



FCC Part 15C Test Report

FCC ID:V3K-E486

Product Name:	Laptop Computer
Trademark:	N/A
Model Name :	E486 E550
Prepared For :	Shenzhen Hasee Computer Co., Ltd.
Address :	Hasee Industrial Park, Bantian, Longgang, Shenzhen, China
Prepared By :	Shenzhen BCTC Technology Co., Ltd.
Address :	No.101, Yousong Road, Longhua New District, Shenzhen, China
Test Date:	Nov. 18 - Nov. 23, 2016
Date of Report :	Nov. 23, 2016
Report No.:	BCTC-FY161105489-1E



VERIFICATION OF COMPLIANCE

Applicant's name.....: Shenzhen Hasee Computer Co., Ltd.

Address.....: Hasee Industrial Park, Bantian, Longgang, Shenzhen, China

Manufacture's Name.....: Shenzhen Hasee Computer Co., Ltd.

Address.....: Hasee Industrial Park, Bantian, Longgang, Shenzhen, China

Product description

Product name.....: Laptop Computer

Trademark: N/A

Model Name: E486, E550

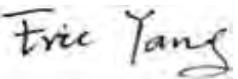
Standards: FCC Part15.249

ANSI C63.10-2013

This device described above has been tested by BCTC, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Test Result.....: **Pass**

Testing Engineer : 

Eric Yang

Reviewer
(Supervisor) : 

Simon Wang

Approved &
Authorized
Signer(Manager) : 

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. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part15 (15.247), Subpart C

Standard Section	Test Item	Verdict	Remark
15.207	Conducted Emission	PASS	
15.247(c)	Radiated Spurious Emission	PASS	
15.247(a)(1)	Hopping Channel Separation	PASS	
15.247(b)(1)	Peak Output Power	PASS	
15.247(a)(iii)	Number of Hopping Frequency	PASS	
15.247(a)(iii)	Dwell Time	PASS	
15.247(a)(1)	Bandwidth	PASS	
15.205	Band Edge Emission	PASS	
15.203	Antenna Requirement	PASS	

Remark:

1. "N/A" denotes test is not applicable in this Test Report.
2. All test items were verified and recorded according to the standards and without any deviation during the test.

TEST FACILITY

Shenzhen BCTC Technology Co., Ltd.

Add.:No.101, Yousong Road, Longhua New District, Shenzhen, China

FCC Registration No.:187086



MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately **95 %** .

No.	Item	Uncertainty
1	Conducted Emission Test	$\pm 1.38\text{dB}$
2	RF power,conducted	$\pm 0.16\text{dB}$
3	Spurious emissions,conducted	$\pm 0.21\text{dB}$
4	All emissions,radiated(<1G)	$\pm 4.68\text{dB}$
5	All emissions,radiated(>1G)	$\pm 4.89\text{dB}$
6	Temperature	$\pm 0.5^\circ\text{C}$
7	Humidity	$\pm 2\%$



. GENERAL INFORMATION

GENERAL DESCRIPTION OF EUT

Equipment	Laptop Computer										
Trade Name	N/A										
Model Name	E486										
Serial Model	E550										
Model Difference	All the same, Only model name is different and outlook color.										
Product Description	<table border="1"><tr><td>Operation Frequency:</td><td>2402~2480 MHz</td></tr><tr><td>Modulation Type:</td><td>GFSK, $\pi/4$ DPSK, 8DPSK</td></tr><tr><td>Bit Rate of Transmitter</td><td>1Mbps/2Mbps/3Mbps</td></tr><tr><td>Number Of Channel</td><td>79 CH</td></tr><tr><td>Antenna Designation:</td><td>Please see Note 3.</td></tr></table>	Operation Frequency:	2402~2480 MHz	Modulation Type:	GFSK, $\pi/4$ DPSK, 8DPSK	Bit Rate of Transmitter	1Mbps/2Mbps/3Mbps	Number Of Channel	79 CH	Antenna Designation:	Please see Note 3.
Operation Frequency:	2402~2480 MHz										
Modulation Type:	GFSK, $\pi/4$ DPSK, 8DPSK										
Bit Rate of Transmitter	1Mbps/2Mbps/3Mbps										
Number Of Channel	79 CH										
Antenna Designation:	Please see Note 3.										
Channel List	Please refer to the Note 2.										
Power Source	Input: AC 120V/60Hz Output: DC 19V/2A										
Adapter	Model: ADS-40SG-19-3 I/P: AC 100-240V 50/60Hz 1.0A max O/P: DC 19V 2.0A										
Battery	DC 10.8V Battery 4400mAh										
Connecting I/O Port(s)	Please refer to the User's Manual										
hardware version	JH M3										
Software version	V1.0										

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.



2.

Channel List					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	27	2429	54	2456
01	2403	28	2430	55	2457
02	2404	29	2431	56	2458
03	2405	30	2432	57	2459
04	2406	31	2433	58	2460
05	2407	32	2434	59	2461
06	2408	33	2435	60	2462
07	2409	34	2436	61	2463
08	2410	35	2437	62	2464
09	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454		
26	2428	53	2455		

3.

Table for Filed Antenna

Ant	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	N/A	N/A	PCB Antenna	N/A	1.0dBi	



DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

For All Mode	Description	Modulation Type
Mode 1	CH00	GFSK, $\pi/4$ DPSK,8DPSK
Mode 2	CH39	
Mode 3	CH78	
Mode 4	Link mode	

Note:

- (1) The measurements are performed at the highest, middle, lowest available channels.
- (2) Fully-charged battery is used during the test

TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING

During testing channel & 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 power parameters of FHSS

Frequency	2402 MHz	2441 MHz	2480 MHz
Channel	Low	Middle	High

BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiated Spurious Emission Test



**DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)**

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	Laptop Computer	N/A	E486	N/A	EUT
E-2	Adapter	N/A	ADS-40SG-19-3	N/A	
E-3	LCD TV	Guanjie	T3250MD	N/A	Peripheral

Item	Shielded Type	Ferrite Core	Length	Note
C1	NO	NO	1.0m	DC cable
C2	NO	NO	1.0M	HDMI cable shielded

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
- (3) "YES" is means "shielded" "with core"; "NO" is means "unshielded" "without core".

**EQUIPMENTS LIST FOR ALL TEST ITEMS**

Radiation test, Band-edge test and 20db bandwidth test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Spectrum Analyzer	Agilent	E4407B	MY4510840	2016.07.06	2017.07.05	1 year
2	Test Receiver	R&S	ESPI	101318	2016.06.07	2017.06.06	1 year
3	Bilog Antenna	R&S	VULB 9168	VULB91 68-438	2016.07.06	2017.07.05	1 year
4	50Ω Coaxial Switch	Anritsu	MP59B	6200264416	2016.06.07	2017.06.06	1 year
5	Spectrum Analyzer	ADVANTEST	R3132	150900201	2016.06.07	2017.06.06	1 year
6	Horn Antenna	R&S	HF906	10027	2016.07.06	2017.07.05	1 year
7	Horn Ant	Schwarzbeck	BBHA 9170	9170-181	2016.07.06	2017.07.05	1 year
8	Amplifier	R&S	BBV9743	9743-019	2016.08.25	2017.08.24	1 year
9	Loop Antenna	ARA	PLA-1030/B	1029	2016.06.08	2017.06.07	1 year
10	RF cables	R&S	R203	R20X	2016.07.06	2017.07.05	1 year
11	Antenna connector	Florida RFLabs	Lab-Fle	RF 01#	2016.07.06	2017.07.05	1 year



EMC EMISSION TEST

CONDUCTED EMISSION MEASUREMENT

POWER LINE CONDUCTED EMISSION Limits (Frequency Range 150KHz-30MHz)

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)		Standard
	Quasi-peak	Average	Quasi-peak	Average	
0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *	CISPR
0.50 -5.0	73.00	60.00	56.00	46.00	CISPR
5.0 -30.0	73.00	60.00	60.00	50.00	CISPR

0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *	FCC
0.50 -5.0	73.00	60.00	56.00	46.00	FCC
5.0 -30.0	73.00	60.00	60.00	50.00	FCC

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

The following table is the setting of the receiver

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

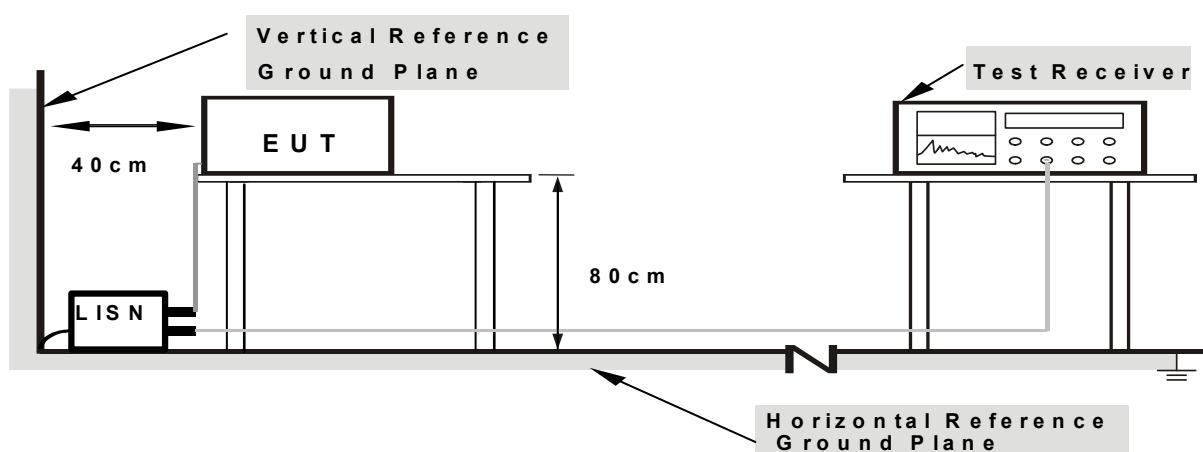
TEST PROCEDURE

- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

DEVIATION FROM TEST STANDARD

No deviation

TEST SETUP



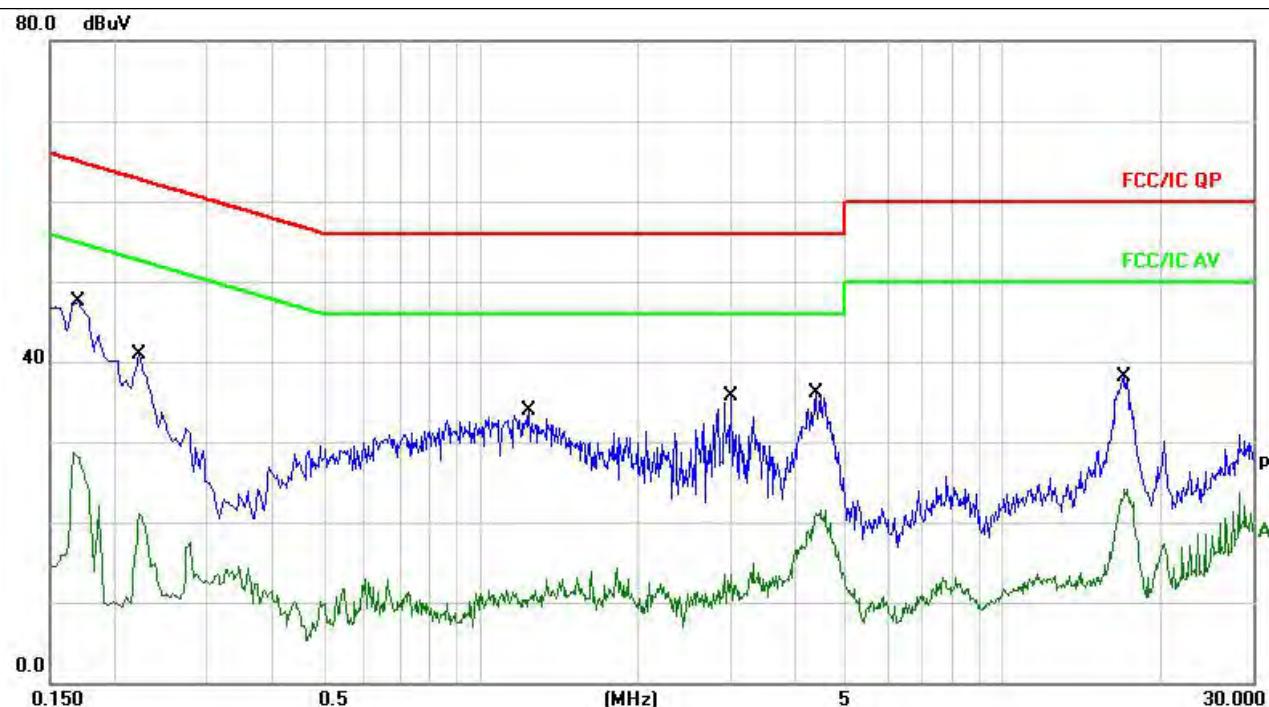
EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.



TEST RESULTS

Temperature :	25 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	L
Test Voltage :	Input: AC 120V/60Hz Output: DC 19V/2A	Test Mode :	Mode 4



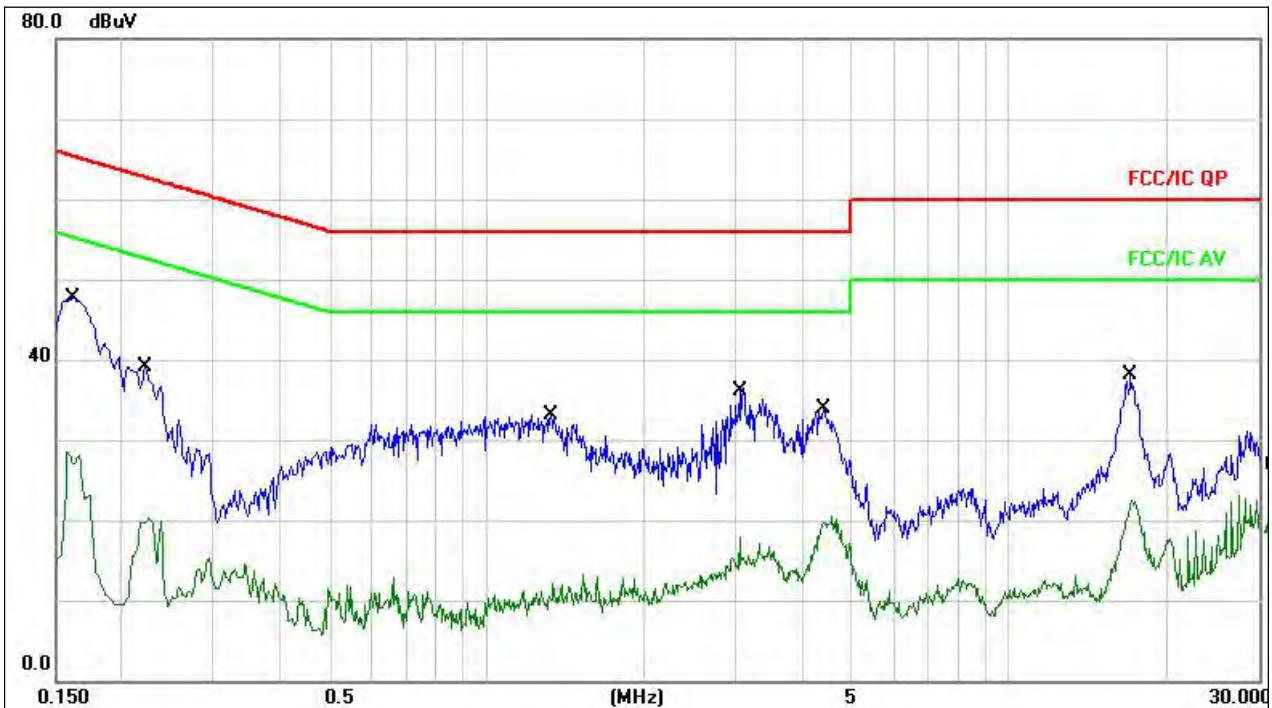
Remark:

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

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dB	Detector	Comment
1	*	0.1539	49.61	9.67	59.28	65.78	-6.50	QP
2		0.1539	28.49	9.67	38.16	55.78	-17.62	AVG
3		0.4420	39.29	9.67	48.96	57.02	-8.06	QP
4		0.4420	16.84	9.67	26.51	47.02	-20.51	AVG
5		0.6460	38.39	9.68	48.07	56.00	-7.93	QP
6		0.6460	17.64	9.68	27.32	46.00	-18.68	AVG
7		1.5700	39.25	9.70	48.95	56.00	-7.05	QP
8		1.5700	19.54	9.70	29.24	46.00	-16.76	AVG
9		5.0739	40.60	9.74	50.34	60.00	-9.66	QP
10		5.0739	19.99	9.74	29.73	50.00	-20.27	AVG
11		10.4339	39.05	9.83	48.88	60.00	-11.12	QP
12		10.4339	22.32	9.83	32.15	50.00	-17.85	AVG



Temperature :	25 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	N
Test Voltage :	Input: AC 120V/60Hz Output: DC 19V/2A	Test Mode :	Mode 4

**Remark:**

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

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dB	Over Detector	Comment
1		0.1539	50.61	9.73	60.34	65.78	-5.44	QP
2		0.1539	29.49	9.73	39.22	55.78	-16.56	AVG
3	*	0.6043	41.92	9.67	51.59	56.00	-4.41	QP
4		0.6043	21.14	9.67	30.81	46.00	-15.19	AVG
5		0.8438	41.35	9.69	51.04	56.00	-4.96	QP
6		0.8438	17.71	9.69	27.40	46.00	-18.60	AVG
7		1.5684	38.75	9.71	48.46	56.00	-7.54	QP
8		1.5684	19.31	9.71	29.02	46.00	-16.98	AVG
9		5.0580	40.60	9.74	50.34	60.00	-9.66	QP
10		5.0580	19.99	9.74	29.73	50.00	-20.27	AVG
11		10.3972	38.55	9.84	48.39	60.00	-11.61	QP
12		10.3972	21.83	9.84	31.67	50.00	-18.33	AVG



RADIATED EMISSION MEASUREMENT

RADIATED EMISSION LIMITS (Frequency Range 9kHz-1000MHz)

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.

Frequencies (MHz)	Field Strength (microvolt/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Class B (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

FREQUENCY RANGE OF RADIATED MEASUREMENT (For unintentional radiators)

Highest frequency generated or Upper frequency of measurement used in the device or on which the device operates or tunes (MHz)	Range (MHz)
Below 1.705	30
1.705 – 108	1000
108 – 500	2000
500 – 1000	5000
Above 1000	5 th harmonic of the highest frequency or 40 GHz, whichever is lower



Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

Receiver Parameter	Setting
Attenuation	Auto
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

TEST PROCEDURE

- a. The measuring distance of at 3 m shall be used for measurements at frequency up to 25GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- b. The EUT was placed on the top of a rotating table 0.8 and 1.5 meters above the ground at a 3 meter semi-chamber test. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment or of the substitution antenna shall be 0.8 m; above 1GHz, the height was 1.5m, the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos.
- g. For the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions 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 radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

Note:

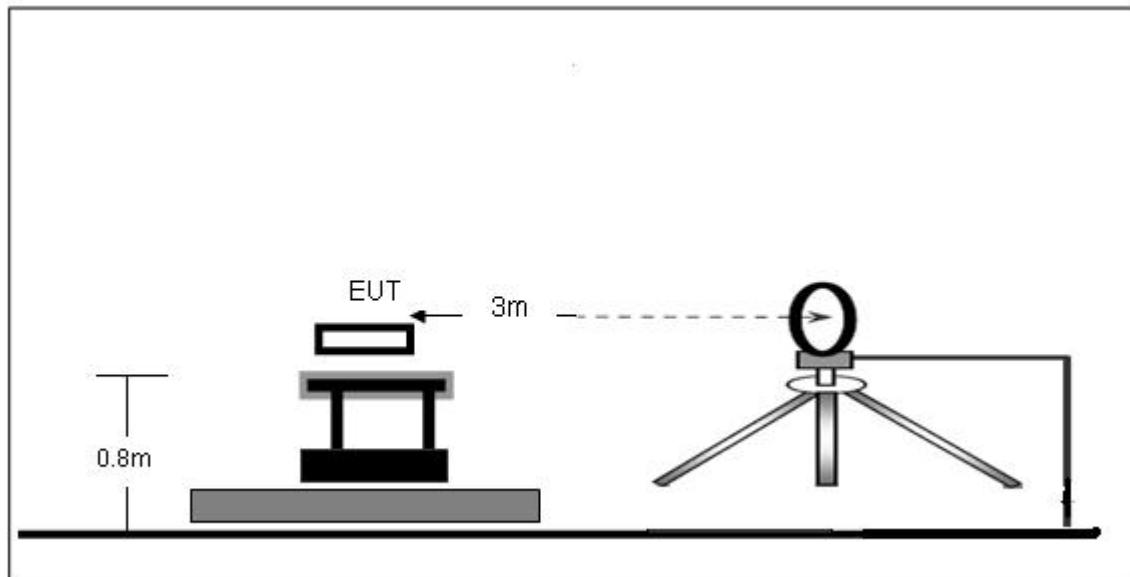
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

DEVIATION FROM TEST STANDARD

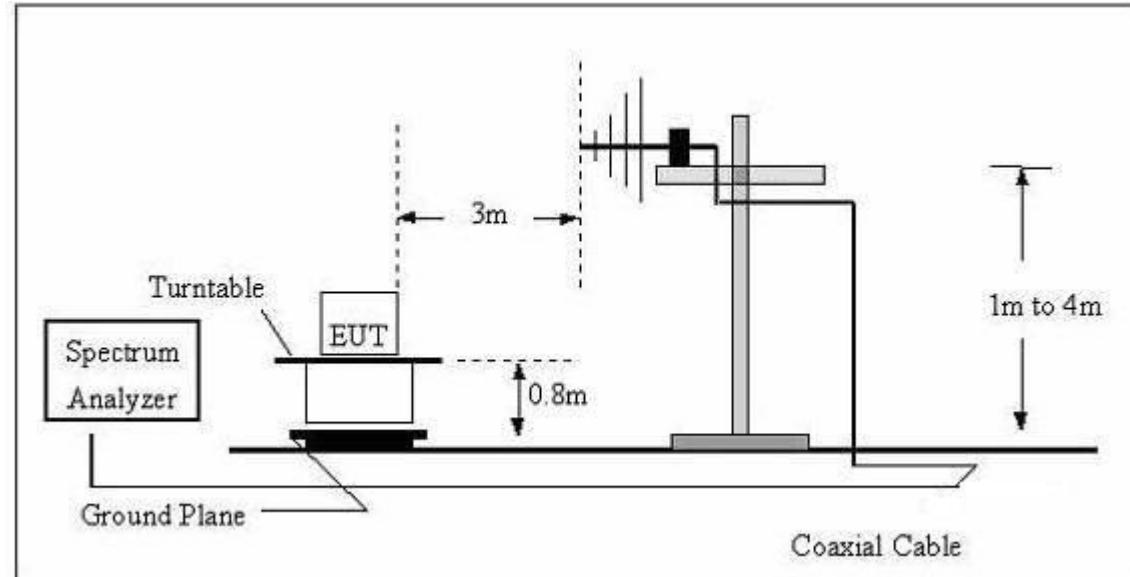
No deviation

TEST SETUP

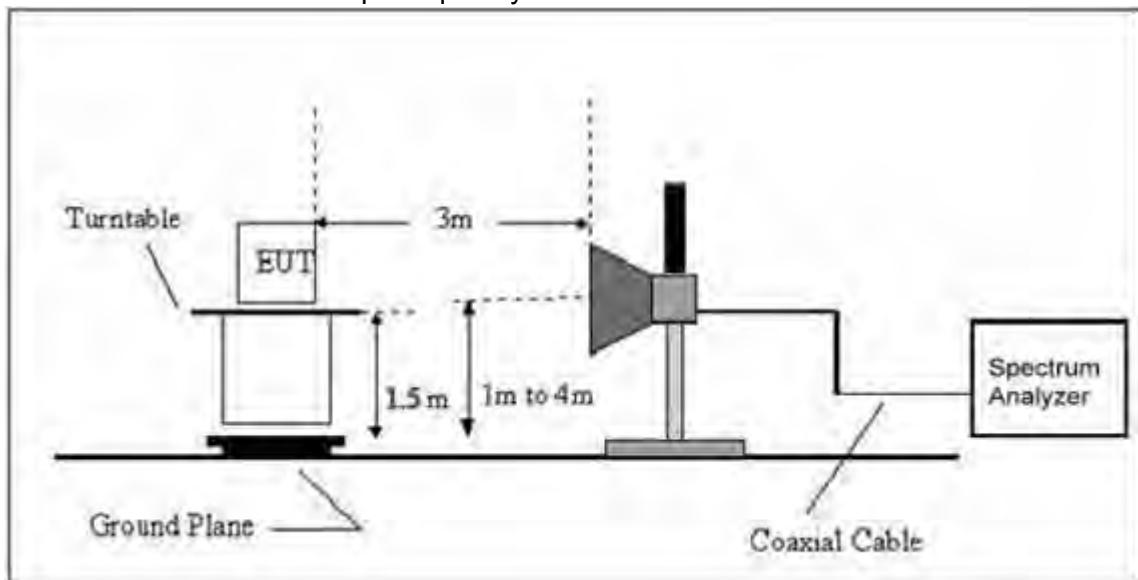
(A) Radiated Emission Test-Up Frequency Below 30MHz



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



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

**EUT OPERATING CONDITIONS**

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.



TEST RESULTS

Radiated Spurious Emission (Below 30MHz)

Temperature :	25 °C	Relative Humidity :	55%
Pressure :	1010 hPa	Polarization :	---
Test Voltage :	DC 10.8V From Battery		
Test Mode :	Mode 1/2/3		

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

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



Radiated Spurious Emission (Between 30MHz – 1GHz)

Temperature :	26°C	Relative Humidity :	54%
Pressure :	1010 hPa	Polarization :	Horizontal
Test Voltage :	DC 10.8V battery		
Test Mode :	Mode 1/2/3		



Remark:

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

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Antenna	Table
			Level	Factor	ment				
MHz									
1		36.8953	43.87	-16.66	27.21	40.00	-12.79	peak	
2		95.7622	53.02	-17.10	35.92	43.50	-7.58	peak	
3	*	198.5880	51.84	-15.74	36.10	43.50	-7.40	peak	
4		308.9126	49.58	-11.92	37.66	46.00	-8.34	peak	
5		360.4476	42.79	-10.40	32.39	46.00	-13.61	peak	
6		962.1623	37.48	1.43	38.91	54.00	-15.09	peak	



Temperature :	26°C	Relative Humidity :	54%
Pressure :	1010 hPa	Polarization :	Vertical
Test Voltage :	DC 10.8V Battery		
Test Mode :	Mode 1/2/3		



Remark:

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

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Antenna	Table		
			Level	Factor	ment						
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector	cm	degree	Comment
1	*	39.9942	55.93	-15.81	40.12	40.00	0.12	peak			
2	!	96.4362	56.38	-17.06	39.32	43.50	-4.18	peak			
3		160.3456	49.89	-18.99	30.90	43.50	-12.60	peak			
4		239.9874	45.65	-14.12	31.53	46.00	-14.47	peak			
5		301.4224	43.40	-12.07	31.33	46.00	-14.67	peak			
6	!	893.8567	39.50	0.61	40.11	46.00	-5.89	peak			

Radiated Spurious Emission (1GHz to 10th harmonics)

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

Frequency (MHz)	Read Level (dB μ V)	Cable loss (dB)	Antenna Factor dB/m	Preamp Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Remark	Comment
4804.214	62.55	5.21	35.59	44.30	59.05	74.00	-14.95	Pk	Vertical
4804.214	40.17	5.21	35.59	44.30	36.67	54.00	-17.33	AV	Vertical
7206.265	59.85	6.48	36.27	44.60	58.00	74.00	-16.00	Pk	Vertical
7206.265	43.36	6.48	36.27	44.60	41.51	54.00	-12.49	AV	Vertical
4804.109	60.52	5.21	35.55	44.30	56.98	74.00	-17.02	Pk	Horizontal
4804.109	42.29	5.21	35.55	44.30	38.75	54.00	-15.25	AV	Horizontal
7206.224	62.28	6.48	36.27	44.52	60.51	74.00	-13.49	Pk	Horizontal
7206.224	46.74	6.48	36.27	44.52	44.97	54.00	-9.03	AV	Horizontal
Mid Channel (2441 MHz)(GFSK)–Above 1G									
4882.396	62.33	5.21	35.66	44.20	59.00	74.00	-15.00	Pk	Vertical
4882.396	42.26	5.21	35.66	44.20	38.93	54.00	-15.07	AV	Vertical
7323.241	59.56	7.10	36.50	44.43	58.73	74.00	-15.27	Pk	Vertical
7323.241	46.65	7.10	36.50	44.43	45.82	54.00	-8.18	AV	Vertical
4882.108	60.41	5.21	35.66	44.20	57.08	74.00	-16.92	Pk	Horizontal
4882.108	47.78	5.21	35.66	44.20	44.45	54.00	-9.55	AV	Horizontal
7323.132	59.85	7.10	36.50	44.43	59.02	74.00	-14.98	Pk	Horizontal
7323.132	41.22	7.10	36.50	44.43	40.39	54.00	-13.61	AV	Horizontal
High Channel (2480 MHz)(GFSK)– Above 1G									
4960.397	65.56	5.21	35.52	44.21	62.08	74.00	-11.92	Pk	Vertical
4960.397	42.25	5.21	35.52	44.21	38.77	54.00	-15.23	AV	Vertical
7440.201	60.59	7.10	36.53	44.60	59.62	74.00	-14.38	Pk	Vertical
7440.201	44.47	7.10	36.53	44.60	43.50	54.00	-10.50	AV	Vertical
4960.225	66.69	5.21	35.52	44.21	63.21	74.00	-10.79	Pk	Horizontal
4960.225	46.63	5.21	35.52	44.21	43.15	54.00	-10.85	AV	Horizontal
7440.298	60.52	7.10	36.53	44.60	59.55	74.00	-14.45	Pk	Horizontal
7440.298	44.47	7.10	36.53	44.60	43.50	54.00	-10.50	AV	Horizontal

Note: (1) All Readings are Peak Value (VBW=3MHz) and AV Value (VBW=10Hz).
(2) Emission Level= Antenna Factor + Cable Loss + Read Level - Preamp Factor
(3)All other emissions more than 20dB below the limit.

**■ Spurious Emission in Band edge**

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

Frequency (MHz)	Meter Reading (dB μ V)	Cable Loss (dB)	Antenna Factor dB/m	Preamp Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type	Comment
1Mbps(GFSK)- Non-hopping									
2310.00	57.26	2.97	27.80	43.80	44.23	74	-29.77	Pk	Horizontal
2310.00	43.15	2.97	27.80	43.80	30.12	54	-23.88	AV	Horizontal
2310.00	58.09	2.97	27.80	43.80	45.06	74	-28.94	Pk	Vertical
2310.00	41.86	2.97	27.80	43.80	28.83	54	-25.17	AV	Vertical
2390.00	57.66	3.14	27.21	43.80	44.21	74	-29.79	Pk	Vertical
2390.00	41.82	3.14	27.21	43.80	28.37	54	-25.63	AV	Vertical
2390.00	56.19	3.14	27.21	43.80	42.74	74	-31.26	Pk	Horizontal
2390.00	41.82	3.14	27.21	43.80	28.37	54	-25.63	AV	Horizontal
2483.50	57.54	3.58	27.70	44.00	44.82	74	-29.18	Pk	Vertical
2483.50	42.16	3.58	27.70	44.00	29.44	54	-24.56	AV	Vertical
2483.50	58.64	3.58	27.70	44.00	45.92	74	-28.08	Pk	Horizontal
2483.50	41.69	3.58	27.70	44.00	28.97	54	-25.03	AV	Horizontal
1Mbps (GFSK)- hopping									
2310.00	58.64	2.97	27.80	43.80	45.61	74	-28.39	Pk	Horizontal
2310.00	43.94	2.97	27.80	43.80	30.91	54	-23.09	AV	Horizontal
2310.00	56.49	2.97	27.80	43.80	43.46	74	-30.54	Pk	Vertical
2310.00	42.87	2.97	27.80	43.80	29.84	54	-24.16	AV	Vertical
2390.00	57.46	3.14	27.21	43.80	44.01	74	-29.99	Pk	Vertical
2390.00	41.69	3.14	27.21	43.80	28.24	54	-25.76	AV	Vertical
2390.00	57.82	3.14	27.21	43.80	44.37	74	-29.63	Pk	Horizontal
2390.00	43.16	3.14	27.21	43.80	29.71	54	-24.29	AV	Horizontal
2483.50	58.13	3.58	27.70	44.00	45.41	74	-28.59	Pk	Vertical
2483.50	43.69	3.58	27.70	44.00	30.97	54	-23.03	AV	Vertical
2483.50	58.12	3.58	27.70	44.00	45.40	74	-28.60	Pk	Horizontal
2483.50	41.83	3.58	27.70	44.00	29.11	54	-24.89	AV	Horizontal

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



■ Spurious Emission in Restricted Band 3260MHz-18000MHz

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

Frequency (MHz)	Reading Level (dB μ V)	Cable Loss (dB)	Antenna Factor dB/m	Preamp Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type	Comment
3260	60.04	4.04	29.57	44.70	48.95	74	-25.05	Pk	Vertical
3260	55.73	4.04	29.57	44.70	44.64	54	-9.36	AV	Vertical
3260	61.08	4.04	29.57	44.70	49.99	74	-24.01	Pk	Horizontal
3260	56.54	4.04	29.57	44.70	45.45	54	-8.55	AV	Horizontal
3332	64.18	4.26	29.87	44.40	53.91	74	-20.09	Pk	Vertical
3332	53.08	4.26	29.87	44.40	42.81	54	-11.19	AV	Vertical
3332	62.11	4.26	29.87	44.40	51.84	74	-22.16	Pk	Horizontal
3332	52.18	4.26	29.87	44.40	41.91	54	-12.09	AV	Horizontal
17797	42.87	10.99	43.95	43.50	54.31	74	-19.69	Pk	Vertical
17797	32.06	10.99	43.95	43.50	43.50	54	-10.50	AV	Vertical
17788	43.75	11.81	43.69	44.60	54.65	74	-19.35	Pk	Horizontal
17788	31.05	11.81	43.69	44.60	41.95	54	-12.05	AV	Horizontal

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



NUMBER OF HOPPING CHANNEL APPLICABLE STANDARD

According to FCC Part 15.247(a)(1) (iii) and ANSI C63.10-2013

CONFORMANCE LIMIT

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

MEASURING INSTRUMENTS

The Measuring equipment is listed in the section 6.3 of this test report.

TEST SETUP

Please refer to Section 6.1 of this test report.

TEST PROCEDURE

The testing follows ANSI C63.10-2013 clause 7.8.3

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT must have its hopping function enabled.

Use the following spectrum analyzer settings:

Span = the frequency band of operation

RBW \geq 1% of the span

VBW \geq RBW

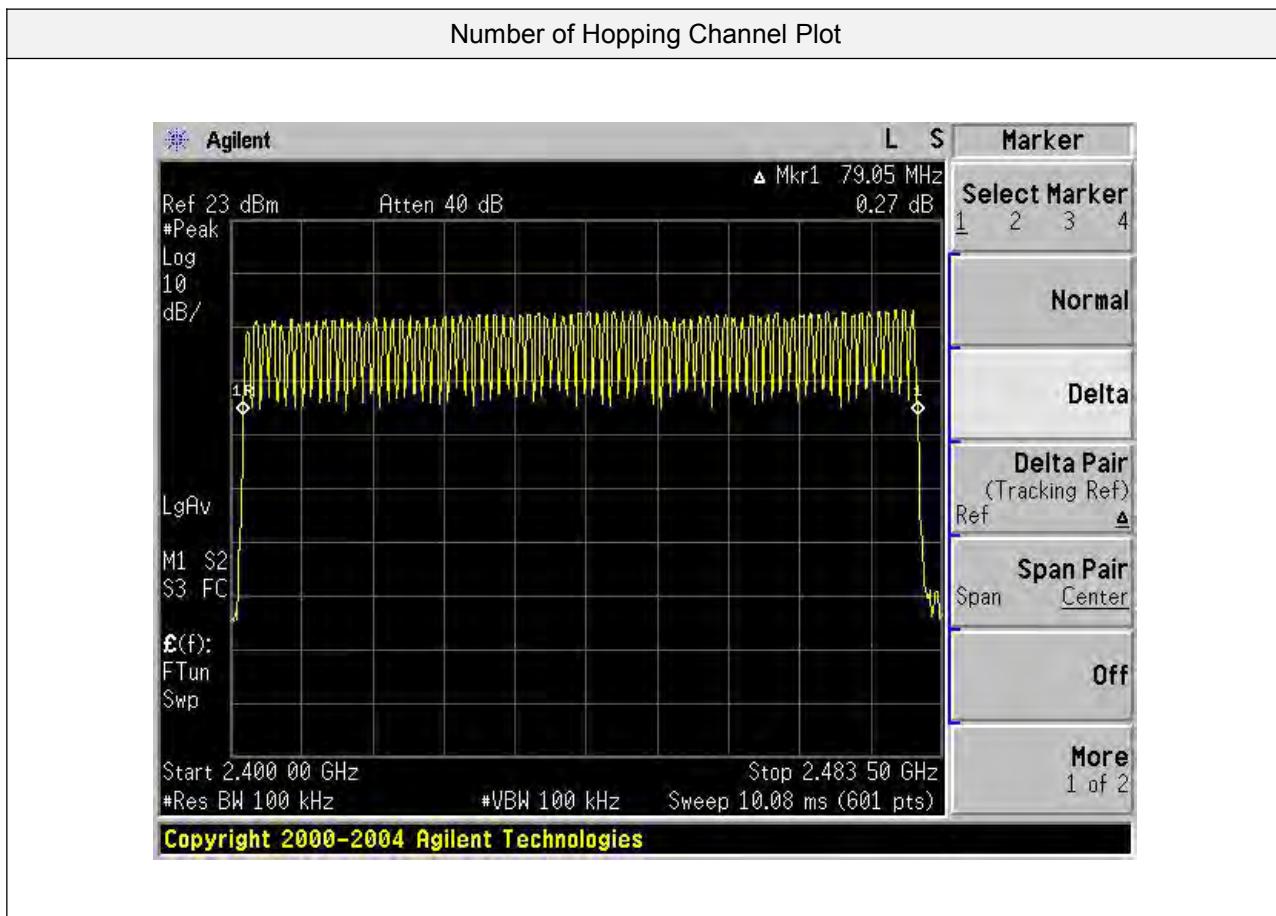
Sweep = auto

Detector function = peak

Trace = max hold

TEST RESULTS

Number of Hopping (Channel)	Adaptive Frequency hopping (Channel)	limit	Verdict
79	20	≥ 15	Pass





HOPPING CHANNEL SEPARATION MEASUREMENT APPLICABLE STANDARD

According to FCC Part 15.247(a)(1) and ANSI C63.10-2013
CONFORMANCE LIMIT

Frequency hopping systems operating in the 2400-2483.5MHz band shall have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

MEASURING INSTRUMENTS

The Measuring equipment is listed in the section 6.3 of this test report.

TEST SETUP

Please refer to Section 6.1 of this test report.

TEST PROCEDURE

The testing follows ANSI C63.10-2013 clause 7.8.2

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT was operating in controlled its channel.

Use the following spectrum analyzer settings:

Span = Measurement Bandwidth or Channel Separation

RBW \geq 30KHz

VBW \geq 3*RBW

Sweep = auto

Detector function = peak

Trace = max hold

**TEST RESULTS**

Temperature :	26°C	Relative Humidity :	54%
Test Voltage :	DC 10.8V battery		
Test Mode :	Mode 1/2/3		

Modulation Mode	Channel Number	Channel Frequency (MHz)	Measurement Bandwidth (kHz)	Limit (kHz)	Verdict
GFSK	0	2402	-1000.00	>870.919	20dB BW
	39	2441	1000.00	>868.348	20dB BW
	78	2480	1004.00	>870.98	20dB BW
$\pi/4$ -DQPSK	0	2402	996.00	>815.333	2/3 of 20dB BW
	39	2441	996.00	>820.000	2/3 of 20dB BW
	78	2480	-1000.00	>820.000	2/3 of 20dB BW
8DPSK	0	2402	-1000.00	>808.667	2/3 of 20dB BW
	39	2441	-1000.00	>810.000	2/3 of 20dB BW
	78	2480	-996.00	>809.333	2/3 of 20dB BW

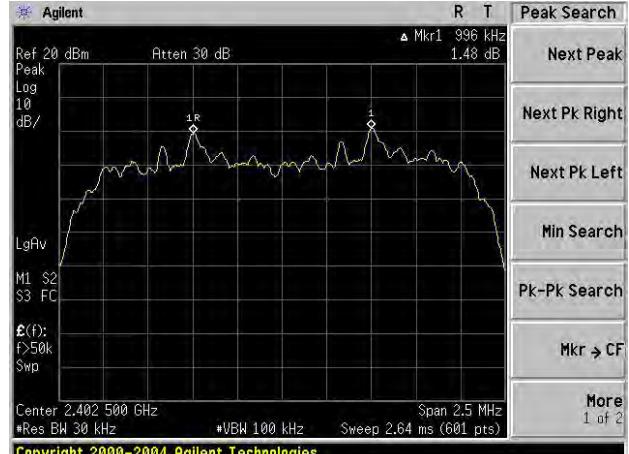


Test Plot

(1Mbps) Channel Separation plot on channel 00-01



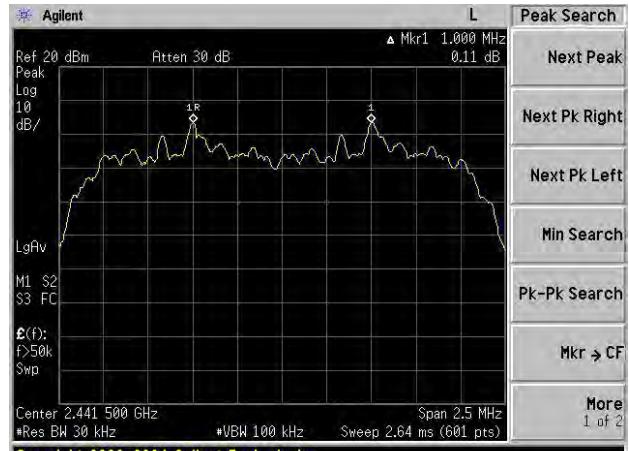
(2Mbps) Channel Separation plot on channel 00-01



(1Mbps) Channel Separation plot on channel 39-40



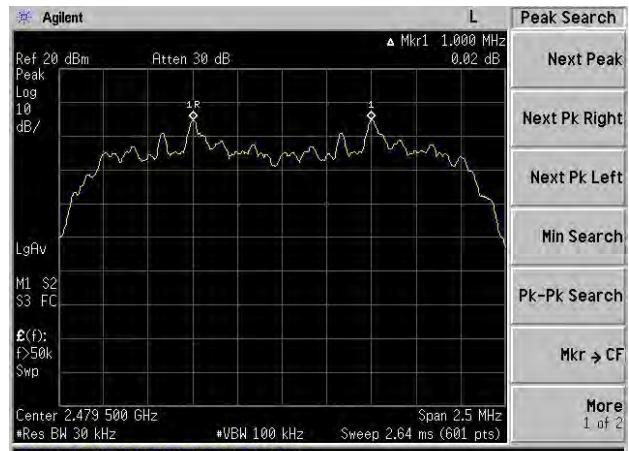
(2Mbps) Channel Separation plot on channel 39-40



(1Mbps) Channel Separation plot on channel 77-78



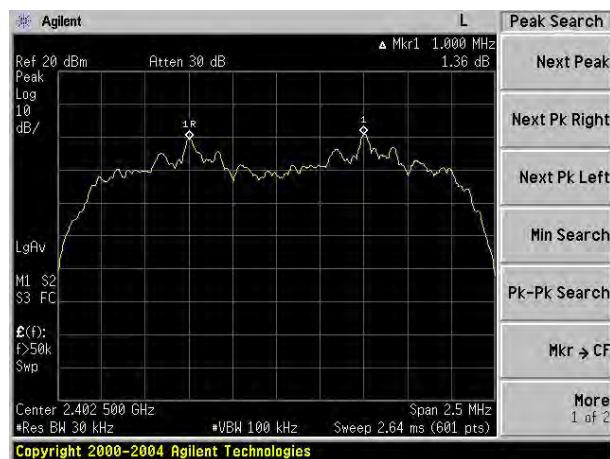
(2Mbps) Channel Separation plot on channel 77-78



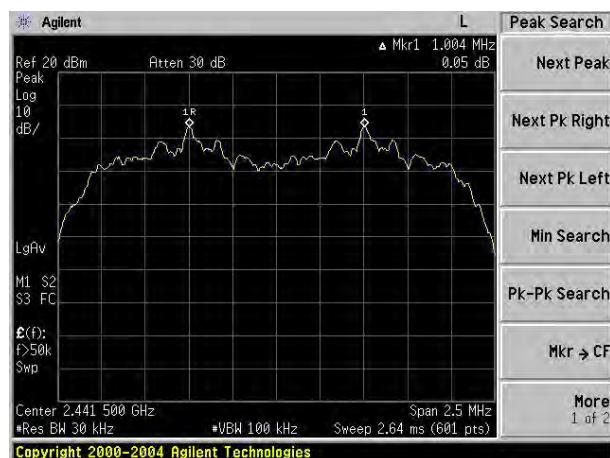


Test Plot

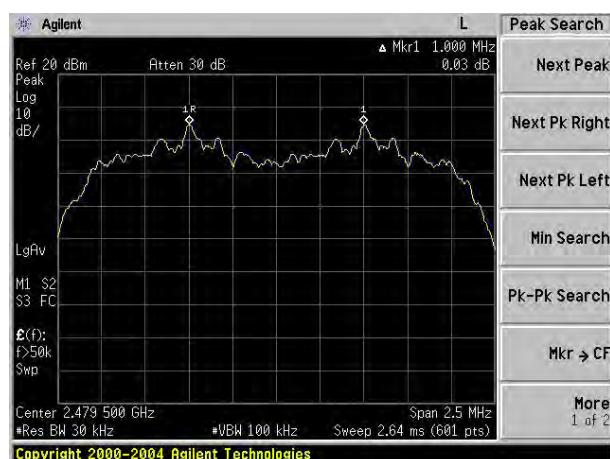
(3Mbps) Channel Separation plot on channel 00-01



(3Mbps) Channel Separation plot on channel 39-40



(3Mbps) Channel Separation plot on channel 77-78





AVERAGE TIME OF OCCUPANCY (DWELL TIME) APPLICABLE STANDARD

According to FCC Part 15.247(a)(1)(iii) and ANSI C63.10-2013

CONFORMANCE LIMIT

The average time of occupancy on any channel shall not be greater than 0.4s within a period of 0.4s multiplied by the number of hopping channels employed.

MEASURING INSTRUMENTS

The Measuring equipment is listed in the section 6.3 of this test report.

TEST SETUP

Please refer to Section 6.1 of this test report.

TEST PROCEDURE

The testing follows ANSI C63.10-2013 clause 7.8.4

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT must have its hopping function enabled.

Use the following spectrum analyzer settings:

Span = zero span, centered on a hopping channel

RBW \geq 1MHz

VBW \geq RBW

Sweep = as necessary to capture the entire dwell time per hopping channel

Detector function = peak

Trace = max hold

Measure the maximum time duration of one single pulse.

Set the EUT for DH5, DH3 and DH1 packet transmitting.

Measure the maximum time duration of one single pulse.



TEST RESULTS

Temperature :	26°C	Relative Humidity :	54%
Test Voltage :	DC 10.8V battery		
Test Mode :	Mode 1/2/3		

Modulation Mode	Channel Number	Packet type	Mode	Hops Over Occupancy Time	Pulse width (ms)	dwell time (ms)	Limit (ms)	Verdict
				(ms)				
GFSK	39	DH1	Normal	320	0.466	149.12	<400	PASS
	39		AFH	160	0.466	74.56	<400	PASS
	39	DH3	Normal	160	1.703	272.48	<400	PASS
	39		AFH	80	1.703	136.24	<400	PASS
	39	DH5	Normal	106.67	2.963	316.0632	<400	PASS
	39		AFH	53.33	2.963	158.0168	<400	PASS
$\pi/4$ -DQPSK	39	2DH1	Normal	320	0.478	152.96	<400	PASS
	39		AFH	160	0.478	76.48	<400	PASS
	39	2DH3	Normal	160	1.75	280	<400	PASS
	39		AFH	80	1.75	140	<400	PASS
	39	2DH5	Normal	106.67	2.987	318.6233	<400	PASS
	39		AFH	53.33	2.987	159.2967	<400	PASS
8DPSK	39	3DH1	Normal	320	0.466	149.12	<400	PASS
	39		AFH	160	0.466	74.56	<400	PASS
	39	3DH3	Normal	160	1.715	274.4	<400	PASS
	39		AFH	80	1.715	137.2	<400	PASS
	39	3DH5	Normal	106.67	2.975	317.3433	<400	PASS
	39		AFH	53.33	2.975	158.6568	<400	PASS

Note:

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)

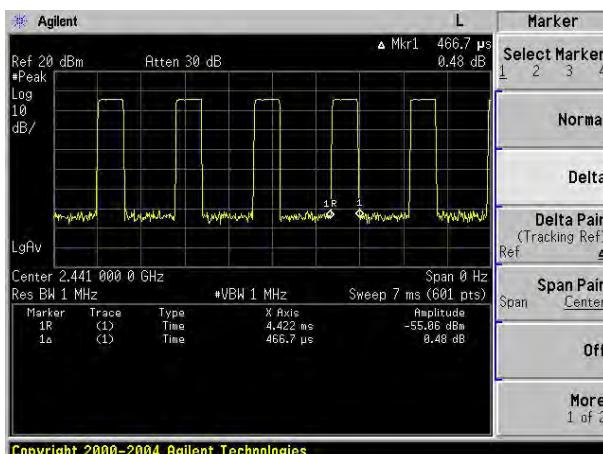
For Example:

1. In normal mode, hopping rate is 1600 hops/s with 6 slots in 79 hopping channels. With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit (0.4 x 79) (s), Hops Over Occupancy Time comes to (1600 / 6 / 79) x (0.4 x 79) = 106.67 hops.
2. In AFH mode, hopping rate is 800 hops/s with 6 slots in 20 hopping channels. With channel hopping rate (800 / 6 / 20) in Occupancy Time Limit (0.4 x 20) (s), Hops Over Occupancy Time comes to (800 / 6 / 20) x (0.4 x 20) = 53.33 hops.
3. Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

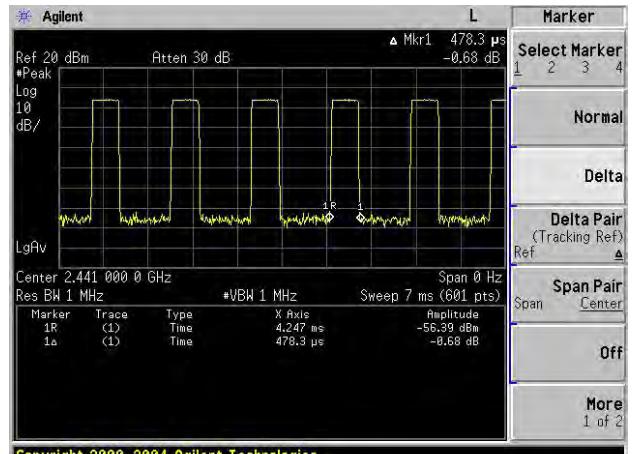


Test Plot

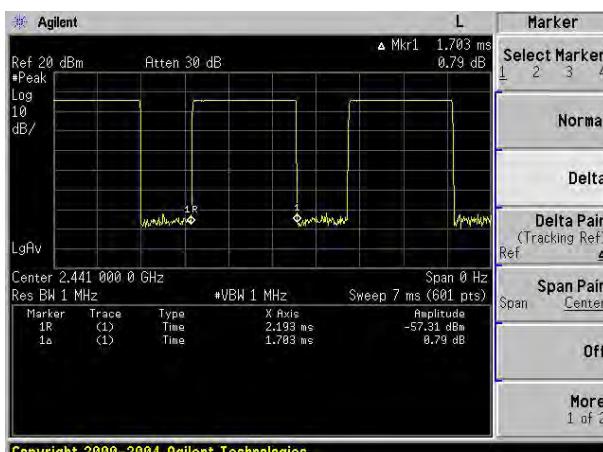
Package Transfer Time Plot CH39-DH1



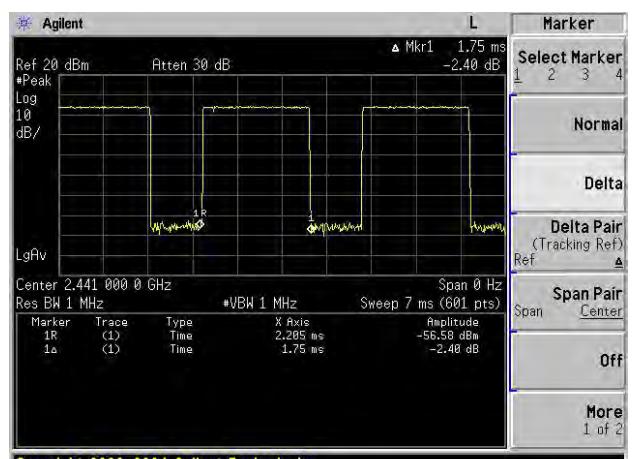
Package Transfer Time Plot CH39-2DH1



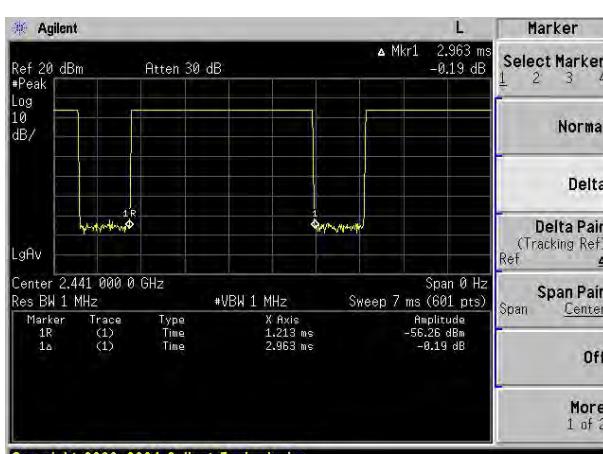
Package Transfer Time Plot CH39-DH3



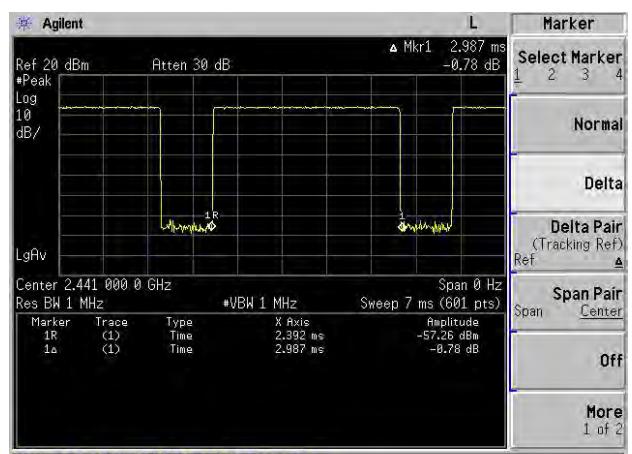
Package Transfer Time Plot CH39-2DH3



Package Transfer Time Plot CH39-DH5



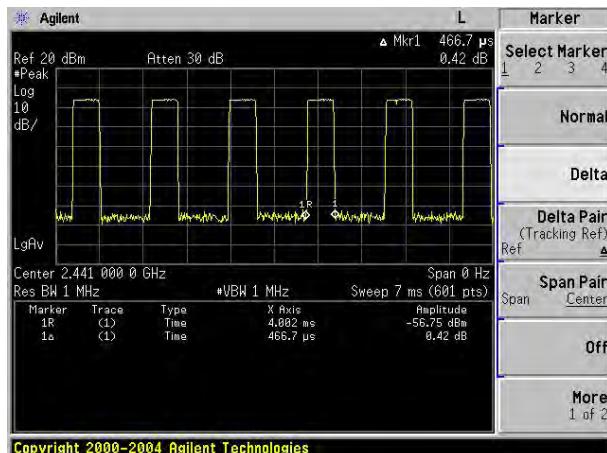
Package Transfer Time Plot CH39-2DH5



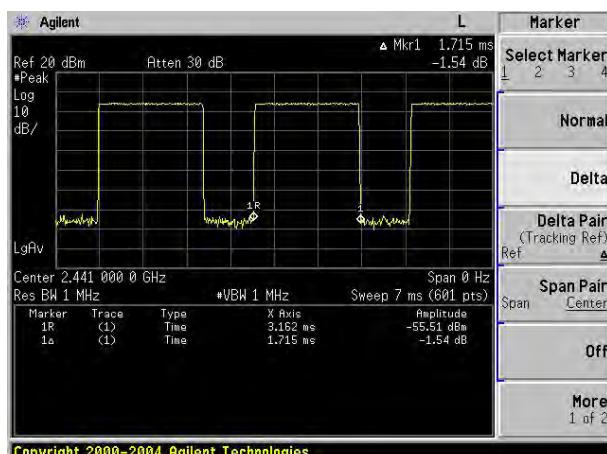


Test Plot

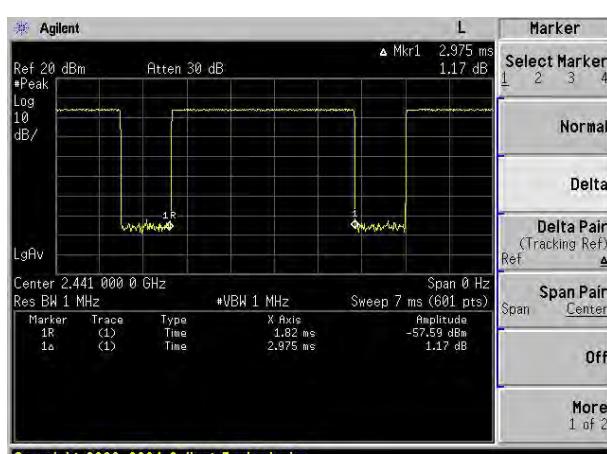
Package Transfer Time Plot CH39-3DH1



Package Transfer Time Plot CH39-3DH3



Package Transfer Time Plot CH39-3DH5





20DB BANDWIDTH TEST APPLICABLE STANDARD

According to FCC Part 15.247(a)(1) and ANSI C63.10-2013
CONFORMANCE LIMIT

No limit requirement.

MEASURING INSTRUMENTS

The Measuring equipment is listed in the section 6.3 of this test report.

TEST SETUP

Please refer to Section 6.1 of this test report.

TEST PROCEDURE

The testing follows ANSI C63.10-2013 clause 6.9.2

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT was operating in controlled its channel.

Use the following spectrum analyzer settings:

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

RBW \geq 1% of the 20 dB bandwidth

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

**TEST RESULTS**

Temperature :	26°C	Relative Humidity :	54%
Test Voltage :	DC 10.8V battery		
Test Mode :	Mode 1/2/3		

Test Channel	Frequency (MHz)	Measurement Bandwidth (KHz)	Limit	Verdict
			(kHz)	
1Mbps				
0	2402	873.878	N/A	PASS
39	2441	871.24	N/A	PASS
78	2480	872.048	N/A	PASS
2Mbps				
0	2402	1207	N/A	PASS
39	2441	1224	N/A	PASS
78	2480	1223	N/A	PASS
3Mbps				
0	2402	1212	N/A	PASS
39	2441	1214	N/A	PASS
78	2480	1211	N/A	PASS

Note: N/A (Not Applicable)



Test Plot

20dB Bandwidth plot on channel 00 (1Mbps)



20dB Bandwidth plot on channel 00 (2Mbps)



20dB Bandwidth plot on channel 39 (1Mbps)



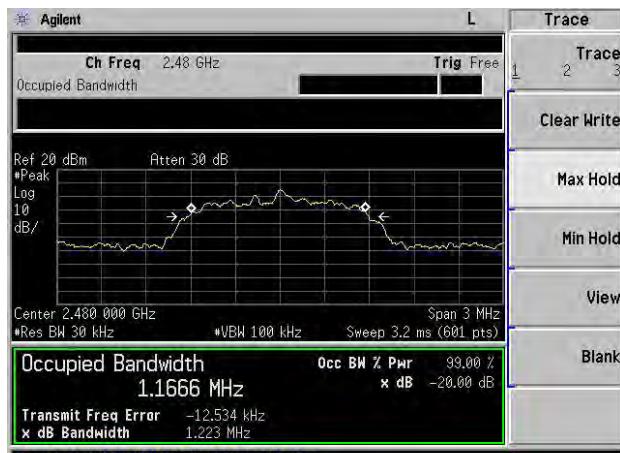
20dB Bandwidth plot on channel 39 (2Mbps)



20dB Bandwidth plot on channel 78 (1Mbps)



20dB Bandwidth plot on channel 78 (2Mbps)





Test Plot

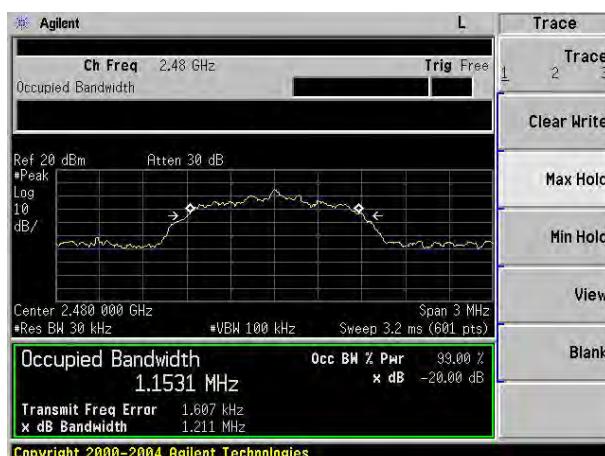
20dB Bandwidth plot on channel 00 (3Mbps)



20dB Bandwidth plot on channel 39 (3Mbps)



20dB Bandwidth plot on channel 78 (3Mbps)





PEAK OUTPUT POWER APPLICABLE STANDARD

According to FCC Part 15.247(b)(1) and ANSI C63.10-2013

CONFORMANCE LIMIT

The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.

MEASURING INSTRUMENTS

The Measuring equipment is listed in the section 6.3 of this test report.

TEST SETUP

Please refer to Section 6.1 of this test report.

TEST PROCEDURE

The testing follows ANSI C63.10-2013 clause 7.8.5.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT was operating in controlled its channel.

Use the following spectrum analyzer settings:

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

RBW \geq the 20 dB bandwidth of the emission being measured

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

**TEST RESULTS**

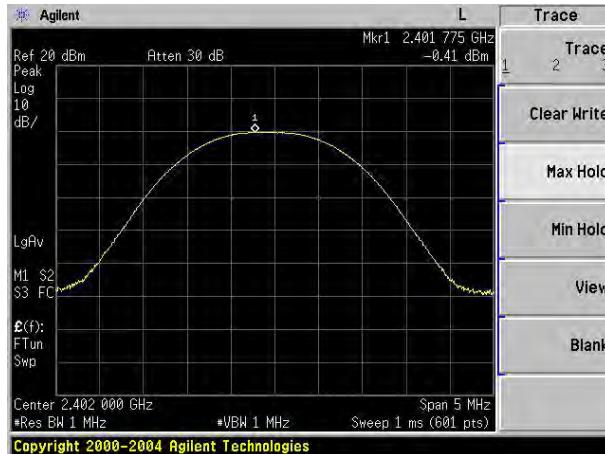
Temperature :	26°C	Relative Humidity :	54%
Test Voltage :	DC 10.8V battery		
Test Mode :	Mode 1/2/3		

Test Channel	Frequency (MHz)	Power Setting	Peak Output Power (dBm)	LIMIT (dBm)	Verdict
1Mbps					
00	2402	Default	-0.41	30	PASS
39	2441	Default	-0.39	30	PASS
78	2480	Default	-0.15	30	PASS
2Mbps					
00	2402	Default	0.98	20.97	PASS
39	2441	Default	1.00	20.97	PASS
78	2480	Default	1.29	20.97	PASS
3Mbps					
00	2402	Default	1.21	20.97	PASS
39	2441	Default	1.23	20.97	PASS
78	2480	Default	1.40	20.97	PASS

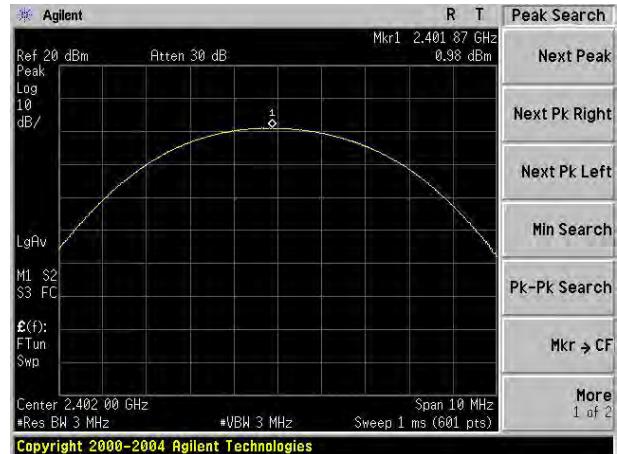


Test Plot

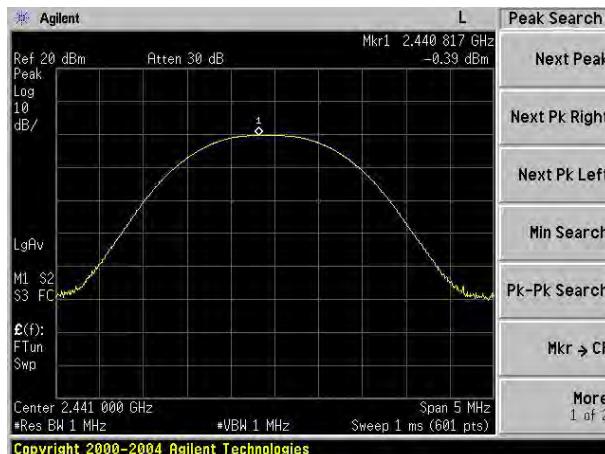
Peak output Power plot on channel 00 (1Mbps)



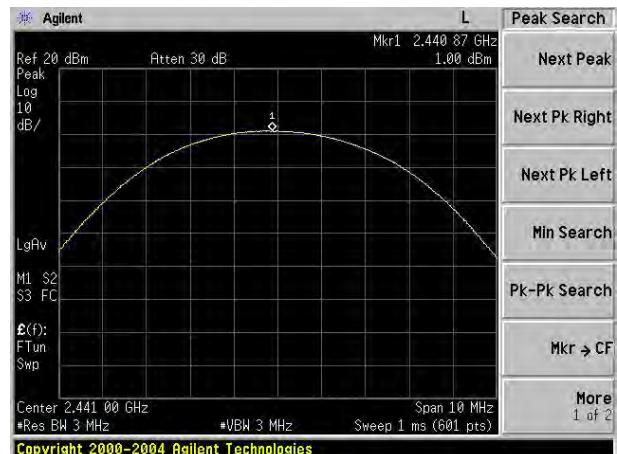
Peak output Power plot on channel 00 (2Mbps)



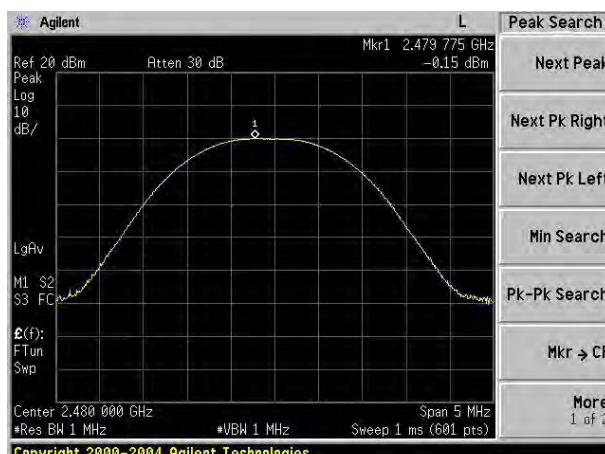
Peak output Power plot on channel 39 (1Mbps)



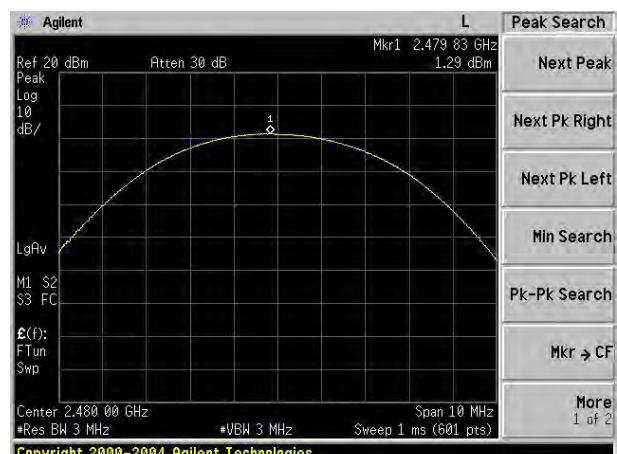
Peak output Power plot on channel 39 (2Mbps)



Peak output Power plot on channel 78 (1Mbps)



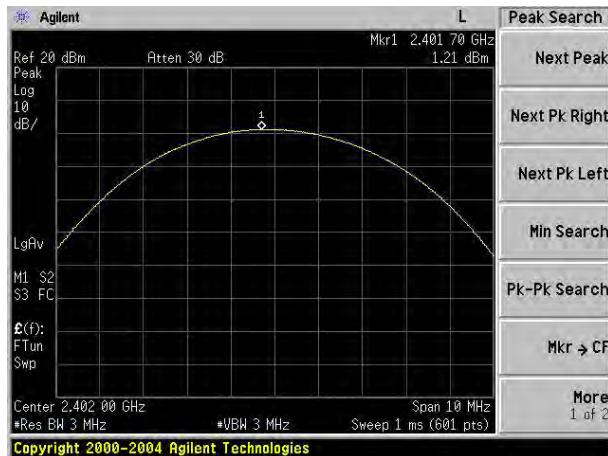
Peak output Power plot on channel 78 (2Mbps)



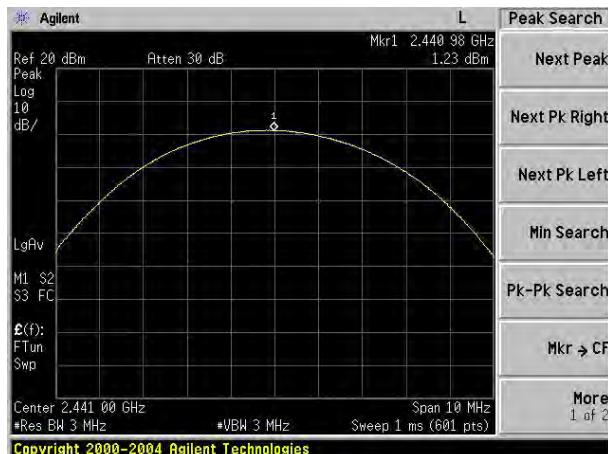


Test Plot

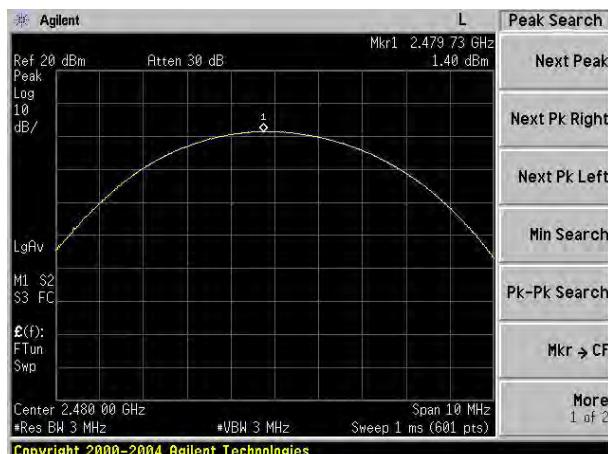
Peak output Power plot on channel 00 (3Mbps)



Peak output Power plot on channel 39 (3Mbps)



Peak output Power plot on channel 78 (3Mbps)





CONDUCTED BAND EDGE MEASUREMENT APPLICABLE STANDARD

According to FCC Part 15.247(d) and ANSI C63.10-2013

CONFORMANCE LIMIT

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)).

MEASURING INSTRUMENTS

The Measuring equipment is listed in the section 6.3 of this test report.

TEST SETUP

Please refer to Section 6.1 of this test report.

TEST PROCEDURE

The testing follows ANSI C63.10-2013 clause 7.8.6.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT must have its hopping function enabled.

Use the following spectrum analyzer settings:

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

RBW = 100KHz

VBW = 100KHz

Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.

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.

Repeat above procedures until all measured frequencies were complete.



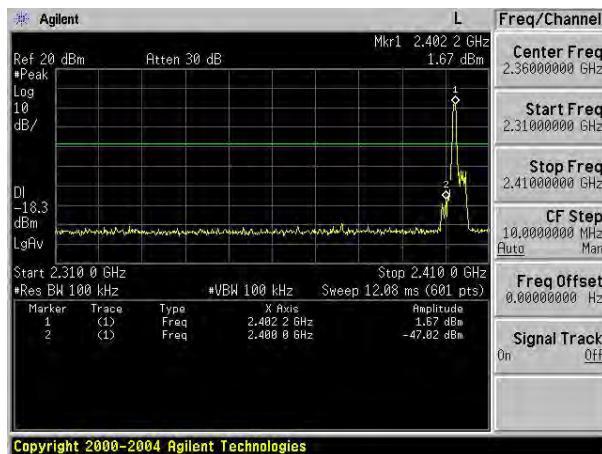
TEST RESULTS

Temperature :	26°C	Relative Humidity :	54%
Test Voltage :	DC 10.8V battery		
Test Mode :	Mode 1/2/3		

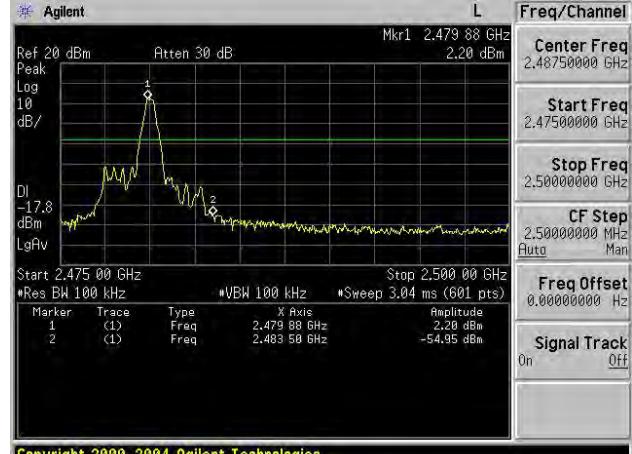
Note: Hopping enabled and disabled have evaluated, and the worst test data was reported

Test Plot

BDR mode (GFSK): Band Edge-Low Channel

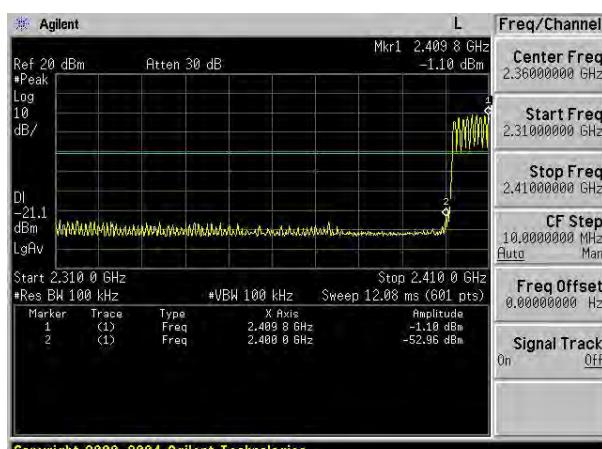


BDR mode (GFSK): Band Edge-High Channel



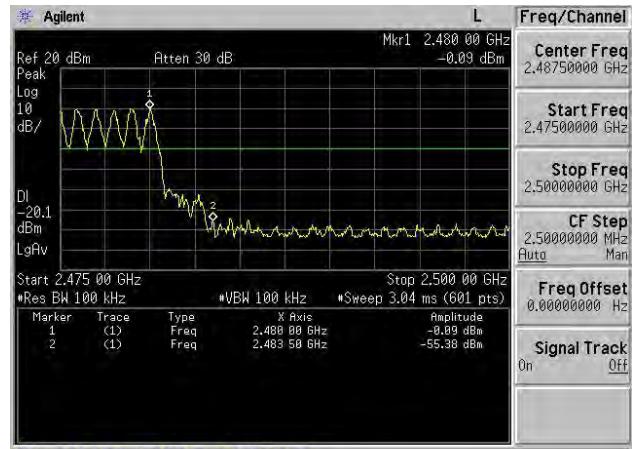
BDR mode (GFSK): Band Edge-Low Channel

(Hopping Mode)



BDR mode (GFSK): Band Edge-High Channel

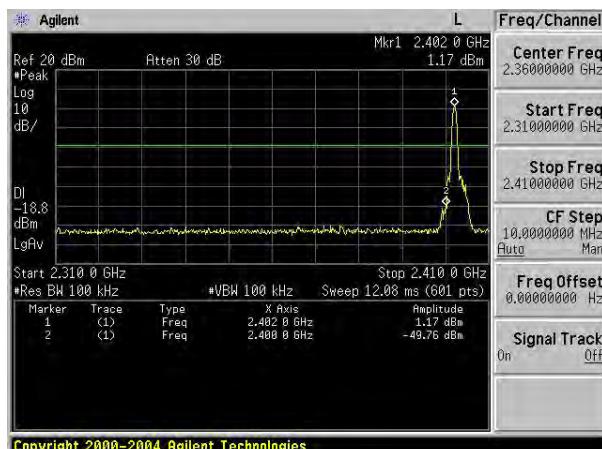
(Hopping Mode)



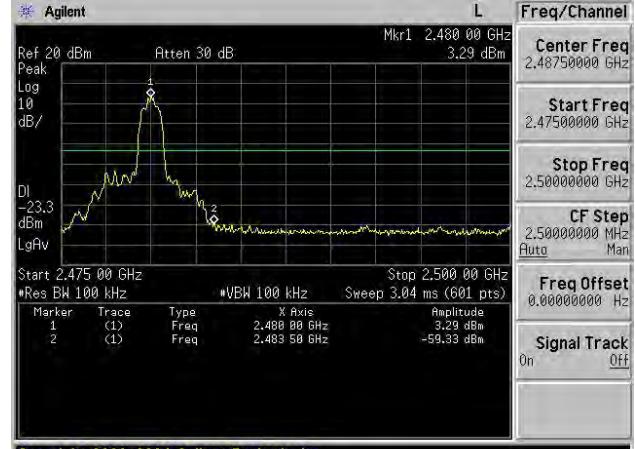


Test Plot

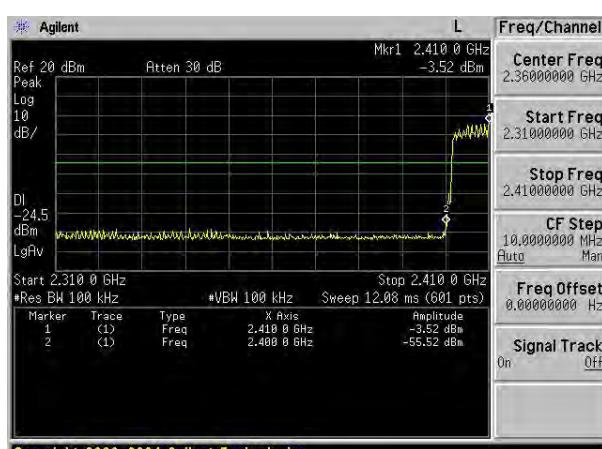
BDR mode ($\pi/4$ -DQPSK): Band Edge-Low Channel



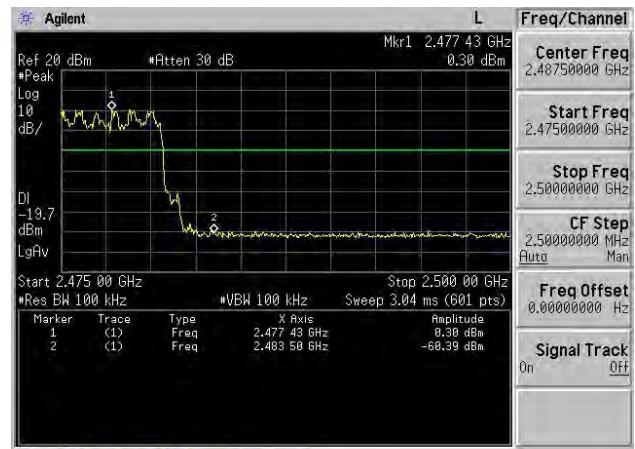
BDR mode ($\pi/4$ -DQPSK): Band Edge-High Channel



BDR mode ($\pi/4$ -DQPSK): Band Edge-Low Channel (Hopping Mode)



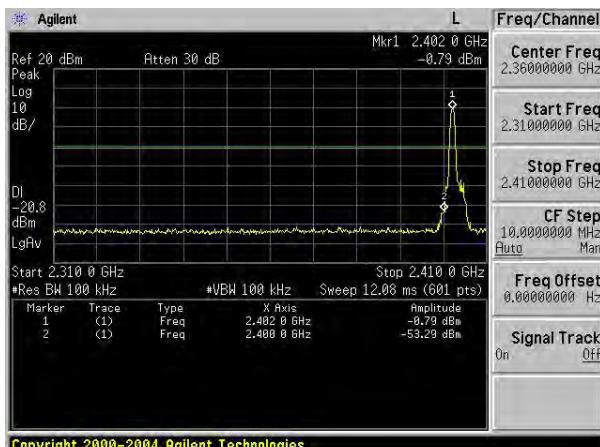
BDR mode ($\pi/4$ -DQPSK): Band Edge-High Channel (Hopping Mode)



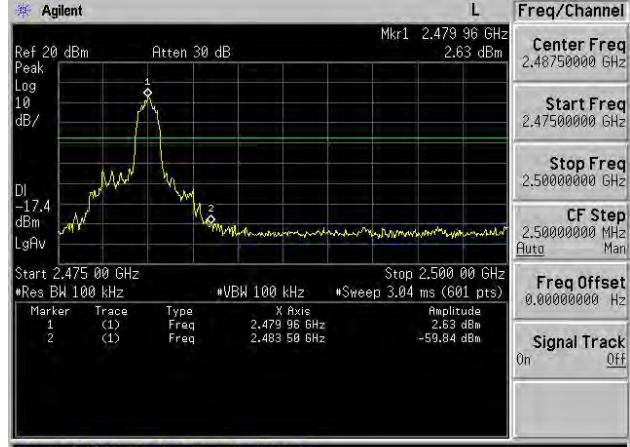


Test Plot

BDR mode (8DPSK): Band Edge-Low Channel

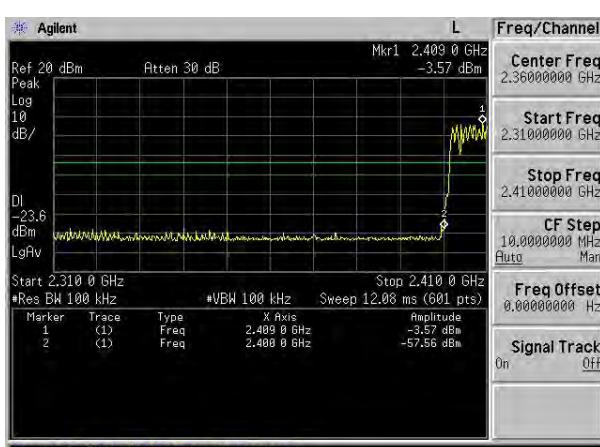


BDR mode (8DPSK): Band Edge-High Channel



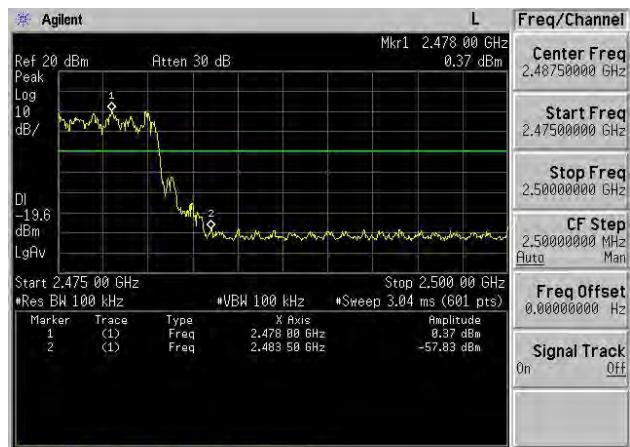
BDR mode (8DPSK): Band Edge-Low Channel

(Hopping Mode)



BDR mode (8DPSK): Band Edge-High Channel

(Hopping Mode)





. ANTENNA REQUIREMENT

STANDARD REQUIREMENT

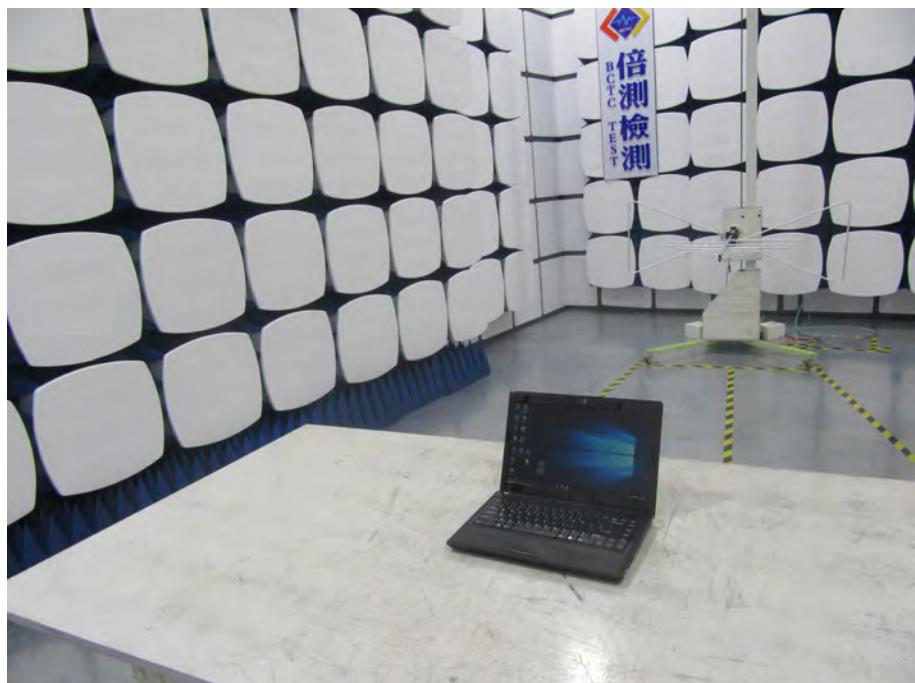
15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

EUT ANTENNA

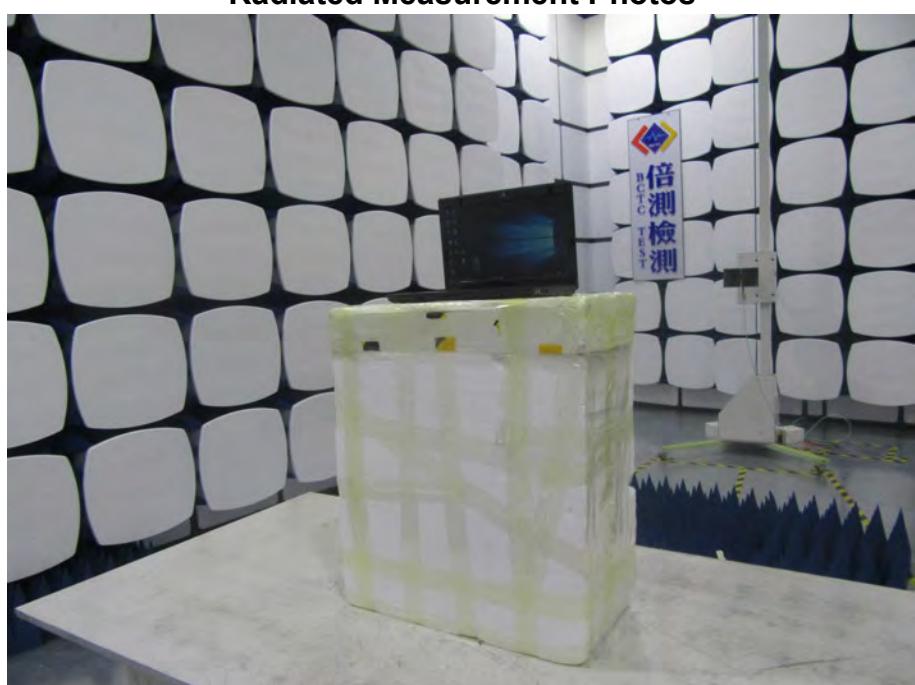
The EUT antenna is Internal antenna. It complies with the standard requirement.

. EUT TEST PHOTO

Radiated Measurement Photos



Radiated Measurement Photos





Conducted Emission





. EUT PHOTO



※※※※ END OF REPORT ※※※※