

FCC TEST REPORT  
for  
GENERALSCAN ELECTRONICS CO., LIMITED

Bluetooth Barcode Scanner  
Model No.: GS X3, GS X5, GS M100BT,  
GS M300BT, GS M500BT, GS R1000BT, GS R5000BT,  
GS SL2000, GS SL3000, GS WT1000

Prepared for : GENERALSCAN ELECTRONICS CO., LIMITED  
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Report Number : R011411102E  
Date of Test : Nov. 07~ 21, 2014  
Date of Report : Nov. 24, 2014

## TABLE OF CONTENTS

Description	Page
Test Report	
<b>1. GENERAL INFORMATION .....</b>	<b>5</b>
1.1 Description of Device (EUT).....	5
1.2 Auxiliary Equipment Used during Test.....	6
1.3 Description of Test Facility .....	6
1.4 Measurement Uncertainty.....	6
<b>2. TEST PROCEDURE .....</b>	<b>7</b>
<b>3. CONDUCTED EMISSION.....</b>	<b>8</b>
3.1 Block Diagram of Test Setup .....	8
3.2 Power Line Conducted Emission Measurement Limits (15.207).....	8
3.3 Configuration of EUT on Measurement .....	8
3.4 Operating Condition of EUT .....	8
3.5 Test Procedure .....	9
3.6 Power Line Conducted Emission Measurement Results .....	9
<b>4. RADIATION INTERFERENCE .....</b>	<b>12</b>
4.1 Requirements (15.247, 15.209): .....	12
4.2 Test Procedure .....	12
4.3 Test Configuration.....	13
4.4 Test Results.....	14
<b>5. CHANNEL SEPARATION TEST .....</b>	<b>23</b>
5.1 Measurement Procedure .....	23
5.2 Test SET-UP .....	23
5.3 Test Equipment.....	23
5.4 Test Results.....	24
<b>6. 20DB BANDWIDTH TEST .....</b>	<b>28</b>
6.1 Measurement Procedure .....	28
6.2 Test SET-UP .....	28
6.3 Test Equipment.....	28
6.4 Test Results.....	28
<b>7. QUANTITY OF HOPPING CHANNEL TEST.....</b>	<b>32</b>
7.1 Measurement Procedure .....	32
7.2 Test SET-UP .....	32
7.3 Test Equipment.....	32
7.4 Test Results.....	32
<b>8. DWELL TIME TEST .....</b>	<b>34</b>
8.1 Measurement Procedure .....	34
8.2 Test SET-UP .....	34
8.3 Test Equipment.....	34
8.4 Test Results.....	34
<b>9. MAXIMUM PEAK OUTPUT POWER TEST .....</b>	<b>41</b>
9.1 Measurement Procedure .....	41

9.2 Test SET-UP ..... 41  
9.3 Test Equipment ..... 41  
9.4 Test Results ..... 42  
**10. BAND EDGE TEST..... 46**  
10.1 Measurement Procedure ..... 46  
10.2 Test SET-UP ..... 46  
10.3 Test Equipment ..... 46  
10.4 Test Results ..... 46  
**11. ANTENNA APPLICATION..... 52**  
11.1 Antenna requirement ..... 52  
11.2 Result ..... 52  
**12. PHOTOGRAPH..... 53**  
12.1 Photo of Power Line Conducted Emission Measurement ..... 53  
12.2 Photo of Radiation Emission Test ..... 53  
**APPENDIX I (EXTERNAL PHOTOS)..... 55**  
**APPENDIX II (INTERNAL PHOTOS) ..... 59**

APPENDIX I (External Photos) (4 Pages)  
APPENDIX II (Internal Photos) (4 Pages)

## TEST REPORT

Applicant : GENERALSCAN ELECTRONICS CO., LIMITED  
Manufacturer : GENERALSCAN ELECTRONICS CO., LIMITED  
EUT : Bluetooth Barcode Scanner  
Model No. : GS X3, GS X5, GS M100BT, GS M300BT, GS M500BT, GS R1000BT, GS R5000BT, GS SL2000, GS SL3000, GS WT1000  
Serial No. : N.A.  
Trade Mark : GENERALSCAN  
Rating : DC 5V, 0.5A

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 : Nov. 07~ 21, 2014



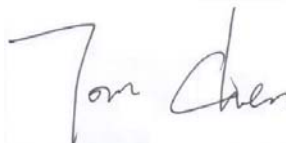
Prepared by :

(Tested Engineer / Kebo Zhang)



Reviewer :

(Project Manager / Amy Ding)



Approved & Authorized Signer :

(Manager / Tom Chen)

## 1. GENERAL INFORMATION

### 1.1 Description of Device (EUT)

EUT	: Bluetooth Barcode Scanner
Model Number	: GS X3, GS X5, GS M100BT, GS M300BT, GS M500BT, GS R1000BT, GS R5000BT, GS SL2000, GS SL3000, GS WT1000 (Note: All samples are the same except the model number and appearance, so we prepare "GS M500BT" for EMC test only.)
Test Power Supply	: DC 5V via adapter AC 120V, 60Hz/ DC 5V(With DC 3.7V Battery inside)
Frequency	: 2402~2480MHz
Antenna Specification	: PCB Antenna: 1.97dBi
Modulation	: GFSK, $\pi/4$ DQPSK, 8DPSK
Applicant Address	: GENERALSCAN ELECTRONICS CO., LIMITED Unit 2C15, 3F, Building 2, YuFeng Plaza, No.32, HeLongYi Road, HuangShi Street, Baiyun District, Guangzhou, 510425, China
Manufacturer Address	: GENERALSCAN ELECTRONICS CO., LIMITED Unit 2C15, 3F, Building 2, YuFeng Plaza, No.32, HeLongYi Road, HuangShi Street, Baiyun District, Guangzhou, 510425, China
Factory Address	: GENERALSCAN ELECTRONICS CO., LIMITED Unit 2C15, 3F, Building 2, YuFeng Plaza, No.32, HeLongYi Road, HuangShi Street, Baiyun District, Guangzhou, 510425, China
Date of receipt	: Nov. 07, 2014
Date of Test	: Nov. 07~ 21, 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:

### **CNAS - LAB Code: L3503**

Shenzhen Anbotek Compliance Laboratory Limited., Laboratory has been assessed and in compliance with CNAS/CL01: 2006 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of Testing Laboratories.

### **FCC-Registration No.: 752021**

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered 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 752021, July 10, 2013.

### **IC-Registration No.: 8058A-1**

Shenzhen Anbotek Compliance Laboratory Limited., 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 8058A, February 22, 2013.

### **Test Location**

All Emissions tests were performed at  
Shenzhen Anbotek Compliance Laboratory Limited. at 1/F., Building 1, SEC Industrial Park, No.0409 Qianhai Road, Nanshan District, Shenzhen, Guangdong, 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

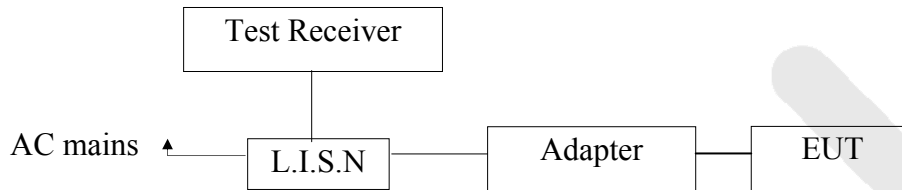
**ANSI STANDARD C63.4-2009 10.1.7 MEASUREMENT PROCEDURES:** The EUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The EUT was placed in the center of the table (1.5m side). The table used for radiated measurements is capable of continuous rotation.

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 to adapter) 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.	Two-Line V-network	Rohde & Schwarz	ENV216	100055	Apr. 22, 2014	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Apr. 22, 2014	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Apr. 22, 2014	1 Year

### 3.6 Power Line Conducted Emission Measurement Results

**PASS.**

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

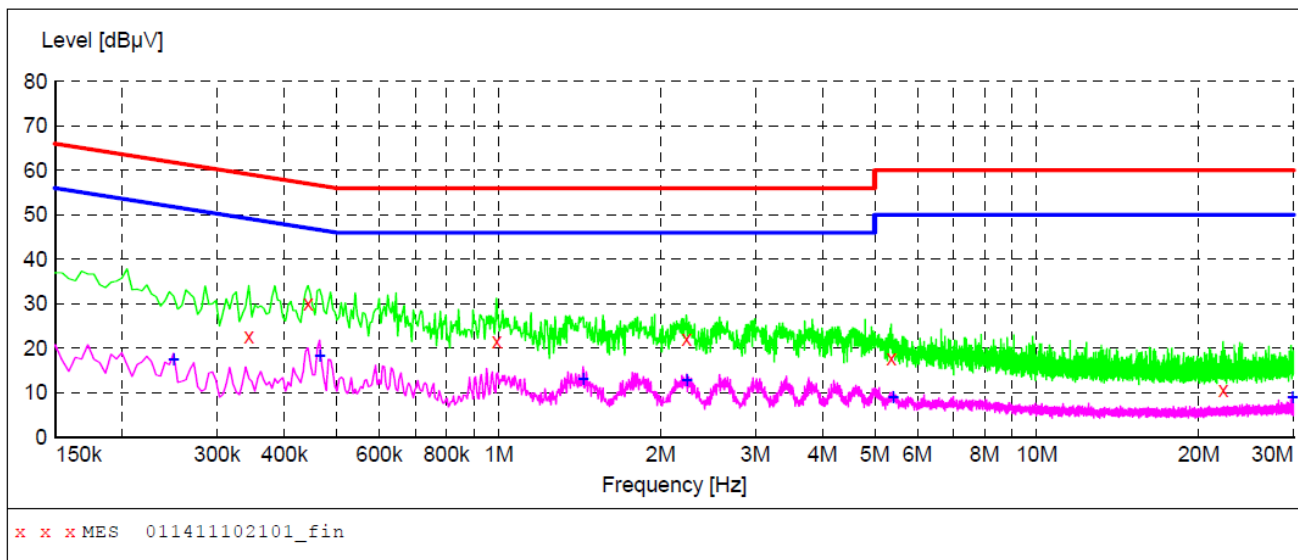
Please refer the following pages.

**CONDUCTED EMISSION TEST DATA**

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

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

Short Description: 150K-30M Disturbance Voltages



**MEASUREMENT RESULT: "011411102101\_fin"**

11/10/2014 8:51AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.343500	22.70	20.1	59	36.4	QP	L1	GND
0.442500	30.10	20.1	57	26.9	QP	L1	GND
0.991500	21.60	20.2	56	34.4	QP	L1	GND
2.233000	22.10	20.3	56	33.9	QP	L1	GND
5.369500	17.70	20.5	60	42.3	QP	L1	GND
22.222000	10.60	20.8	60	49.4	QP	L1	GND

**MEASUREMENT RESULT: "011411102101\_fin2"**

11/10/2014 8:51AM

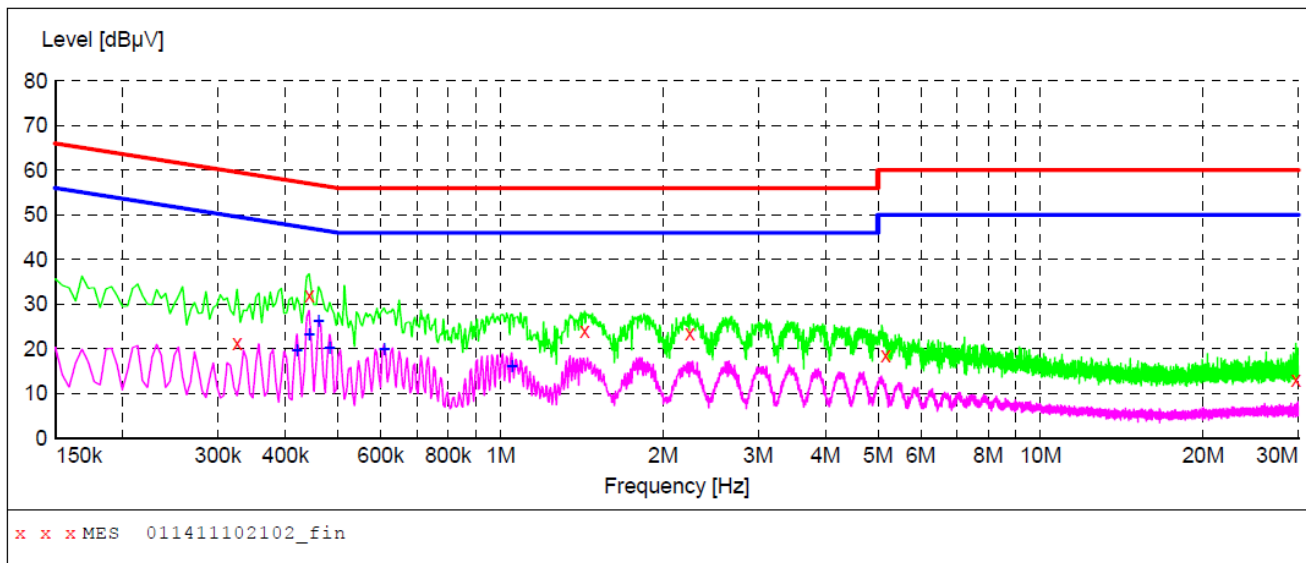
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.249000	17.40	20.1	52	34.4	AV	L1	GND
0.465000	18.20	20.1	47	28.4	AV	L1	GND
1.436500	13.10	20.3	46	32.9	AV	L1	GND
2.237500	12.80	20.3	46	33.2	AV	L1	GND
5.410000	8.90	20.5	50	41.1	AV	L1	GND
29.899000	9.10	20.9	50	40.9	AV	L1	GND

**CONDUCTED EMISSION TEST DATA**

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

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

Short Description: 150K-30M Disturbance Voltages



**MEASUREMENT RESULT: "011411102102\_fin"**

11/10/2014 8:58AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.325500	21.30	20.1	60	38.3	QP	N	GND
0.442500	32.00	20.1	57	25.0	QP	N	GND
1.432000	23.90	20.3	56	32.1	QP	N	GND
2.242000	23.60	20.3	56	32.4	QP	N	GND
5.167000	18.60	20.5	60	41.4	QP	N	GND
29.719000	13.20	20.9	60	46.8	QP	N	GND

**MEASUREMENT RESULT: "011411102102\_fin2"**

11/10/2014 8:58AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.420000	19.70	20.1	47	27.7	AV	N	GND
0.442500	23.30	20.1	47	23.7	AV	N	GND
0.460500	26.30	20.1	47	20.4	AV	N	GND
0.483000	20.30	20.1	46	26.0	AV	N	GND
0.609000	19.80	20.1	46	26.2	AV	N	GND
1.049500	16.00	20.2	46	30.0	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. The EUT is tested in 9\*6\*6 Chamber.

#### **For 30MHz to 1000MHz:**

Set the spectrum analyzer as:  
 RBW = 100kHz, VBW =300kHz,  
 Detector= Quasi-Peak  
 Trace mode= Max hold.  
 Sweep- auto couple.

#### **For Above 1GHz:**

Set the spectrum analyzer as:  
 RBW = 1MHz, VBW =3MHz,  
 Detector= Peak  
 Trace mode= Max hold.  
 Sweep- auto couple.

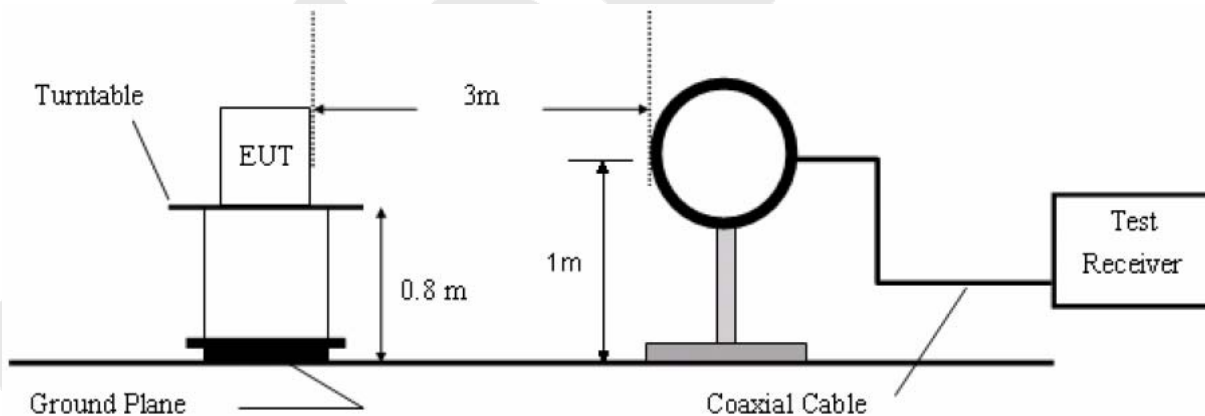
Set the spectrum analyzer as:  
RBW =1MHz, VBW =10Hz  
Detector= Average  
Trace mode= Max hold.  
Sweep- auto couple.

Test Equipment

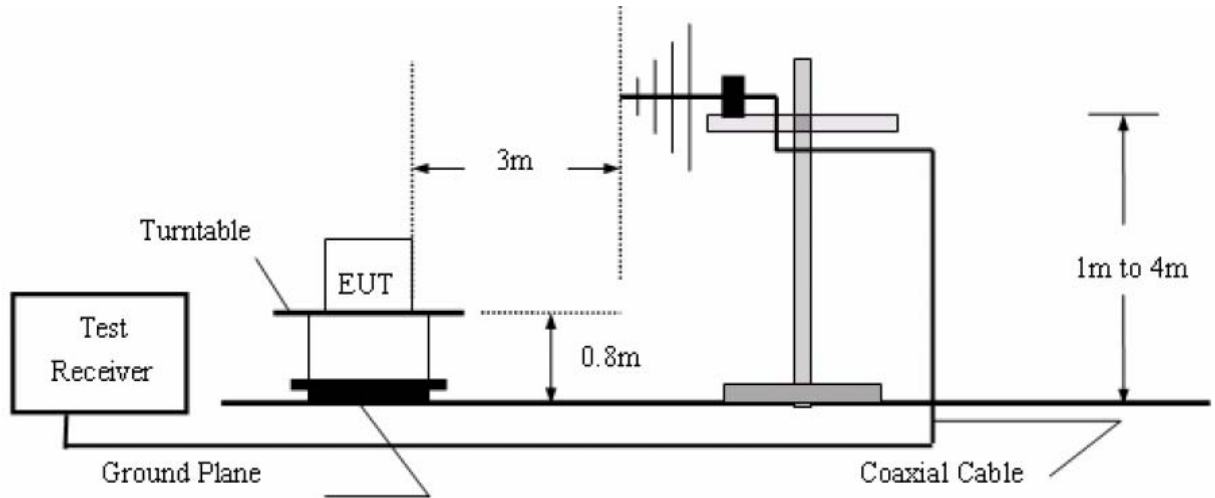
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Aug. 08, 2014	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Aug. 08, 2014	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 22, 2014	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 04, 2014	1 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 24, 2014	1 Year
6.	Pre-amplifier	SONOMA	310N	186860	Aug. 08, 2014	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

4.3 Test Configuration

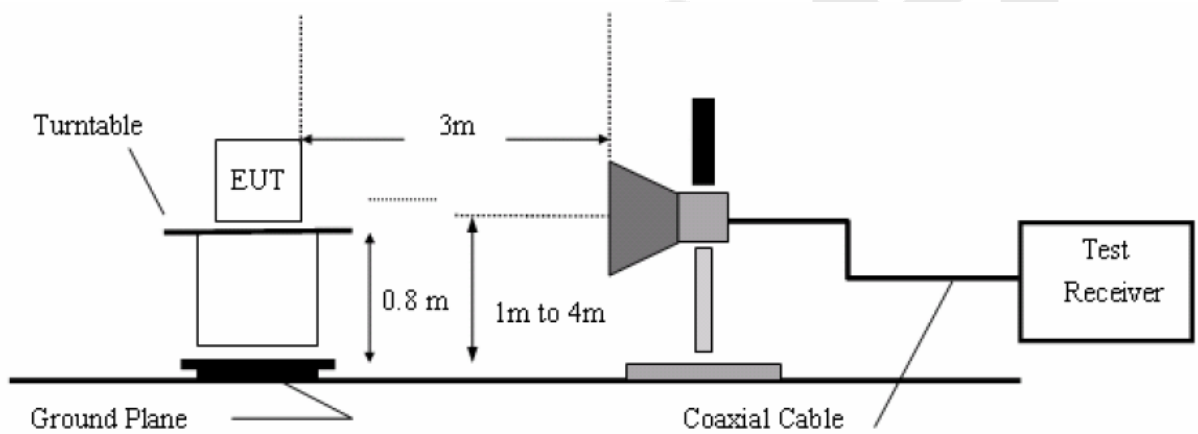
4.3.1. 9k to 30MHz emissions:



4.3.2. 30M to 1G emissions:



4.3.3. 1G to 40G emissions:

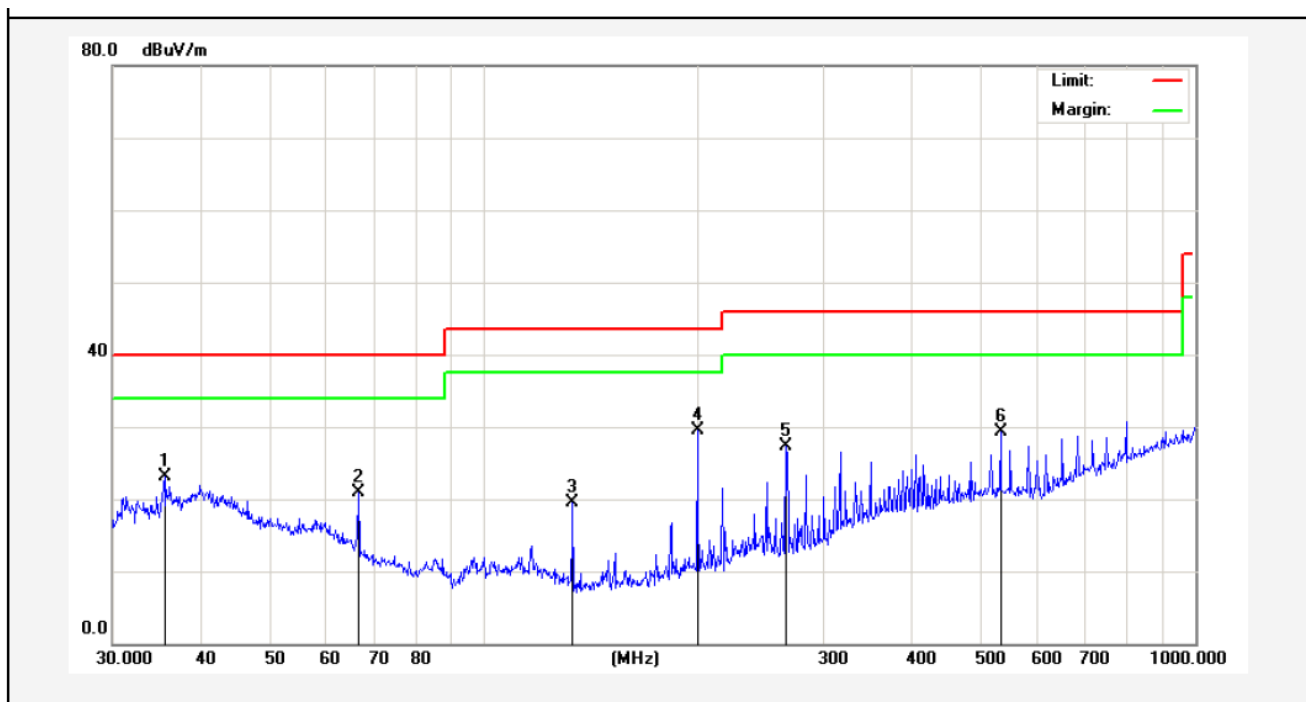


4.4 Test Results

PASS.

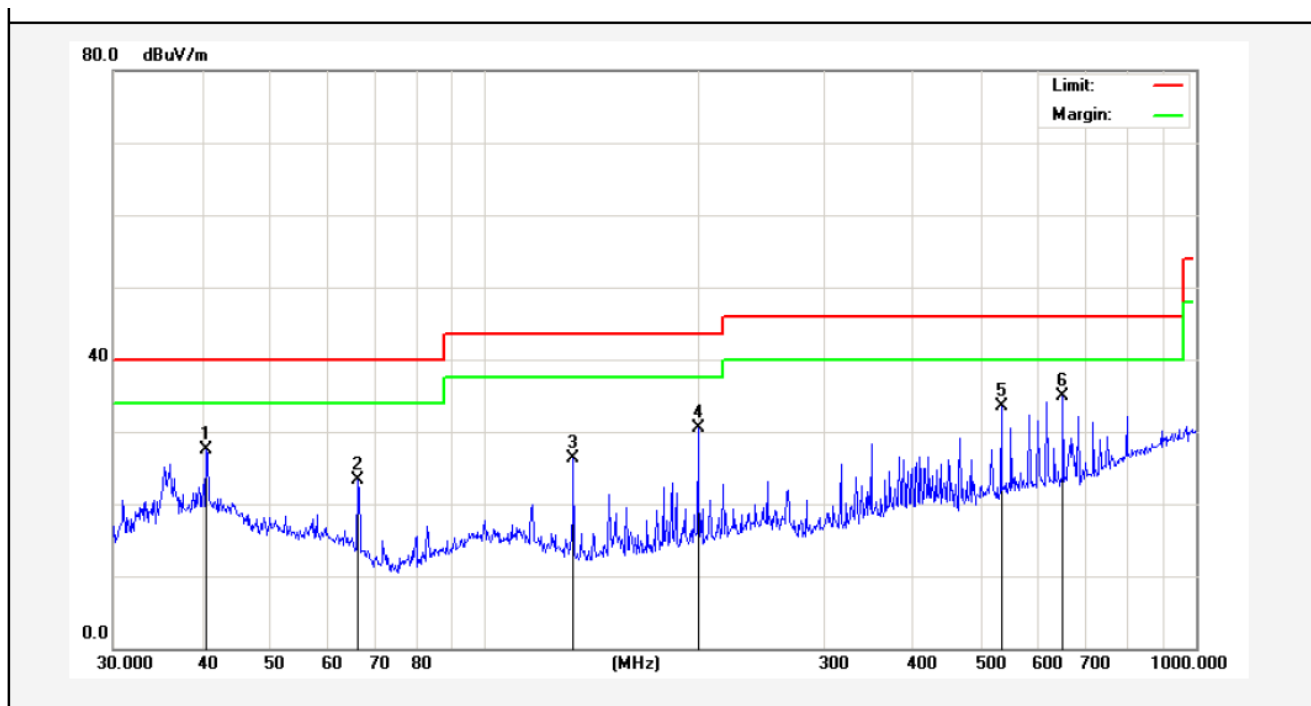
The EUT was tested on (Charging to adapter, On) modes, only the worst data of (On) are attached in the following pages.

Job No.:	011411102E	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:	On	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	35.4993	36.91	-13.90	23.01	40.00	-16.99	peak			
2	66.4989	38.98	-18.12	20.86	40.00	-19.14	peak			
3	133.1511	42.45	-23.02	19.43	43.50	-24.07	peak			
4	199.2855	50.38	-20.87	29.51	43.50	-13.99	peak			
5	265.6757	45.99	-18.77	27.22	46.00	-18.78	peak			
6	531.9635	40.40	-11.04	29.36	46.00	-16.64	peak			

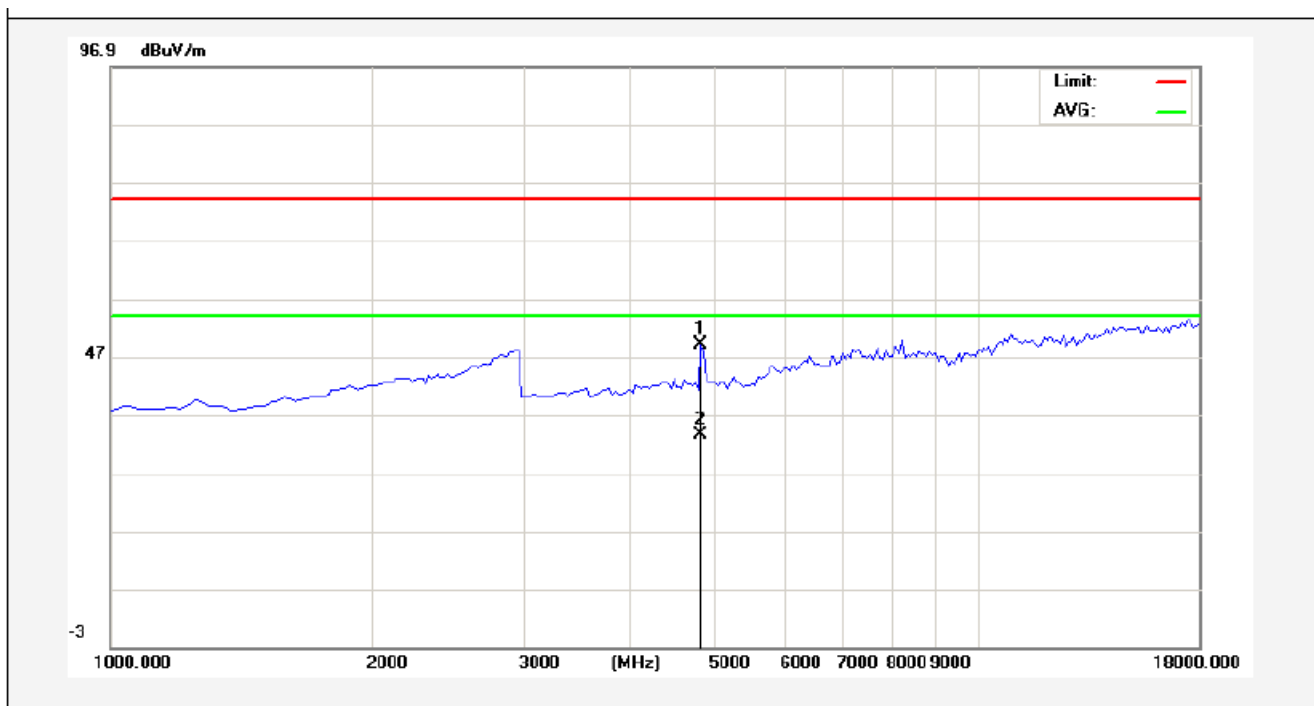
Job No.:	011411102E	Polarization:	Vertical
Standard:	(RE)FCC PART 15C_3m	Power Source:	DC 3.7V
Test item:	Radiation Test (30~1000MHz)	Temp.(C)/Hum.(%RH):	24.3( C)/55%RH
Test Mode:	On	Distance:	3m



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	40.5591	38.10	-10.58	27.52	40.00	-12.48	peak			
2	66.2661	41.26	-18.01	23.25	40.00	-16.75	peak			
3	133.1511	44.27	-18.02	26.25	43.50	-17.25	peak			
4	199.2855	46.42	-15.87	30.55	43.50	-12.95	peak			
5	531.9634	43.96	-10.40	33.56	46.00	-12.44	peak			
6	649.6597	43.80	-8.85	34.95	46.00	-11.05	peak			

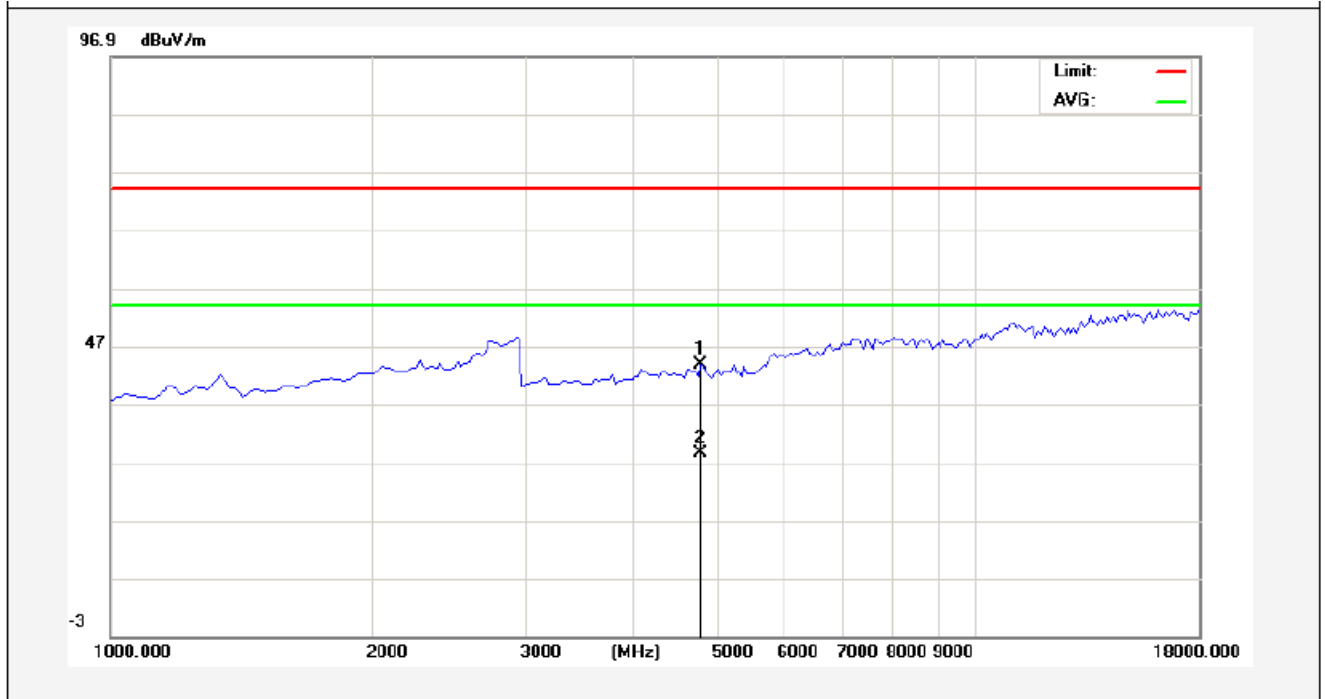


Job No.:	011411102E	Polarization:	Horizontal
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 3.7V
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3( C)/55%RH
Test Mode:	TX(2402 MHz)	Distance:	3m



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			

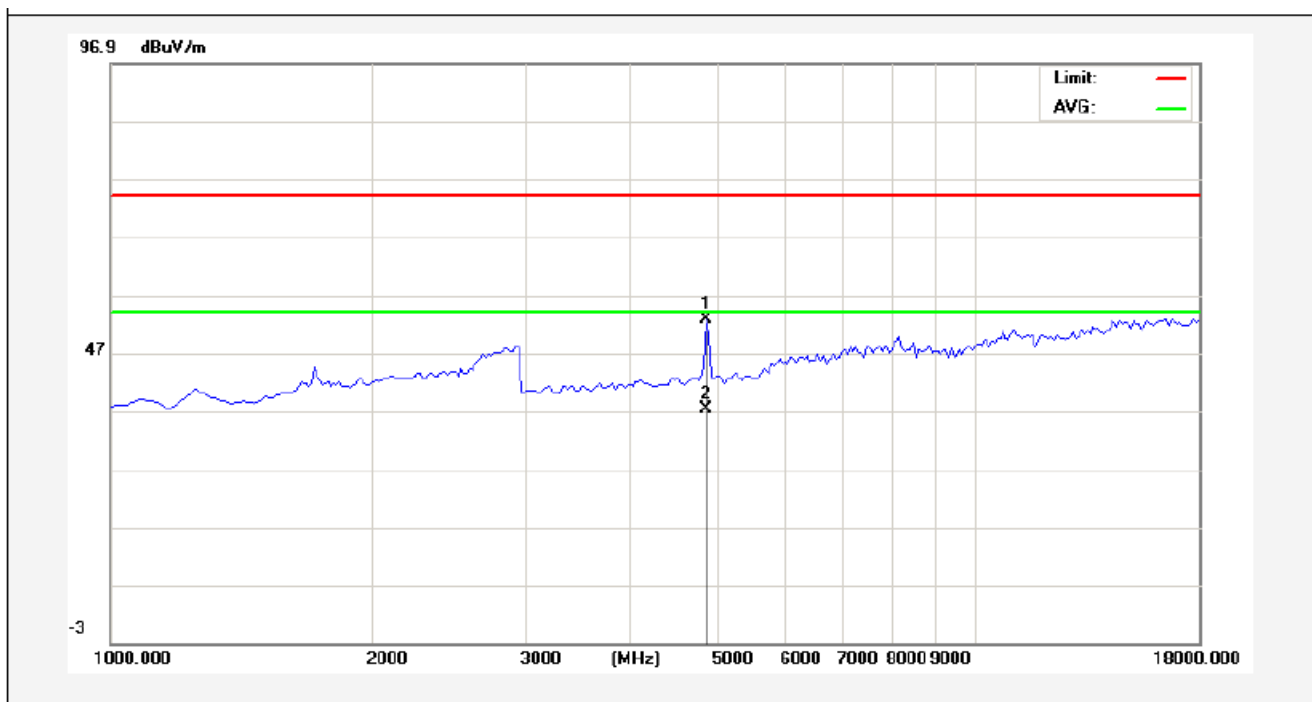
Job No.:	011411102E	Polarization:	Vertical
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 3.7V
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3( C)/55%RH
Test Mode:	TX(2402 MHz)	Distance:	3m



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			

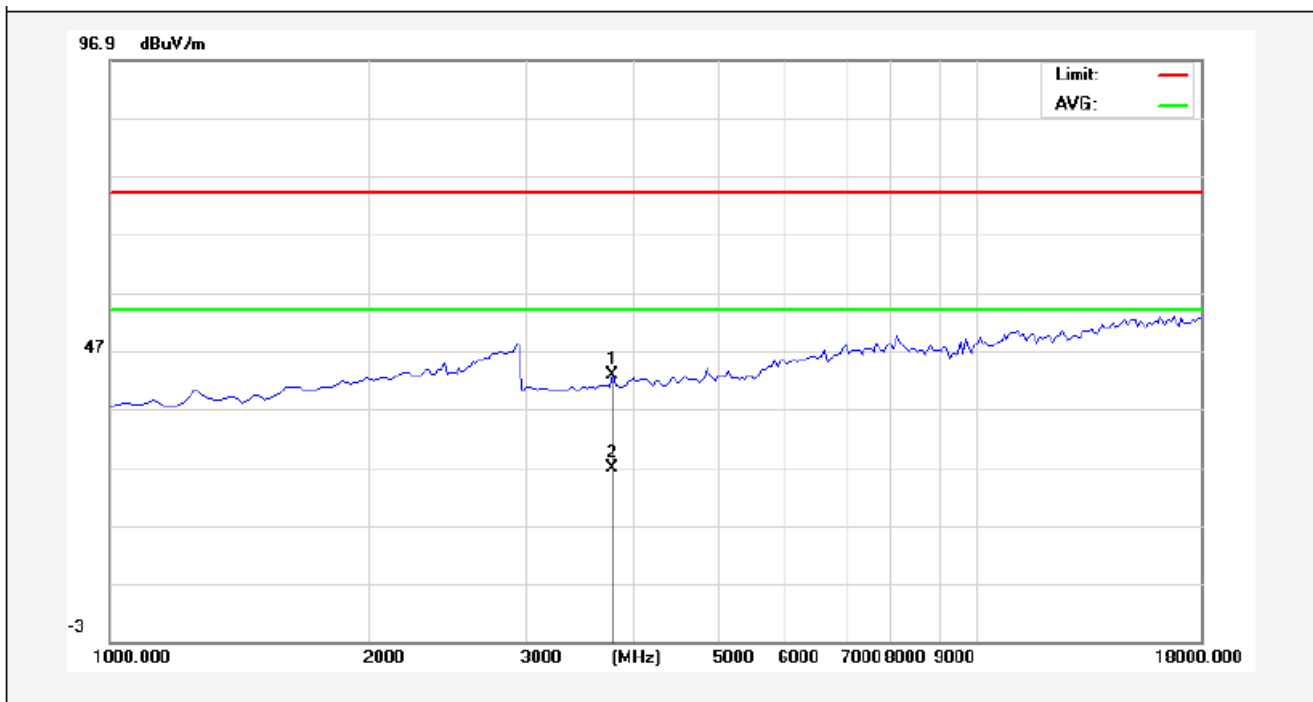
AMT

Job No.:	011411102E	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



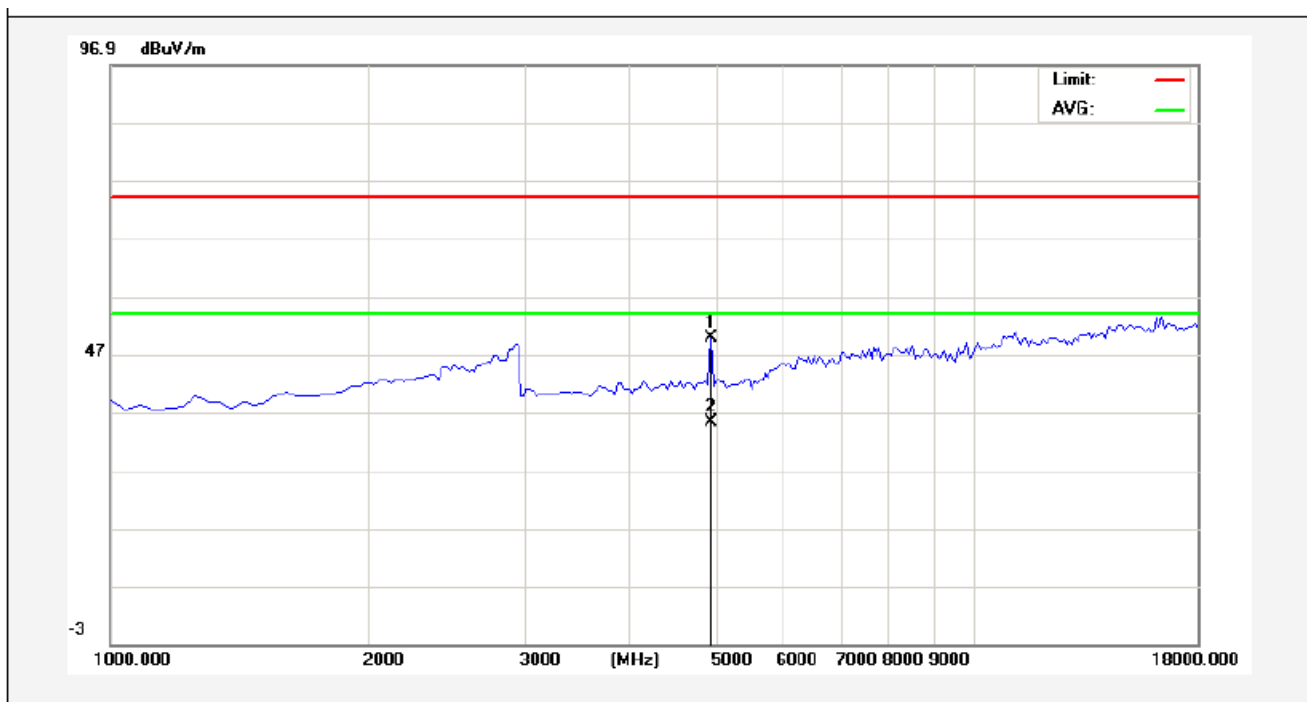
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4867.500	49.41	3.41	52.82	74.00	-21.18	peak			
2	4867.500	33.83	3.41	37.24	54.00	-16.76	AVG			

Job No.:	011411102E	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			

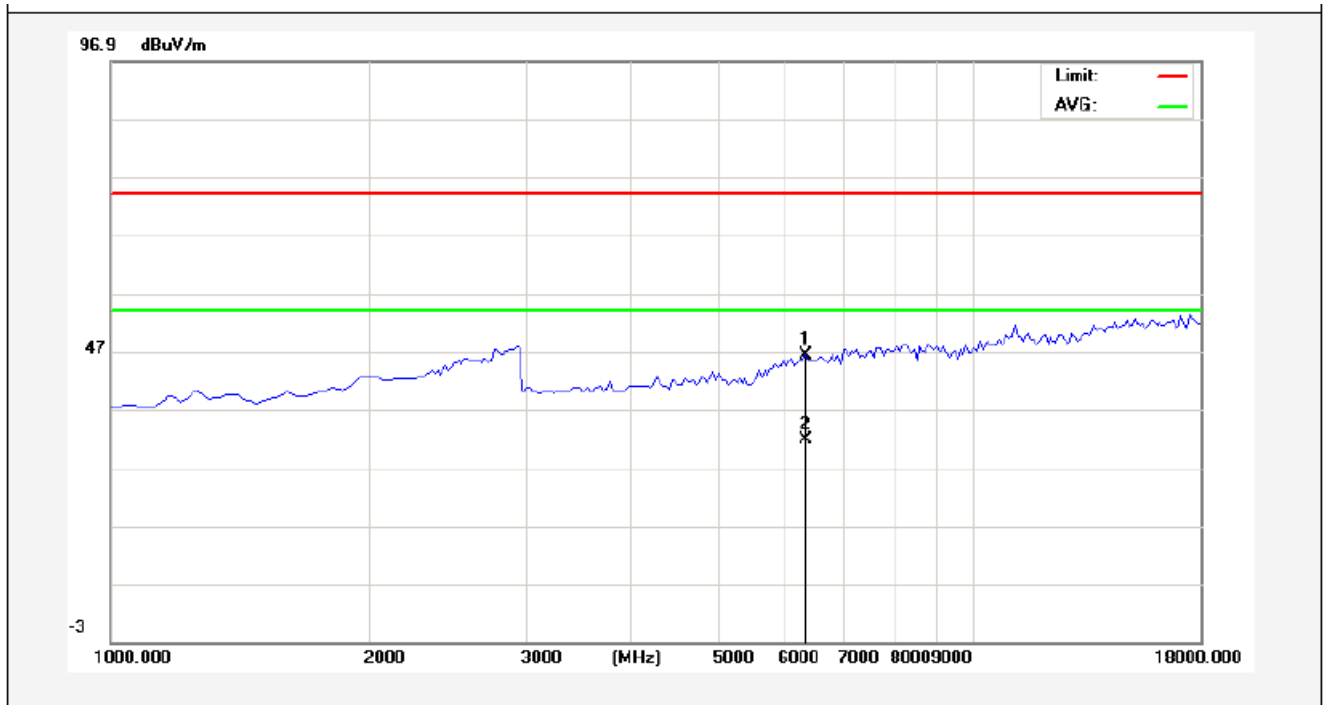
Job No.:	011411102E	Polarization:	Horizontal
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 3.7V
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3( C)/55%RH
Test Mode:	TX(2480 MHz)	Distance:	3m



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			

AMR

Job No.:	011411102E	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 must have its hopping function enabled. Using the following spectrum analyzer settings:

1. Span= Wide enough to capture the peaks of two adjacent channels
2. Set the RBW = 30 kHz.
3. Set the VBW = 100 kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

### 5.2 Test SET-UP



### 5.3 Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Aug. 08, 2014	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Aug. 08, 2014	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 22, 2014	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 04, 2014	1 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 24, 2014	1 Year
6.	Pre-amplifier	SONOMA	310N	186860	Aug. 08, 2014	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

5.4 Test Results

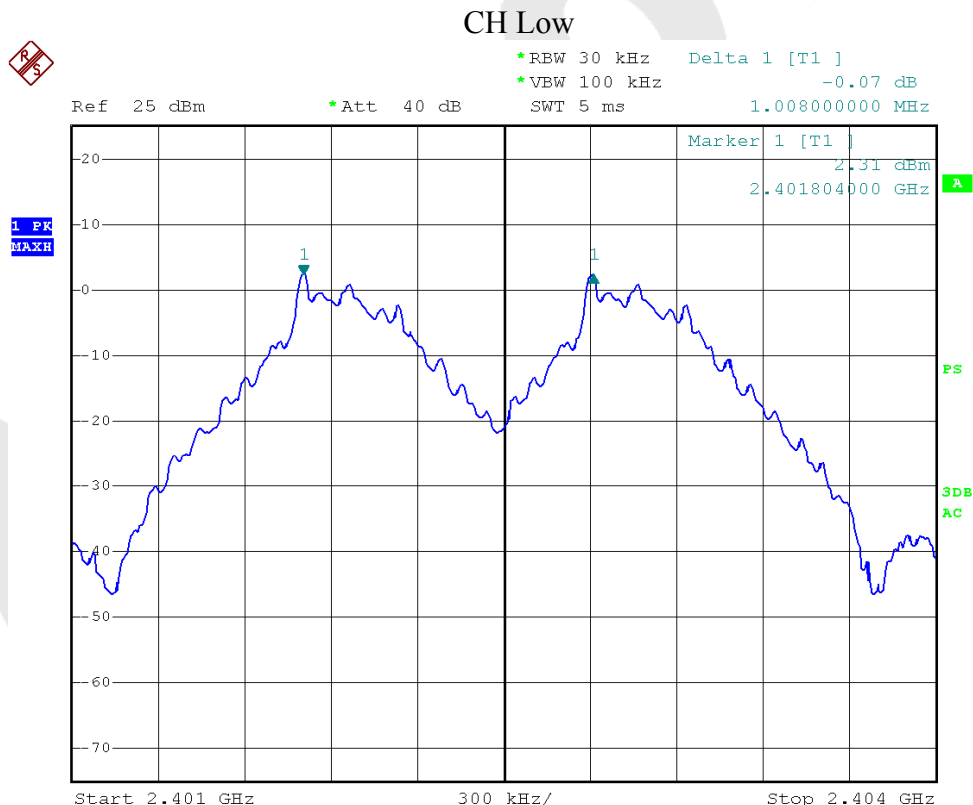
Test Item : Frequency Separation Test Mode : CH Low ~ CH High  
 Test Voltage : DC 3.7V Temperatur : 24°C  
 Test Result : PASS Humidity : 55%RH

Channel	Frequency (MHz)	Separation Read Value (kHz)	Limit (kHz)	Modulation Mode
Low	2401	1008	880	GFSK
Mid	2441	1002	880	GFSK
High	2480	1002	880	GFSK
Low	2401	1002	813	$\pi/4$ DQPSK
Mid	2441	1002	813	$\pi/4$ DQPSK
High	2480	1002	813	$\pi/4$ DQPSK
Low	2401	1002	813	8DPSK
Mid	2441	1002	813	8DPSK
High	2480	1002	813	8DPSK

Remark:

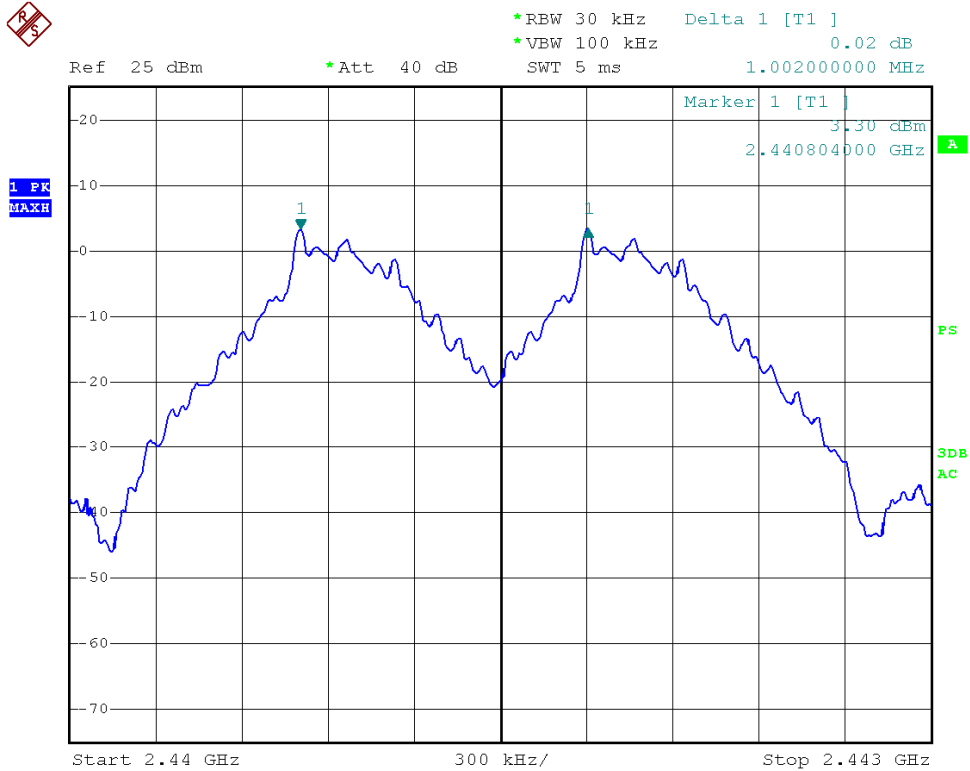
- The limit of modulation ( $\pi/4$ DQPSK, 8DPSK ) is 2/3 of 20dB BW;

Modulation Mode: GFSK

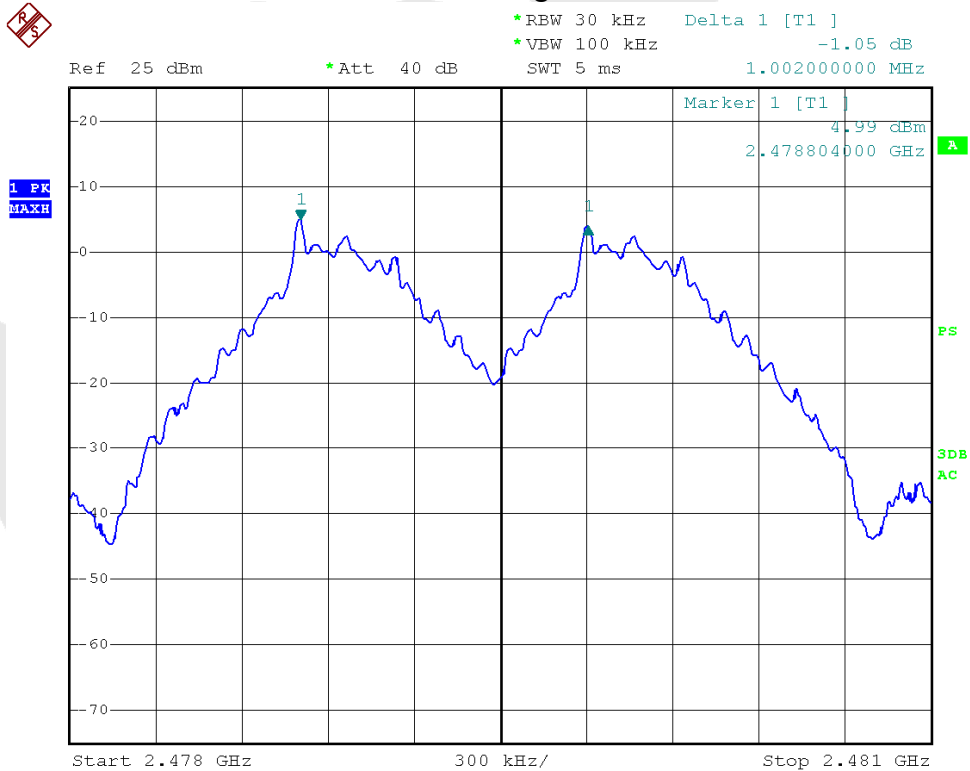




CH Mid

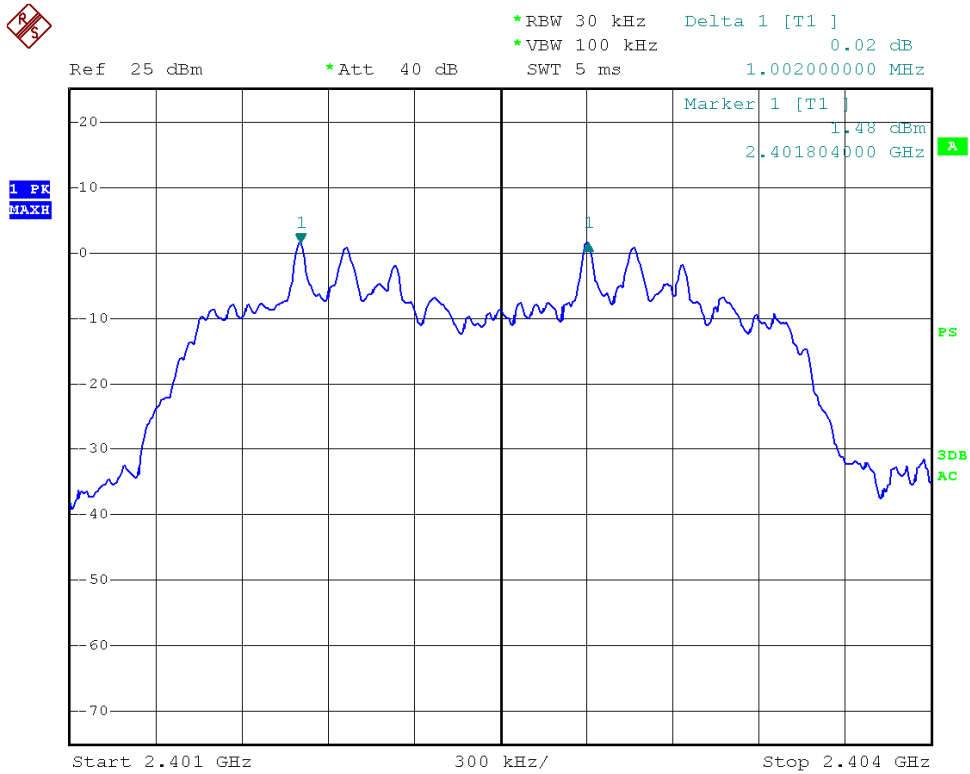


CH High

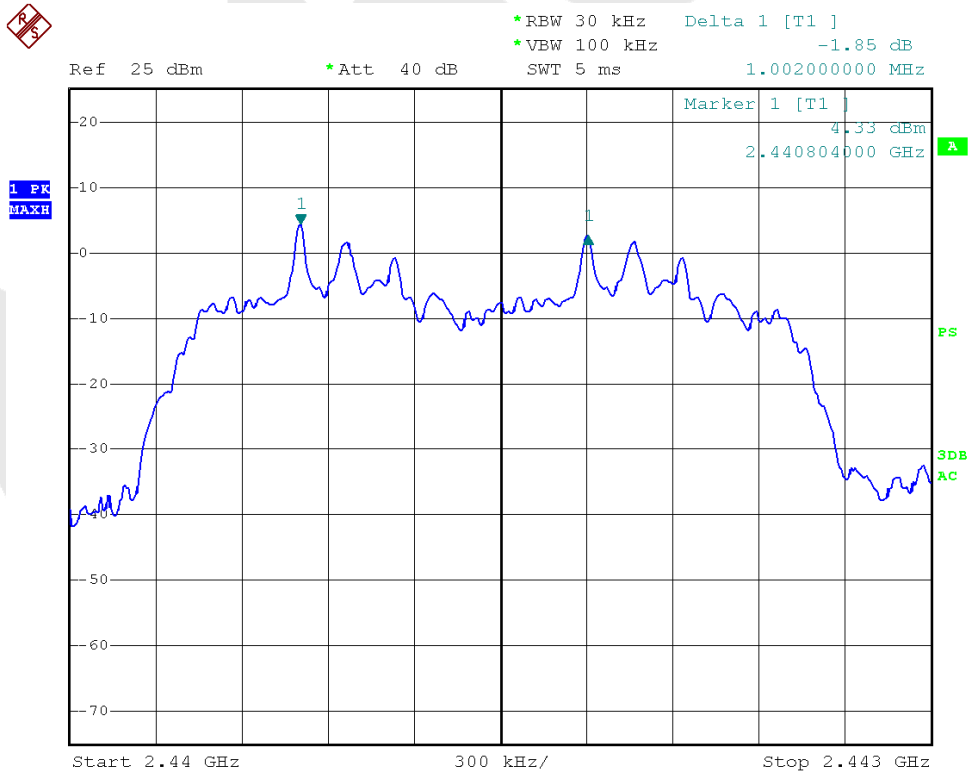


Modulation Mode:  $\pi/4$ DQPSK& 8DPSK

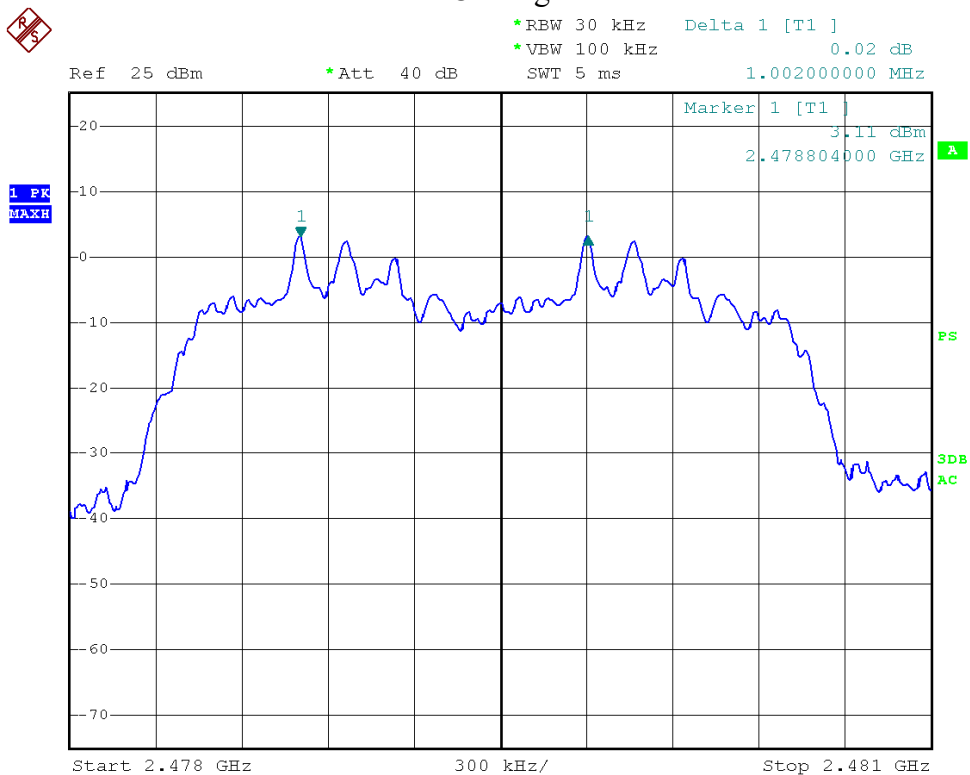
CH Low



CH Mid



CH High



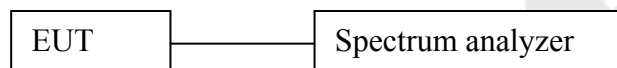
## 6. 20DB BANDWIDTH TEST

### 6.1 Measurement Procedure

Using the following spectrum analyzer settings:

1. Span= approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel.
2. Set the RBW = 30 kHz.
3. Set the VBW = 100 kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

### 6.2 Test SET-UP



### 6.3 Test Equipment

Same as the equipment listed in 5.3.

### 6.4 Test Results

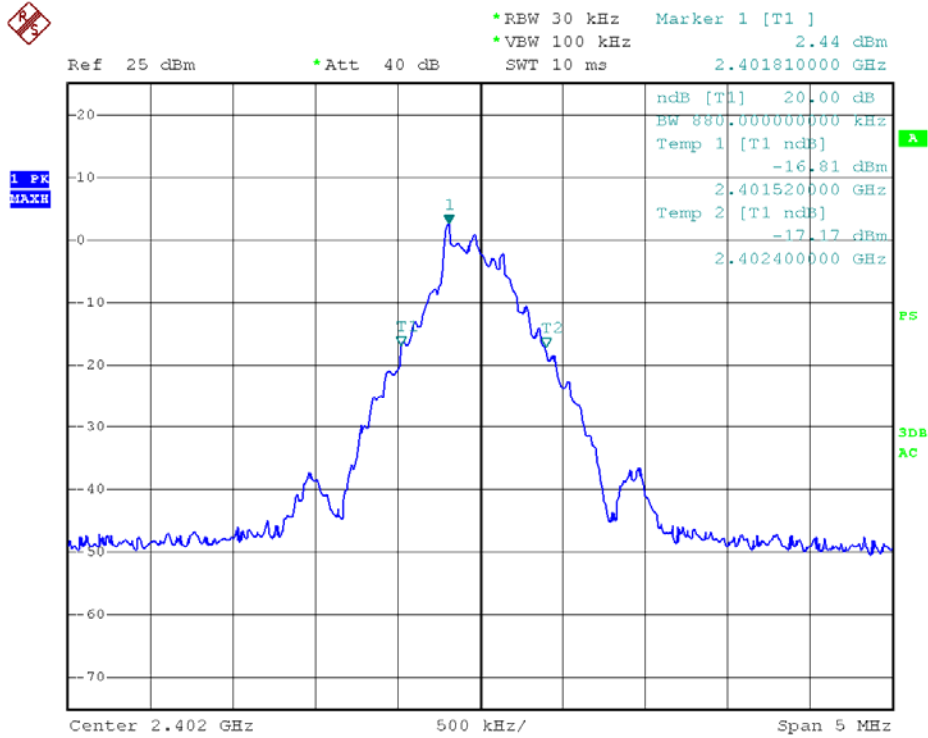
Test Item	: 20dB BW	Test Mode	: CH Low ~ CH High
Test Voltage	: DC 3.7V	Temperatur	: 24°C
Test Result	: PASS	Humidity	: 55%RH

Channel	Frequency (MHz)	20dB Down BW(kHz)	Modulation Mode
Low	2401	880	GFSK
Mid	2441	880	GFSK
High	2480	880	GFSK
Low	2401	1220	$\pi/4$ DQPSK
Mid	2441	1220	$\pi/4$ DQPSK
High	2480	1220	$\pi/4$ DQPSK
Low	2401	1220	8DPSK
Mid	2441	1220	8DPSK
High	2480	1220	8DPSK

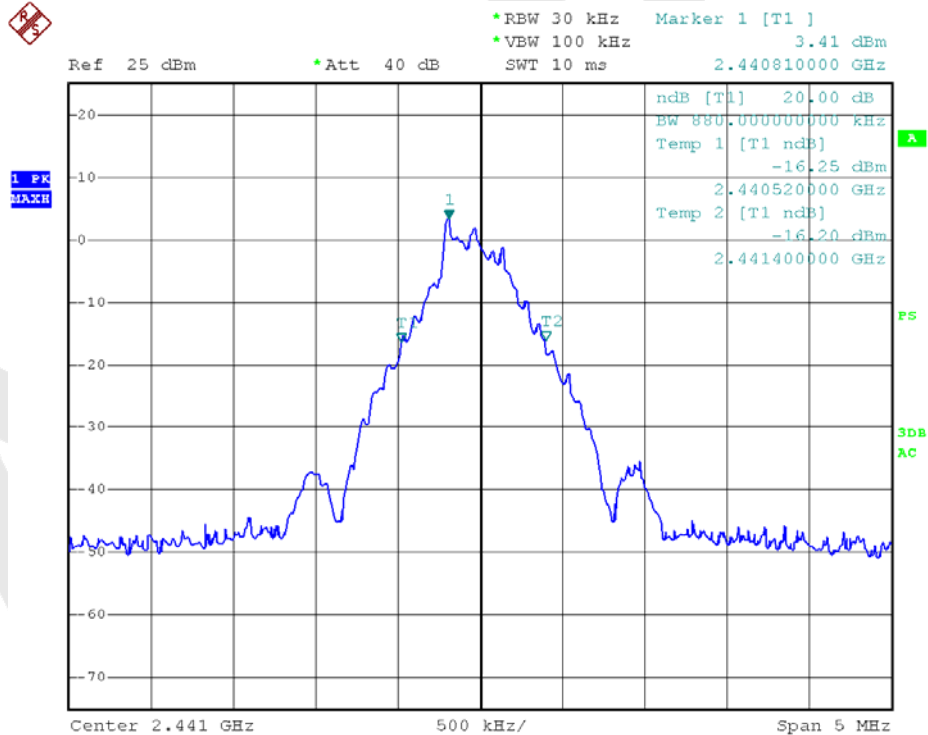
Remark: The results of modulations  $\pi/4$ DQPSK and 8DPSK are the same.

Modulation Mode: GFSK

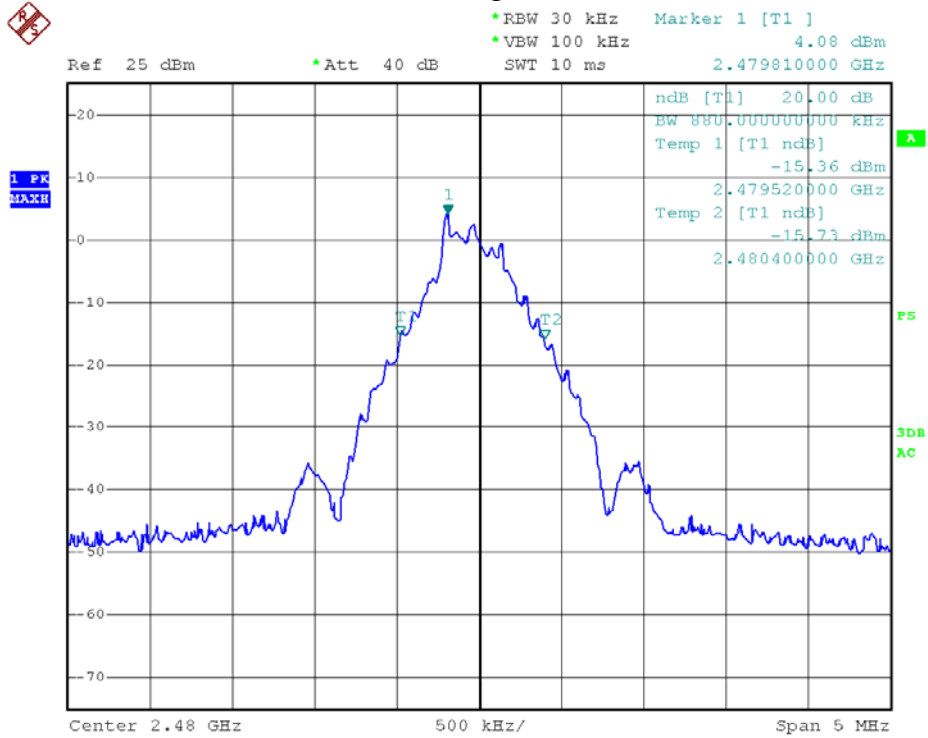
CH Low



CH Middle

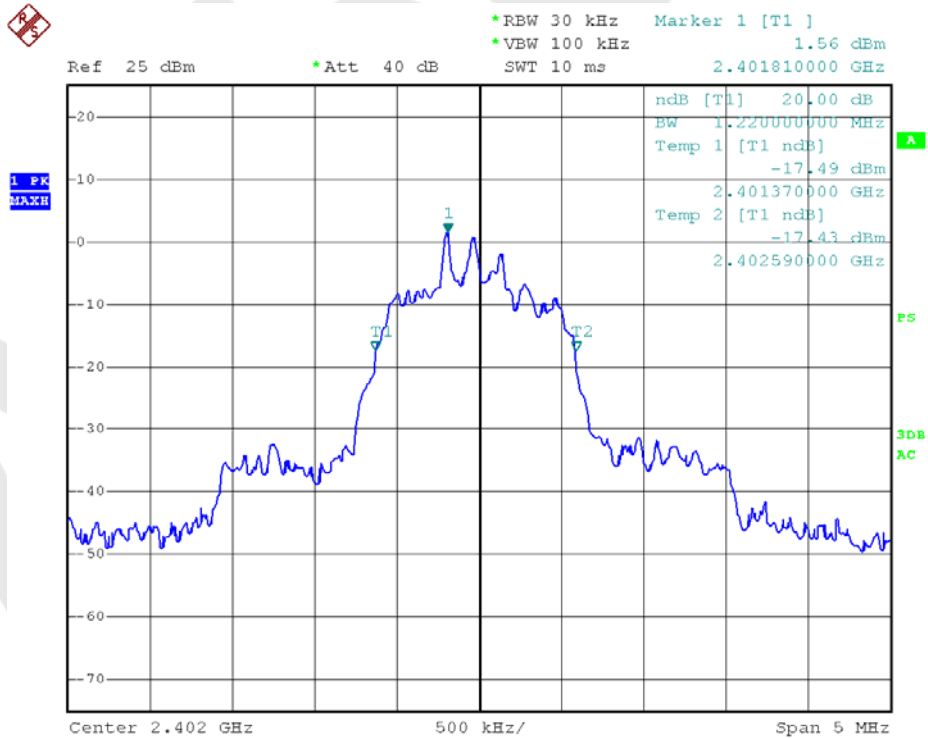


CH High

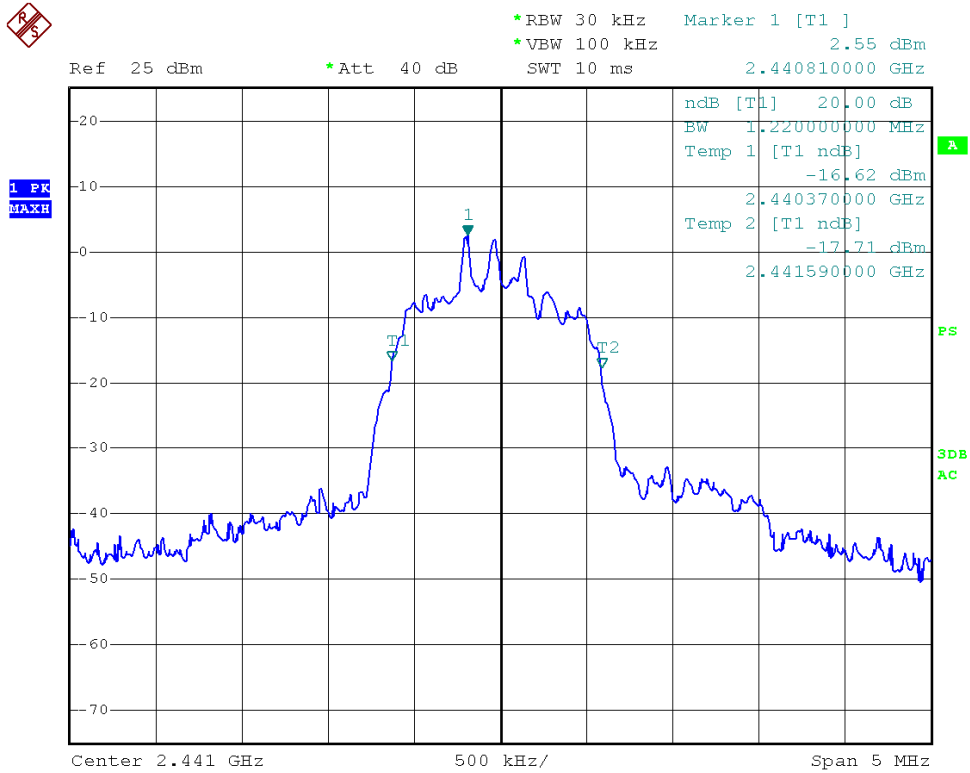


Modulation Mode:  $\pi/4$ DQPSK & 8DPSK

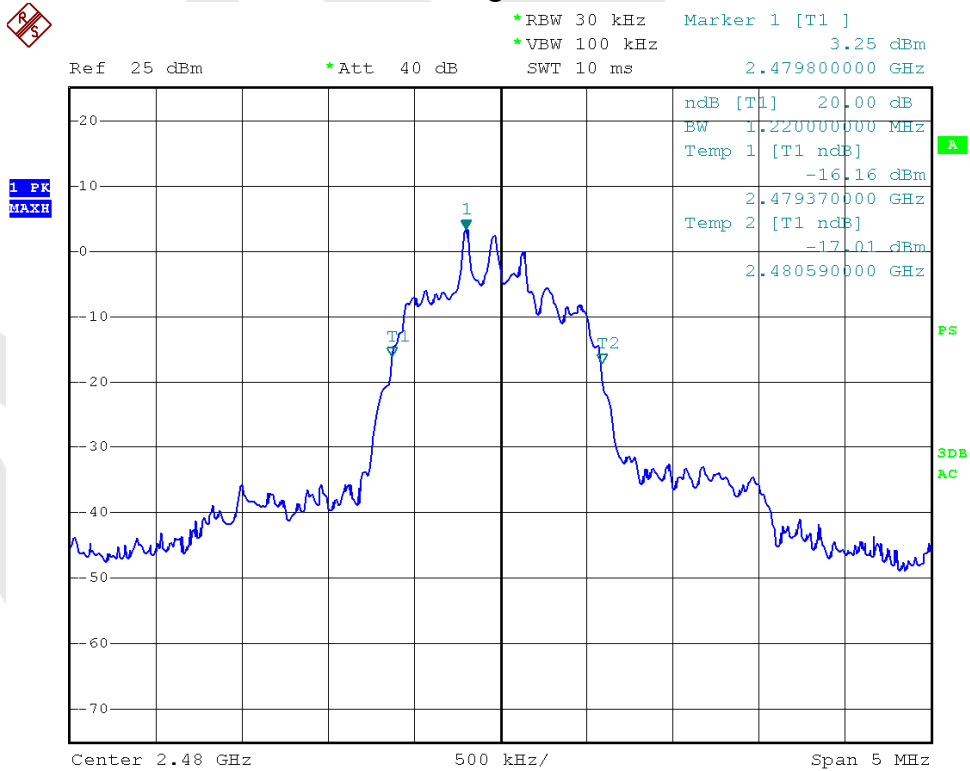
CH Low



CH Middle



CH High



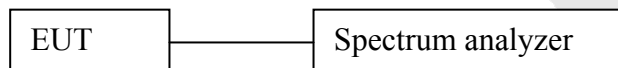
## 7. QUANTITY OF HOPPING CHANNEL TEST

### 7.1 Measurement Procedure

The EUT must have its hopping function enabled. Using the following spectrum analyzer setting:

1. Span= the frequency band of operation
2. Set the RBW = 1 MHz.
3. Set the VBW = 1 MHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

### 7.2 Test SET-UP



### 7.3 Test Equipment

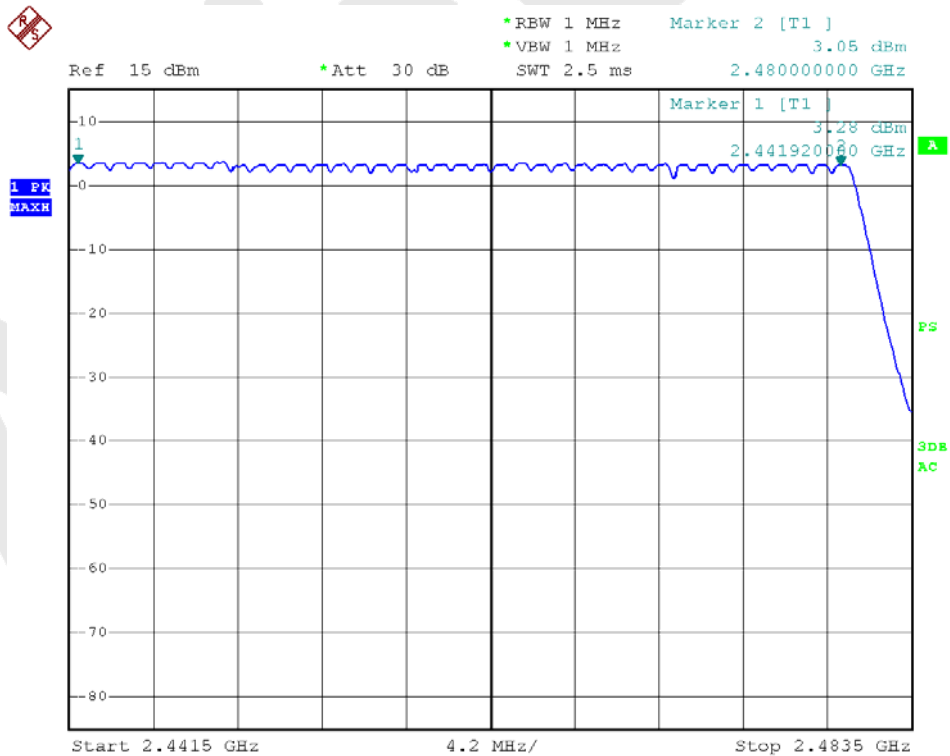
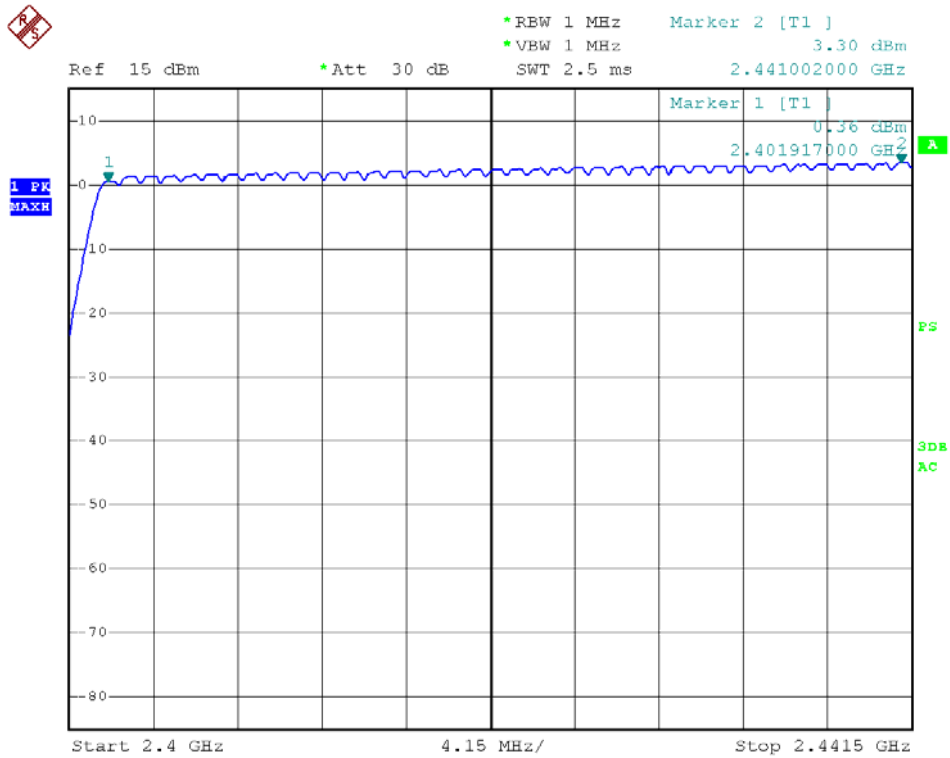
Same as the equipment listed in 5.3.

### 7.4 Test Results

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

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





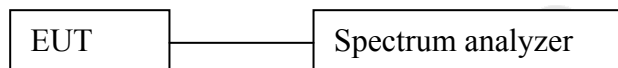
## 8. DWELL TIME TEST

### 8.1 Measurement Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span= zero span, centered on a hopping channel
2. Set the RBW = 1 MHz.
3. Set the VBW = 1 MHz.
4. Sweep time = as necessary to capture the entire dwell time per hopping channel.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

### 8.2 Test SET-UP



### 8.3 Test Equipment

Same as the equipment listed in 5.3.

### 8.4 Test Results

PASS.

Please refer to the following pages.

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

Modulation Mode: GFSK

Package Type	<i>Pulse width (ms)</i>	Time slot length(ms)	Dwell time (ms)	Limit (s)
DH1	0.420	time slot length *1600/2 /79 * 31.6	134.40	0.4
DH3	1.694	time slot length *1600/4 /79 * 31.6	271.04	0.4
DH5	2.940	time slot length *1600/6 /79 * 31.6	313.60	0.4

Modulation Mode:  $\pi/4$ DQPSK

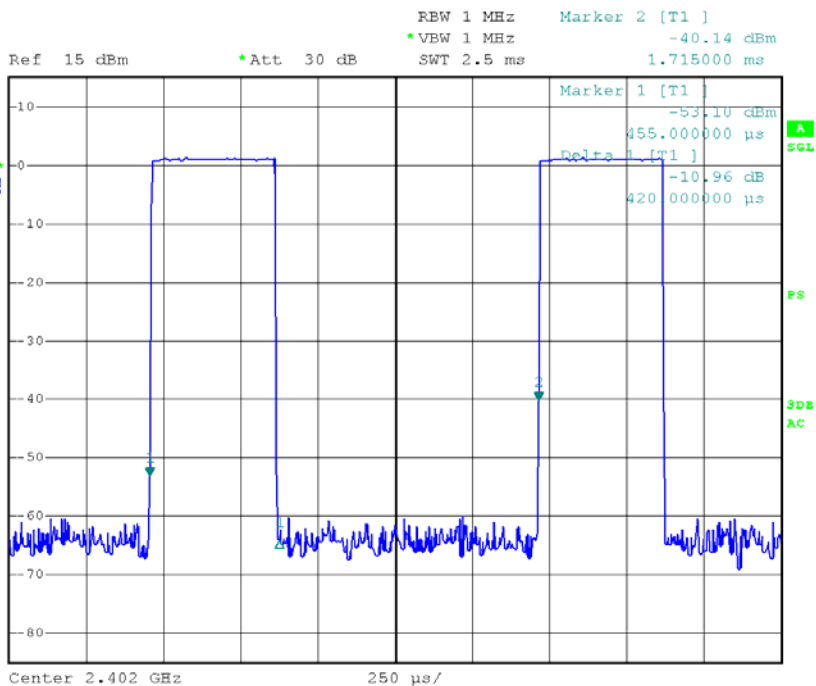
Package Type	<i>Pulse width (ms)</i>	Time slot length(ms)	Dwell time (ms)	Limit (s)
DH1	0.415	time slot length *1600/2 /79 * 31.6	132.80	0.4
DH3	1.694	time slot length *1600/4 /79 * 31.6	271.04	0.4
DH5	2.956	time slot length *1600/6 /79 * 31.6	315.31	0.4

Modulation Mode: 8DPSK

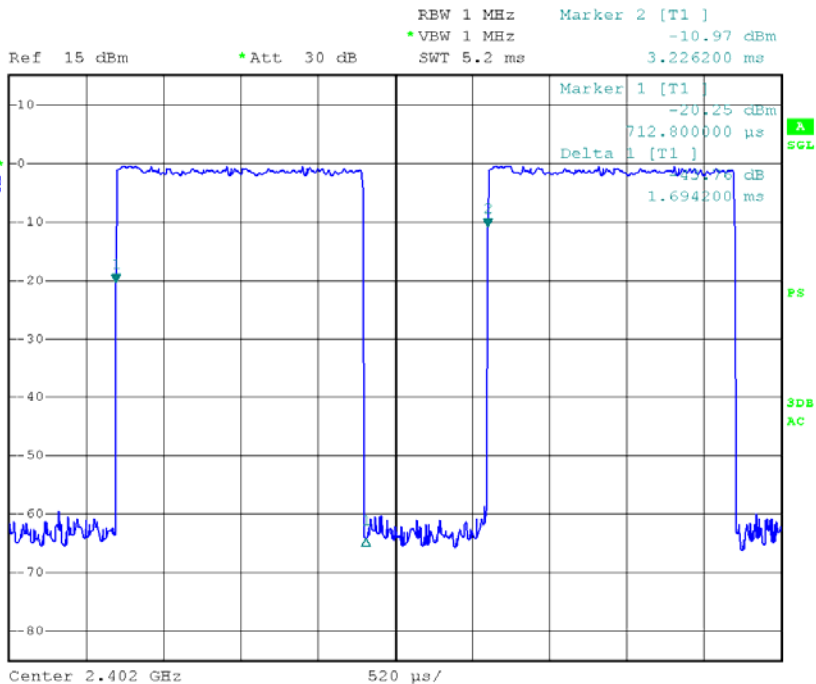
Package Type	<i>Pulse width (ms)</i>	Time slot length(ms)	Dwell time (ms)	Limit (s)
DH1	0.415	time slot length *1600/2 /79 * 31.6	132.80	0.4
DH3	1.694	time slot length *1600/4 /79 * 31.6	271.04	0.4
DH5	2.956	time slot length *1600/6 /79 * 31.6	315.31	0.4

Modulation Mode: GFSK

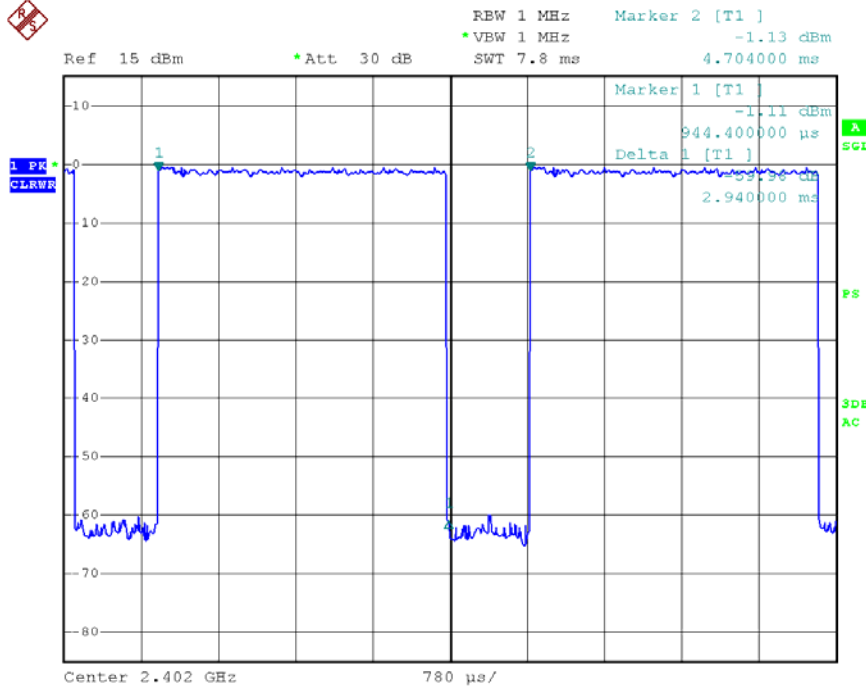
DH1



DH3

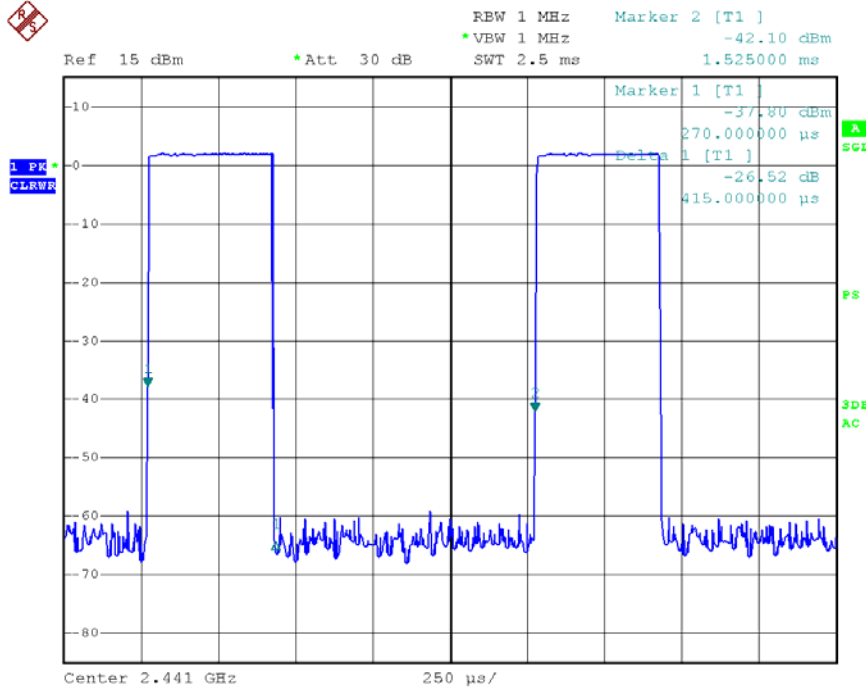


DH5

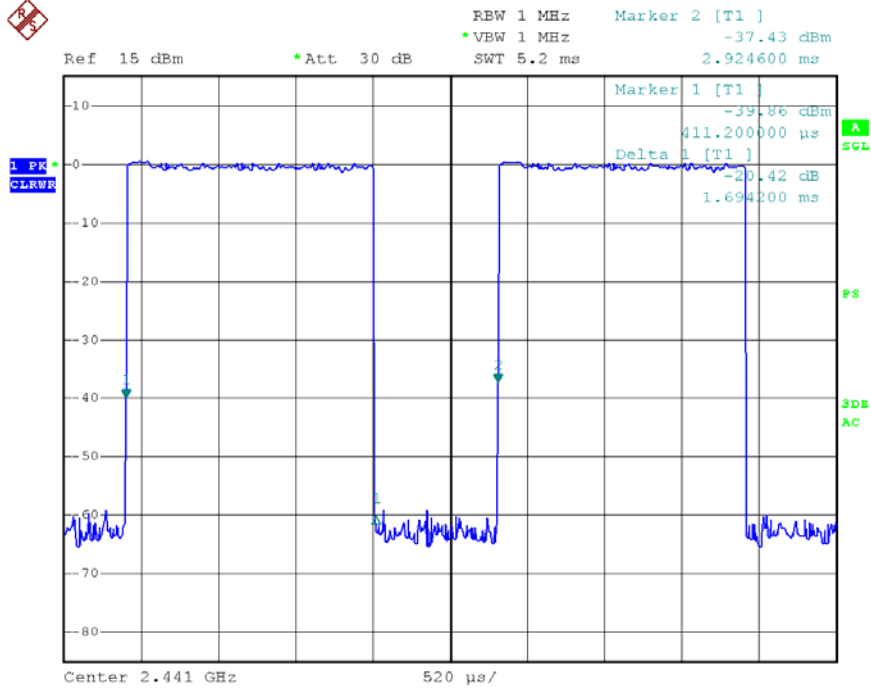


Modulation Mode:  $\pi/4$ QPSK

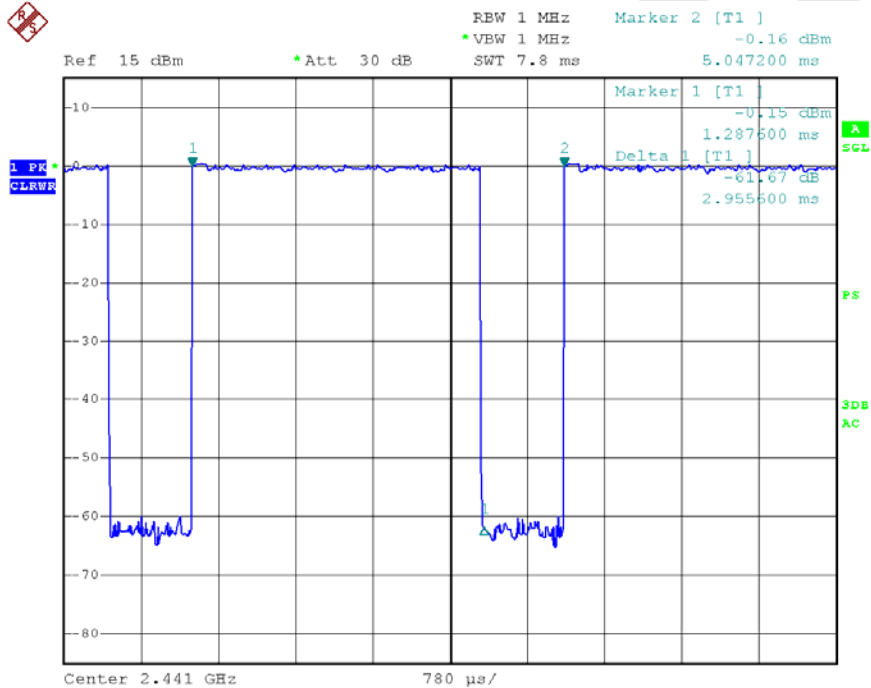
DH1



DH3

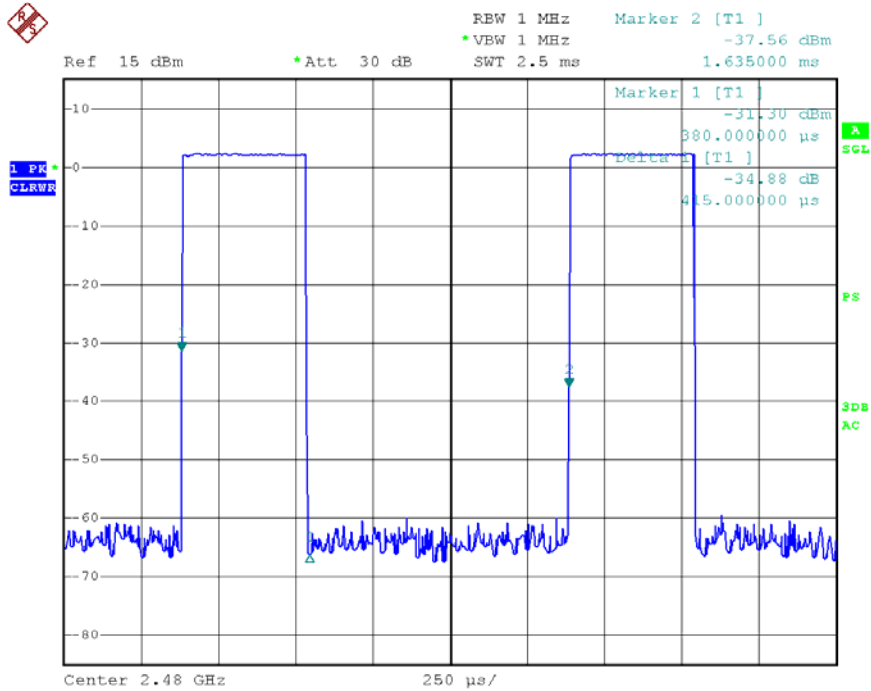


DH5

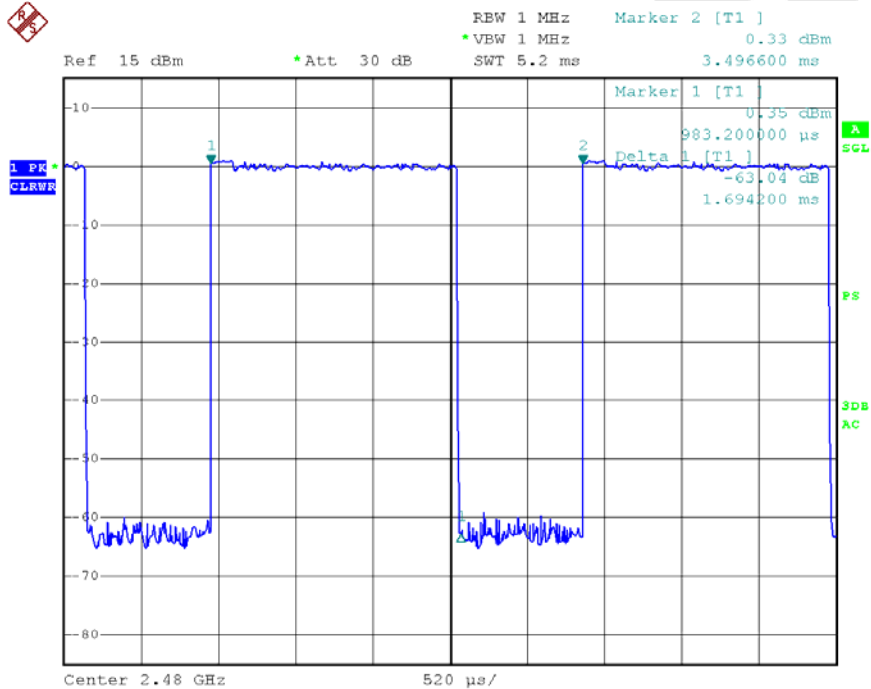


Modulation Mode: 8DPSK

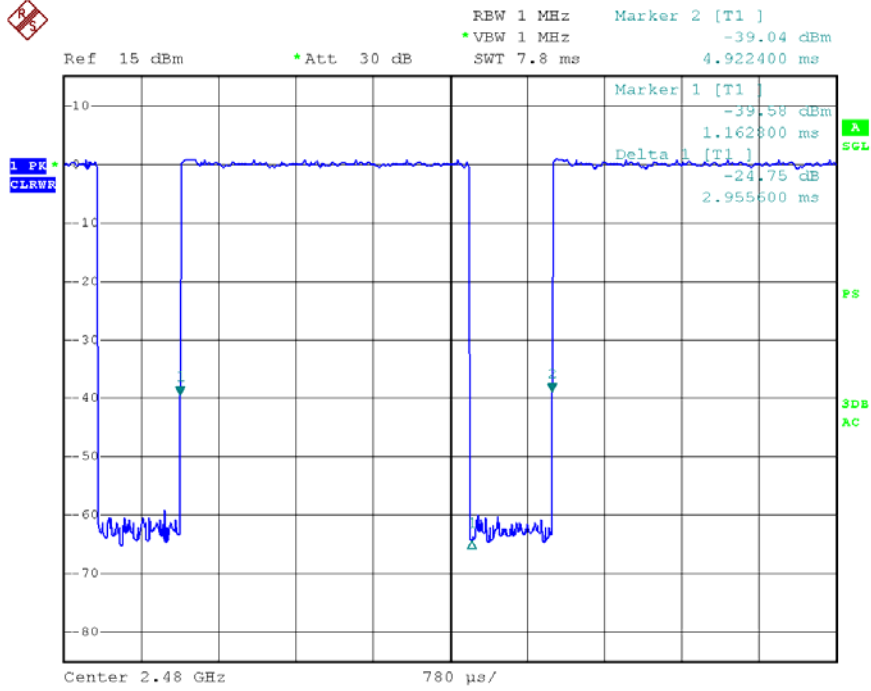
DH1



DH3



DH5





## 9. MAXIMUM 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.

Using the following spectrum analyzer settings:

1. Span= approximately 5 times the 20dB bandwidth, centered on a hopping channel
2. Set the RBW = 3 MHz.
3. Set the VBW = 3 MHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

### 9.2 Test SET-UP



### 9.3 Test Equipment

Same as the equipment listed in 5.3.

### 9.4 Test Results

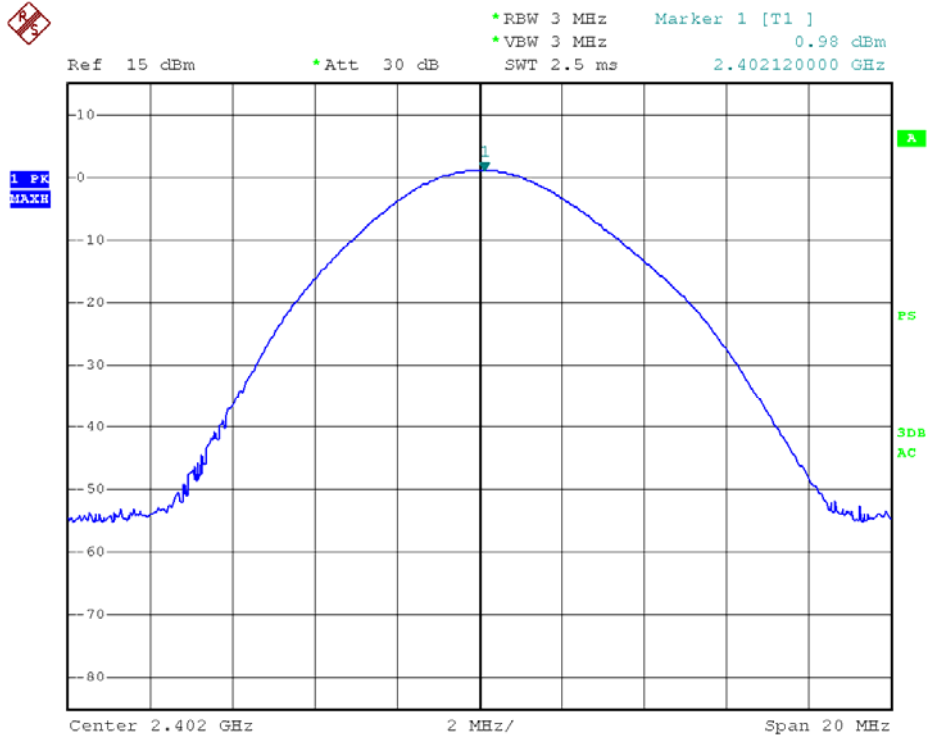
Test Item	: Max. peak output power	Test Mode	: CH Low ~ CH High
Test Voltage	: DC 3.7V	Temperature	: 24°C
Test Result	: PASS	Humidity	: 55%RH

Channel Frequency (MHz)	Peak Power output(mW)	Peak Power output(dBm )	Peak Power Limit(mW)	Results	Modulation
2402	1.26	0.98	1000	PASS	GFSK
2441	1.34	1.27	1000	PASS	GFSK
2480	<b>1.45</b>	<b>1.62</b>	1000	PASS	GFSK
2402	0.28	-0.63	125	PASS	$\pi/4$ DQPSK
2441	0.54	-0.30	125	PASS	$\pi/4$ DQPSK
2480	1.02	0.07	125	PASS	$\pi/4$ DQPSK
2402	0.28	-0.63	125	PASS	8DPSK
2441	0.54	-0.30	125	PASS	8DPSK
2480	1.02	0.07	125	PASS	8DPSK

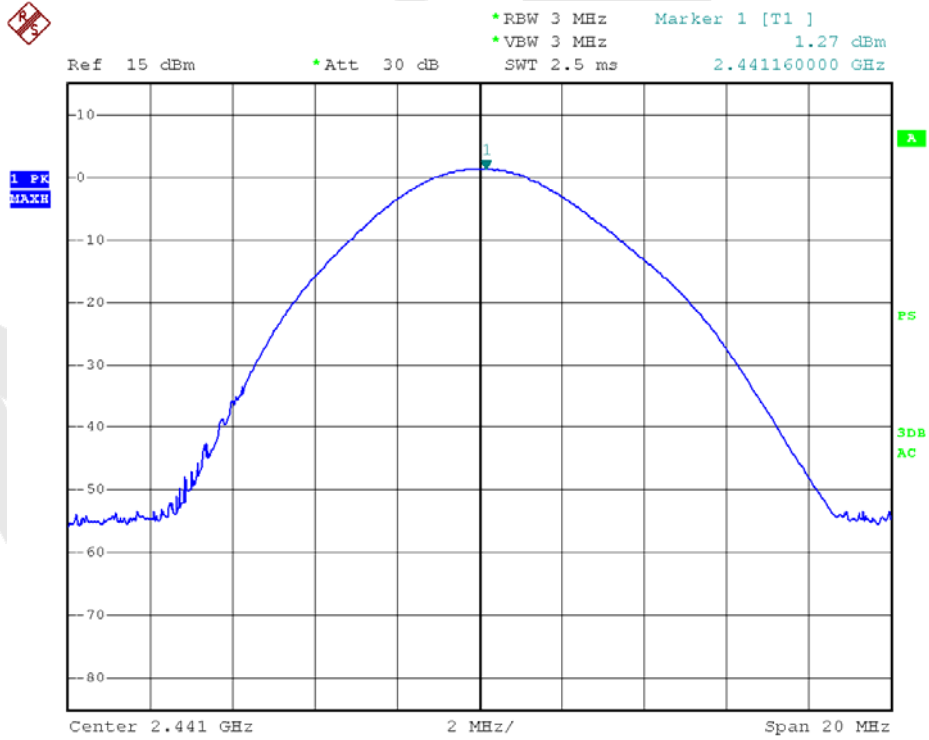
Remark: The results of modulations  $\pi/4$ DQPSK and 8DPSK are the same.

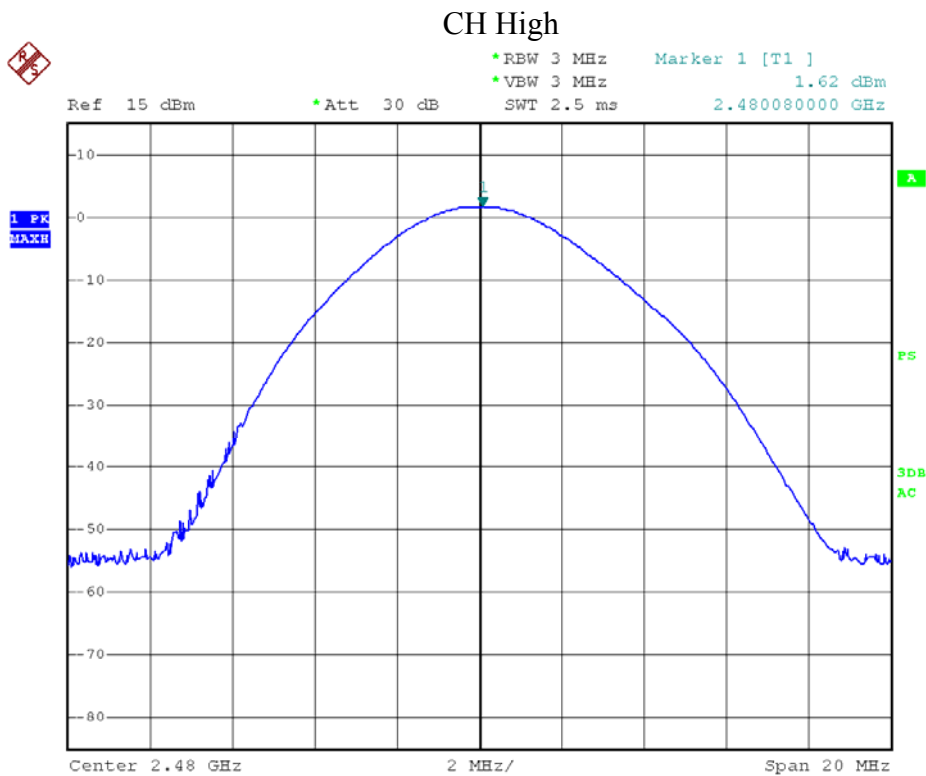
Modulation Mode: GFSK

### CH Low

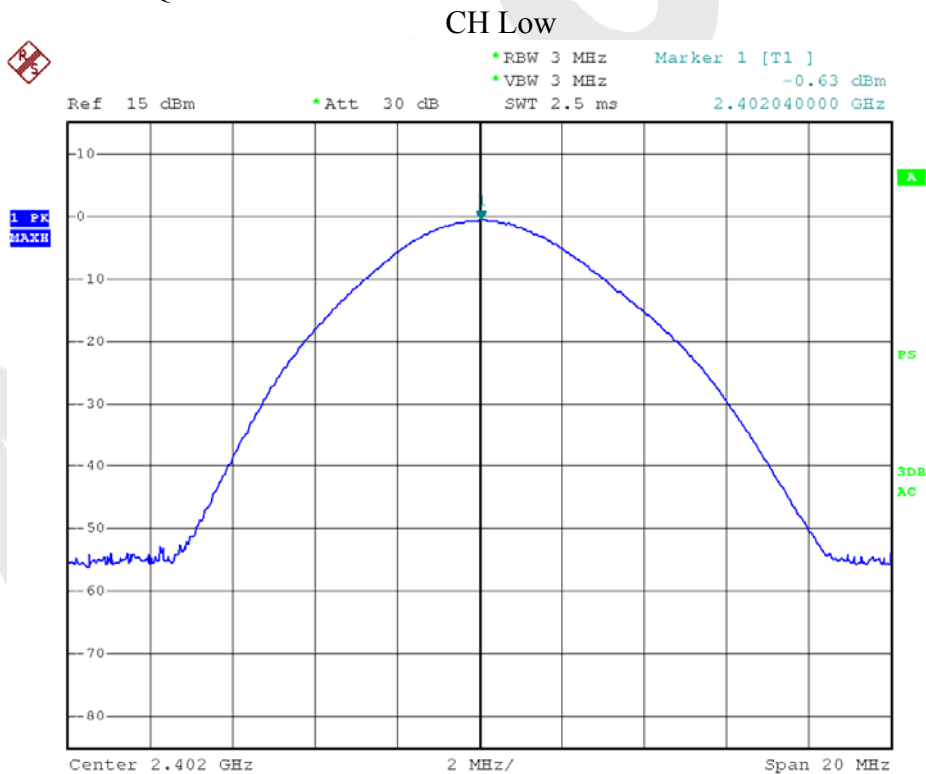


### CH Mid

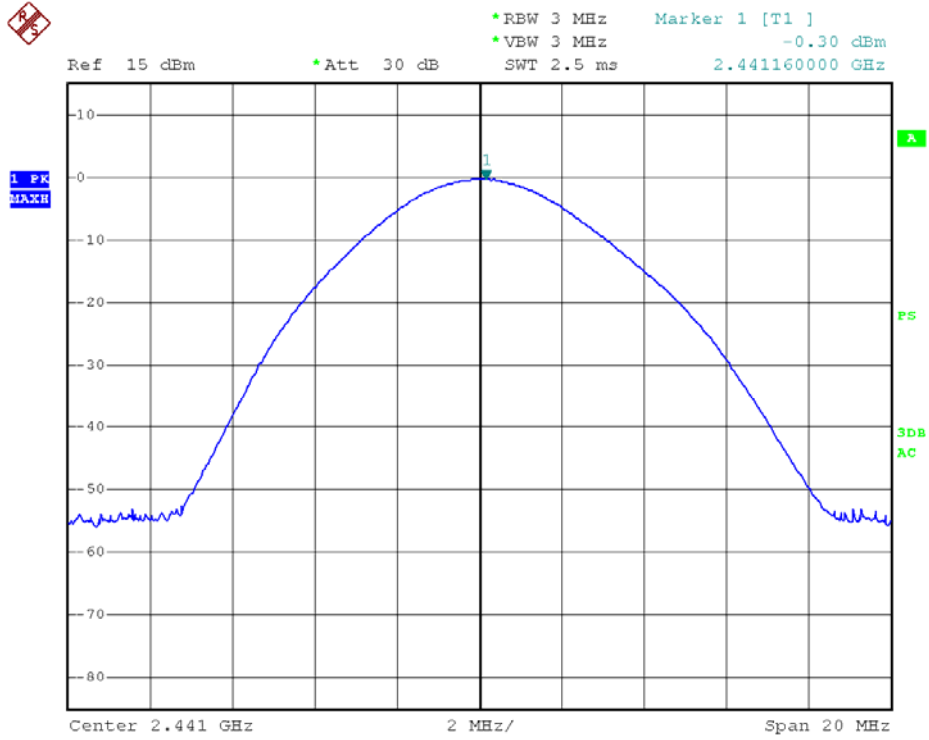




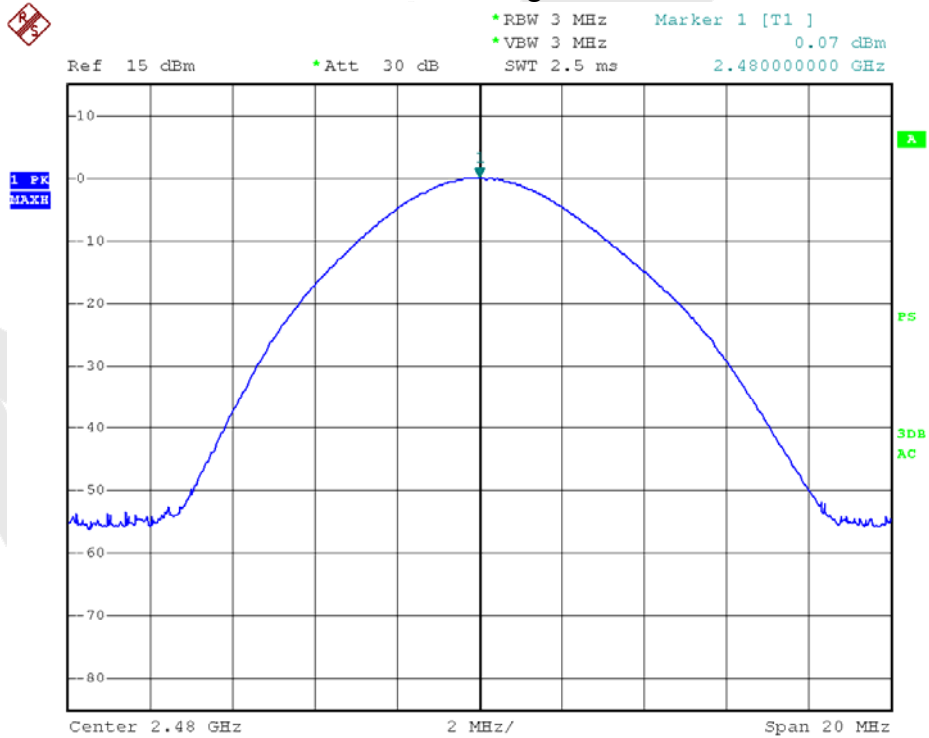
Modulation Mode:  $\pi/4$ DQPSK & 8DPSK



### CH Mid



### CH High

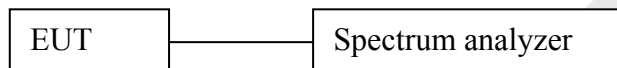


## 10. BAND EDGE TEST

### 10.1 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Put it on the Rotated table and turn on the EUT and make it operate in transmitting mode. Then set it to low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW= 1 MHz, VBW= 3 MHz.
4. Measurement 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.
5. Report above procedures until all measured frequencies were complete.

### 10.2 Test SET-UP



### 10.3 Test Equipment

Same as the equipment listed in 5.3.

### 10.4 Test Results

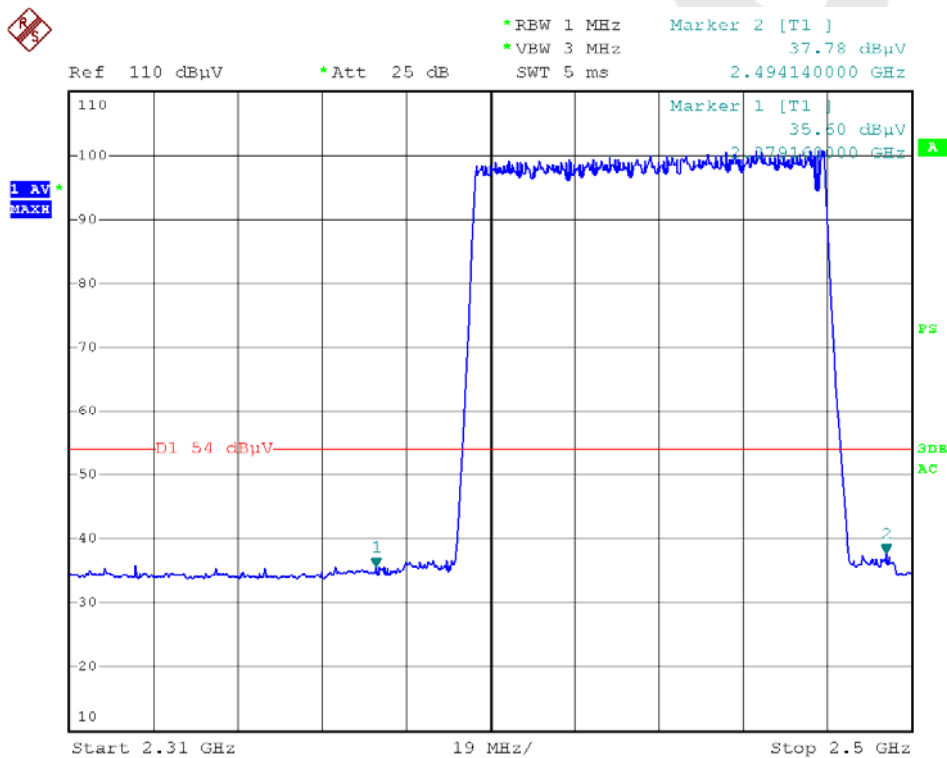
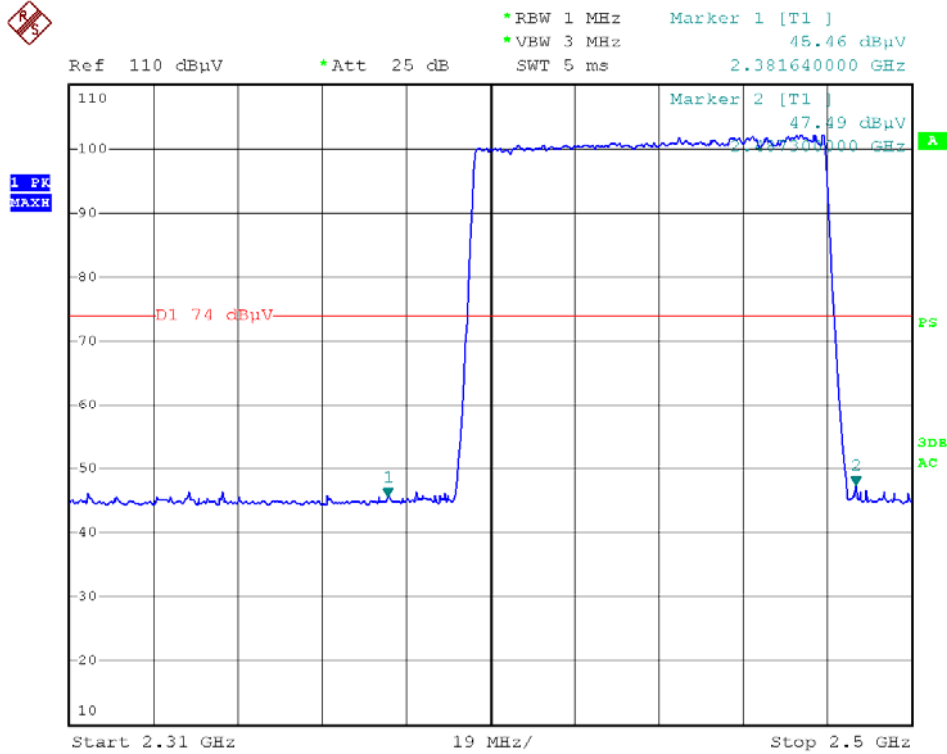
Pass.

Please refer the following data.

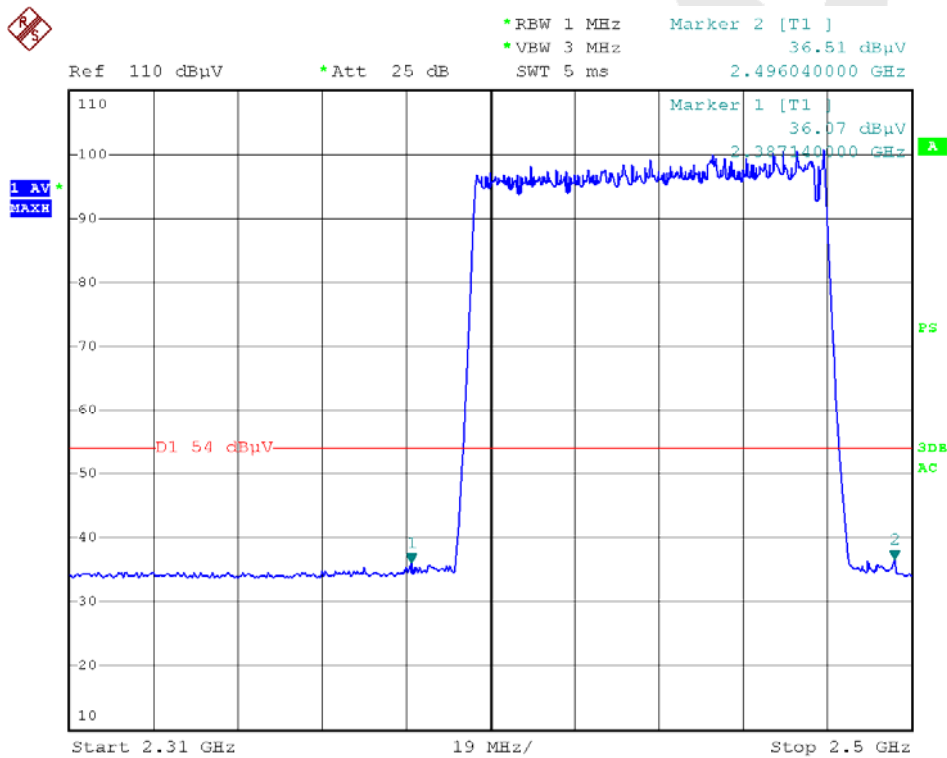
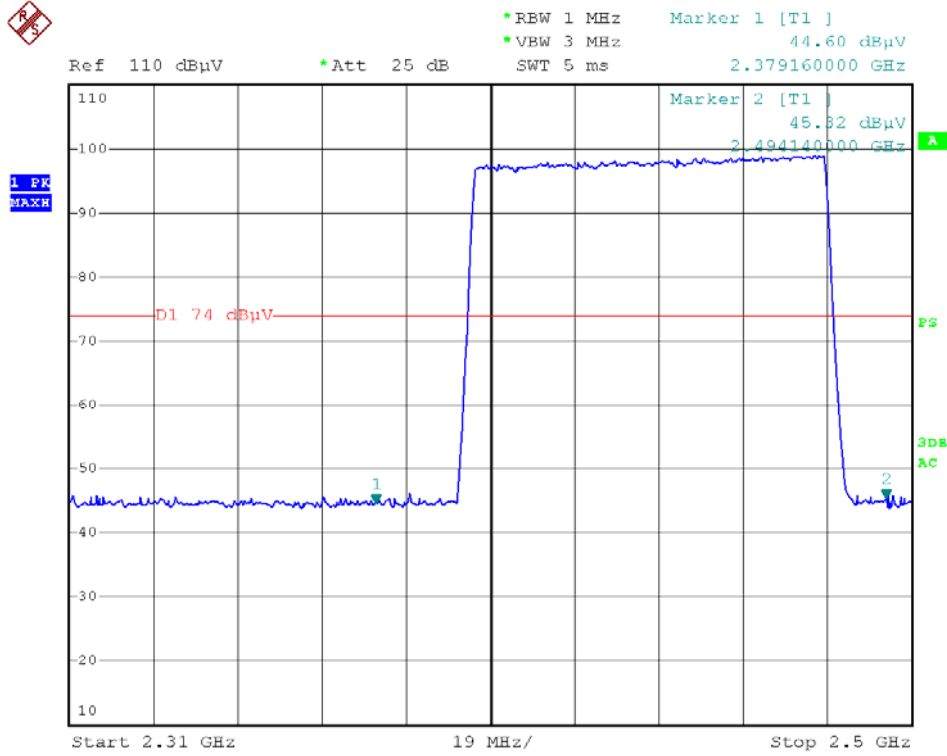
Test Item	: Band eadge	Test Mode	: CH Low ~ CH High
Test Voltage	: DC 3.7V	Temperatur	: 24°C
Test Result	: PASS	e	
		Humidity	: 55%RH

### For Hopping Mode:

Modulation Mode: GFSK



Modulation Mode:  $\pi/4$ DQPSK & 8DPSK





Test Item	: Band edge	Test Mode	: CH Low ~ CH High
Test Voltage	: DC 3.7V	Temperatur	: 24°C
Test Result	: PASS	e	
		Humidity	: 55%RH

**For Non-Hopping Mode:**

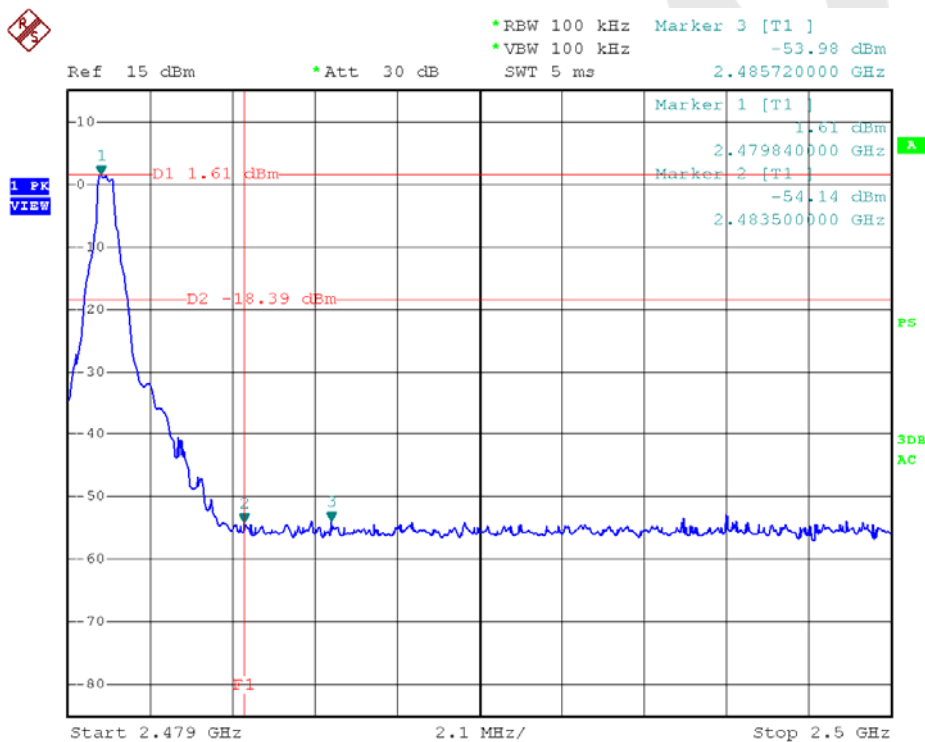
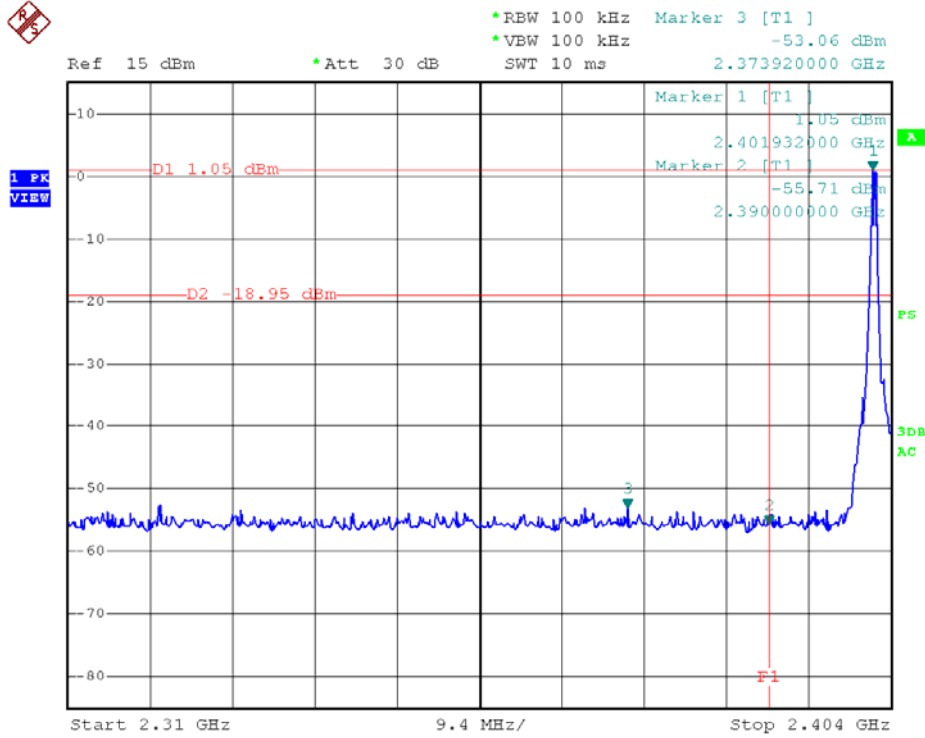
1. Conducted Test

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	$\pi/4$ DQPSK
	-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	$\pi/4$ DQPSK
	-0.11	-53.51	46.18	>20dBc	8DPSK

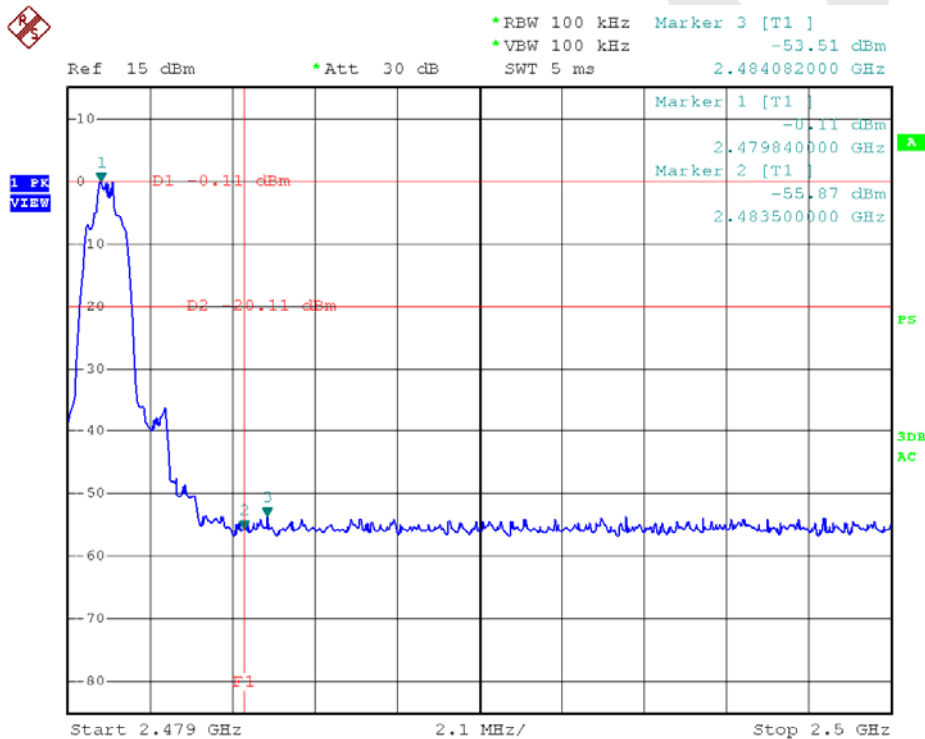
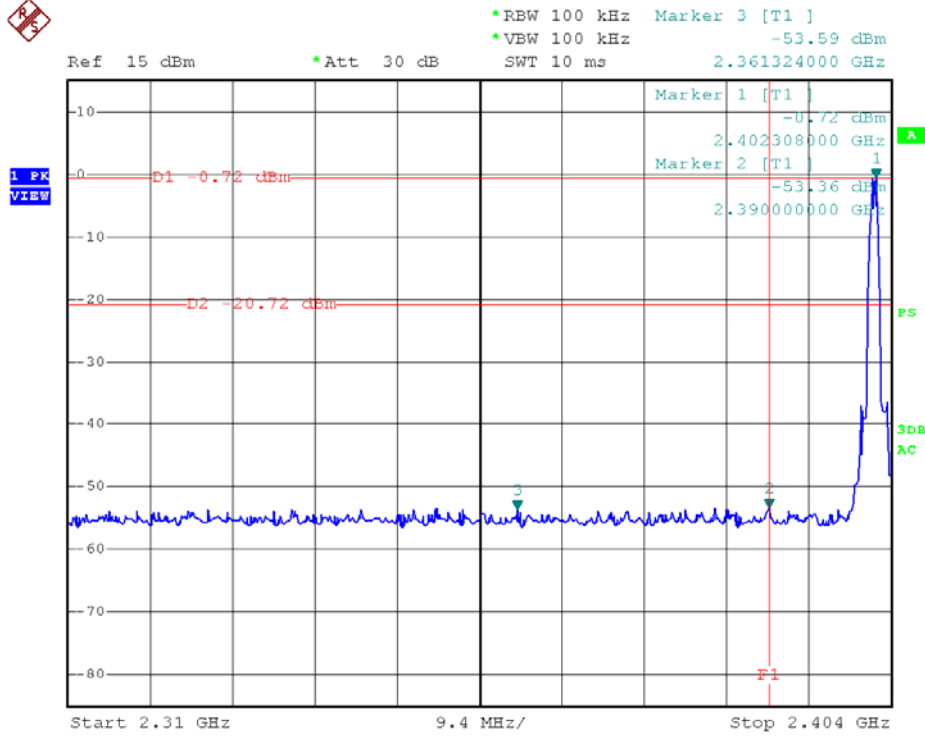
2. Radiated emission Test

Frequency (MHz)	Antenna polarization (H/V)	Emission (dBuV/m)		Band edge Limit (dBuV/m)		Modulation
		PK	AV	PK	AV	
<2400	V	57.39	37.32	74.00	54.00	GFSK
	V	53.25	38.19	74.00	54.00	$\pi/4$ DQPSK
	V	52.27	35.85	74.00	54.00	8DPSK
>2483.5	V	51.09	38.17	74.00	54.00	GFSK
	V	53.14	36.66	74.00	54.00	$\pi/4$ DQPSK
	V	50.90	38.84	74.00	54.00	8DPSK

Modulation Mode: GFSK



Modulation Mode:  $\pi/4$ DQPSK & 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

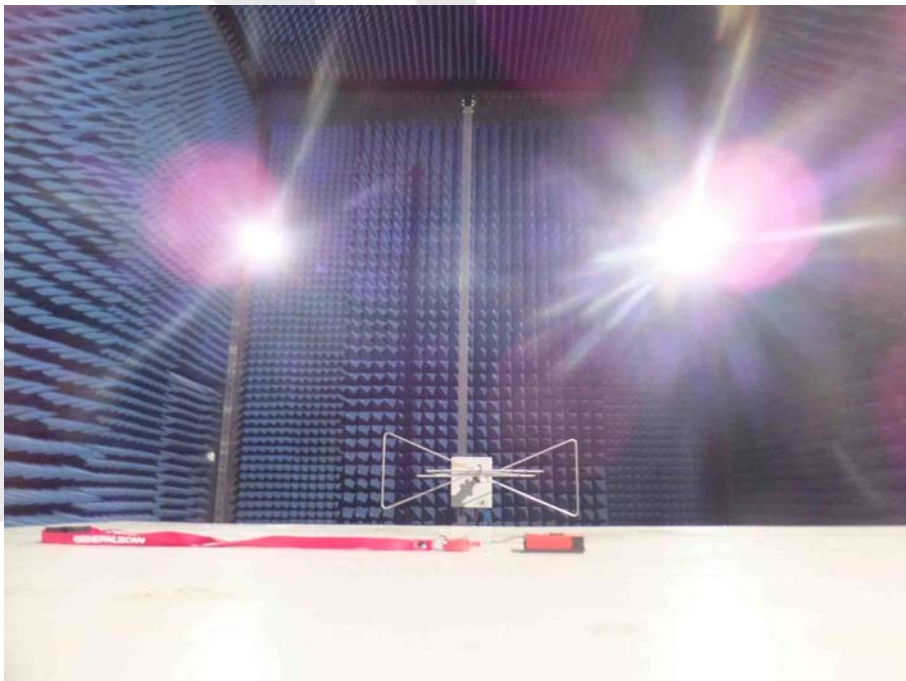
The EUT's antenna used a chip antenna and integrated on PCB, The antenna's gain is 0dBi and meets the requirement.

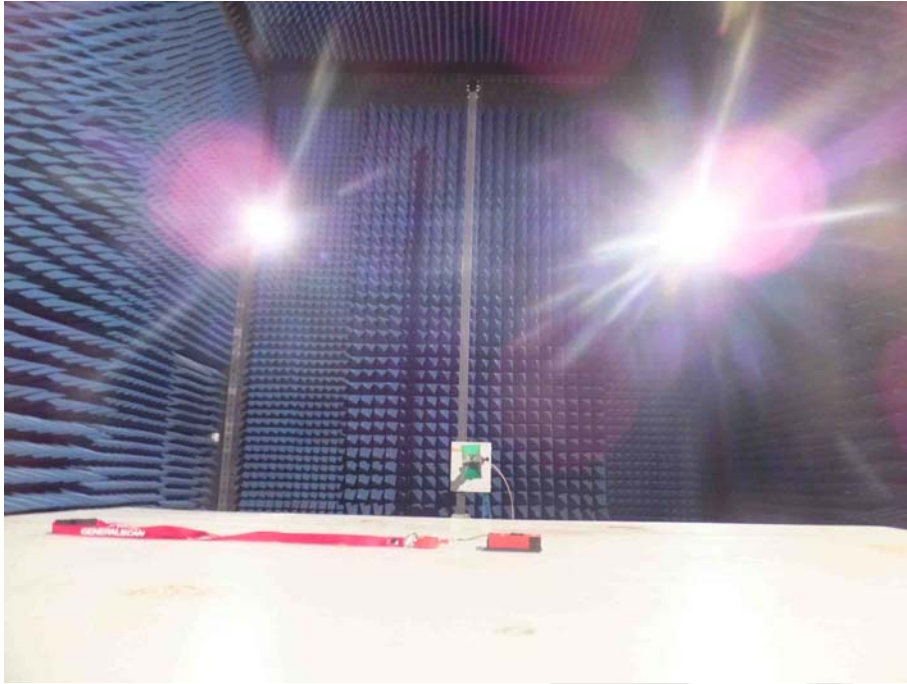
## 12. PHOTOGRAPH

### 12.1 Photo of Power Line Conducted Emission Measurement



### 12.2 Photo of Radiation Emission Test





Anbotek



## APPENDIX I (EXTERNAL PHOTOS)

Figure 1  
The EUT-Overall View



Figure 2  
The EUT-Top View



Figure 3  
The EUT-Bottom View



Figure 4  
The EUT-Front View

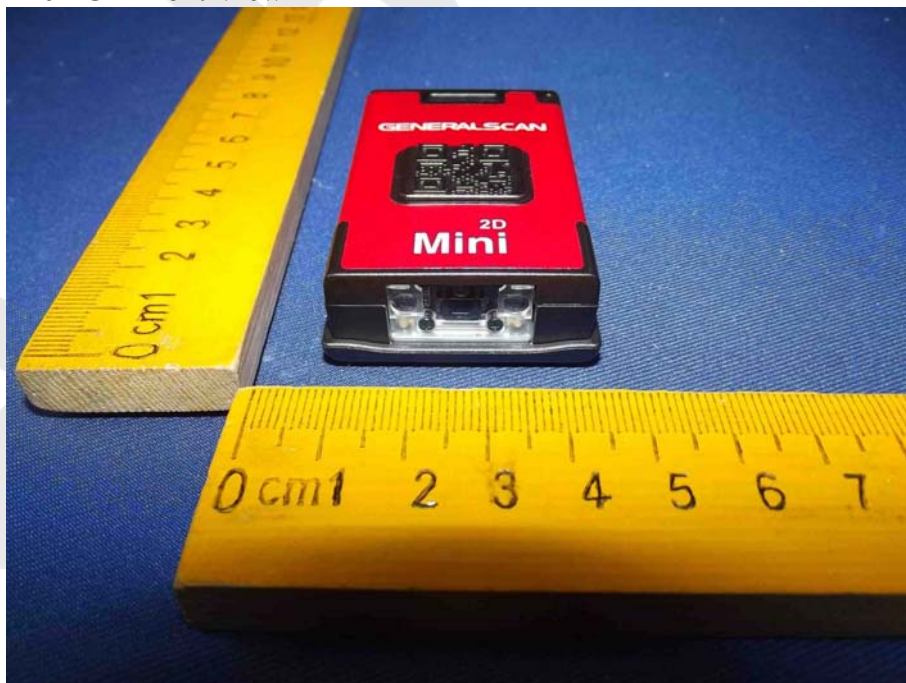




Figure 5  
The EUT-Back View



Figure 6  
The EUT-Right View



Figure 7  
The EUT-Left View



## APPENDIX II (INTERNAL PHOTOS)

Figure 8  
The EUT-Inside View



Figure 9  
PCB of the EUT-Front View

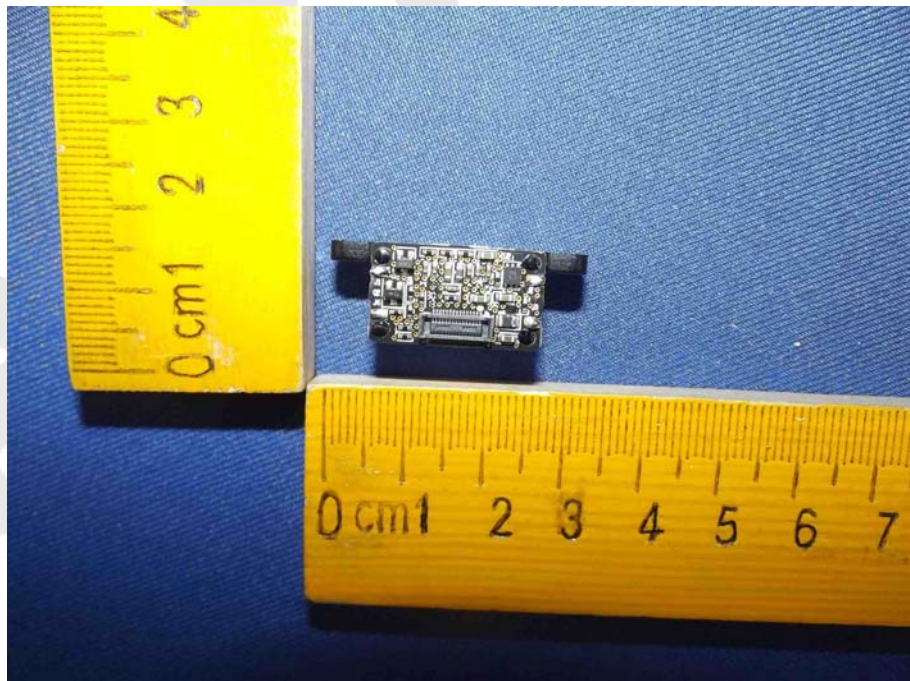




Figure 10  
PCB of the EUT-Front View

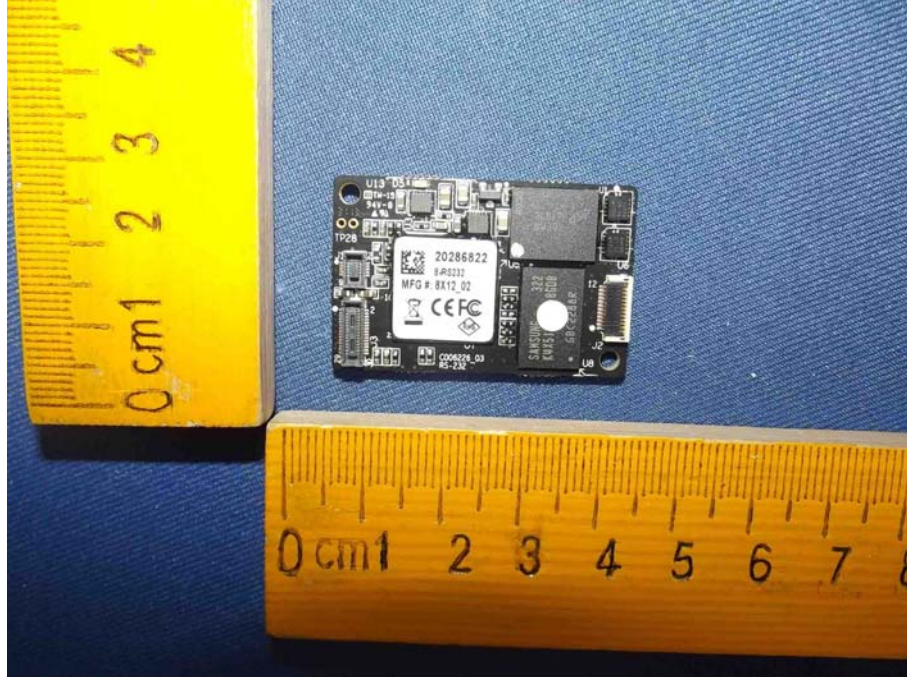


Figure 11  
PCB of the EUT-Back View

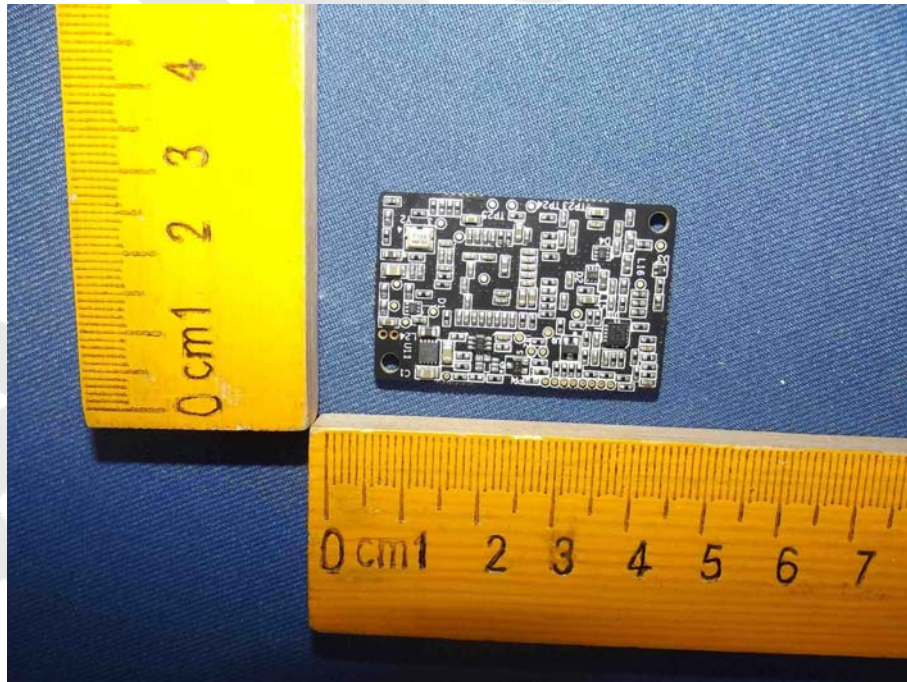


Figure 12  
PCB of the EUT-Front View

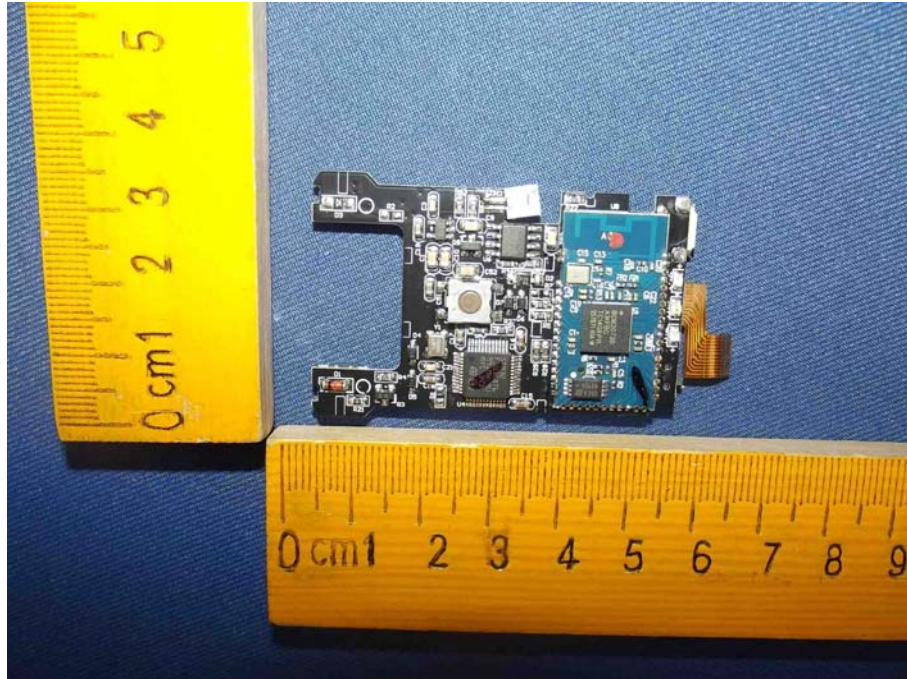


Figure 13  
PCB of the EUT-Back View

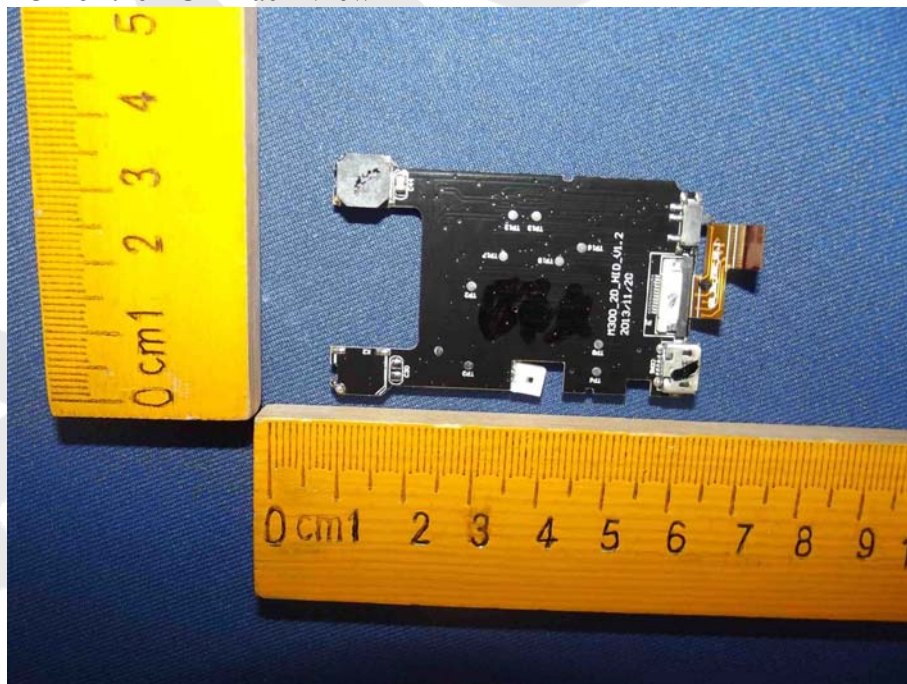




Figure 14  
PCB of the EUT-Front View

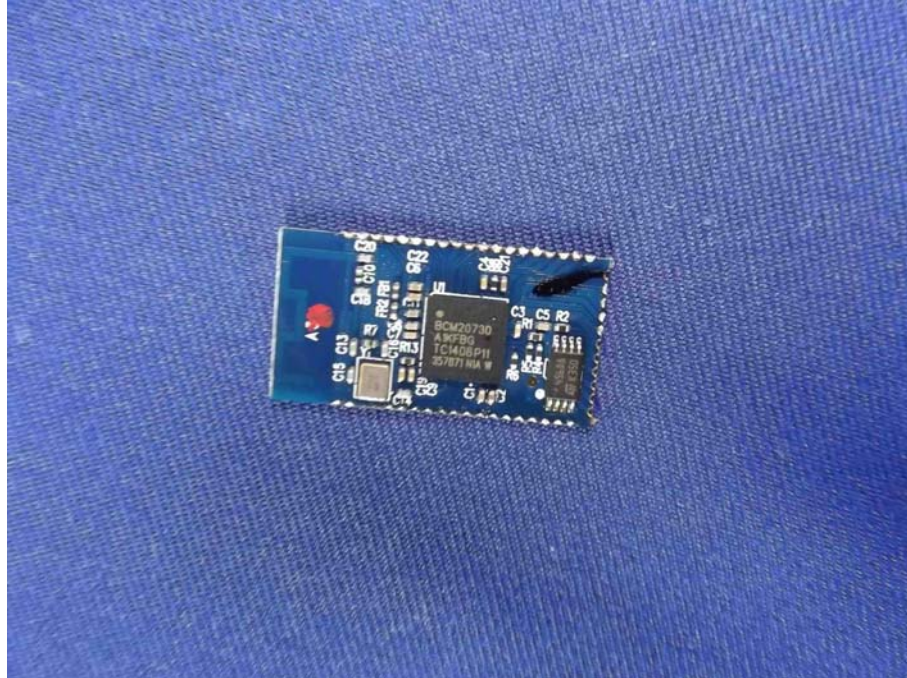


Figure 15  
PCB of the EUT-Back View

