FCC TEST REPORT
for
Yantouch Corporation

Bluetooth gateway
Model No.: MCR-001, MCR-002, MCR-003, MCR-004,
MCR-005, MCR-006, MCR-007, MCR-008, MCR-009

Prepared for	:	Yantouch Corporation
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Report Number	:	201402776F
Date of Test	:	Feb. 22~ Mar. 05, 2014
Date of Report	:	Mar. 06, 2014

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TEST REPORT

Applicant	:	Yantouch Corporation
Manufacturer	:	Yantouch Corporation
EUT	:	Bluetooth gateway
Model No.	:	MCR-001, MCR-002, MCR-003, MCR-004, MCR-005, MCR-006, MCR-007, MCR-008, MCR-009
Serial No.	:	N.A.
Trade Mark	:	N.A.
Rating	:	DC 3.7V, 500mA

Measurement Procedure Used:

FCC Part15 Subpart C, Paragraph 15.207, 15.247 & 15.209

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart C requirements.
This report applies to above tested sample only and shall not be reproduced in part without
written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Test : Feb. 22~ Mar. 05, 2014

Prepared by : (Tested Engineer / Rock Zeng)

Reviewer : (Project Manager / Amy Ding)

Approved & Authorized Signer : (Manager / Tom Chen)

1. GENERAL INFORMATION

1.1 Description of Device (EUT)

EUT	:	Bluetooth gateway
Model Number	:	MCR-001, MCR-002, MCR-003, MCR-004, MCR-005, MCR-006, MCR-007, MCR-008, MCR-009 (Note: All samples are the same except the model number and appearance, so we prepare "MCR-001" for EMC test only.)
Test Power Supply	:	DC 5V via adapter AC 120V, 60Hz/ DC 3.7V
Frequency	:	2402~2480MHz
Antenna Specification	:	PCB Antenna: 1.76dBi
Modulation	:	GFSK, π/4DQPSK, 8DPSK
Applicant	:	Yantouch Corporation
Address	:	Rm. 303, 4F-1., No.5, Xin'an Rd., Hsinchu Science, Hsinchu City 300, Taiwan
Manufacturer	:	Yantouch Corporation
Address	:	Rm. 303, 4F-1., No.5, Xin'an Rd., Hsinchu Science, Hsinchu City 300, Taiwan
Factory	:	Yantouch Corporation
Address	:	Rm. 303, 4F-1., No.5, Xin'an Rd., Hsinchu Science, Hsinchu City 300, Taiwan
Date of receiver	:	Feb. 22, 2014
Date of Test	:	Feb. 22~ Mar. 05, 2014

1.2 Auxiliary Equipment Used during Test

Adapter	:	Power Supply Model:MX12L3-0502000V Input: AC 100-240V, 50-60Hz, 0.35A Output: DC 3.7V, 2A CE , FCC

1.3 Description of Test Facility

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

FCC-Registration No.: 463622
EMC Laboratory has been registed and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 463622, June 14, 2011.

IC-Registration No.: 46405-9469
EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada. The acceptance letter from the IC is maintained in our files. Registration 46405-9469, May 02, 2011.

Test Location
All Emissions tests were performed at
NINGBO EMTEK CO., LTD. at 1F Building 4, 1177#, Lingyun Road, Ningbo National Hi-Tech Zone, Ningbo, Zhejiang, China

1.4 Measurement Uncertainty

Radiation Uncertainty	:	Ur = 4.3dB
Conduction Uncertainty	:	Uc = 3.4dB

2. Test Procedure

GENERAL: This report shall NOT be reproduced except in full without the written approval of Shenzhen Anbotek Compliance Laboratory Limited. The EUT was transmitting a test signal during the testing.

RADIATION INTERFERENCE: The test procedure used was ANSI STANDARD C63.4-2009 using a spectrum analyzer with a pre-selector. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100KHz and the video bandwidth was 300KHz up to 1.0GHz and 1.0MHz with a video BW of 3.0MHz above 1.0GHz. The ambient temperature of the EUT was 74.3oF with a humidity of 69%.

FORMULA OF CONVERSION FACTORS: The Field Strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBuV) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB. The gain of the Preselector was accounted for in the Spectrum Analyzer Meter Reading.

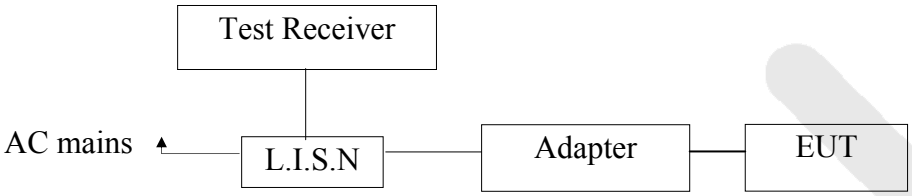
Example:
Freq (MHz) METER READING + ACF = FS
20 dBuV + 10.36 dB = 30.36 dBuV/m @ 3m

ANSI STANDARD C63.4-2009 10.1.7 MEASUREMENT PROCEDURES: The EUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The EUT was placed in the center of the table (1.5m side). The table used for radiated measurements is capable of continuous rotation.
When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes.

3. Conducted Emission

3.1 Block Diagram of Test Setup

3.1.1. Block diagram of connection between the EUT and simulators



3.2 Power Line Conducted Emission Measurement Limits (15.207)

Frequency MHz	Limits dB(μV)	
	Quasi-peak Level	Average Level
0.15 ~ 0.50	66 ~ 56*	56 ~ 46*
0.50 ~ 5.00	56	46
5.00 ~ 30.00	60	50

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

3.3 Configuration of EUT on Measurement

The following equipments are installed on Power Line Conducted Emission Measurement to meet the commission requirement and operating regulations in a manner which tends to maximize its emission characteristics in a normal application.

3.4 Operating Condition of EUT

3.4.1. Setup the EUT and simulator as shown as Section 3.1.

3.4.2. Turn on the power of all equipment.

3.4.3. Let the EUT work in test mode (Charging) and measure it.

3.5 Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.4-2003 on Conducted Emission Measurement.

The bandwidth of test receiver (ESCI) set at 9KHz.

The frequency range from 150KHz to 30MHz is checked.

The test results are reported on Section 3.6.

Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Test Receiver	Rohde & Schewarz	ESCI	101108	08/01/2013	1 Year
2.	L.I.S.N	Rohde & Schewarz	ENV216	101193	08/01/2013	1 Year
3.	L.I.S.N	Schwarzbeck	NSLK 8126	8126-462	08/01/2013	1 Year
4.	Pulse Limiter	MTS-system technik	IMP-136	2611115-001-0033	08/01/2013	1 Year

3.6 Power Line Conducted Emission Measurement Results

PASS.

The frequency range from 150KHz to 30 MHz is investigated.

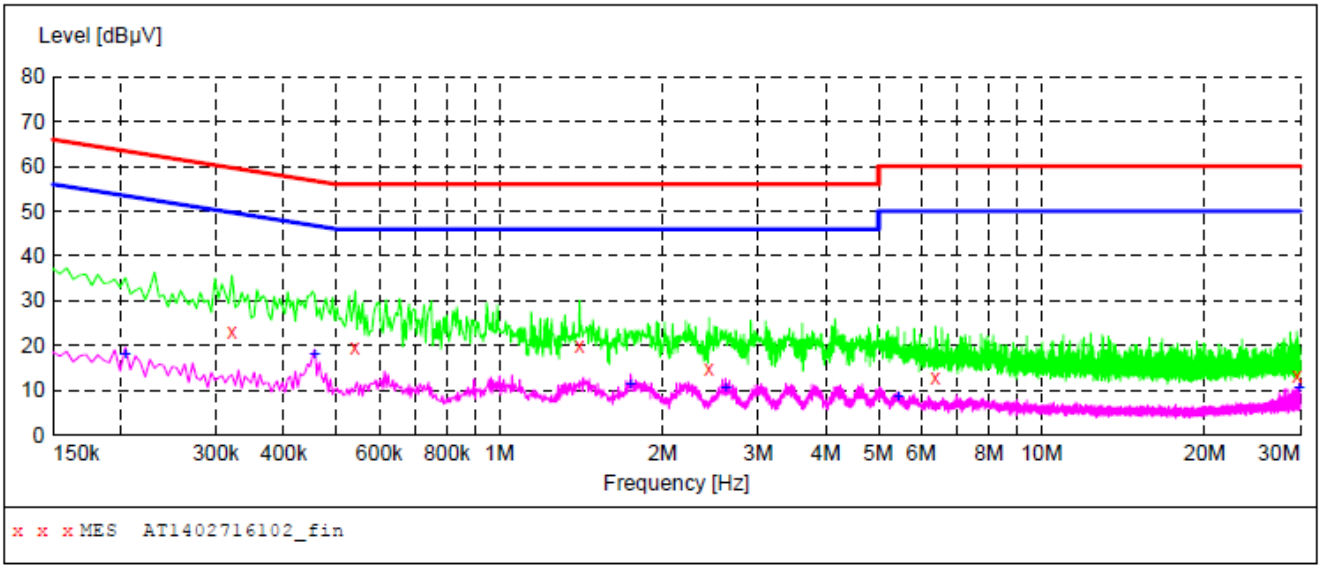
Please refer the following pages.

CONDUCTED EMISSION TEST DATA

Test Site:	1# Shielded Room
Operating Condition:	Charging
Test Specification:	DC 5V via adapter AC 120V, 60Hz
Comment:	Live Line
	Tem:25℃ Hum:50%

SCAN TABLE: "Voltage(150K~30M)FIN"

Short Description: 150K-30M Disturbance Voltages



MEASUREMENT RESULT: "AT1402716102_fin"

2/24/2014 2:54PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.321000	23.10	20.1	60	36.6	QP	L1	GND
0.541500	19.70	20.1	56	36.3	QP	L1	GND
1.405000	19.90	20.2	56	36.1	QP	L1	GND
2.435500	14.90	20.3	56	41.1	QP	L1	GND
6.368500	12.70	20.5	60	47.3	QP	L1	GND
29.543500	13.30	20.9	60	46.7	QP	L1	GND

MEASUREMENT RESULT: "AT1402716102_fin2"

2/24/2014 2:54PM

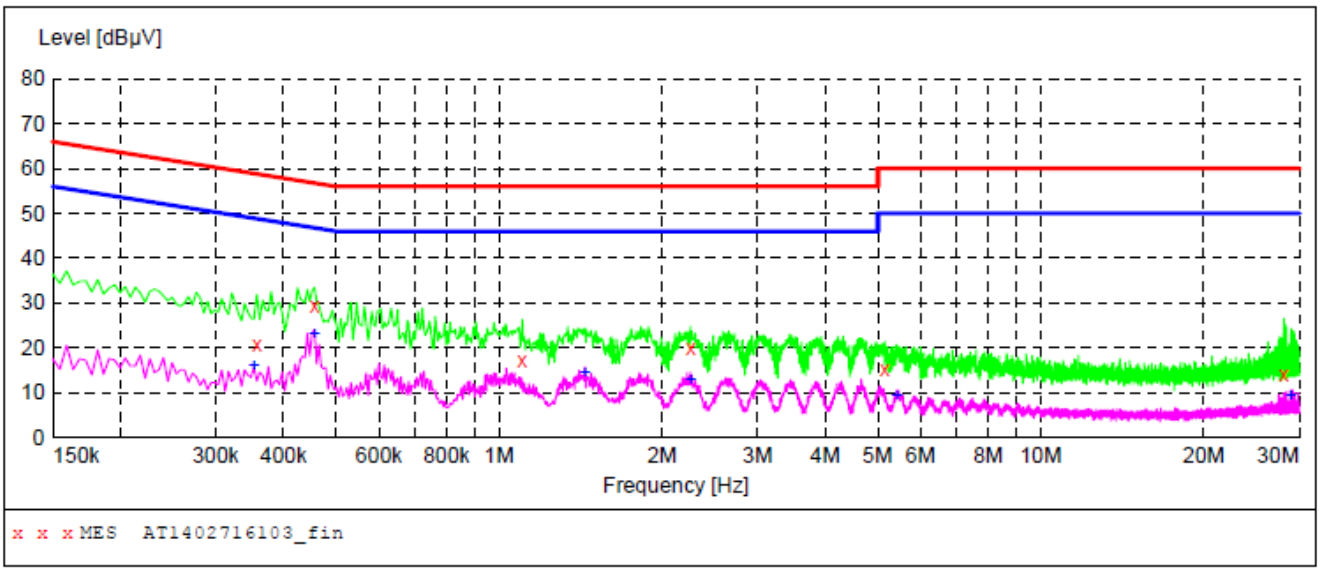
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.204000	18.10	20.1	53	35.3	AV	L1	GND
0.456000	17.90	20.1	47	28.9	AV	L1	GND
1.747000	11.40	20.3	46	34.6	AV	L1	GND
2.611000	10.30	20.4	46	35.7	AV	L1	GND
5.432500	8.40	20.5	50	41.6	AV	L1	GND
29.899000	10.30	20.9	50	39.7	AV	L1	GND

CONDUCTED EMISSION TEST DATA

Test Site:	1# Shielded Room
Operating Condition:	Charging
Test Specification:	DC 5V via adapter AC 120V, 60Hz
Comment:	Neutral Line
	Tem:25℃ Hum:50%

SCAN TABLE: "Voltage(150K~30M)FIN"

Short Description: 150K-30M Disturbance Voltages



MEASUREMENT RESULT: "AT1402716103_fin"

2/24/2014 2:58PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.357000	20.80	20.1	59	38.0	QP	N	GND
0.456000	29.40	20.1	57	27.4	QP	N	GND
1.103500	17.00	20.2	56	39.0	QP	N	GND
2.255500	20.10	20.3	56	35.9	QP	N	GND
5.153500	15.40	20.5	60	44.6	QP	N	GND
28.103500	14.20	20.9	60	45.8	QP	N	GND

MEASUREMENT RESULT: "AT1402716103_fin2"

2/24/2014 2:58PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.352500	15.90	20.1	49	33.0	AV	N	GND
0.456000	23.00	20.1	47	23.8	AV	N	GND
1.441000	14.40	20.3	46	31.6	AV	N	GND
2.255500	12.80	20.3	46	33.2	AV	N	GND
5.428000	9.20	20.5	50	40.8	AV	N	GND
28.940500	9.40	20.9	50	40.6	AV	N	GND

4. Radiation Interference

4.1 Requirements (15.247, 15.209):

4.1.1. Test Limits (< 30 MHZ)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30

4.1.2. Test Limits (≥ 30 MHZ)

FIELD STRENGTH of Fundamental: @3M	FIELD STRENGTH of Harmonics	S15.209	
902-928 MHZ		30 - 88 MHz	40 dBuV/m
2.4-2.4835 GHz		88 - 216 MHz	43.5
94 dBμV/m @3m	54 dBμV/m @3m	216 - 960 MHz	46
		ABOVE 960 MHz	54dBuV/m

For range 9KHz~30MHz, The measured value is really too low to be recorded.

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in 15.209, whichever is the lesser attenuation.

4.2 Test Procedure

The EUT is placed on a turn table which is 0.8 meter high above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Rotated the EUT through three orthogonal axes to determine the maximum emissions, both horizontal and vertical polarization of the antenna are set on test.

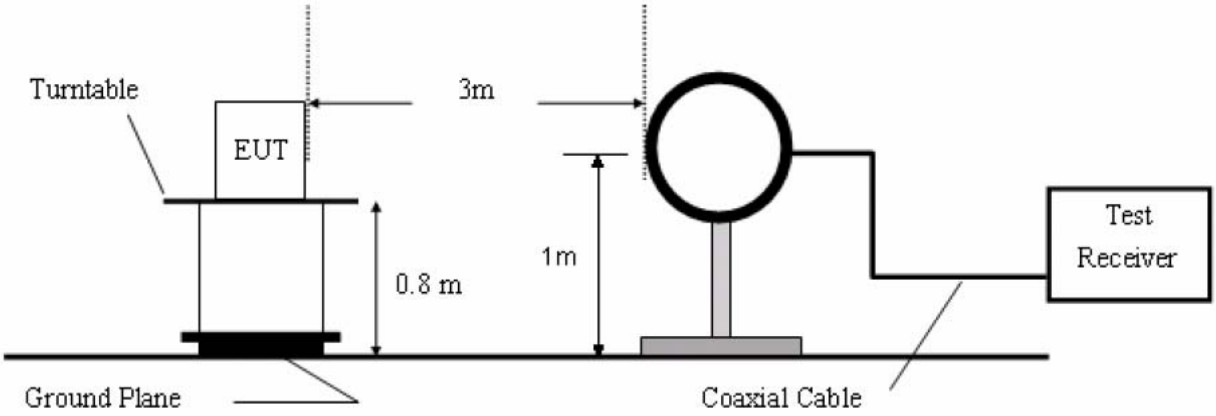
All readings from 30MHz to 1GHz are quasi-peak values with a resolution bandwidth of 120kHz. All reading are above 1GHz, peak & average values with a resolution bandwidth of 1MHz. The EUT is tested in 9*6*6 Chamber.

Test Equipment

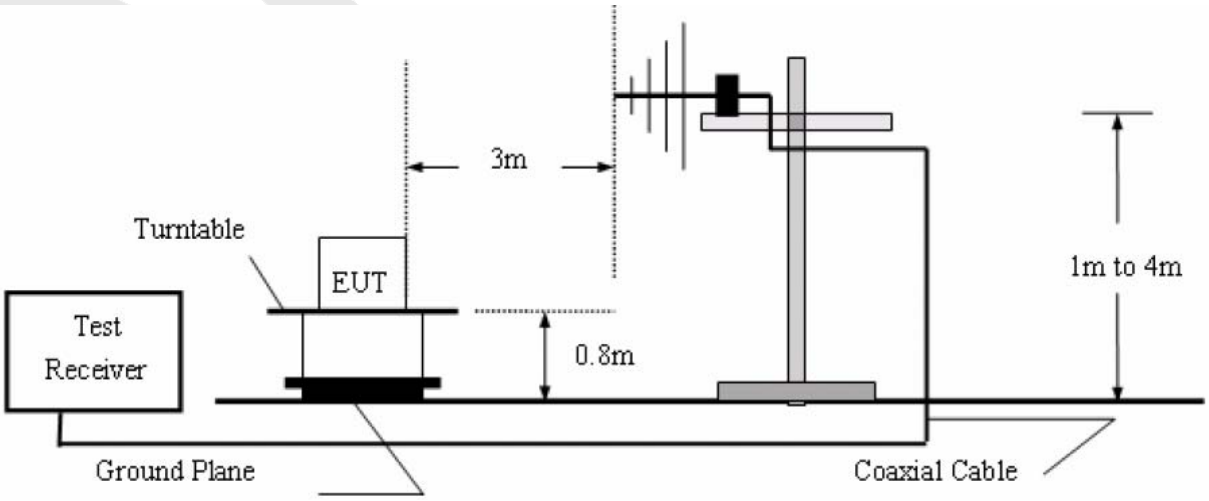
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Aug. 09, 2013	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Aug. 09, 2013	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 23, 2013	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Aug. 09, 2013	3 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 23, 2013	3 Year
6.	Loop Antenna	ARA	PLA-1030/B	1029	Apr. 23, 2013	3 Year
7.	Pre-amplifier	SONOMA	310N	186860	Apr. 23, 2013	1 Year
8.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

4.3 Test Configuration

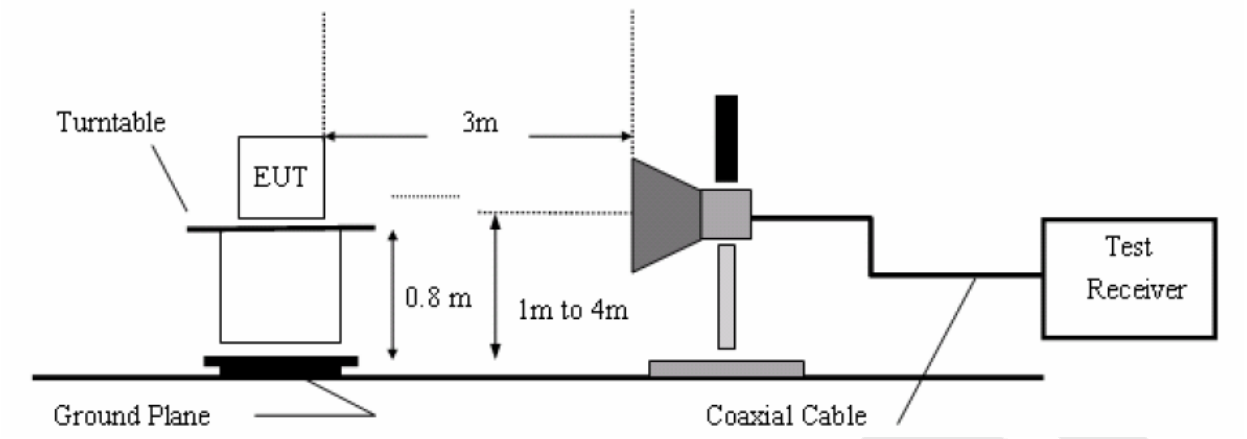
4.3.1. 9k to 30MHz emissions:



4.3.2. 30M to 1G emissions:



4.3.3. 1G to 40G emissions:

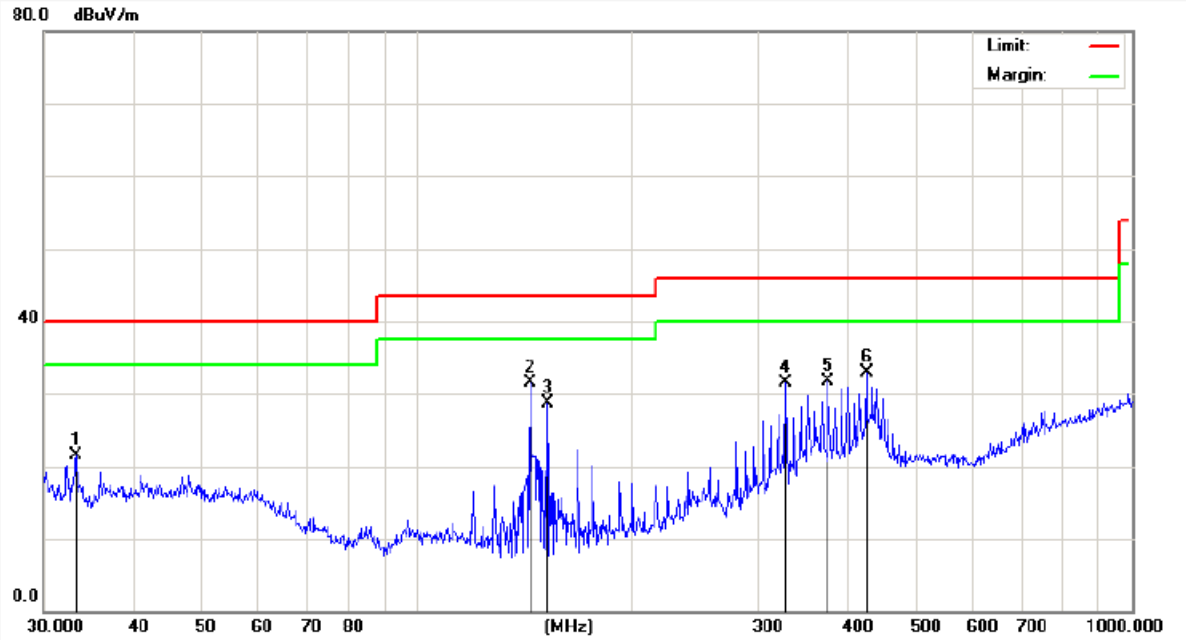


4.4 Test Results

PASS.

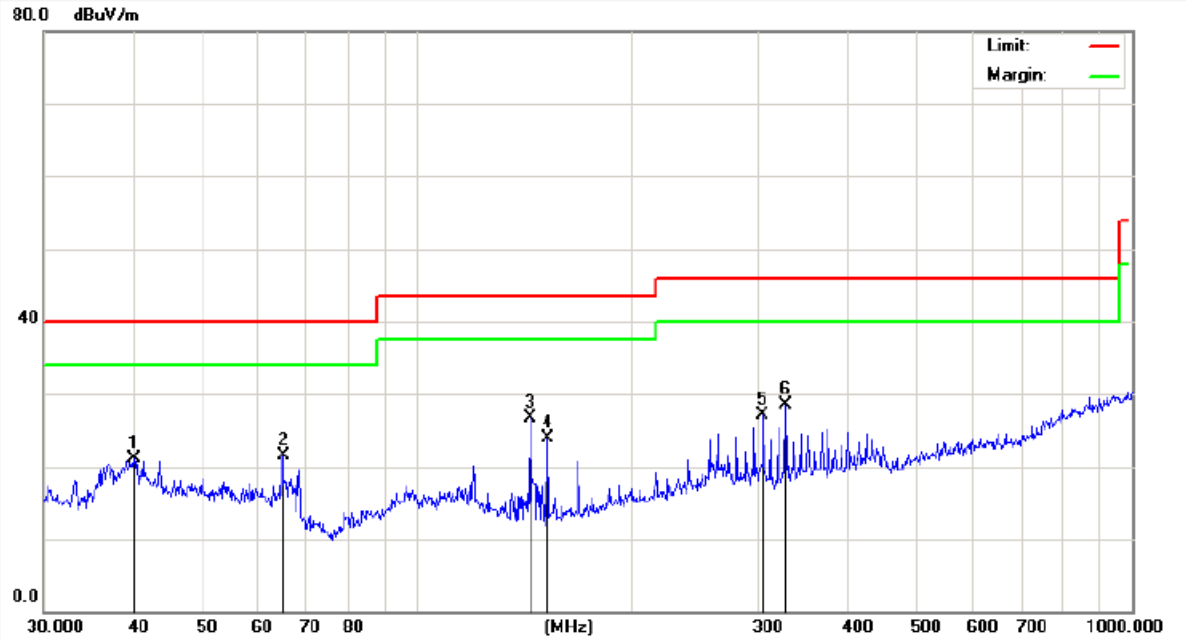
The EUT was tested on (Charging, BT Mode) modes, only the worst data of (BT Mode) are attached in the following pages.

Job No.:	**AT1402716F**	**Polarization:**	**Horizontal**
Standard:	**(RE)FCC PART 15C _3m**	**Power Source:**	**DC 3.7V**
Test item:	**Radiation Test (30~1000MHz)**	**Temp.(C)/Hum.(%RH):**	**24.3(C)/55%RH**
Test Mode:	**BT Mode**	**Distance:**	**3m**



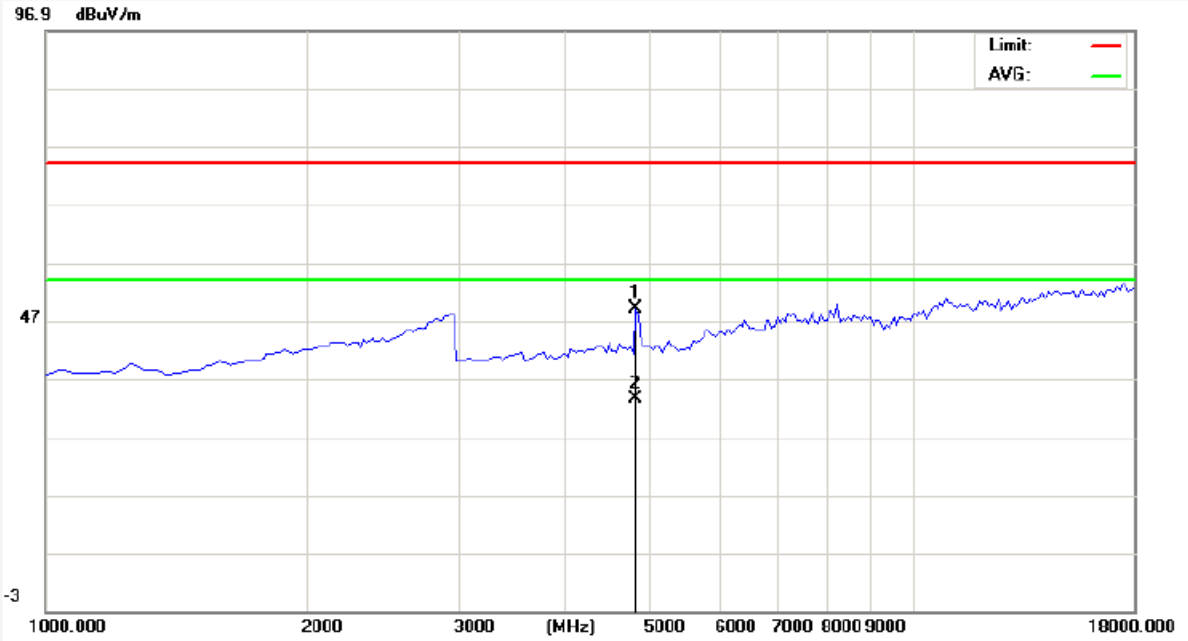
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	33.3278	37.93	-16.51	21.42	40.00	-18.58	peak			
2	143.8294	54.87	-23.43	31.44	43.50	-12.06	peak			
3	152.1297	52.03	-23.24	28.79	43.50	-14.71	peak			
4	327.8872	46.36	-14.88	31.48	46.00	-14.52	peak			
5	375.9384	45.02	-13.35	31.67	46.00	-14.33	peak			
6	425.0280	45.32	-12.33	32.99	46.00	-13.01	peak			

Job No.:	**AT1402716F**	**Polarization:**	**Vertical**
Standard:	**(RE)FCC PART 15C _3m**	**Power Source:**	**DC 3.7V**
Test item:	**Radiation Test (30~1000MHz)**	**Temp.(C)/Hum.(%RH):**	**24.3(C)/55%RH**
Test Mode:	**BT Mode**	**Distance:**	**3m**



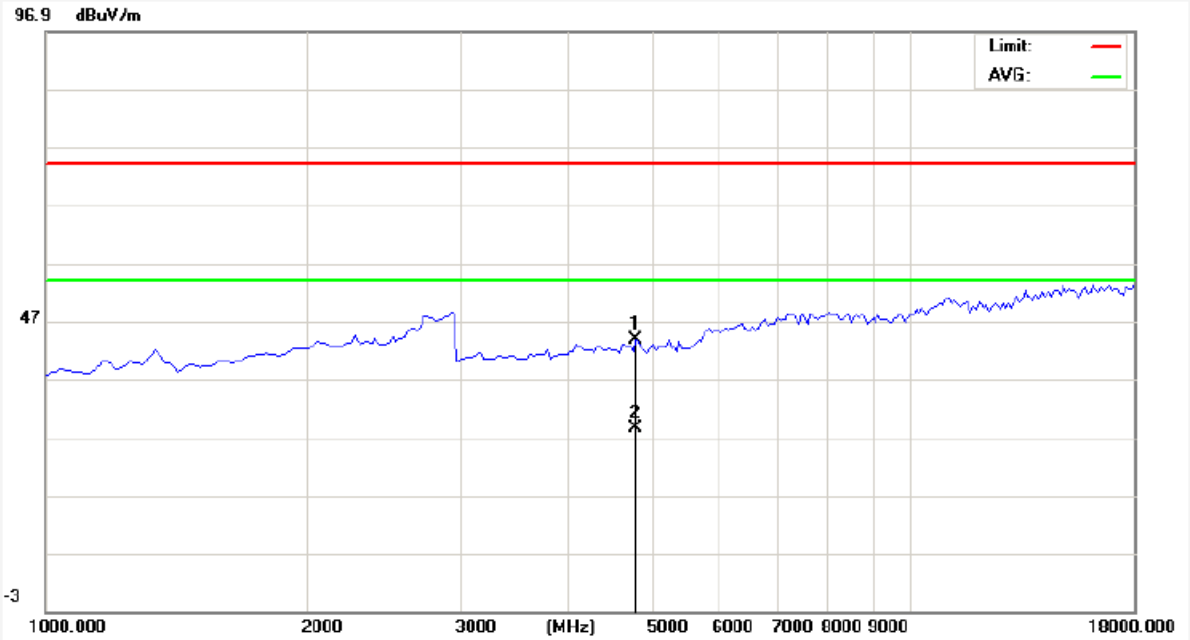
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	40.1347	35.50	-14.37	21.13	40.00	-18.87	peak			
2	64.8865	38.86	-17.43	21.43	40.00	-18.57	peak			
3	143.8295	45.05	-18.43	26.62	43.50	-16.88	peak			
4	152.1297	42.12	-18.24	23.88	43.50	-19.62	peak			
5	304.6099	41.62	-14.59	27.03	46.00	-18.97	peak			
6	327.8873	42.40	-13.88	28.52	46.00	-17.48	peak			

Job No.:	**AT1402716F**	**Polarization:**	**Horizontal**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**DC 3.7V**
Test item:	**Radiation Test (Above 1GHz)**	**Temp.(C)/Hum.(%RH):**	**24.3(C)/55%RH**
Test Mode:	**TX(2402 MHz)**	**Distance:**	**3m**



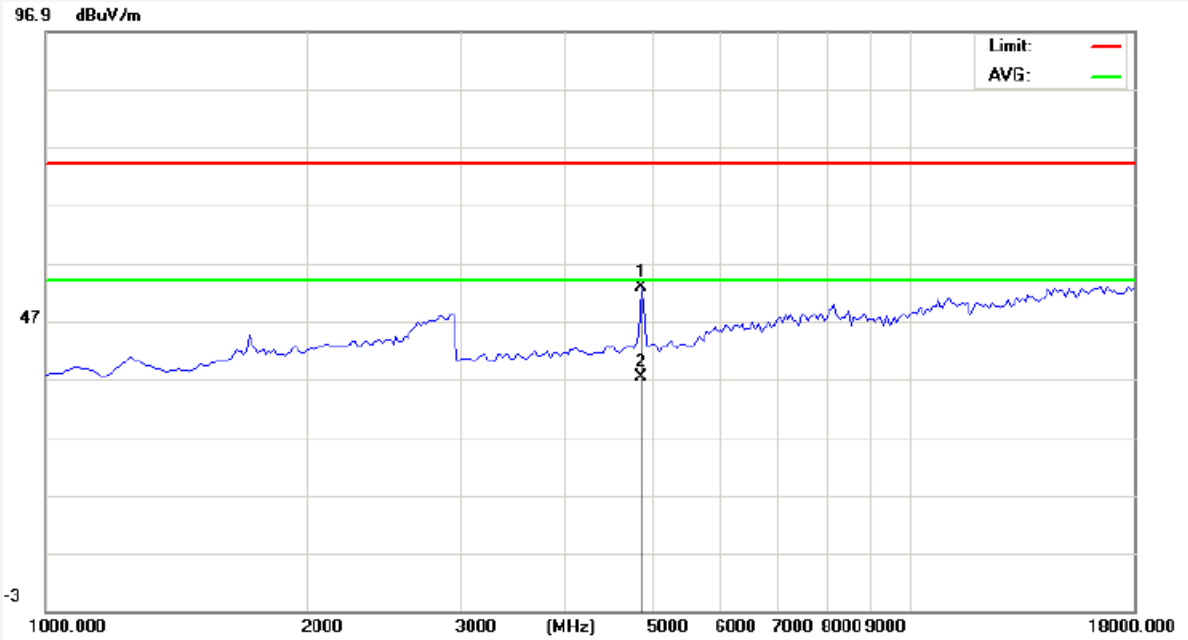
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4825.000	45.64	3.34	48.98	74.00	-25.02	peak			
2	4825.000	30.22	3.34	33.56	54.00	-20.44	AVG			

Job No.:	**AT1402716F**	**Polarization:**	**Vertical**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**DC 3.7V**
Test item:	**Radiation Test (Above 1GHz)**	**Temp.(C)/Hum.(%RH):**	**24.3(C)/55%RH**
Test Mode:	**TX(2402 MHz)**	**Distance:**	**3m**



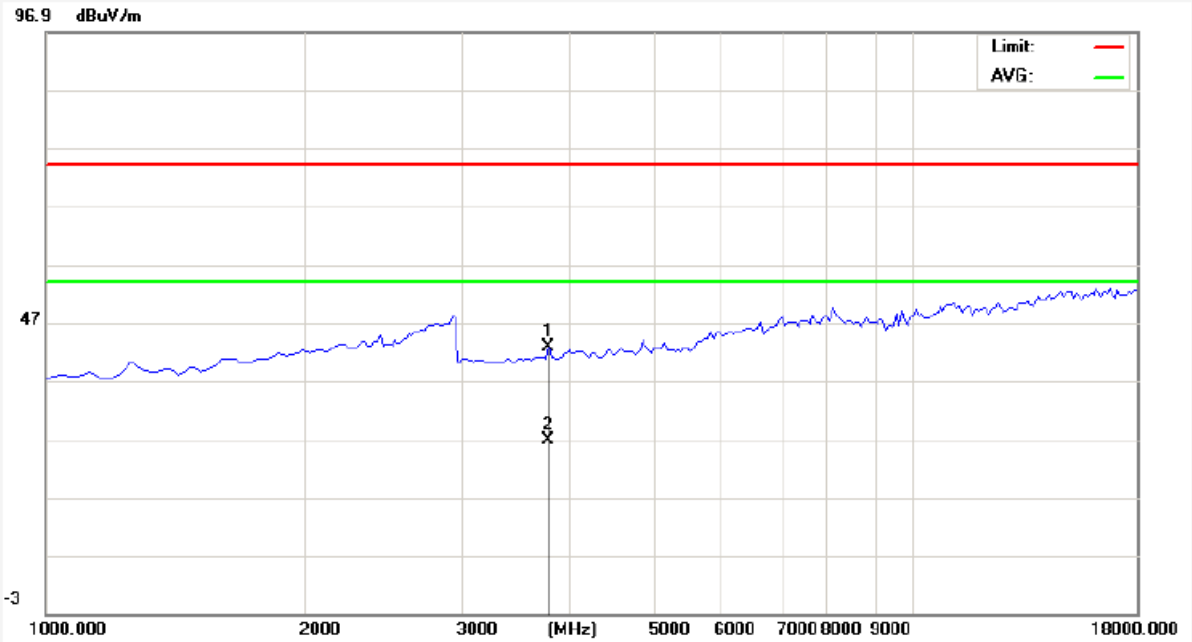
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4825.000	40.50	3.34	43.84	74.00	-30.16	peak			
2	4825.000	25.11	3.34	28.45	54.00	-25.55	AVG			

Job No.:	**AT1402716F**	**Polarization:**	**Horizontal**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**DC 3.7V**
Test item:	**Radiation Test (Above 1GHz)**	**Temp.(C)/Hum.(%RH):**	**24.3(C)/55%RH**
Test Mode:	**TX(2441 MHz)**	**Distance:**	**3m**



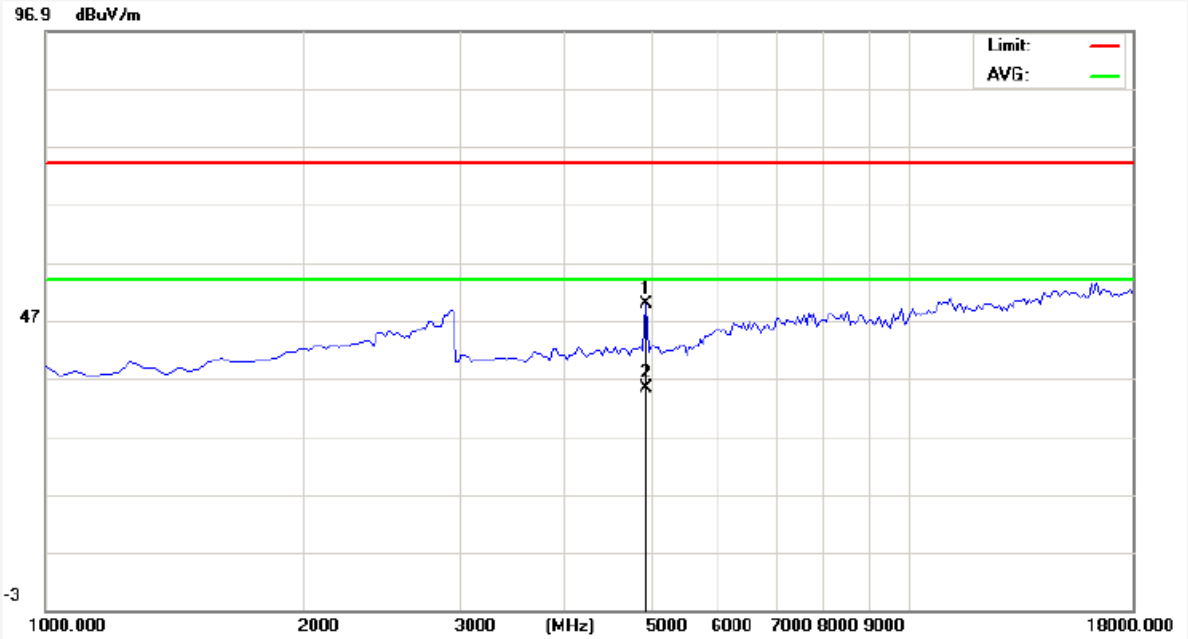
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4867.500	49.41	3.41	52.82	74.00	-21.18	peak			
2	4867.500	33.83	3.41	37.24	54.00	-16.76	AVG			

Job No.:	**AT1402716F**	**Polarization:**	**Vertical**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**DC 3.7V**
Test item:	**Radiation Test (Above 1GHz)**	**Temp.(C)/Hum.(%RH):**	**24.3(C)/55%RH**
Test Mode:	**TX(2441 MHz)**	**Distance:**	**3m**



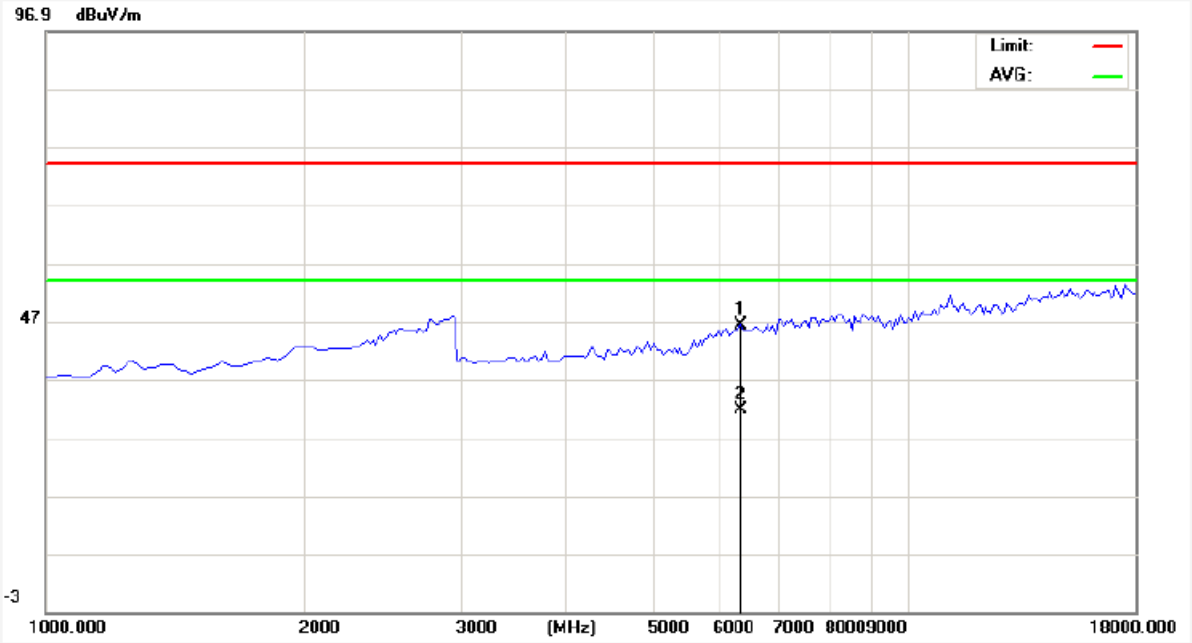
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	3805.000	41.14	1.59	42.73	74.00	-31.27	peak			
2	3805.000	25.24	1.59	26.83	54.00	-27.17	AVG			

Job No.:	**AT1402716F**	**Polarization:**	**Horizontal**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**DC 3.7V**
Test item:	**Radiation Test (Above 1GHz)**	**Temp.(C)/Hum.(%RH):**	**24.3(C)/55%RH**
Test Mode:	**TX(2480 MHz)**	**Distance:**	**3m**



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4952.500	46.23	3.57	49.80	74.00	-24.20	peak			
2	4952.500	31.66	3.57	35.23	54.00	-18.77	AVG			

Job No.:	**AT1402716F**	**Polarization:**	**Vertical**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**DC 3.7V**
Test item:	**Radiation Test (Above 1GHz)**	**Temp.(C)/Hum.(%RH):**	**24.3(C)/55%RH**
Test Mode:	**TX(2480 MHz)**	**Distance:**	**3m**



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	6355.000	38.94	7.46	46.40	74.00	-27.60	peak			
2	6355.000	24.39	7.46	31.85	54.00	-22.15	AVG			

5. CHANNEL SEPARATION TEST

5.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

5.2 Test SET-UP

EUT ——— Spectrum analyzer

5.3 Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Aug. 09, 2013	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Aug. 09, 2013	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 23, 2013	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Aug. 09, 2013	3 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 23, 2013	3 Year
6.	Pre-amplifier	SONOMA	310N	186860	Apr. 23, 2013	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

5.4 Test Results

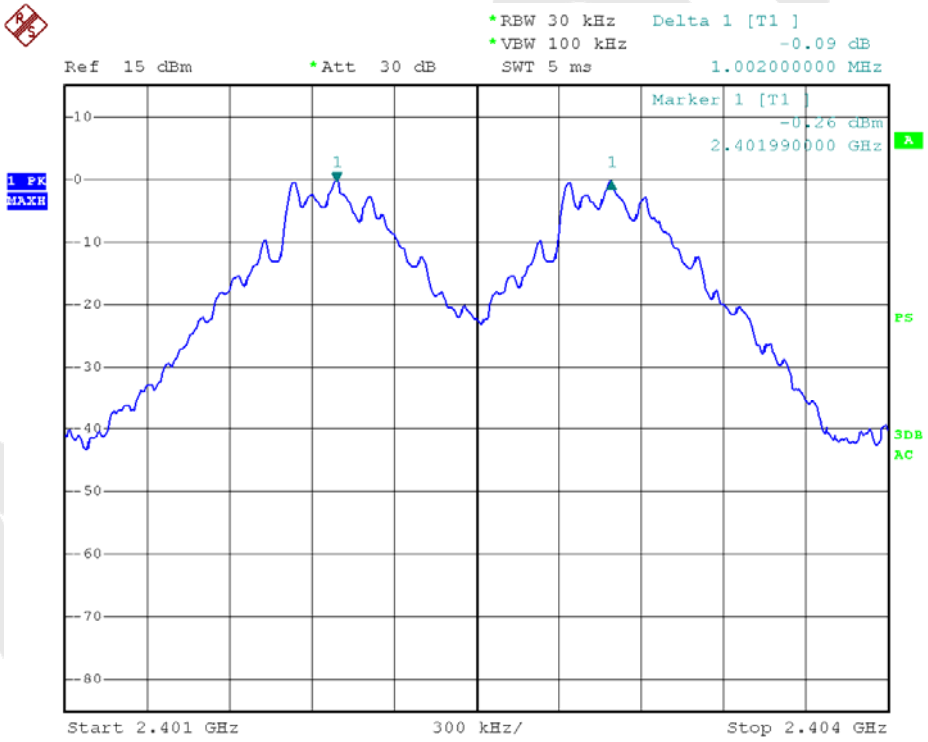
Test Item	:	Frequency Separation	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3.7V	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

Channel	Frequency (MHz)	Separation Read Value (kHz)	Limit (kHz)	Modulation Mode
Low	2401	1002	850	GFSK
Mid	2441	1002	860	GFSK
High	2480	1002	840	GFSK
Low	2401	1002	806	π/4DQPSK
Mid	2441	1002	806	π/4DQPSK
High	2480	1002	806	π/4DQPSK
Low	2401	1002	806	8DPSK
Mid	2441	1002	806	8DPSK
High	2480	1002	806	8DPSK

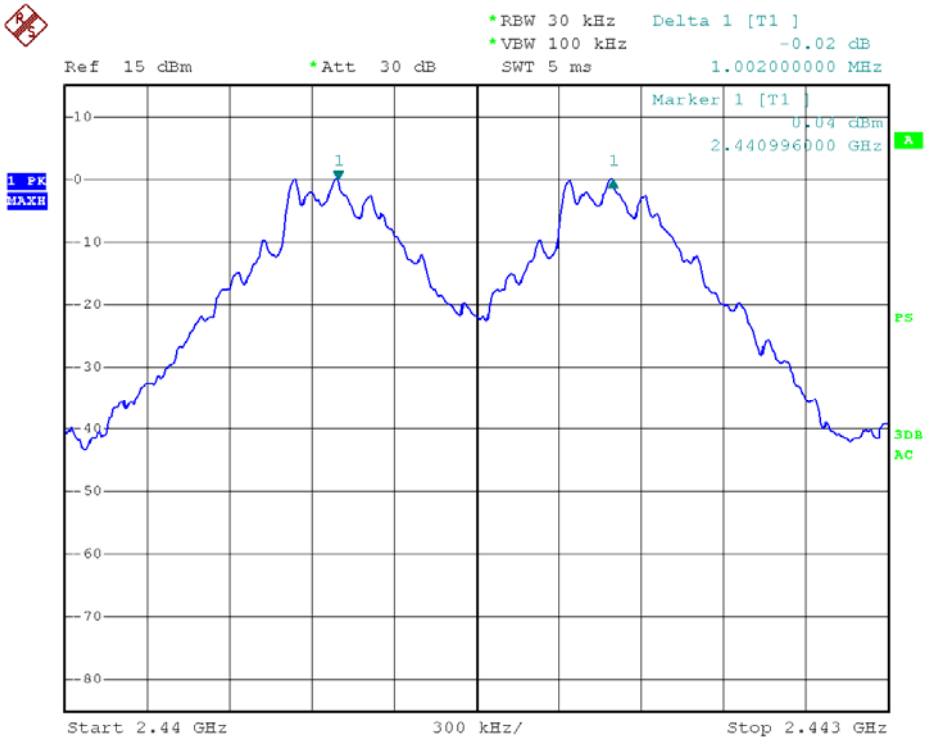
Remark:
1. The limit of modulation (π/4DQPSK, 8DPSK) is 2/3 of 20dB BW;

Modulation Mode: GFSK

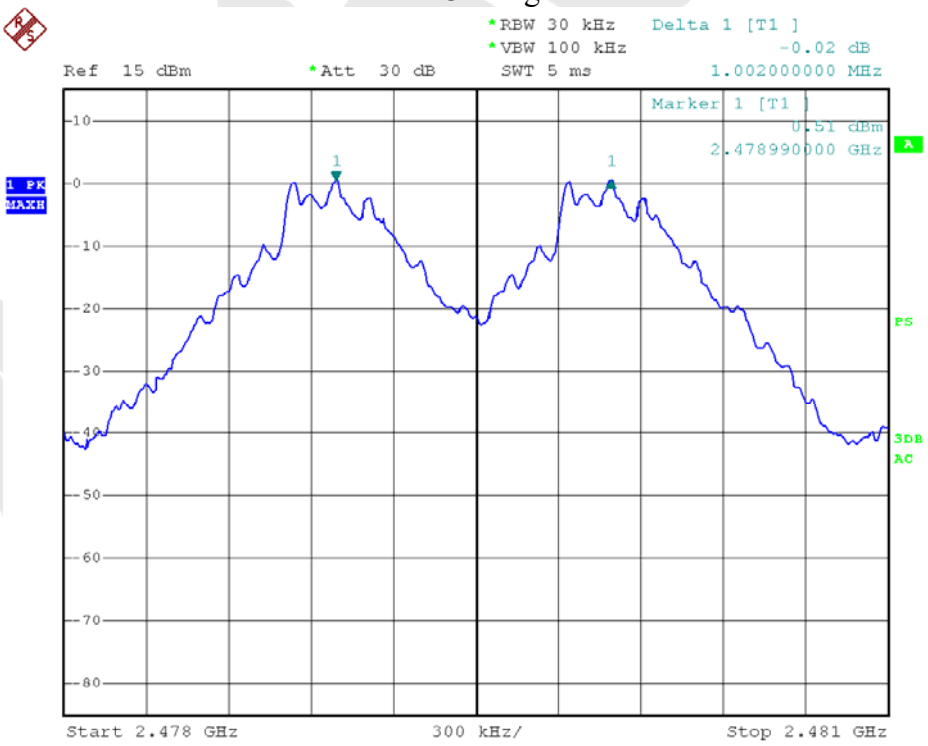
CH Low



CH Mid

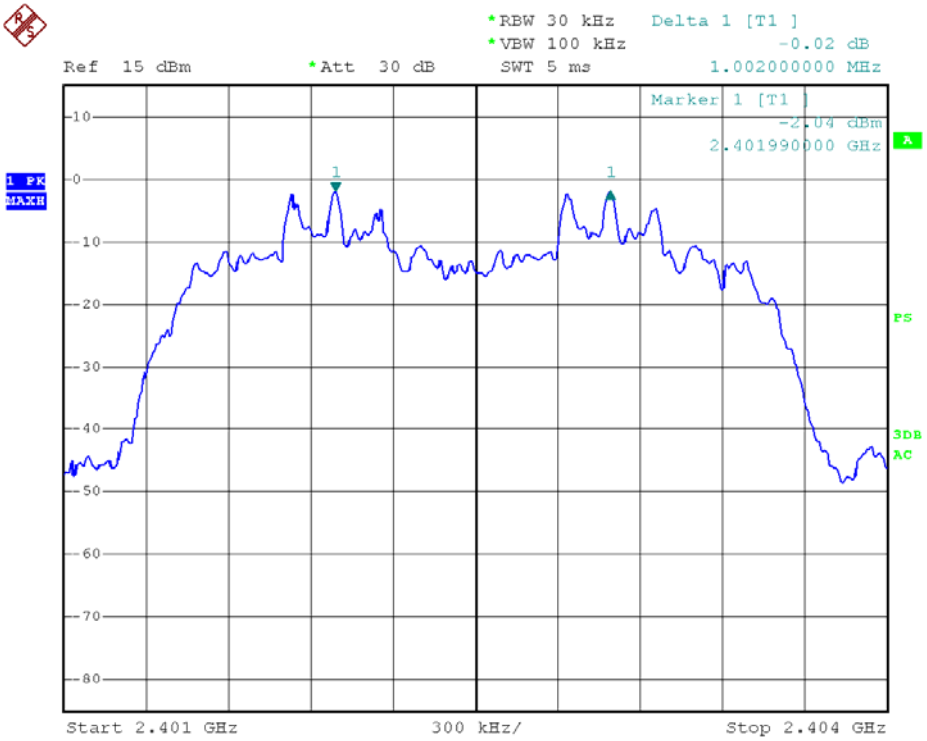


CH High

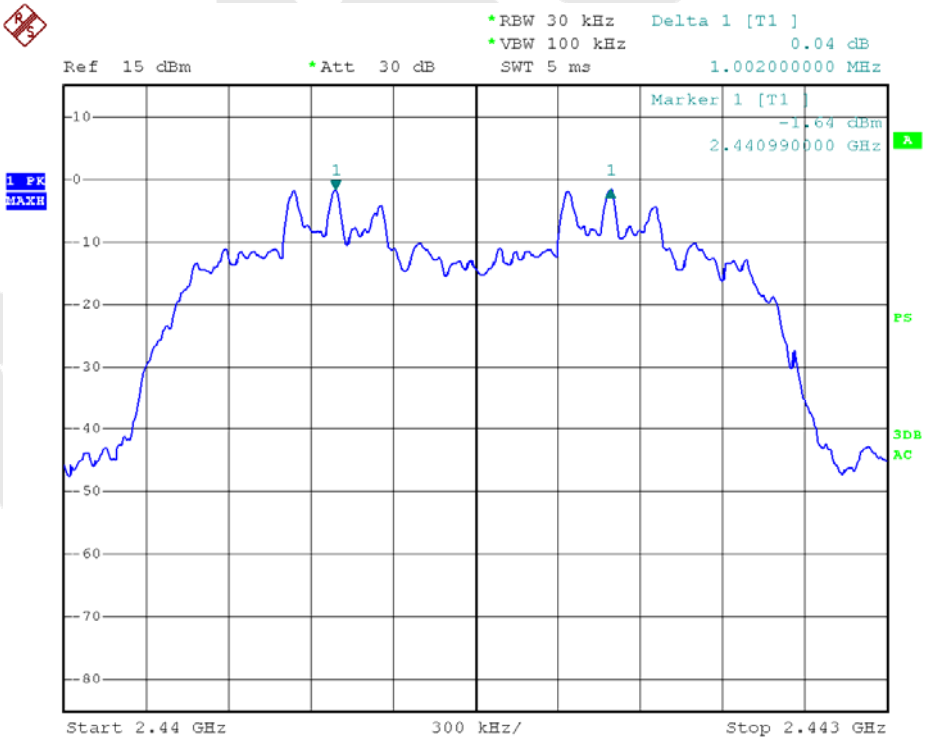


Modulation Mode: π/4DQPSK & 8DPSK

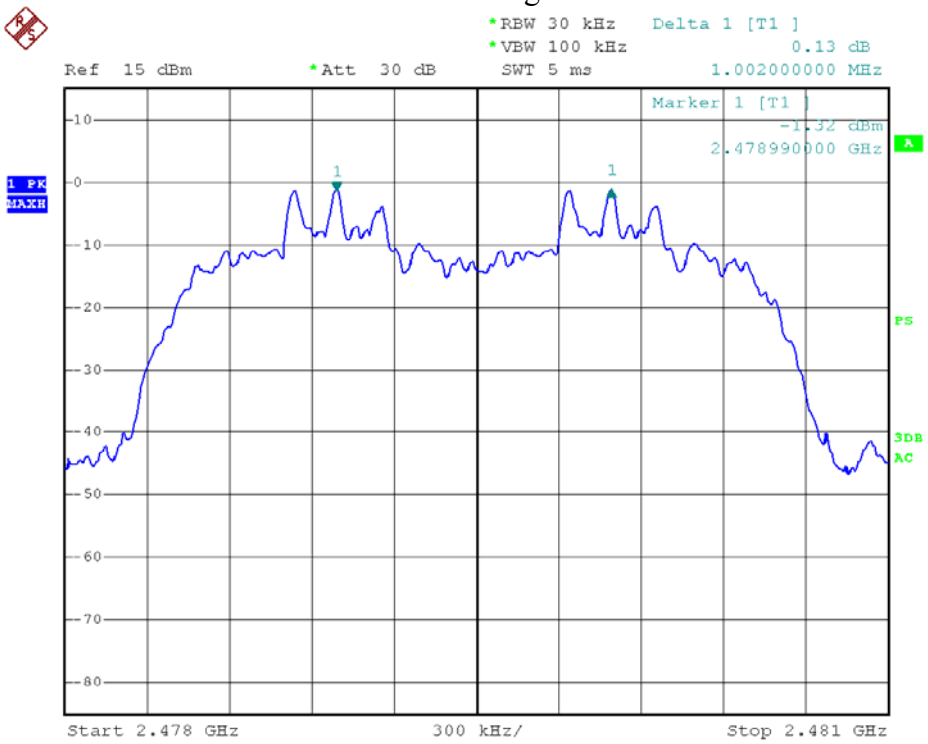
CH Low



CH Mid



CH High


*RBW 30 kHz
*VBW 100 kHz
SWT 5 ms
Delta 1 [T1]
0.13 dB
1.002000000 MHz
Ref 15 dBm
*Att 30 dB
Marker 1 [T1]
-1.32 dBm
2.478990000 GHz
1 PK
MAXH
A
PS
3DB
AC
Start 2.478 GHz
300 kHz/
Stop 2.481 GHz

6. 20DB BANDWIDTH TEST

6.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

6.2 Test SET-UP

EUT —— Spectrum analyzer

6.3 Test Equipment

Same as the equipment listed in 5.3.

6.4 Test Results

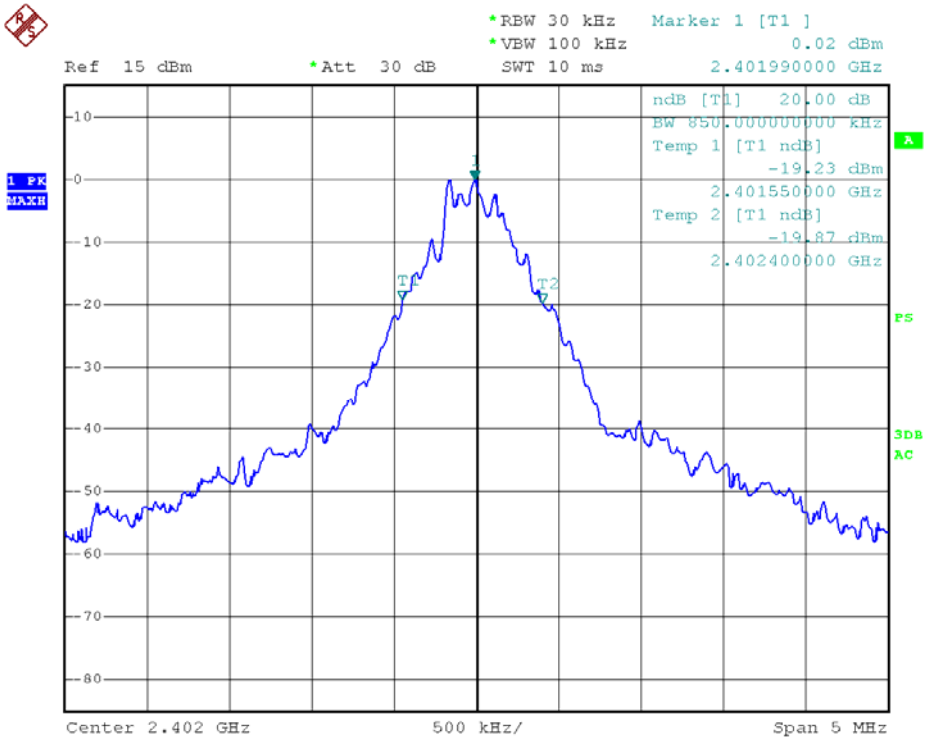
Test Item	:	20dB BW	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3.7V	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

Channel	Frequency (MHz)	20dB Down BW(kHz)	Modulation Mode
Low	2401	850	GFSK
Mid	2441	860	GFSK
High	2480	840	GFSK
Low	2401	1210	π/4DQPSK
Mid	2441	1210	π/4DQPSK
High	2480	1210	π/4DQPSK
Low	2401	1210	8DPSK
Mid	2441	1210	8DPSK
High	2480	1210	8DPSK

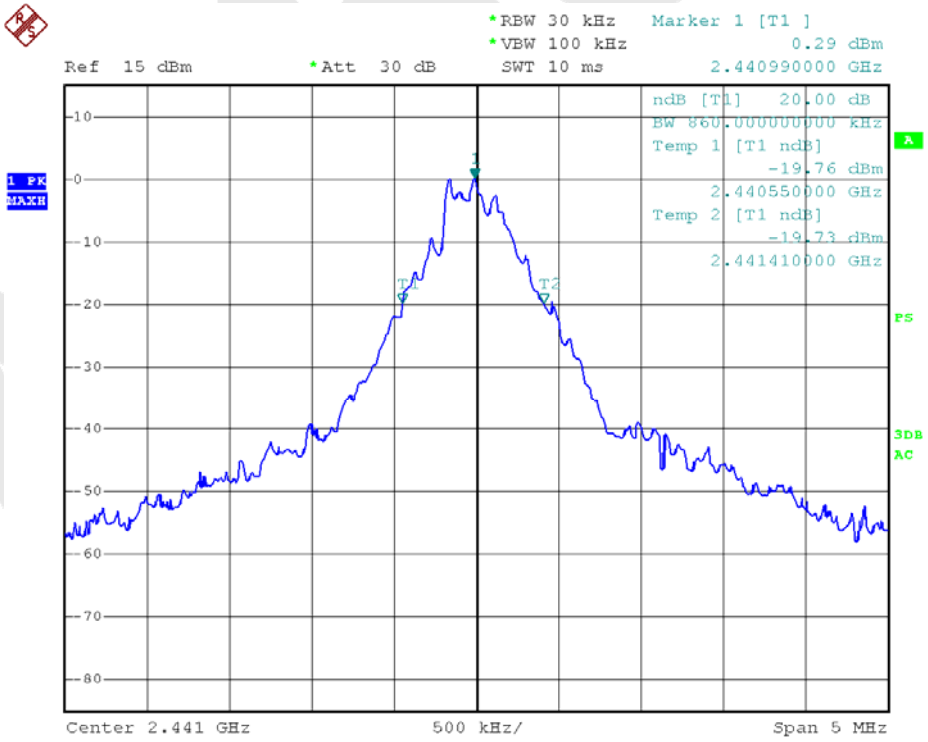
Remark: The results of modulationsπ/4DQPSK and 8DPSK are the same.

Modulation Mode: GFSK

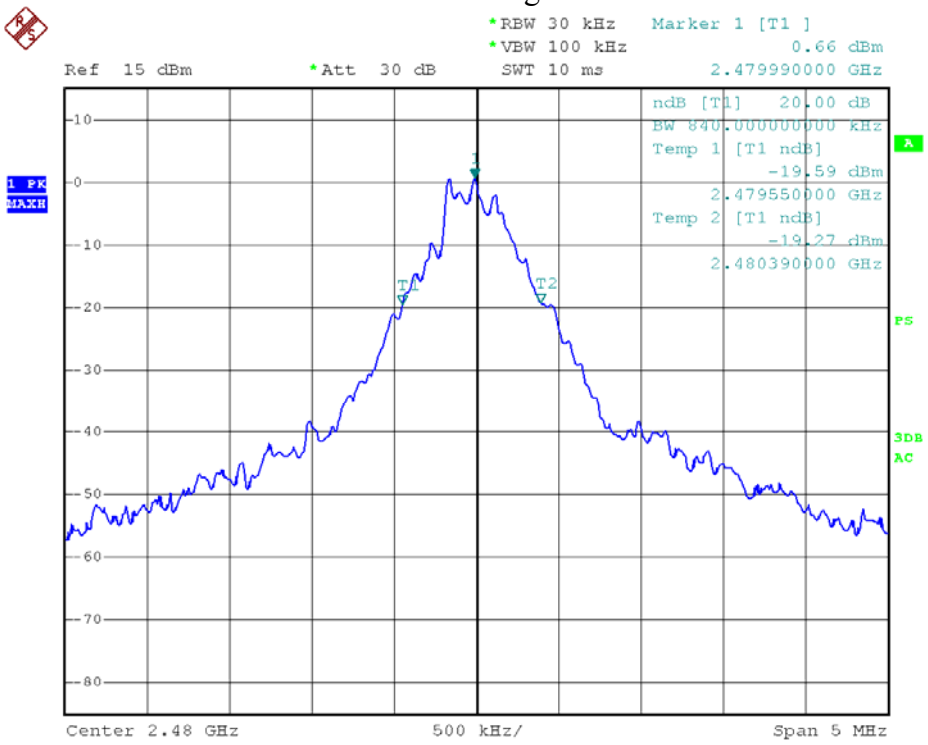
CH Low



CH Mid

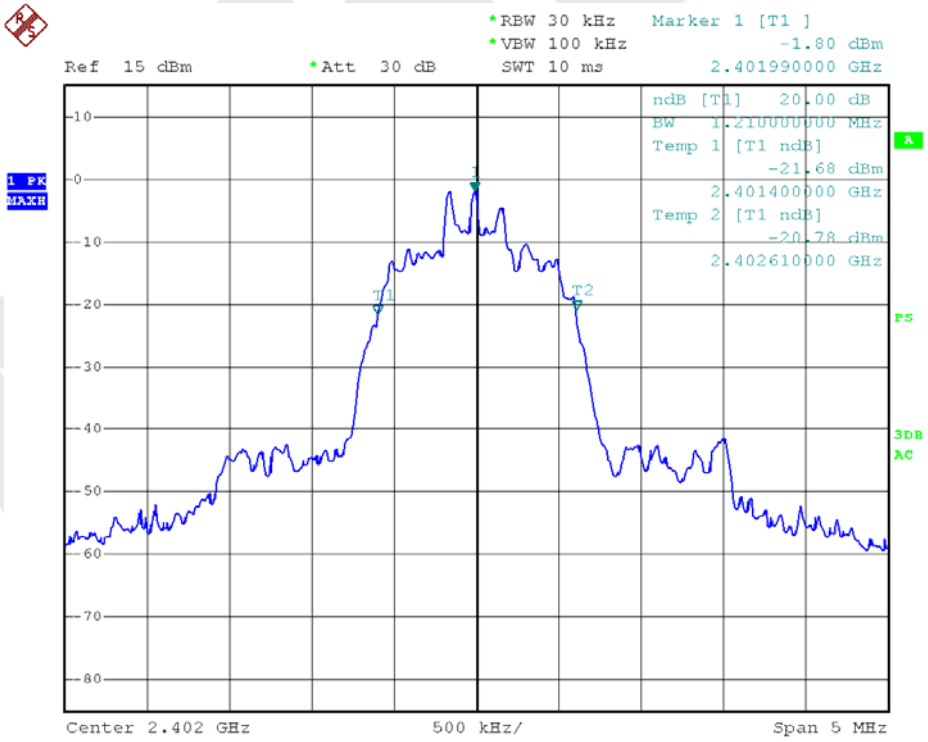


CH High

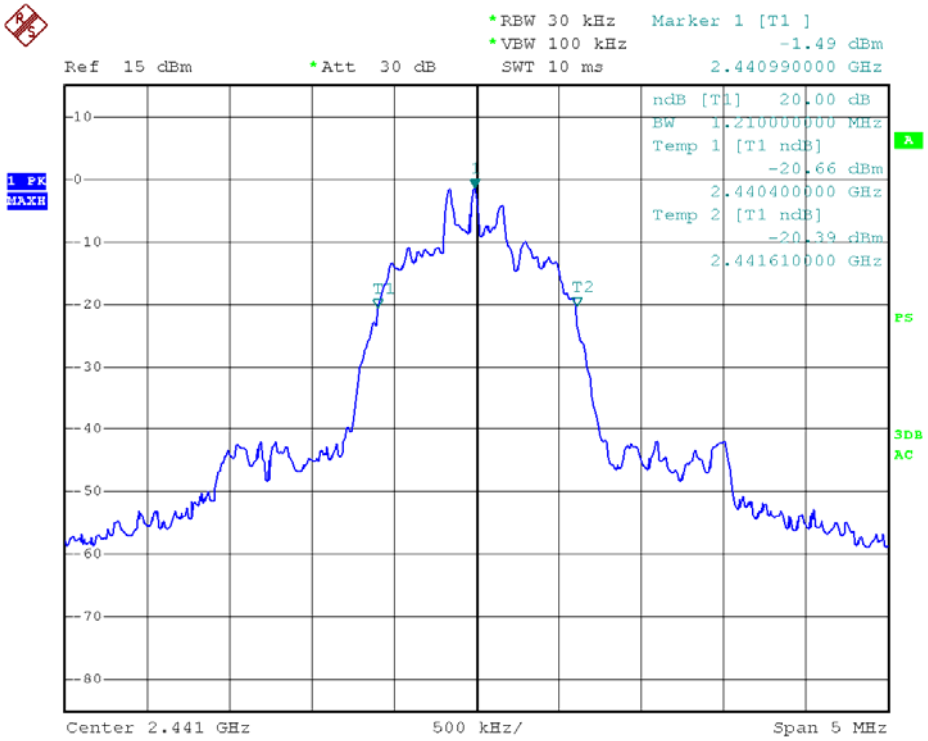


Modulation Mode: π/4DQPSK & 8DPSK

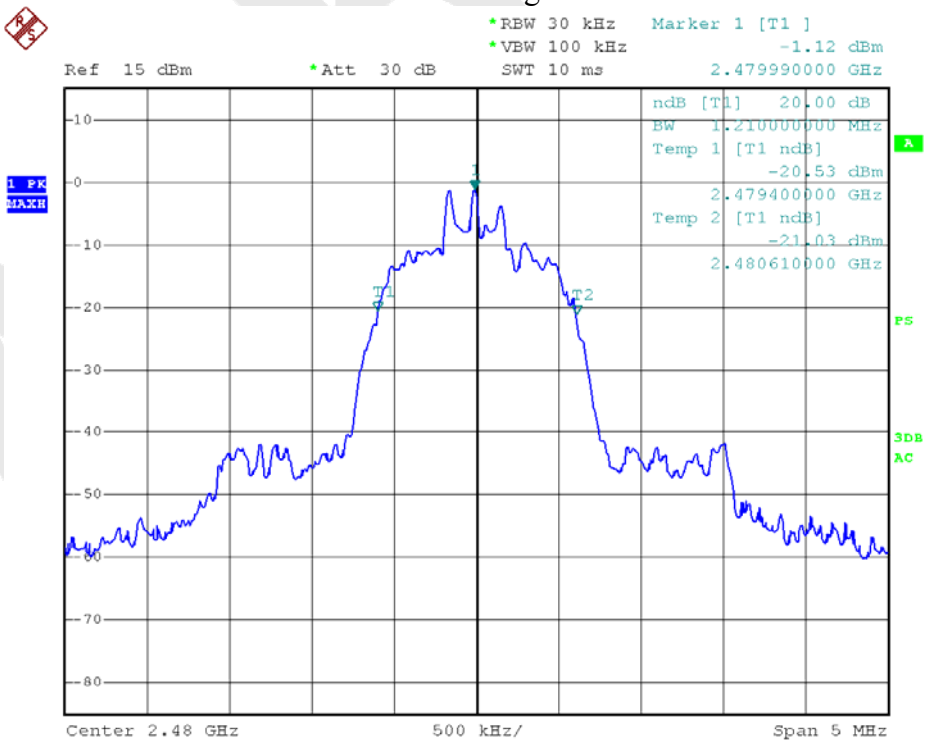
CH Low



CH Mid



CH High



7. QUANTITY OF HOPPING CHANNEL TEST

7.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

7.2 Test SET-UP

EUT —— Spectrum analyzer

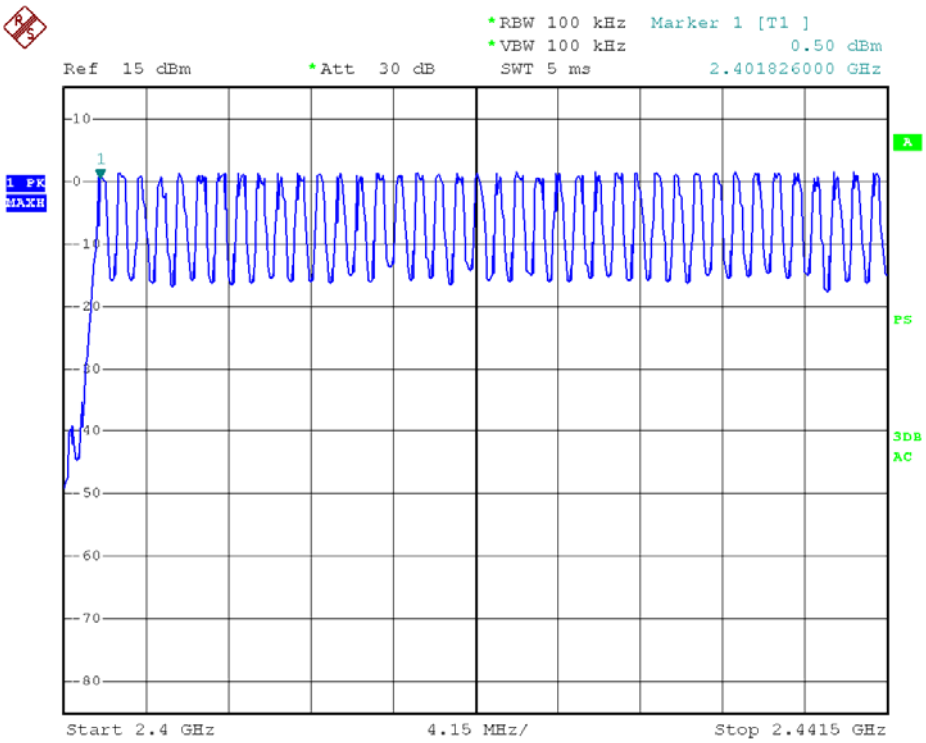
7.3 Test Equipment

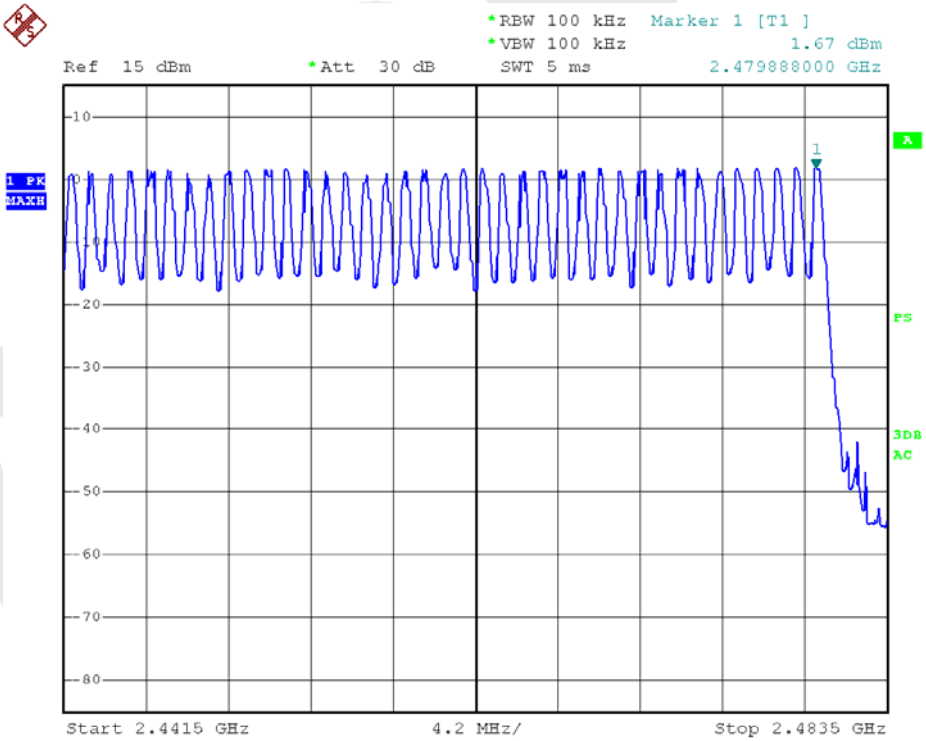
Same as the equipment listed in 5.3.

7.4 Test Results

Test Item	:	Number of Hopping Frequency	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3.7V	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

Hopping Channel Frequency Range	Quantity of Hopping Channel	Quantity of Hopping Channel
2402-2480	79	＞15


*RBW 100 kHz
*VBW 100 kHz
SWT 5 ms
Marker 1 [T1]
0.50 dBm
2.401826000 GHz
Ref 15 dBm
*Att 30 dB
1 PK
MAXH
A
PS
3DB
AC
Start 2.4 GHz
4.15 MHz/
Stop 2.4415 GHz


*RBW 100 kHz
*VBW 100 kHz
SWT 5 ms
Marker 1 [T1]
1.67 dBm
2.479888000 GHz
Ref 15 dBm
*Att 30 dB
1 PK
MAXH
A
PS
3DB
AC
Start 2.4415 GHz
4.2 MHz/
Stop 2.4835 GHz

8. DWELL TIME TEST

8.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

8.2 Test SET-UP

EUT —— Spectrum analyzer

8.3 Test Equipment

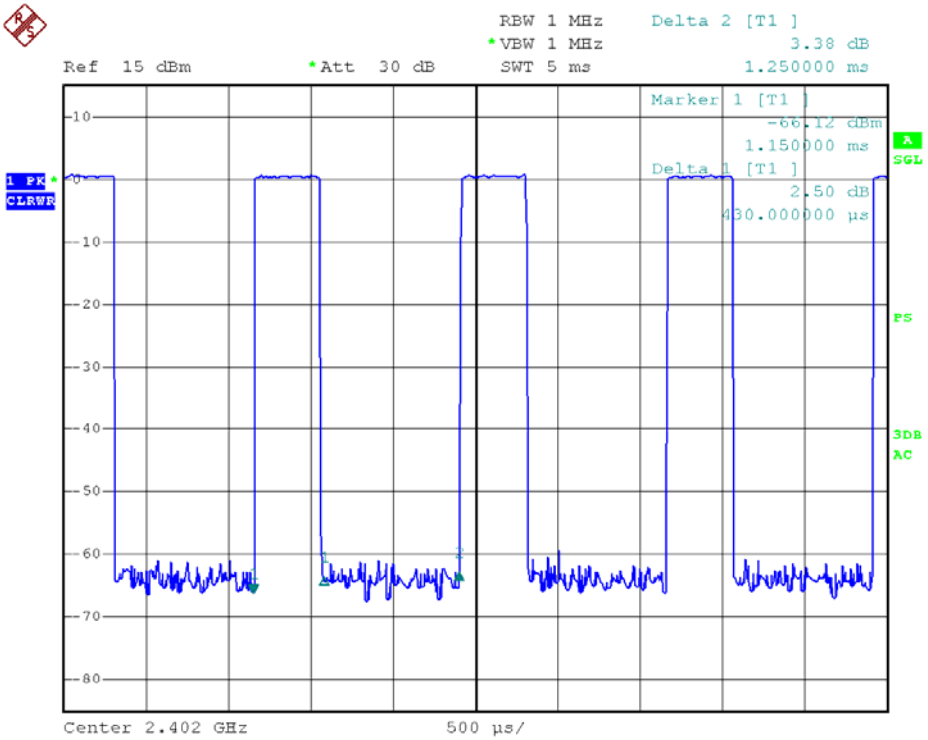
Same as the equipment listed in 5.3.

8.4 Test Results

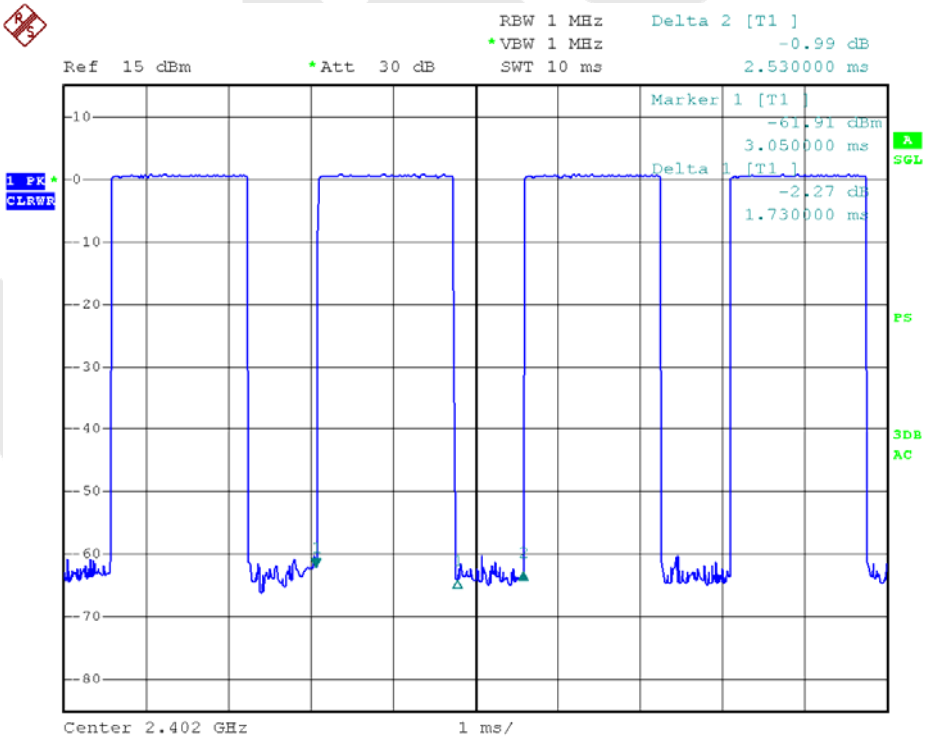
Test Item	:	Time of Occupancy	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3.7V	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

Package Type	***Pulse width (ms)***	**Time slot length(ms)**	**Dwell time (ms)**	**Limit (s)**
DH1	0.430	time slot length *1600/2 /79 * 31.6	137.60	0.4
DH3	1.730	time slot length *1600/4 /79 * 31.6	276.80	0.4
DH5	2.970	time slot length *1600/6 /79 * 31.6	316.80	0.4

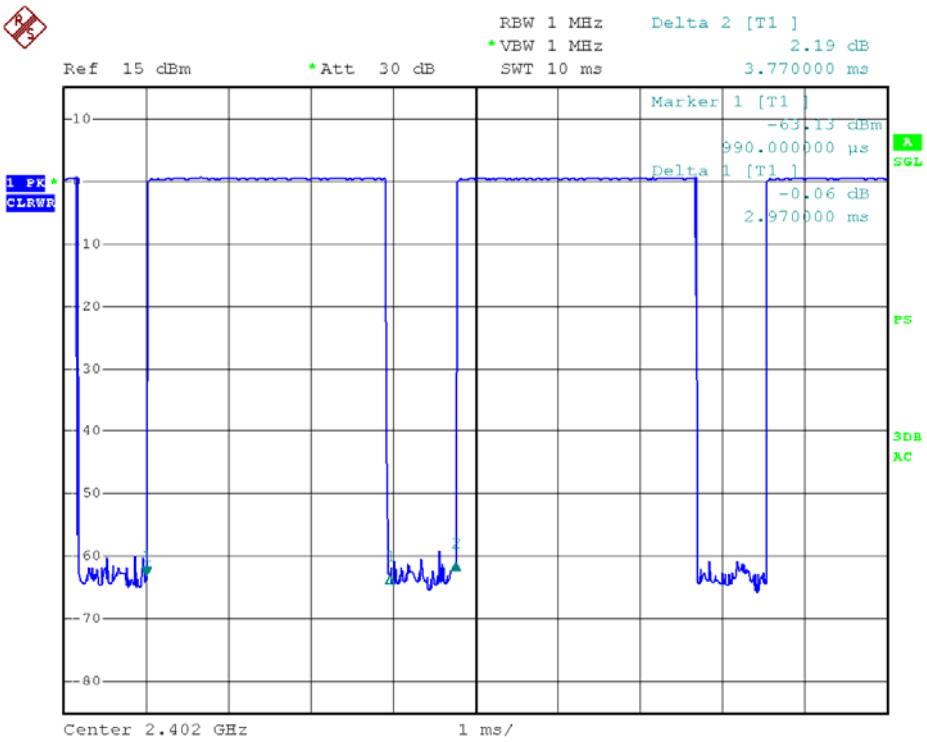
DH1


RBW 1 MHz
*VBW 1 MHz
SWT 5 ms
Delta 2 [T1]
3.38 dB
1.250000 ms
Ref 15 dBm
*Att 30 dB
Marker 1 [T1]
-66.12 dBm
1.150000 ms
Delta 1 [T1]
2.50 dB
430.000000 µs
1 PK
CLRWR
A
SGL
PS
3DB
AC
Center 2.402 GHz
500 µs/

DH3


RBW 1 MHz
*VBW 1 MHz
SWT 10 ms
Delta 2 [T1]
-0.99 dB
2.530000 ms
Ref 15 dBm
*Att 30 dB
Marker 1 [T1]
-61.91 dBm
3.050000 ms
Delta 1 [T1]
-2.27 dB
1.730000 ms
1 PK
CLRWR
A
SGL
PS
3DB
AC
Center 2.402 GHz
1 ms/

DH5


RBW 1 MHz
*VBW 1 MHz
SWT 10 ms
Delta 2 [T1]
2.19 dB
3.770000 ms
Ref 15 dBm
*Att 30 dB
Marker 1 [T1]
-63.13 dBm
990.000000 µs
Delta 1 [T1]
-0.06 dB
2.970000 ms
1 PK
CLRWR
A
SGL
PS
3DB
AC
Center 2.402 GHz
1 ms/

9. MAX IMUM PEAK OUTPUT POWER TEST

9.1 Measurement Procedure

a. Check the calibration of the measuring instrument(SA) using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
c. The center frequency of the spectrum analyzer is set to the fundamental frequency and using proper RBW and VBW setting.
d. Measure the captured power within the band and recording the plot.
e. Repeat above procedures until all frequencies required were complete.

9.2 Test SET-UP

EUT —— Spectrum analyzer

9.3 Test Equipment

Same as the equipment listed in 5.3.

9.4 Test Results

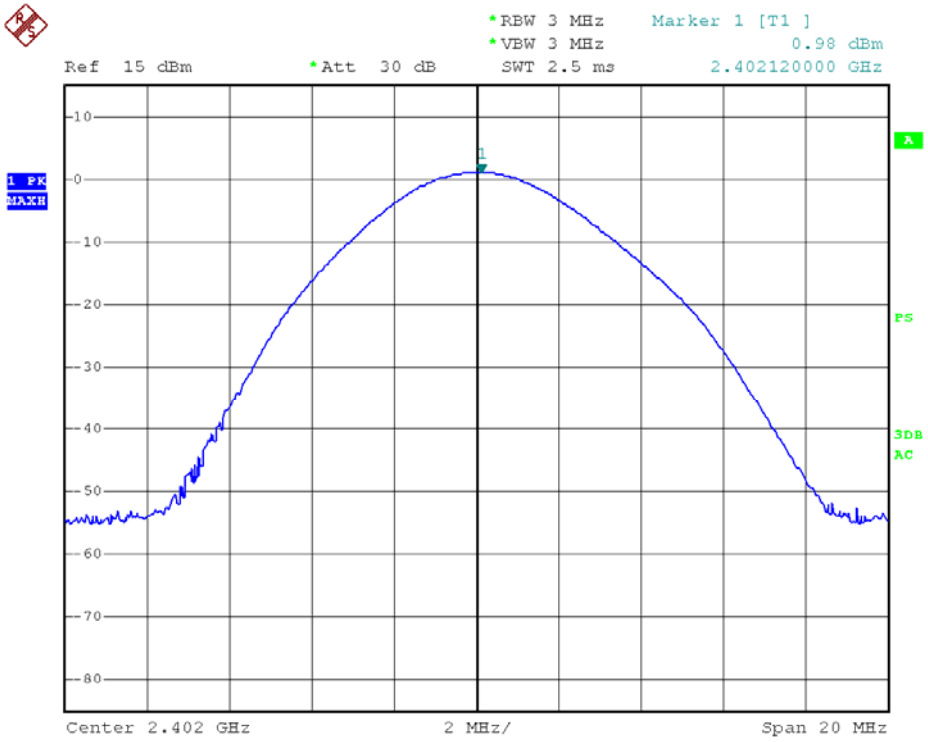
Test Item	:	Max. peak output power	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3.7V	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

Channel Frequency (MHz)	Peak Power output(mW)	Peak Power output(dBm)	Peak Power Limit(mW)	Results	Modulation
2402	1.26	0.98	125	PASS	GFSK
2441	1.34	1.27	125	PASS	GFSK
2480	**1.46**	**1.62**	125	PASS	GFSK
2402	0.28	-0.63	125	PASS	π/4DQPSK
2441	0.54	-0.30	125	PASS	π/4DQPSK
2480	1.02	0.07	125	PASS	π/4DQPSK
2402	0.28	-0.63	125	PASS	8DPSK
2441	0.54	-0.30	125	PASS	8DPSK
2480	1.02	0.07	125	PASS	8DPSK

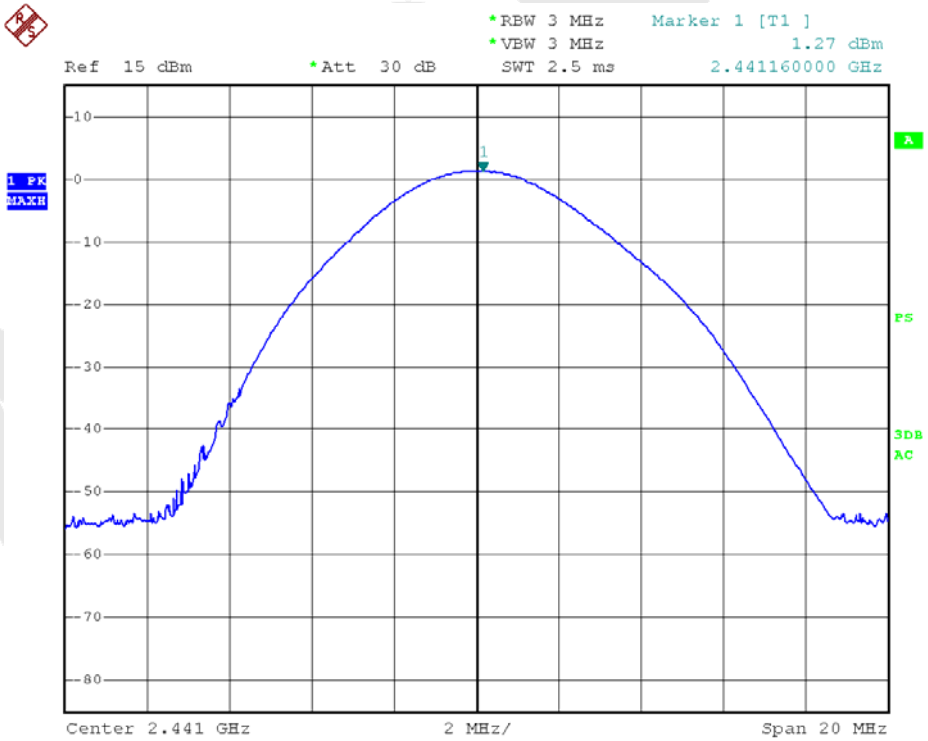
Remark: The results of modulationsπ/4DQPSK and 8DPSK are the same.

Modulation Mode: GFSK

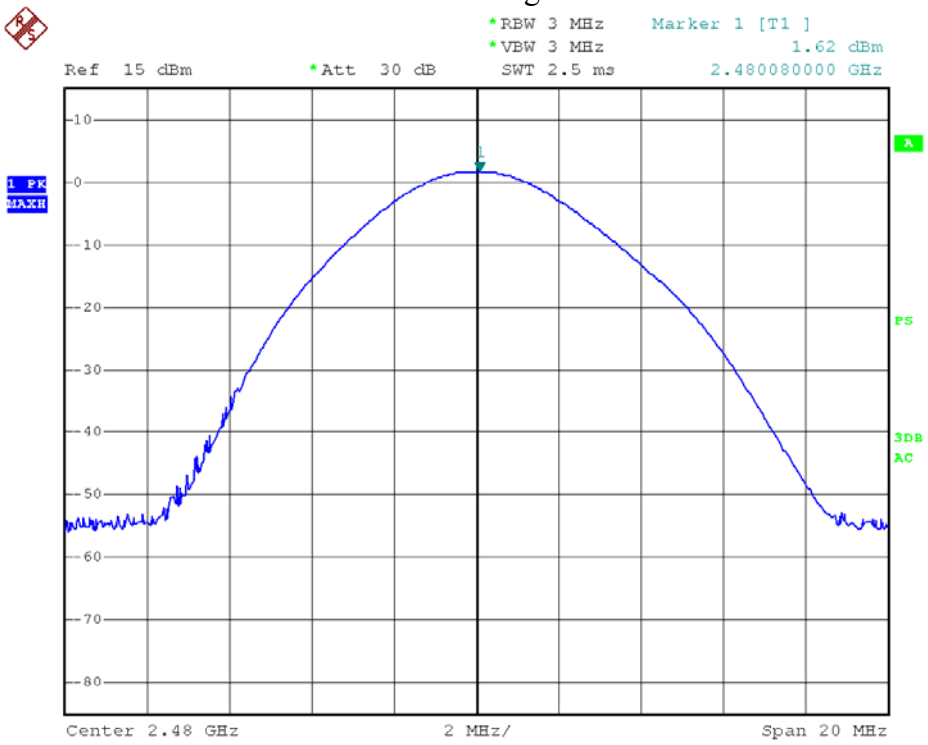
CH Low



CH Mid

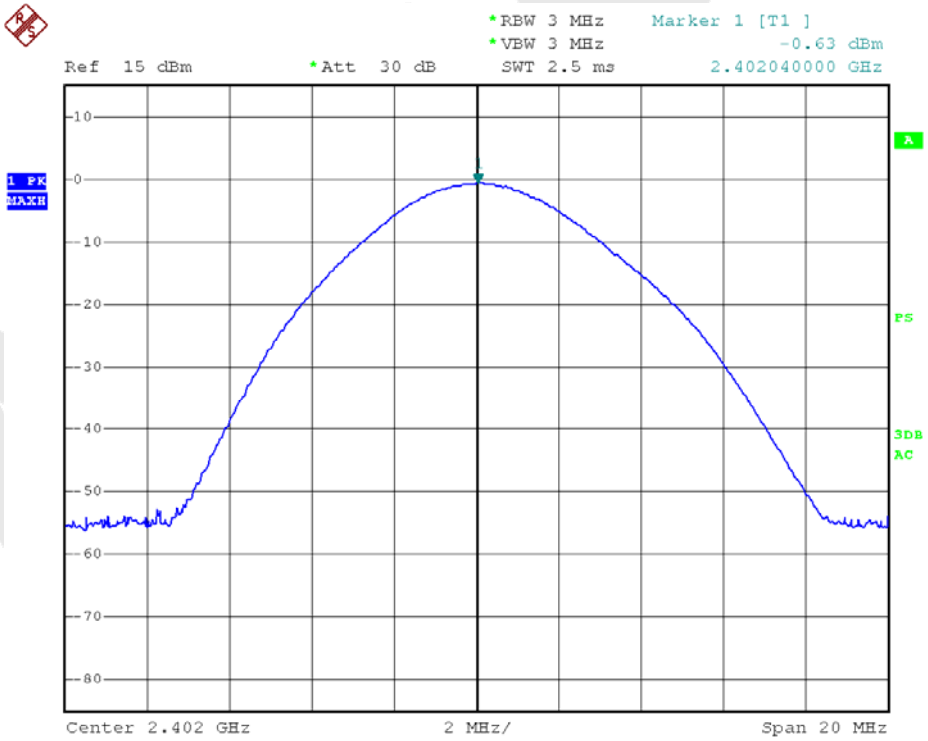


CH High

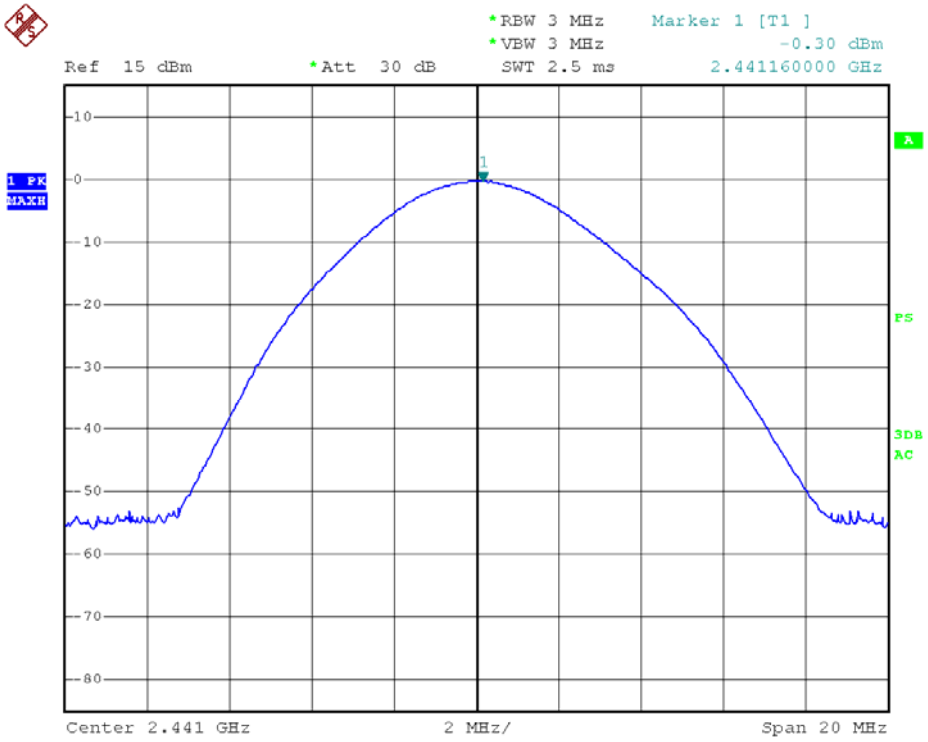


Modulation Mode: π/4DQPSK & 8DPSK

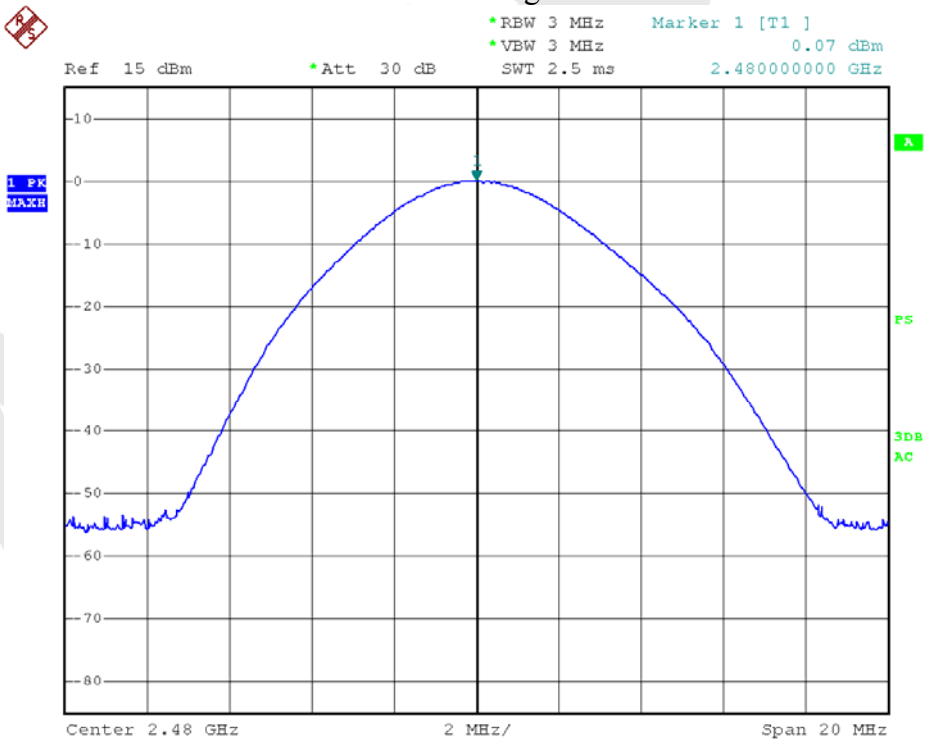
CH Low



CH Mid



CH High



10. BAND EDGE TEST

10.1 Measurement Procedure

1. The EUT was Operating in hopping mode or could be controlled its channel. Printed out test result from the spectrum by hard copy function.
2. The EUT was placed on a turn table which is 0.8m above ground plane.
3. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
4. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
5. Repeat above procedures until all frequency measured were complete.

10.2 Test SET-UP

Same as the radiated emission test.

10.3 Test Equipment

Same as the equipment listed in 5.3.

10.4 Test Results

Pass.

Please refer the following data.

Test Item	:	Band eadge	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3.7V	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

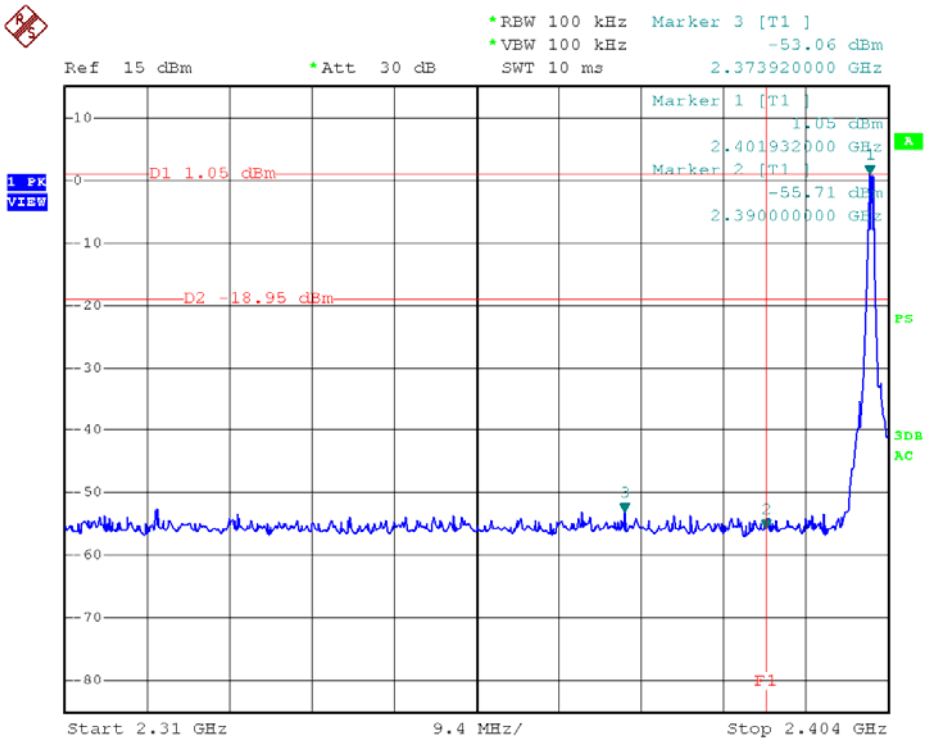
1. Conducted Test

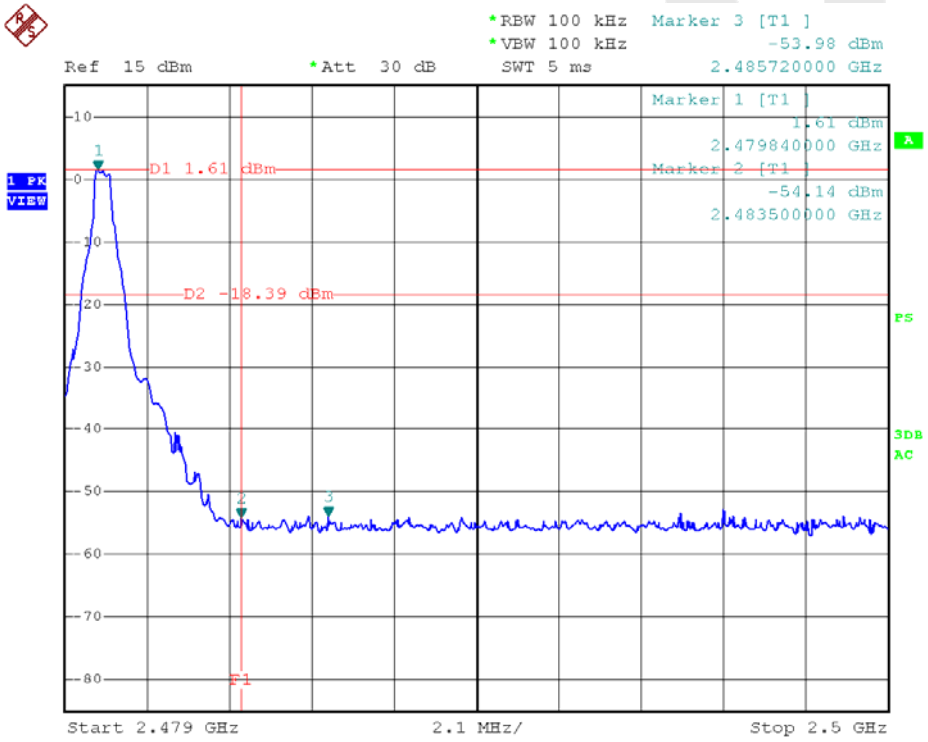
Frequency (MHz)	Peak Power Output(dBm)	Emission read Value(dBm)	Result of Band edge(dBc)	Band edge Limit(dBc)	Modulation
<2400	1.05	-53.06	49.72	>20dBc	GFSK
	-0.72	-53.36	43.55	>20dBc	π/4DQPSK
	-0.72	-53.36	43.55	>20dBc	8DPSK
>2483.5	1.61	-53.98	47.08	>20dBc	GFSK
	-0.11	-53.51	46.18	>20dBc	π/4DQPSK
	-0.11	-53.51	46.18	>20dBc	8DPSK

2. Radiated emission Test

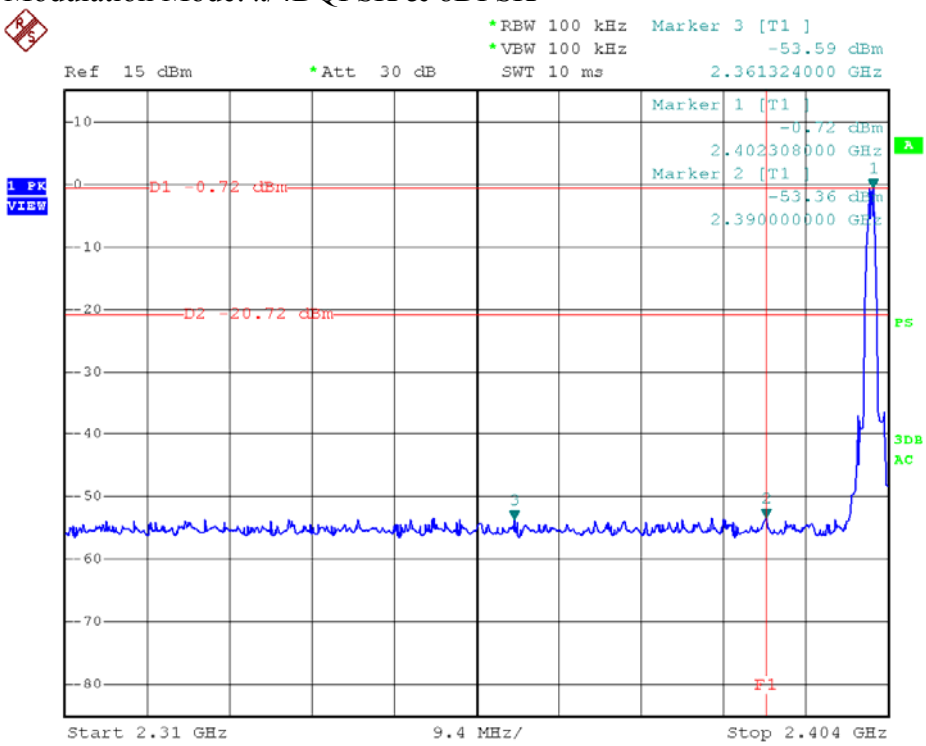
Frequency (MHz)	Antenna polarization (H/V)	Emission (dBuV/m)		Band edge Limit (dBuV/m)		Modulation
		PK	AV	PK	AV	
<2400	V	57.34	37.37	74.00	54.00	GFSK
	V	53.21	38.18	74.00	54.00	π/4DQPSK
	V	52.29	35.87	74.00	54.00	8DPSK
>2483.5	V	51.07	38.19	74.00	54.00	GFSK
	V	53.16	36.69	74.00	54.00	π/4DQPSK
	V	50.92	38.82	74.00	54.00	8DPSK

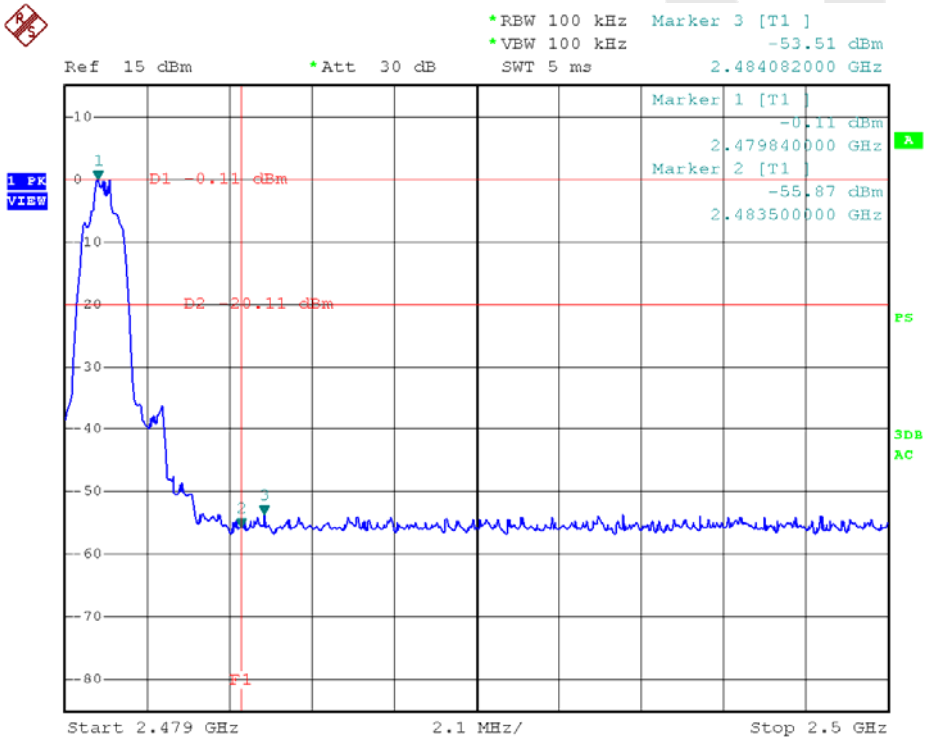
Modulation Mode: GFSK





Modulation Mode: π/4DQPSK & 8DPSK





11. ANTENNA APPLICATION

11.1 Antenna requirement

The EUT'S antenna is met the requirement of FCC part 15C section 15.203 and 15.247.

FCC part 15C section 15.247 requirements:
Systems operating in the 2402-2480MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

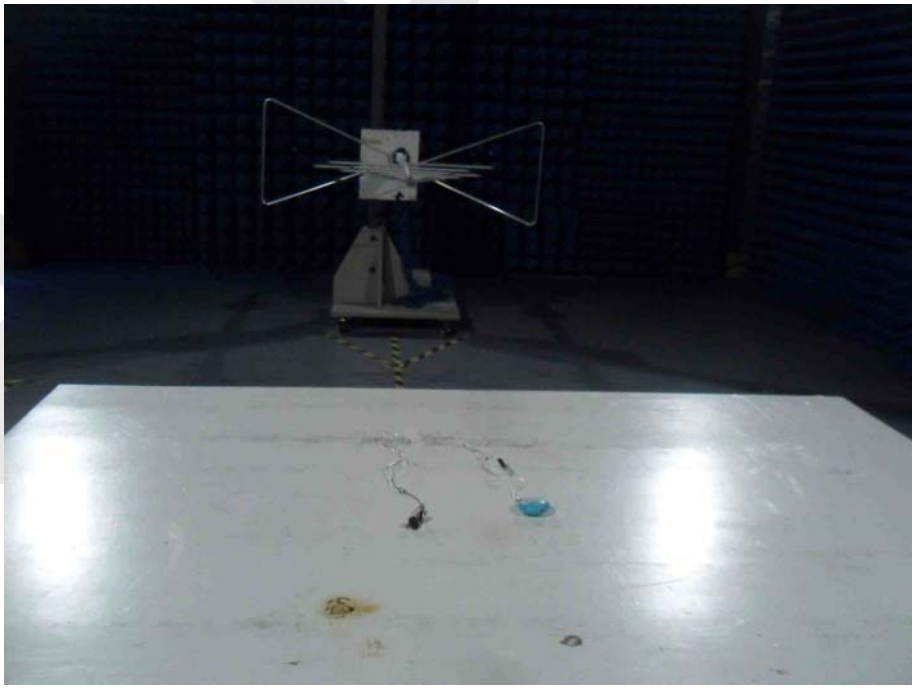
11.2 Result

The EUT's antenna used a chip antenna and integrated on PCB, The antenna's gain is 0dBi and meets the requirement.

12. PHOTOGRAPH

12.1 Photo of Power Line Conducted Emission Measurement

12.2 Photo of Radiation Emission Test



APPENDIX I (EXTERNAL PHOTOS)

Figure 1
The EUT-Overall View

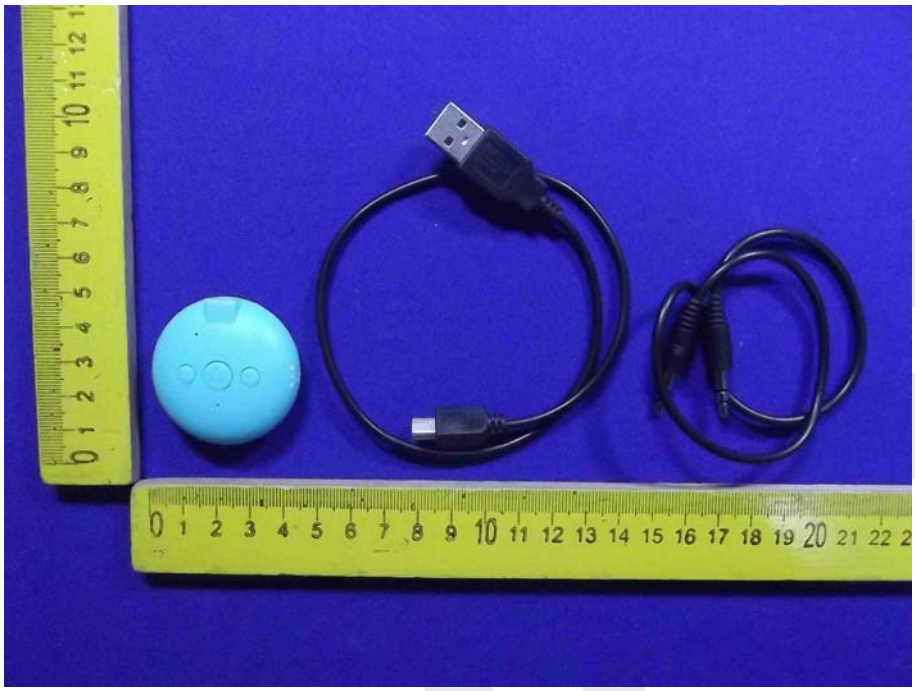


Figure 2
The EUT- Front View

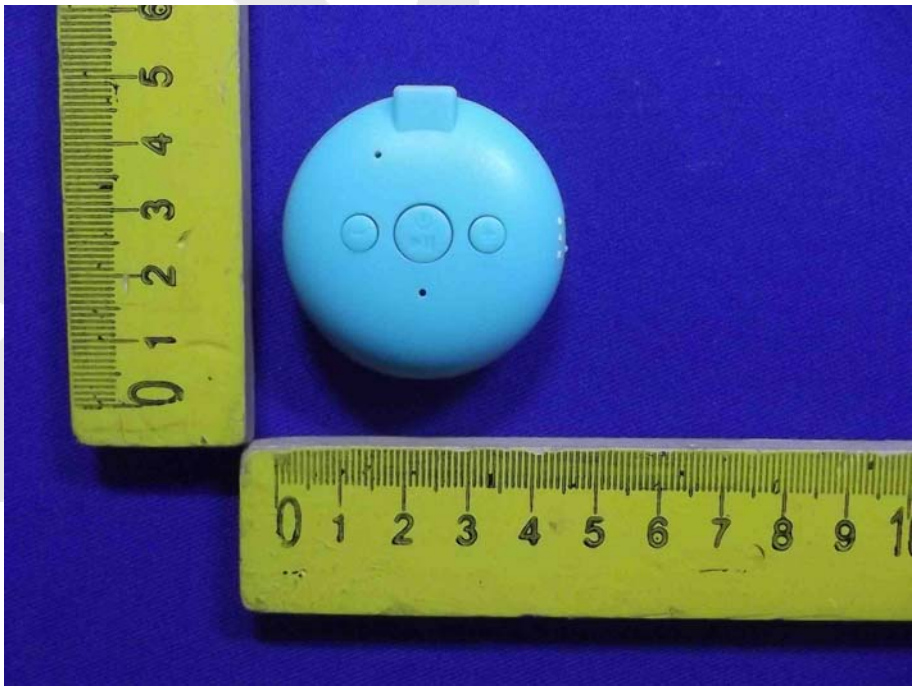


Figure 3
The EUT- Back View

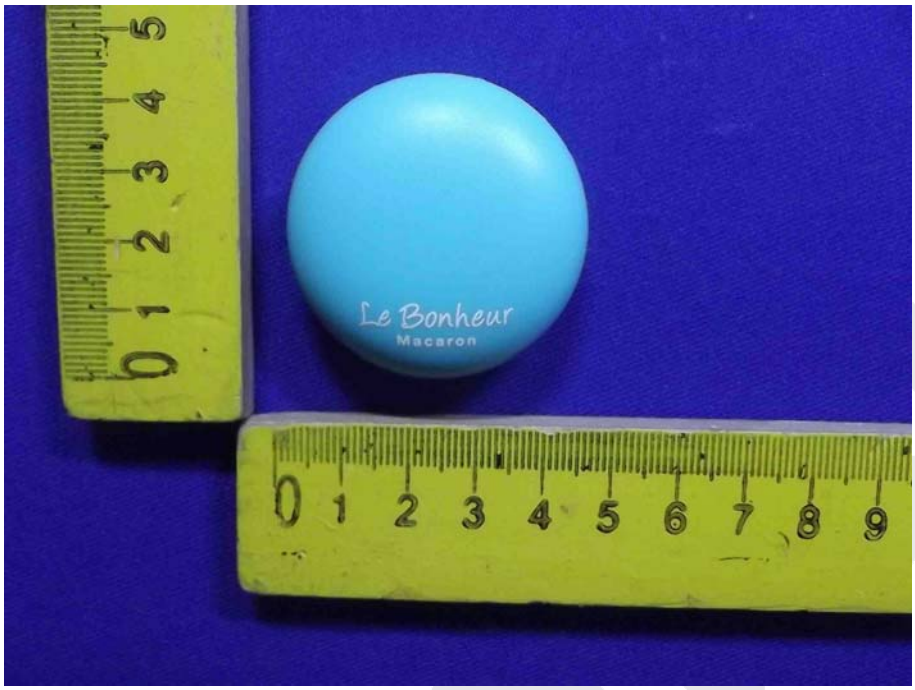


Figure 4
The EUT- Side View

Figure 5
The EUT- Side View

APPENDIX Ⅱ(INTERNAL PHOTOS)

Figure 6
The EUT-Inside View

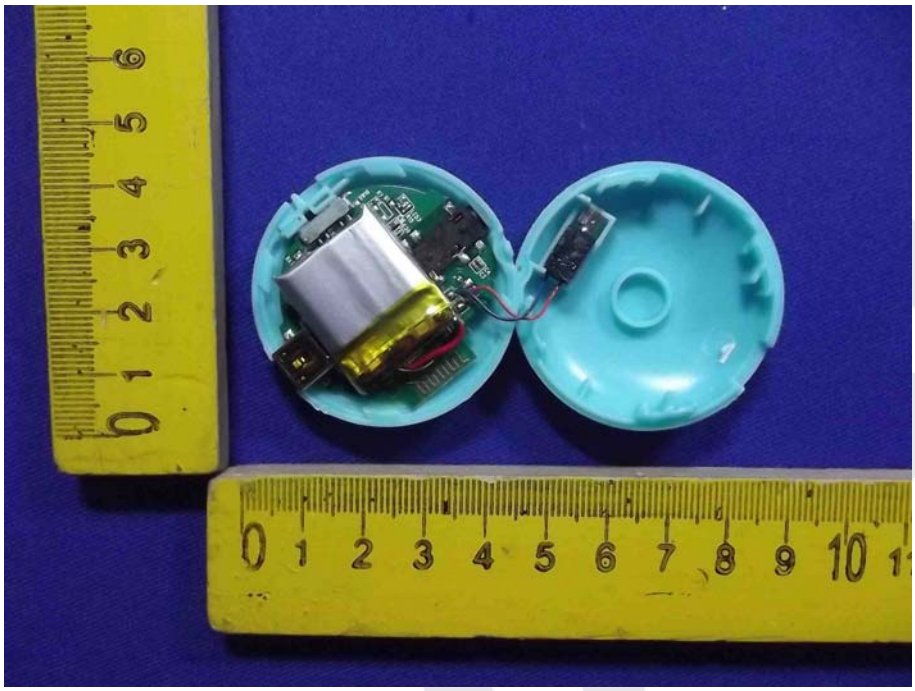


Figure 7
PCB of the EUT-Front View

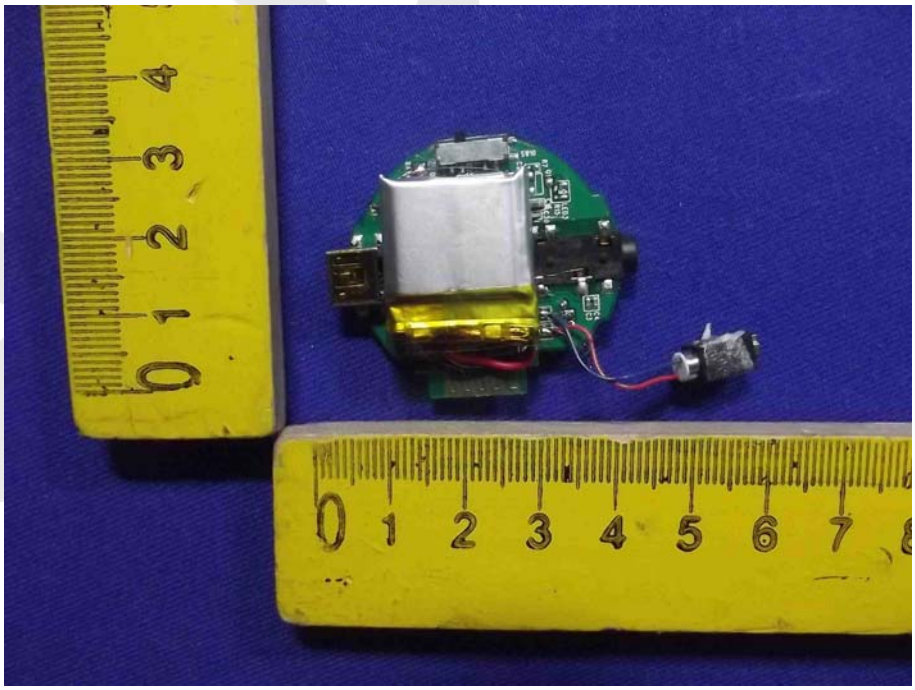


Figure 8
PCB of the EUT-Front View

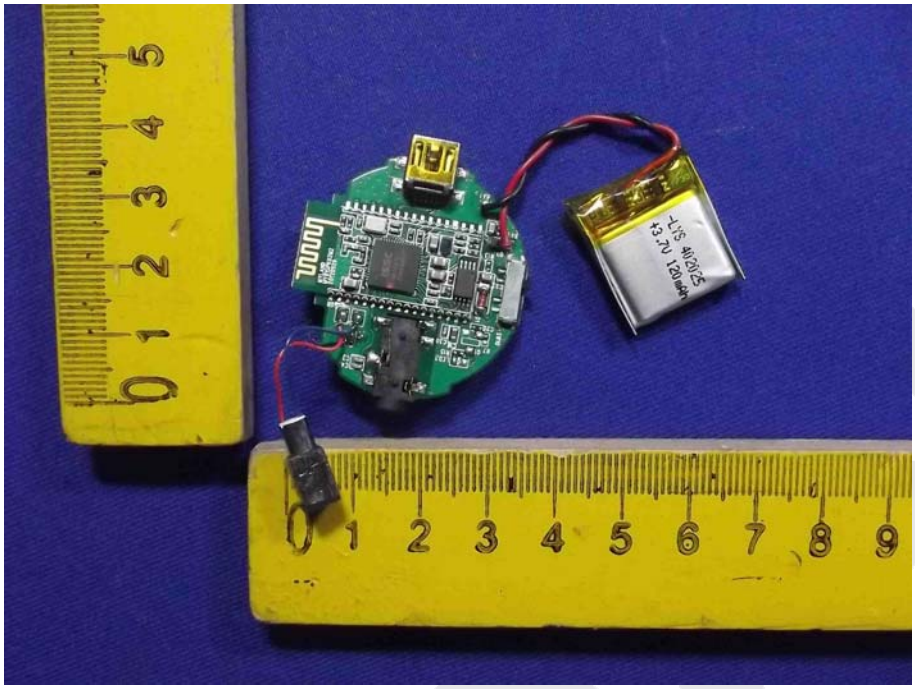


Figure 9
PCB of the EUT-Back View

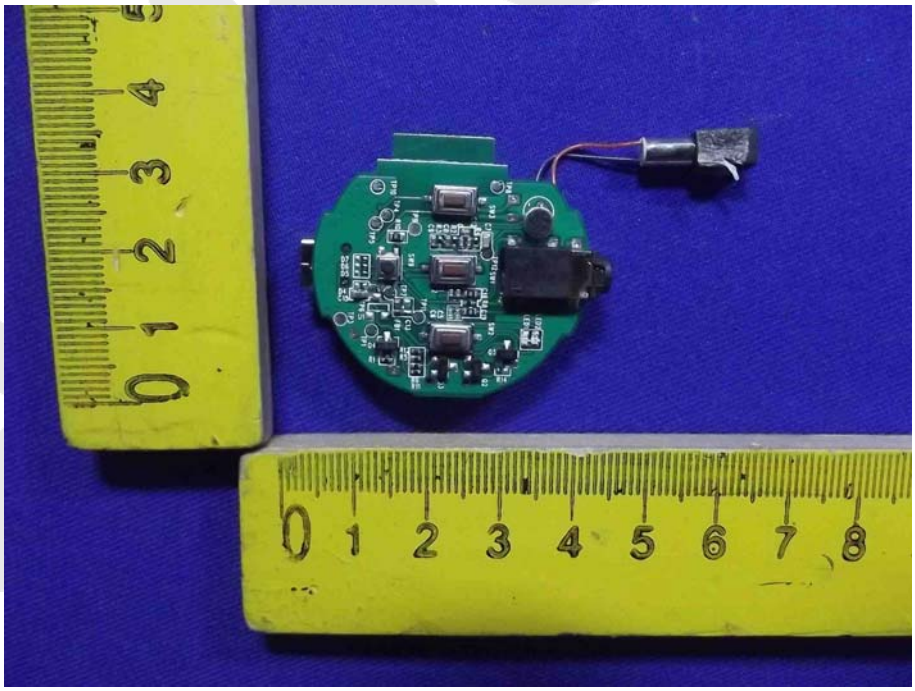


Figure 10
PCB of the EUT-Front View

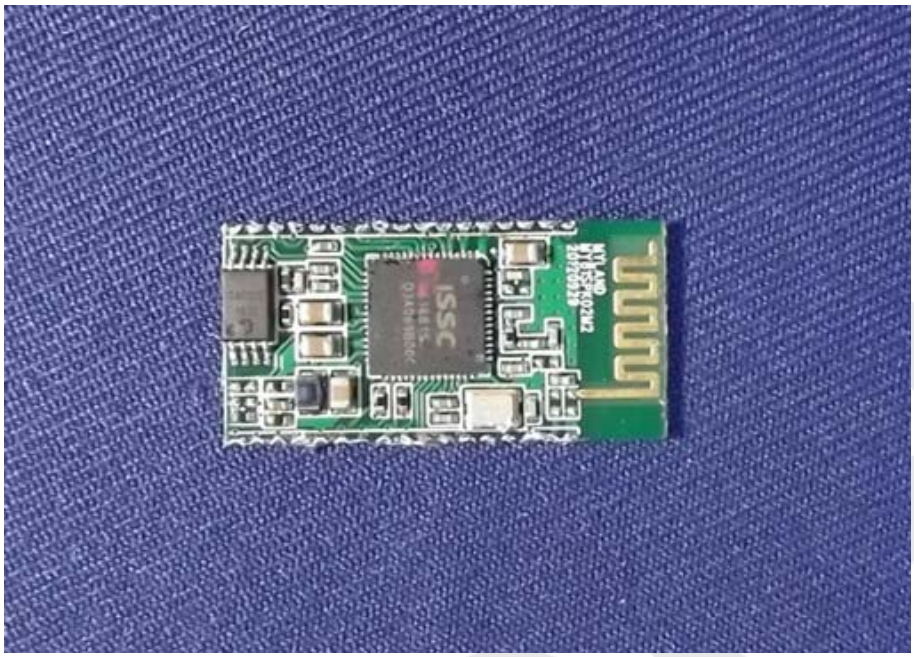
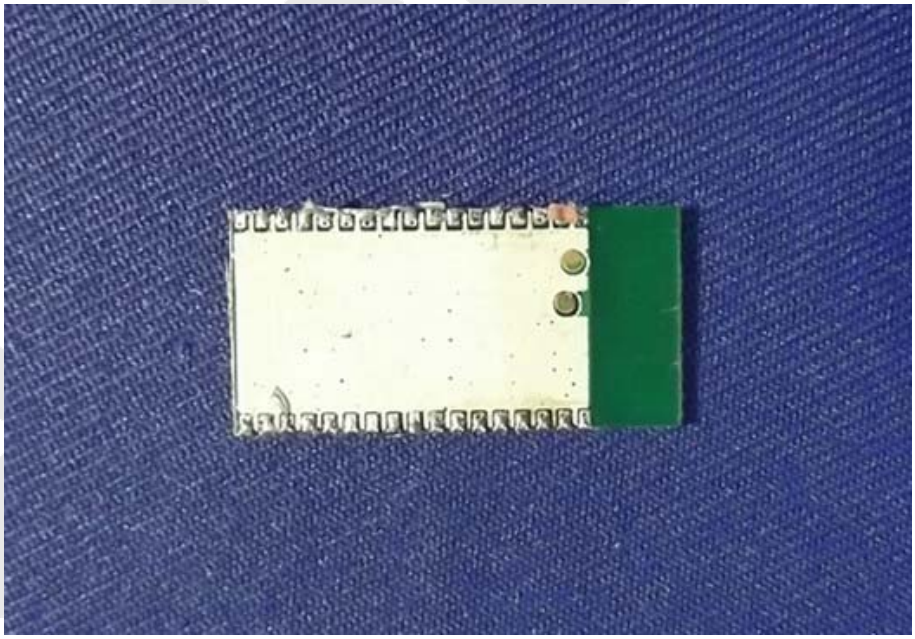



Figure 11
PCB of the EUT-Back View