



TEST REPORT

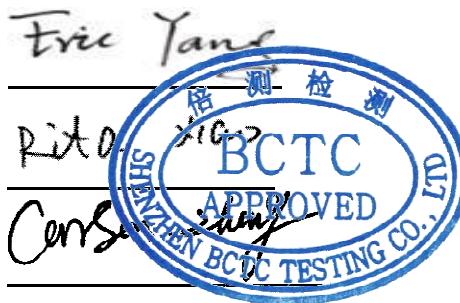
FCC ID: RWCAX8100

Product Name: Wireless keyboard
Trademark: N/A
Model Number: AX8100
Prepared For: AIKUN(CHINA) ELECTRONICS COMPANY LIMITED
Address: A2 BUILDING, LIANHE INDUSTRIAL PARK, FENGTANG ROAD, FUYONG TOWN, SHENZHEN, CHINA
Manufacturer: AIKUN(CHINA) ELECTRONICS COMPANY LIMITED
Address: A2 BUILDING, LIANHE INDUSTRIAL PARK, FENGTANG ROAD, FUYONG TOWN, SHENZHEN, CHINA
Prepared By: Shenzhen BCTC Testing Co., Ltd.
Address: BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road, Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China
Sample Received Date: Jul. 28, 2018
Sample tested Date: Jul. 28, 2018 to Aug. 13, 2018
Issue Date: Aug. 13, 2018
Report No.: BCTC-FY180704224E
Test Standards: FCC Part15.247
ANSI C63.10-2013
Test Results: PASS
Remark: This is 2.4G FHSS radio test report.

Prepared by(Engineer): Eric Yang

Reviewer(Supervisor): Rita Xiao

Approved(Manager): Carson Zhang



The test report is effective only with both signature and specialized stamp. This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen BCTC Testing Co., Ltd, this report can't be reproduced except in full. The tested sample(s) and the sample information are provided by the client.

The Shenzhen BCTC Testing Co., Ltd. designation number : CN1212.



TABLE OF CONTENT

Test Report Declaration	Page
1. VERSION	4
2. TEST SUMMARY	5
3. MEASUREMENT UNCERTAINTY	6
4. PRODUCT INFORMATION AND TEST SETUP	7
4.1 Product Information	7
4.2 Test Setup Configuration	7
4.3 Support Equipment	8
4.4 Channel List	8
4.5 Test Mode	8
5. TEST FACILITY AND TEST INSTRUMENT USED	9
5.1 Test Facility	9
5.2 Test Instrument Used	9
6. CONDUCTED EMISSIONS	11
6.1 Block Diagram Of Test Setup	11
6.2 Limit	11
6.3 Test procedure	11
6.4 Test Result	12
7. RADIATED EMISSIONS	14
7.1 Block Diagram Of Test Setup	14
7.2 Limit	15
7.3 Test procedure	15
7.4 Test Result	18
8. CONDUCTED EMISSION	23
8.1 Block Diagram Of Test Setup	23
8.2 Limit	23
8.3 Test procedure	23
8.4 Test Result	23
9. 20 DB BANDWIDTH	26
9.1 Block Diagram Of Test Setup	26
9.2 Limit	26
9.3 Test procedure	26
9.4 Test Result	27
10. MAXIMUM PEAK OUTPUT POWER	29
10.1 Block Diagram Of Test Setup	29
10.2 Limit	29
10.3 Test procedure	29
10.4 Test Result	30
11. HOPPING CHANNEL SEPARATION	32
11.1 Block Diagram Of Test Setup	32
11.2 Limit	32



11.3	Test procedure	32
11.4	Test Result	33
12.	NUMBER OF HOPPING FREQUENCY	35
12.1	Block Diagram Of Test Setup	35
12.2	Limit	35
12.3	Test procedure	35
12.4	Test Result	36
13.	DWELL TIME	37
13.1	Block Diagram Of Test Setup	37
13.2	Limit	37
13.3	Test procedure	37
13.4	Test Result	38
14.	ANTENNA REQUIREMENT	40
15.	EUT PHOTOGRAPHS	41
16.	EUT TEST SETUP PHOTOGRAPHS	42

(Note: N/A means not applicable)



1. VERSION

Report No.	Issue Date	Description	Approved
BCTC-FY180704224E	Aug. 13, 2018	Original	Valid



2. TEST SUMMARY

The Product has been tested according to the following specifications:

No.	Test Parameter	Clause No	Results
1	Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
2	Conducted Spurious emissions	15.247(d)	PASS
3	Band edge	15.247(d) 15.205(a)	PASS
4	Conducted Emission	15.207	PASS
5	20dB Bandwidth	15.247(a)	PASS
6	Maximum Peak Output Power	15.247(b)	PASS
7	Frequency Separation	15.247(a)	PASS
8	Number of Hopping Frequency	15.247(a)	PASS
9	Dwell time	15.247(a)	PASS
10	Antenna Requirement	15.203	PASS

Note: N/A is an abbreviation for Not Applicable and means this test item is not applicable for this device according to the technology characteristic of device.



3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

RF frequency	1×10^{-7}
RF power, conducted	1.38dB
Conducted spurious emission (30MHz-1GHz)	1.28dB
Conducted spurious emission (1GHz-18GHz)	1.576dB
Radiated Spurious emission (30MHz-1GHz)	4.3dB
Radiated Spurious emission (1GHz-18GHz)	4.5dB
Temperature	0.59 °C
Humidity	5.3%



4. PRODUCT INFORMATION AND TEST SETUP

4.1 Product Information

Model(s): AX8100

Model Description: N/A

Modulation Technology: 2.4G FHSS

Operation Frequency: 2407-2477MHz

Max. RF output power: 2.405dBm

Type of Modulation: GFSK

Antenna installation: PCB antenna

Antenna Gain: 0dBi

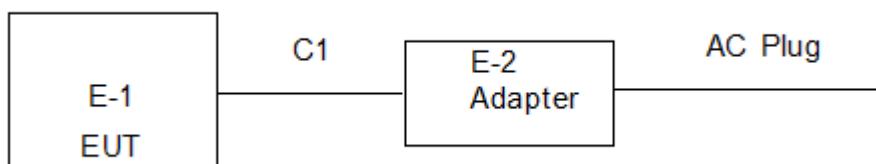
Ratings: Battery DC 3.7V

Adapter: N/A

4.2 Test Setup Configuration

See test photographs attached in *EUT TEST SETUP PHOTOGRAPHS* for the actual connections between Product and support equipment.

Conducted Emission Test



Radiated Spurious Emission





4.3 Support Equipment

No.	Device Type	Brand	Model	Series No.	Note
E-1	Wireless keyboard	N/A	AX8100	N/A	EUT
E-2	Adapter	N/A	BCTC005	N/A	Auxiliary

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.4 Channel List

CH	Frequency (MHz)						
0	2407	4	2421	8	2440	12	2455
1	2408	5	2428	9	2441	13	2467
2	2410	6	2435	10	2442	14	2468
3	2414	7	2437	11	2449	15	2477

4.5 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

The EUT is Continue Transmitting.

The software is installed in operation system, named “RFTestTool” ,Version 1.0.

Test Mode	Test mode	Low channel	Middle channel	High channel
1	Transmitting(GFSK)	2407MHz	2440MHz	2477MHz
2		Transmitting		
3		Charge+Transmitting		



5. TEST FACILITY AND TEST INSTRUMENT USED

5.1 Test Facility

All measurement facilities used to collect the measurement data are located at BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road, Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

5.2 Test Instrument Used

Radiation Test						
Item	Equipment	Manufacturer	Type No.	Serial No.	Cal.Date	Cal.Due date
1	Spectrum Analyzer (9kHz-26.5GHz)	Agilent	E4407B	MY45108040	Aug. 27, 2017	Aug.26, 2018
2	Test Receiver (9kHz-7GHz)	R&S	ESPI	101318	Aug. 27, 2017	Aug.26, 2018
3	Bilog Antenna (30MHz-1GHz)	R&S	VULB 9168	VULB91 68-438	Aug. 27, 2017	Aug.26, 2018
4	Horn Antenna (1GHz-18GHz)	SCHWARZB ECK	BBHA9120D	1201	Sep.03, 2017	Sep.02,2018
5	Horn Antenna (14GHz-40GHz)	SCHWARZB ECK	BBHA 9170	9170-181	Sep.03, 2017	Sep.02,2018
6	Amplifier (9KHz-6GHz)	SCHWARZB ECK	BBV9744	9744-0037	Aug. 27, 2017	Aug.26, 2018
7	Amplifier (1GHz-18GHz)	SCHWARZB ECK	BBV9718	9718-309	Aug. 27, 2017	Aug.26, 2018
8	Amplifier (18GHz-40GHz)	SCHWARZB ECK	BBV 9721	9721-205	Aug. 27, 2017	Aug.26, 2018
9	Loop Antenna (9KHz-30MHz)	SCHWARZB ECK	FMZB1519B	00014	Sep.03, 2017	Sep.02,2018
10	RF cables1 (9kHz-1GHz)	R&S	R203	R20X	Aug. 27, 2017	Aug.26, 2018
11	RF cables2 (1GHz-40GHz)	R&S	R204	R21X	Aug. 27, 2017	Aug.26, 2018
12	Antenna connector	Florida RF Labs	N/A	RF 01#	Aug. 27, 2017	Aug.26, 2018
13	Power Meter	ANRITSU	ML2487A	6K00001568	Aug. 27, 2017	Aug.26, 2018
14	Power Sensor (AV)	ANRITSU	ML2491A	030989	Aug. 27, 2017	Aug.26, 2018
15	Signal Analyzer 9kHz-26.5GHz	Agilent	N9010A	MY48030494	Aug. 27, 2017	Aug.26, 2018
16	Test Receiver 20kHz-40GHz	R&S	ESU 40	100376	Aug. 27, 2017	Aug.26, 2018
17	D.C. Power Supply	LongWei	PS-305D	010964729	Aug. 27, 2017	Aug.26, 2018



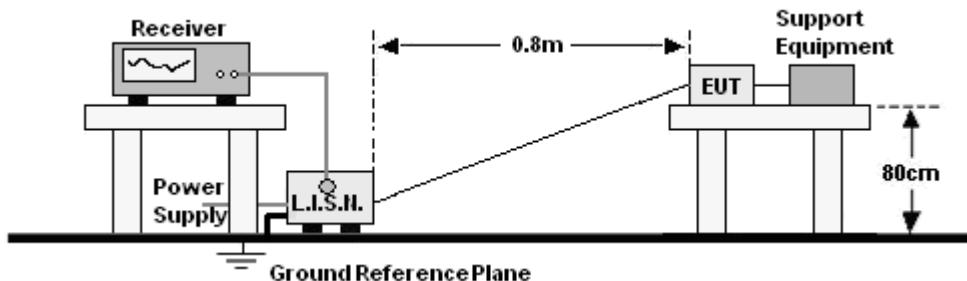
Conduction Test

Item	Equipment	Manufacturer	Type No.	Serial No.	Cal.Date	Cal.Due date
1	Test Receiver	R&S	ESCI	1166.5950K0 3-101165-ha	Aug. 27, 2017	Aug.26, 2018
2	LISN	SCHWARZB ECK	NSLK8127	8127739	Aug. 27, 2017	Aug.26, 2018
3	LISN	R&S	NSLK8126	8126487	Aug. 27, 2017	Aug.26, 2018
4	RF cables	R&S	R204	R20X	Sep.03, 2017	Sep.02,2018
5	Attenuator	R&S	ESH3-Z2	143206	Sep.03, 2017	Sep.02,2018



6. CONDUCTED EMISSIONS

6.1 Block Diagram Of Test Setup



6.2 Limit

FREQUENCY (MHz)	Limit (dBuV)	
	Quas-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

Notes:

1. *Decreasing linearly with logarithm of frequency.
2. The lower limit shall apply at the transition frequencies.

6.3 Test procedure

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

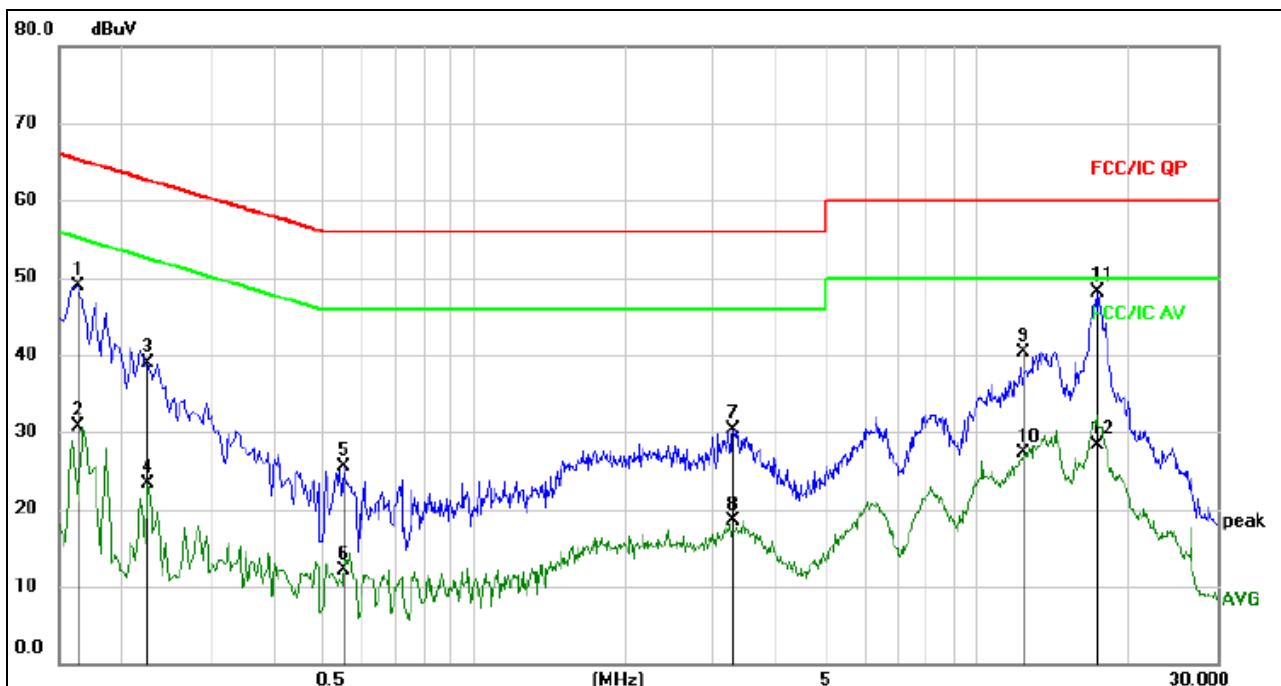
- The Product was placed on a nonconductive table 0.8 m above the horizontal ground reference plane, and 0.4 m from the vertical ground reference plane, and connected to the main through Line Impedance Stability Network (L.I.S.N.).
- The RBW of the receiver was set at 9 kHz in 150 kHz ~ 30MHz with Peak and AVG detector in Max Hold mode. Run the receiver's pre-scan to record the maximum disturbance generated from Product in all power lines in the full band.
- For each frequency whose maximum record was higher or close to limit, measure its QP and AVG values and record.

We pretest AC 120V and AC 240V, the worst voltage was AC 120V and the data recording in the report.



6.4 Test Result

Temperature :	25 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	L
Test Voltage :	AC120V/60Hz	Test Mode :	Mode 3



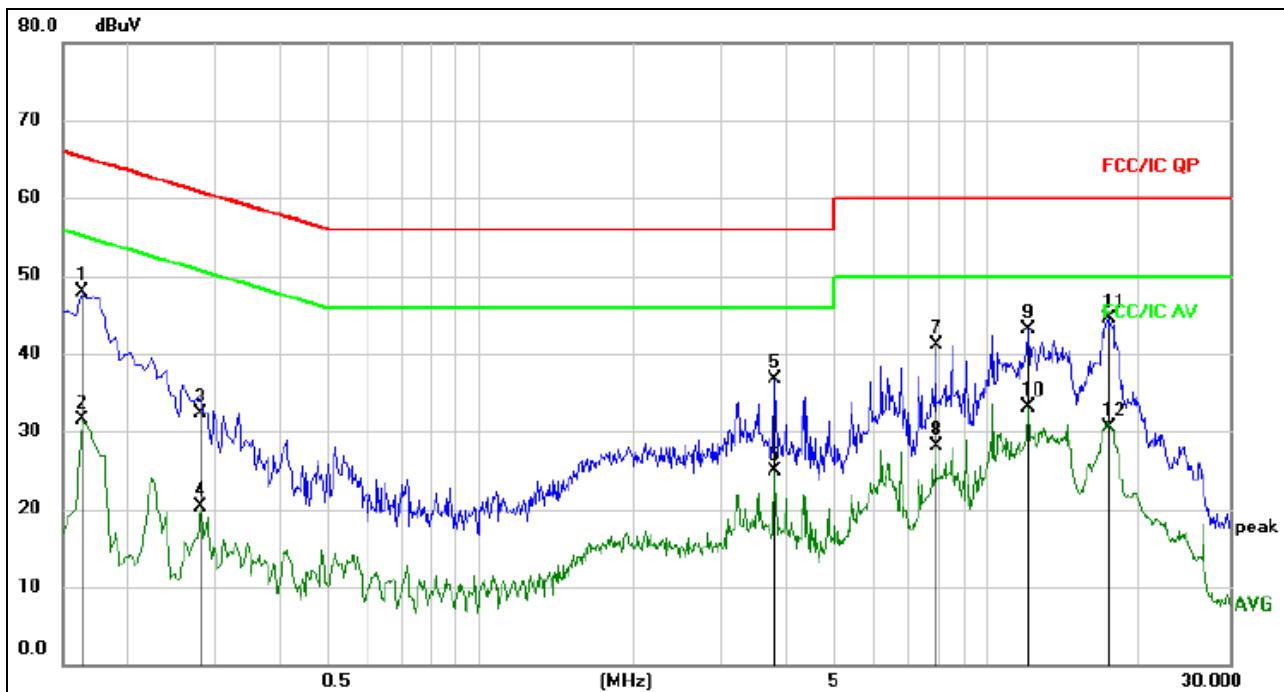
Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

No.	Mk.	Freq. MHz	Reading	Correct	Measure-	Limit	Over	Detector	Comment
			Level dBuV	Factor dB	ment dBuV				
1		0.1635	39.05	9.77	48.82	65.28	-16.46	QP	
2		0.1635	21.02	9.77	30.79	55.28	-24.49	AVG	
3		0.2265	29.15	9.77	38.92	62.58	-23.66	QP	
4		0.2265	13.61	9.77	23.38	52.58	-29.20	AVG	
5		0.5550	15.45	10.02	25.47	56.00	-30.53	QP	
6		0.5550	2.05	10.02	12.07	46.00	-33.93	AVG	
7		3.2775	20.44	9.84	30.28	56.00	-25.72	QP	
8		3.2775	8.72	9.84	18.56	46.00	-27.44	AVG	
9		12.5024	30.32	9.95	40.27	60.00	-19.73	QP	
10		12.5024	17.29	9.95	27.24	50.00	-22.76	AVG	
11	*	17.3580	38.01	10.04	48.05	60.00	-11.95	QP	
12		17.3580	18.28	10.04	28.32	50.00	-21.68	AVG	



Temperature :	25 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	N
Test Voltage :	AC120V/60Hz	Test Mode :	Mode 3



Remark:

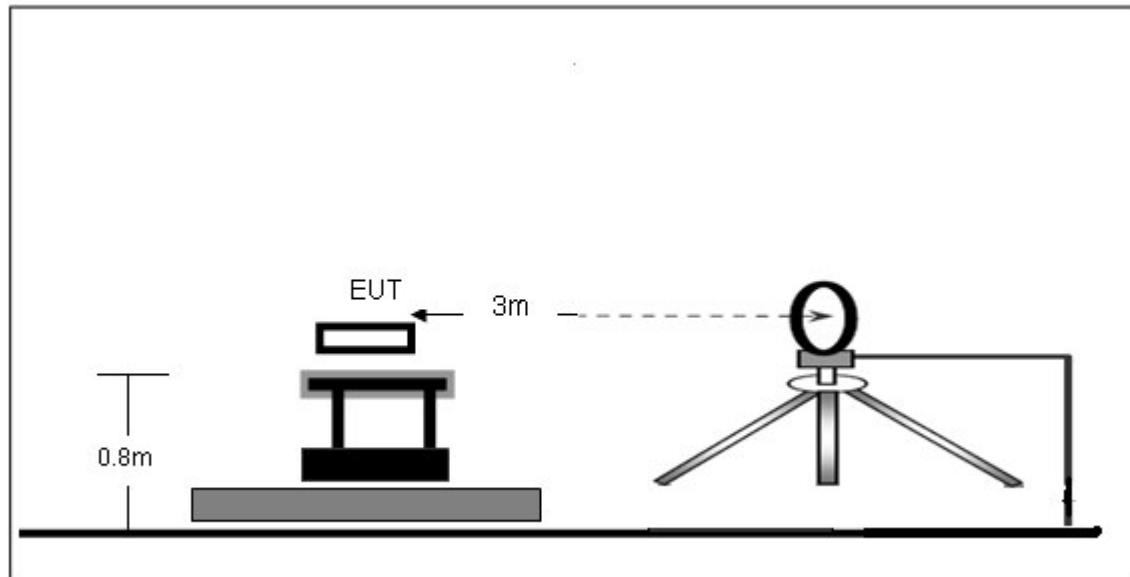
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Detector	Comment
			Level	Factor	ment				
1		0.1635	38.11	9.77	47.88	65.28	-17.40	QP	
2		0.1635	21.79	9.77	31.56	55.28	-23.72	AVG	
3		0.2805	22.53	9.78	32.31	60.80	-28.49	QP	
4		0.2805	10.52	9.78	20.30	50.80	-30.50	AVG	
5		3.8175	26.88	9.86	36.74	56.00	-19.26	QP	
6		3.8175	15.02	9.86	24.88	46.00	-21.12	AVG	
7		7.9260	31.23	9.91	41.14	60.00	-18.86	QP	
8		7.9260	18.20	9.91	28.11	50.00	-21.89	AVG	
9		12.0345	33.17	9.93	43.10	60.00	-16.90	QP	
10		12.0345	23.08	9.93	33.01	50.00	-16.99	AVG	
11	*	17.3040	34.54	10.04	44.58	60.00	-15.42	QP	
12		17.3040	20.49	10.04	30.53	50.00	-19.47	AVG	

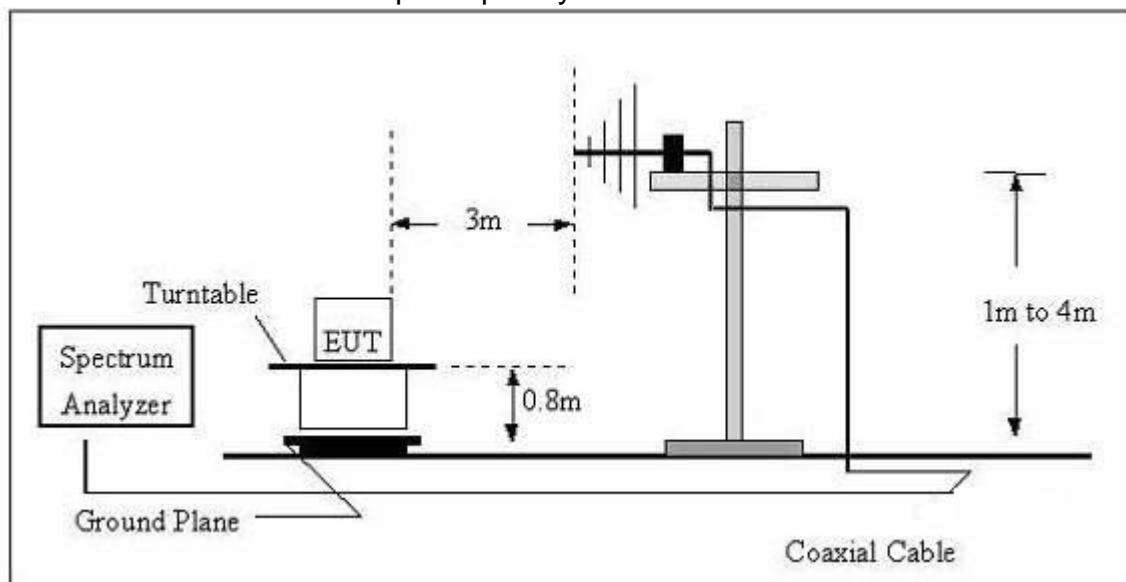
7. RADIATED EMISSIONS

7.1 Block Diagram Of Test Setup

(A) Radiated Emission Test-Up Frequency Below 30MHz

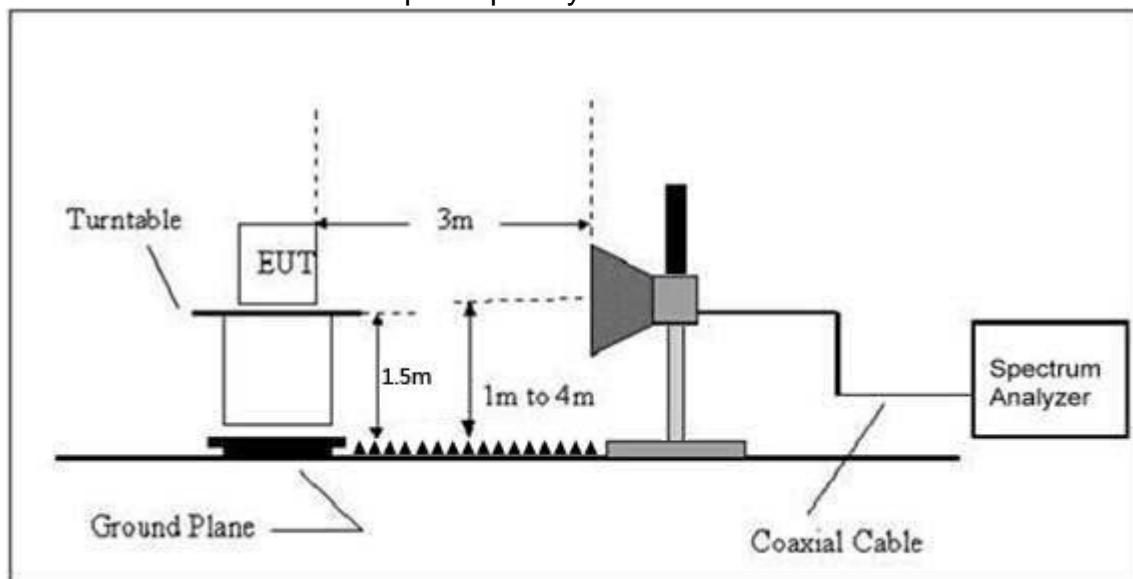


(B) Radiated Emission Test-Up Frequency 30MHz~1GHz





(C) Radiated Emission Test-Up Frequency Above 1GHz



7.2 Limit

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency (MHz)	Field Strength uV/m	Distance (m)	Field Strength Limit at 3m Distance	
			uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	20log ^{(2400/F(kHz))} + 80
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	20log ^{(24000/F(kHz))} + 40
1.705 ~ 30	30	30	100 * 30	20log ⁽³⁰⁾ + 40
30 ~ 88	100	3	100	20log ⁽¹⁰⁰⁾
88 ~ 216	150	3	150	20log ⁽¹⁵⁰⁾
216 ~ 960	200	3	200	20log ⁽²⁰⁰⁾
Above 960	500	3	500	20log ⁽⁵⁰⁰⁾

7.3 Test procedure

Receiver Parameter	Setting
Attenuation	Auto
9kHz~150kHz	RBW 200Hz for QP
150kHz~30MHz	RBW 9kHz for QP
30MHz~1000MHz	RBW 120kHz for QP

Spectrum Parameter	Setting
1-25GHz	RBW 1 MHz /VBW 1 MHz for Peak, RBW 1 MHz / VBW 10Hz for Average



Below 1GHz test procedure as below:

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Above 1GHz test procedure as below:

- g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 metre to 1.5 metre(Above 18GHz the distance is 1 meter and table is 1.5 metre).

- h. Test the EUT in the lowest channel ,the middle channel ,the Highest channel.

Note:

Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

Above 1GHz test procedure as below:

- a.The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b.The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c.The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.



d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. Test the EUT in the lowest channel, the Highest channel.

Note:

Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.



7.4 Test Result

Below 30MHz

Temperature:	25°C	Relative Humidity:	54%
Pressure:	101kPa	Test Voltage :	DC 3.7V
Test Mode :	Mode 2	Polarization :	--

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

Note:

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

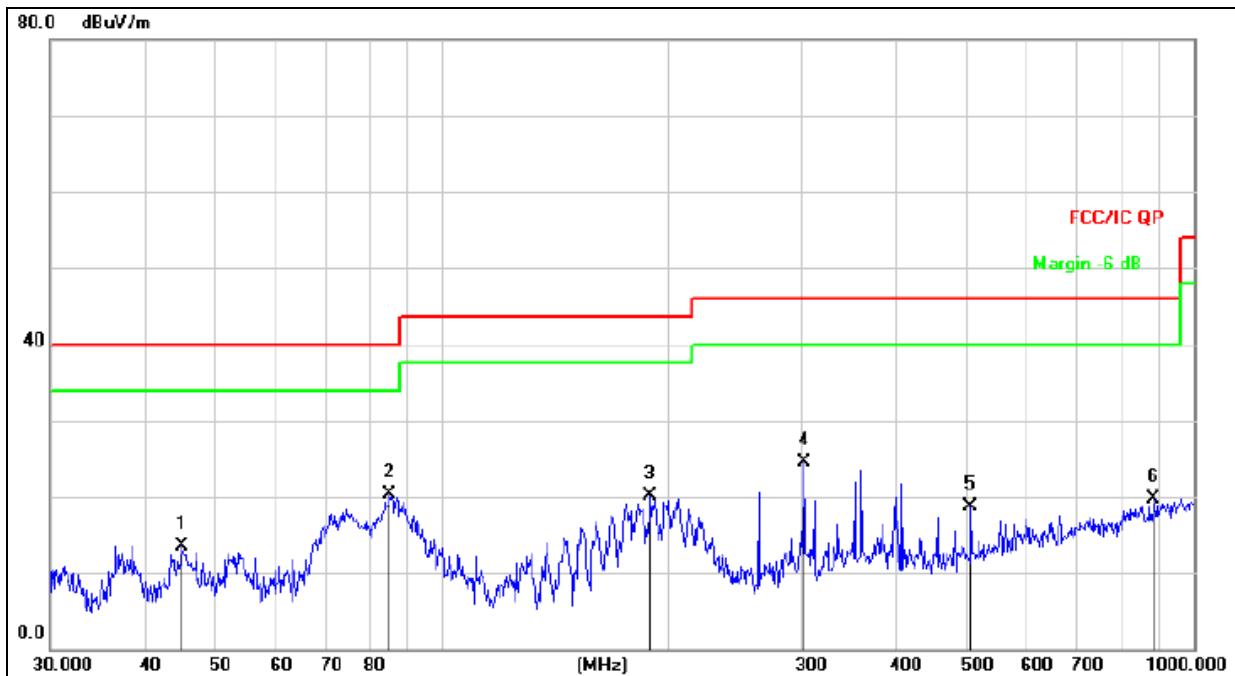
Distance extrapolation factor = $40 \log (\text{specific distance/test distance})$ (dB);

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



Between 30MHz – 1GHz

Temperature:	25°C	Relative Humidity:	54%
Pressure:	101kPa	Test Voltage :	DC 3.7V
Test Mode :	Mode 2	Polarization :	Horizontal



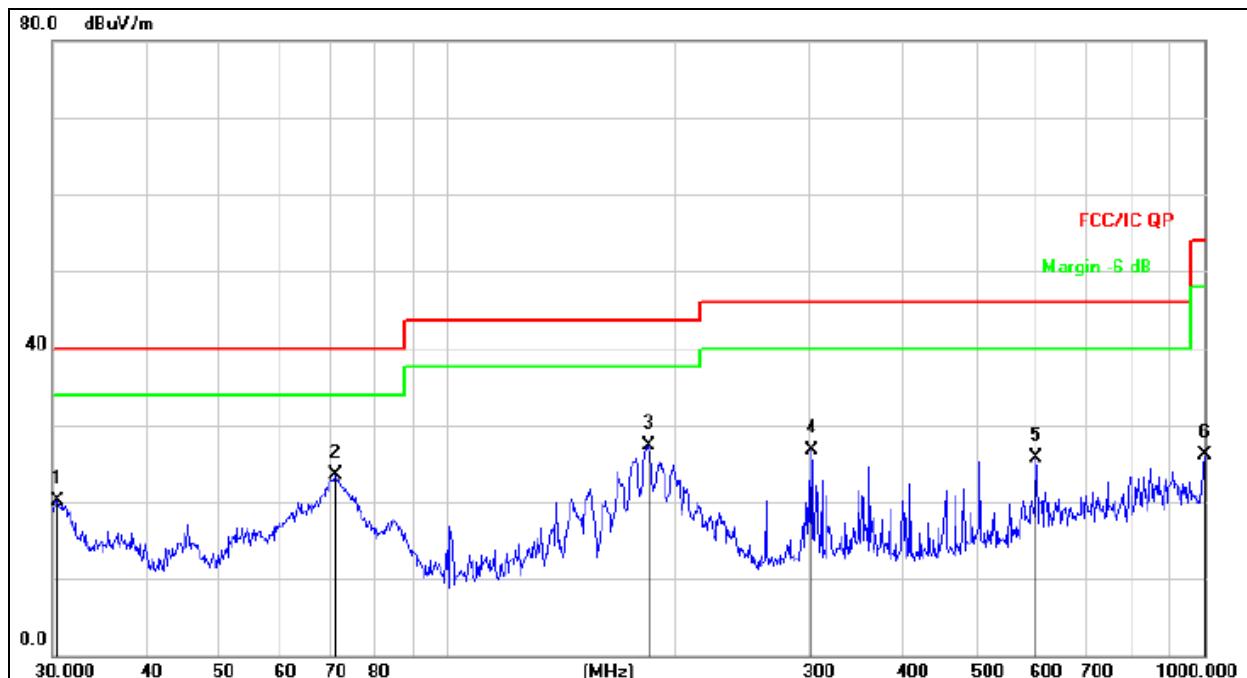
Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		44.9006	27.48	-14.05	13.43	40.00	-26.57	QP
2	*	84.9995	38.76	-18.53	20.23	40.00	-19.77	QP
3		189.0743	37.31	-17.17	20.14	43.50	-23.36	QP
4		302.4812	38.03	-13.47	24.56	46.00	-21.44	QP
5		504.7062	28.00	-9.23	18.77	46.00	-27.23	QP
6		884.5029	22.62	-2.95	19.67	46.00	-26.33	QP



Temperature:	25°C	Relative Humidtity:	54%
Pressure:	101kPa	Test Voltage :	DC 3.7V
Test Mode :	Mode 2	Polarization :	Vertical



Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over
			Level	Factor	ment		
		MHz	dBuV	dB	dBuV/m	dB/m	dB
1		30.4238	36.97	-16.81	20.16	40.00	-19.84
2		71.0803	41.35	-17.81	23.54	40.00	-16.46
3	*	184.4898	45.02	-17.63	27.39	43.50	-16.11
4		302.4812	40.12	-13.47	26.65	46.00	-19.35
5		599.3212	32.37	-6.74	25.63	46.00	-20.37
6		1000.000	27.58	-1.54	26.04	54.00	-27.96

Between 1-25GHz



Polar (H/V)	Frequency	Meter Reading	Pre-ampli fier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	

GFSK Low Channel:2407MHz

V	4814.00	54.17	39.55	7.57	25.45	47.64	74.00	-26.36	PK
V	4814.00	43.66	39.55	7.57	25.45	37.13	54.00	-16.87	AV
V	7221.00	54.83	38.33	7.35	24.78	48.63	74.00	-25.37	PK
V	7221.00	43.25	38.33	7.35	24.78	37.05	54.00	-16.95	AV
V	15450.00	54.67	35.23	6.42	26.47	52.33	74.00	-21.67	PK
H	4814.00	50.39	35.23	6.42	26.47	48.05	74.00	-25.95	PK
H	4814.00	43.21	39.55	7.57	25.45	36.68	54.00	-17.32	AV
H	7221.00	52.38	39.55	7.57	25.45	45.85	74.00	-28.15	PK
H	7221.00	43.33	38.33	7.35	24.78	37.13	54.00	-16.87	AV
H	15450.00	54.08	35.23	6.42	26.47	51.74	74.00	-22.26	PK

Polar (H/V)	Frequency	Meter Reading	Pre-ampli fier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	

GFSK Middle Channel:2440MHz

V	4880.00	52.93	39.55	7.57	25.45	46.40	74.00	-27.60	PK
V	4880.00	43.51	39.55	7.57	25.45	36.98	54.00	-17.02	AV
V	7320.00	54.42	38.33	7.35	24.78	48.22	74.00	-25.78	PK
V	7320.00	43.63	38.33	7.35	24.78	37.43	54.00	-16.57	AV
V	15450.00	51.37	35.23	6.42	26.47	49.03	74.00	-24.97	PK
H	4880.00	51.31	35.23	6.42	26.47	48.97	74.00	-25.03	PK
H	4880.00	43.61	39.55	7.57	25.45	37.08	54.00	-16.92	AV
H	7320.00	53.55	39.55	7.57	25.45	47.02	74.00	-26.98	PK
H	7320.00	43.60	38.33	7.35	24.78	37.40	54.00	-16.60	AV
H	15450.00	52.63	35.23	6.42	26.47	50.29	74.00	-23.71	PK

Polar (H/V)	Frequency	Meter Reading	Pre-ampli fier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	

GFSK High Channel:2477MHz

V	4954.00	51.28	39.55	7.57	25.45	44.75	74.00	-29.25	PK
V	4954.00	43.20	39.55	7.57	25.45	36.67	54.00	-17.33	AV
V	7431.00	51.55	38.33	7.35	24.78	45.35	74.00	-28.65	PK
V	7431.00	43.51	38.33	7.35	24.78	37.31	54.00	-16.69	AV
V	15450.00	53.37	35.23	6.42	26.47	51.03	74.00	-22.97	PK
H	4954.00	50.96	35.23	6.42	26.47	48.62	74.00	-25.38	PK
H	4954.00	43.98	39.55	7.57	25.45	37.45	54.00	-16.55	AV
H	7431.00	50.35	39.55	7.57	25.45	43.82	74.00	-30.18	PK
H	7431.00	43.54	38.33	7.35	24.78	37.34	54.00	-16.66	AV
H	15450.00	51.99	35.23	6.42	26.47	49.65	74.00	-24.35	PK

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier,
Margin= Emission Level - Limit
2. If peak below the average limit, the average emission was no test.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value
has no need to be reported.



Radiated Band edge Emission

Temperature:	25°C	Relative Humidity:	54%
Pressure:	101kPa	Test Voltage :	DC 3.7V
Test Mode :	Mode 1	Polarization :	

Radiated Bandedge Emission

Modulation	Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre- amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission evel (dBuV/m)	Limits (dBuV/m)		Result
								PK	PK	
Low Channel 2407MHz										
GFSK	H	2390.00	57.14	38.06	7.42	20.15	46.65	74.00	54.00	PASS
	H	2400.00	56.25	38.06	7.42	20.15	45.76	74.00	54.00	PASS
	V	2390.00	55.48	38.06	7.42	20.15	44.99	74.00	54.00	PASS
	V	2400.00	61.05	38.06	7.42	20.15	50.56	74.00	54.00	PASS
	High Channel 2477MHz									
	H	2483.50	56.45	38.17	7.45	20.54	46.27	74.00	54.00	PASS
	H	2485.50	53.14	38.17	7.45	20.54	42.96	74.00	54.00	PASS
	V	2483.50	62.14	38.20	7.45	20.54	52.93	74.00	54.00	PASS
	V	2485.50	57.16	38.20	7.45	20.54	46.95	74.00	54.00	PASS

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier,
Margin= Emission Level - Limit
2. If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

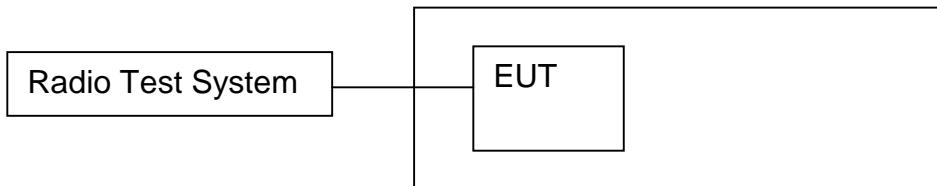
All the modulation modes have been tested, and the worst result was report as below:

Note: (1) All other emissions more than 20dB below the limit.



8. CONDUCTED EMISSION

8.1 Block Diagram Of Test Setup



8.2 Limit

Regulation 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 conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated 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) (see §15.205(c)).

8.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;

2. Set the spectrum analyzer:

Below 30MHz:

RBW = 100kHz, VBW = 300kHz, Sweep = auto

Detector function = peak, Trace = max hold

Above 30MHz:

RBW = 100KHz, VBW = 300KHz, Sweep = auto

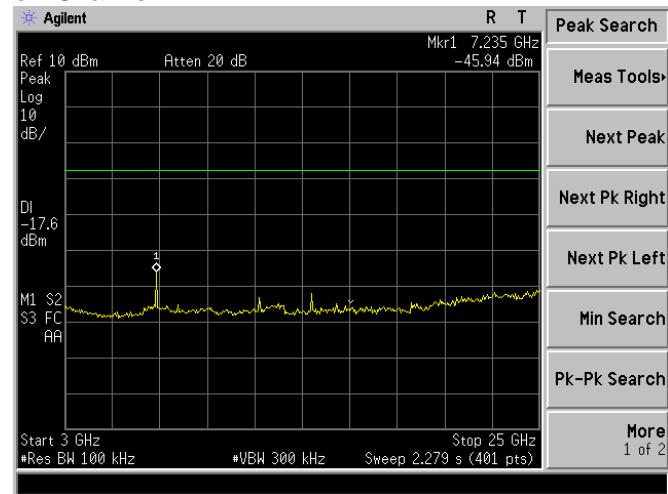
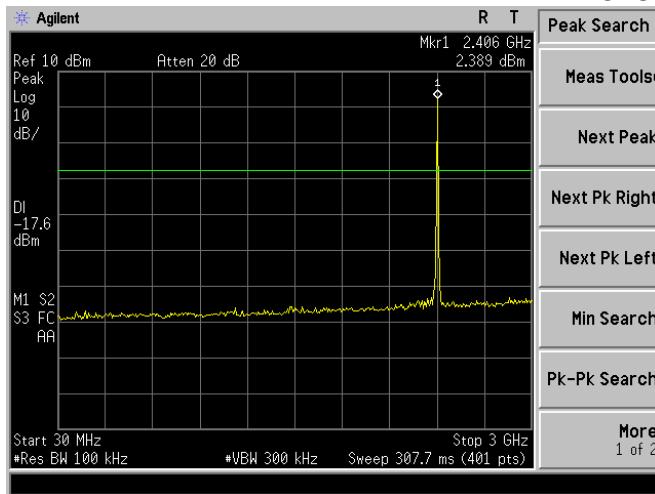
Detector function = peak, Trace = max hold

8.4 Test Result

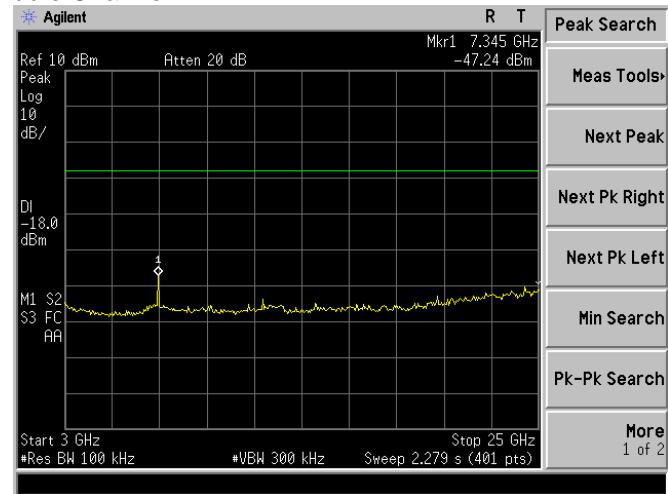
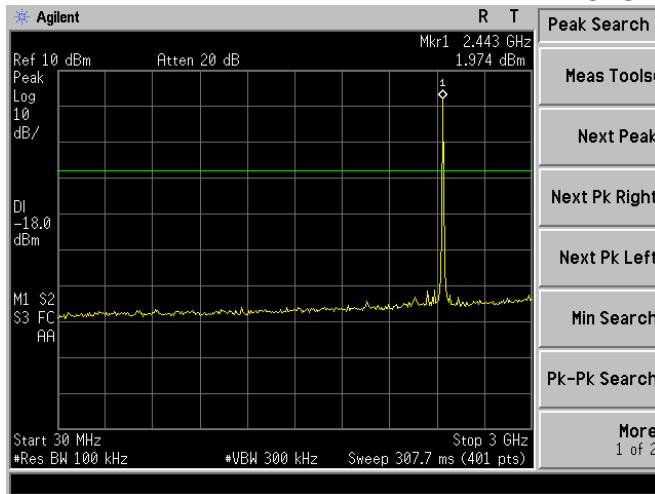


30MHz – 25GHz

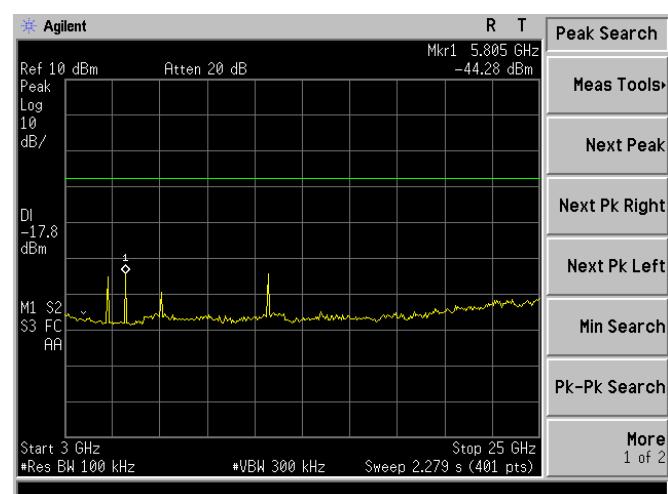
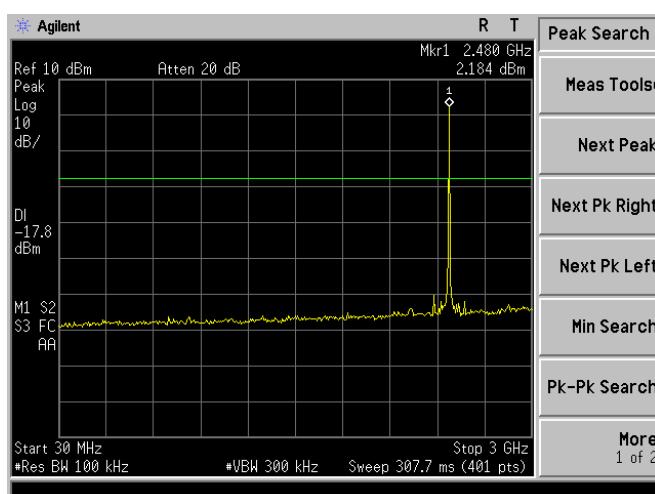
GFSK Low Channel



GFSK Middle Channel

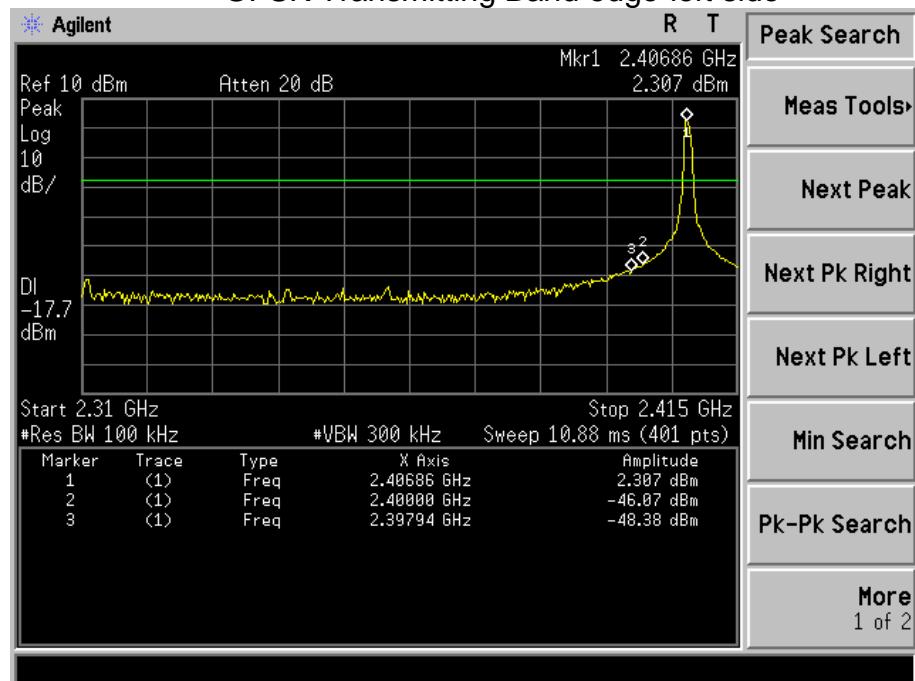


GFSK High Channel

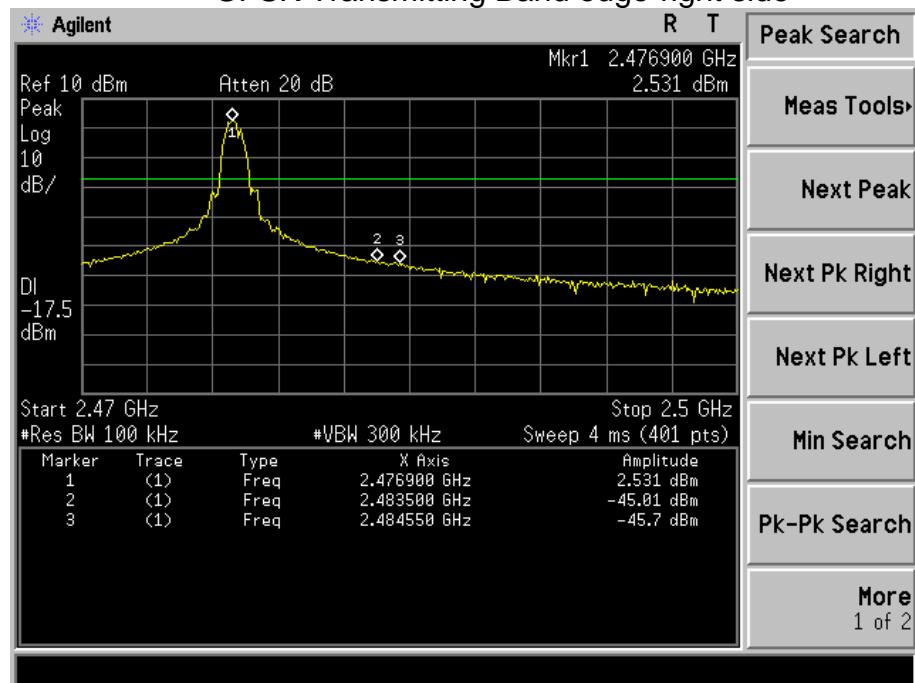




GFSK Transmitting Band edge-left side



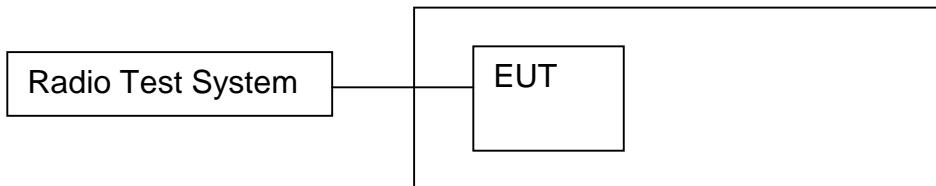
GFSK Transmitting Band edge-right side





9. 20 DB BANDWIDTH

9.1 Block Diagram Of Test Setup



9.2 Limit

N/A

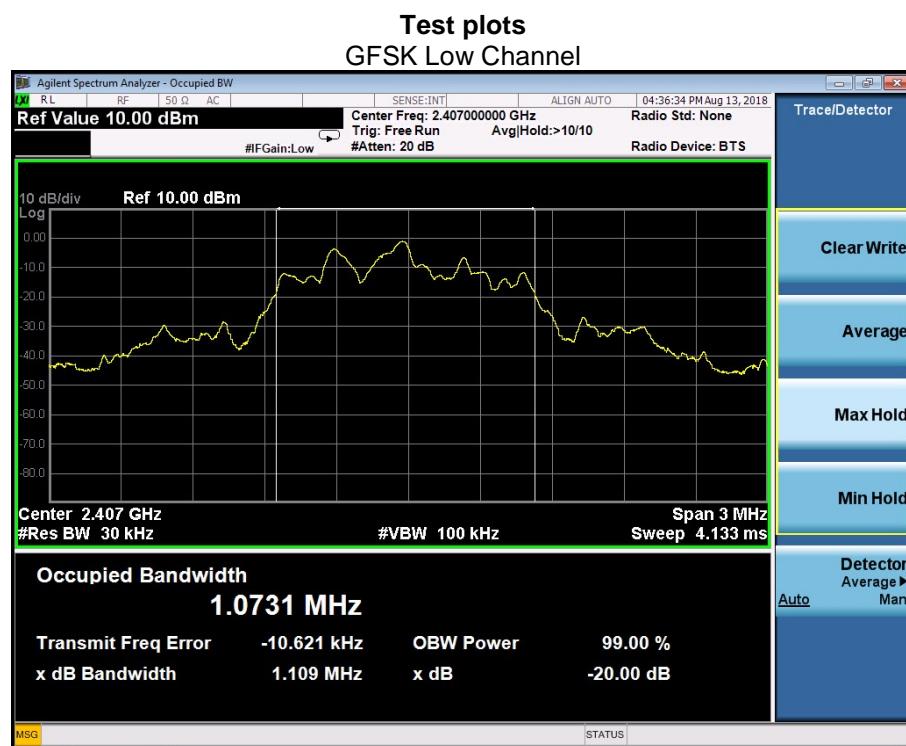
9.3 Test procedure

1. Set RBW = 30 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



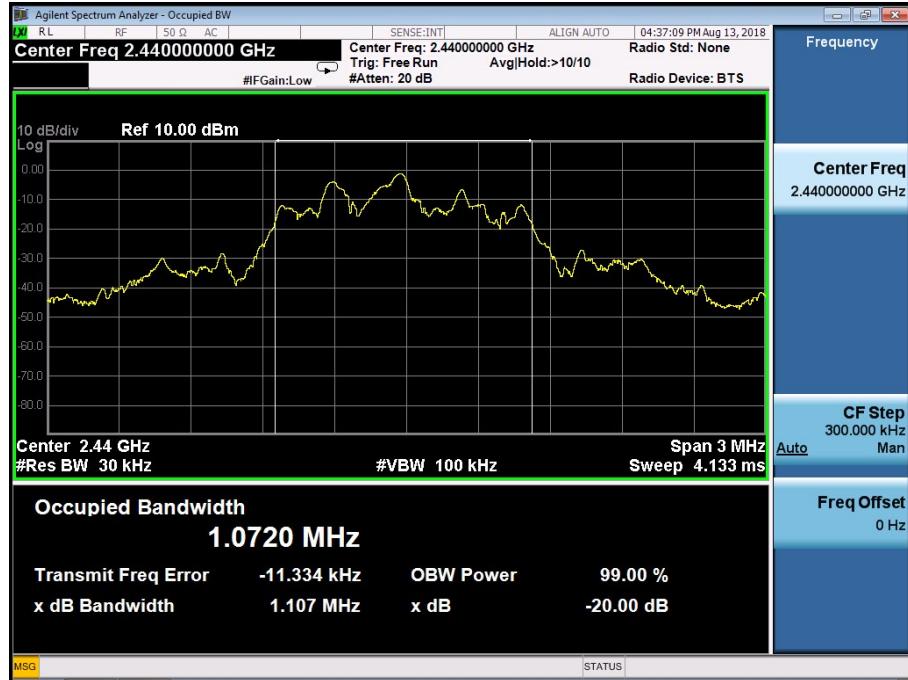
9.4 Test Result

Modulation	Test Channel	Bandwidth(MHz)
GFSK	Low	1.109
GFSK	Middle	1.107
GFSK	High	1.106

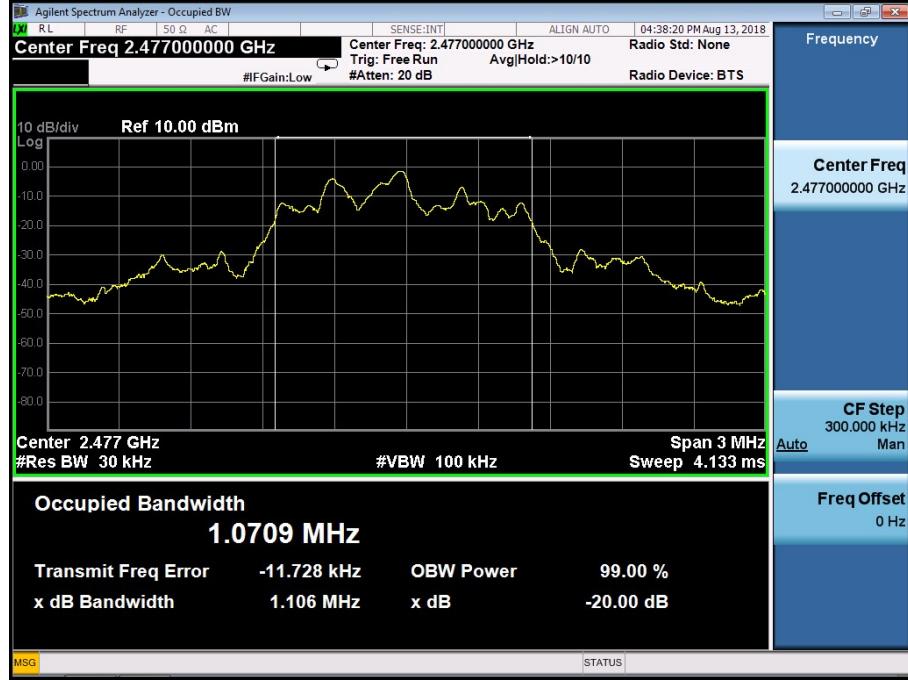




GFSK Middle Channel



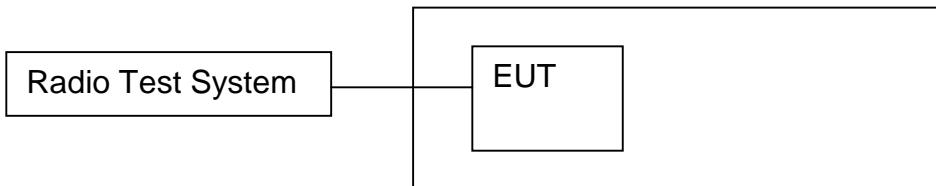
GFSK High Channel





10. MAXIMUM PEAK OUTPUT POWER

10.1 Block Diagram Of Test Setup



10.2 Limit

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

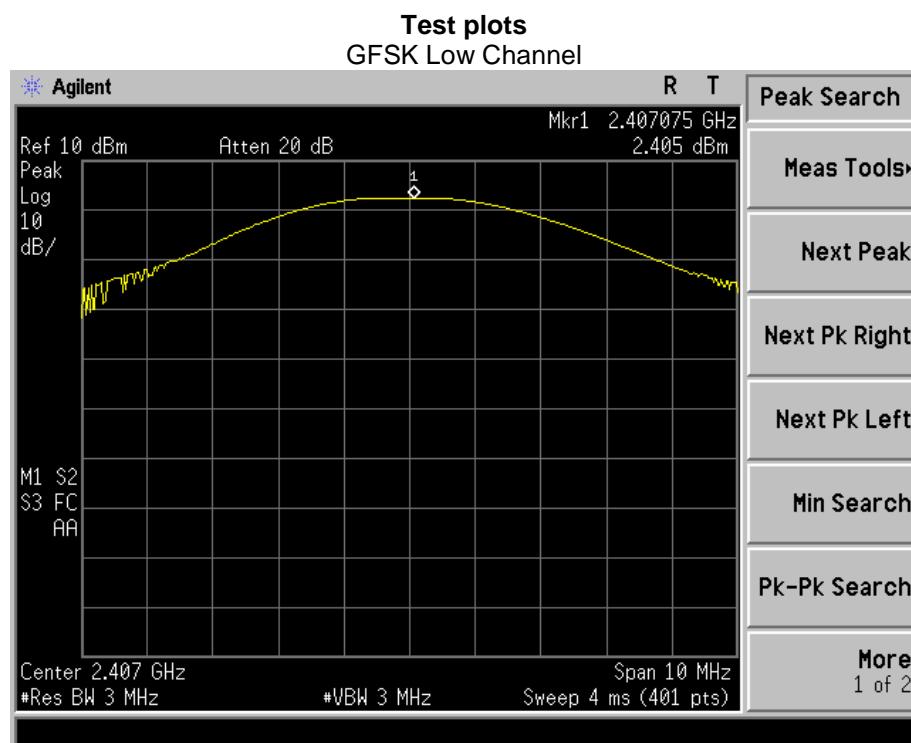
10.3 Test procedure

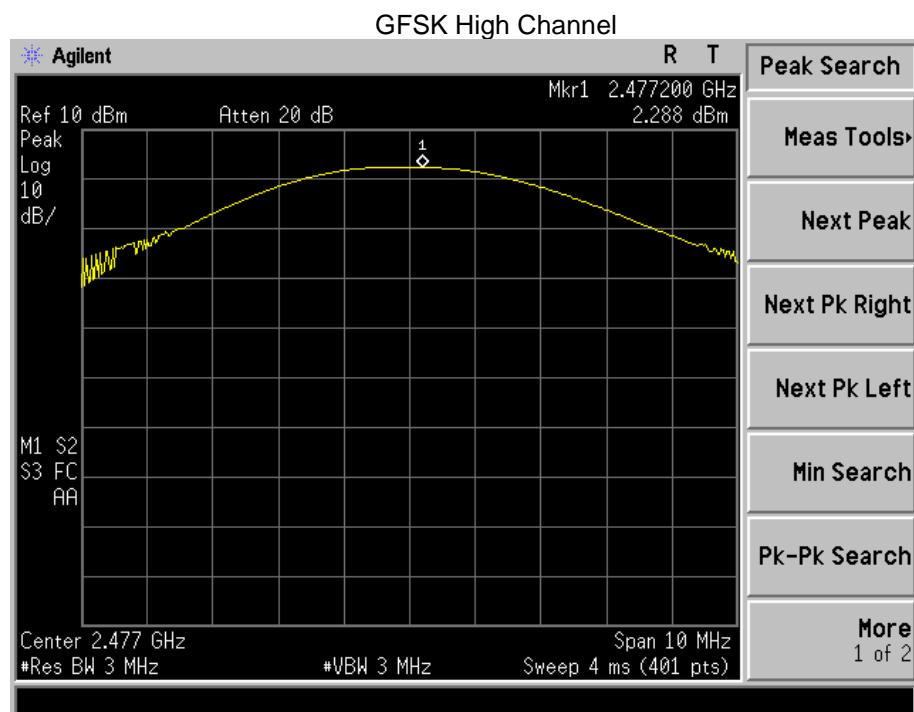
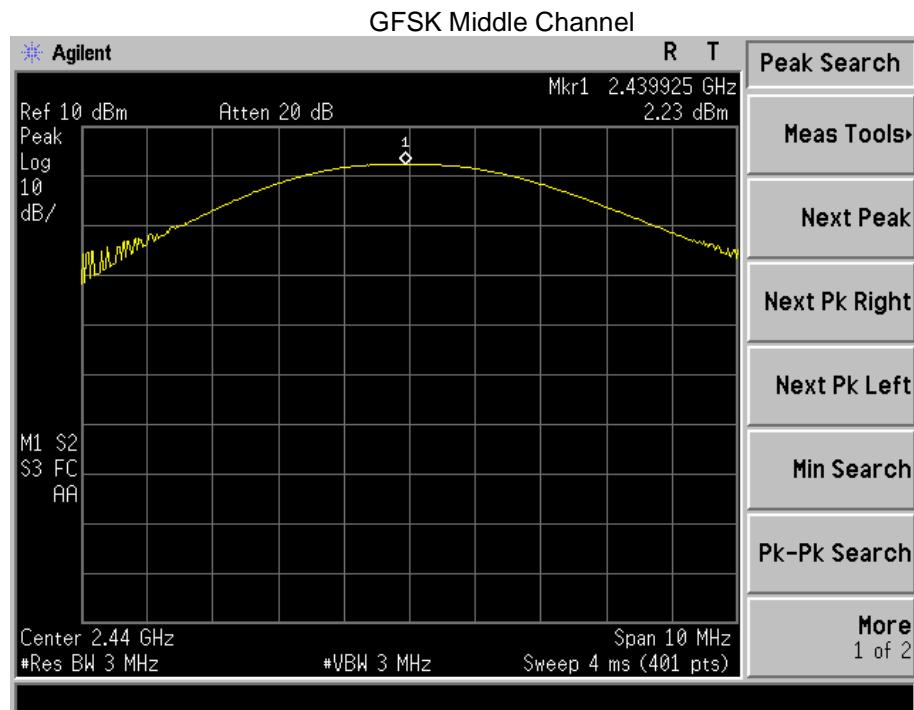
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3MHz. VBW = 3MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.



10.4 Test Result

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	2.405	30
GFSK	Middle	2.230	30
GFSK	High	2.288	30

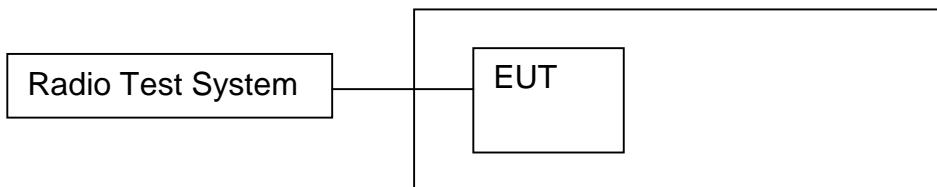






11. HOPPING CHANNEL SEPARATION

11.1 Block Diagram Of Test Setup



11.2 Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 0.125W.

11.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30kHz. VBW = 100kHz , Span = 3.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.



11.4 Test Result

Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	1.263	1.109	PASS
GFSK	Middle	1.275	1.107	PASS
GFSK	High	8.957	1.106	PASS





GFSK Middle Channel



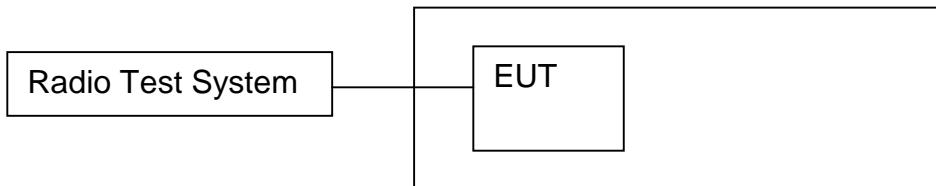
GFSK High Channel





12. NUMBER OF HOPPING FREQUENCY

12.1 Block Diagram Of Test Setup



12.2 Limit

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

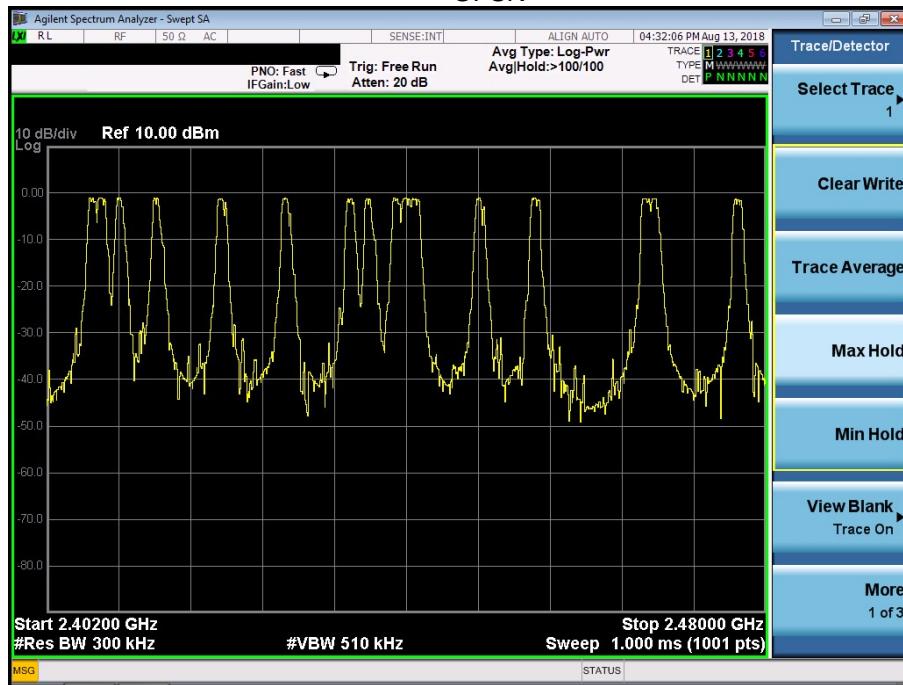
12.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 300kHz. VBW = 510kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;



12.4 Test Result

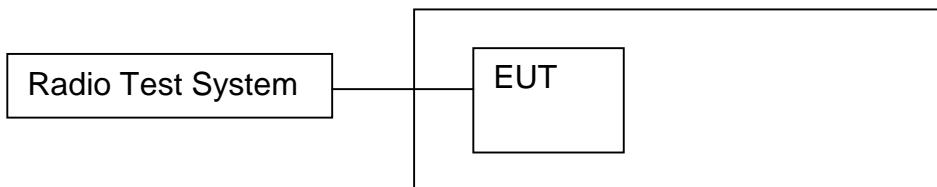
Test Plots:
16 Channels in total
GFSK





13. DWELL TIME

13.1 Block Diagram Of Test Setup



13.2 Limit

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.

13.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. Centred on a hopping channel;
3. Set RBW = 1MHz and VBW = 3MHz. Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 and DH1 packet transmitting.
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).



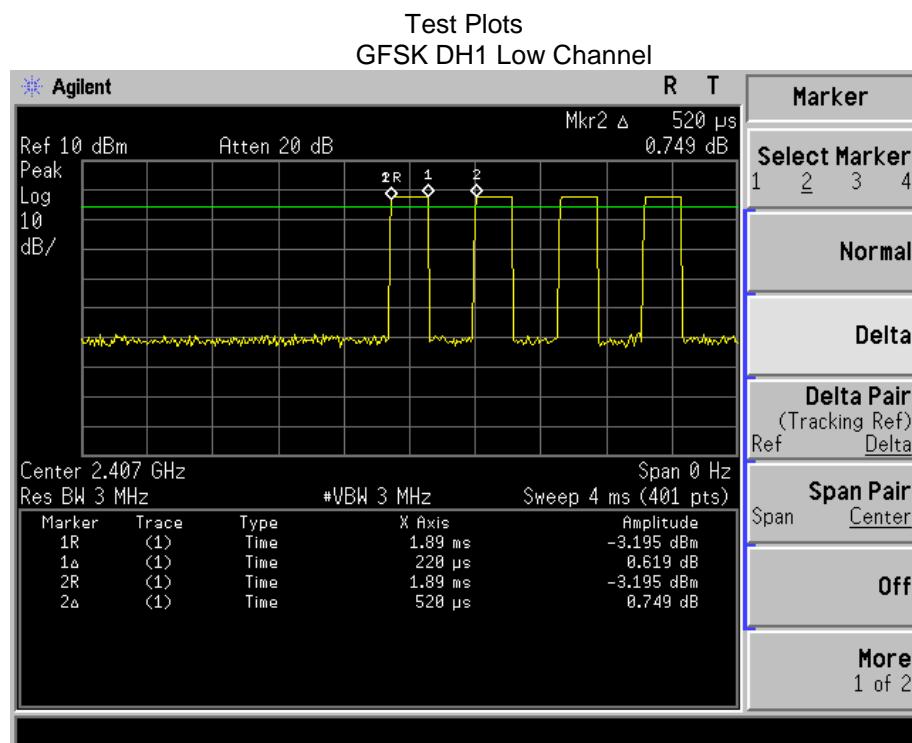
13.4 Test Result

DH1 Packet permit maximum 1600 / 16 /2 hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

DH1:1600/16/2*0.4*16*(MkrDelta)/1000

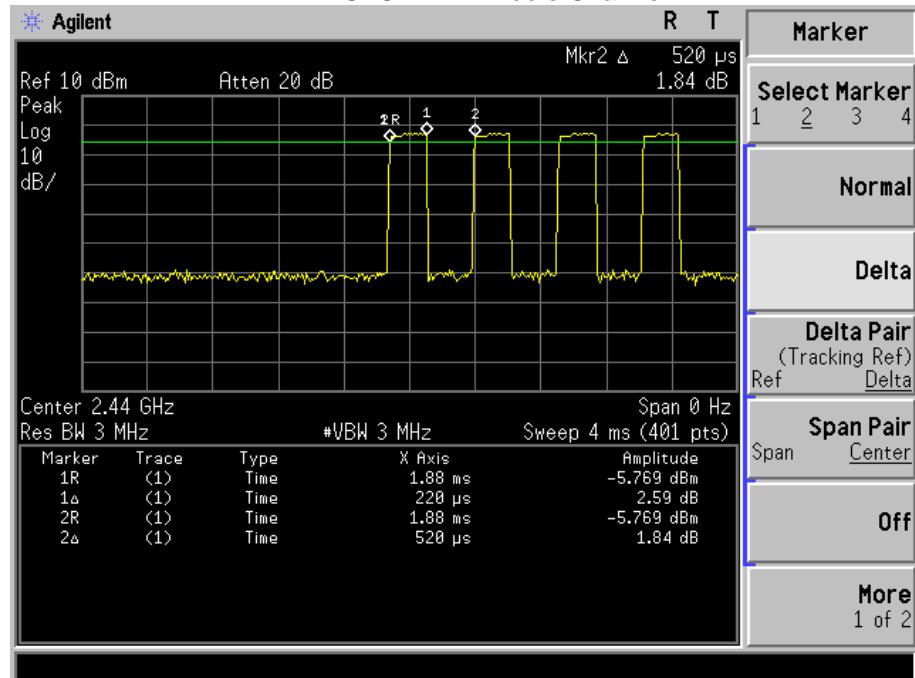
Remark: Mkr Delta is once pulse time.

Modulation	Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
GFSK	DH1	Low	0.22	0.0704	0.4
		middle	0.22	0.0704	0.4
		High	0.22	0.0704	0.4

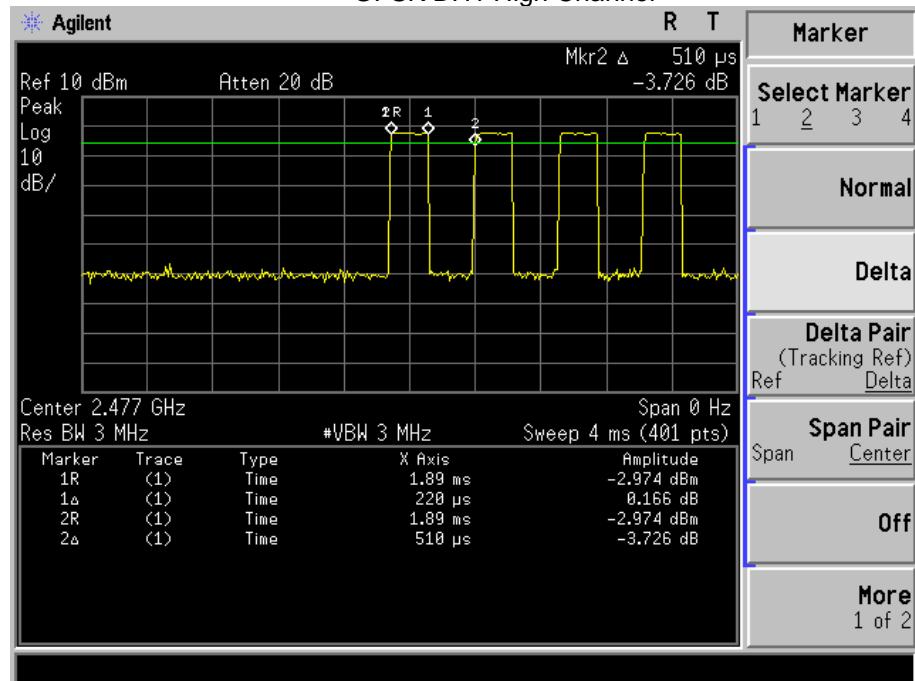




GFSK DH1 Middle Channel



GFSK DH1 High Channel





14. ANTENNA REQUIREMENT

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

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.

The EUT has a PCB antenna, meets the requirements of FCC 15.203.

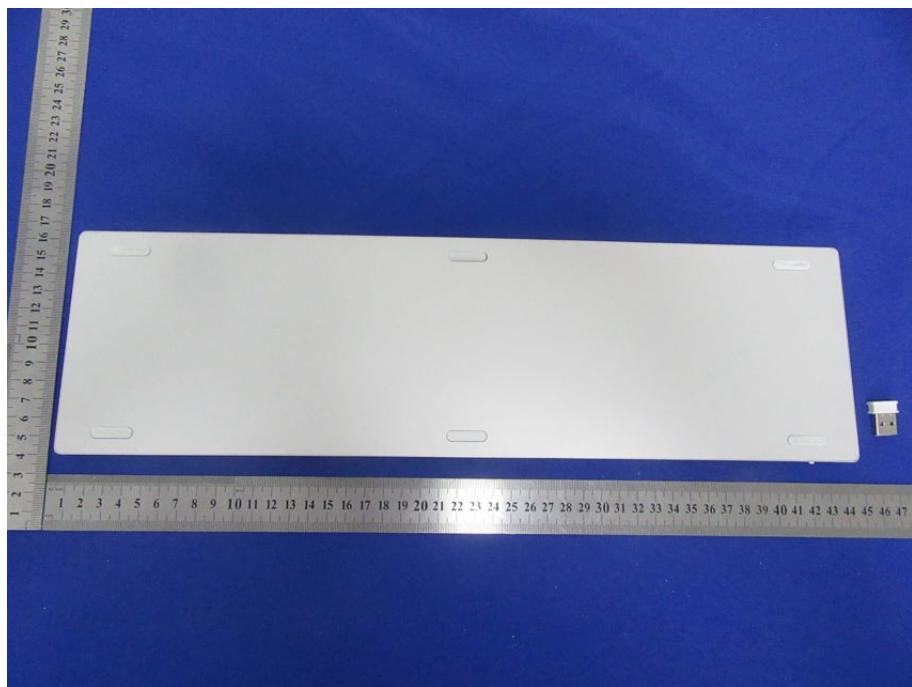


15. EUT PHOTOGRAPHS

EUT Photo 1



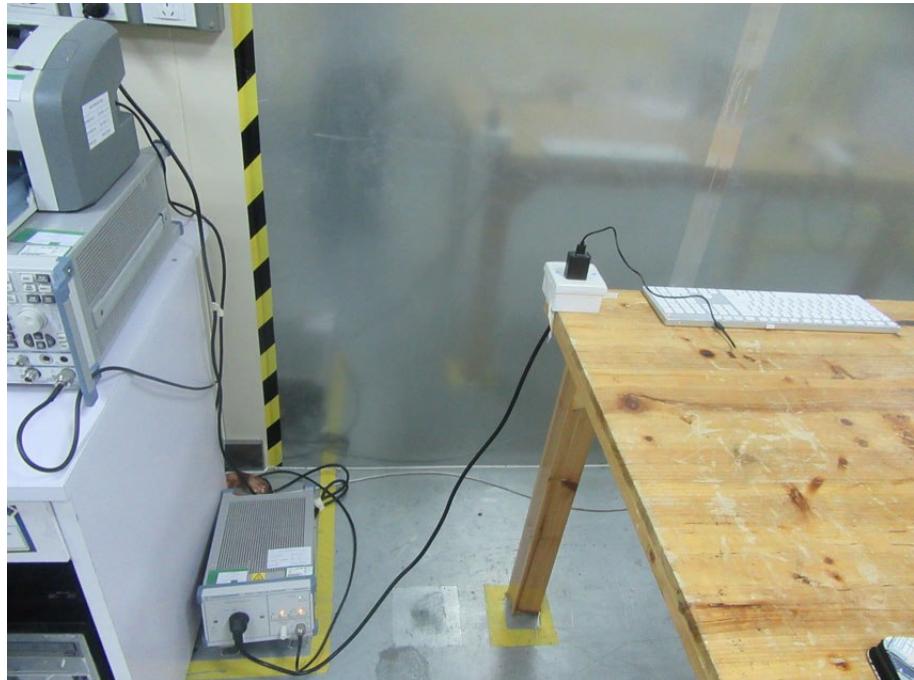
EUT Photo 2





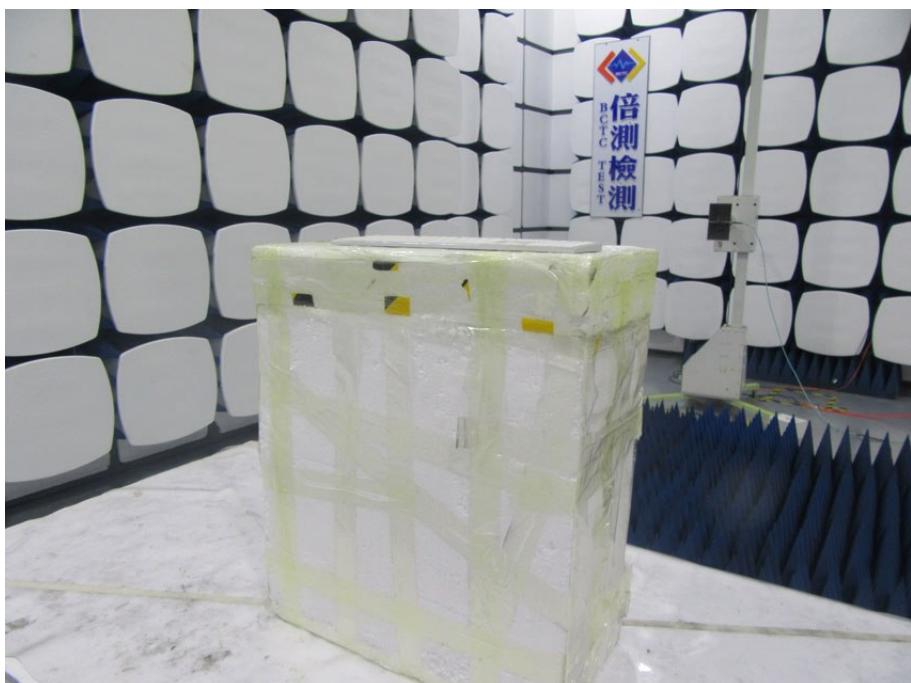
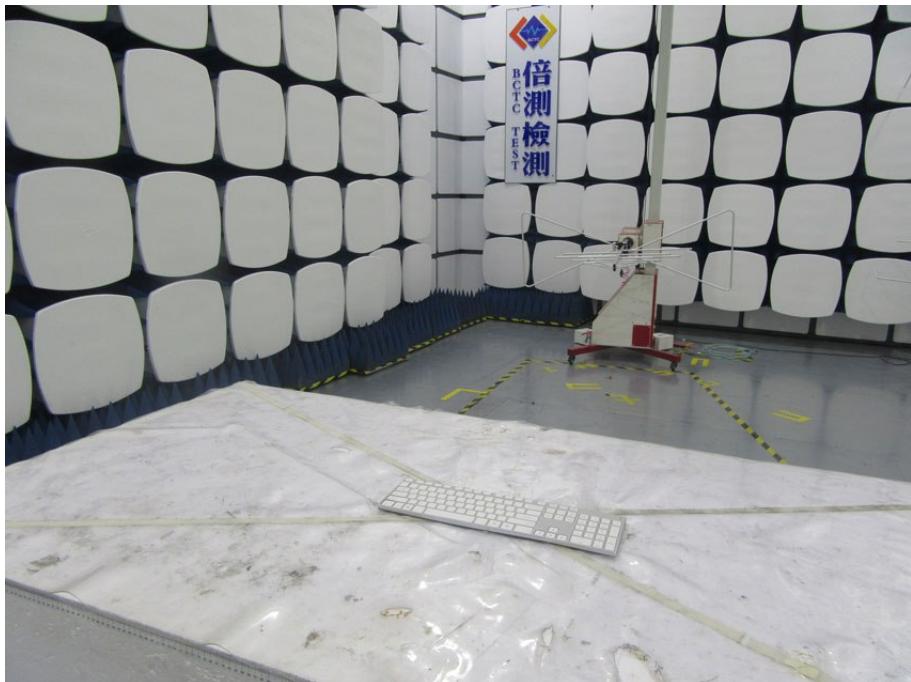
16. EUT TEST SETUP PHOTOGRAPHS

Conducted Emission





Radiated Measurement Photos



***** END OF REPORT *****