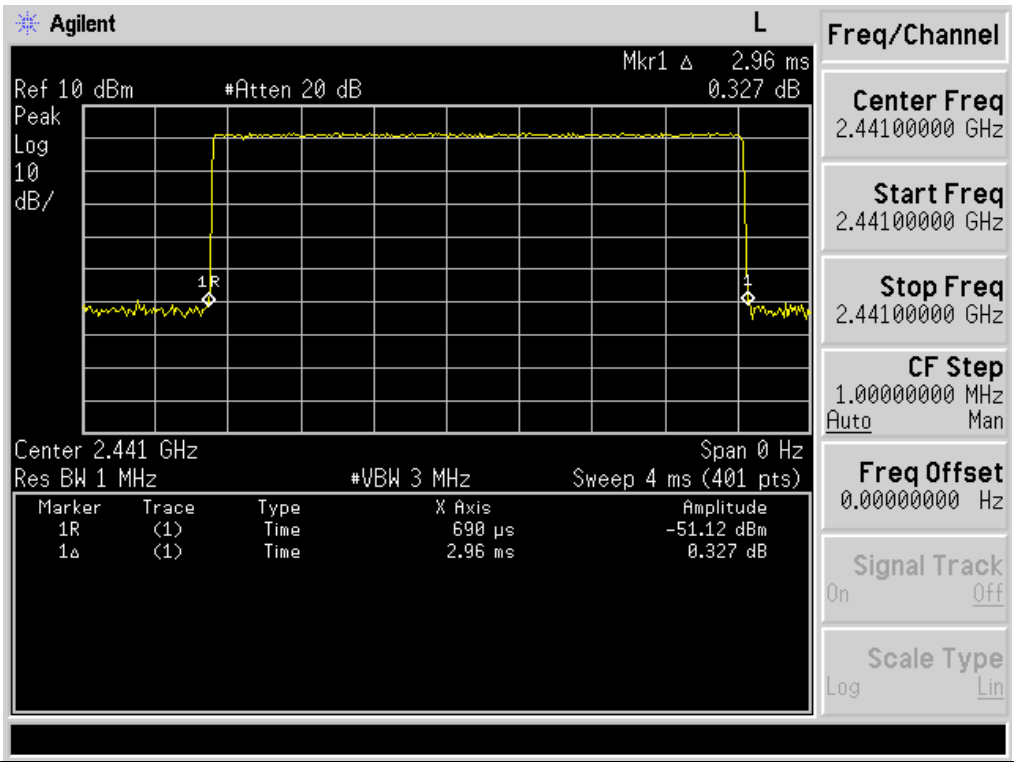


Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(s)	(s)
DH5	2441 MHz	2.96	0.32	0.4
2DH5	2441 MHz	2.96	0.32	0.4
3DH5	2441 MHz	2.97	0.32	0.4

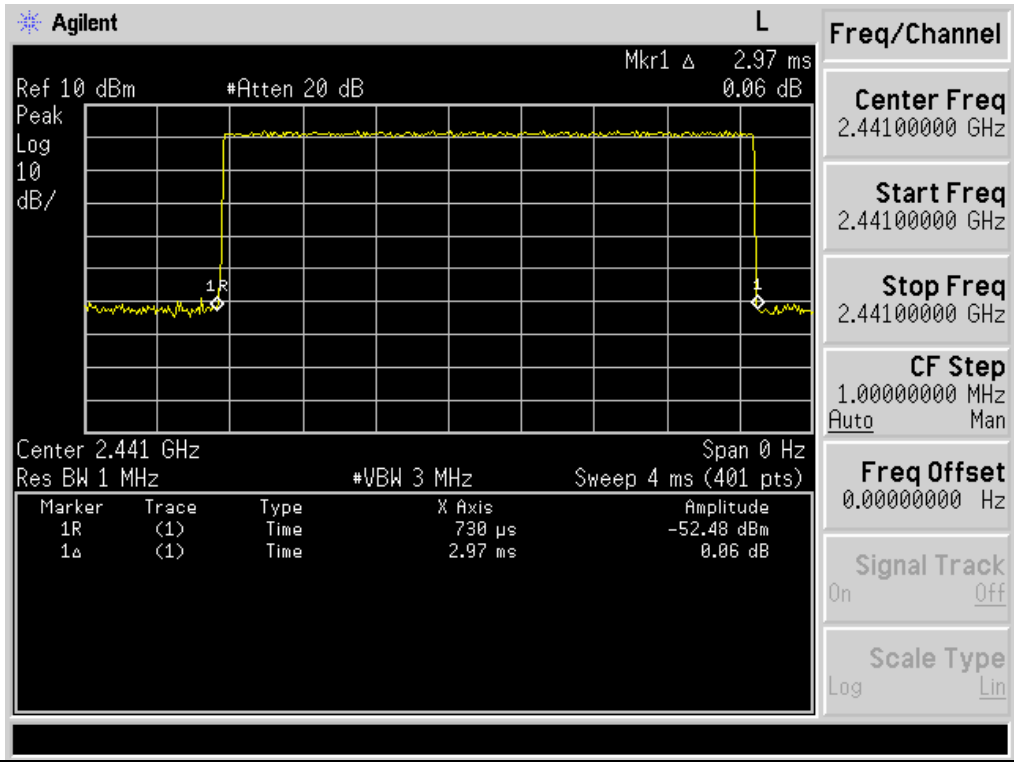
CH39-DH5



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.

10.3.Test Procedure

a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
c) Set RBW to 100 kHz and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
d) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
e) Repeat above procedures until all measured frequencies were complete.

Test plot as follows:

For radiated test as follows:

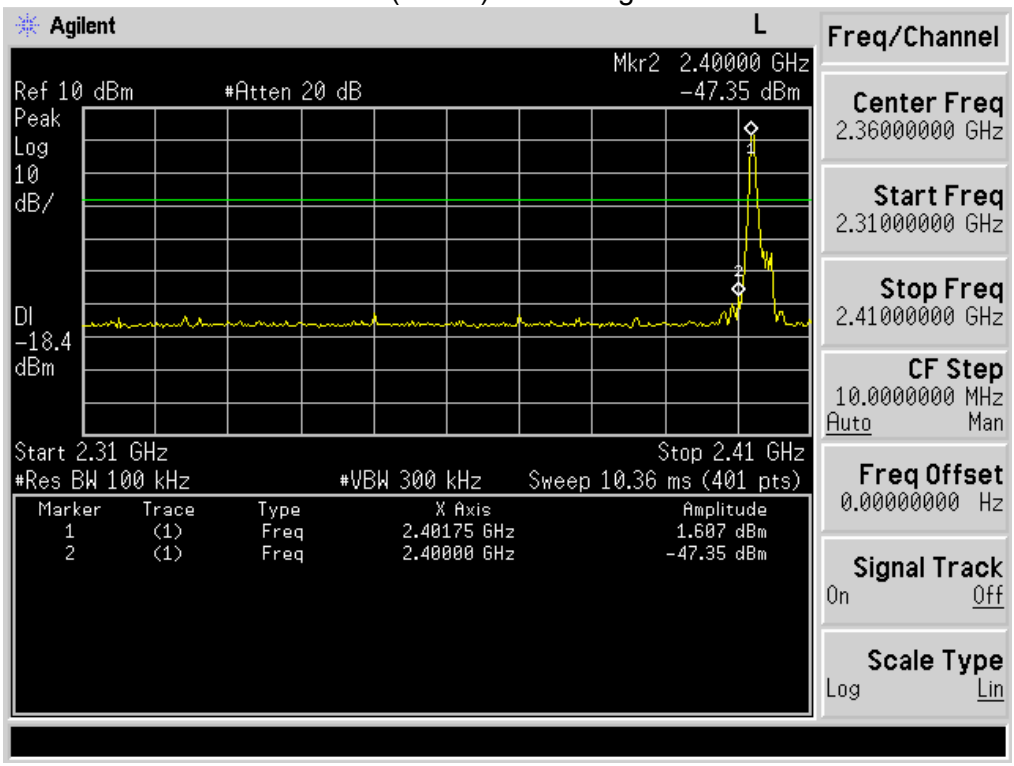
Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type	Comment
1Mbps Non-hopping							
2390	36.12	13.06	49.18	74	-24.82	peak	Vertical
2390	36.87	13.06	49.93	74	-24.07	peak	Horizontal
2483.5	37.12	12.78	49.90	74	-24.10	peak	Vertical
2483.5	37.26	12.78	50.04	74	-23.96	peak	Horizontal
1Mbps hopping							
2390	35.87	13.06	48.93	74	-25.07	peak	Vertical
2390	37.13	13.06	50.19	74	-23.81	peak	Horizontal
2483.5	37.56	12.78	50.34	74	-23.66	peak	Vertical
2483.5	37.76	12.78	50.54	74	-23.46	peak	Horizontal
2Mbps Non-hopping							
2390	35.15	13.06	48.21	74	-25.79	peak	Vertical
2390	36.34	13.06	49.4	74	-24.60	peak	Horizontal
2483.5	35.64	12.78	48.42	74	-25.58	peak	Vertical
2483.5	34.19	12.78	46.97	74	-27.03	peak	Horizontal
2Mbps hopping							
2390	34.76	13.06	47.82	74	-26.18	peak	Vertical
2390	36.32	13.06	49.38	74	-24.62	peak	Horizontal
2483.5	36.54	12.78	49.32	74	-24.68	peak	Vertical
2483.5	37.87	12.78	50.65	74	-23.35	peak	Horizontal
3Mbps Non-hopping							
2390	36.68	13.06	49.74	74	-24.26	peak	Vertical
2390	34.12	13.06	47.18	74	-26.82	peak	Horizontal
2483.5	37.45	12.78	50.23	74	-23.77	peak	Vertical
2483.5	38.68	12.78	51.46	74	-22.54	peak	Horizontal
3Mbps hopping							
2390	34.87	13.06	47.93	74	-26.07	peak	Vertical
2390	34.32	13.06	47.38	74	-26.62	peak	Horizontal
2483.5	35.37	12.78	48.15	74	-25.85	peak	Vertical
2483.5	36.23	12.78	49.01	74	-24.99	peak	Horizontal

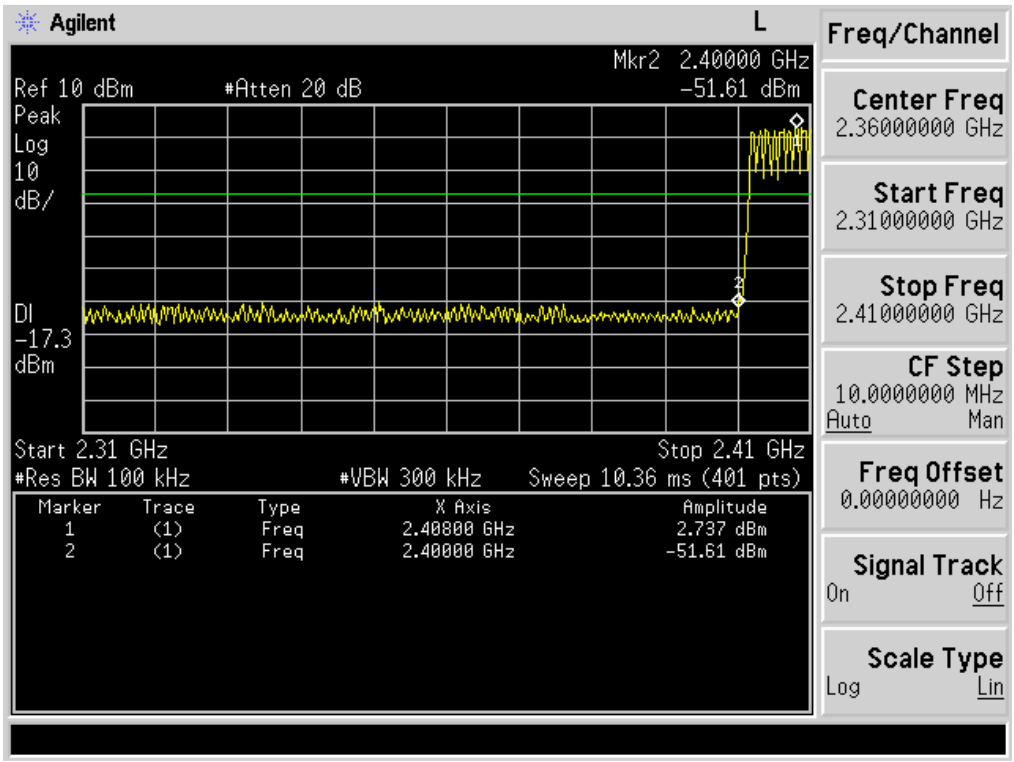
If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

For conducted test:

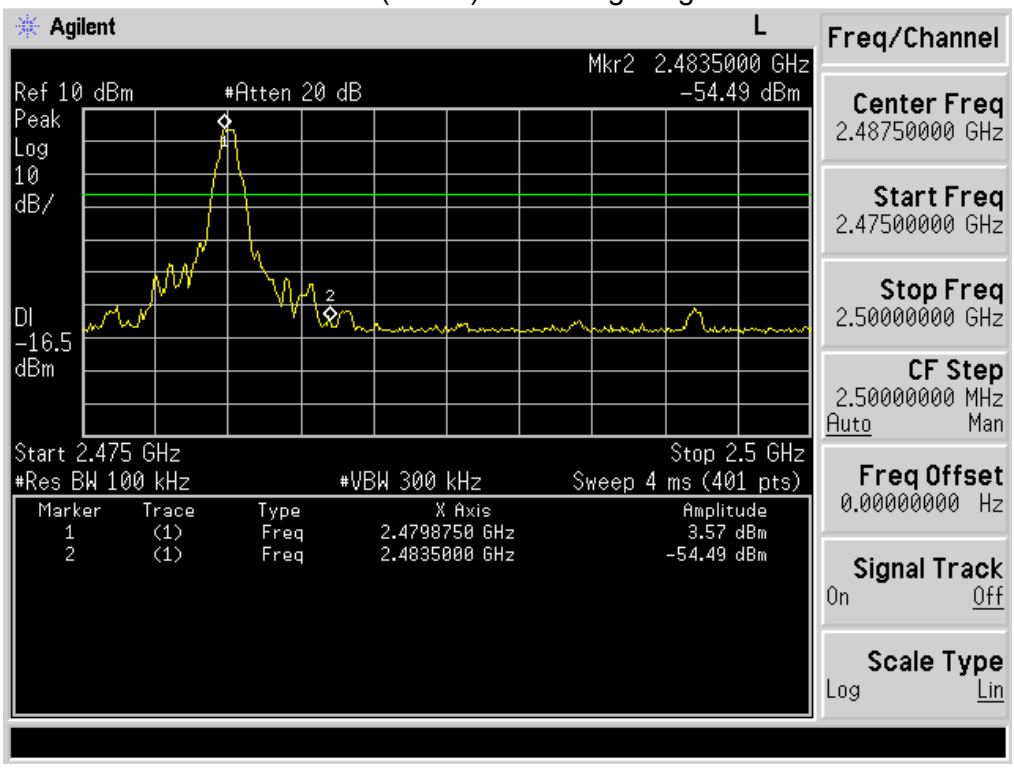
Frequency Band	Delta Peak to band emission (dBc)	＞Limit (dBc)	Result
GFSK Non-hopping			
Left Band	48.96	20	Pass
Right Band	58.06	20	Pass
π/4-DQPSK Non-hopping			
Left Band	48.19	20	Pass
Right Band	55.18	20	Pass
8DPSK Non-hopping			
Left Band	49.10	20	Pass
Right Band	50.67	20	Pass
GFSK hopping			
Left Band	54.35	20	Pass
Right Band	60.68	20	Pass
π/4-DQPSK hopping			
Left Band	51.24	20	Pass
Right Band	55.06	20	Pass
8DPSK hopping			
Left Band	54.69	20	Pass
Right Band	56.60	20	Pass

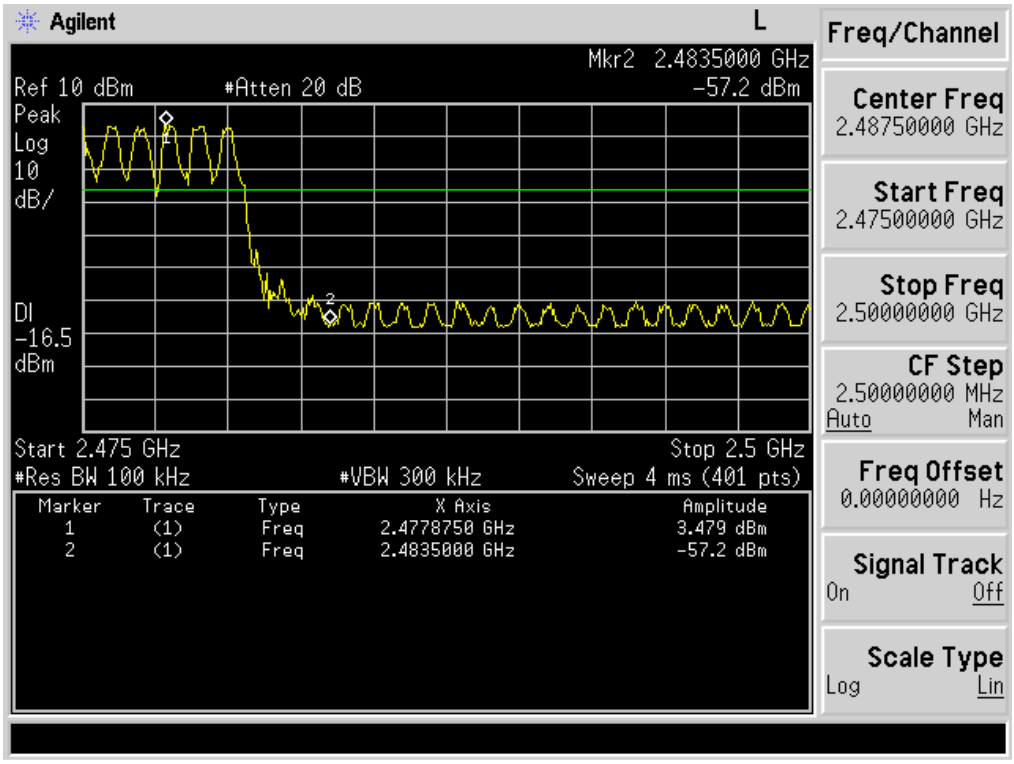
BDR mode (GFSK): Band Edge-Left Side



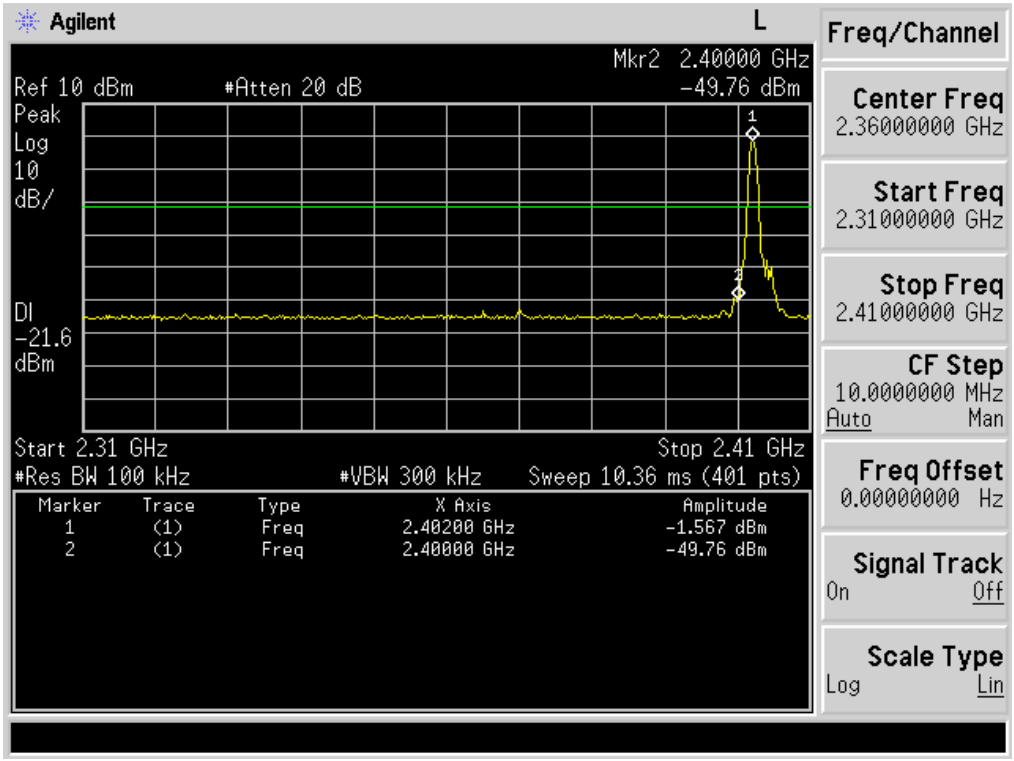


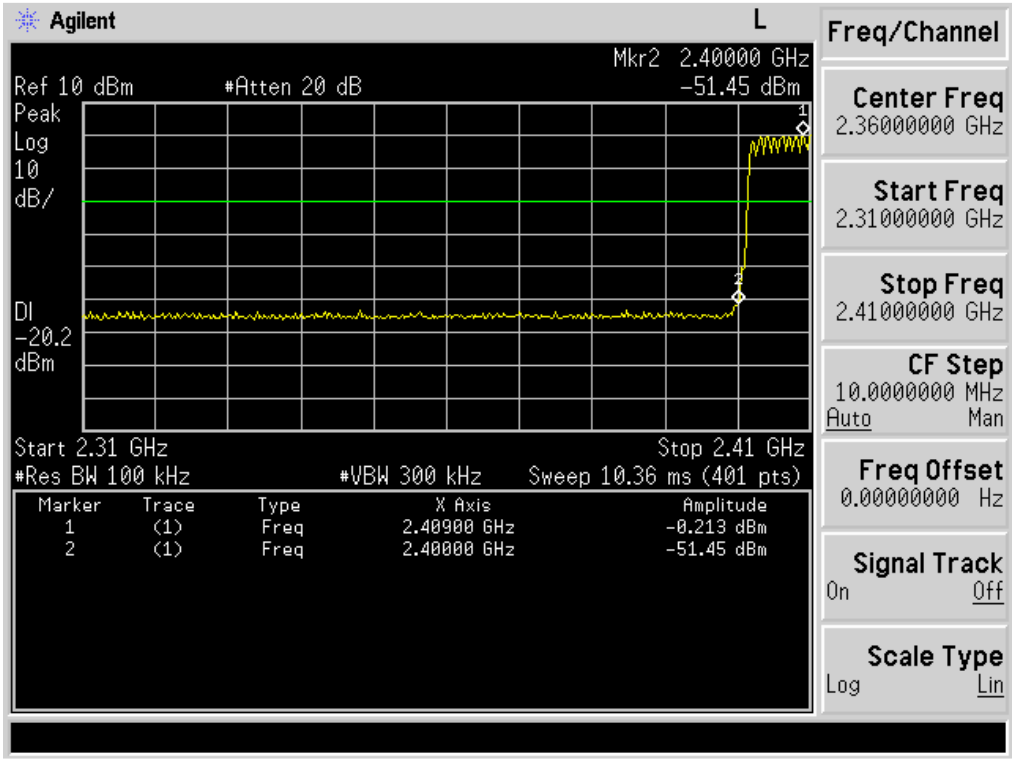
BDR mode (GFSK): Band Edge-Right Side



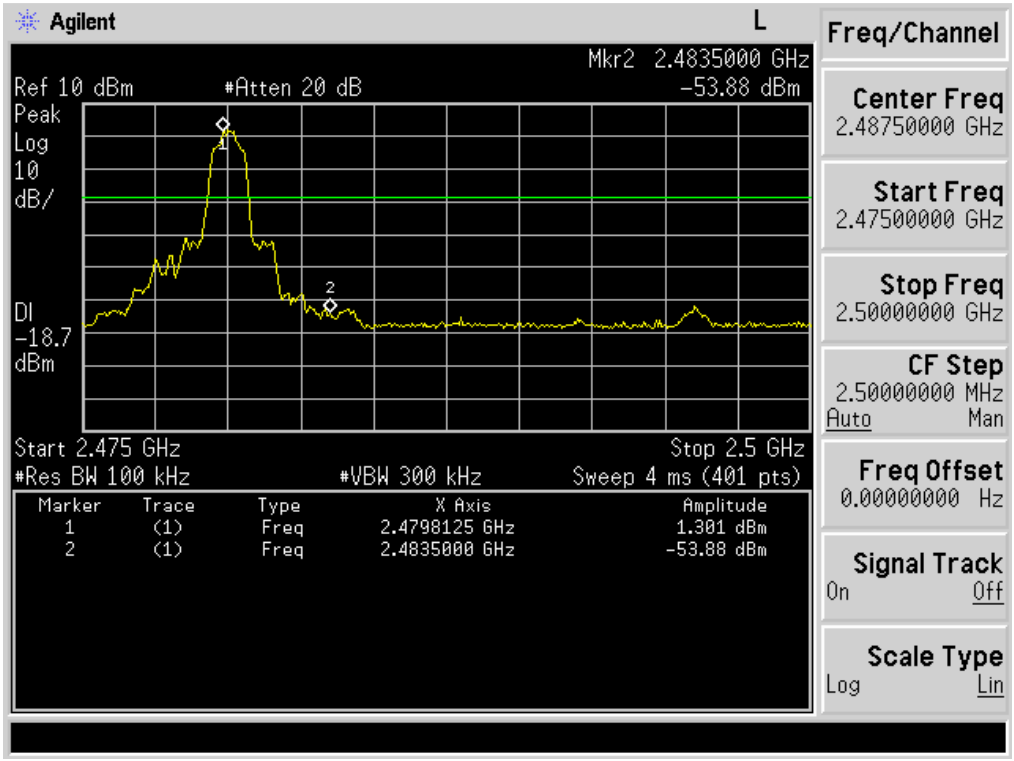


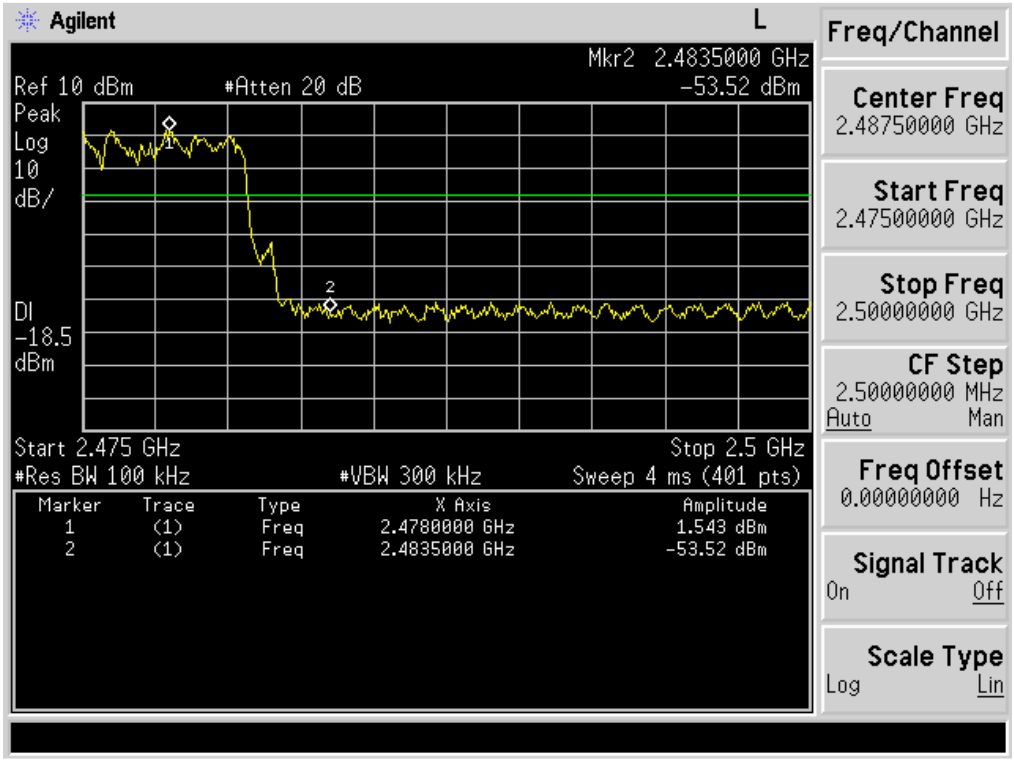
EDR mode (π /4-DQPSK): Band Edge-Left Side



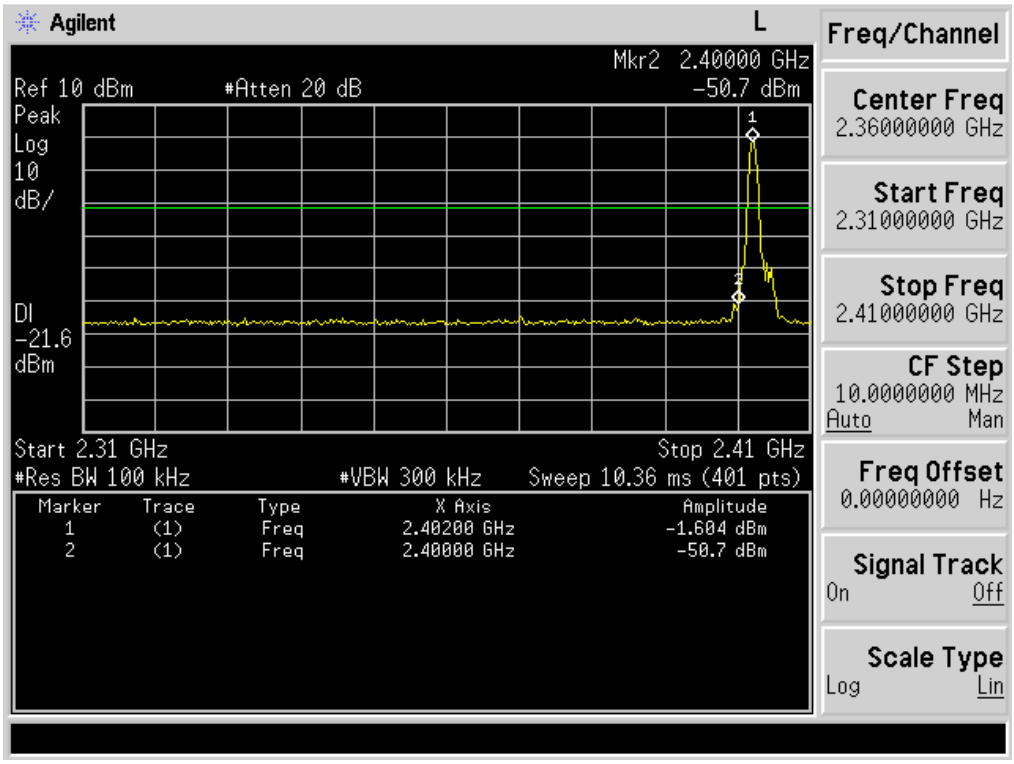


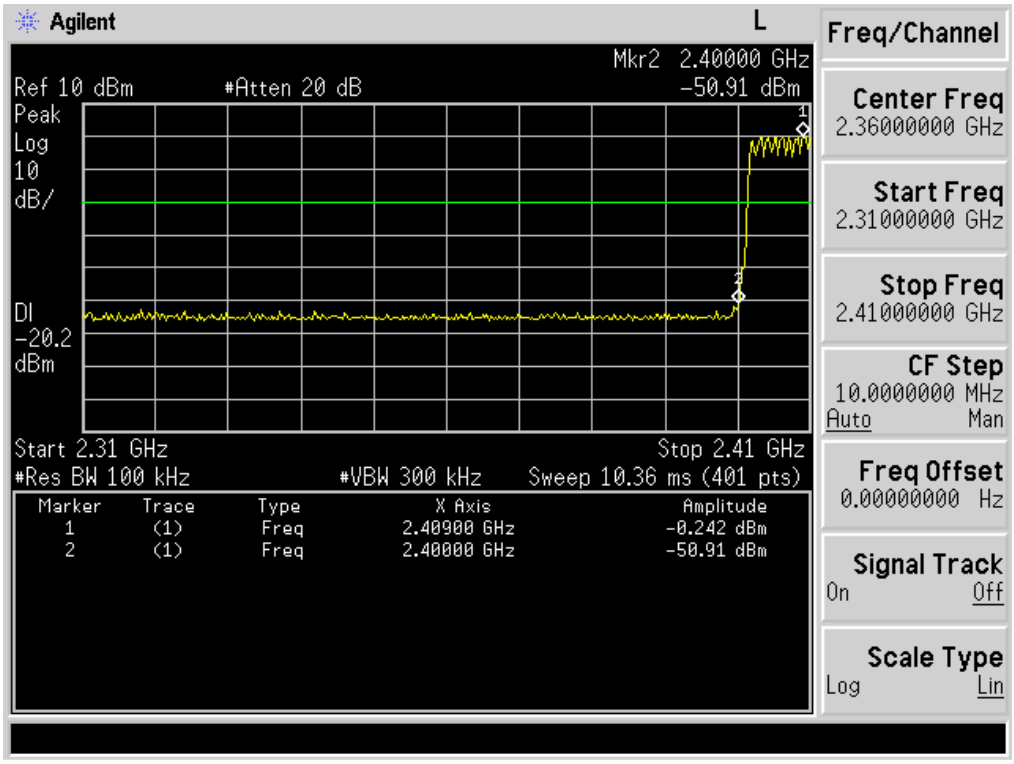
EDR mode (π /4-DQPSK): Band Edge- Right Side



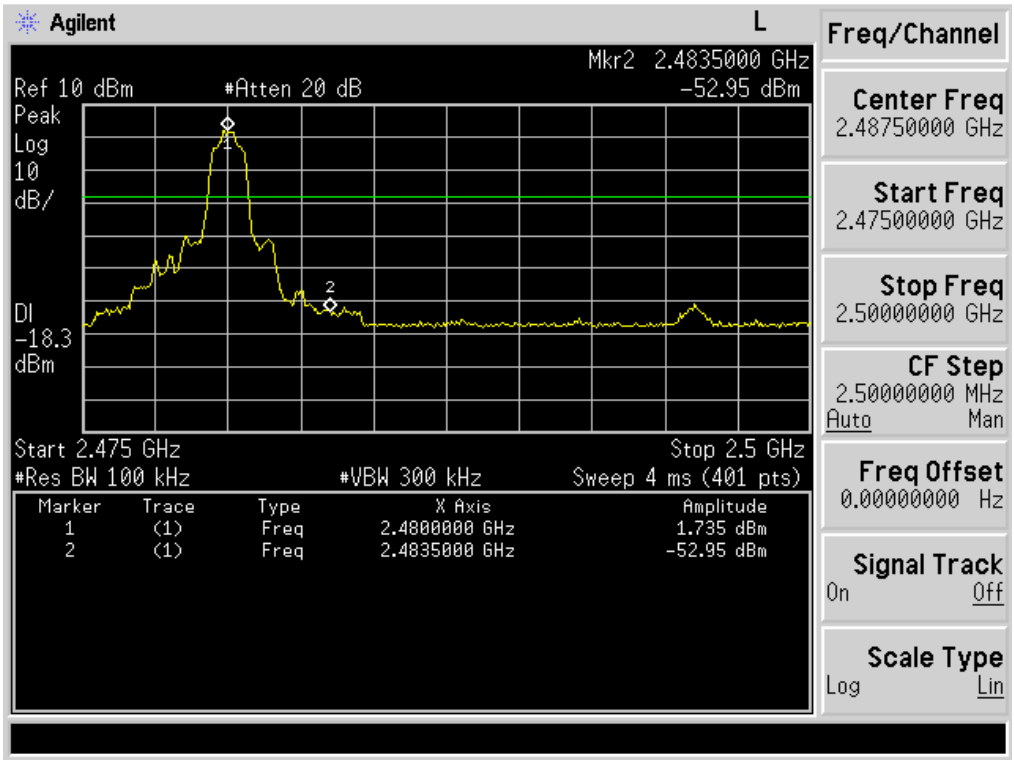


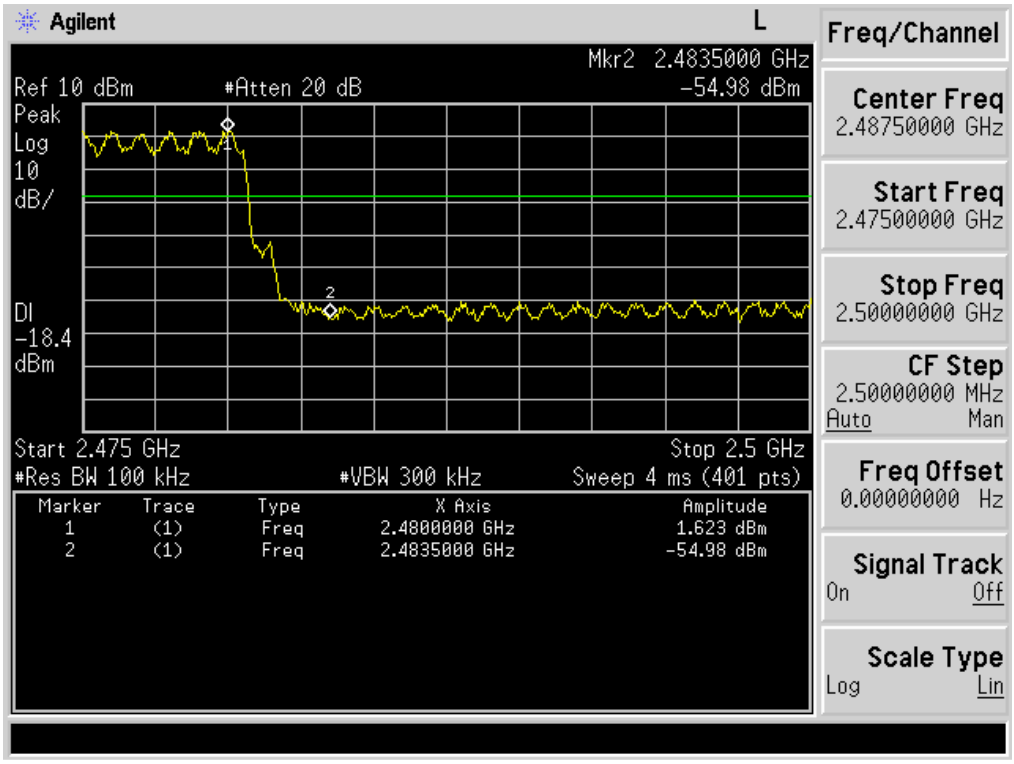
EDR mode(8DPSK): Band Edge-Left Side





EDR mode(8DPSK): Band Edge-Right Side





NOTE: Hopping enabled and disabled have evaluated,and the worstest data was reported

11. ANTENNA REQUIREMENTS

11.1. Limits

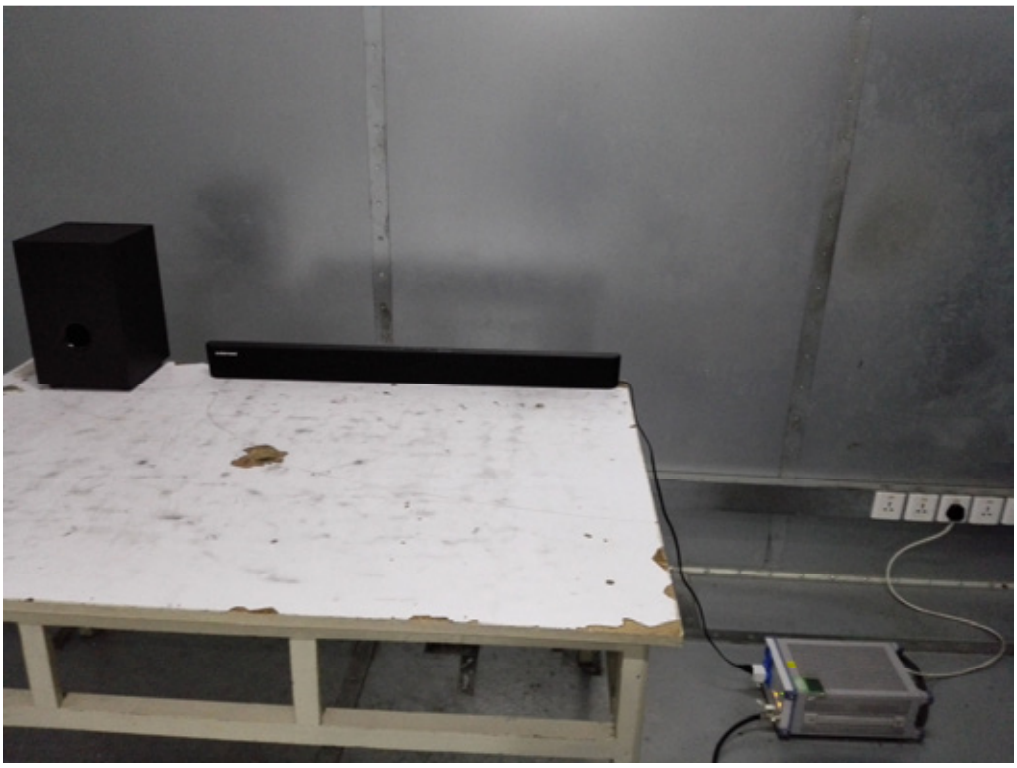
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional 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

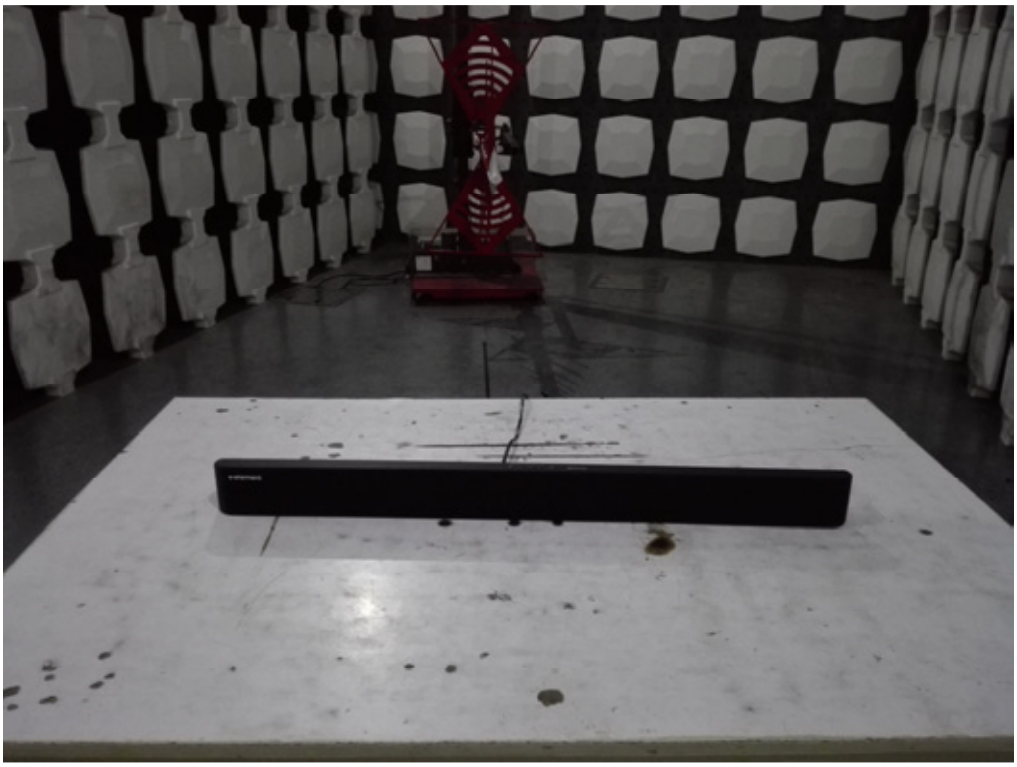
The antennas used for this product are Permanently fixed antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 0.0dBi.

12. PHOTOGRAPHS OF TEST SET-UP

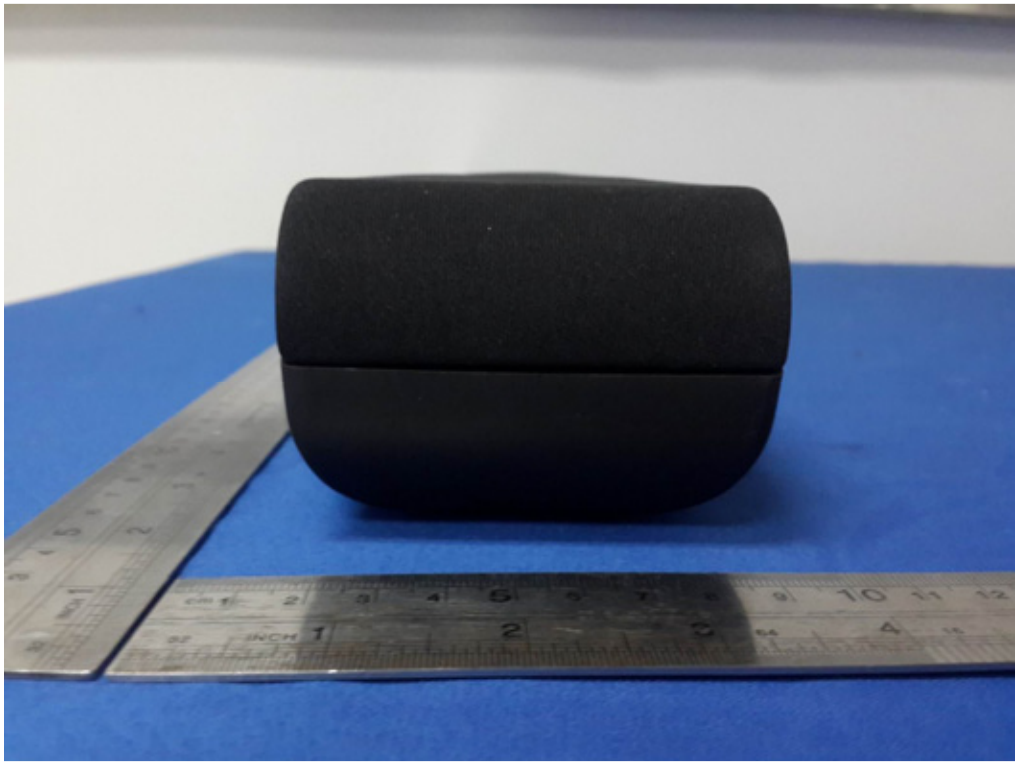
Conducted Emission at the Mains Terminals Test

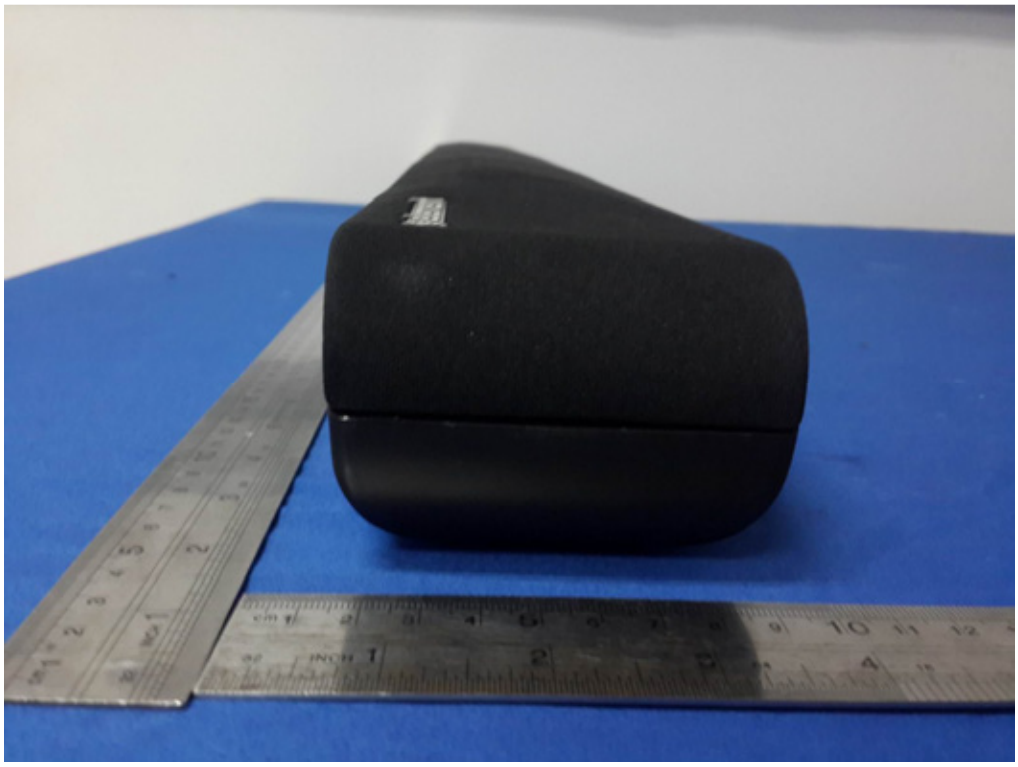


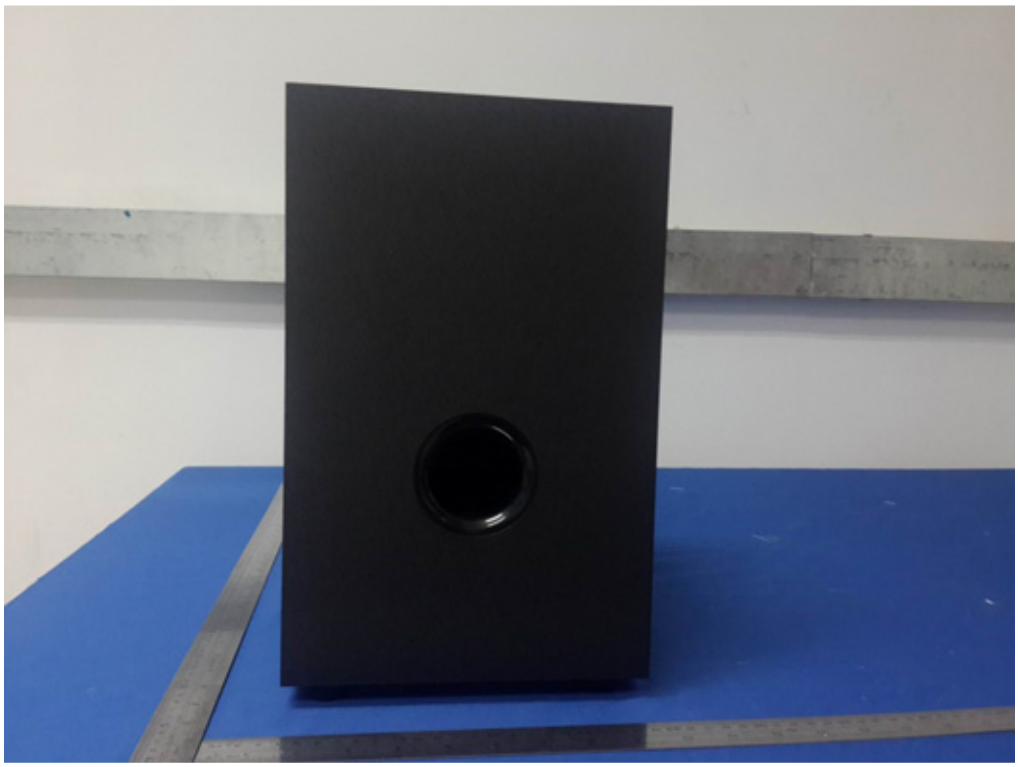
Radiated Emission Test

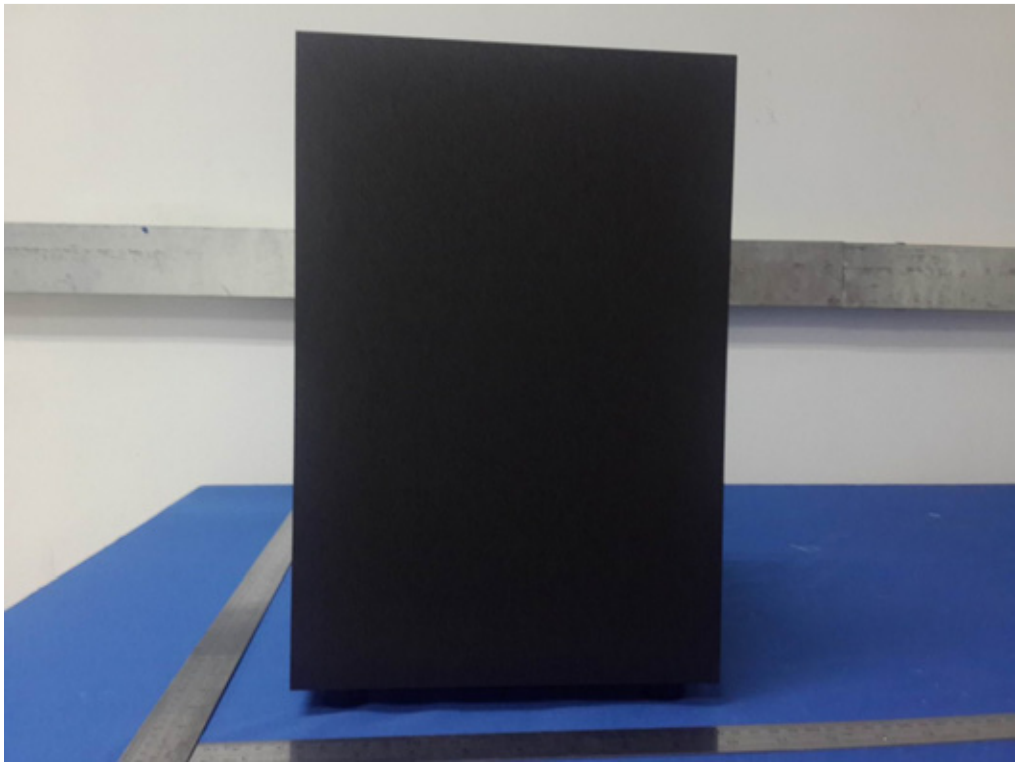


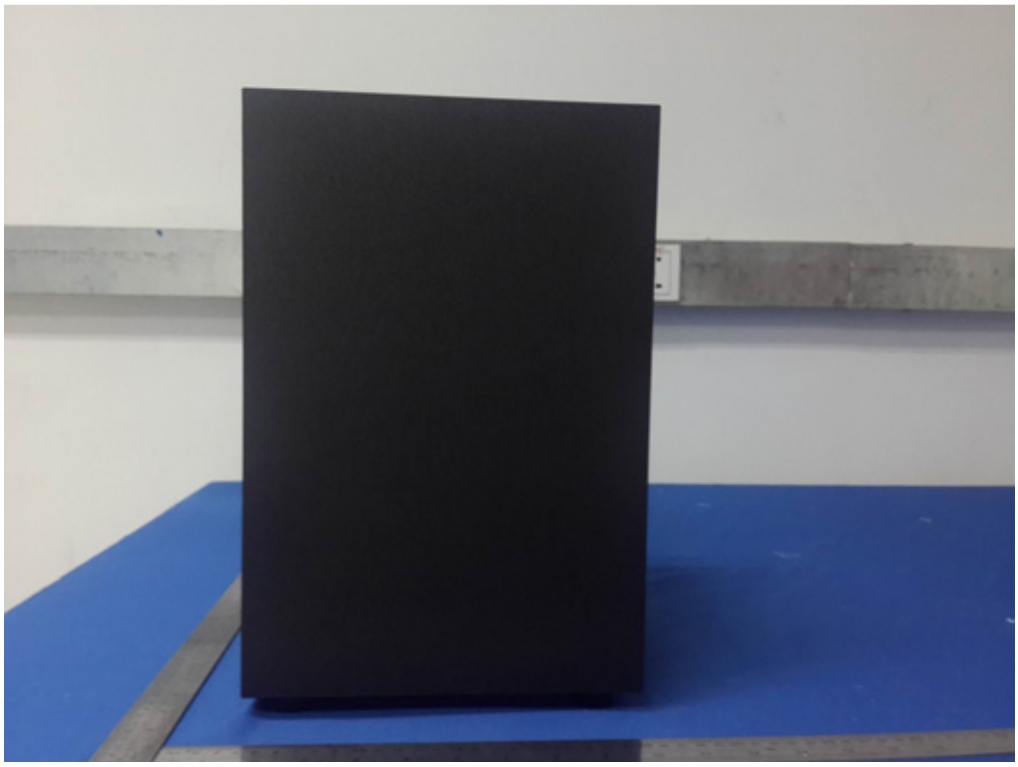
13. PHOTOGRAPHS OF THE EUT

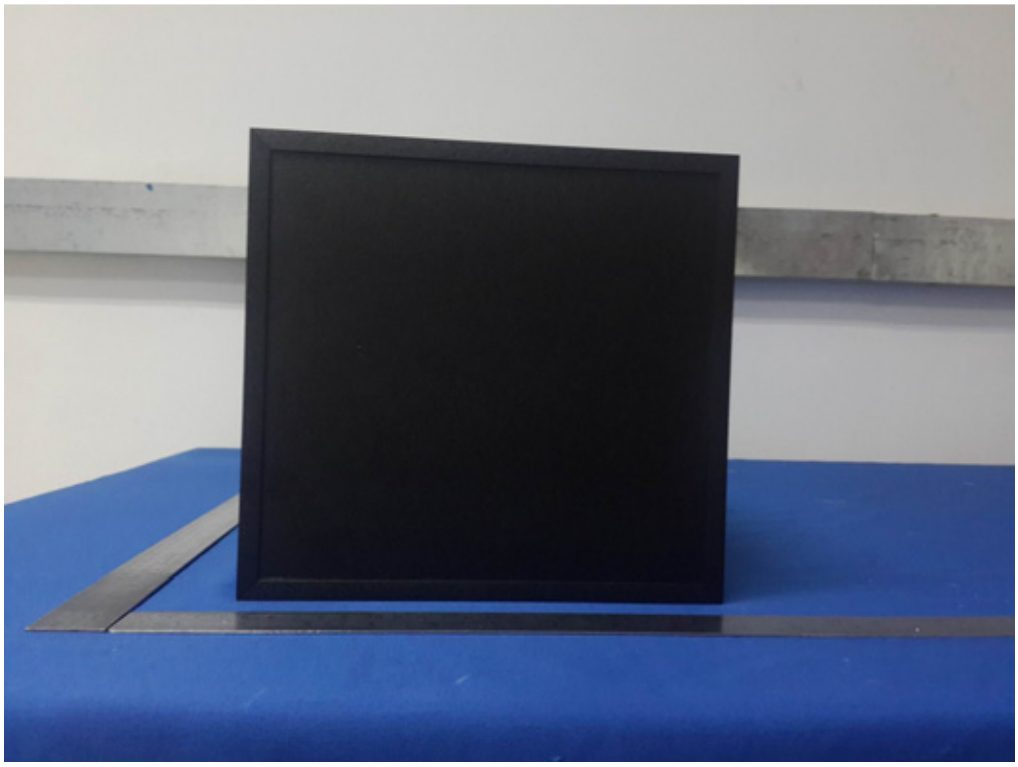


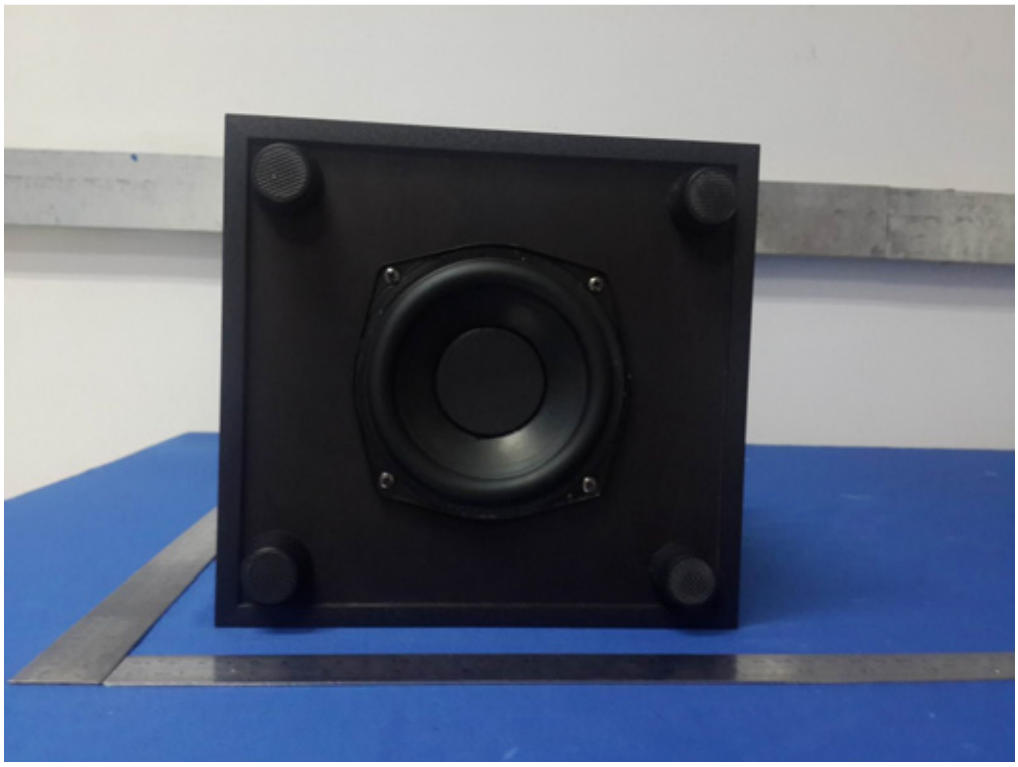


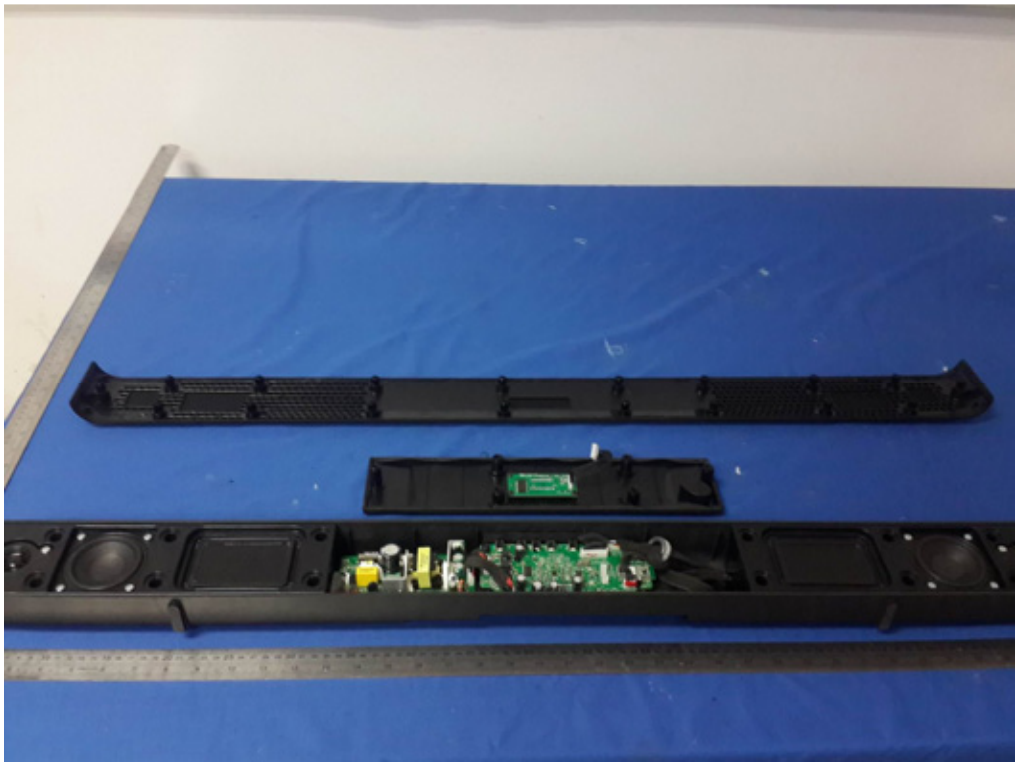


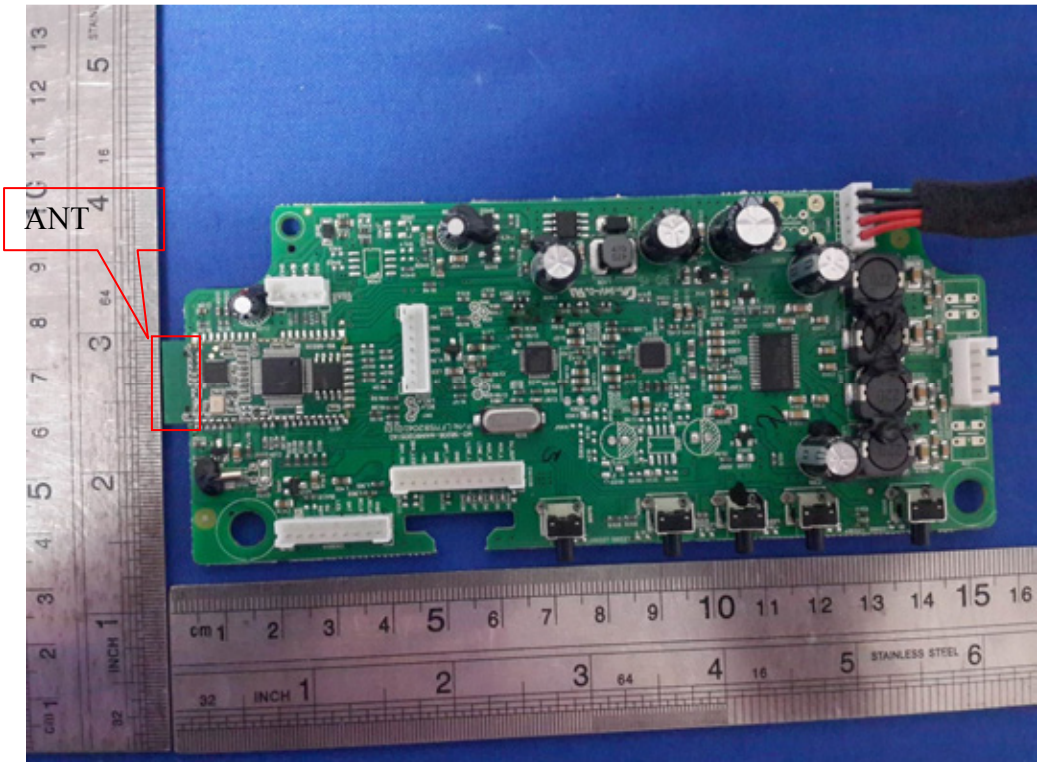








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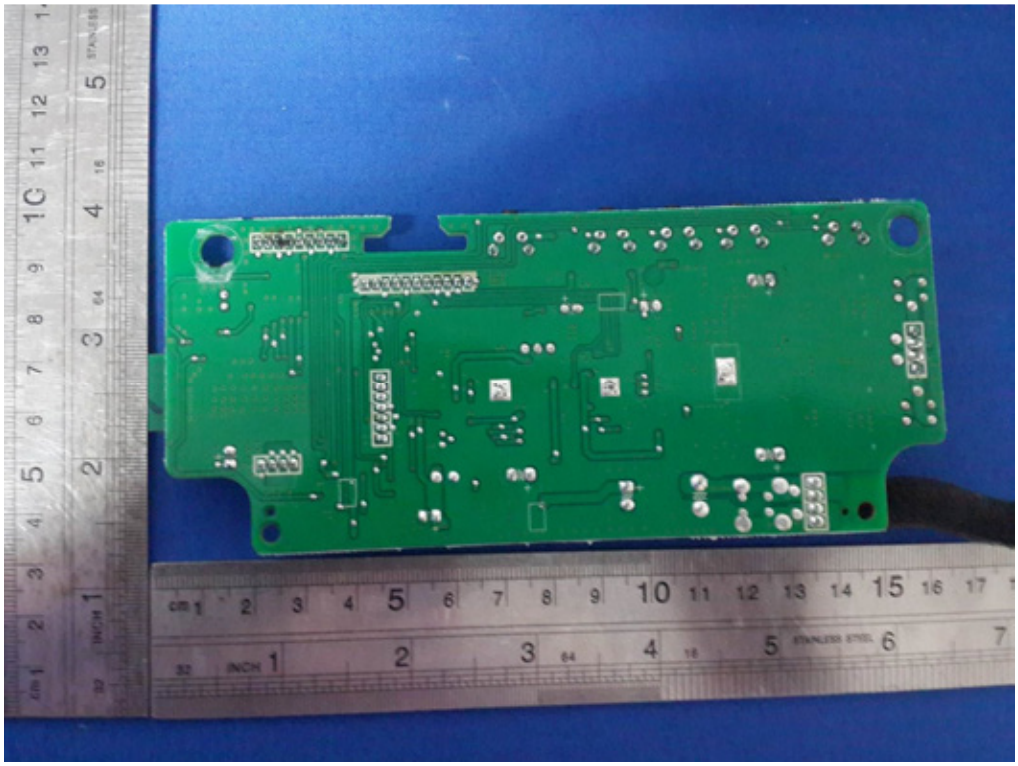

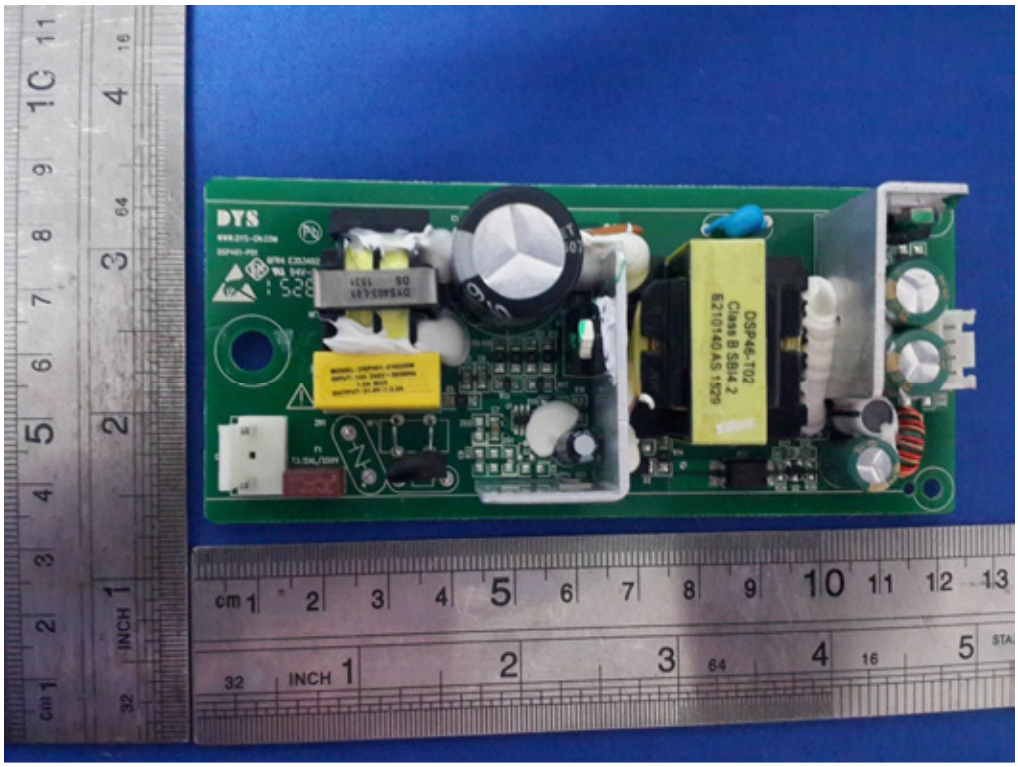
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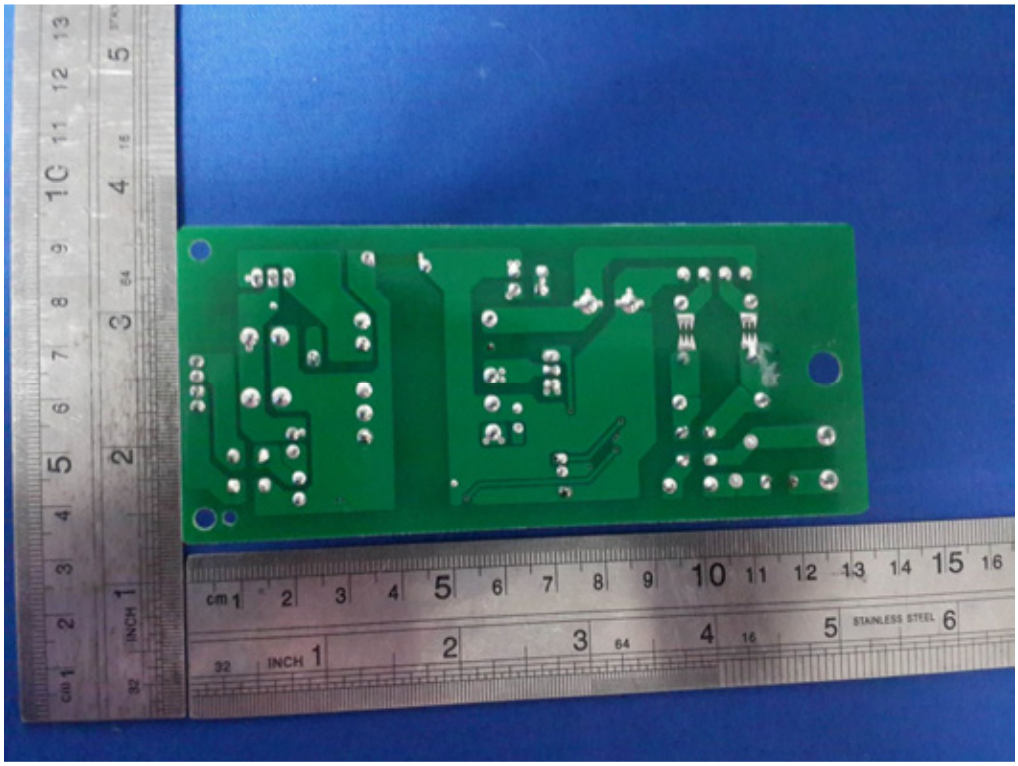
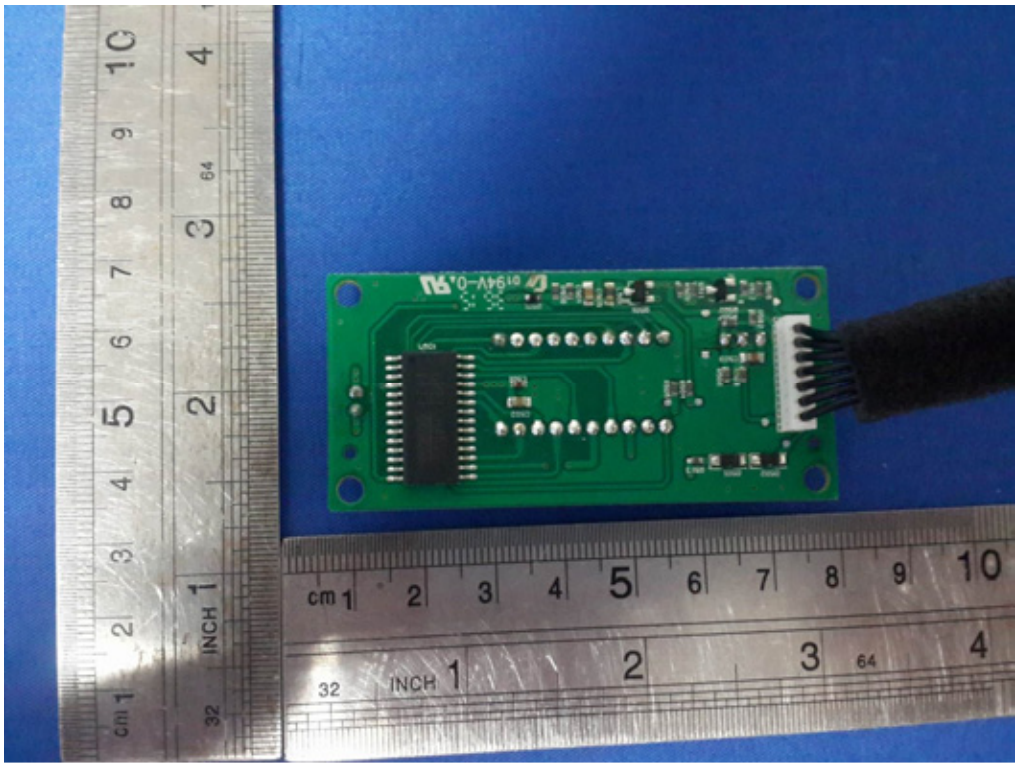
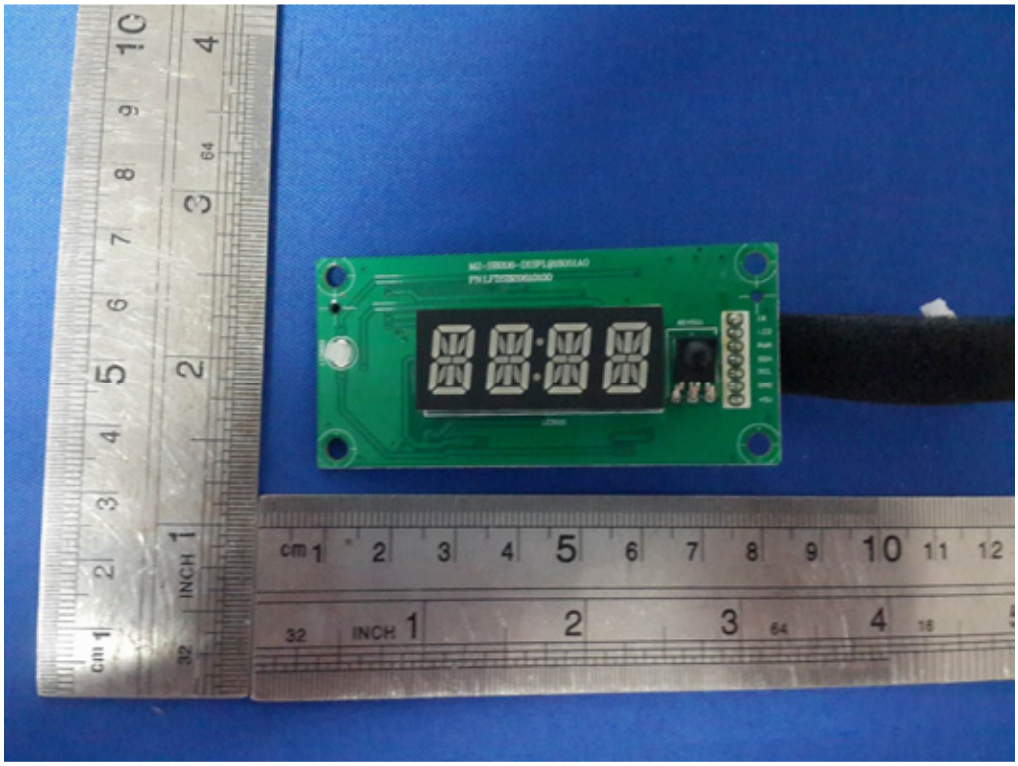
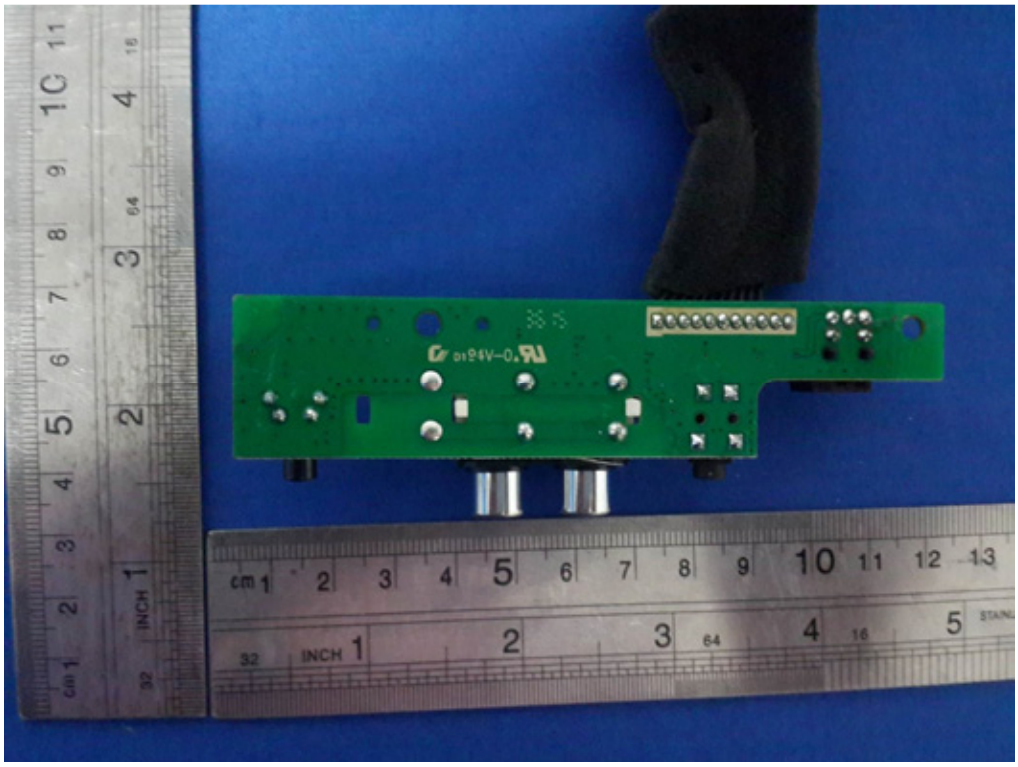
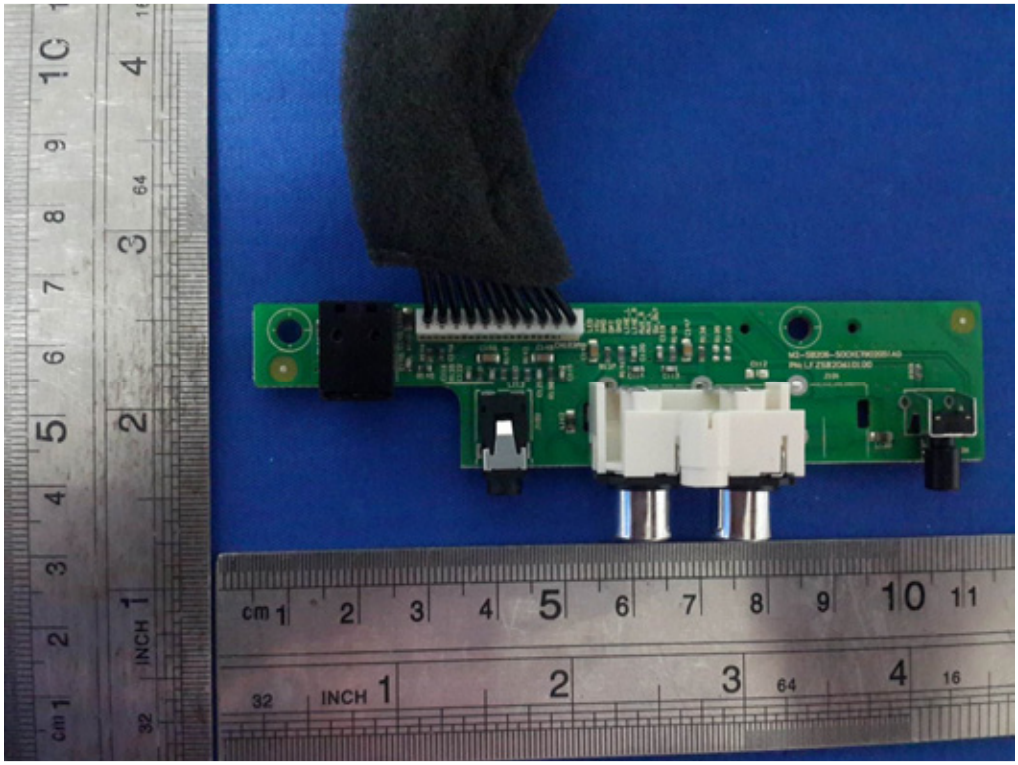
DSP46-T02
Class B SB4 2
E210140 AS 1529
cm 1 2 3 4 5 6 7 8 9 10 11 12 13
INCH 1 2 3 4 5

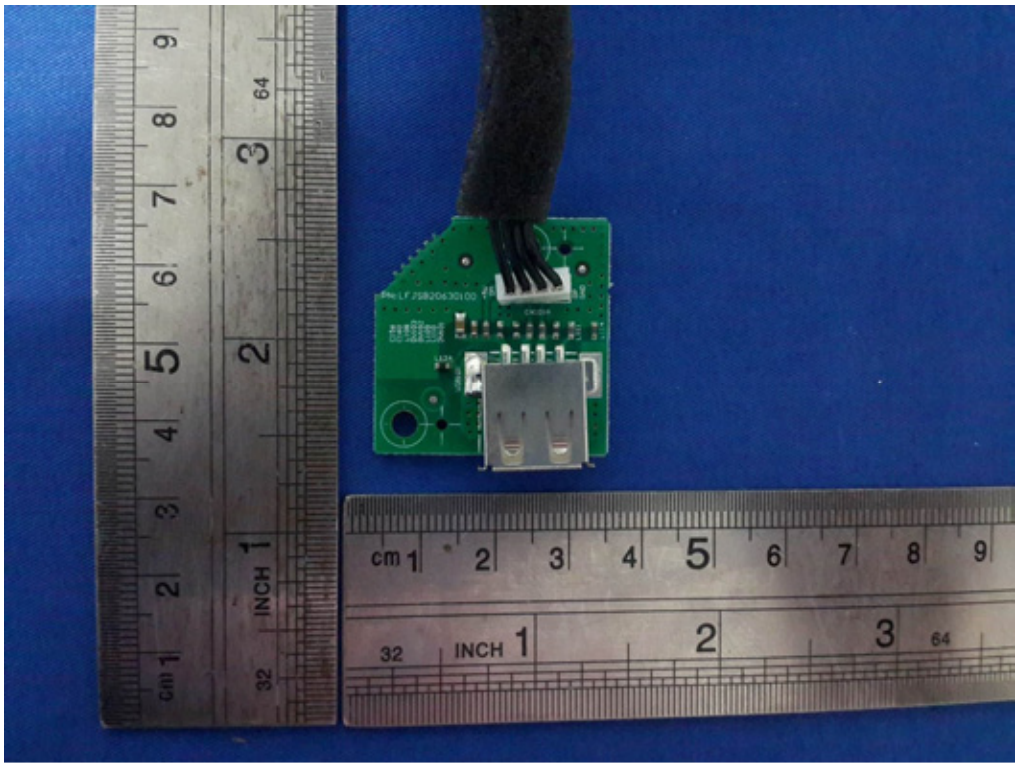

cm 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
INCH 1 2 3 4 5
STAINLESS STEEL

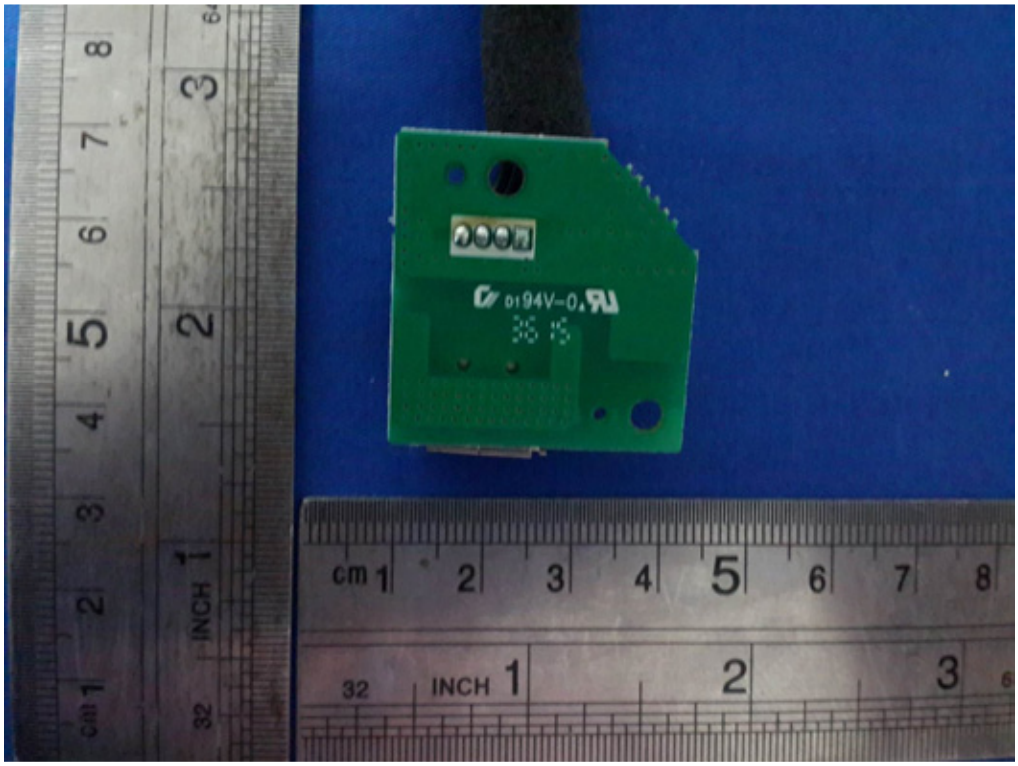


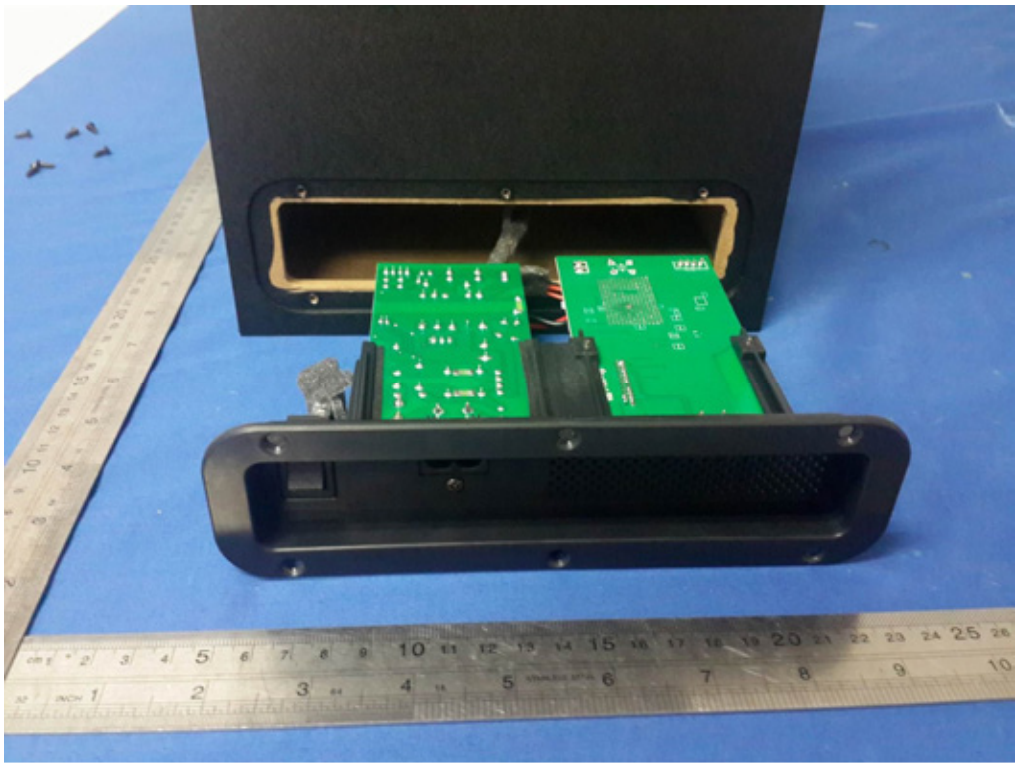


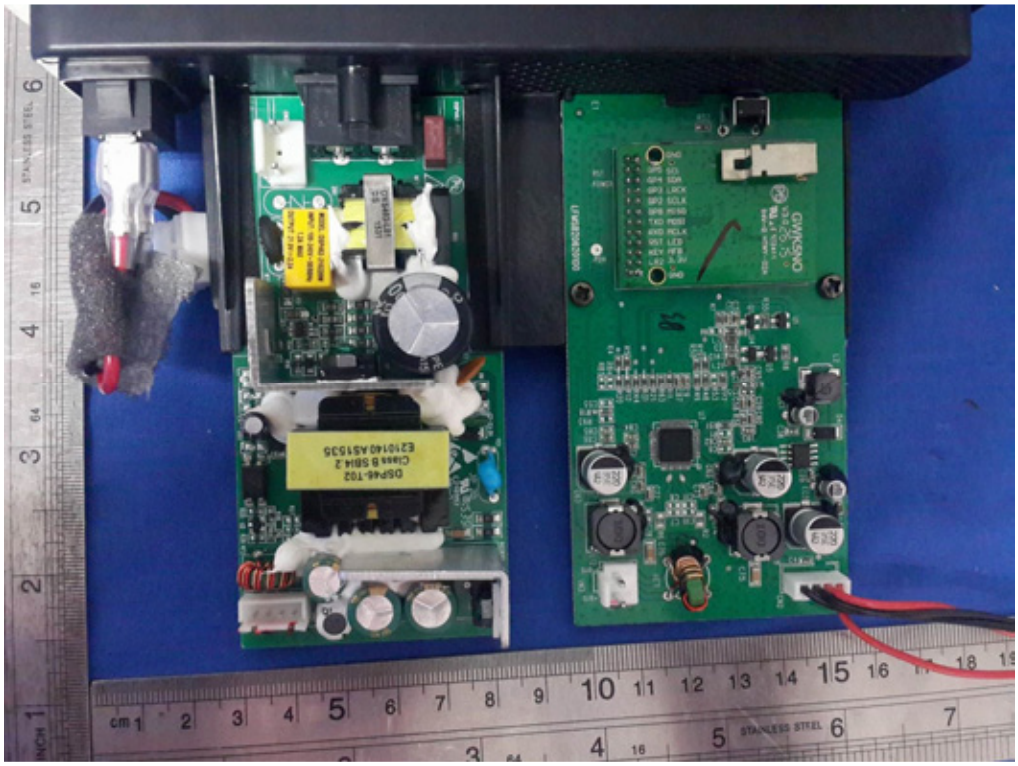


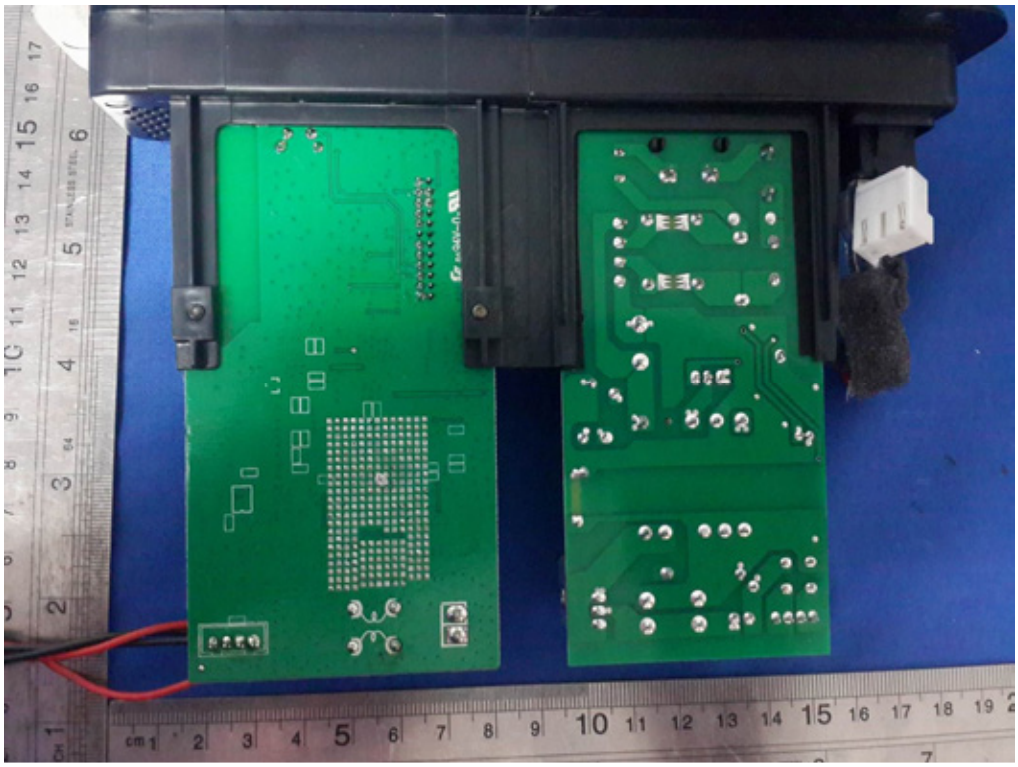












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