TEST REPORT

FCC Rules and Regulations Part 15 Subpart C Section 15.247
ANSI C63.10: 2013
RSS-GEN: Issue 5
RSS-247: Issue 2

Test report
On Behalf of
Alpine Electronics of America Inc
For
DSP Subwoofer with built-in 4-Channel Amplifier
Model No.: BT-001

FCC ID: DVU-PWD-X5
IC: 700A-PWDX5

Prepared for : Alpine Electronics of America Inc
19145 Gramercy Place, Torrance, California 90501, United States

Prepared By : Shenzhen HUAK Testing Technology Co., Ltd.
1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China

Date of Test: Oct. 26, 2018 ~ Nov. 06,, 2018
Date of Report: Nov. 08, 2018
Report Number: HK1811061479E

TEST RESULT CERTIFICATION

Applicant's name ..... :	Alpine Electronics of America Inc
Address..... :	19145 Gramercy Place, Torrance, California 90501, United States
Manufacture's Name..... :	ALPINE ELECTRONICS (CHINA) CO.,LTD.
Address..... :	28F, East Tower, Hanwei Plaza, No.7 Guanghua Road, Chaoyang District Beijing, China
Product description	
Trade Mark:	ALPINE
Product Name..... :	DSP Subwoofer with built-in 4-Channel Amplifier
Model and/or type reference... :	BT-001
Standards..... :	FCC Rules and Regulations Part 15 Subpart C Section 15.247 ANSI C63.10: 2013 RSS-GEN: Issue 5 RSS-247: Issue 2

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Date of Test..... :	
Date (s) of performance of tests..... :	Oct. 26, 2018 ~ Nov. 06,, 2018
Date of Issue..... :	Nov. 08, 2018
Test Result..... :	**Pass**

Testing Engineer : Gary Qian

(Gary Qian)

Technical Manager : Eden Hu

(Eden Hu)

Authorized Signatory : Jason Zhou

(Jason Zhou)

TABLE OF CONTENTS **PAGE**

1 . TEST SUMMARY 5

2 . GENERAL INFORMATION 6

2.1 . GENERAL DESCRIPTION OF EUT 6

2.2 . CARRIER FREQUENCY OF CHANNELS 7

2.3 . OPERATION OF EUT DURING TESTING 7

2.4 . DESCRIPTION OF TEST SETUP 8

2.5. EQUIPMENT USED IN EUT SYSTEM 8

2.6. MEASUREMENT INSTRUMENTS LIST 9

3. PEAK OUTPUT POWER 10

3.1. MEASUREMENT PROCEDURE 10

3.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 10

3.3. LIMITS AND MEASUREMENT RESULT 11

4. BANDWIDTH 17

4.1. MEASUREMENT PROCEDURE 17

4.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 17

4.3. LIMITS AND MEASUREMENT RESULTS 17

5. CONDUCTED SPURIOUS EMISSION 24

5.1. MEASUREMENT PROCEDURE 24

5.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 24

5.3. LIMITS AND MEASUREMENT RESULT 25

6. RADIATED EMISSION 29

6.1. TEST LIMIT 29

6.2. MEASUREMENT PROCEDURE 29

6.3. TEST SETUP 31

6.4. TEST RESULT 33

7. BAND EDGE EMISSION 46

7.1. MEASUREMENT PROCEDURE 46

7.2. TEST SET-UP 46

7.3. TEST RESULT 47

8. NUMBER OF HOPPING FREQUENCY 51

8.1. MEASUREMENT PROCEDURE 51

8.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION) 51

8.3. LIMITS AND MEASUREMENT RESULT 51

9. TIME OF OCCUPANCY (DWELL TIME) 53

TABLE OF CONTENTS **PAGE**

9.1. MEASUREMENT PROCEDURE 53
9.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION) 53
9.3. LIMITS AND MEASUREMENT RESULT 53
10. FREQUENCY SEPARATION 56
10.1. MEASUREMENT PROCEDURE 56
10.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION) 56
10.3. LIMITS AND MEASUREMENT RESULT 56
11. LINE CONDUCTED EMISSION TEST 58
11.1. LIMITS OF LINE CONDUCTED EMISSION TEST 58
11.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST 58
11.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST 59
11.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST 59
11.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST 59
12. ANTENNA REQUIREMENT 60
13. PHOTOGRAPH OF TEST 61
14. PHOTOGRAPHS OF EUT 64

1. TEST SUMMARY

1.1. TEST PROCEDURES AND RESULTS

DESCRIPTION OF TEST	RESULT
Peak Output Power	Compliant
20 dB Bandwidth	Compliant
Conducted Spurious Emission	Compliant
Radiated Emission	Compliant
Band Edges	Compliant
Number of hopping frequency	Compliant
Time of Occupancy	Compliant
Frequency Separation	Compliant
Line conduction Emission	N/A

Note: N/A means it’s not applicable to this item.

1.2. TEST FACILITY

1.2.1 Address of the test laboratory

Shenzhen HUAK Testing Technology Co., Ltd.

Add.:1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park,Heping Community, Fuhai Street, Bao'an District, Shenzhen, China

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 32/EN 55032 requirements.

1.2.2 Laboratory accreditation

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

IC Registration No.: 21210

The 3m alternate test site of Shenzhen HUAK Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 21210 on May 24, 2016.

FCC Registration No.: CN1229

Test Firm Registration Number : 616276

1.3. MEASUREMENT UNCERTAINTY

Measurement Uncertainty

Conducted Emission Expanded Uncertainty	=	2.23dB, k=2
Radiated emission expanded uncertainty(9kHz-30MHz)	=	3.08dB, k=2
Radiated emission expanded uncertainty(30MHz-1000MHz)	=	4.42dB, k=2
Radiated emission expanded uncertainty(Above 1GHz)	=	4.06dB, k=2

2. GENERAL INFORMATION

2.1. GENERAL DESCRIPTION OF EUT

Operation Frequency	2.402 GHz to 2.480GHz
RF Output Power	3.20dBm(Max)
Bluetooth Version	V4.0
Modulation	BR ☒GFSK, EDR ☒π /4-DQPSK, ☒8DPSK BLE ☐GFSK
Number of channels	79 for BR/EDR
Hardware Version	V1.01
Software Version	V1.08
Antenna Designation	Ceramic Antenna
Antenna Gain	0dBi
Power Supply	DC 5V by 4.1 Channel DSP Subwoofer

2.2. CARRIER FREQUENCY OF CHANNELS

BR/EDR Channel List

Frequency Band	Channel Number	Frequency
2400~2483.5MHz	0	2402MHz
	1	2403MHz
	:	:
	38	2440 MHz
	39	2441 MHz
	40	2442 MHz
	:	:
	77	2479 MHz
	78	2480 MHz

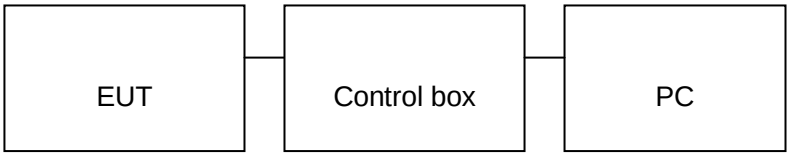
2.3. OPERATION OF EUT DURING TESTING

NO.	TEST MODE DESCRIPTION
1	Low channel GFSK
2	Middle channel GFSK
3	High channel GFSK
4	Low channel π /4-DQPSK
5	Middle channel π /4-DQPSK
6	High channel π /4-DQPSK
7	Low channel 8DPSK
8	Middle channel 8DPSK
9	High channel 8DPSK
10	BT Link(Hopping mode)

2.4. DESCRIPTION OF TEST SETUP

Configure 1: (Normal hopping)

Configure 2: (Control continuous TX)



2.5. EQUIPMENT USED IN EUT SYSTEM

Item	Equipment	Mfr/Brand	Model/Type No.	Remark
1	DSP Subwoofer with built-in 4-Channel Amplifier	ALPINE	BT-001	EUT
2	4.1 Channel DSP	ALPINE	BT-001	Accessory
3	USB Cable	N/A	4.8m unshielded	Accessory
4	AUX in Cable	N/A	1m unshielded	A.E
5	PC	APPLE	A1465	A.E
6	Control box	CSR	USB_SPI_TOOLS	A.E
7	USB Cable	N/A	1m unshielded	A.E
8	Mobile Phone	Huawei	V8	A.E
9	Speaker	My music	B61	A.E
10	Battery	SAIL	12V 60Ah 356A	A.E
11	Temporary Antenna Connector	T10	N/A	A.E

Note: The temporary antenna connector is a RF SMA connector with fifty ohm resistor, which is welded to the PCB board or module.

2.6. MEASUREMENT INSTRUMENTS LIST

TEST EQUIPMENT OF RADIATED EMISSION TEST

Item	Equipment	Manufacturer	Model No.	Lab Equipment No.	Last Cal.	Cal. Interval
1.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 28, 2017	1 Year
2.	Preamplifier	Schwarzbeck	BBV 9743	HKE-006	Dec. 28, 2017	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESCI 7	HKE-010	Dec. 28, 2017	1 Year
4.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	Dec. 28, 2017	1 Year
5.	Loop Antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 28, 2017	1 Year
6.	Horn Antenna	Schewarzbeck	9120D	HKE-013	Dec. 28, 2017	1 Year
7.	Broad-band Horn Antenna	A-INFOMW	LB-180400-KF	HKE-031	Dec. 28, 2017	1 Year
8.	Pre-amplifier	EMCI	EMC051845SE	HKE-015	Dec. 28, 2017	1 Year
9.	Pre-amplifier	Agilent	83051A	HKE-016	Dec. 28, 2017	1 Year
10.	Radiation Cable 1	MXT	HK1	R05	N/A	N/A
11.	Radiation Cable 2	MXT	HK1	R06	N/A	N/A

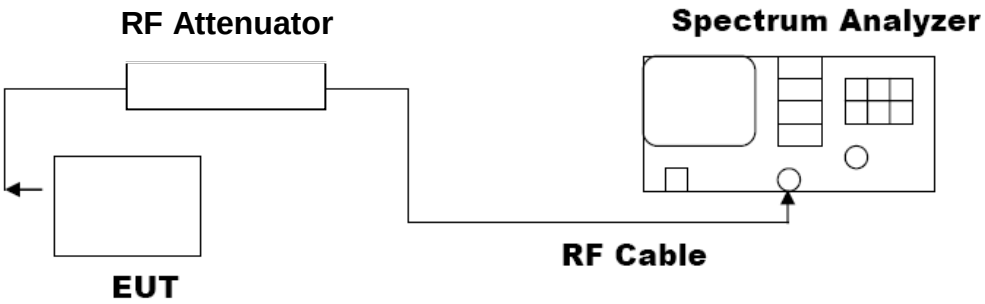
3. PEAK OUTPUT POWER

3.1. MEASUREMENT PROCEDURE

For peak power test:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, middle and the bottom operation frequency individually.
3. RBW > the 20 dB bandwidth of the emission being measured, VBW ≥ RBW.
4. Record the maximum power from the Spectrum Analyzer.
5. The maximum peak power shall be less 21dBm.

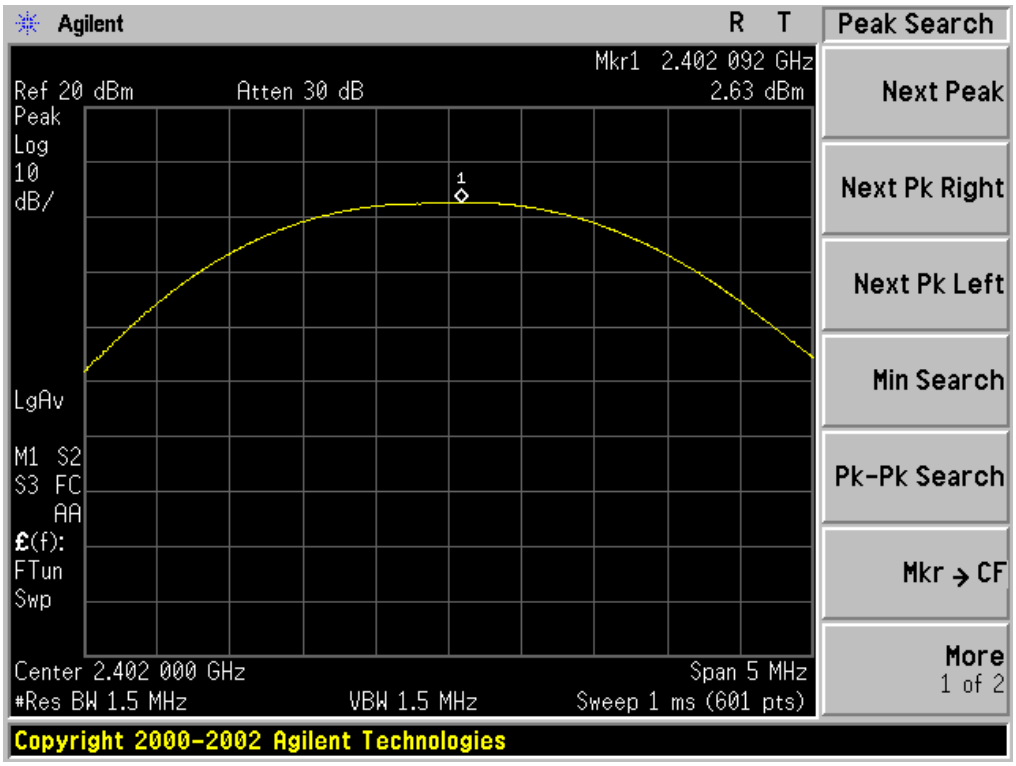
3.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



3.3. LIMITS AND MEASUREMENT RESULT

PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION			
Frequency (GHz)	**Peak Power (dBm)**	**Applicable Limits (dBm)**	**Pass or Fail**
2.402	2.63	21	Pass
2.441	3.20	21	Pass
2.480	3.13	21	Pass

CH0



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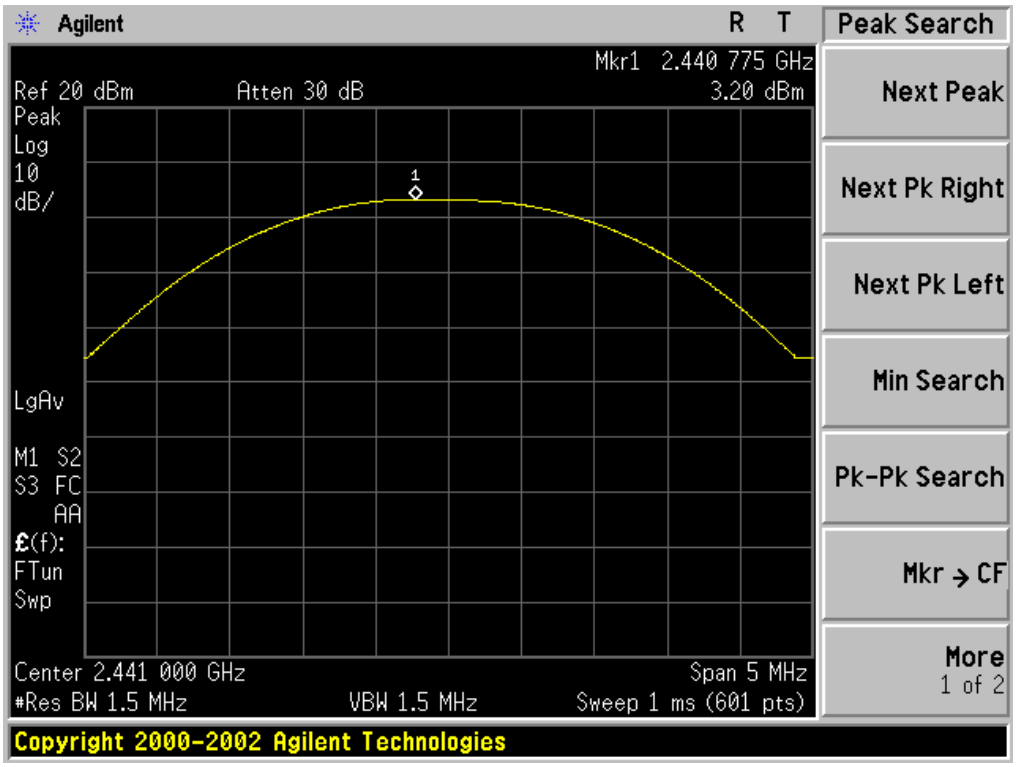
Agilent
R T
Peak Search
Mkr1 2.440 775 GHz
Ref 20 dBm
Atten 30 dB
3.20 dBm
Next Peak
Peak
Log
10
dB/
Next Pk Right
Next Pk Left
Min Search
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Pk-Pk Search
Mkr → CF
Center 2.441 000 GHz
Span 5 MHz
More
1 of 2
#Res BW 1.5 MHz
VBW 1.5 MHz
Sweep 1 ms (601 pts)
Copyright 2000-2002 Agilent Technologies

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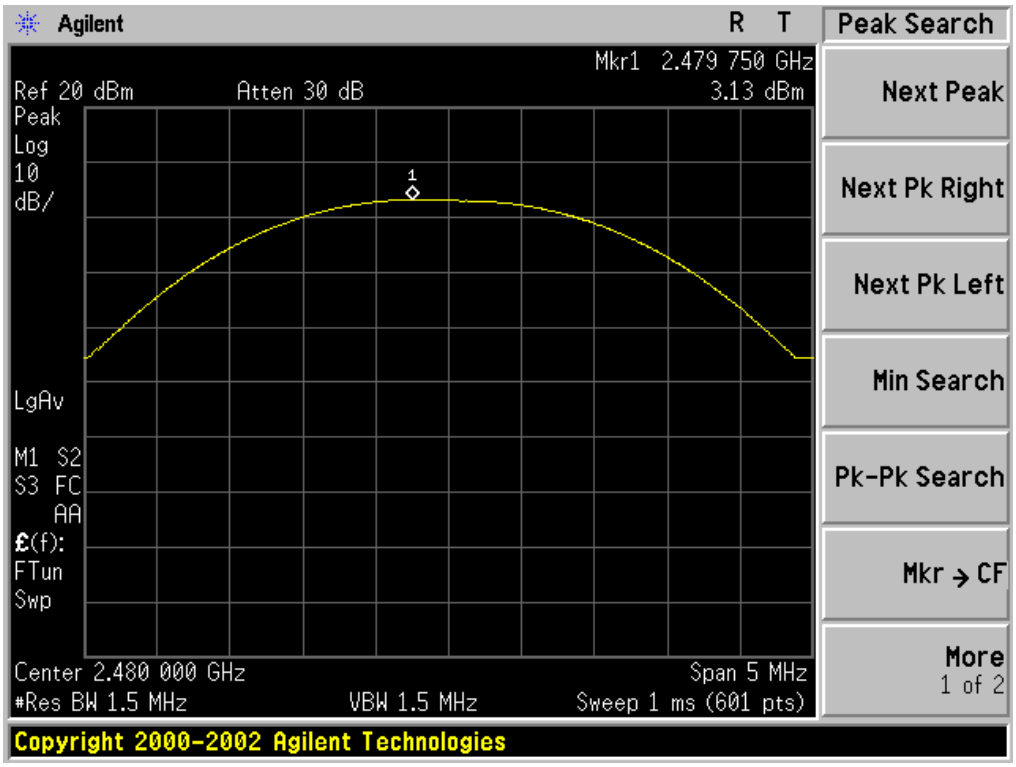
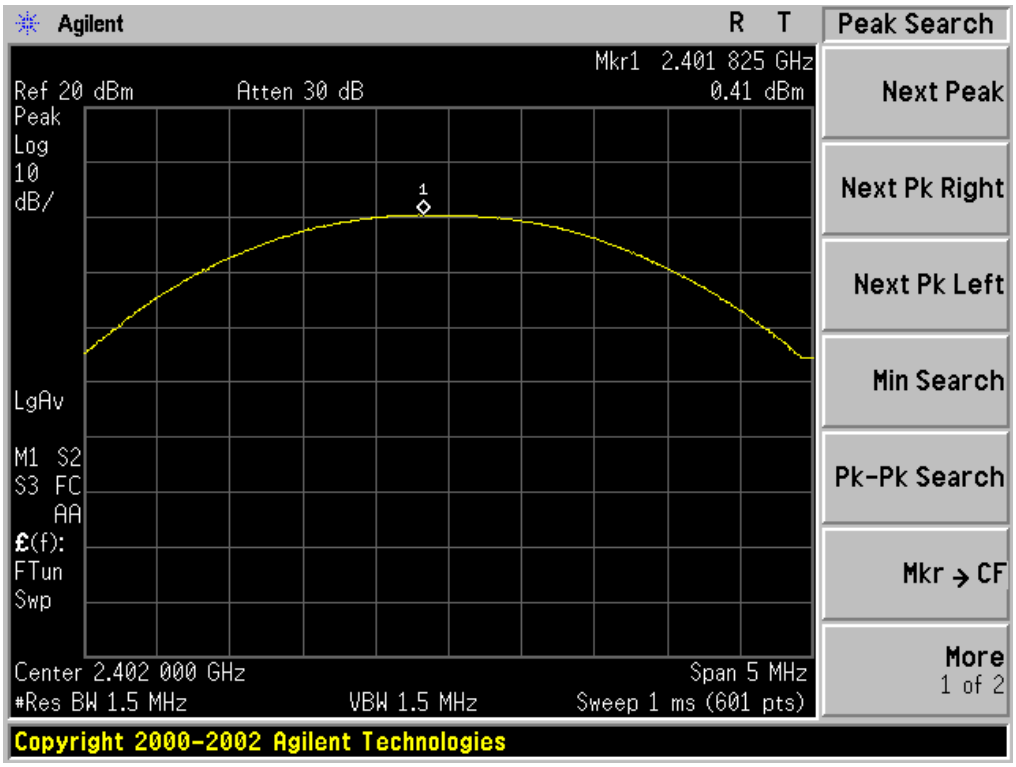

Agilent
R T
Peak Search
Mkr1 2.479 750 GHz
Ref 20 dBm
Atten 30 dB
3.13 dBm
Next Peak
Peak
Log
10
dB/
Next Pk Right
Next Pk Left
Min Search
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Pk-Pk Search
Mkr → CF
Center 2.480 000 GHz
Span 5 MHz
More
1 of 2
#Res BW 1.5 MHz
VBW 1.5 MHz
Sweep 1 ms (601 pts)
Copyright 2000-2002 Agilent Technologies

PEAK OUTPUT POWER MEASUREMENT RESULT FOR Ⅱ /4-DQPSK MODULATION			
Frequency (GHz)	**Peak Power (dBm)**	**Applicable Limits (dBm)**	**Pass or Fail**
2.402	0.41	21	Pass
2.441	1.10	21	Pass
2.480	0.94	21	Pass

CH0



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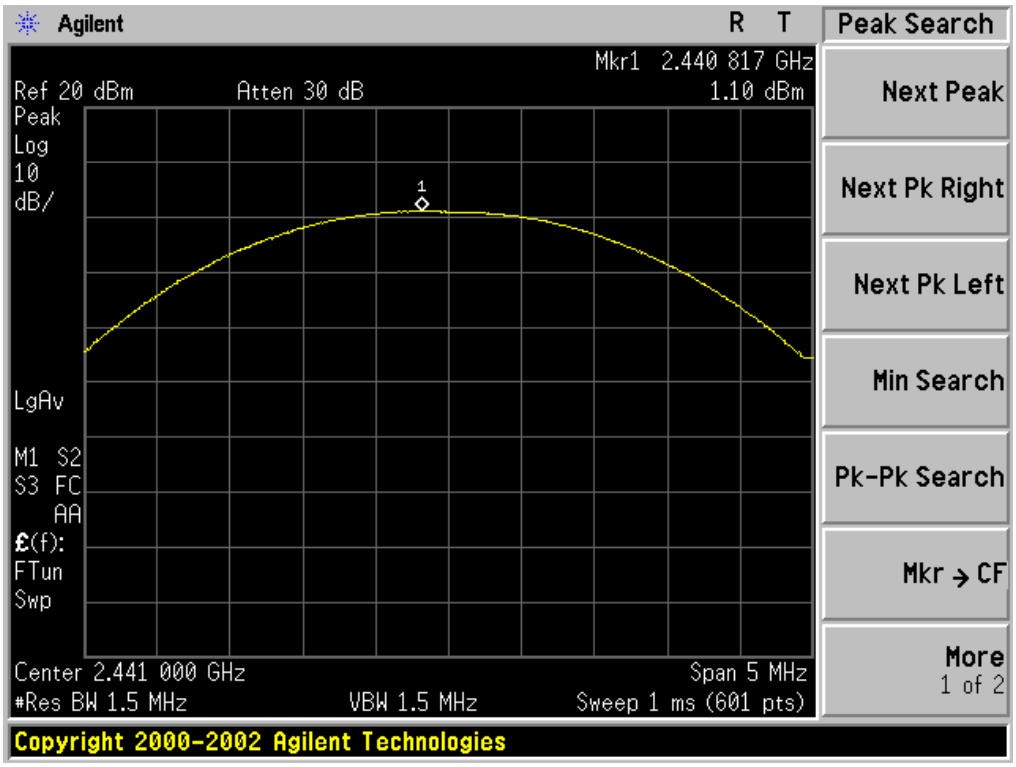
Agilent
R T
Peak Search
Mkr1 2.440 817 GHz
Ref 20 dBm
Atten 30 dB
1.10 dBm
Next Peak
Peak
Log
10
dB/
Next Pk Right
Next Pk Left
Min Search
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Pk-Pk Search
Mkr → CF
More
1 of 2
Center 2.441 000 GHz
Span 5 MHz
#Res BW 1.5 MHz
VBW 1.5 MHz
Sweep 1 ms (601 pts)
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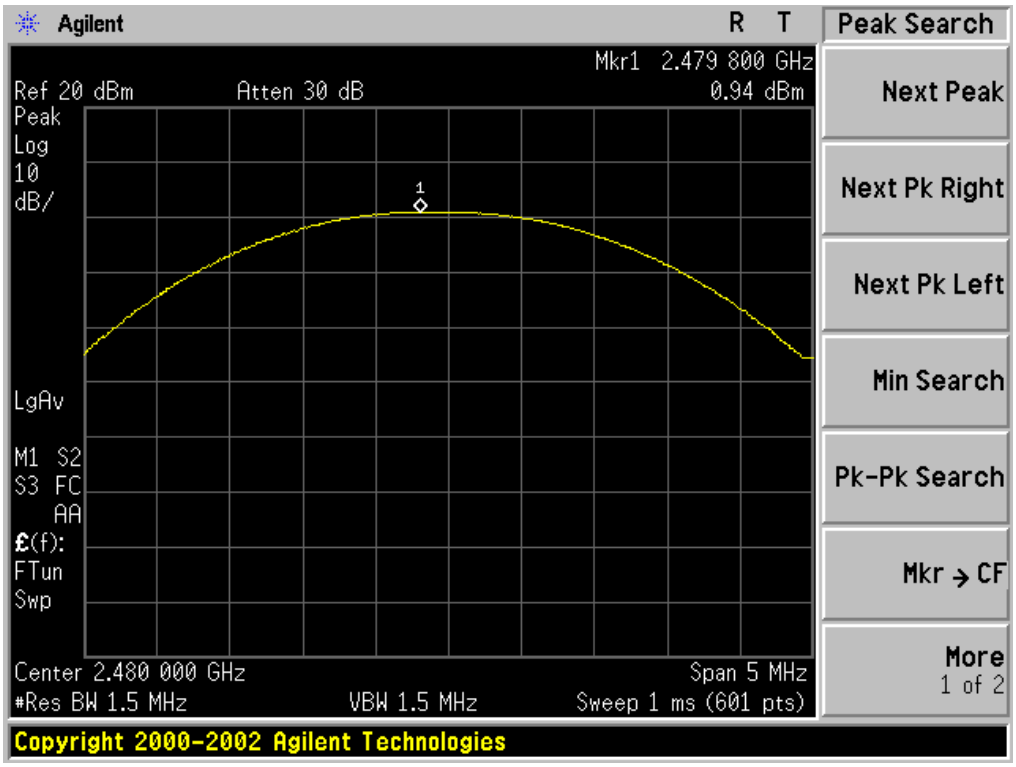
Agilent
R T
Peak Search
Mkr1 2.479 800 GHz
Ref 20 dBm
Atten 30 dB
0.94 dBm
Next Peak
Peak
Log
10
dB/
Next Pk Right
Next Pk Left
Min Search
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Pk-Pk Search
Mkr → CF
More
1 of 2
Center 2.480 000 GHz
Span 5 MHz
#Res BW 1.5 MHz
VBW 1.5 MHz
Sweep 1 ms (601 pts)
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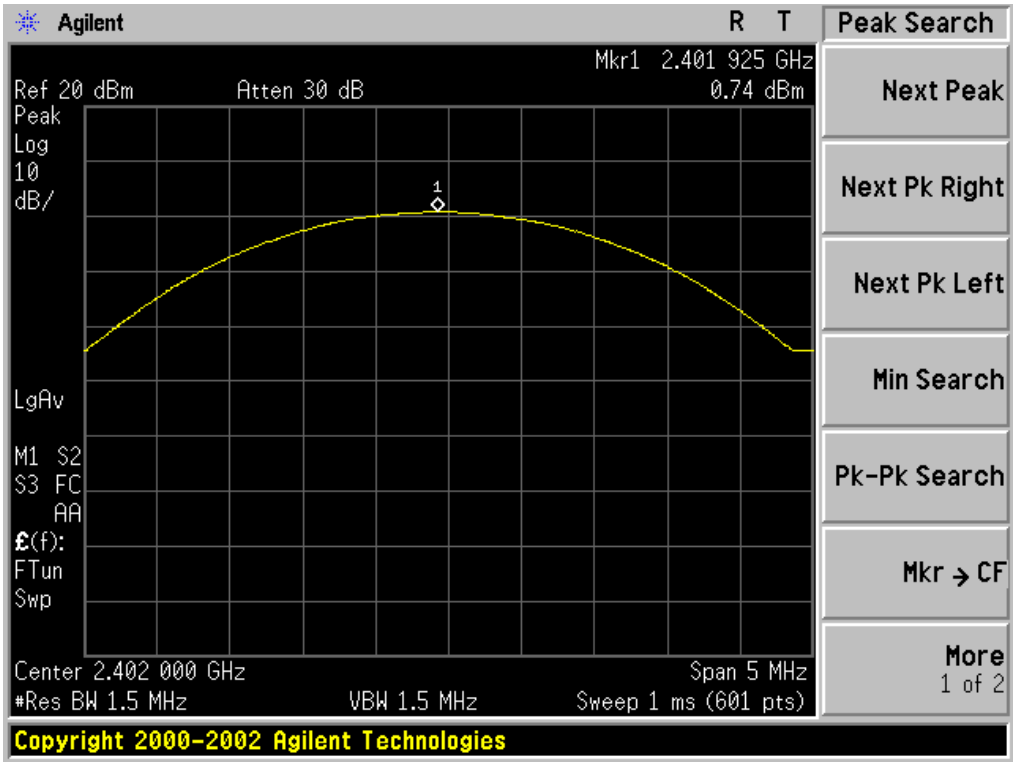
PEAK OUTPUT POWER MEASUREMENT RESULT FOR 8DPSK MODULATION			
Frequency (GHz)	**Peak Power (dBm)**	**Applicable Limits (dBm)**	**Pass or Fail**
2.402	0.74	21	Pass
2.441	1.53	21	Pass
2.480	1.35	21	Pass

CH0



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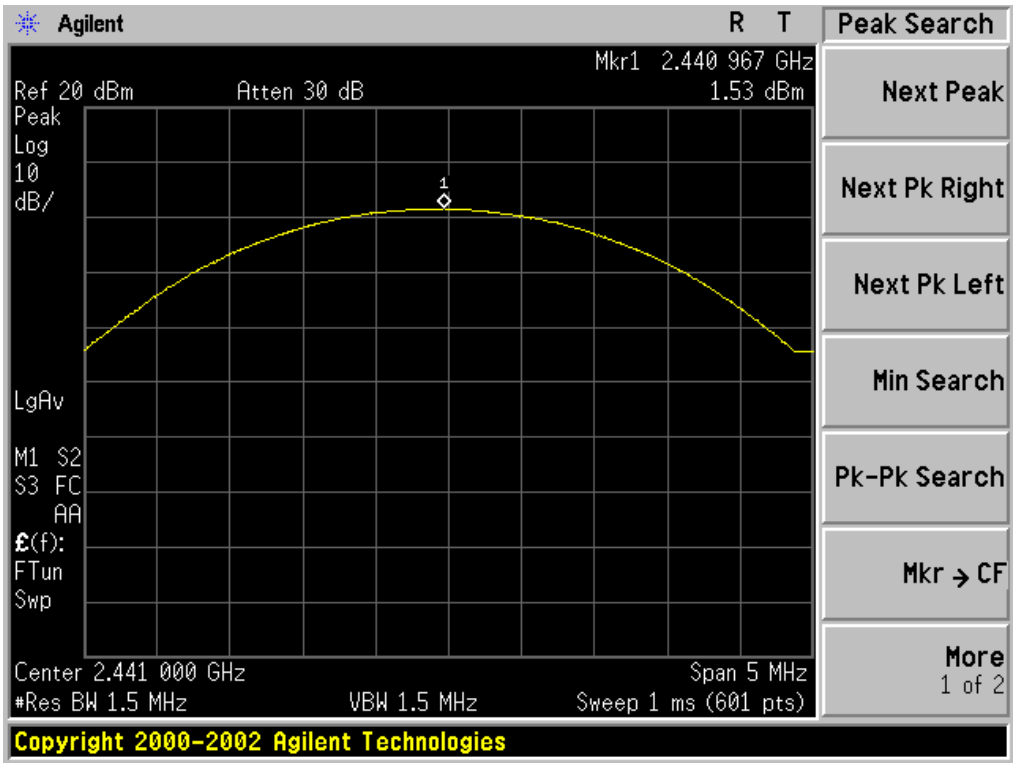
Agilent
R T
Peak Search
Mkr1 2.440 967 GHz
Ref 20 dBm
Atten 30 dB
1.53 dBm
Next Peak
Peak
Log
10
dB/
Next Pk Right
Next Pk Left
Min Search
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Pk-Pk Search
Mkr → CF
Center 2.441 000 GHz
Span 5 MHz
More
1 of 2
#Res BW 1.5 MHz
VBW 1.5 MHz
Sweep 1 ms (601 pts)
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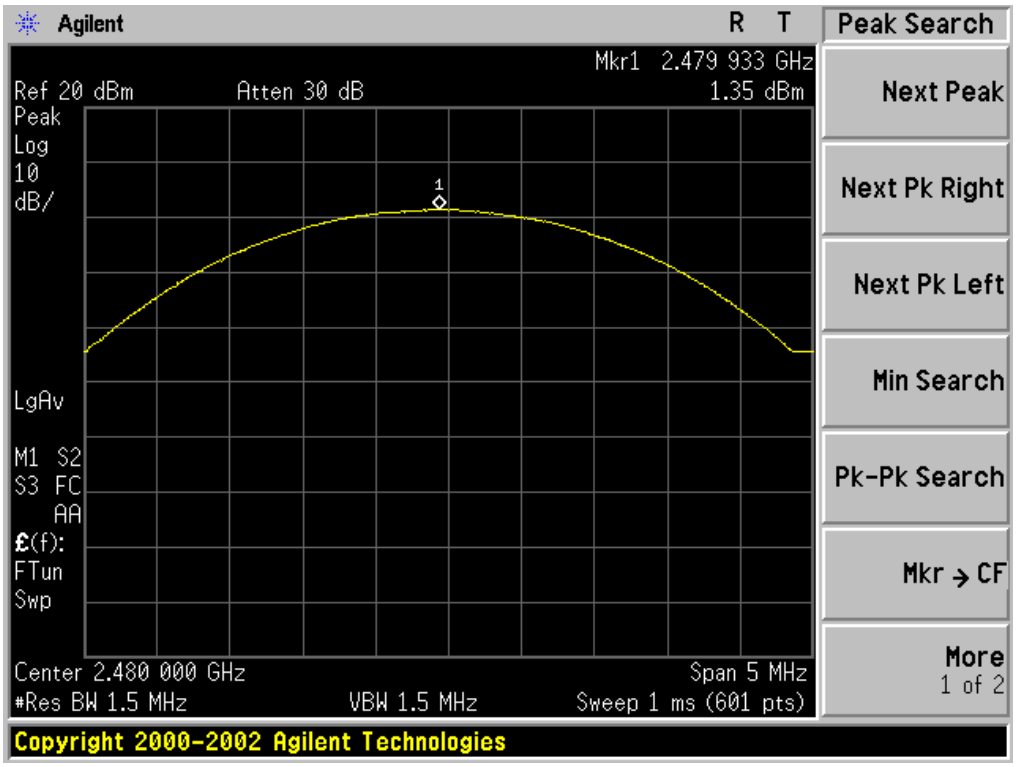
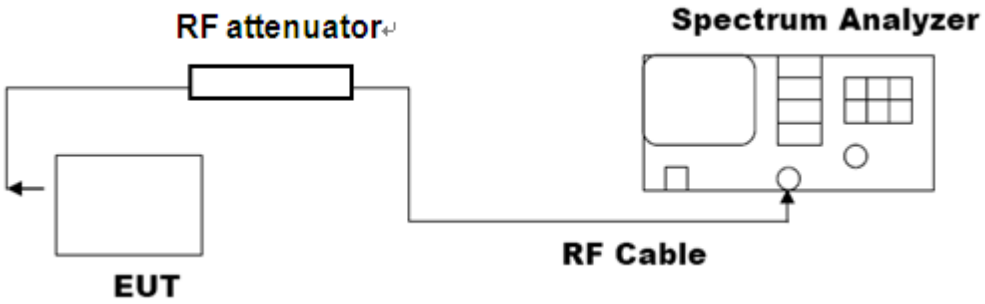

Agilent
R T
Peak Search
Mkr1 2.479 933 GHz
Ref 20 dBm
Atten 30 dB
1.35 dBm
Next Peak
Peak
Log
10
dB/
Next Pk Right
Next Pk Left
Min Search
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Pk-Pk Search
Mkr → CF
Center 2.480 000 GHz
Span 5 MHz
More
1 of 2
#Res BW 1.5 MHz
VBW 1.5 MHz
Sweep 1 ms (601 pts)
Copyright 2000-2002 Agilent Technologies

4. BANDWIDTH

4.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hoping channel RBW ≥ 1% of the 20 dB bandwidth, VBW ≥ 3RBW; Sweep = auto; Detector function = peak
4. Set SPA Trace 1 Max hold, then View.

4.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

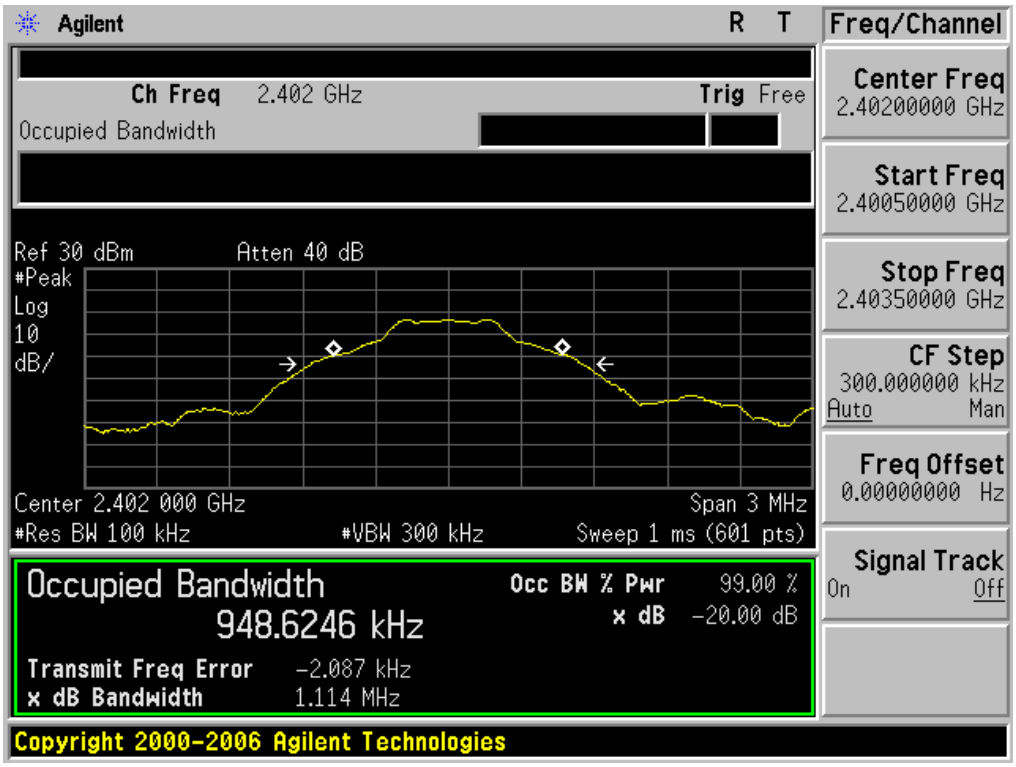


Note: The EUT has been used temporary antenna connector for testing.

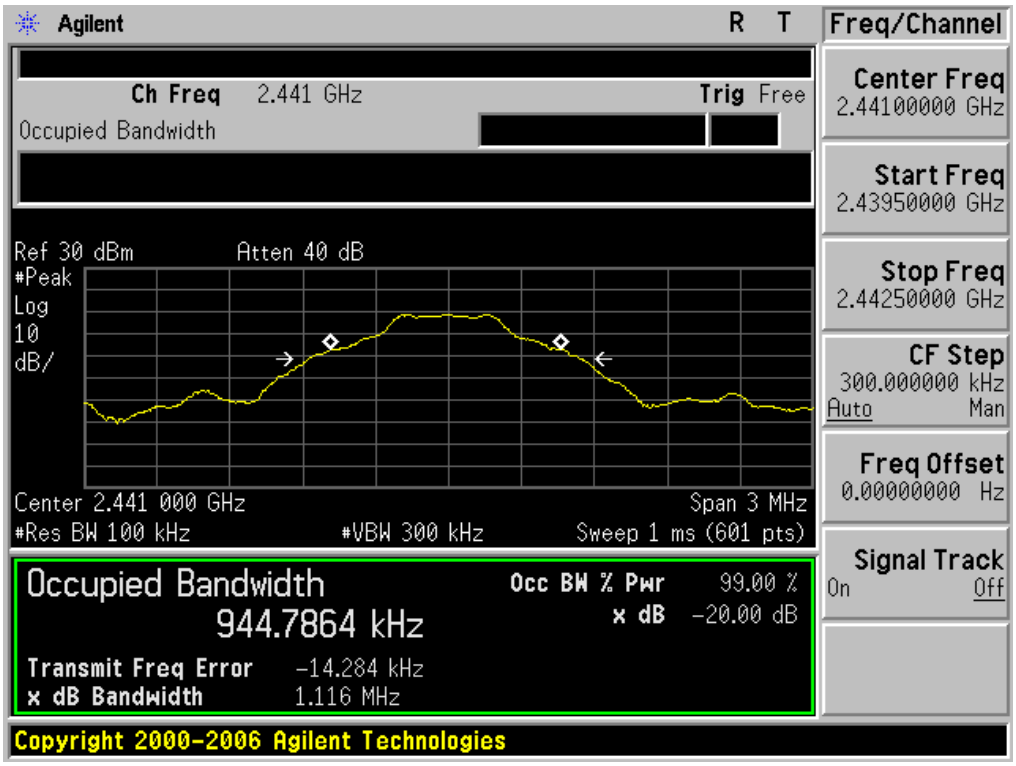
4.3. LIMITS AND MEASUREMENT RESULTS

BLUETOOTH 1MBPS LIMITS AND MEASUREMENT RESULT				
Applicable Limits	Measurement Result			
	Test Data (MHz)			Result
		99%OBW (MHz)	-20dB BW(MHz)	
N/A	Low Channel	0.949	1.114	PASS
	Middle Channel	0.945	1.116	PASS
	High Channel	0.939	1.104	PASS

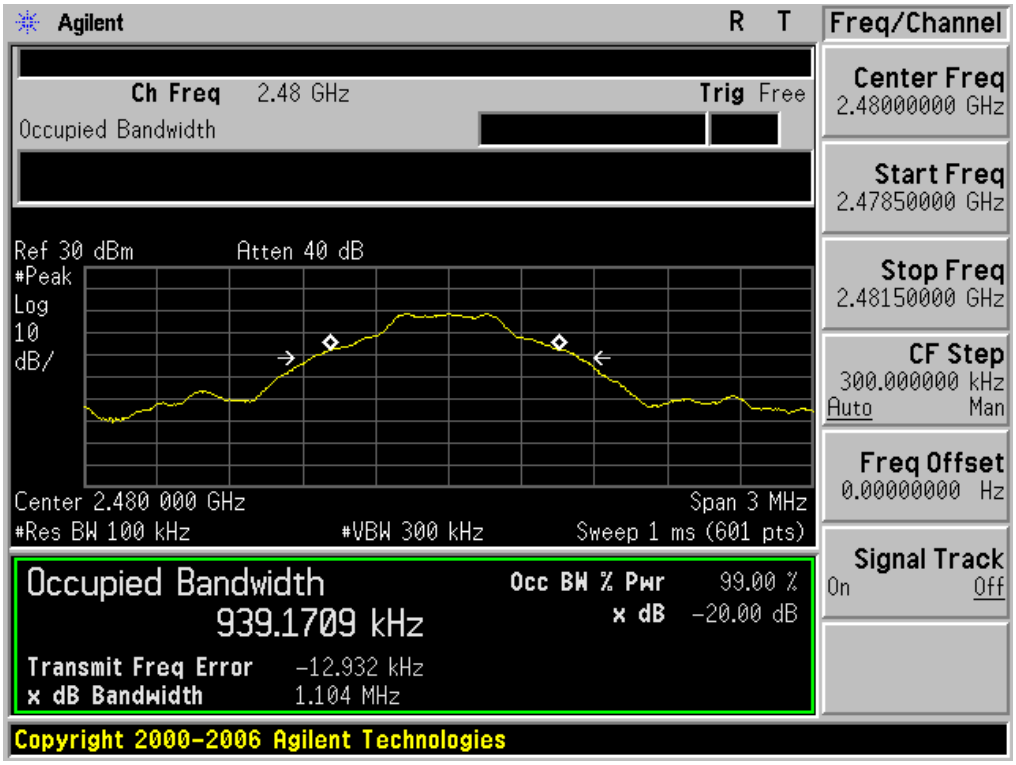
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

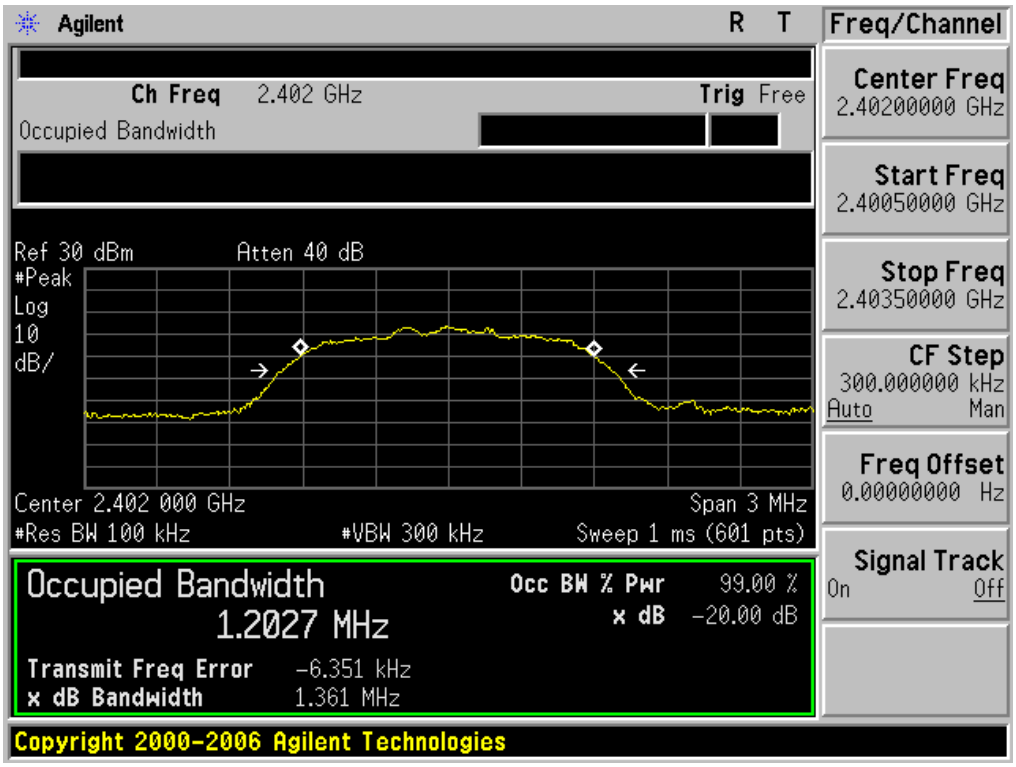


TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

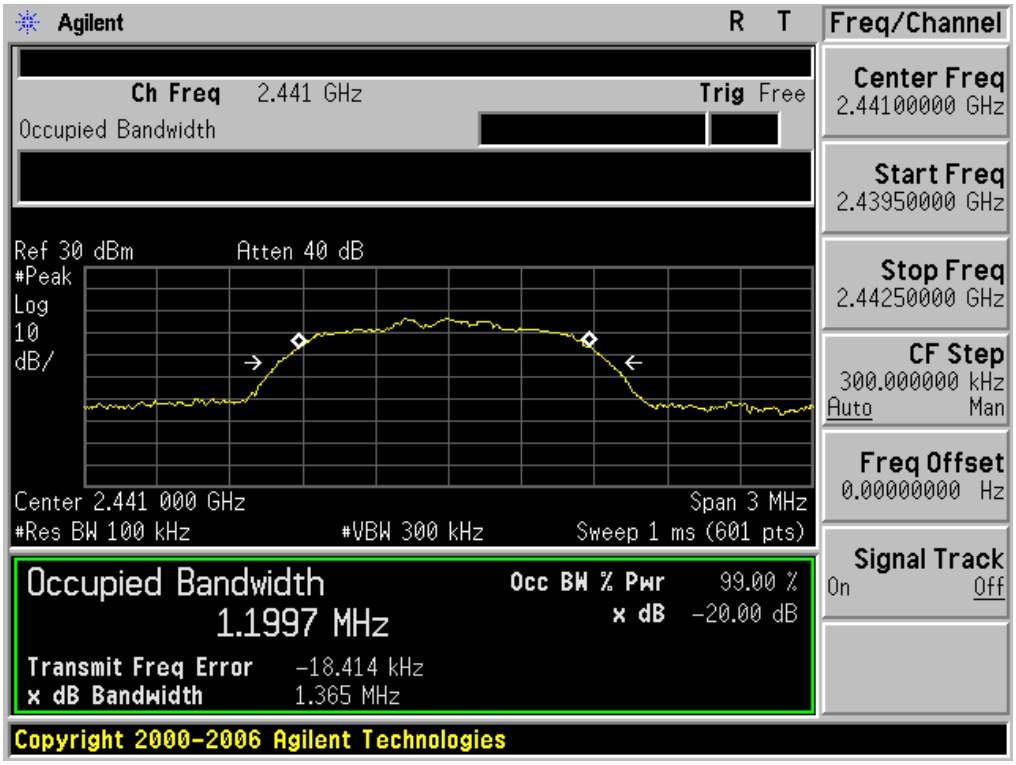


BLUETOOTH 2MBPS LIMITS AND MEASUREMENT RESULT				
Applicable Limits	Measurement Result			
	Test Data (MHz)			Result
		99%OBW (MHz)	-20dB BW(MHz)	
N/A	Low Channel	1.203	1.361	PASS
	Middle Channel	1.200	1.365	PASS
	High Channel	1.206	1.347	PASS

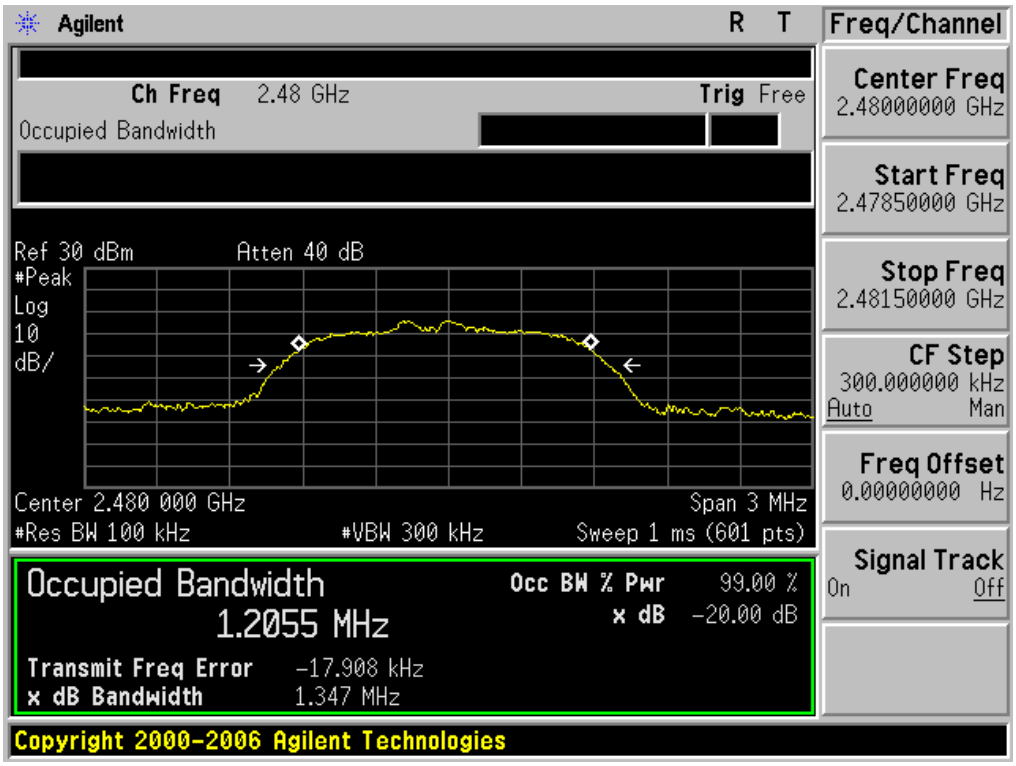
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

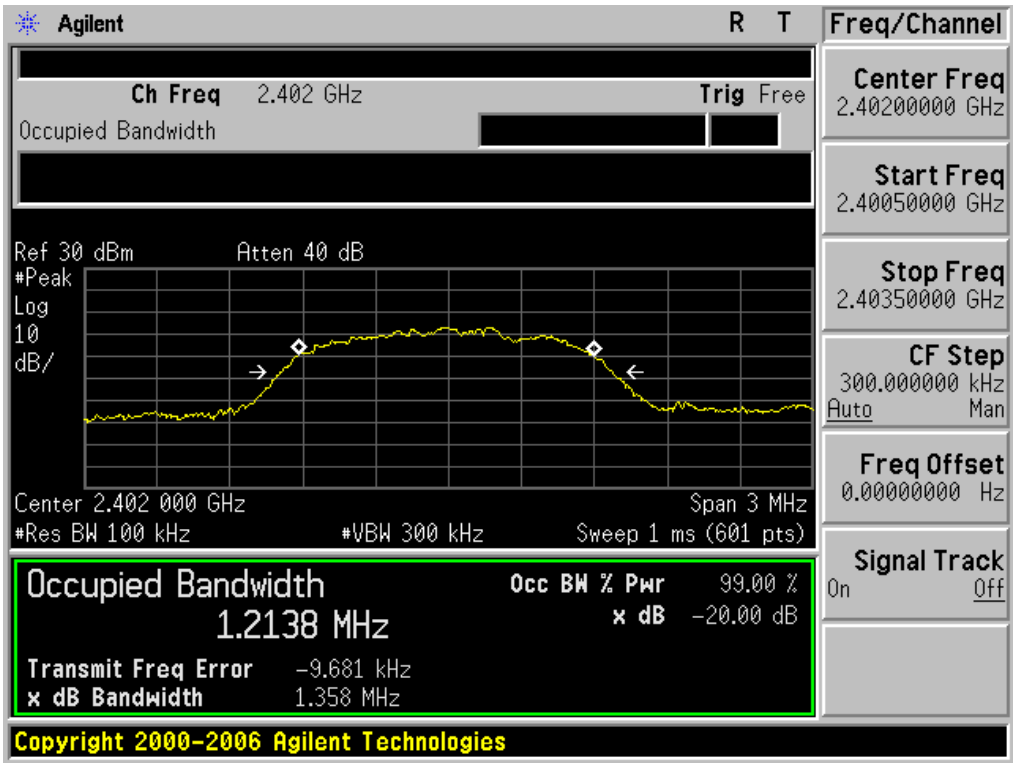


TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

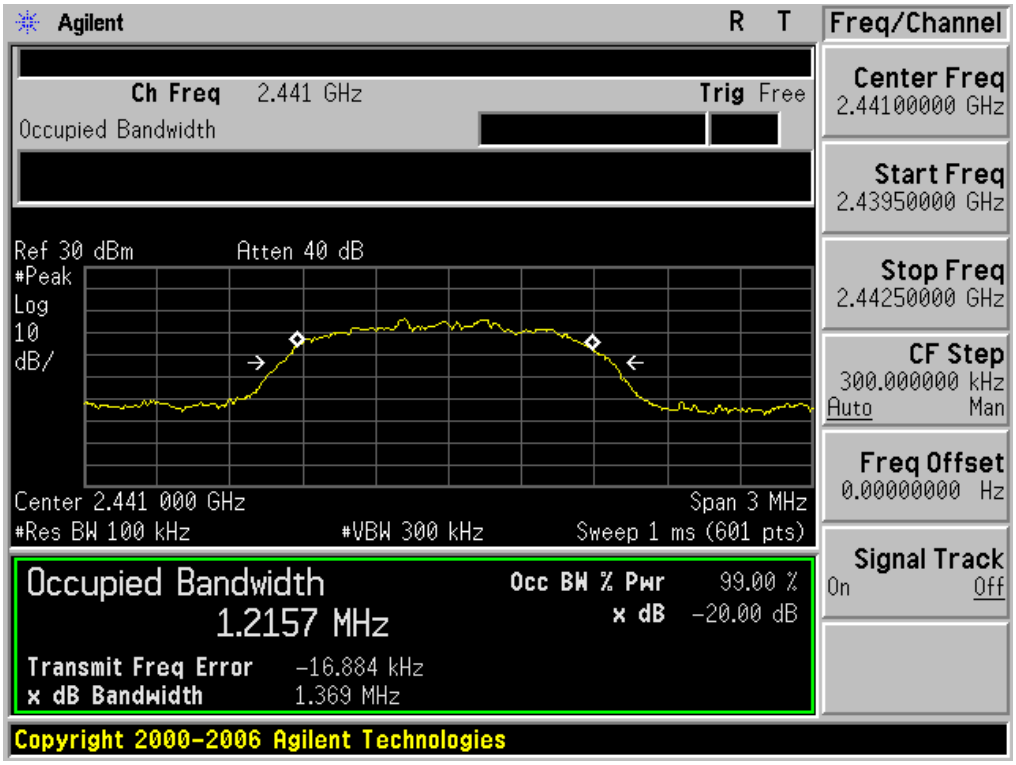


BLUETOOTH 3MBPS LIMITS AND MEASUREMENT RESULT				
Applicable Limits	Measurement Result			
	Test Data (MHz)			Result
		99%OBW (MHz)	-20dB BW(MHz)	
N/A	Low Channel	1.214	1.358	PASS
	Middle Channel	1.216	1.369	PASS
	High Channel	1.226	1.363	PASS

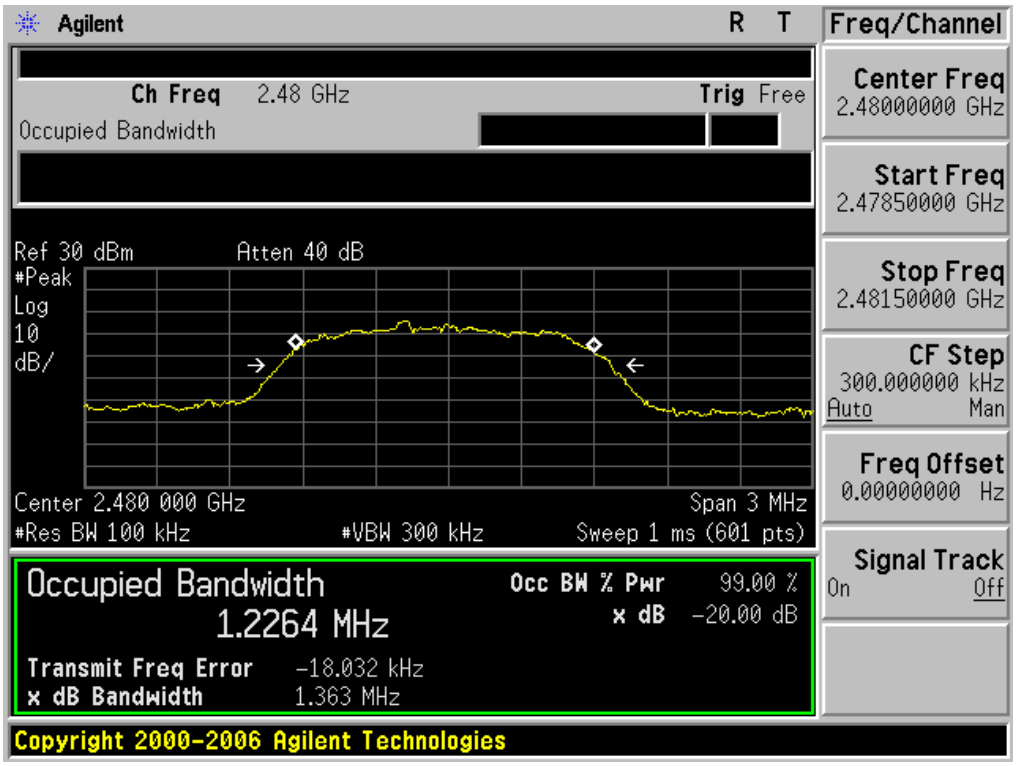
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

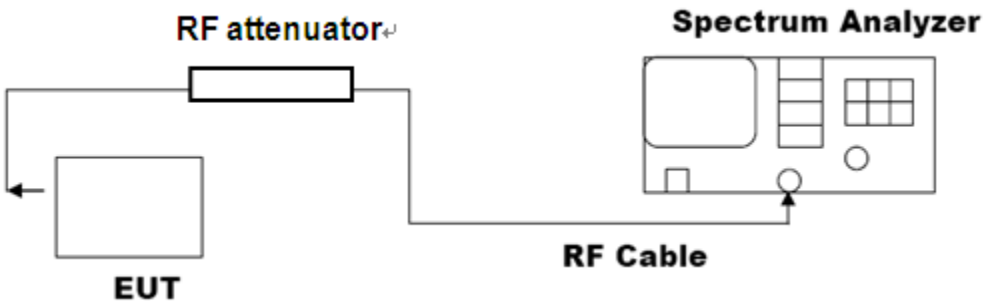


5. CONDUCTED SPURIOUS EMISSION

5.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the Middle and the bottom operation frequency individually.
3. Set the Span = wide enough to capture the peak level of the in-band emission and all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic. RBW = 100 kHz; VBW = 300kHz; Sweep = auto; Detector function = peak.
4. Set SPA Trace 1 Max hold, then View.

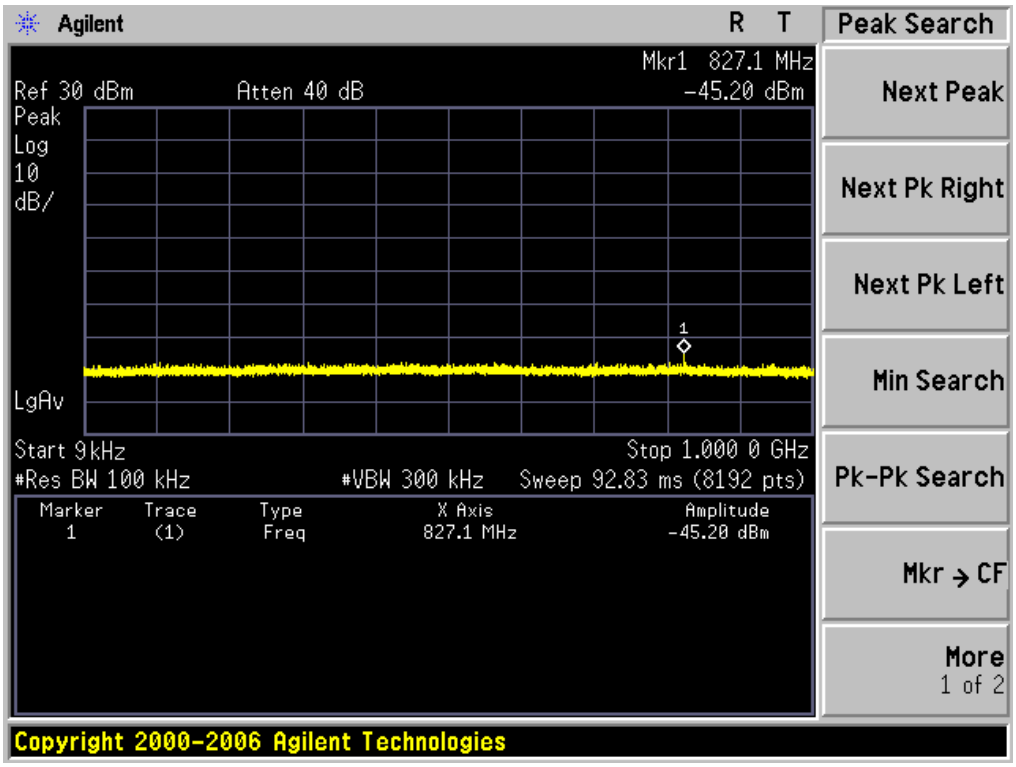
5.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

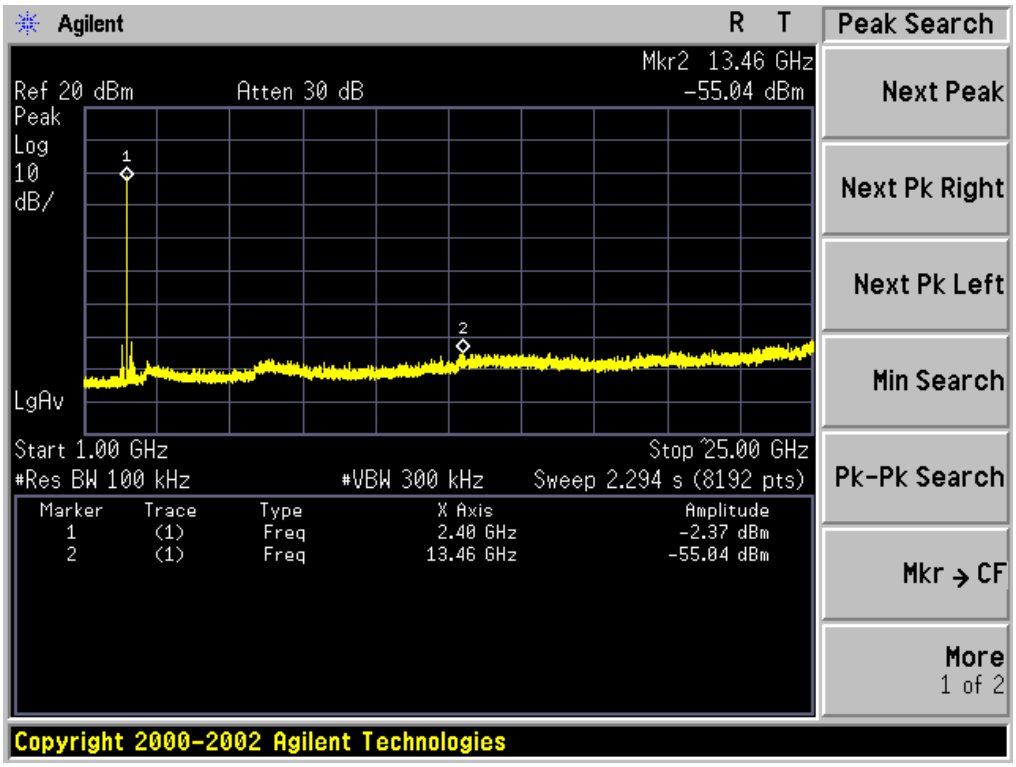


5.3. LIMITS AND MEASUREMENT RESULT

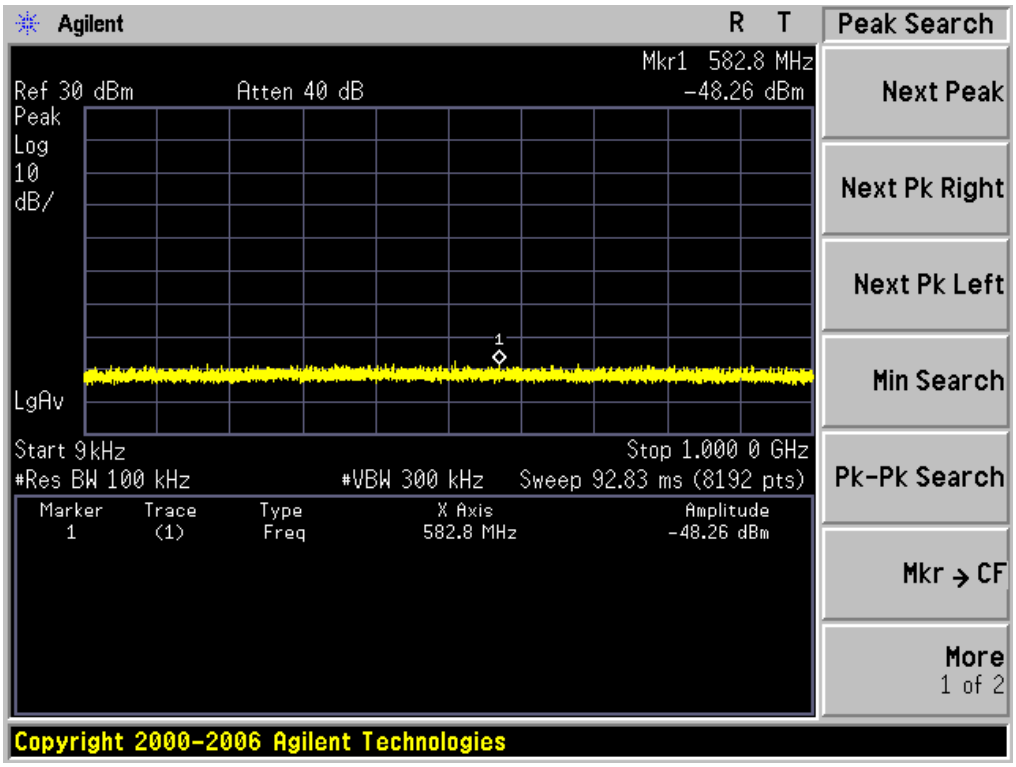
LIMITS AND MEASUREMENT RESULT		
Applicable Limits	**Measurement Result**	
	Test Data	**Result**
FCC requirement: In any 100 KHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiation emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in§15.209(a)) **IC requirement:** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.	At least -20dBc than the limit Specified on the BOTTOM Channel	PASS
	At least -20dBc than the limit Specified on the TOP Channel	PASS

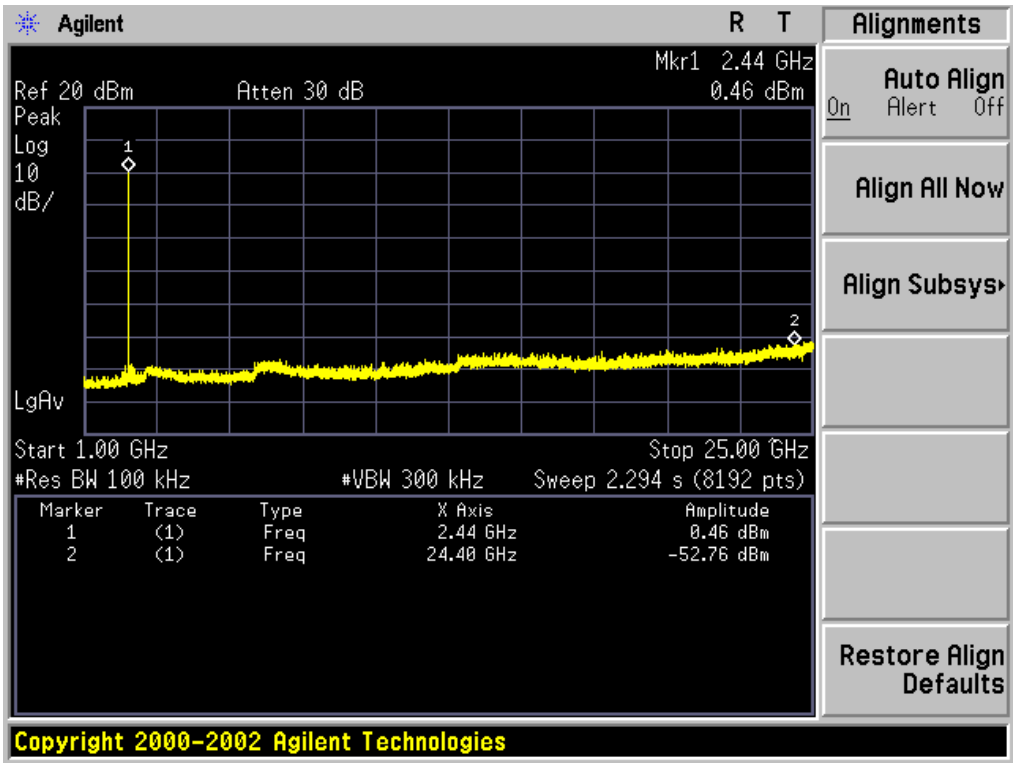
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OF GFSK MODULATION IN LOW CHANNEL



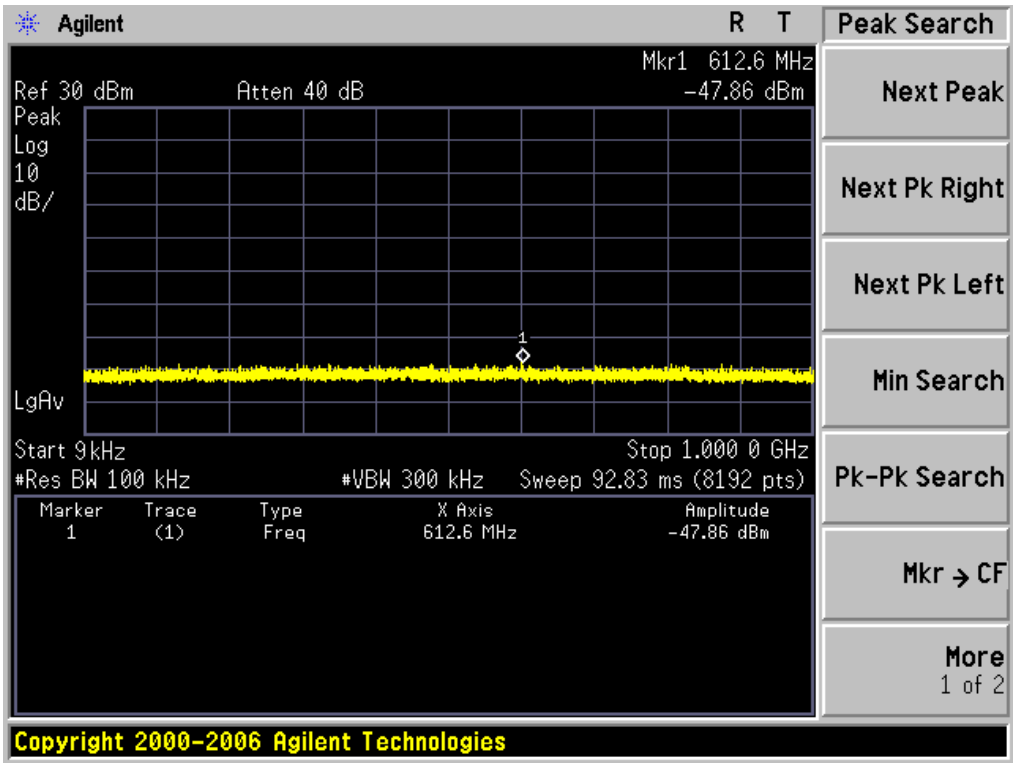


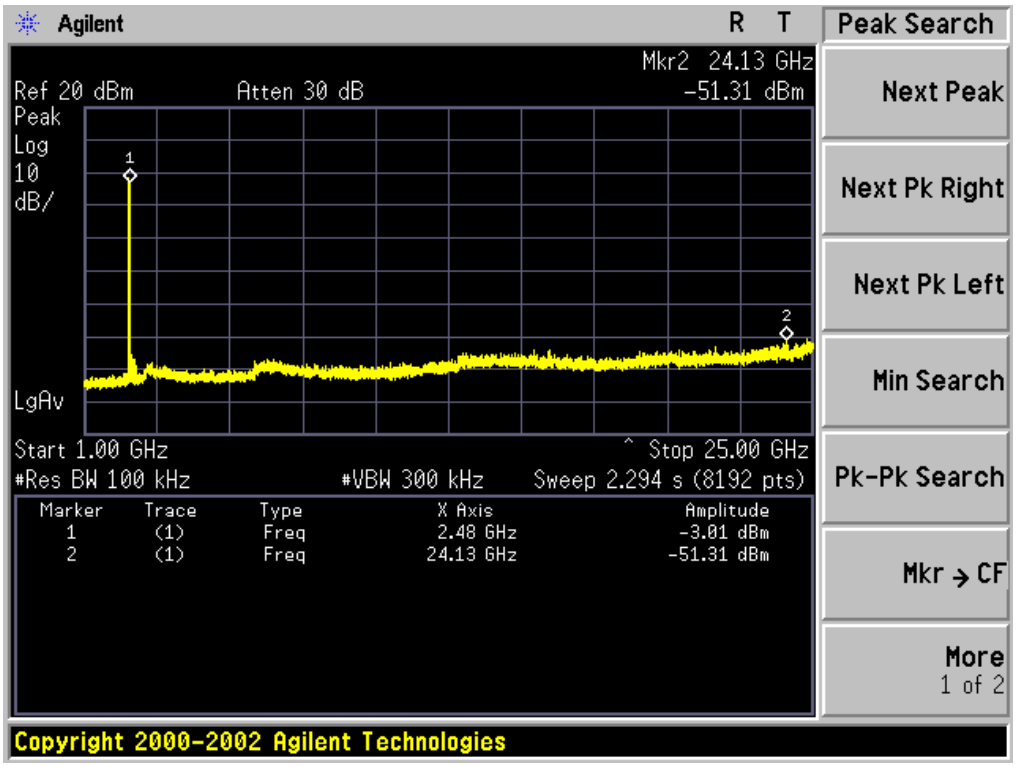
TEST PLOT OF OUT OF BAND EMISSIONS
OF GFSK MODULATION IN MIDDLE CHANNEL





TEST PLOT OF OUT OF BAND EMISSIONS
OF GFSK MODULATION IN HIGH CHANNEL





6. RADIATED EMISSION

6.1. TEST LIMIT

Frequency (MHz)	Distance Meters	Field Strengths Limit	
		μ V/m	dB(μV)/m
0.009 ~ 0.490	300	2400/F(kHz)	---
0.490 ~ 1.705	30	24000/F(kHz)	---
1.705 ~ 30	30	30	---
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	Other:74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

Remark: (1) Emission level dBμ V = 20 log Emission level μ V/m

(2) The smaller limit shall apply at the cross point between two frequency bands.

(3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

6.2. MEASUREMENT PROCEDURE

1. The measuring distance of 3m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation(Below 1GHz)
2. The measuring distance of 3m shall used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation(Above 1GHz)
3. The height of the test antenna shall vary between 1m to 4m.Both horizontal and vertical polarization Of the antenna are set to make the measurement.
4. The initial step in collecting radiated emission data is a receive peak detector mode. Pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
5. All readings are peak unless otherwise stated QP in column of Note. Peak denoted that the Peak reading compliance with the QP limits and then QP Mode measurement didn't perform(Below 1GHz)
6. All readings are Peak mode value unless otherwise stated AVG in column of Note. If the Peak mode measured value compliance with the Peak limits and lower than AVG Limits, the EUT shall be deemed to meet Peak&AVG limits and then only Peak mode was measured, but AVG mode didn't perform.(Above 1GHz)

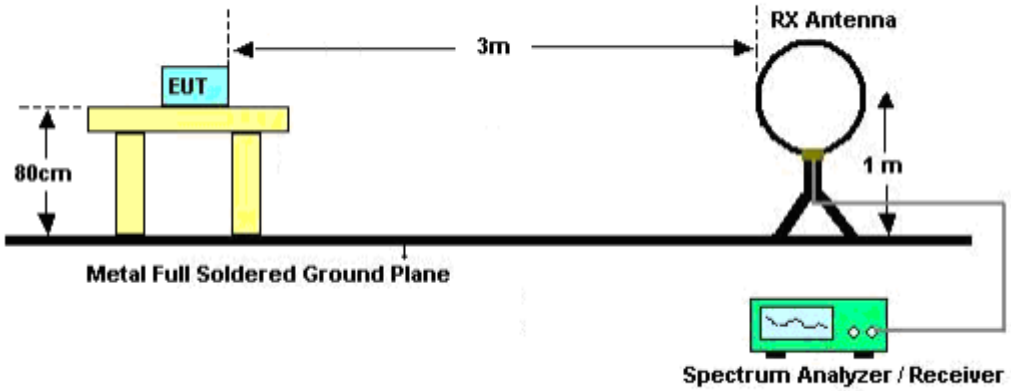
The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP
Start ~Stop Frequency	1GHz~26.5GHz RBW 1MHz/ VBW 3MHz for Peak, RBW 1MHz/ VBW 10Hz for Average

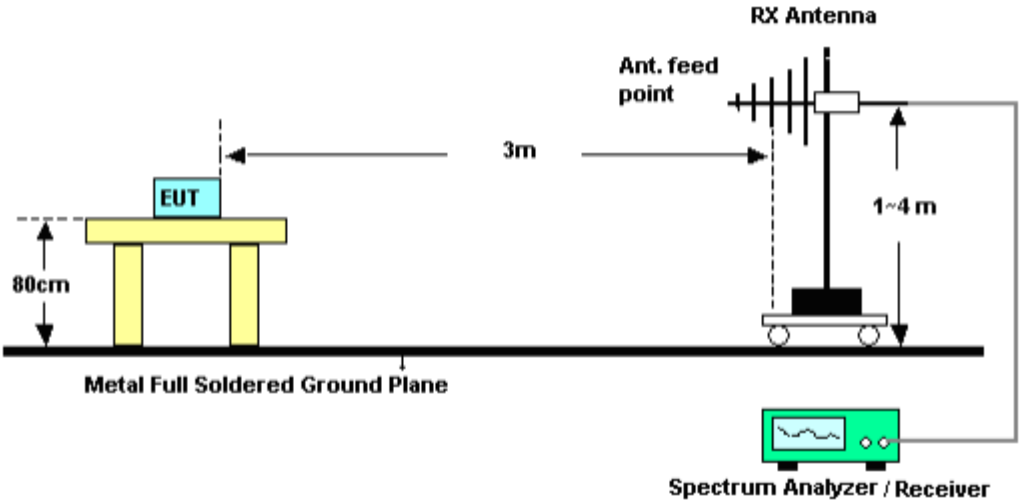
Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP

6.3. TEST SETUP

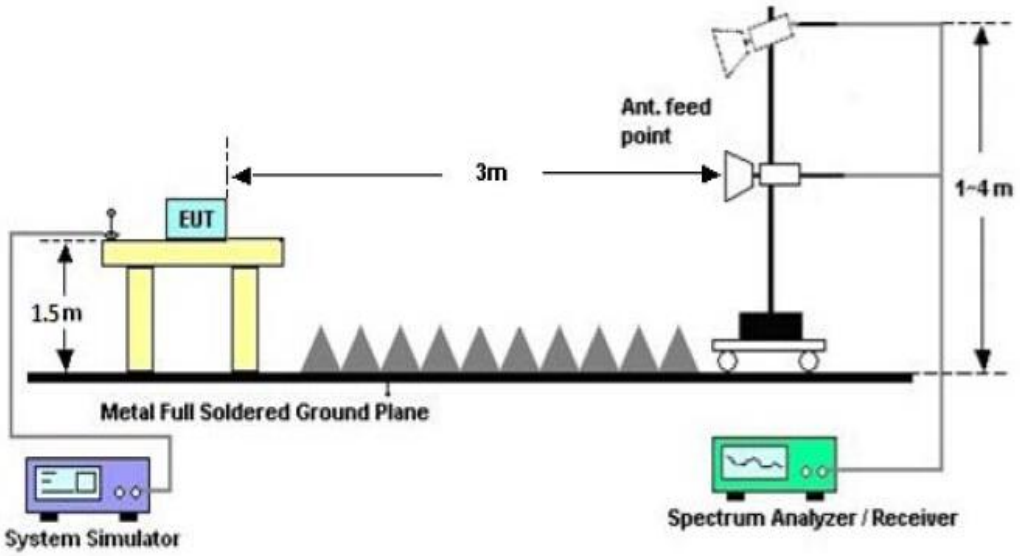
RADIATED EMISSION TEST SETUP BELOW 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



6.4. TEST RESULT

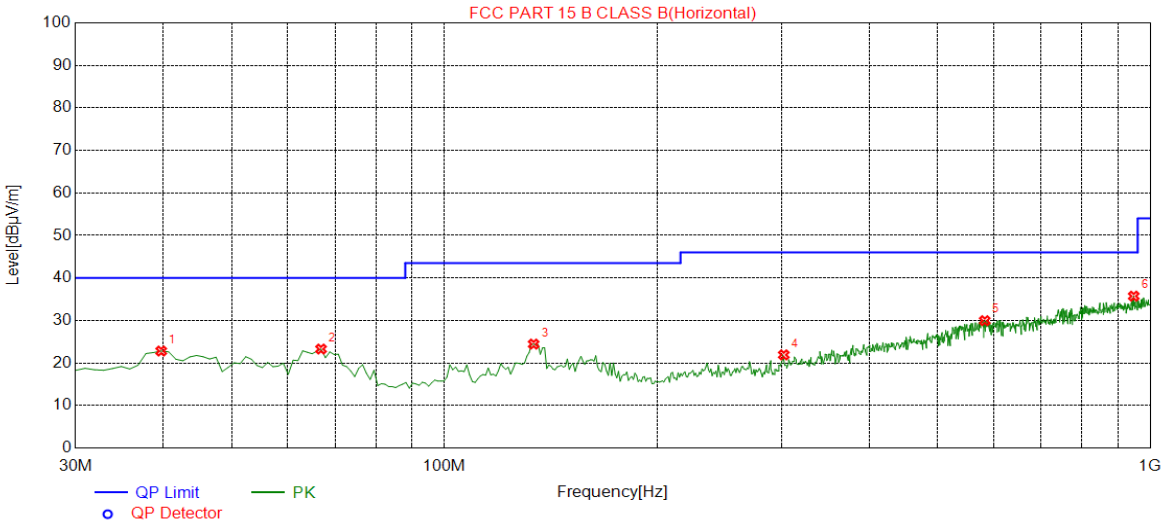
(Worst Modulation: GFSK)

RADIATED EMISSION BELOW 30MHz

No emission found between lowest internal used/generated frequencies to 30MHz.

RADIATED EMISSION BELOW 1GHz

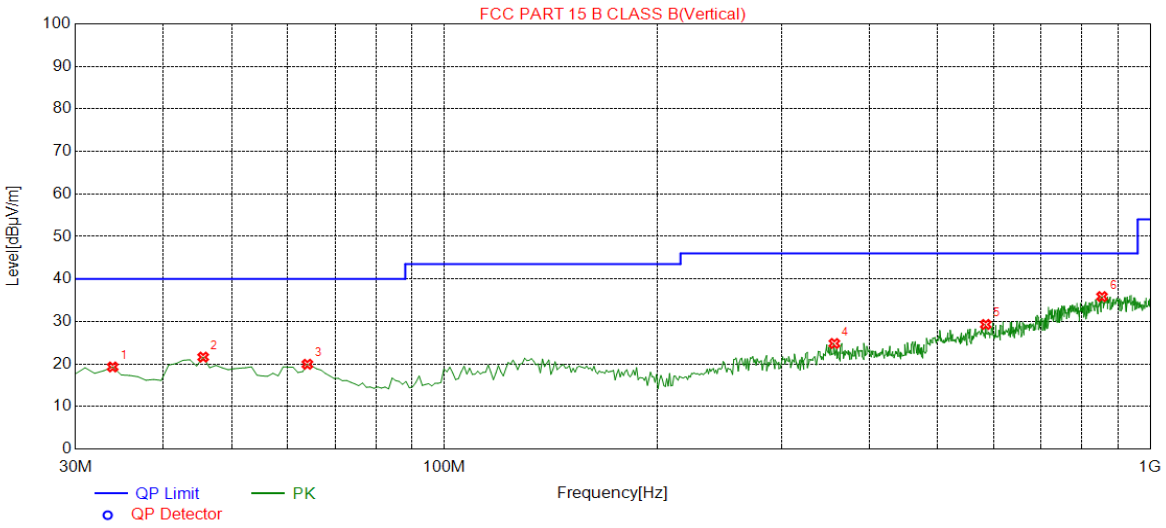
RADIATED EMISSION TEST- (30MHz-1GHz)-LOW CHANNEL-HORIZONTAL



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	39.7000	22.81	14.57	40.00	17.19	100	60	Horizontal
2	66.8600	23.28	12.37	40.00	16.72	200	70	Horizontal
3	133.790	24.45	13.82	43.50	19.05	200	180	Horizontal
4	302.570	21.91	15.04	46.00	24.09	100	200	Horizontal
5	582.900	29.95	22.58	46.00	16.05	100	320	Horizontal
6	947.620	35.72	28.67	46.00	10.28	150	30	Horizontal

RESULT: PASS

RADIATED EMISSION TEST- (30MHz-1GHz)-LOW CHANNEL -VERTICAL



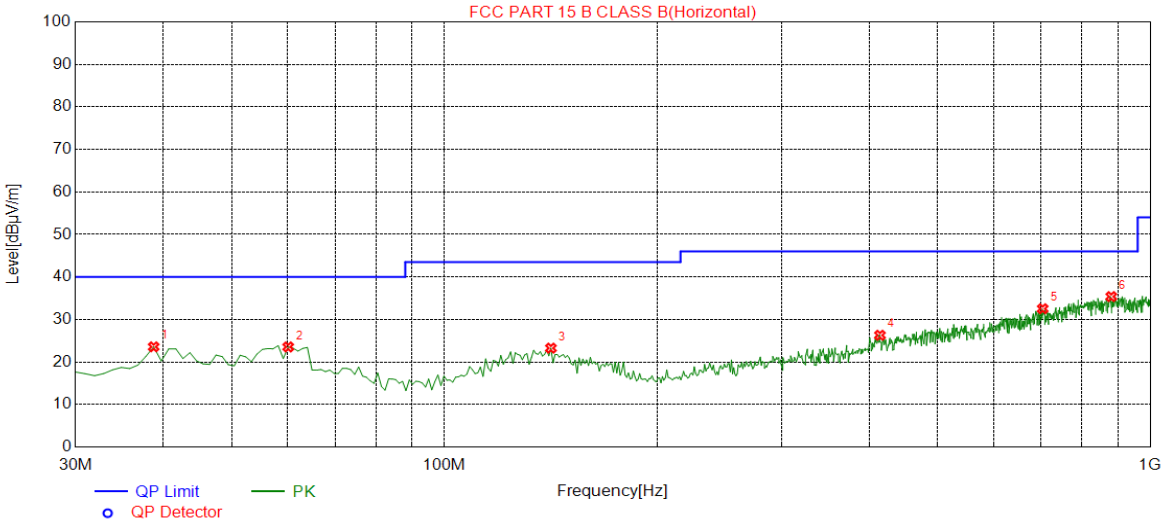
Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	33.8800	19.31	13.27	40.00	20.69	100	90	Vertical
2	45.5200	21.62	14.47	40.00	18.38	150	210	Vertical
3	63.9500	19.94	12.87	40.00	20.06	100	300	Vertical
4	356.890	24.83	17.04	46.00	21.17	150	140	Vertical
5	584.840	29.30	22.62	46.00	16.70	200	240	Vertical
6	854.500	35.85	27.61	46.00	10.15	200	360	Vertical

RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. The “Factor” value can be calculated automatically by software of measurement system.

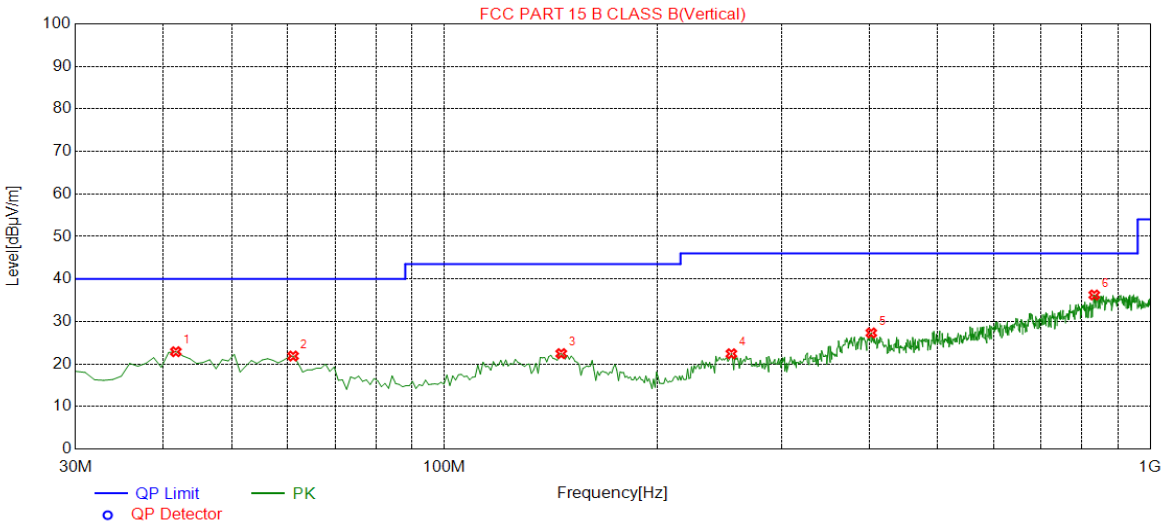
RADIATED EMISSION TEST- (30MHz-1GHz)-MIDDLE CHANNEL-HORIZONTAL



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	38.7300	23.57	14.34	40.00	16.43	100	290	Horizontal
2	60.0700	23.54	13.53	40.00	16.46	200	270	Horizontal
3	141.550	23.26	14.24	43.50	20.24	100	320	Horizontal
4	414.120	26.29	18.99	46.00	19.71	150	120	Horizontal
5	704.150	32.53	24.52	46.00	13.47	200	270	Horizontal
6	880.690	35.38	27.99	46.00	10.62	100	10	Horizontal

RESULT: PASS

RADIATED EMISSION TEST- (30MHz-1GHz)- MIDDLE CHANNEL -VERTICAL



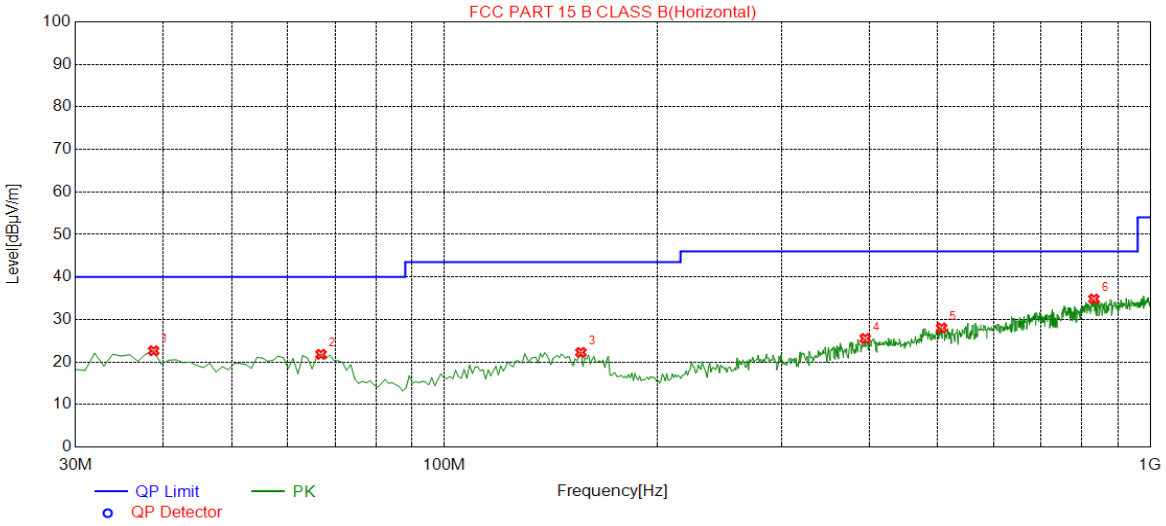
Suspected Data List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	41.6400	22.89	14.59	40.00	17.11	150	350	Vertical
2	61.0400	21.87	13.36	40.00	18.13	200	300	Vertical
3	146.400	22.44	14.25	43.50	21.06	200	170	Vertical
4	255.040	22.41	13.77	46.00	23.59	200	270	Vertical
5	402.480	27.30	18.73	46.00	18.70	100	110	Vertical
6	833.160	36.24	27.29	46.00	9.76	100	260	Vertical

RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. The “Factor” value can be calculated automatically by software of measurement system.

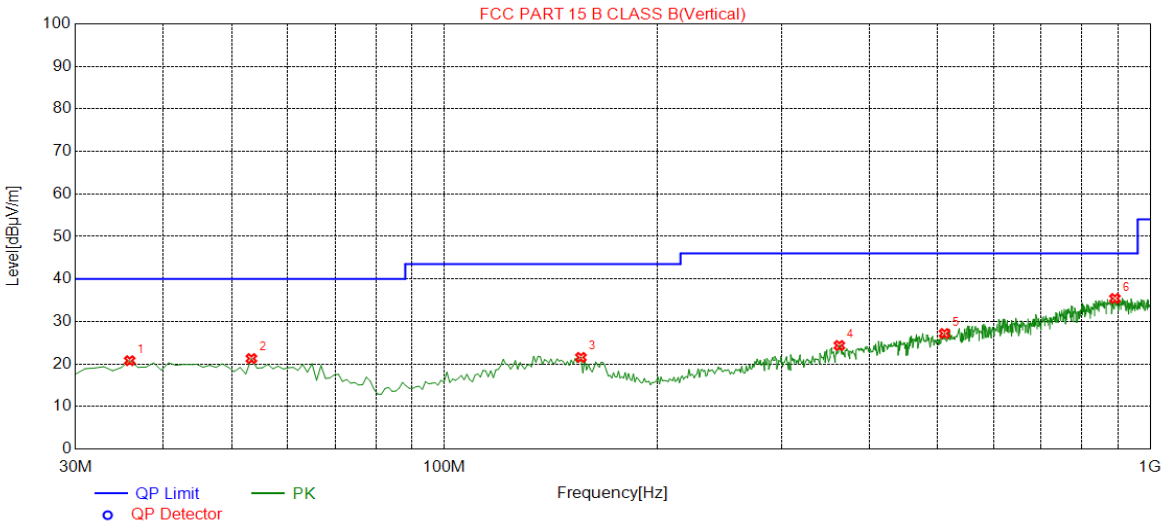
RADIATED EMISSION TEST- (30MHz-1GHz)-HIGH CHANNEL-HORIZONTAL



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	38.7300	22.64	14.34	40.00	17.36	150	150	Horizontal
2	66.8600	21.80	12.37	40.00	18.20	200	30	Horizontal
3	156.100	22.25	14.26	43.50	21.25	150	10	Horizontal
4	394.720	25.53	18.47	46.00	20.47	200	330	Horizontal
5	506.270	28.00	21.03	46.00	18.00	200	10	Horizontal
6	832.190	34.83	27.28	46.00	11.17	100	10	Horizontal

RESULT: PASS

RADIATED EMISSION TEST- (30MHz-1GHz)-HIGH CHANNEL -VERTICAL



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	35.8200	20.78	13.66	40.00	19.22	100	320	Vertical
2	53.2800	21.28	14.08	40.00	18.72	150	90	Vertical
3	156.100	21.55	14.26	43.50	21.95	100	10	Vertical
4	362.710	24.35	17.25	46.00	21.65	150	120	Vertical
5	511.120	27.17	21.13	46.00	18.83	100	10	Vertical
6	891.360	35.40	28.13	46.00	10.60	150	170	Vertical

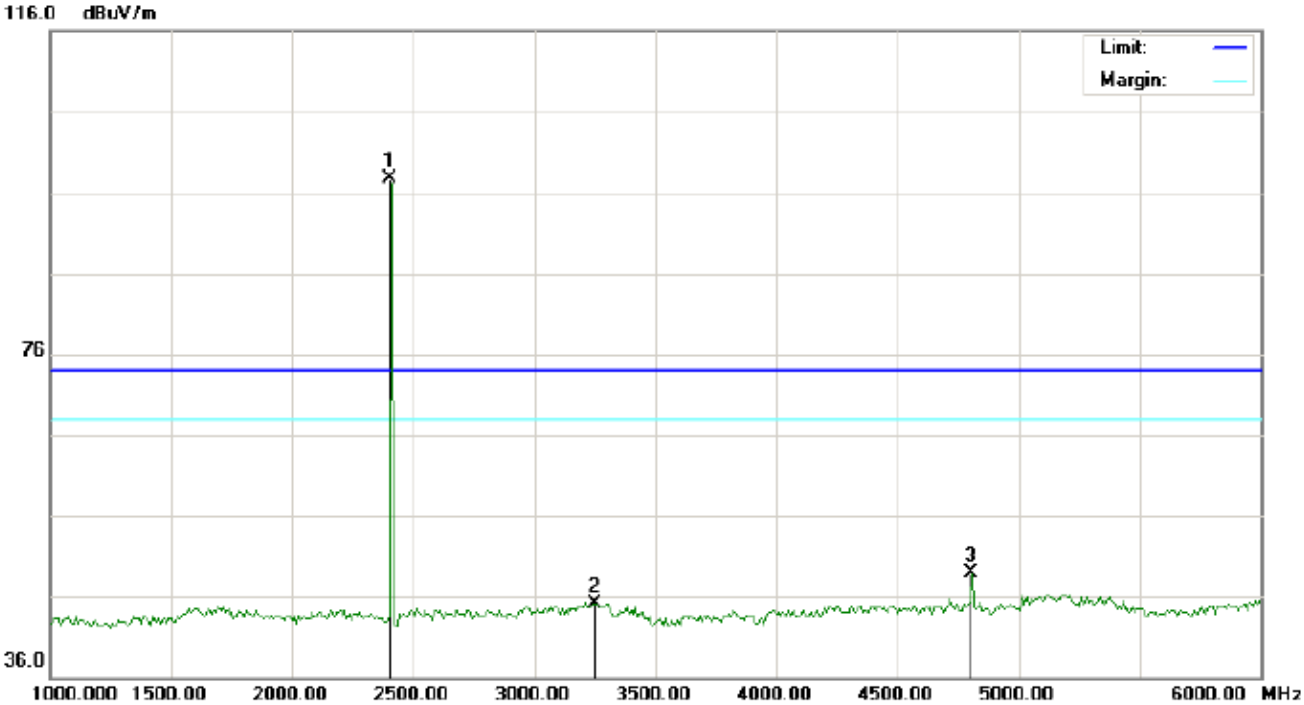
RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. The “Factor” value can be calculated automatically by software of measurement system.

RADIATED EMISSION ABOVE 1GHz

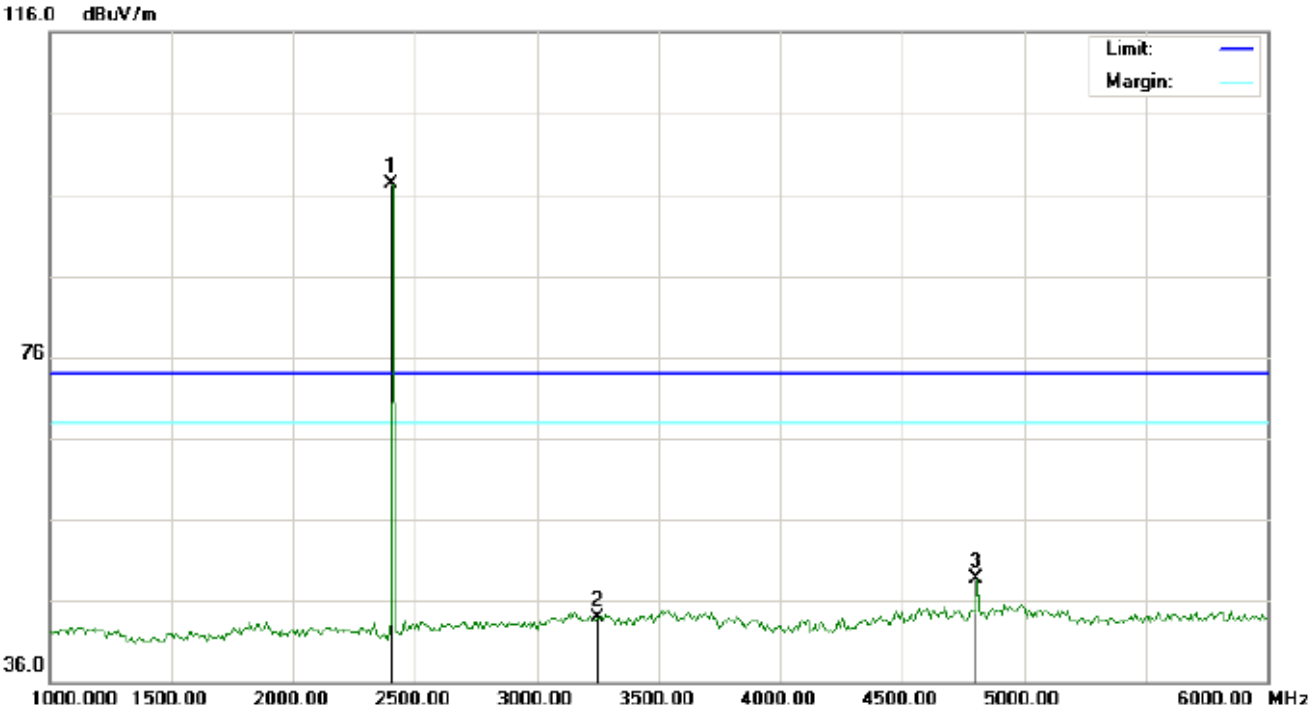
RADIATED EMISSION ABOVE 1GHz (1-10th Harmonics)-LOW CHANNEL-HORIZONTAL



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	2402.000	87.41	10.32	97.73	74.00	23.73	peak			
2		3251.000	33.21	11.88	45.09	74.00	-28.91	peak			
3		4804.000	41.21	7.69	48.90	74.00	-25.10	peak			

RESULT: PASS

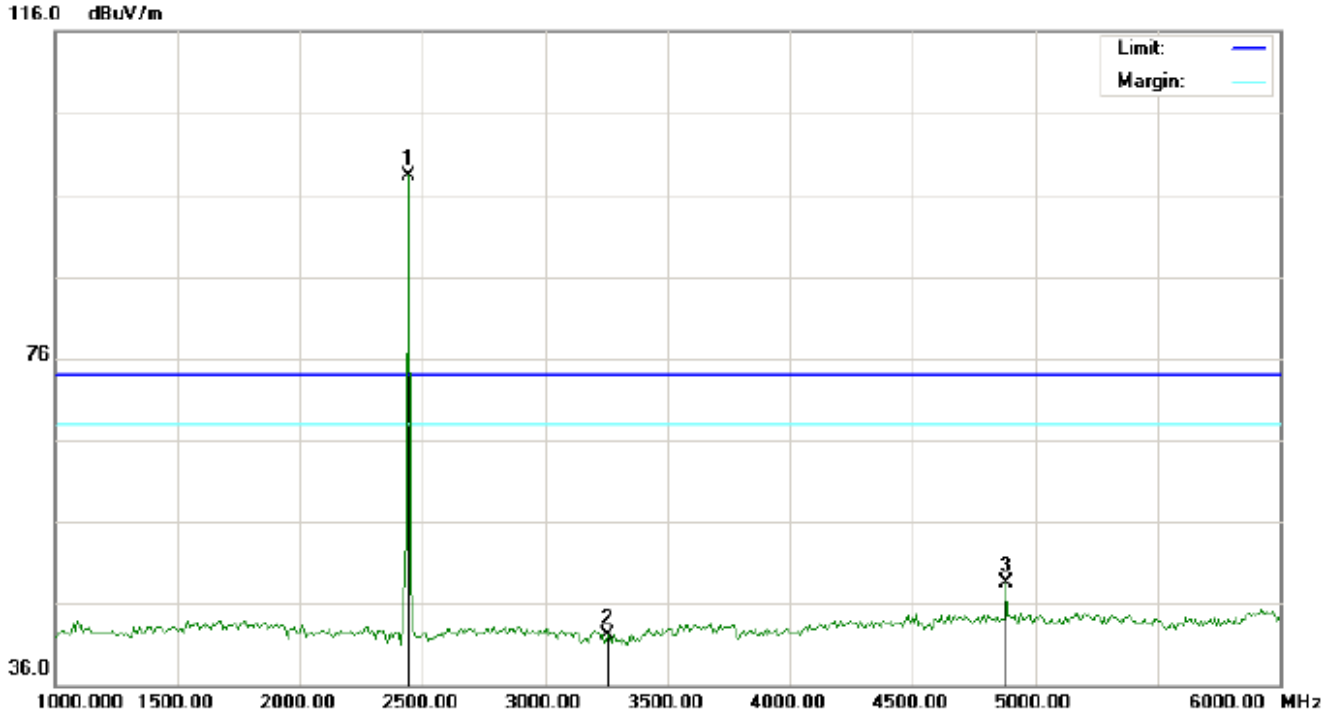
RADIATED EMISSION ABOVE 1GHz (1-10th Harmonics)-LOW CHANNEL –VERTICAL



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	2402.000	86.94	10.32	97.26	74.00	23.26	peak			
2		3251.000	32.06	11.88	43.94	74.00	-30.06	peak			
3		4804.000	41.05	7.69	48.74	74.00	-25.26	peak			

RESULT: PASS

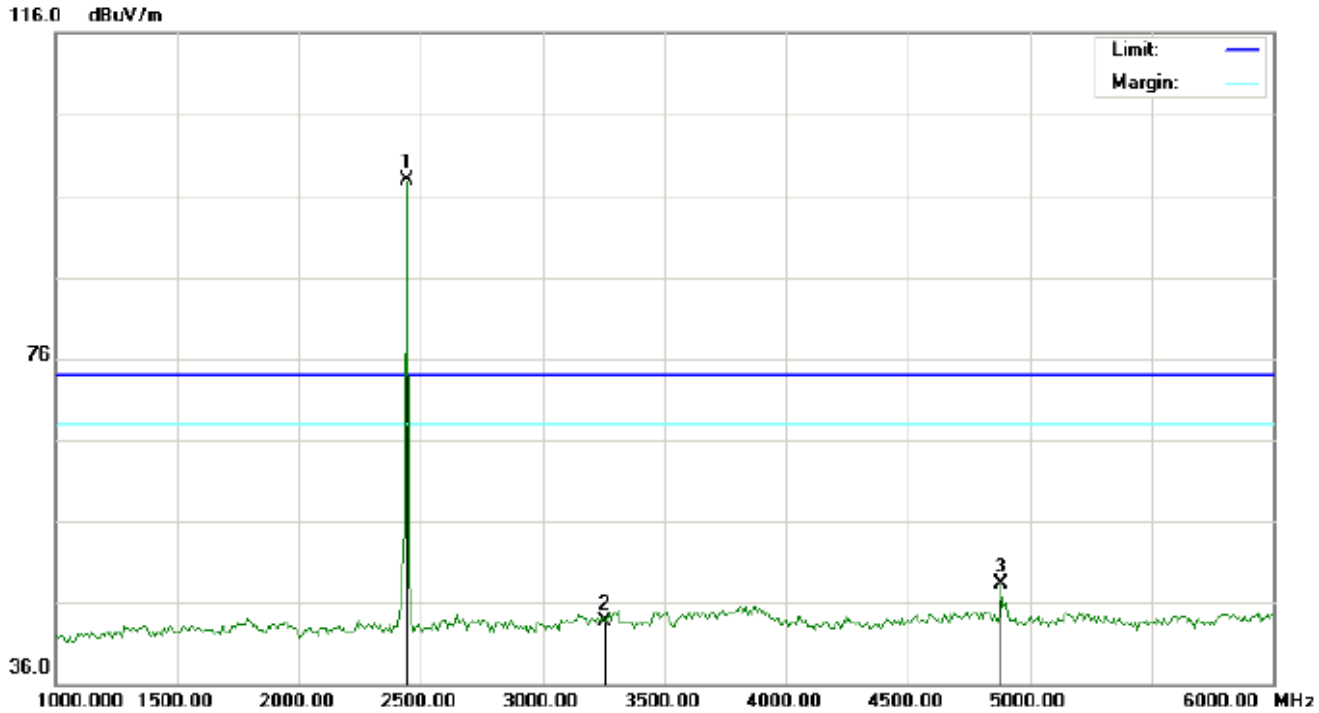
RADIATED EMISSION ABOVE 1GHz (1-10th Harmonics)-MIDDLE CHANNEL-HORIZONTAL



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	2441.000	88.03	10.36	98.39	74.00	24.39	peak			
2		3256.000	30.23	11.88	42.11	74.00	-31.89	peak			
3		4882.000	40.66	7.89	48.55	74.00	-25.45	peak			

RESULT: PASS

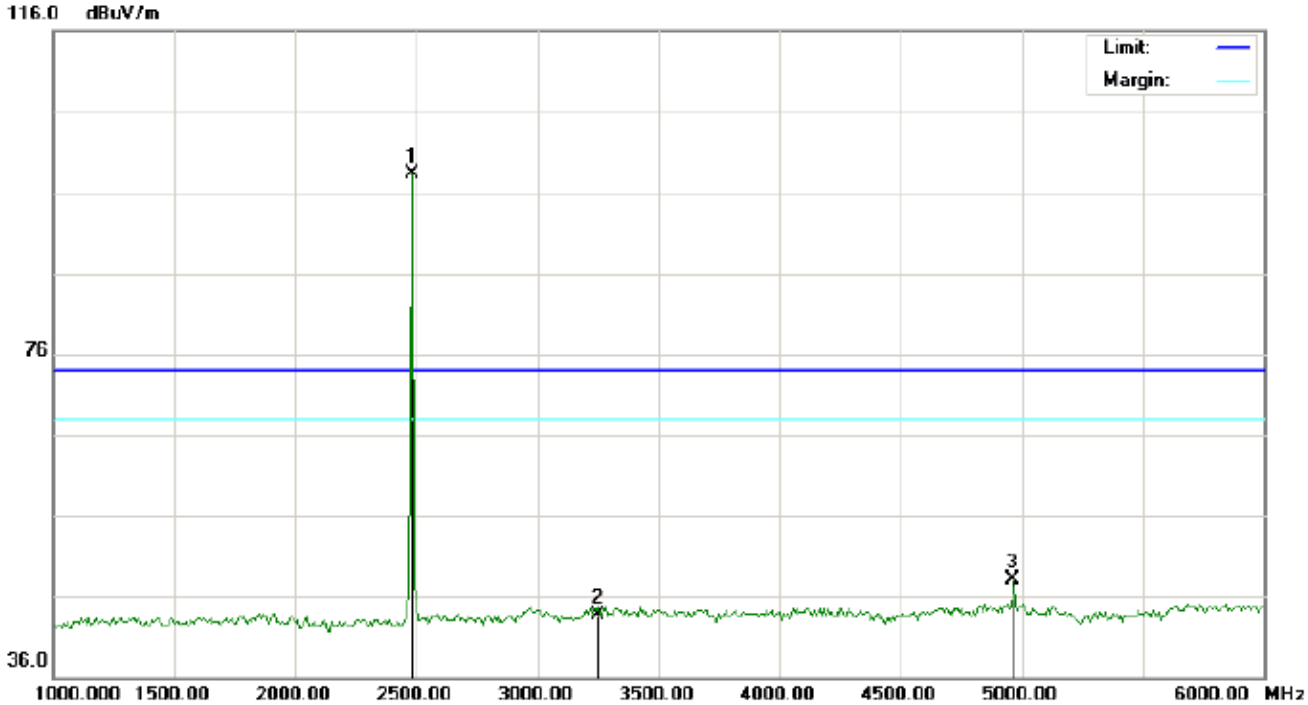
RADIATED EMISSION ABOVE 1GHz (1-10th Harmonics) - MIDDLE CHANNEL –VERTICAL



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	2441.000	87.56	10.36	97.92	74.00	23.92	peak			
2		3256.000	31.87	11.88	43.75	74.00	-30.25	peak			
3		4882.000	40.39	7.89	48.28	74.00	-25.72	peak			

RESULT: PASS

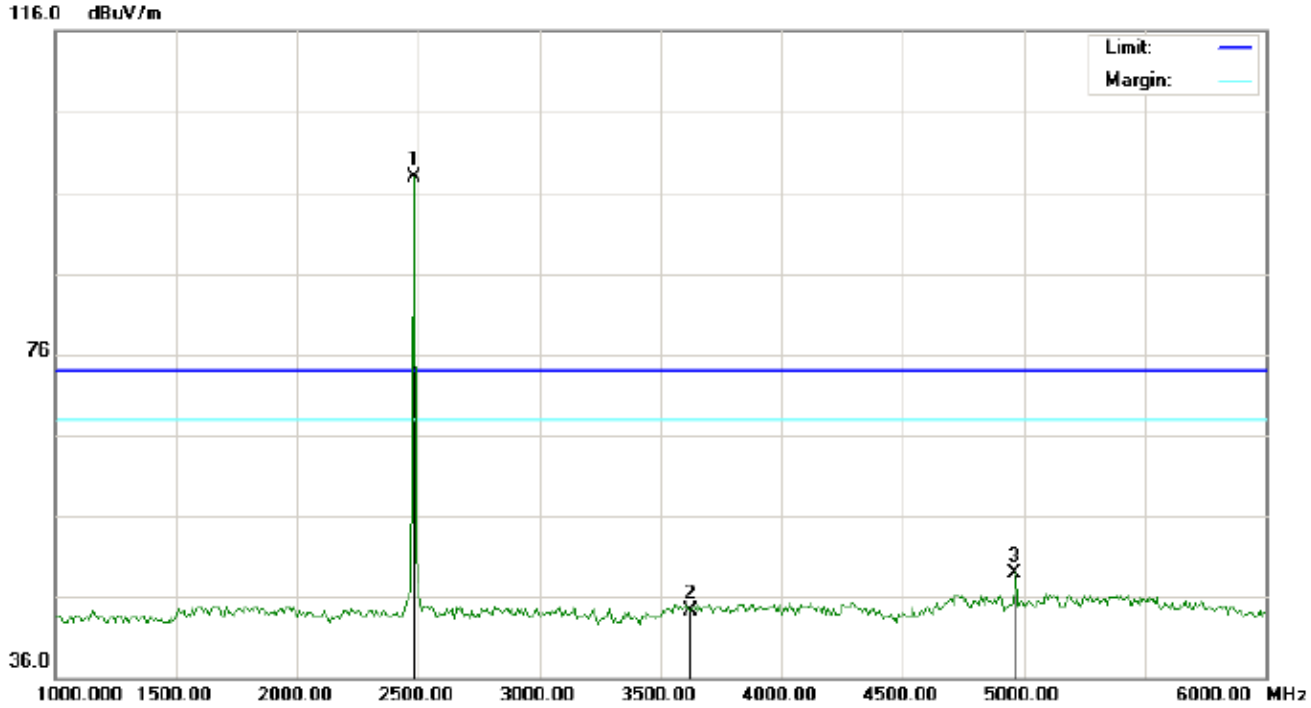
RADIATED EMISSION ABOVE 1GHz (1-10th Harmonics)-HIGH CHANNEL-HORIZONTAL



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	2480.000	87.90	10.41	98.31	74.00	24.31	peak			
2		3251.000	31.91	11.88	43.79	74.00	-30.21	peak			
3		4960.000	40.10	8.09	48.19	74.00	-25.81	peak			

RESULT: PASS

RADIATED EMISSION ABOVE 1GHz (1-10th Harmonics)-HIGH CHANNEL –VERTICAL



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	2480.000	87.47	10.41	97.88	74.00	23.88	peak			
2		3625.000	31.42	12.88	44.30	74.00	-29.70	peak			
3		4960.000	40.91	8.09	49.00	74.00	-25.00	peak			

RESULT: PASS

Note: 6~25GHz at least have 20dB margin. No recording in the test report.

Factor=Antenna Factor+ Cable loss-Amplifier gain, Margin=Measurement-Limit.

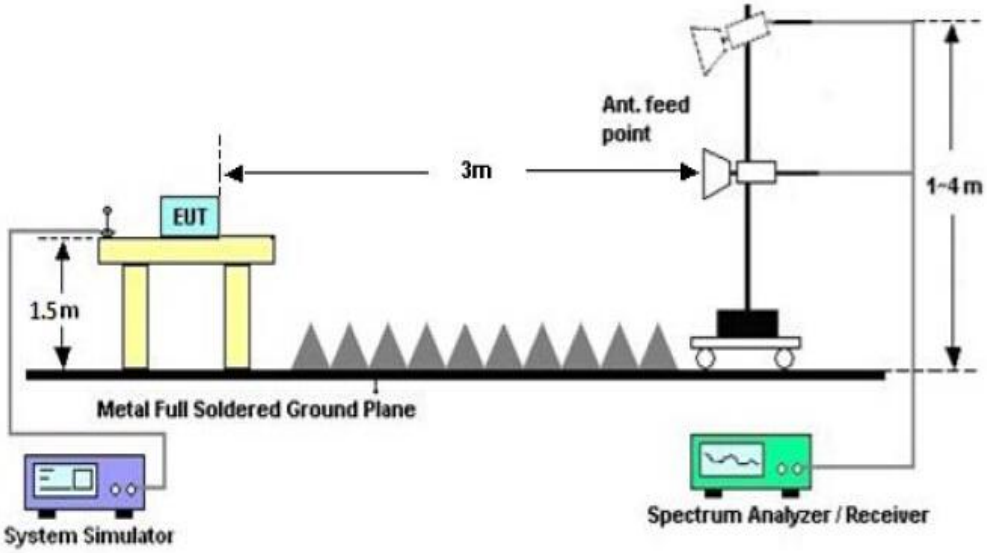
The “Factor” value can be calculated automatically by software of measurement system.

7. BAND EDGE EMISSION

7.1. MEASUREMENT PROCEDURE

1. Set the EUT Work on the top, the bottom operation frequency individually.
2. Set SPA Start or Stop Frequency=Operation Frequency,
   For unrestricted band: RBW=100kHz, VBW=300kHz
   For restricted band: RBW=1MHz, VBW=3*RBW
   Center frequency =Operation frequency
3. The band edges was measured and recorded.

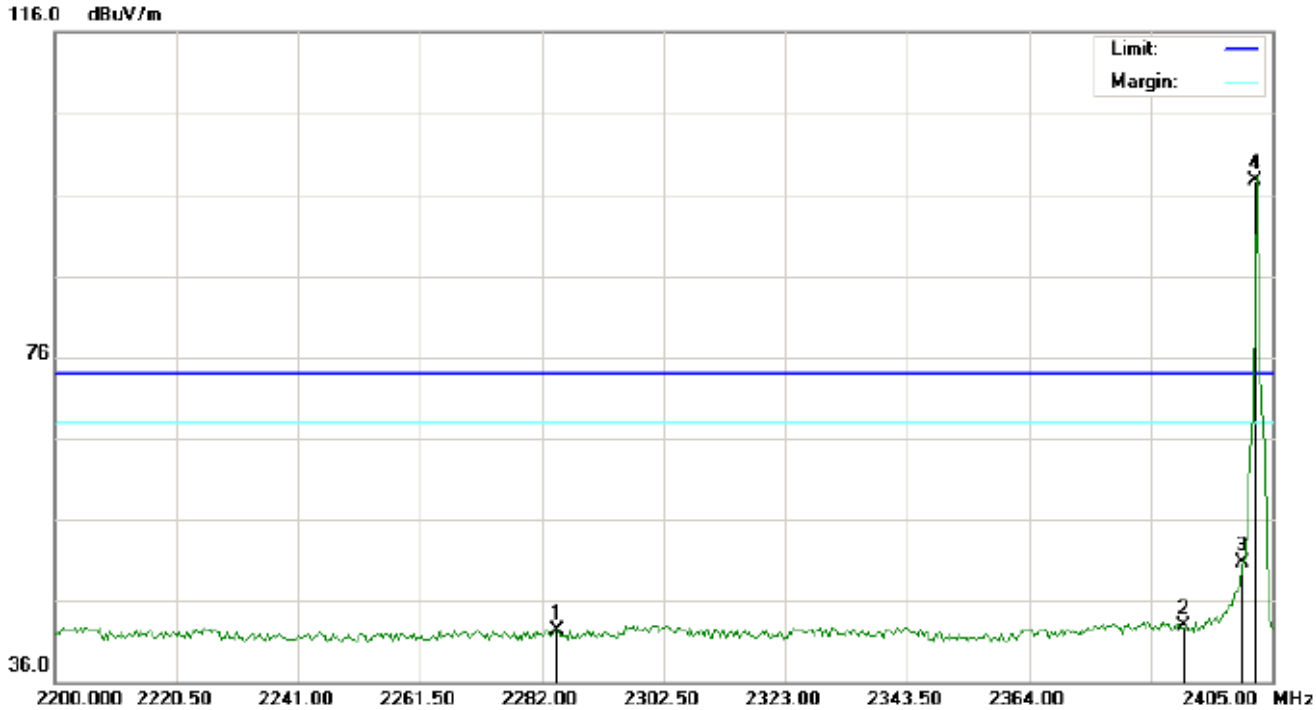
7.2. TEST SET-UP



7.3. TEST RESULT

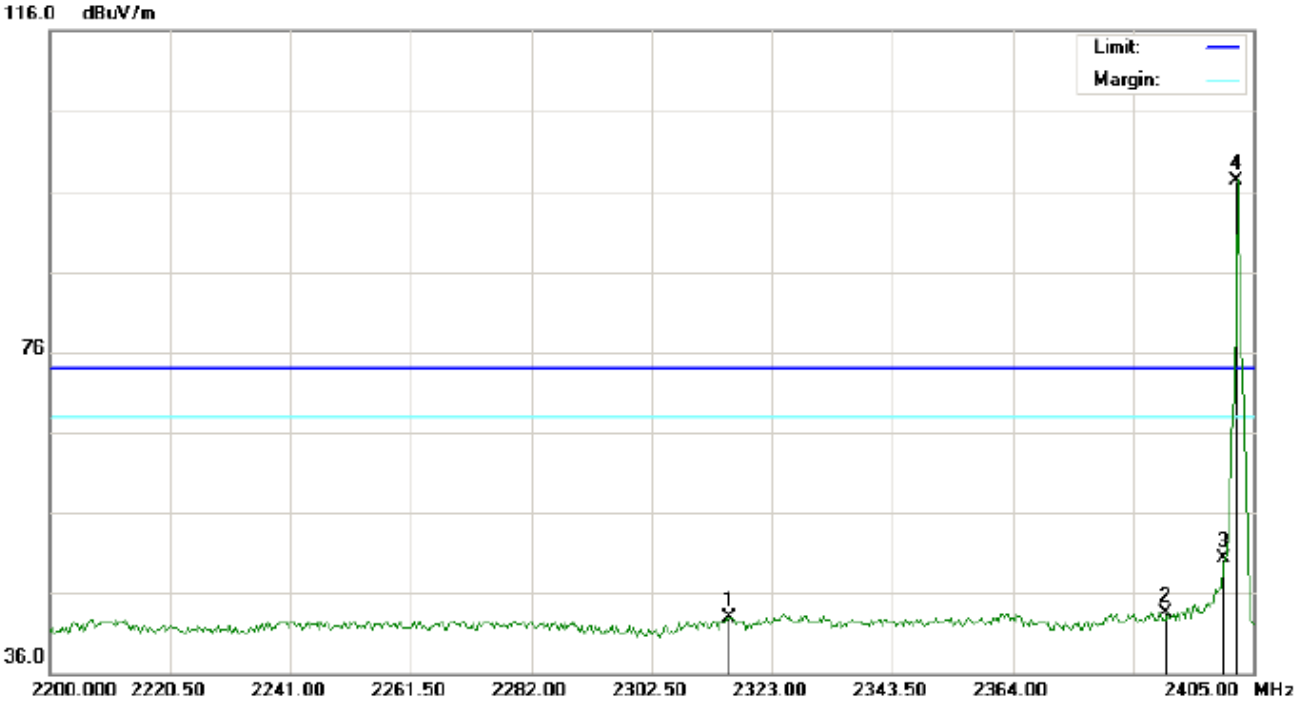
(Worst Modulation: GFSK)

TEST PLOT OF BAND EDGE FOR LOW CHANNEL (1Mbps)-Horizontal



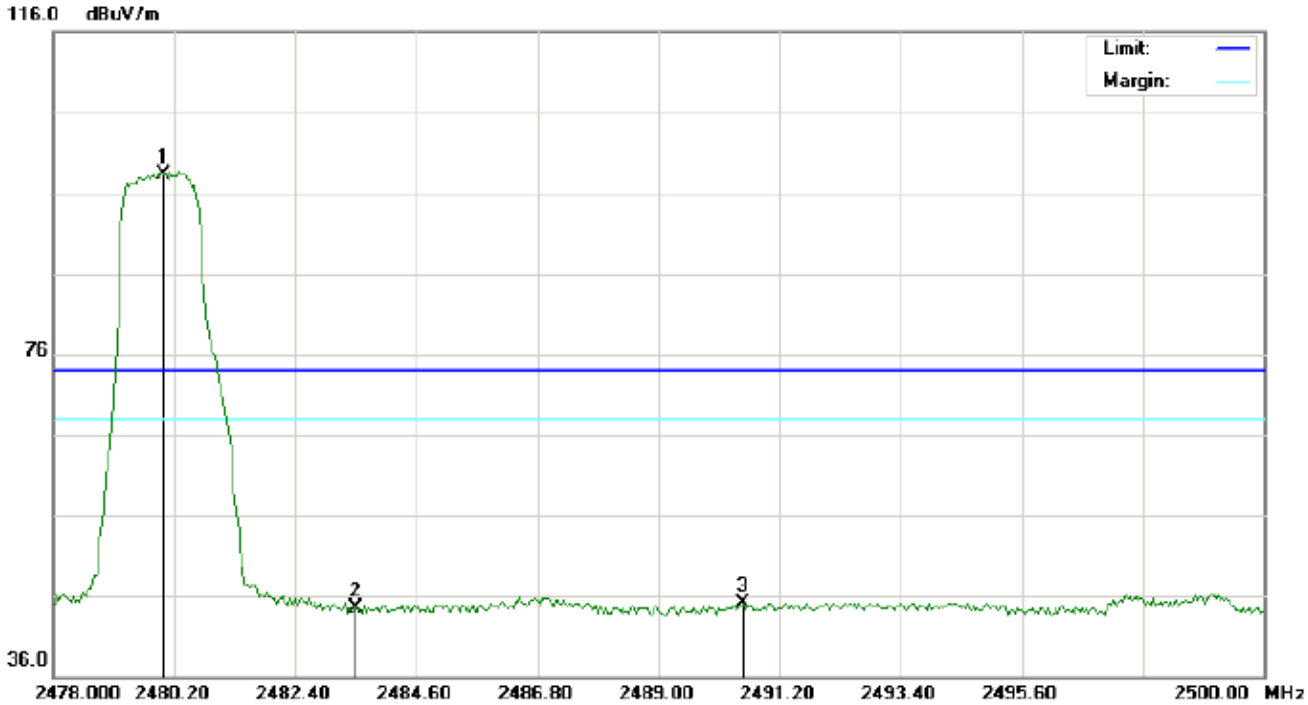
No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		2284.733	32.11	10.19	42.30	74.00	-31.70	peak			
2		2390.000	32.50	10.31	42.81	74.00	-31.19	peak			
3		2400.000	40.47	10.32	50.79	74.00	-23.21	peak			
4	*	2402.000	87.47	10.32	97.79	74.00	23.79	peak			

TEST PLOT OF BAND EDGE FOR LOW CHANNEL (1Mbps)-Vertical



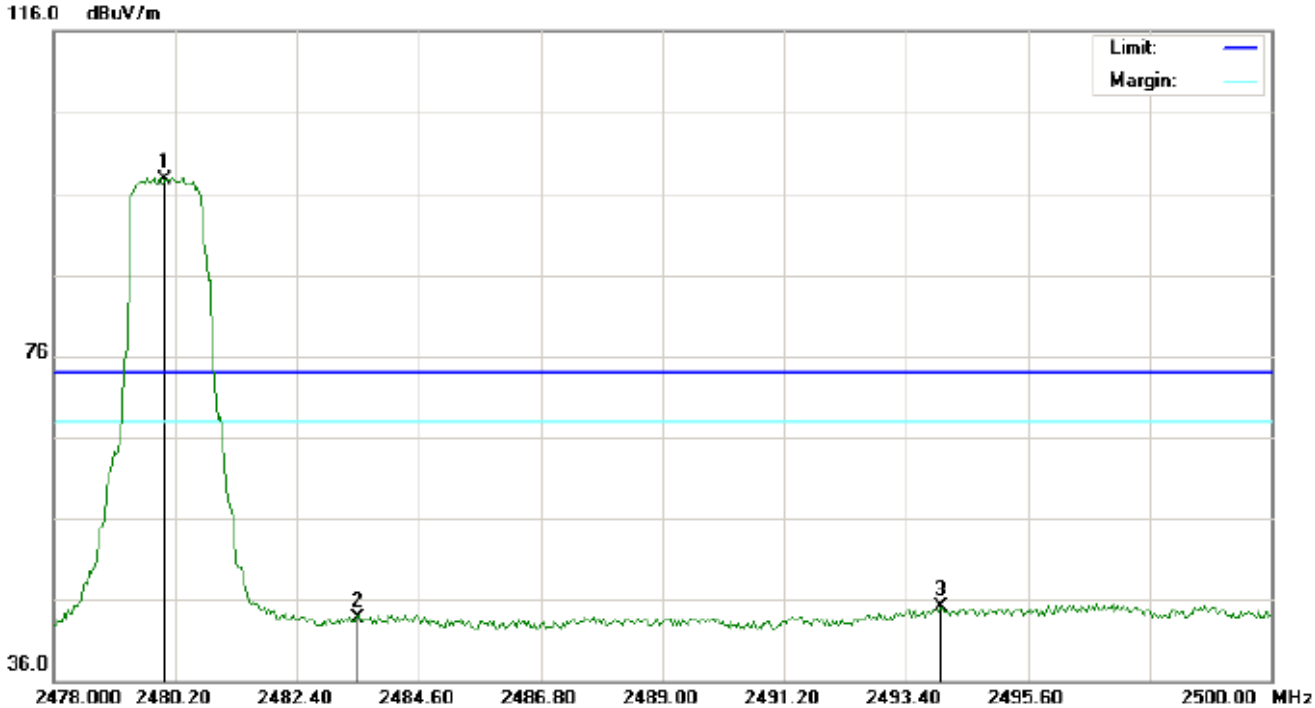
No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	.	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		2315.825	32.75	10.23	42.98	74.00	-31.02	peak			
2		2390.000	33.21	10.31	43.52	74.00	-30.48	peak			
3		2400.000	40.06	10.32	50.38	74.00	-23.62	peak			
4	*	2402.000	86.93	10.32	97.25	74.00	23.25	peak			

TEST PLOT OF BAND EDGE FOR HIGH CHANNEL (1Mbps)-Horizontal



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	2480.000	87.94	10.41	98.35	74.00	24.35	peak			
2		2483.500	34.19	10.41	44.60	74.00	-29.40	peak			
3		2490.539	34.74	10.42	45.16	74.00	-28.84	peak			

TEST PLOT OF BAND EDGE FOR HIGH CHANNEL (1Mbps)-Vertical



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	2480.000	87.32	10.41	97.73	74.00	23.73	peak			
2		2483.500	33.26	10.41	43.67	74.00	-30.33	peak			
3		2494.023	34.62	10.42	45.04	74.00	-28.96	peak			

RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. The “Factor” value can be calculated automatically by software of measurement system.

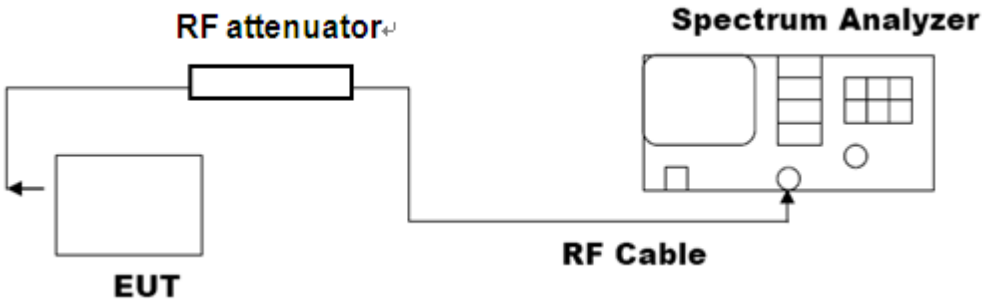
3. Hopping off and Hopping on have been tested and only worst case recorded

8. NUMBER OF HOPPING FREQUENCY

8.1. MEASUREMENT PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer Start = 2.4GHz Stop = 2.4835GHz
4. Set the Spectrum Analyzer as RBW>=1%span, VBW>=3RBW.

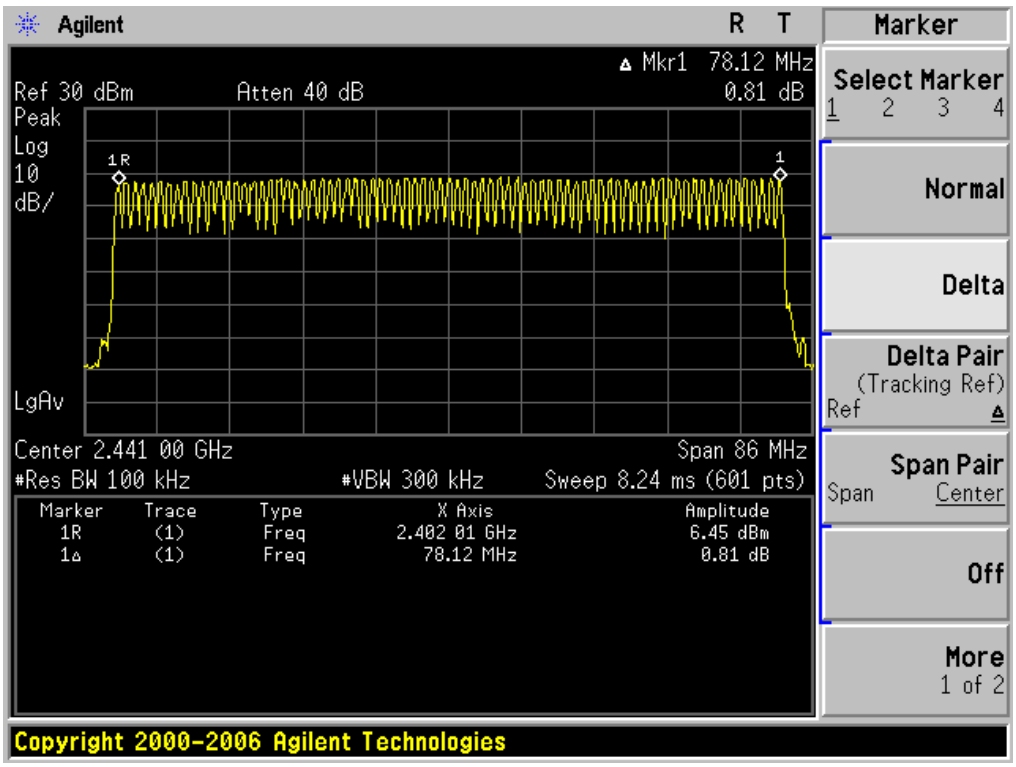
8.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)



8.3. LIMITS AND MEASUREMENT RESULT

TOTAL NO. OF HOPPING CHANNEL	LIMIT (NO. OF CH)	MEASUREMENT (NO. OF CH)	RESULT
	>=15	79	PASS

TEST PLOT FOR NO. OF TOTAL CHANNELS

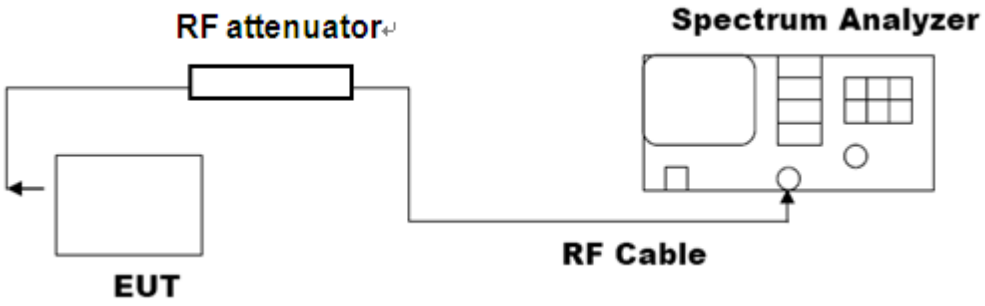


9. TIME OF OCCUPANCY (DWELL TIME)

9.1. MEASUREMENT PROCEDURE

1. Place the EUT on the table and set it in transmitting mode
2. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum analyzer.
3. Set Span = zero span, centered on a hoping channel
4. Set the spectrum analyzer as RBW=1MHz, VBW>=RBW, Span = 0 Hz

9.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)



9.3. LIMITS AND MEASUREMENT RESULT

The Worst Case (3Mbps)

Channel	Time of Pulse for DH5 (ms)	Period Time (s)	Sweep Time (ms)	Limit (ms)
Low	2.898	31.6	309.12	400
Middle	2.898	31.6	309.12	400
High	2.884	31.6	307.63	400

Low Channel Time

2.898*(1600/6)/79*31.6=309.12ms

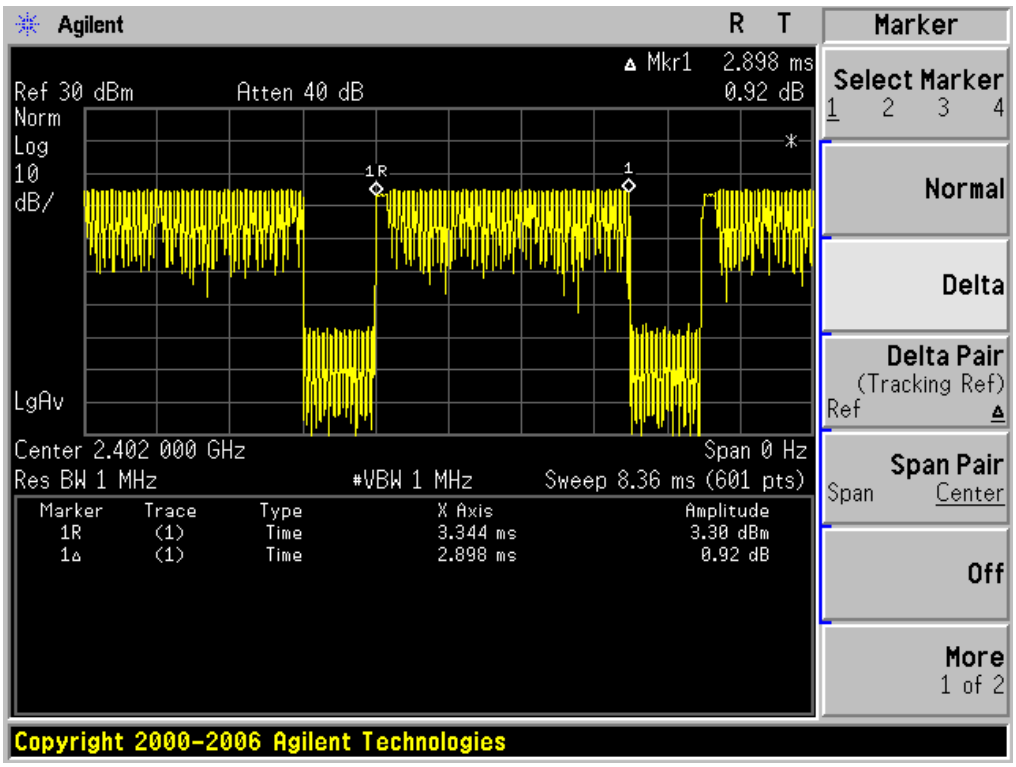
Middle Channel Time

2.898*(1600/6)/79*31.6=309.12ms

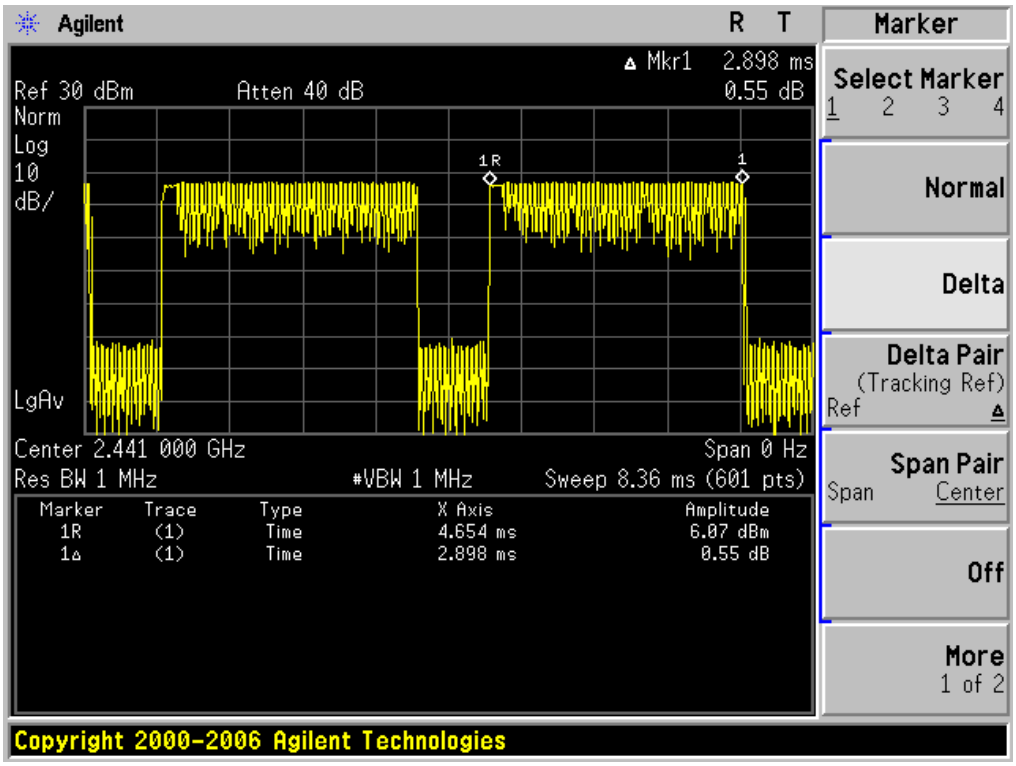
High Channel Time

2.884*(1600/6)/79*31.6=307.63ms

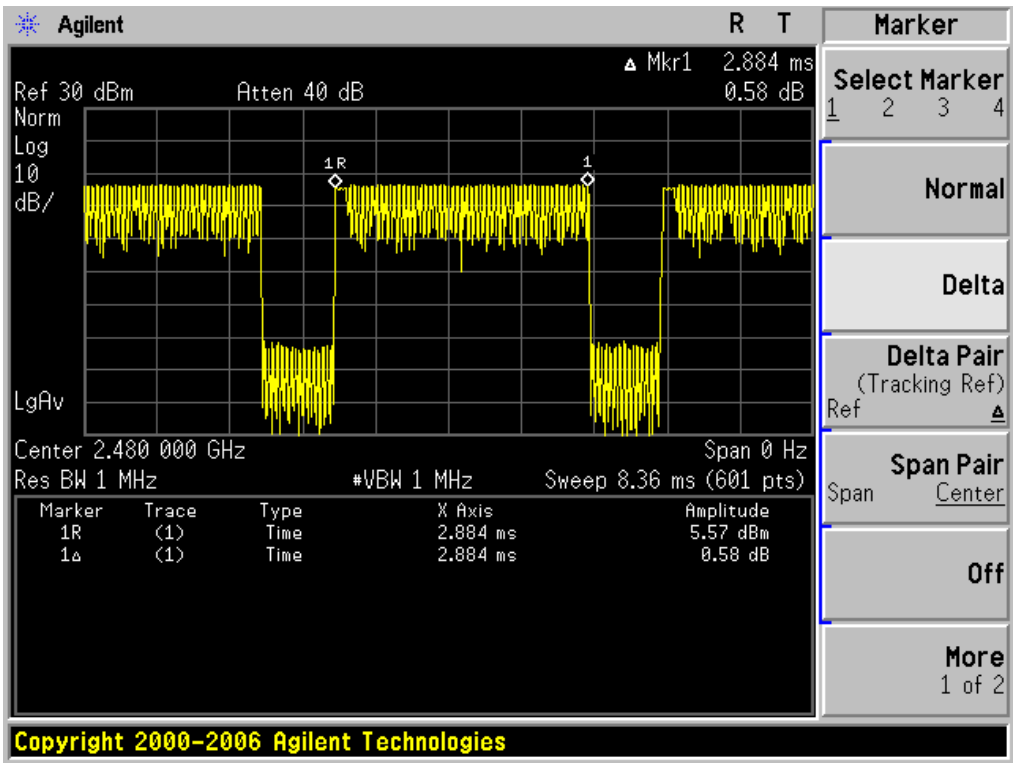
TEST PLOT OF LOW CHANNEL



TEST PLOT OF MIDDLE CHANNEL



TEST PLOT OF HIGH CHANNEL

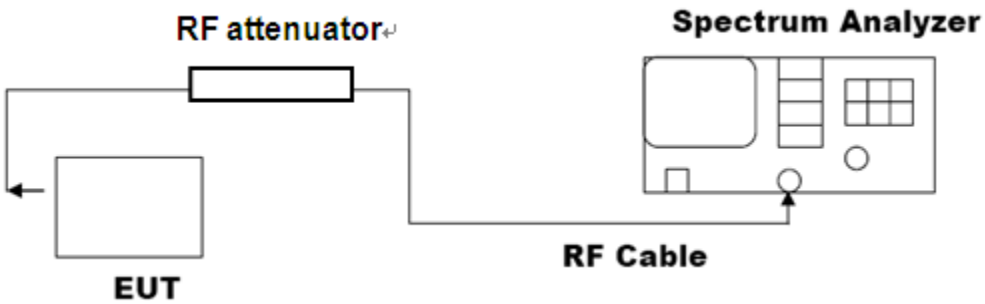


10. FREQUENCY SEPARATION

10.1. MEASUREMENT PROCEDURE

1. Place the EUT on the table and set it in transmitting mode
2. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum analyzer
3. Set Span = wide enough to capture the peaks of two adjacent channels Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span Video (or Average) Bandwidth (VBW) ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold

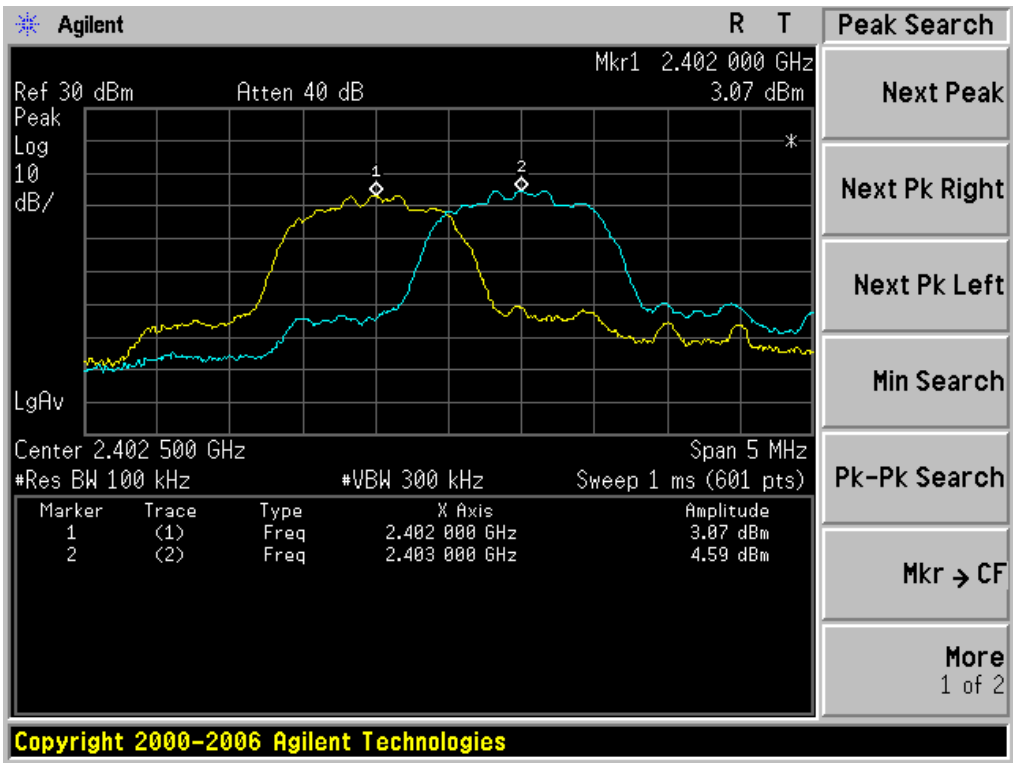
10.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)



10.3. LIMITS AND MEASUREMENT RESULT

CHANNEL	CHANNEL SEPARATION	LIMIT	RESULT
	KHz	KHz	
CH00-CH01	1000	>=25 KHz or 2/3 20 dB BW	Pass

TEST PLOT FOR FREQUENCY SEPARATION（3Mbps）



11. LINE CONDUCTED EMISSION TEST

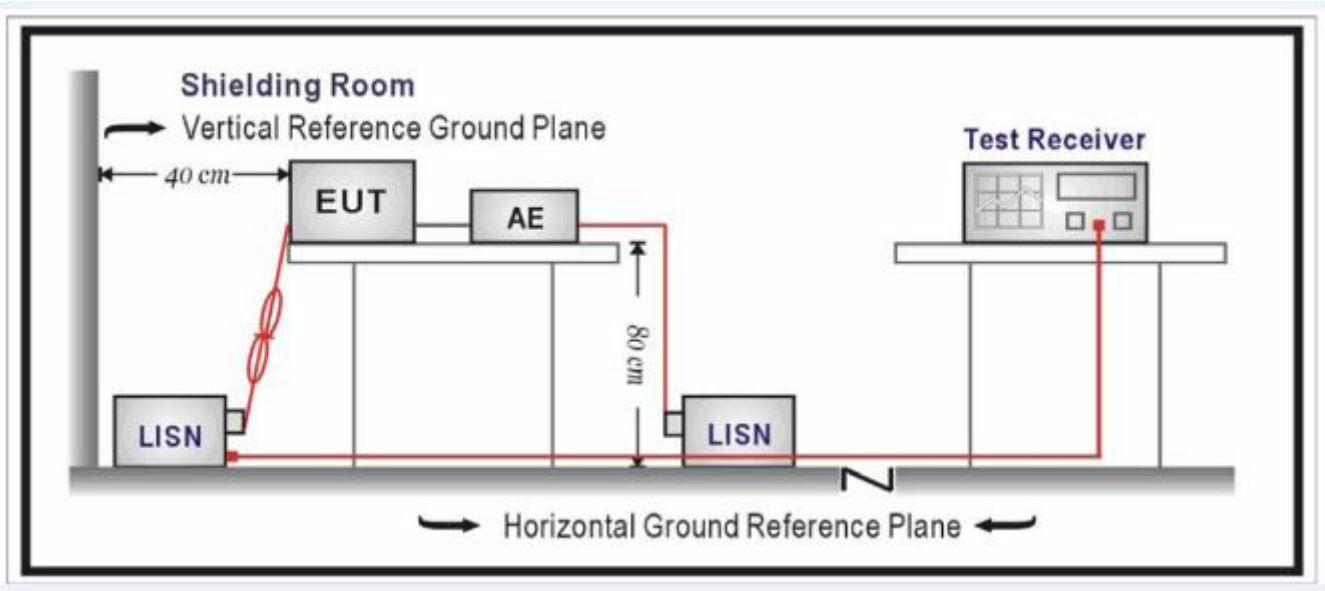
11.1. LIMITS OF LINE CONDUCTED EMISSION TEST

Frequency	Maximum RF Line Voltage	
	Q.P.(dBuV)	Average(dBuV)
150kHz~500kHz	66-56	56-46
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Note:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

11.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST



11.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10, RSS-GEN (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
2. Support equipment, if needed, was placed as per ANSI C63.10, RSS-GEN.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10, RSS-GEN.
4. All support equipments received AC120V/60Hz power from a LISN, if any.
5. The EUT received DC charging voltage by adapter which received 120V/60Hzpower by a LISN.
6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.
9. The test mode(s) were scanned during the preliminary test.

Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

11.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
2. A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less –2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
3. The test data of the worst case condition(s) was reported on the Summary Data page.

11.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST

N/A

Note: The BT was supplied by DC source, it's not applicable to this item.

12. ANTENNA REQUIREMENT

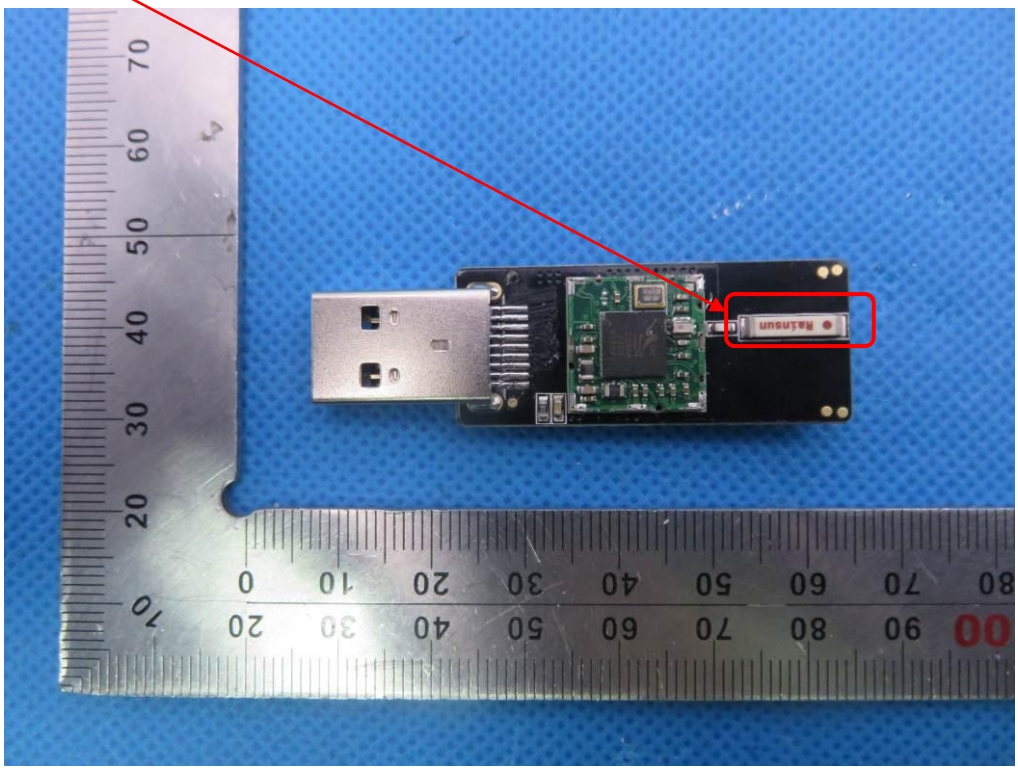
Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203 and RSS-GEN, 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.

Refer to statement below for compliance.

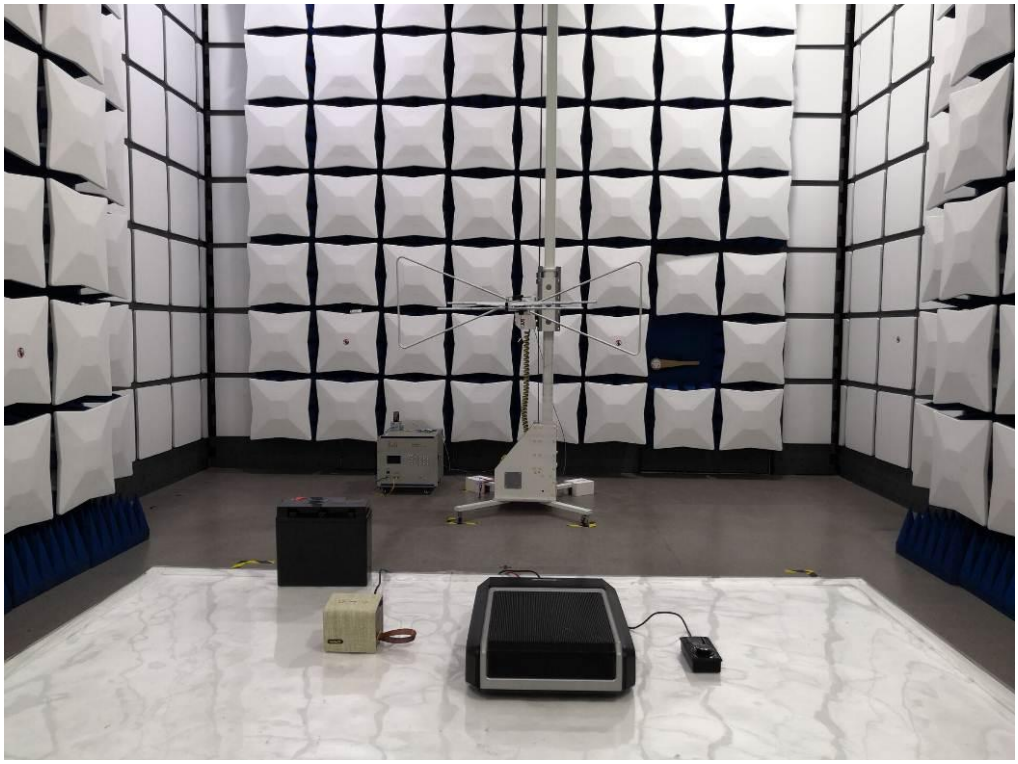
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

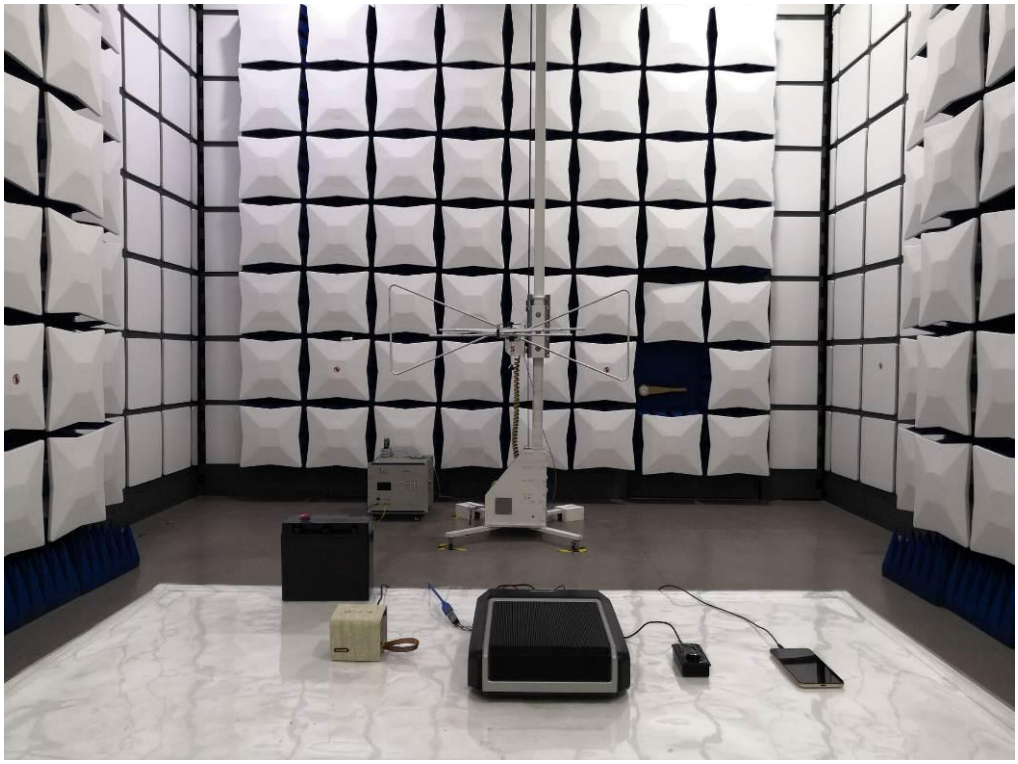
ANTENNA

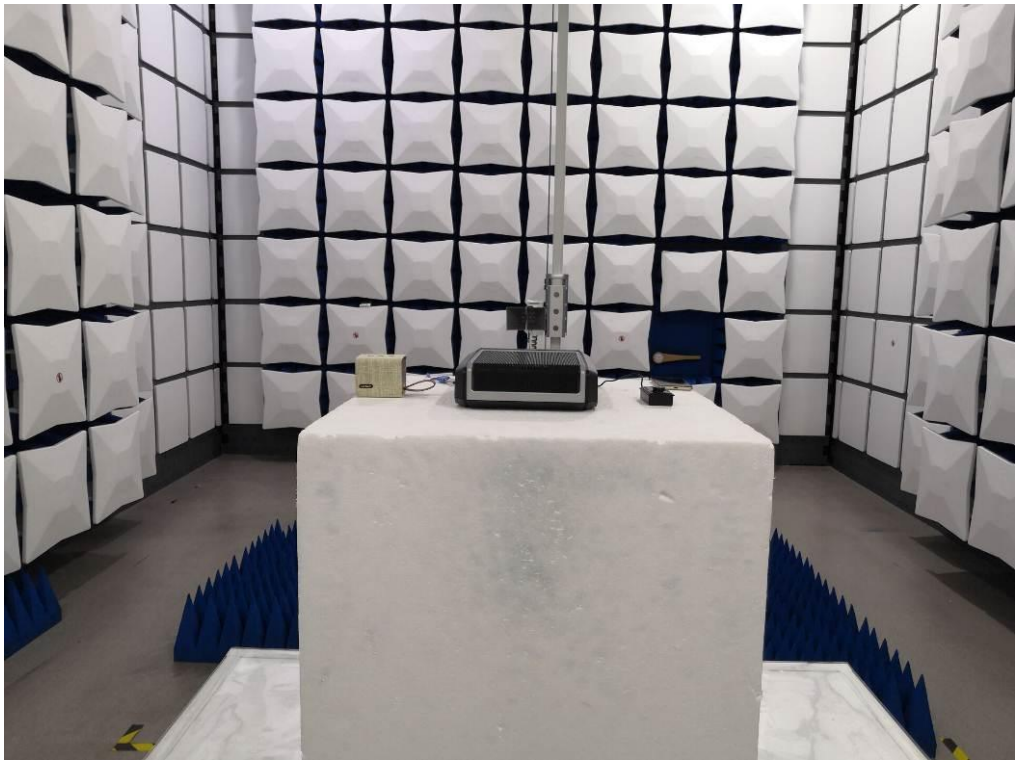


13. PHOTOGRAPH OF TEST

FCC RADIATED EMISSION TEST SETUP







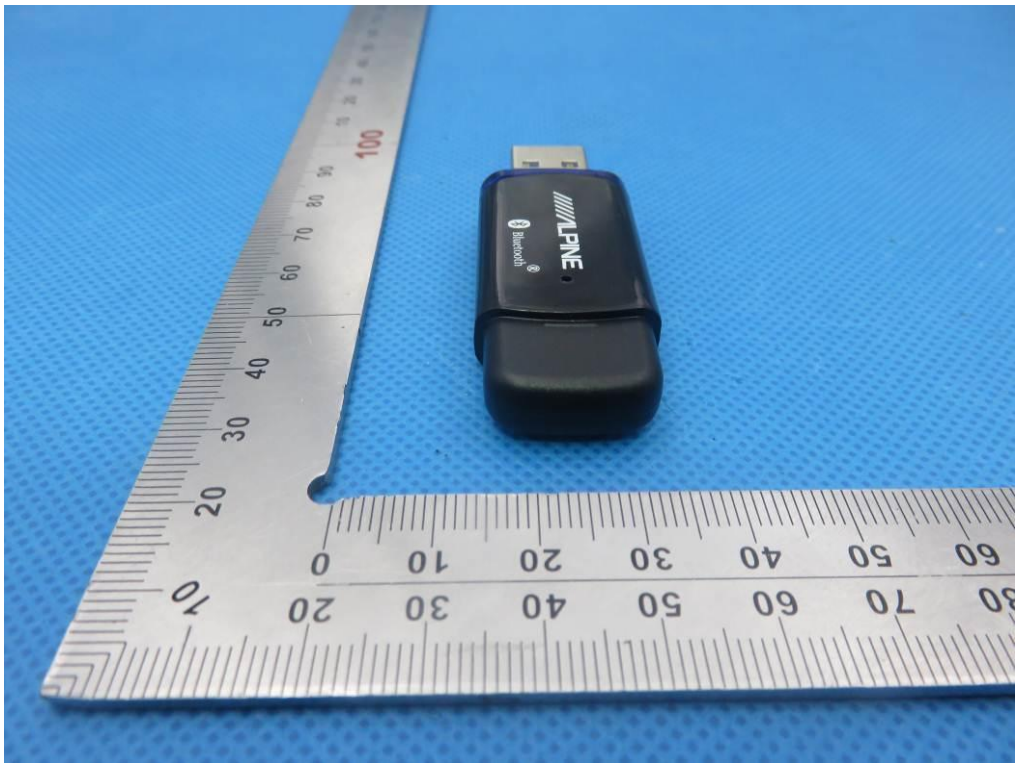
14. PHOTOGRAPHS OF EUT

TOTAL VIEW OF EUT

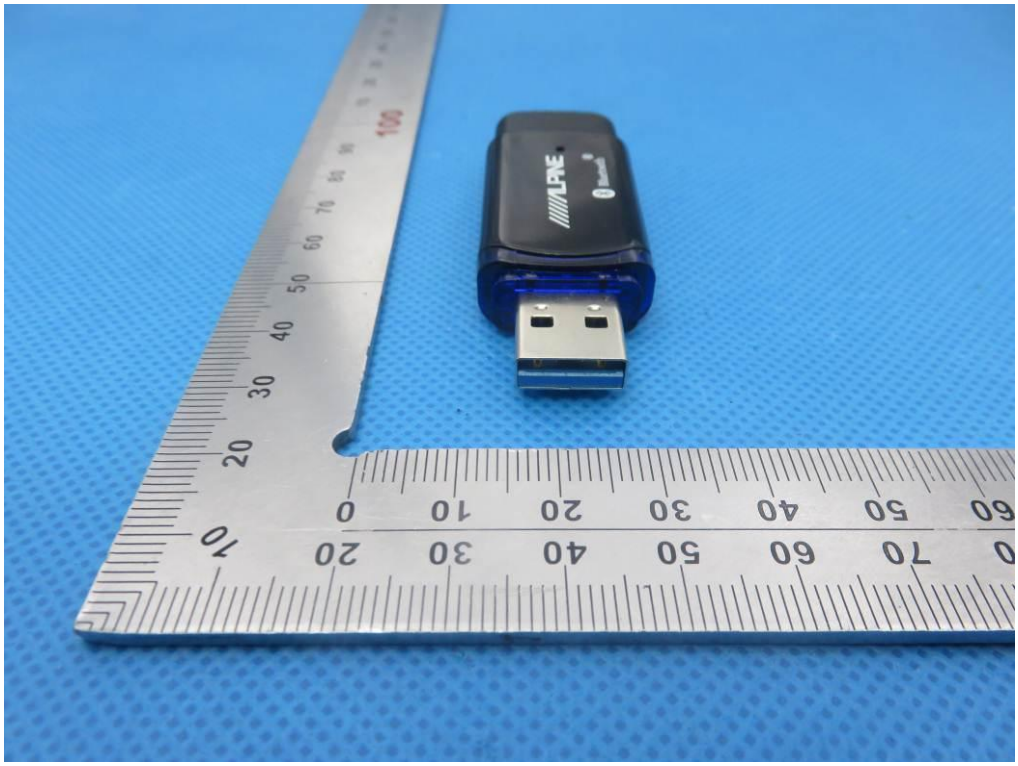
TOP VIEW OF EUT

BOTTOM VIEW OF EUT

FRONT VIEW OF EUT



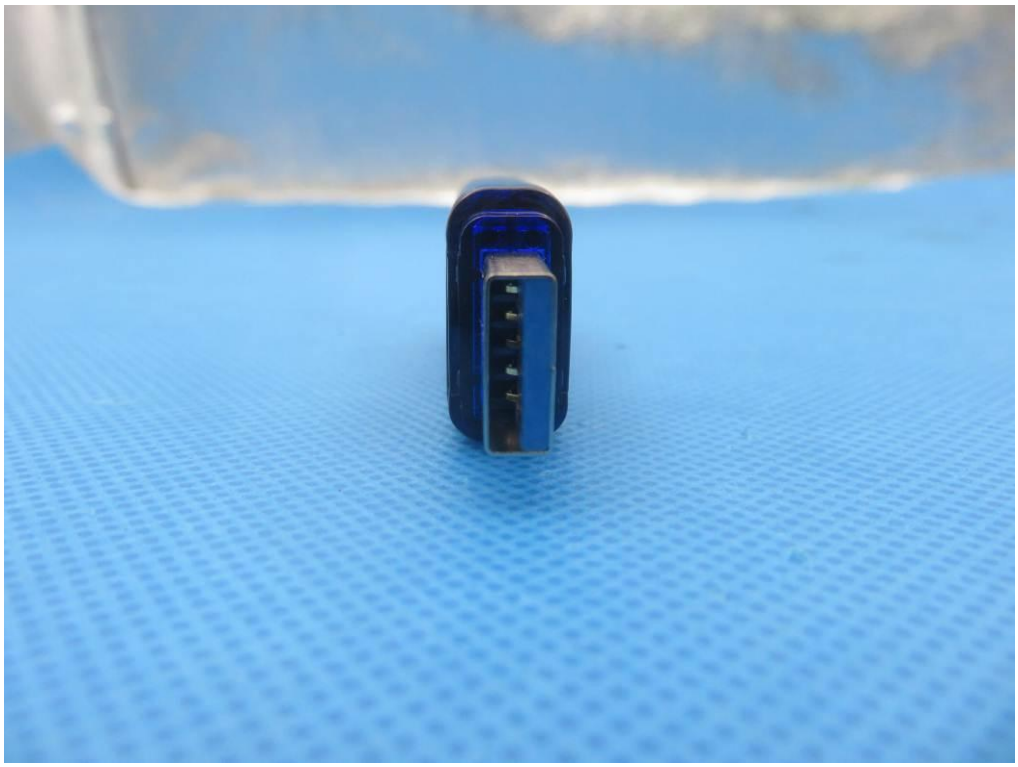
BACK VIEW OF EUT



LEFT VIEW OF EUT

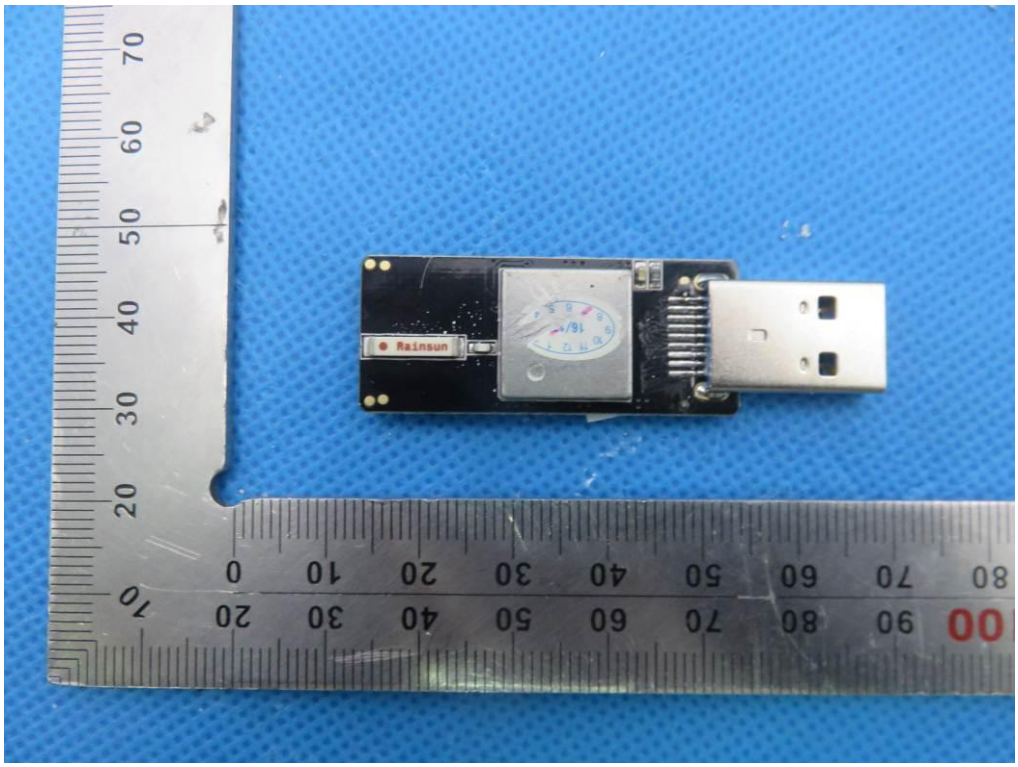
RIGHT VIEW OF EUT

VIEW OF EUT (port)

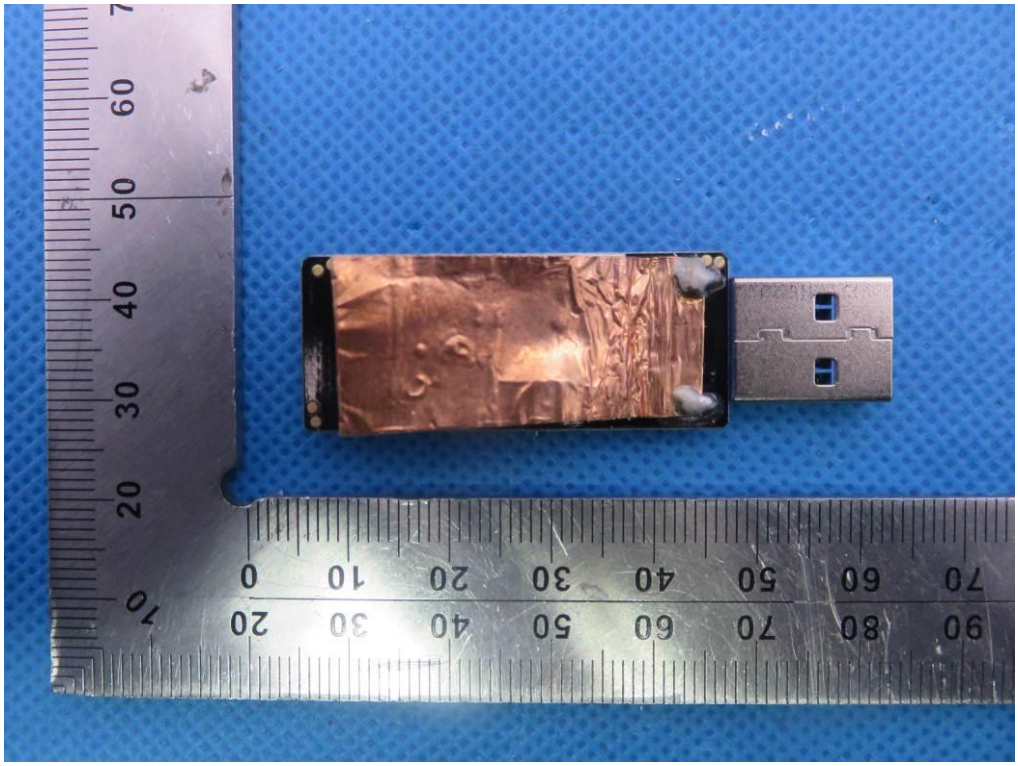


OPEN VIEW OF EUT

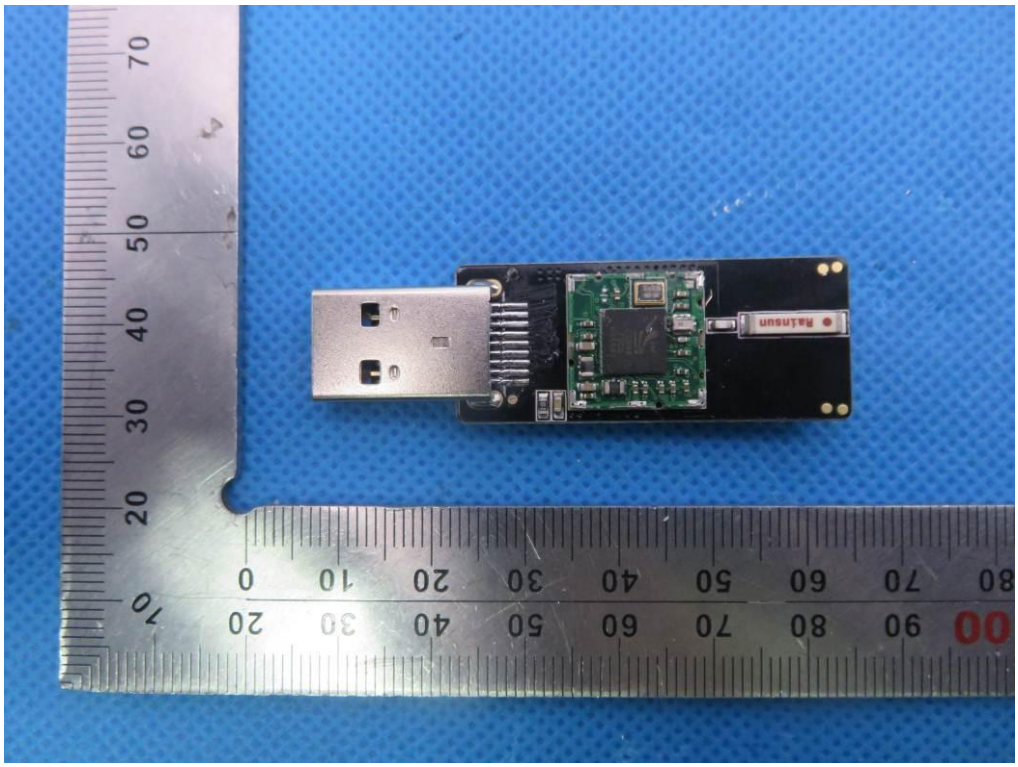
INTERNAL VIEW OF EUT-1



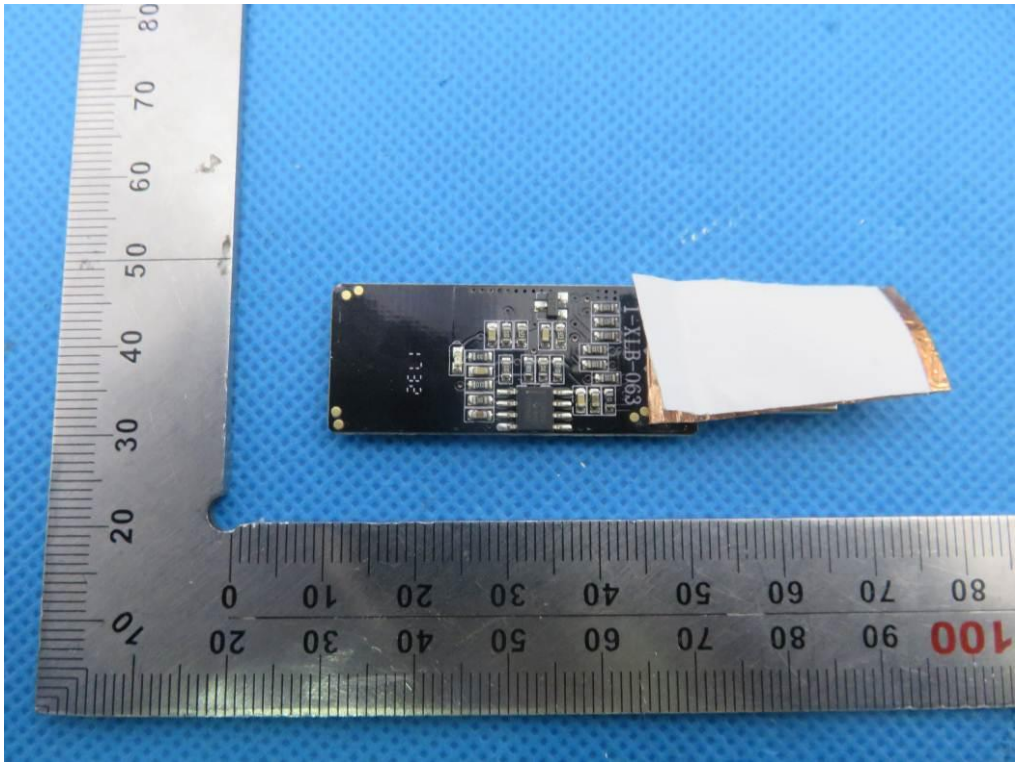
INTERNAL VIEW OF EUT-2



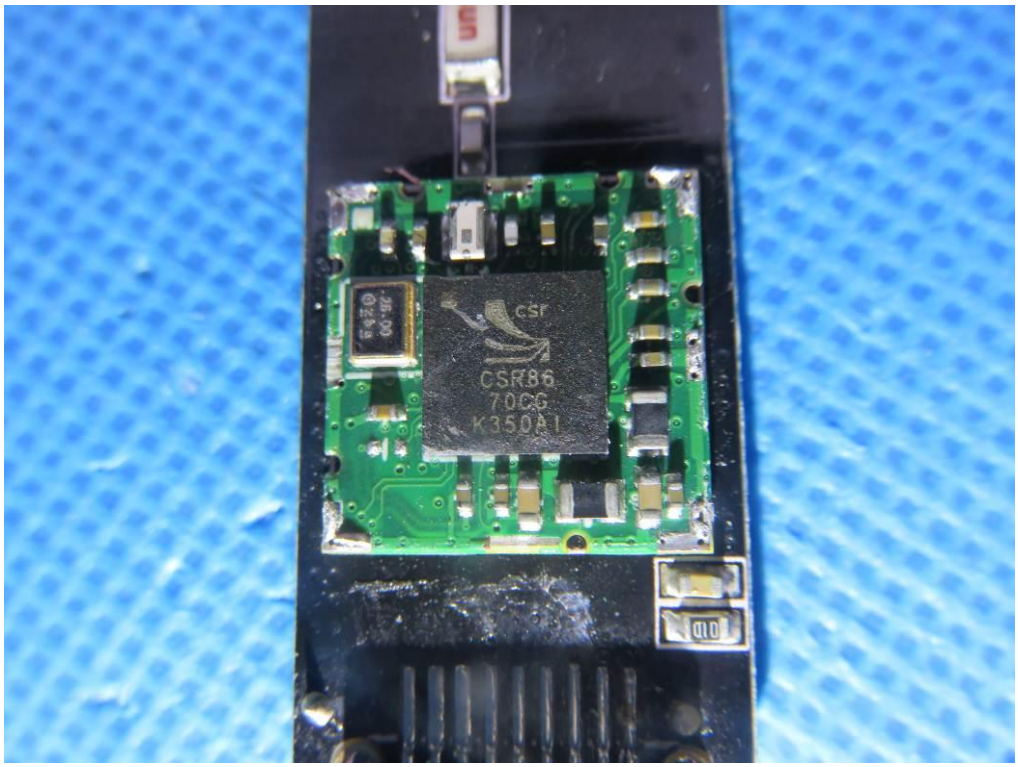
INTERNAL VIEW OF EUT-3



INTERNAL VIEW OF EUT-4



INTERNAL VIEW OF EUT-5



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