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## FCC PART 15 SUBPART C TEST REPORT

### FCC Part 15.247

**Report Reference No.**..... **CTL1501140132-WB01**

Compiled by

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Date of issue.....: Feb. 10, 2015

**Test Firm**..... **Shenzhen CTL Testing Technology Co., Ltd.**

Address.....: Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road,  
Nanshan District, Shenzhen, China 518055

**Applicant's name**..... **United Telelinks (Bangalore) Limited**

Address.....: NO 39/13, Appareddy palya Main Road, off 7th Main, HAL2nd  
stage, Indiranagar 2nd stage, Bangalore, India -560038

#### Test specification:

Standard .....: FCC Part 15.247: Operation within the bands 902–928 MHz, 2400–  
2483.5 MHz, and 5725–5850 MHz.

Master TRF.....: Dated 2011-01

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**Test item description** ..... : **handsets**

**FCC ID**.....: **2AD3G-X4009**

Trade Mark .....: N/A

Model/Type reference.....: X4009

#### GSM/WCDMA

Transmit .....: 2G:GSM 850: 824~849MHz, PCS 1900: 1850~1910MHz  
3G:WCDMA Band II: 1850-1910MHz,  
WCDMA Band V: 824~849MHz

Receive .....: 2G:GSM 850: 869~894MHz, PCS 1900: 1930~1990MHz  
3G:WCDMA Band II: 1930~1990MHz,  
WCDMA Band V: 869~894MHz

Release Version .....: 2G:R99  
3G:Rel-6

Type of modulation .....	2G: GMSK for GSM/GPRS 3G: QPSK
GPRS Type .....	Class B
GPRS Class .....	Class 12
<b>GPS</b>	
work frequency .....	1575.42MHz
Type of modulation .....	BPSK
<b>Bluetooth</b>	
Work frequency .....	2402~2480MHz
Version.....	V3.0+EDR, V4.0
Type of modulation .....	FHSS
Data Rate.....	1Mbps(GFSK), 2Mbps(Pi/4 DQPSK), 3Mbps(8DPSK)
<b>Wi-Fi</b>	
Work frequency .....	802.11b/g/n(20MHz): 2412~2462MHz 802.11n(40MHz): 2422~2452MHz
Type of modulation .....	802.11b DSSS, 802.11g/n: OFDM
Data Rate.....	802.11b: 1/2/5.5/11 Mbps 802.11g: 6/9/12/18/24/36/48/54 Mbps 802.11n: up to 150 Mbps
Antenna Gain .....	1.29 dBi for GSM850 and WCDMA Band V 2.27 dBi for PCS1900 and WCDMA Band II 0.84 dBi for Bluetooth and Wi-Fi
Antenna type .....	Internal
Result.....	<b>Positive</b>

## TEST REPORT

Test Report No. :	CTL1501140132-WB01	Feb. 10, 2015 Date of issue
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**Equipment under Test** : handsets

**Model /Type** : X4009

**Applicant** : **United Telelinks (Bangalore) Limited**

**Address** : NO 39/13, Appareddy palya Main Road, off 7th Main, HAL2nd stage, Indiranagar 2nd stage, Bangalore, India -560038

**Manufacturer** : **NEW EXPLORER TELECOM CO.,LTD**

**Address** : ROOM 5B, 5<sup>TH</sup> FLOOR, BLDG.1, FINANCE BASE, NO.8 KEFA RD, NANSHAN, SHENZHEN, CHINA

**Test Result** according to the standards on page 5:

**Positive**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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## 1. TEST STANDARDS

The tests were performed according to following standards:

**FCC Rules Part 15.247:** Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

**ANSI C63.10-2009:** American National Standard for Testing Unlicensed Wireless Devices

**FCC Public Notice DA 00-705:** Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

**ANSI C63.4-2009**

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. The public notice DA 00-705 for frequency hopping spread spectrum systems shall be performed also.



## 2. SUMMARY

### 2.1. General Remarks

Date of receipt of test sample : Jan. 14, 2015

Testing commenced on : Jan. 14, 2015

Testing concluded on : Feb. 10, 2015

### 2.2. Equipment Under Test

#### Power supply system utilised

Power supply voltage	:	<input checked="" type="radio"/> 120V / 60 Hz	<input type="radio"/> 115V / 60Hz
		<input type="radio"/> 12 V DC	<input type="radio"/> 24 V DC
<input checked="" type="radio"/> Other (specified in blank below)			

DC 3.7V from battery

### 2.3. Short description of the Equipment under Test (EUT)

A handsets with UMTS/GSM, Bluetooth, GPS and wifi function.

For more details, refer to the user's manual of the EUT.

Serial number: Prototype

### 2.4. EUT operation mode

The EUT has been tested under typical operating condition. The Applicant provides communication tools software (Bluetest 3) to control the EUT for staying in continuous transmitting and receiving mode for testing. There are 79 channels of EUT, and the test carried out at the lowest channel, middle channel and highest channel.

Frequency Range:	2402-2480MHz
Channel number:	79 channels
Modulation type:	GFSK, $\pi/4$ -DQPSK, 8-DPSK
Antenna:	internal

Test Channel	Test Frequency
Low Channel	2402 MHz
Middle Channel	2441 MHz
High Channel	2480 MHz

## 2.5. EUT configuration

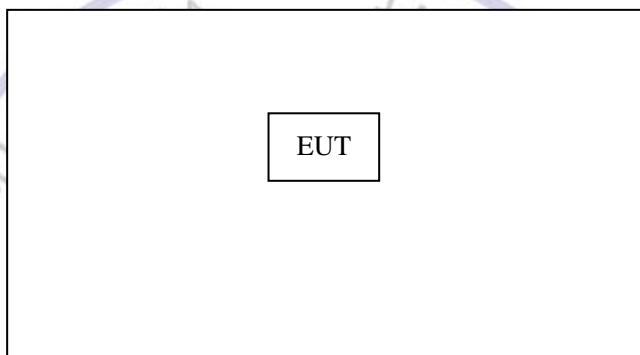
The following peripheral devices and interface cables were connected during the measurement:

- supplied by the manufacturer
- supplied by the lab

<input type="radio"/>	AC adapter	Manufacturer :	MGT
		Model No. :	Strong4.0
<input type="radio"/>	Earphone	Manufacturer :	MGT
		Model No. :	-----

## 2.6. Configuration of Tested System

Fig. 2-1 Configuration of Tested System



## 2.7. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: 2AD3G-X4009 filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

## 2.8. Modifications

No modifications were implemented to meet testing criteria.

## 2.9. Note

1. The EUT is a an Bluetooth Standard type device,The functions of the EUT listed as below:

	Test Standards	Reference Report
Radio	FCC Part 15 Subpart C (Section15.247)	CTL1501140132-WB01
RF Exposure	FCC Per 47 CFR 2.1093	CTL1501140132-SAR

2. The frequency bands used in this EUT are listed as follows:

Frequency Band(MHz)	2400-2483.5	5150-5350	5470-5725	5725-5850
Bluetooth	√	—	—	—

3. The EUT provides one completed transmitter and receiver.

Modulation Mode	TX Function
Bluetooth	1TX

## 2.10. Frequency Hopping System Requirements

### Standard Applicable

According to FCC Part 15.247(a)(1), The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

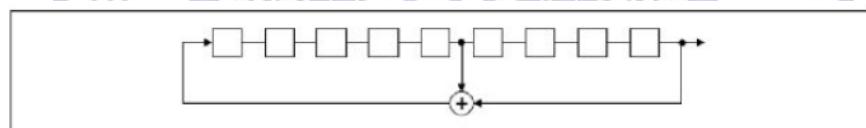
### EUT Pseudorandom Frequency Hopping Sequence

The pseudorandom sequence may be generated in a nine-stage shift register whose 5<sup>th</sup> and 9<sup>th</sup> stage outputs are added in a modulo-two addition stage, and the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

Number of shift register stages: 9

Length of pseudo-random sequence:  $2^9 - 1 = 511$  bits

Longest sequence of zeros: 8 (non-inverted signal)



*Linear Feedback Shift Register for Generation of the PRBS sequence*

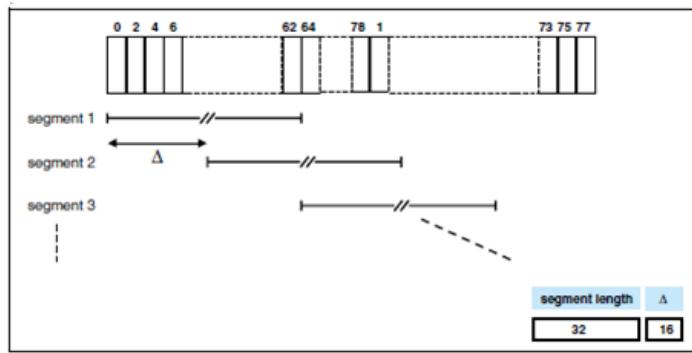
The frequencies allocated for the Handsets is  $F(\text{MHz}) = 2402 + 1 * n$  ( $0 \leq n \leq 78$ ). The lowest, middle, highest channel numbers of the Handsets used and tested in this report are separately 0 (2402MHz), 39 (2441MHz) and 78 (2480MHz).

Each frequency used equally on the average by each transmitter.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

The selection scheme chooses a segment of 32 hop frequencies spanning about 64 MHz and visits these hops in a pseudo-random order. Next, a different 32-hop segment is chosen, etc. In the page, master page response, slave page response, page scan, inquiry, inquiry response and inquiry scan hopping sequences, the same 32-hop segment is used all the time (the segment is selected by the address; different devices will have different paging segments).

When the basic channel hopping sequence is selected, the output constitutes a pseudo-random sequence that slides through the 79 hops.



Hop selection scheme in CONNECTION state.

## Channels 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		

The pseudorandom frequency hopping sequence sample:

42,41,66,4,78,59,55,48,54,46,52,78,41,26,24,34,39,32,51,18,25,9,12,73,70,58,54,6,66,4,32,67,60,16,3,78,78,76,47,45,47,49,14,34, etc.

### Frequency Hopping System

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.

This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 channels (1 MHz separation; from 2402 to 2480 MHz) in the range 2,400-2,483.5 MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

This device was tested with an bluetooth system receiver to check that the device maintained hopping synchronization, and the device complied with these requirements for DA 00-705 and FCC Part 15.247 rule.

## 2.11. Mode of Operation

CTL has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode
Mode 1: Transmitter-1Mbps(GFSK_DH5) DH5
Mode 2: Transmitter-2Mbps(Pi/4 DQPSK_DH5) 2DH5
Mode 3: Transmitter-3Mbps(8DPSK_DH5) 3DH5



### 3. TEST ENVIRONMENT

#### 3.1. Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.  
Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055

The sites are constructed in conformance with the requirements of ANSI C6230, ANSI C63.4 (2003) and CISPR Publication 22.

#### 3.2. Test Facility

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

##### IC Registration No.: 9618B

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 9618B on November 13, 2013.

##### FCC-Registration No.: 970318

Shenzhen CTL Testing Technology Co., Ltd. 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 970318, December 19, 2013.

#### 3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 °C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

#### 3.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen CTL Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CTL laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10dB	(1)
Radiated Emission	Above 1GHz	4.32dB	(1)
Conducted Disturbance	0.15~30MHz	3.20dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

### 3.5. Test Description

FCC PART 15 Subpart C		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 15.247(a)	20dB Bandwidth	PASS
FCC Part 15.247(d)	Spurious Emission	PASS
FCC Part 15.247(b)	Maximum Peak Output Power	PASS
FCC Part 15.109/ 15.205/ 15.209	Radiated Emissions	PASS
FCC Part 15.247(d)	Band Edge	PASS
FCC Part 15.247(a)(1)	Frequency Separation	PASS
FCC Part 15.247(a)(1)(iii)	Number of hopping frequency	PASS
FCC Part 15.247(a)(1)(iii)	Time of Occupancy	PASS
FCC Part 15.203/15.247 (b)	Antenna Requirement	PASS

Remark: The measurement uncertainty is not included in the test result.



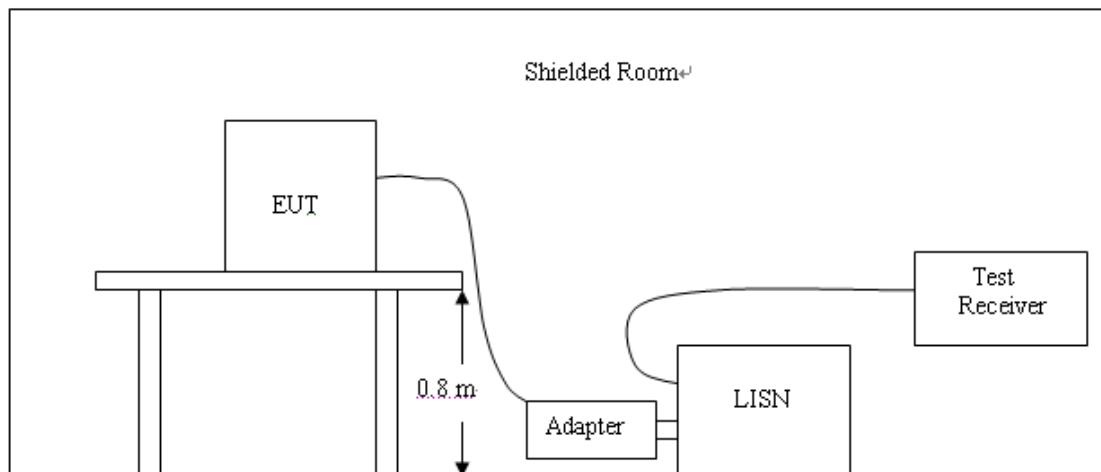
### 3.6. Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
Bilog Antenna	Sunol Sciences Corp.	JB1	A061713	2014/07/12	2015/07/11
EMI Test Receiver	R&S	ESCI	103710	2014/07/10	2015/07/09
Spectrum Analyzer	Agilent	E4407B	MY45108355	2014/07/06	2015/07/05
Controller	EM Electronics	Controller EM 1000	N/A	2014/07/06	2015/07/05
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2014/07/12	2015/07/11
Horn Antenna	SCHWARZBECK	BBHA9170	1562	2014/07/12	2015/07/11
Active Loop Antenna	SCHWARZBECK	FMZB1519	1519-037	2014/07/12	2015/07/11
LISN	R&S	ENV216	101316	2014/07/10	2015/07/09
LISN	SCHWARZBECK	NSLK8127	8127687	2014/07/10	2015/07/09
Microwave Preamplifier	HP	8349B	3155A00882	2014/07/10	2015/07/09
Amplifier	HP	8447D	3113A07663	2014/07/10	2015/07/09
Transient Limiter	Com-Power	LIT-153	532226	2014/07/10	2015/07/09
Radio Communication Tester	R&S	CMU200	3655A03522	2014/07/06	2015/07/05
Temperature/Humidity Meter	zhicheng	ZC1-2	22522	2014/07/10	2015/07/09
SIGNAL GENERATOR	HP	8647A	3200A00852	2014/07/10	2015/07/09
Wideband Peak Power Meter	Anritsu	ML2495A	220.23.35	2014/07/06	2015/07/05
Power Sensor	Anritsu	MA2411B	0738552	2014/07/06	2015/07/05
Climate Chamber	ESPEC	EL-10KA	A20120523	2014/07/06	2015/07/05
High-Pass Filter	K&L	9SH10-2700/X12750-O/O	/	2014/07/06	2015/07/05
High-Pass Filter	K&L	41H10-1375/U12750-O/O	/	2014/07/06	2015/07/05
RF Cable	HUBER+SUHNER	RG214	/	2014/07/09	2015/07/08

## 4. TEST CONDITIONS AND RESULTS

### 4.1. AC Power Conducted Emission

#### TEST CONFIGURATION



#### TEST PROCEDURE

- 1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2013.
- 2 Support equipment, if needed, was placed as per ANSI C63.10-2013
- 3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
- 4 The EUT received DC5V power from the adapter, the adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
- 5 All support equipments received AC power from a second LISN, if any.
- 6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
- 8 During the above scans, the emissions were maximized by cable manipulation.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

#### AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following :

Frequency (MHz)	Maximum RF Line Voltage (dB $\mu$ V)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

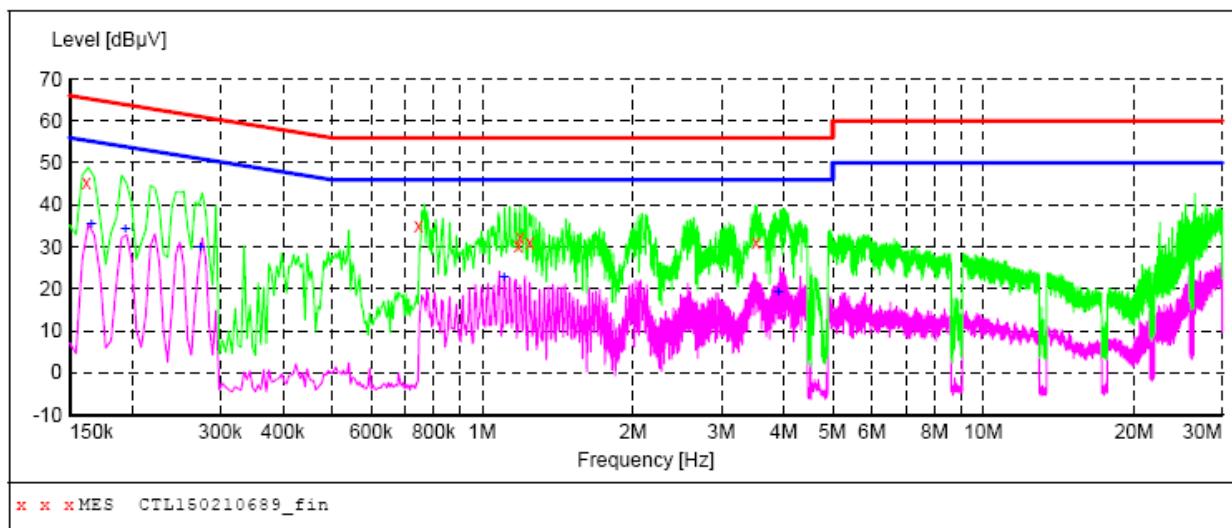
\* Decreasing linearly with the logarithm of the frequency

## TEST RESULTS

The 1Mbps (GFSK Modulation) is the worst case as results in the report based on the Pre-test for all modulation models.

Mode 1:

**SCAN TABLE: "Voltage (9K-30M) FIN"**  
Short Description: 150K-30M Voltage



### **MEASUREMENT RESULT: "CTL150210689\_fin"**

2/10/2015 5:22PM

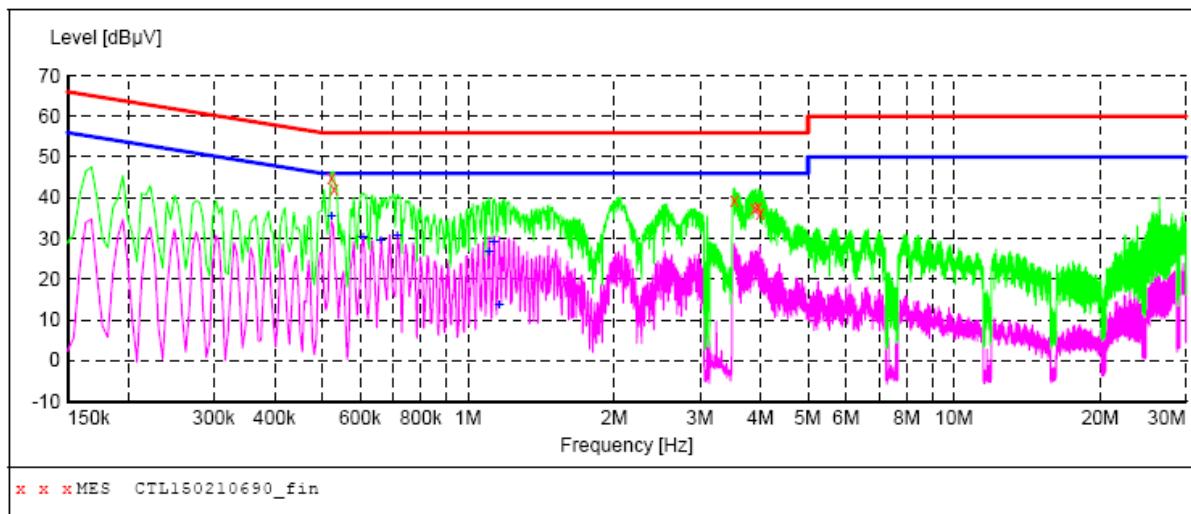
Frequency MHz	Level dB $\mu$ V	Transd dB	Limit dB $\mu$ V	Margin dB	Detector	Line	PE
0.162000	45.30	10.2	65	20.1	QP	N	GND
0.746000	35.00	10.2	56	21.0	QP	N	GND
1.178000	30.10	10.3	56	25.9	QP	N	GND
1.190000	32.40	10.3	56	23.6	QP	N	GND
1.244000	31.10	10.3	56	24.9	QP	N	GND
3.518000	30.90	10.4	56	25.1	QP	N	GND

### **MEASUREMENT RESULT: "CTL150210689\_fin2"**

2/10/2015 5:22PM

Frequency MHz	Level dB $\mu$ V	Transd dB	Limit dB $\mu$ V	Margin dB	Detector	Line	PE
0.166000	35.40	10.2	55	19.8	AV	N	GND
0.194000	34.30	10.2	54	19.6	AV	N	GND
0.274000	29.80	10.2	51	21.2	AV	N	GND
1.106000	22.70	10.3	46	23.3	AV	N	GND
3.902000	19.30	10.4	46	26.7	AV	N	GND

**SCAN TABLE: "Voltage (9K-30M) FIN"**  
 Short Description: 150K-30M Voltage



**MEASUREMENT RESULT: "CTL150210690\_fin"**

2/10/2015 5:25PM

Frequency MHz	Level dB $\mu$ V	Transd dB	Limit dB $\mu$ V	Margin dB	Detector	Line	PE
0.524000	44.90	10.2	56	11.1	QP	L1	GND
0.530000	42.20	10.2	56	13.8	QP	L1	GND
3.536000	39.20	10.4	56	16.8	QP	L1	GND
3.884000	37.20	10.4	56	18.8	QP	L1	GND
3.956000	37.70	10.4	56	18.3	QP	L1	GND
3.992000	36.20	10.4	56	19.8	QP	L1	GND

**MEASUREMENT RESULT: "CTL150210690\_fin2"**

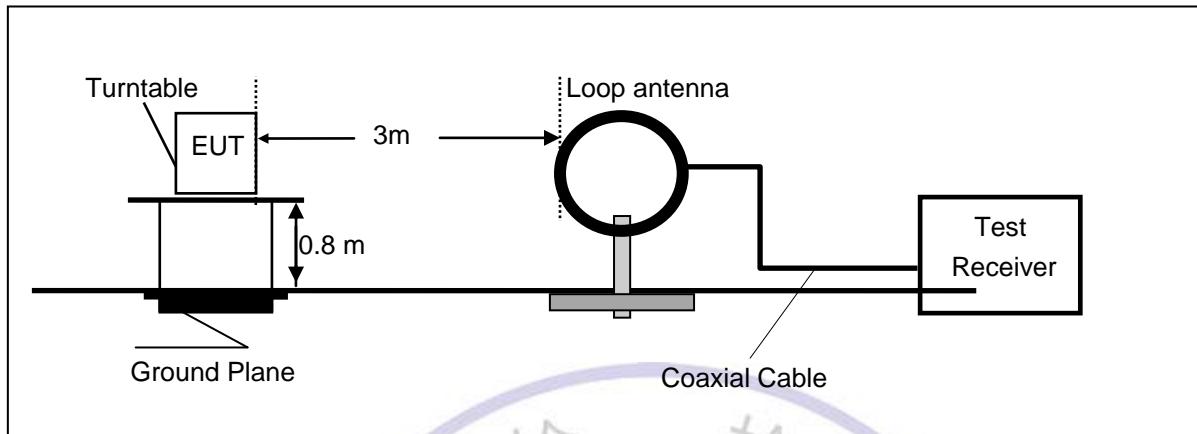
2/10/2015 5:25PM

Frequency MHz	Level dB $\mu$ V	Transd dB	Limit dB $\mu$ V	Margin dB	Detector	Line	PE
0.524000	35.30	10.2	46	10.7	AV	L1	GND
0.608000	30.40	10.2	46	15.6	AV	L1	GND
0.662000	29.30	10.2	46	16.7	AV	L1	GND
0.716000	30.70	10.2	46	15.3	AV	L1	GND
1.106000	26.80	10.3	46	19.2	AV	L1	GND
1.130000	28.90	10.3	46	17.1	AV	L1	GND

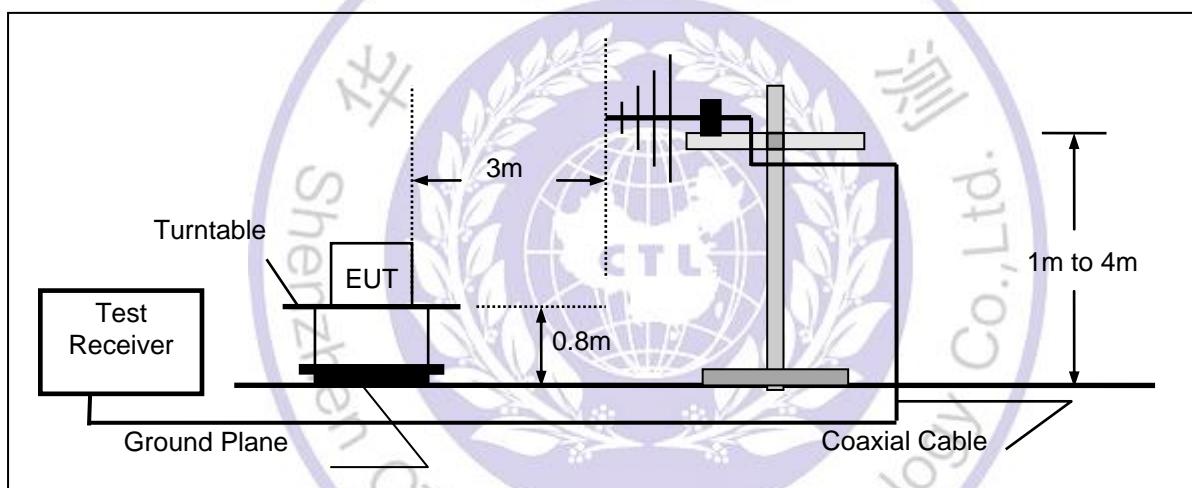
## 4.2. Radiated Emission

### TEST CONFIGURATION

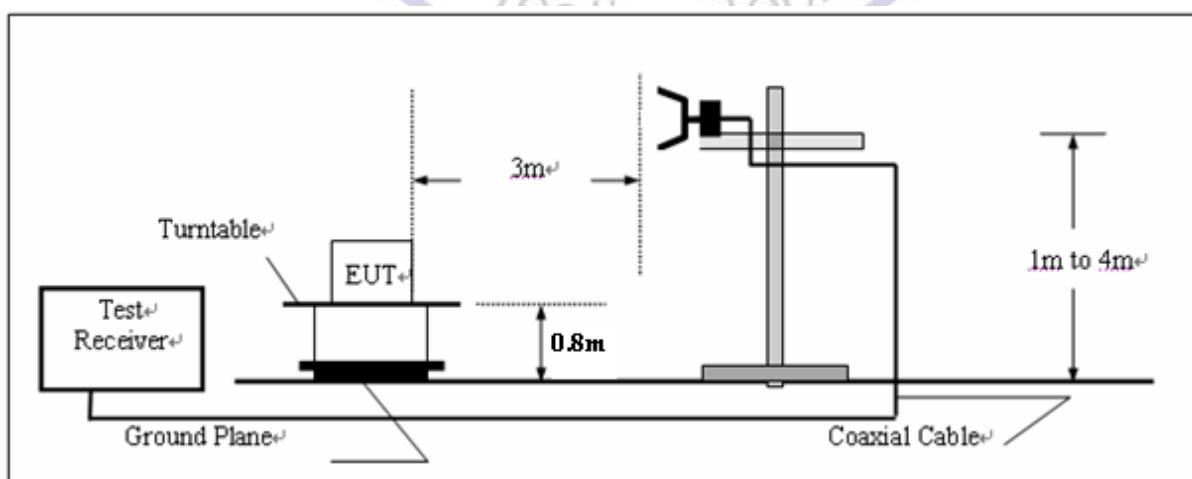
Radiated Emission Test Set-Up  
Frequency range 9KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



## TEST PROCEDURE

- 1 The EUT was placed on a turn table which is 0.8m above ground plane.
- 2 Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0°C to 360°C to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. The fundamental frequency is 2400-2483.5MHz, So the radiation emissions frequency range were tested from 9KHz to 25GHz.

## Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

For example

Frequency (MHz)	FS (dB $\mu$ V/m)	RA (dB $\mu$ V/m)	AF (dB)	CL (dB)	AG (dB)	Transd (dB)
300.00	40	58.1	12.2	1.6	31.90	-18.1

$$\text{Transd} = \text{AF} + \text{CL} - \text{AG}$$

## RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.

Frequency (MHz)	Distance (Meters)	Radiated (dB $\mu$ V/m)	Radiated ( $\mu$ V/m)
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

**TEST RESULTS**

Mode 1: Transmitter-1Mbps(GFSK\_DH5)

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
0	H	2402.1	71.1	31.2	102.3	Fundamental	/	PK
	H	301.7	13.2	16.4	29.6	46	16.4	QP
	H	522.4	11.9	19.3	31.2	46	14.8	QP
	H	3252.5	63.1	-16.0	47.1	54(Note)	6.9	PK
	V	4884.5	60.0	-11.7	48.3	54(Note)	5.7	PK
	V	7206.1	47.4	-3.5	43.9	54(Note)	10.1	PK
	H	24000	60.5	-8.9	51.6	54(Note)	2.4	PK
39	H	2440.9	71.7	31.2	102.9	Fundamental	/	PK
	H	468.2	14.0	18.9	32.9	46	13.1	QP
	H	543.1	9.1	20.6	29.7	46	16.3	QP
	H	3252.5	62.1	-16.0	46.1	54(Note)	7.9	PK
	V	4884.5	57.0	-11.7	45.3	54(Note)	8.7	PK
	V	7323.0	45.3	-3.0	42.3	54(Note)	11.7	PK
	H	24000	60.5	-8.9	51.6	54(Note)	2.4	PK
78	H	2480.0	71.3	31.2	102.5	Fundamental	/	PK
	H	109.2	14.5	14.7	29.2	46	16.8	QP
	H	407.3	13.2	18.4	31.6	46	14.4	QP
	H	3303.5	61.4	-16.2	45.2	54(Note)	8.8	PK
	V	4961.0	58.5	-11.4	47.1	54(Note)	6.9	PK
	V	7440.0	46.3	-2.6	43.7	54(Note)	10.3	PK
	H	24000	60.5	-8.9	51.6	54(Note)	2.4	PK

Note:

1. Measure Level = Reading Level + Factor.
2. The test results which are attenuated more than 20 dB below the permissible value limit (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.
3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.
4. RBW 1MHz VBW 3MHz peak detector for PK value, RMS detector for AV value.

## Mode 2: Transmitter-2Mbps(Pi/4 DQPSK\_DH5)

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
0	H	2402.1	72.2	31.2	103.4	Fundamental	/	PK
	H	227.5	11.8	16.4	28.2	46	17.8	QP
	H	305.9	12.3	19.3	31.6	46	14.4	QP
	H	3252.5	62.6	-15.9	46.7	54(Note)	7.3	PK
	V	4884.5	55.7	-11.9	43.8	54(Note)	10.2	PK
	V	7206.1	48.6	-3.5	45.1	54(Note)	8.9	PK
	H	24000	60.5	-8.9	51.6	54(Note)	2.4	PK
39	H	2440.9	71.6	31.2	102.8	Fundamental	/	PK
	H	238.1	13.7	18.9	32.6	46	13.4	QP
	H	513.4	6.2	21.2	27.4	46	18.6	QP
	H	3252.5	61.7	-16.0	45.7	54(Note)	8.3	PK
	V	4884.5	58.6	-11.7	46.9	54(Note)	7.1	PK
	V	7323.0	46.5	-3.0	43.5	54(Note)	10.5	PK
	H	24000	60.5	-8.9	51.6	54(Note)	2.4	PK
78	H	2480.0	70.7	31.2	101.9	Fundamental	/	PK
	H	259.1	10.8	15.3	26.1	46	19.9	QP
	H	603.7	14.4	18.4	32.8	46	13.2	QP
	H	3303.5	62.1	-16.2	45.9	54(Note)	8.1	PK
	V	4961.2	55.4	-11.4	44.0	54(Note)	10.0	PK
	V	7440.1	45.0	-2.6	42.4	54(Note)	11.6	PK
	H	24000	60.5	-8.9	51.6	54(Note)	2.4	PK

## Note:

1. Measure Level = Reading Level + Factor.
2. The test results which are attenuated more than 20 dB below the permissible value limit (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.
3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.
4. RBW 1MHz VBW 3MHz peak detector for PK value, RMS detector for AV value.

## Mode 3: Transmitter-3Mbps(8DPSK\_DH5)

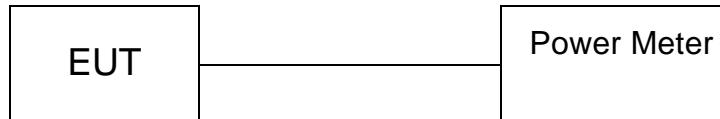
CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
0	H	2402.1	71.5	31.2	102.7	Fundamental	/	PK
	H	458.5	5.1	20.6	25.7	46	20.3	QP
	H	513.7	9.3	22.5	31.8	46	14.2	QP
	H	3252.5	58.5	-15.9	42.6	54(Note)	11.4	PK
	V	4884.5	59.8	-11.9	47.9	54(Note)	6.1	PK
	V	7206.1	46.6	-3.5	43.1	54(Note)	10.9	PK
	H	24000	60.5	-8.9	51.6	54(Note)	2.4	PK
39	H	2440.9	72.1	31.2	103.3	Fundamental	/	PK
	H	330.1	8.0	21.2	29.2	46	16.8	QP
	H	409.2	10.5	22.4	32.9	46	13.1	QP
	H	3252.5	61.4	-16	45.4	54(Note)	8.6	PK
	V	4884.5	58.9	-11.7	47.2	54(Note)	6.8	PK
	V	7323	46.8	-3	43.8	54(Note)	10.2	PK
	H	24000	60.5	-8.9	51.6	54(Note)	2.4	PK
78	H	2480	70.7	31.2	101.9	Fundamental	/	PK
	H	281.7	20.1	15.3	35.4	46	10.6	QP
	H	329.6	12.2	20.6	32.8	46	13.2	QP
	H	3303.5	62.3	-16.2	46.1	54(Note)	7.9	PK
	V	4961.2	57.3	-11.4	45.9	54(Note)	8.1	PK
	V	7440.4	46.2	-2.6	43.6	54(Note)	10.4	PK
	H	24000	60.5	-8.9	51.6	54(Note)	2.4	PK

## Note:

1. Measure Level = Reading Level + Factor.
2. The test results which are attenuated more than 20 dB below the permissible value limit (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.
3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.
4. RBW 1MHz VBW 3MHz peak detector for PK value, RMS detector for AV value.

### 4.3. Maximum Peak Output Power

#### TEST CONFIGURATION



#### TEST PROCEDURE

According to ANSI C63.10: 2009.

The EUT was directly connected to the power meter / spectrum analyzer and antenna output port as show in the block diagram as TEST CONFIGURATION shows.

Use the power meter to test peak power and record the result.

#### LIMIT

The Maximum Peak Output Power Measurement limit is 30dBm.

#### TEST RESULTS

##### DH5 Mode:

Channel Frequency (MHz)	Peak Power Output (dBm)	Peak Power Limit (dBm)	Pass / Fail
2402	6.13	30	PASS
2441	6.99	30	PASS
2480	6.21	30	PASS

*Note: The test results including the cable lose.*

##### 2DH5 Mode:

Frequency (MHz)	Peak Power Output (dBm)	Peak Power Limit (dBm)	Pass / Fail
2402	5.84	30	PASS
2441	6.42	30	PASS
2480	5.47	30	PASS

*Note: The test results including the cable lose.*

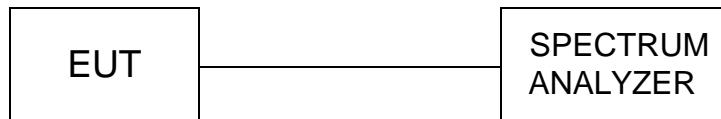
##### 3DH5 Mode:

Channel Frequency (MHz)	Peak Power Output (dBm)	Peak Power Limit (dBm)	Pass / Fail
2402	5.77	30	PASS
2441	6.53	30	PASS
2480	5.58	30	PASS

*Note: The test results including the cable lose.*

## 4.4. 20dB Bandwidth

### TEST CONFIGURATION



### TEST PROCEDURE

According to ANSI C63.10: 2009.

Use the following spectrum analyzer settings:

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

RBW  $\geq$  1% of the 20dB bandwidth, VBW  $\geq$  RBW, Sweep = auto, Detector function = peak, Trace = max hold

The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize.

Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.

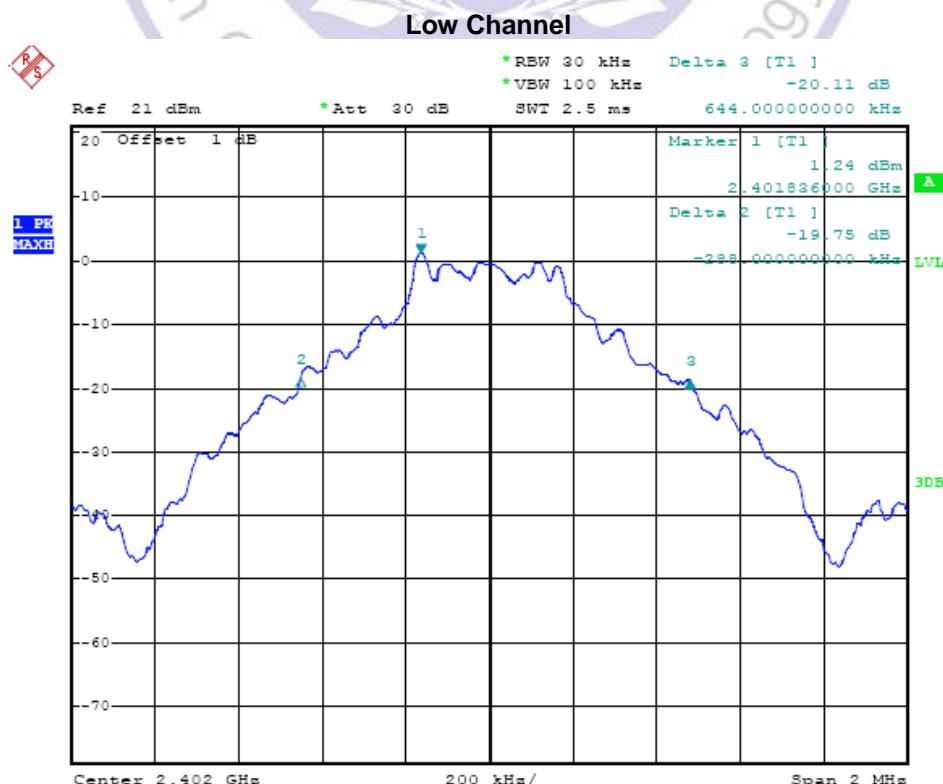
### LIMIT

For frequency hopping systems operating in the 2400MHz-2483.5MHz no limit for 20dB bandwidth.

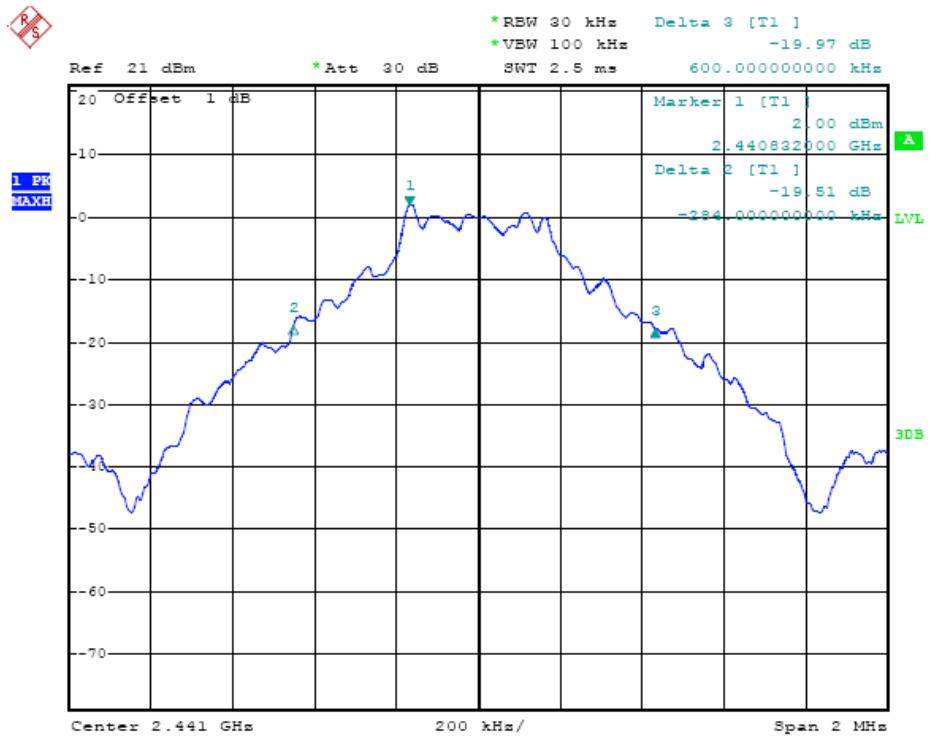
### TEST RESULTS

DH5 Mode:

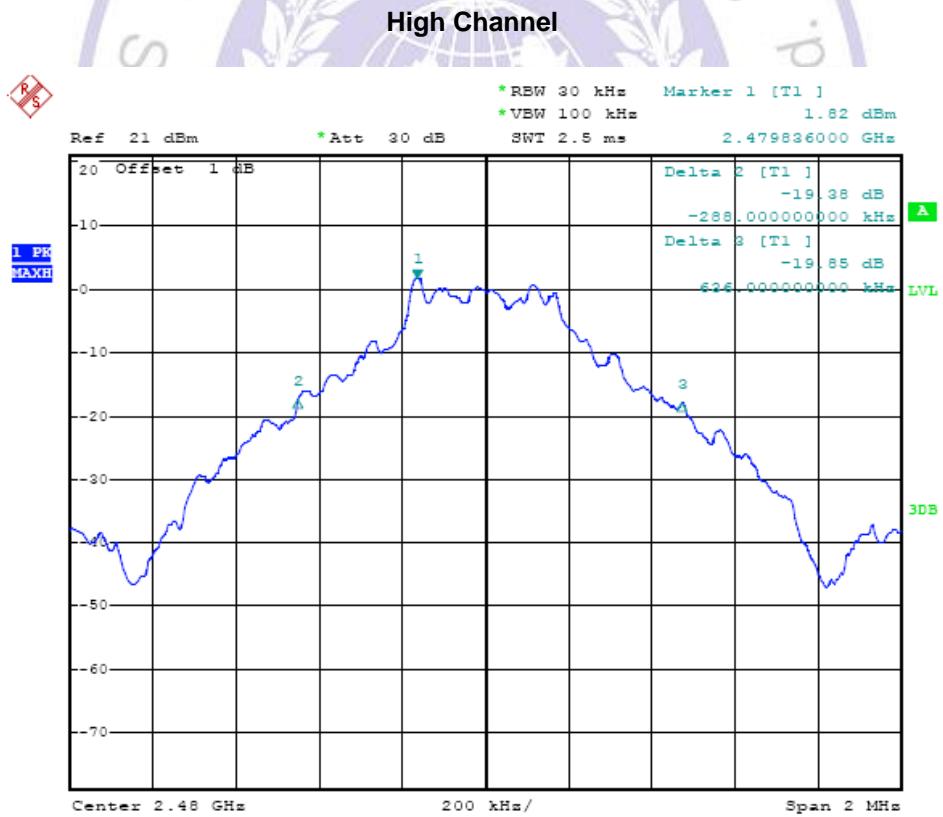
CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)	LIMIT (MHz)	PASS/FAIL
2402	0.932	/	PASS
2441	0.884	/	PASS
2480	0.914	/	PASS



## Middle Channel



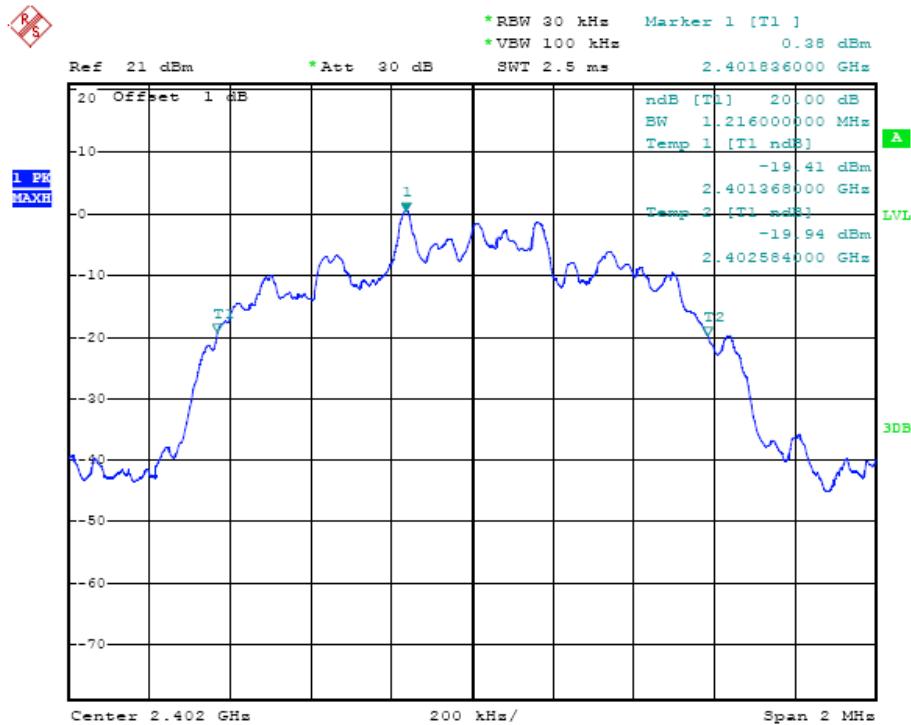
## High Channel



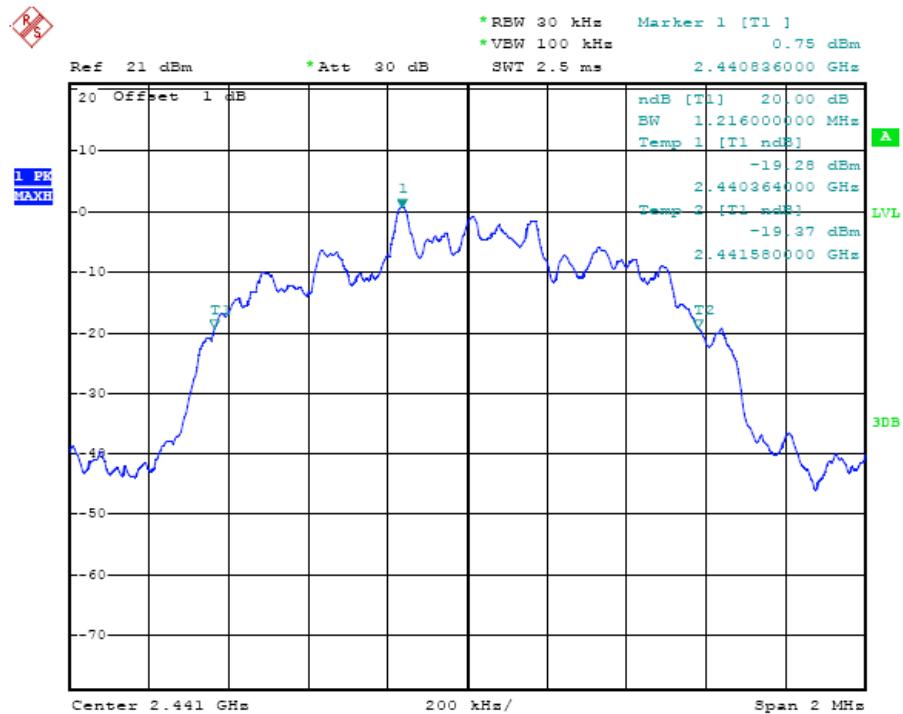
## 2DH5 Mode:

CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)	LIMIT (MHz)	PASS/FAIL
2402	1.216	/	PASS
2441	1.216	/	PASS
2480	1.216	/	PASS

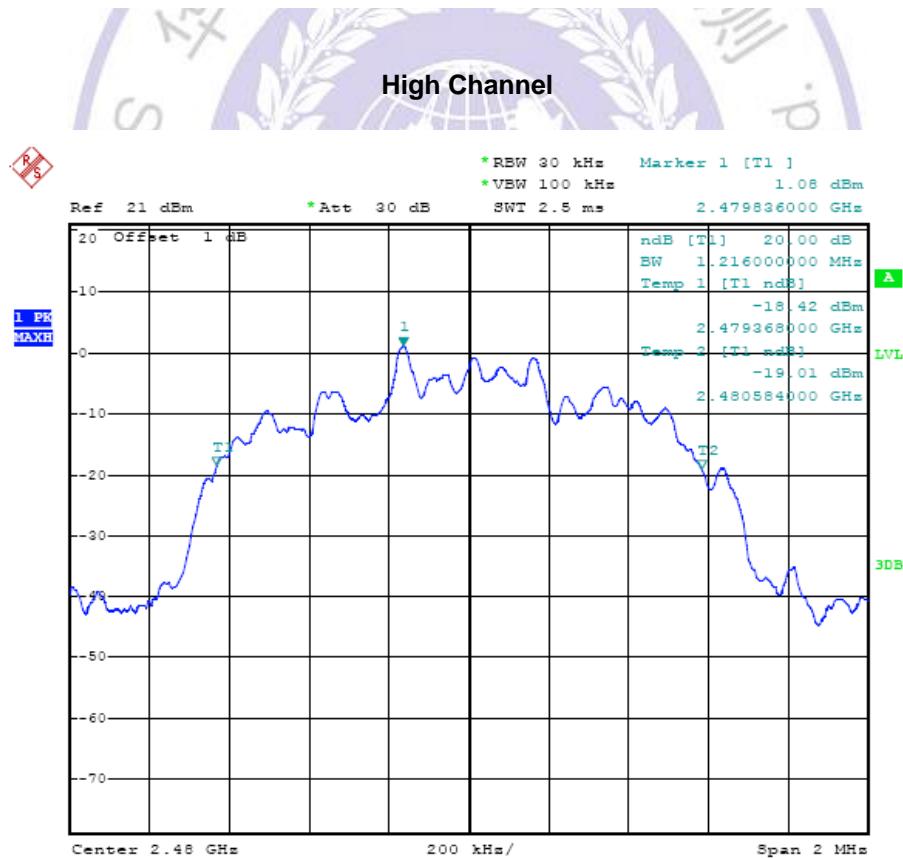
## Low Channel



## Middle Channel



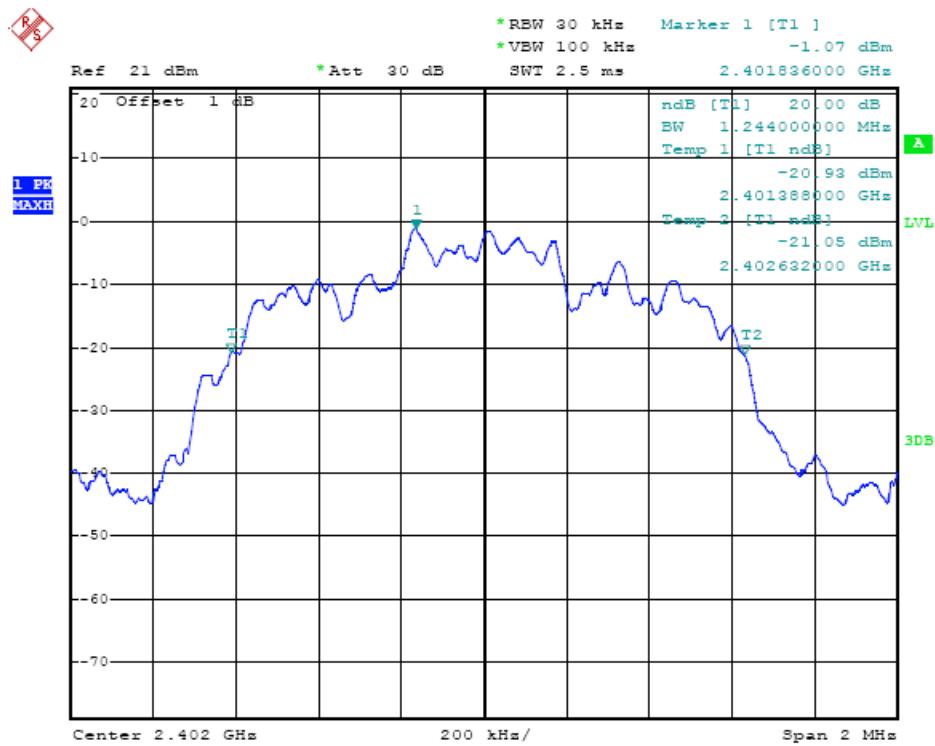
## High Channel



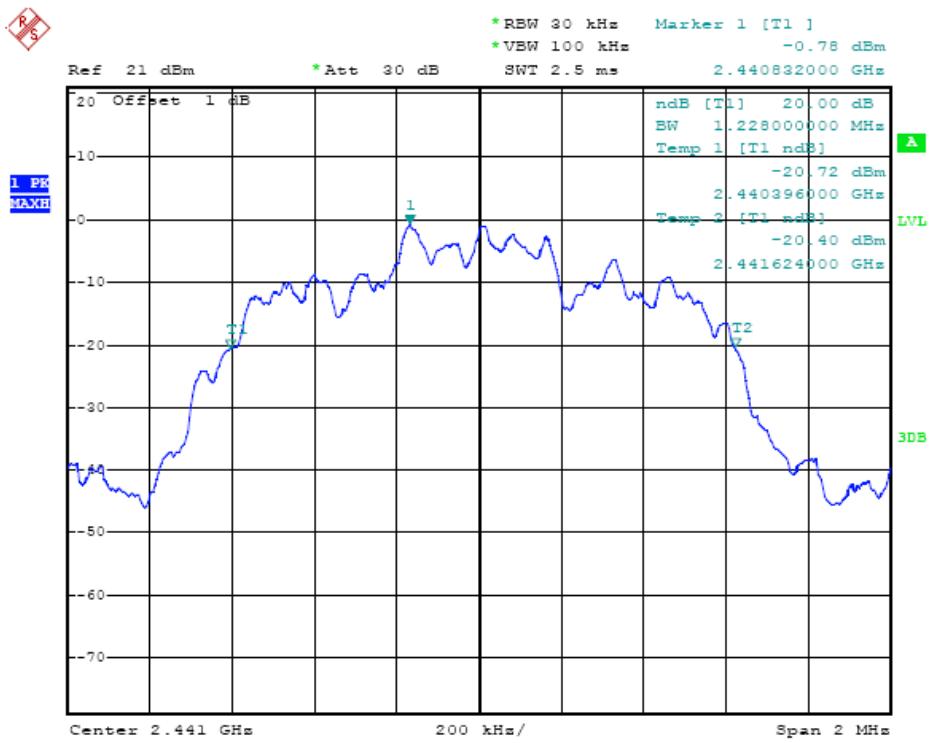
## 3DH5 Mode:

CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)	LIMIT (MHz)	PASS/FAIL
2402	1.244	/	PASS
2441	1.228	/	PASS
2480	1.240	/	PASS

## Low Channel



## Middle Channel



## High Channel



## 4.5. Band Edge

### Applicable Standard

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)).

### TEST PROCEDURE

According to ANSI C63.10: 2009.

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation.

RBW  $\geq$  1% of the span

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. The marker-delta value now displayed must comply with the limit specified in this Section.

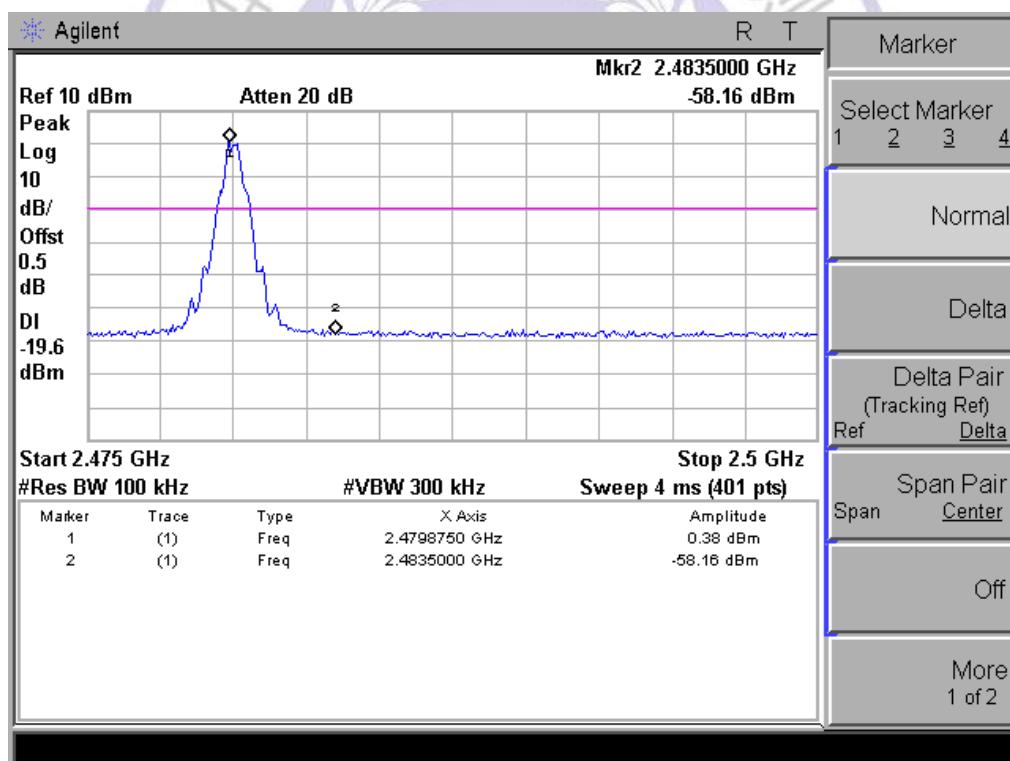
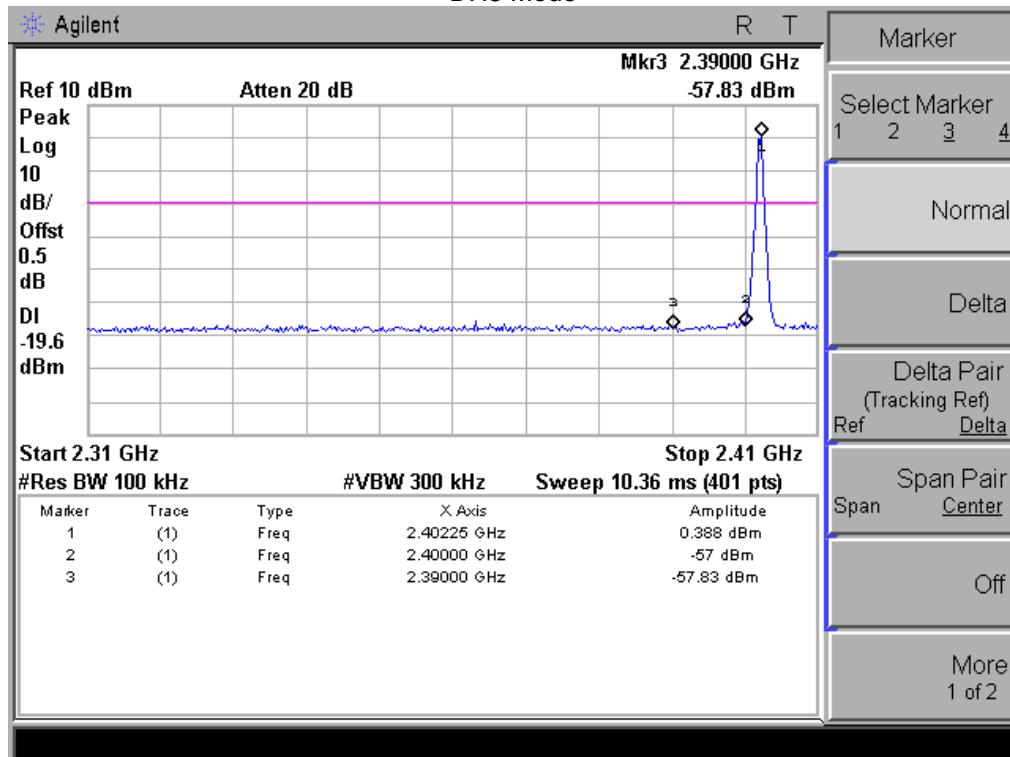
Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit.

### TEST RESULTS

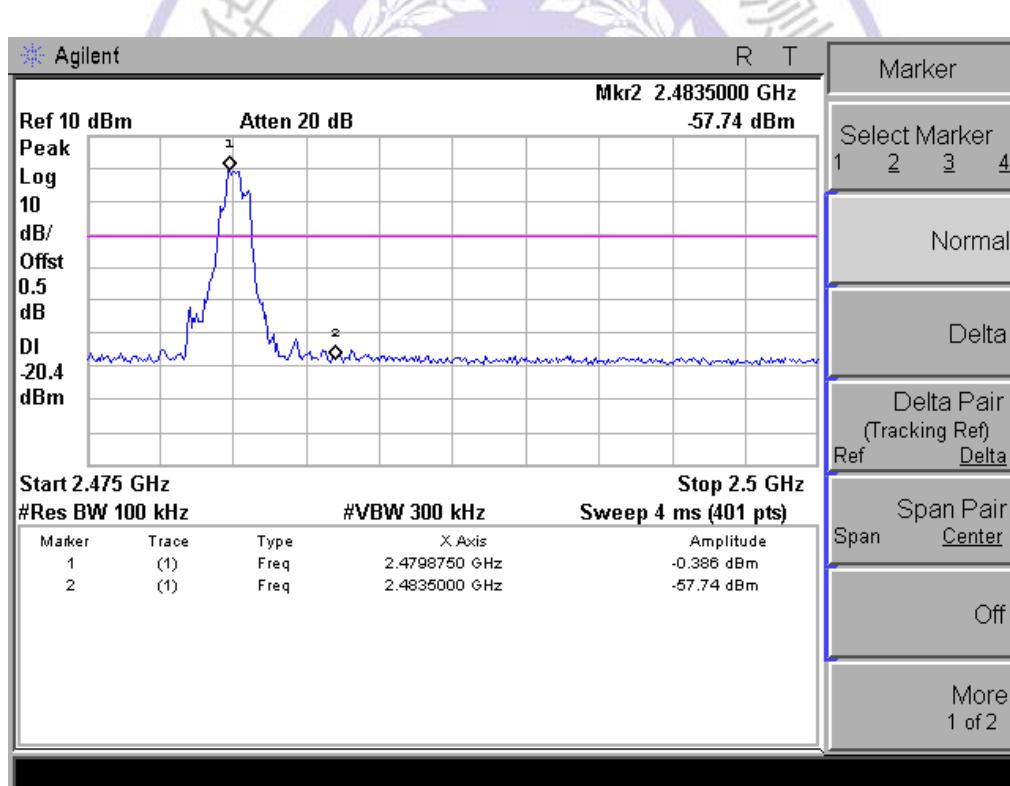
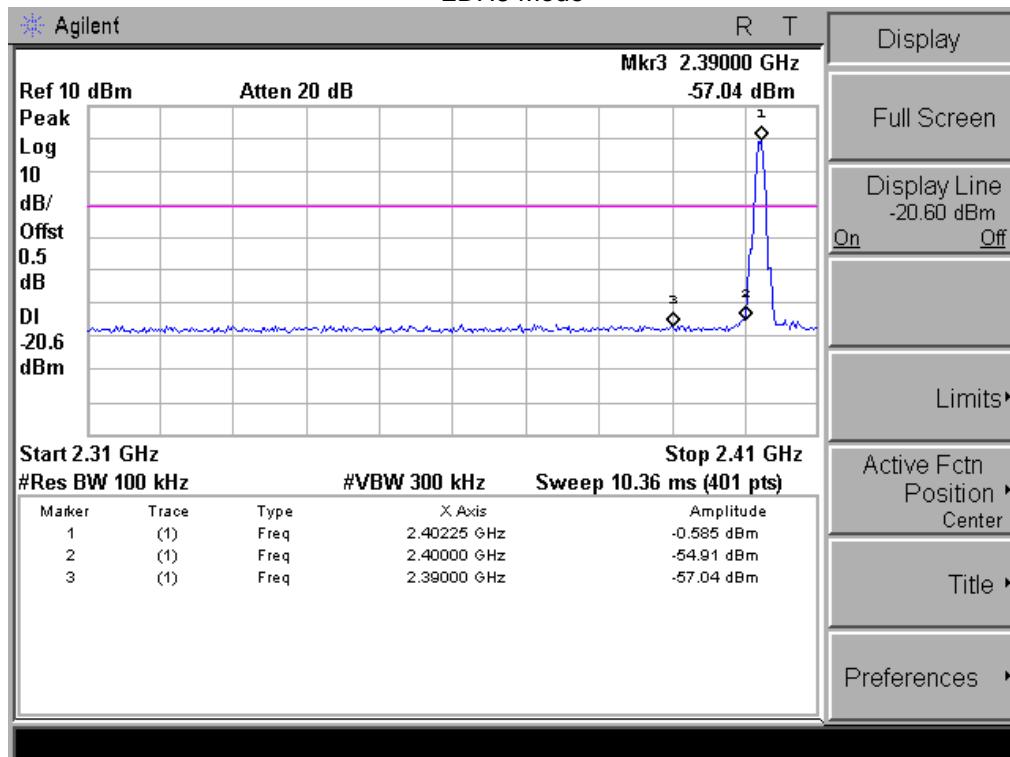
See next pages.

Conducted Test:

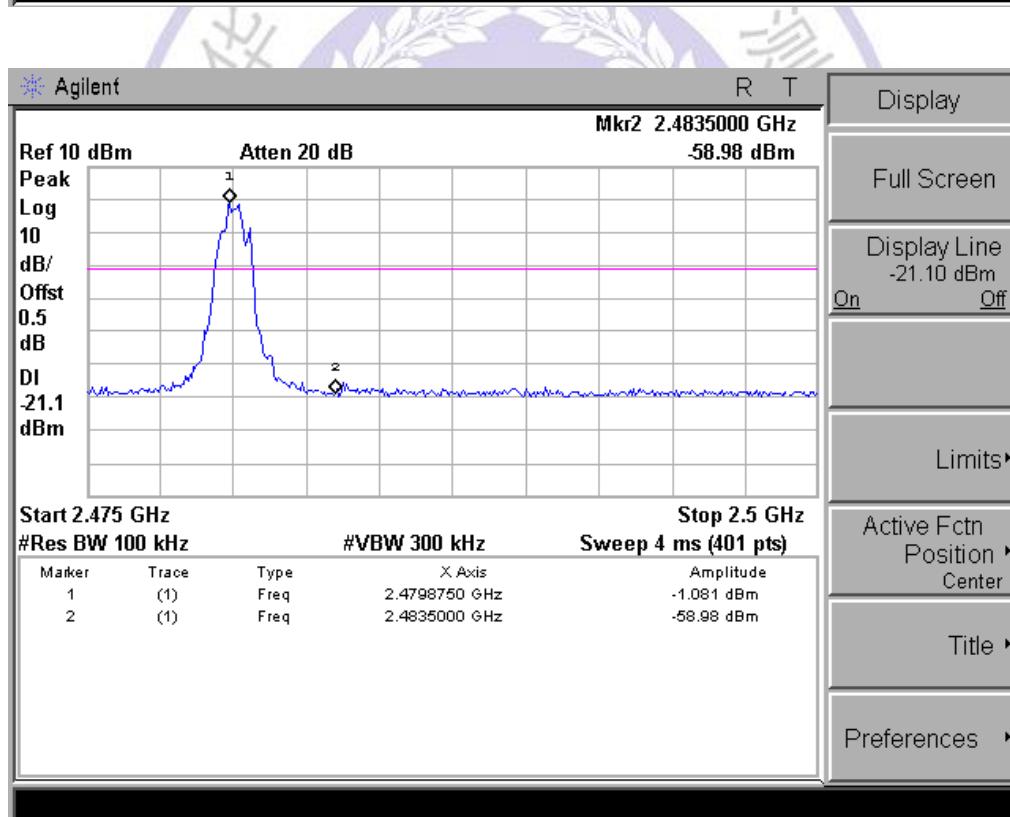
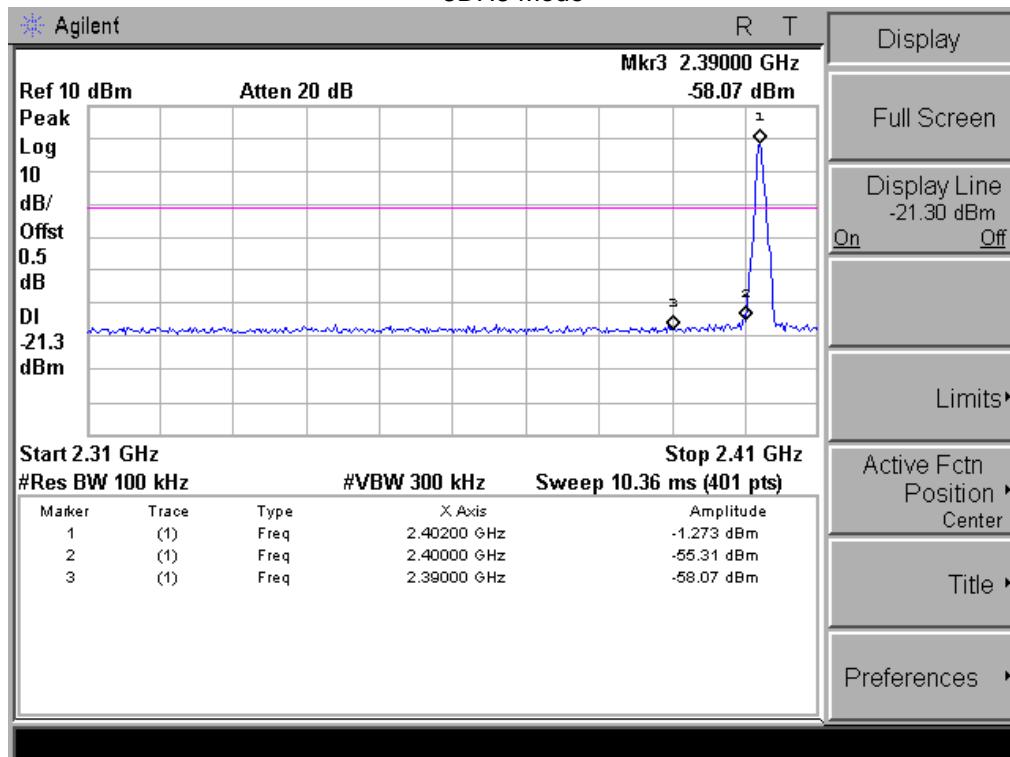
DH5 Mode



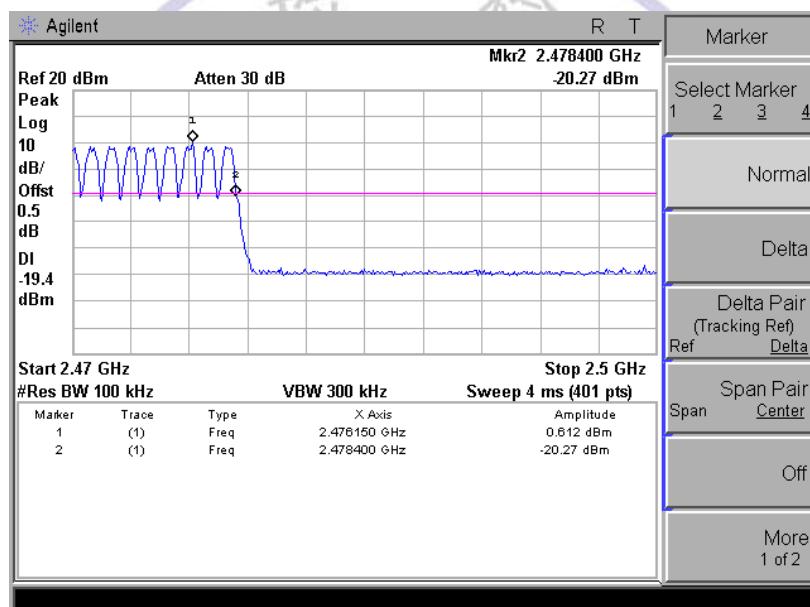
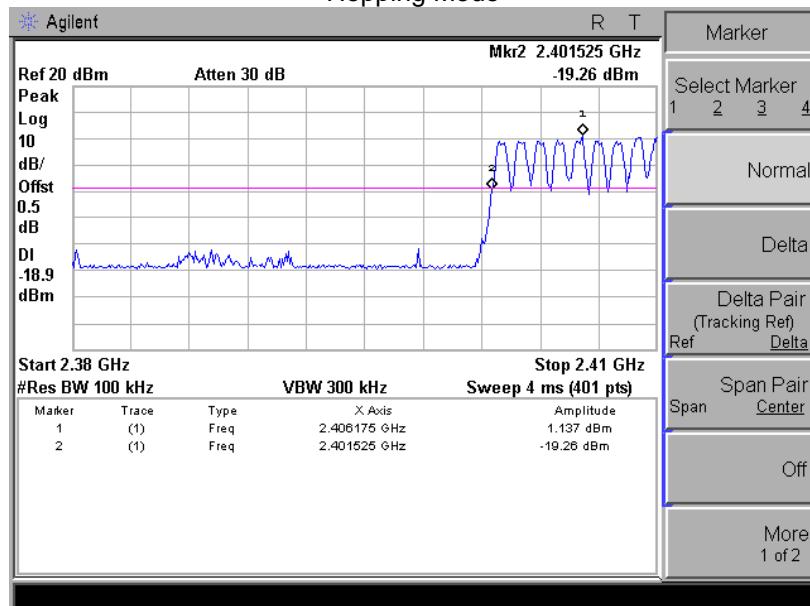
## 2DH5 Mode



## 3DH5 Mode

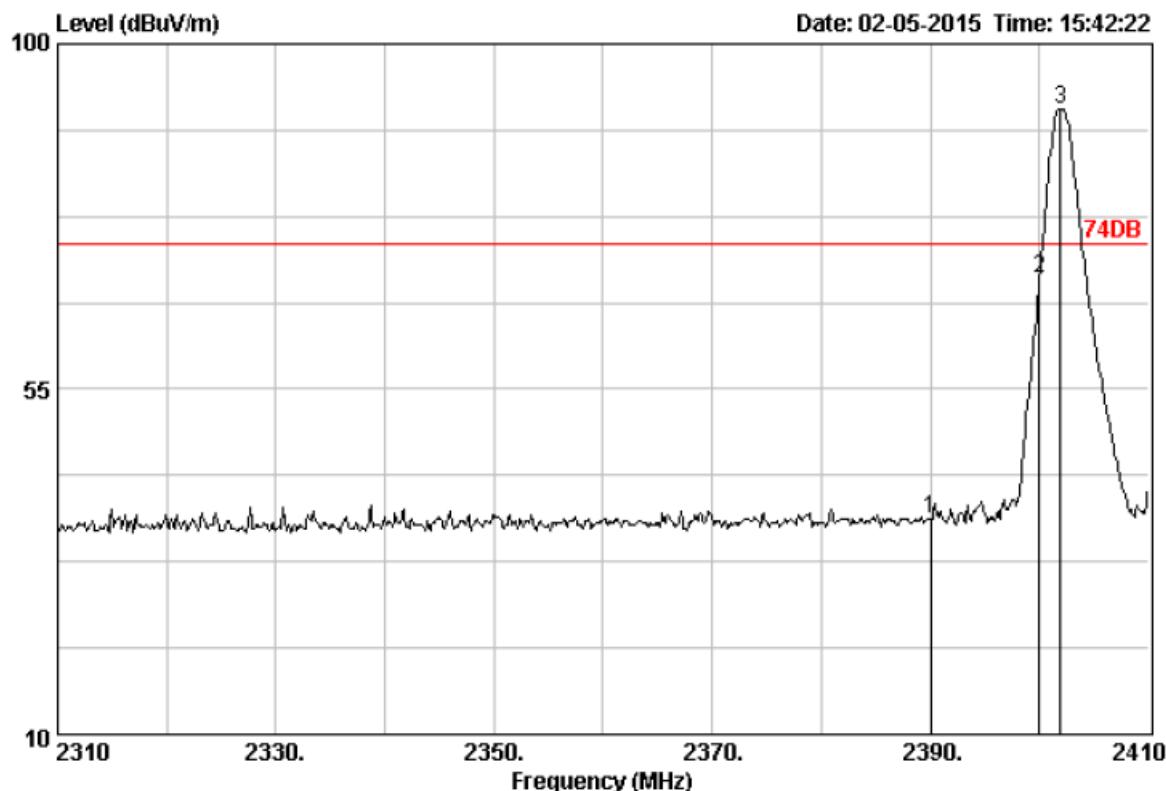


## Hopping Mode



**Radiated Test:**

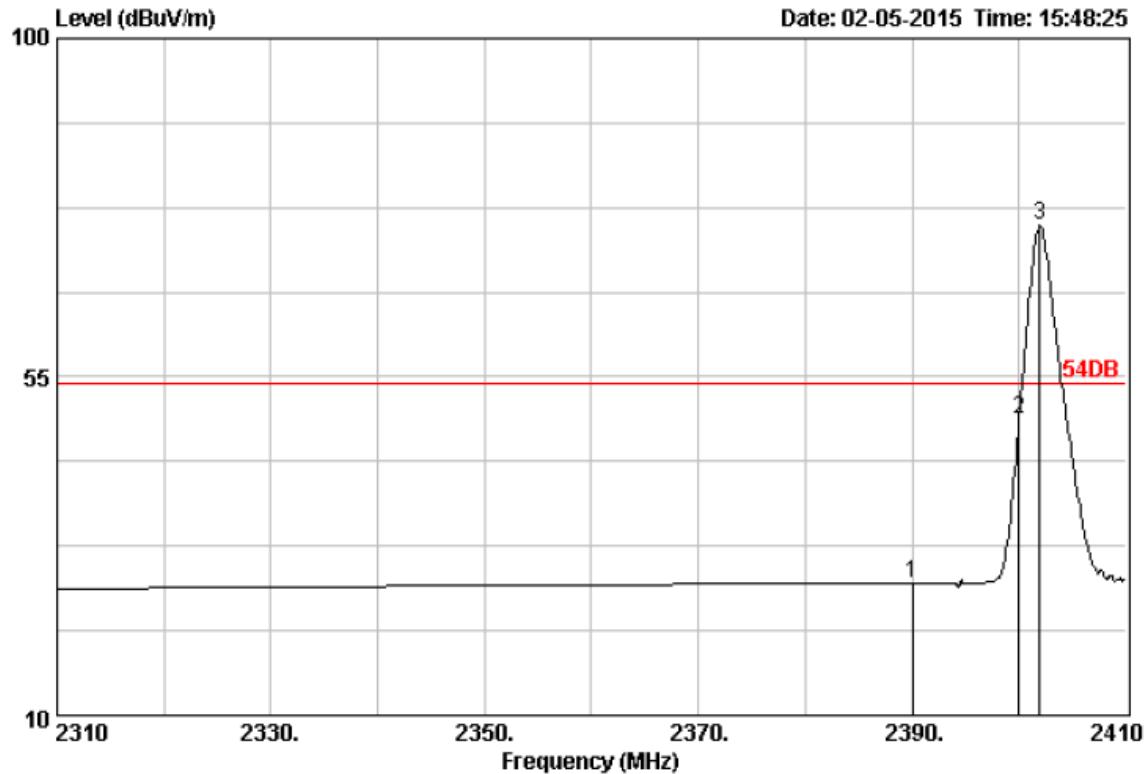
Engineer: Nice	Time: 2015/02/05
Site: AC5	Margin: 0
Limit: FCC_Part15.209 RE(3m)	Polarity: Horizontal
Probe: Horn_DRH-118(1-18GHz)	Power: By Battery
EUT: Handsets	
Note: Mode 1: Transmit at channel 2402MHz by DH5	



Site no. : 3m Chamber Data no. : 526  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : HORIZONTAL  
 Limit : 74DB  
 Env. / Ins. : 23\*C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Int. (dB)	Cable (dB)	Emission				
			Factor (dB)	Loss (dB)	Reading (dBuV)	Level (dBuV/m)	Limits (dBuV/m)
<hr/>							
1 2390.00	28.78	4.61	40.14	38.17	74.00	35.83	Peak
2 2400.00	28.78	4.61	71.35	69.38	74.00	4.62	Peak
3 2401.90	28.78	4.61	93.53	91.56	74.00	-17.56	Peak

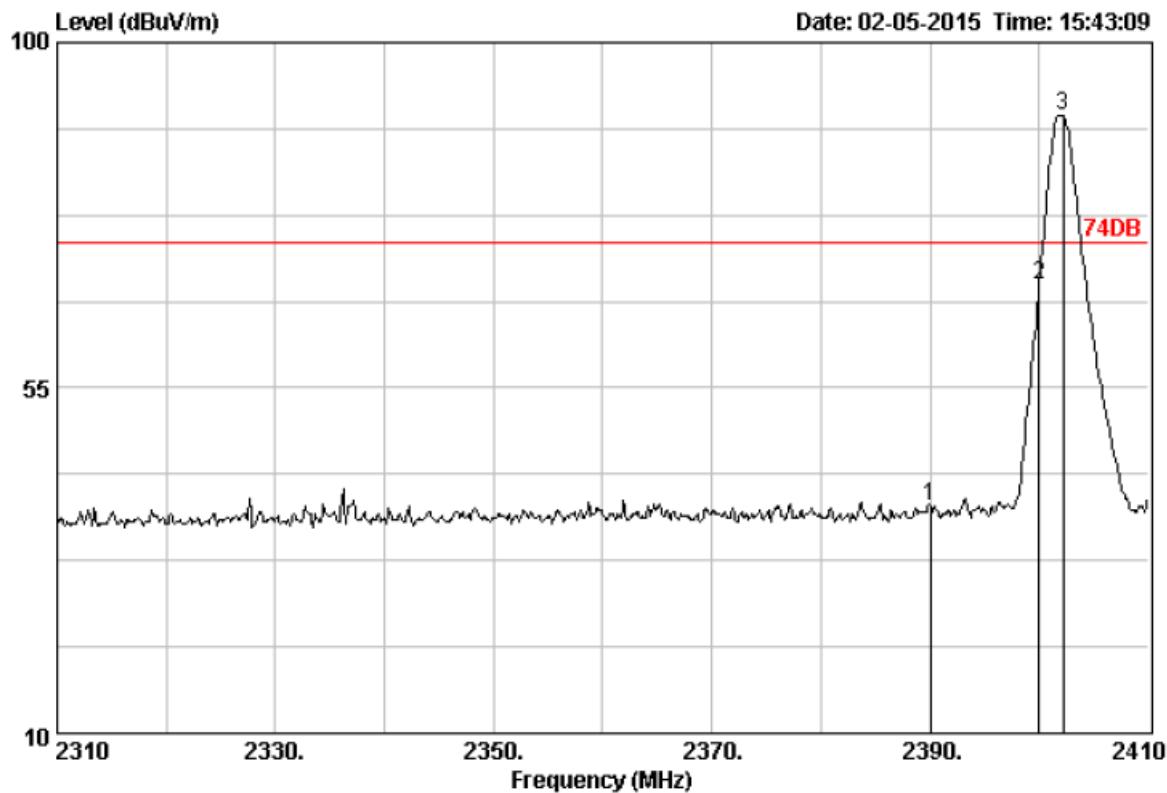
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Horizontal
EUT: Handsets	Power: By Battery
Note: Mode 1: Transmit at channel 2402MHz by DH5	



Site no. : 3m Chamber Data no. : 528  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : HORIZONTAL  
 Limit : 54DB  
 Env. / Ins. : 23\*C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Emission					Remark
			Reading (dBuV)	Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)		
<hr/>								
1 2390.00	28.78	4.61	29.56	27.59	54.00	26.41	Average	
2 2400.00	28.78	4.61	51.36	49.39	54.00	4.61	Average	
3 2401.90	28.78	4.61	77.19	75.22	54.00	-21.22	Average	

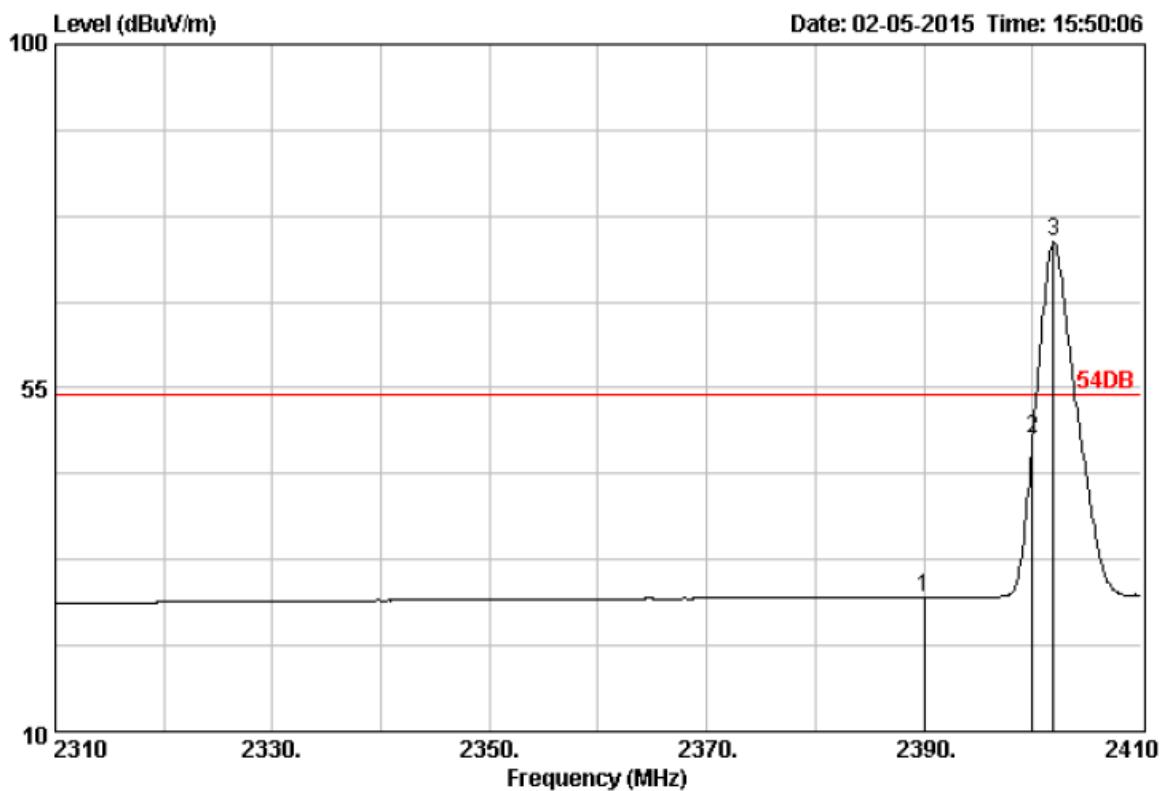
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Vertical
EUT: Handsets	Power: By Battery
Note: Mode 1: Transmit at channel 2402MHz by DH5	



Site no. : 3m Chamber Data no. : 527  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : VERTICAL  
 Limit : 74DB  
 Env. / Ins. : 23\*C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Emission				
			Reading (dBuV)	Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1 2390.00	28.78	4.61	41.54	39.57	74.00	34.43	Peak
2 2400.00	28.78	4.61	70.45	68.48	74.00	5.52	Peak
3 2402.20	28.78	4.61	92.51	90.54	74.00	-16.54	Peak

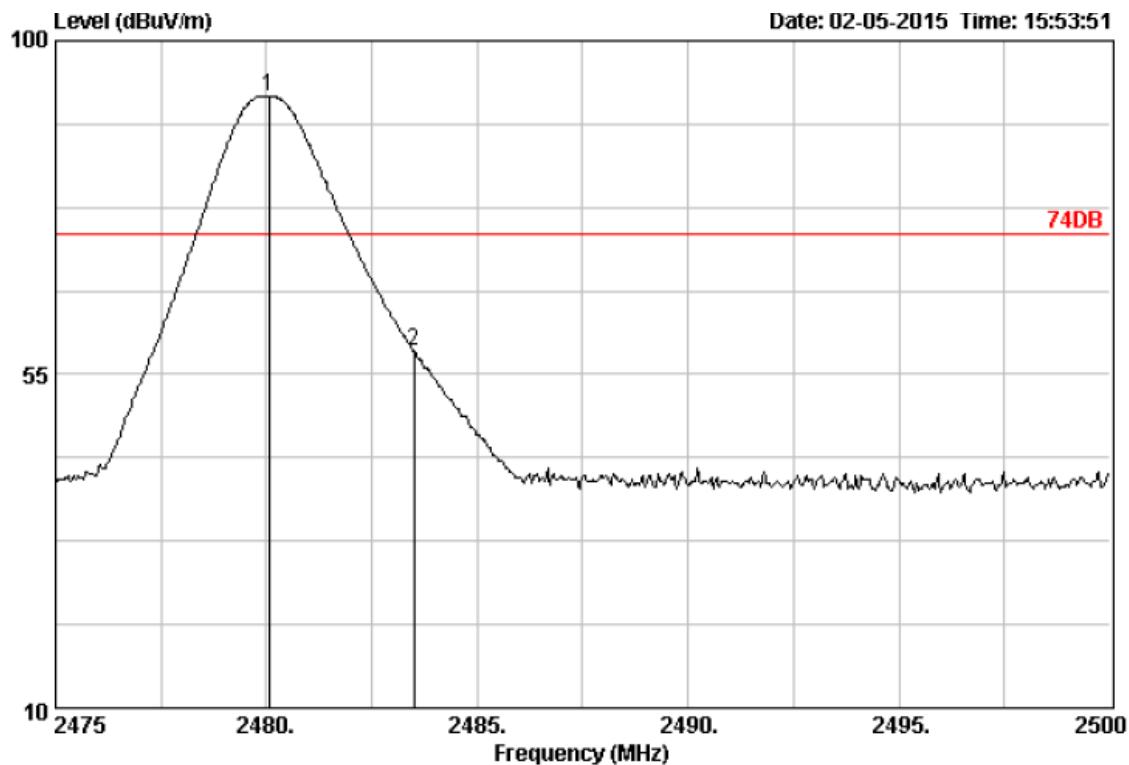
Engineer: Nice	Time: 2015/02/05
Site: AC5	Margin: 0
Limit: FCC_Part15.209 RE(3m)	Polarity: Vertical
Probe: Horn_DRH-118(1-18GHz)	Power: By Battery
EUT: Handsets	Note: Mode 1: Transmit at channel 2402MHz by DH5



Site no. : 3m Chamber Data no. : 529  
Dis. / Ant. : 3m DRH-118 Ant. pol. : VERTICAL  
Limit : 54DB  
Env. / Ins. : 23°C/54%  
Engineer :  
EUT :  
Power :  
M/N :  
Test Mode :

Freq. (MHz)	Factor (dB)	Loss (dB)	Reading (dBuV)	Emission				Remark
				Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)		
1 2390.00	28.78	4.61	29.59	27.62	54.00	26.38	Average	
2 2400.00	28.78	4.61	50.33	48.36	54.00	5.64	Average	
3 2401.90	28.78	4.61	76.15	74.18	54.00	-20.18	Average	

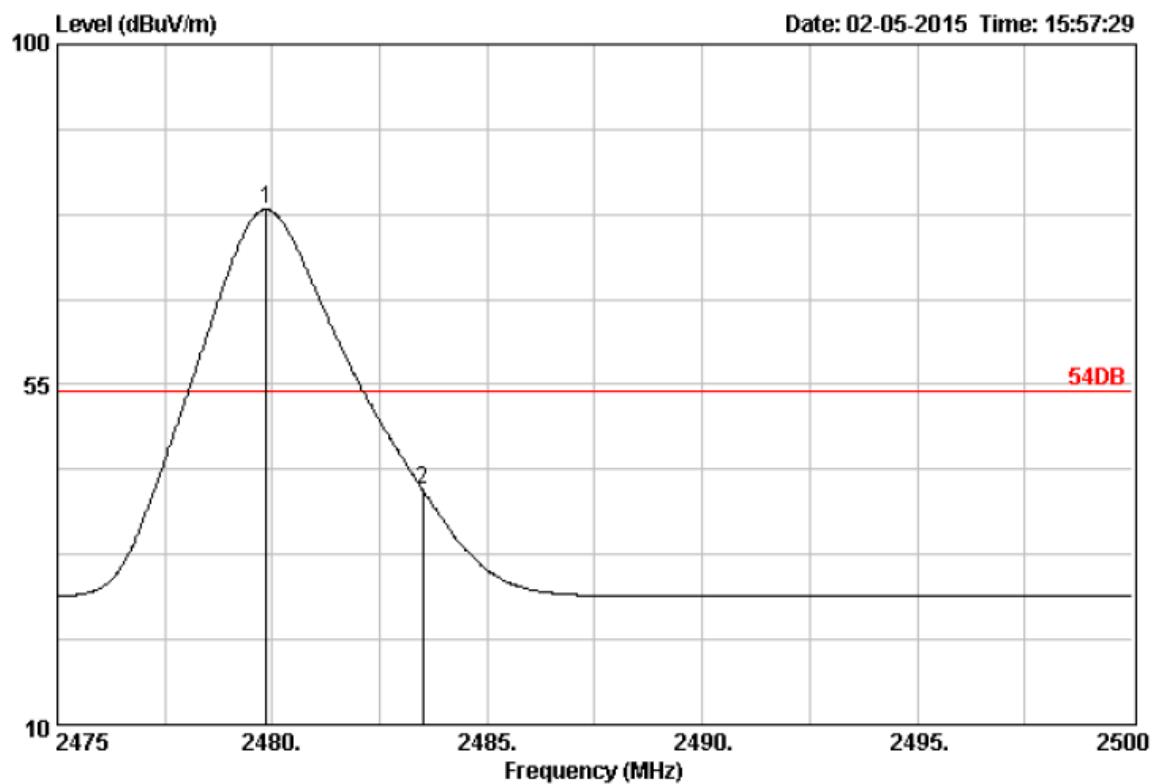
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Horizontal
EUT: Handsets	Power: By Battery
Note: Mode 1: Transmit at channel 2480MHz by DH5	



Site no. : 3m Chamber Data no. : 531  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : HORIZONTAL  
 Limit : 74DB  
 Env. / Ins. : 23°C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission			
				Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
<hr/>							
1 2480.05	28.93	4.70	94.27	92.52	74.00	-18.52	Peak
2 2483.50	28.93	4.70	59.88	58.13	74.00	15.87	Peak

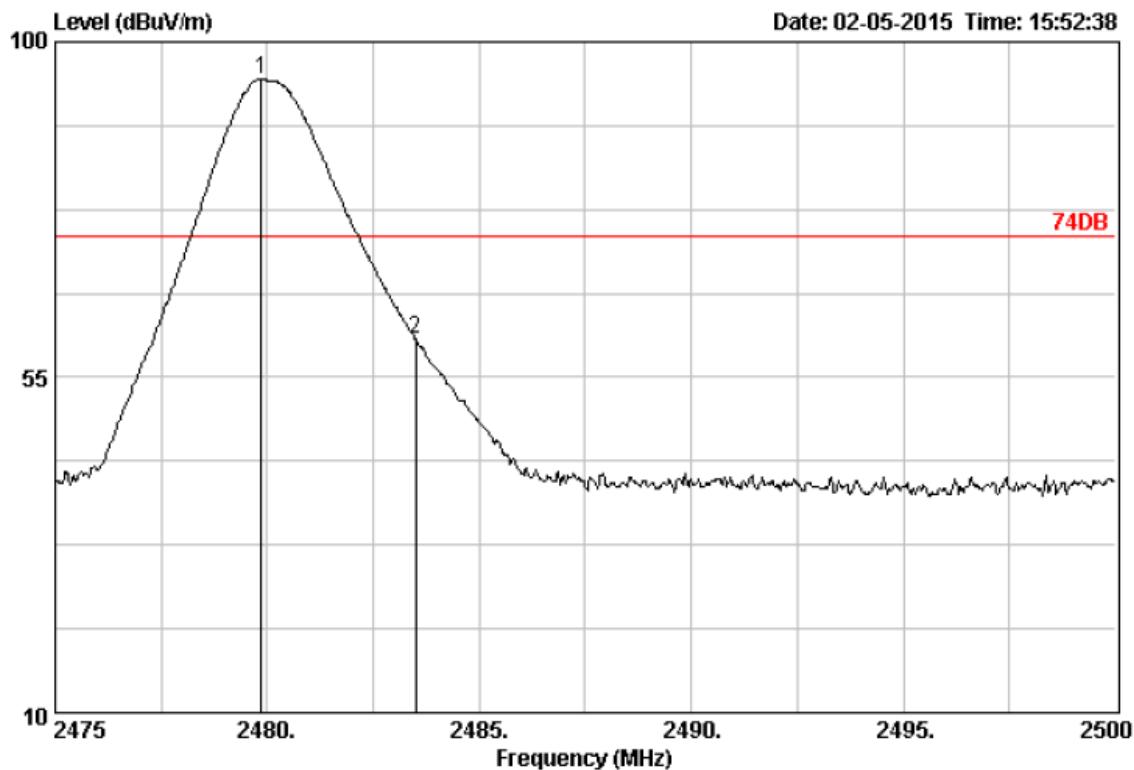
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Horizontal
EUT: Handsets	Power: By Battery
Note: Mode 1: Transmit at channel 2480MHz by DH5	



Site no. : 3m Chamber Data no. : 533  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : HORIZONTAL  
 Limit : 54DB  
 Env. / Ins. : 23°C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Emission					Remark
			Reading (dBuV)	Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)		
<hr/>								
1 2479.85	28.93	4.70	79.91	78.16	54.00	-24.16	Average	
2 2483.50	28.93	4.70	42.75	41.00	54.00	13.00	Average	

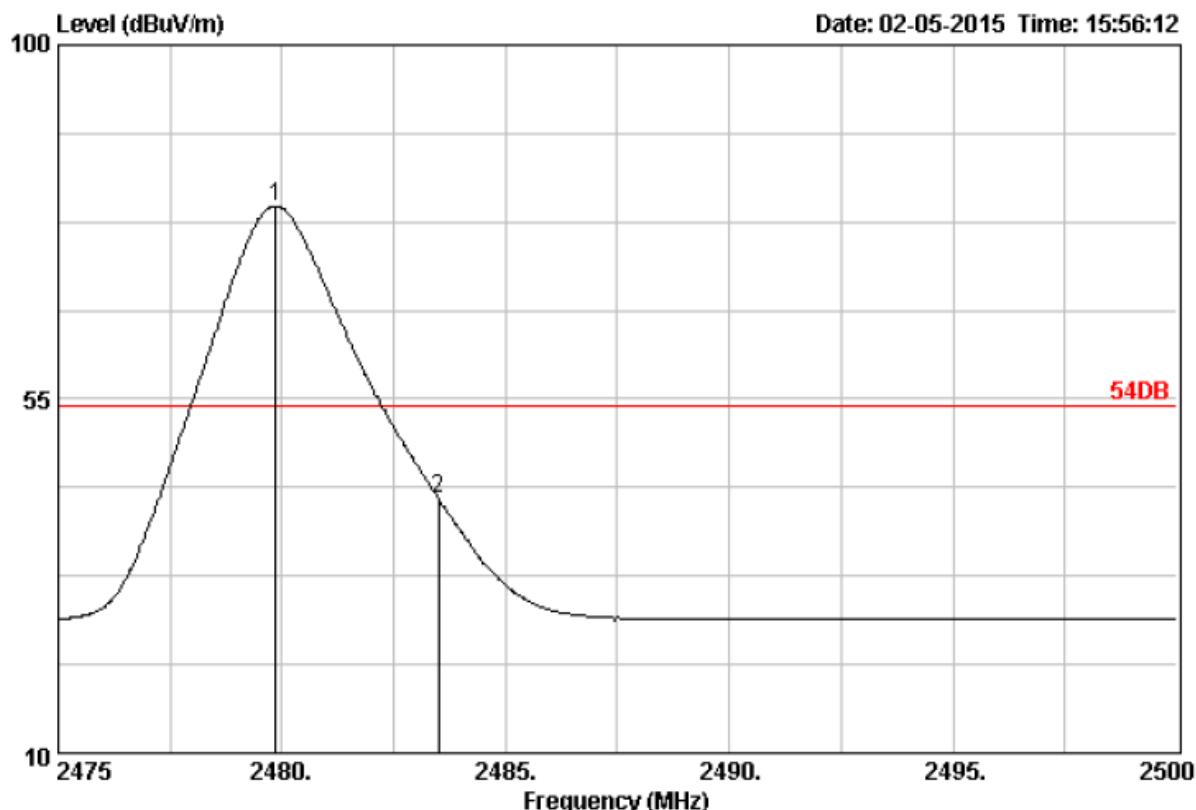
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Vertical
EUT: Handsets	Power: By Battery
Note: Mode 1: Transmit at channel 2480MHz by DH5	



Site no. : 3m Chamber Data no. : 530  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : VERTICAL  
 Limit : 74DB  
 Env. / Ins. : 23\*C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Emission					Remark
			Reading (dBuV)	Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)		
1 2479.85	28.93	4.70	96.76	95.01	74.00	-21.01	Peak	
2 2483.50	28.93	4.70	61.83	60.08	74.00	13.92	Peak	

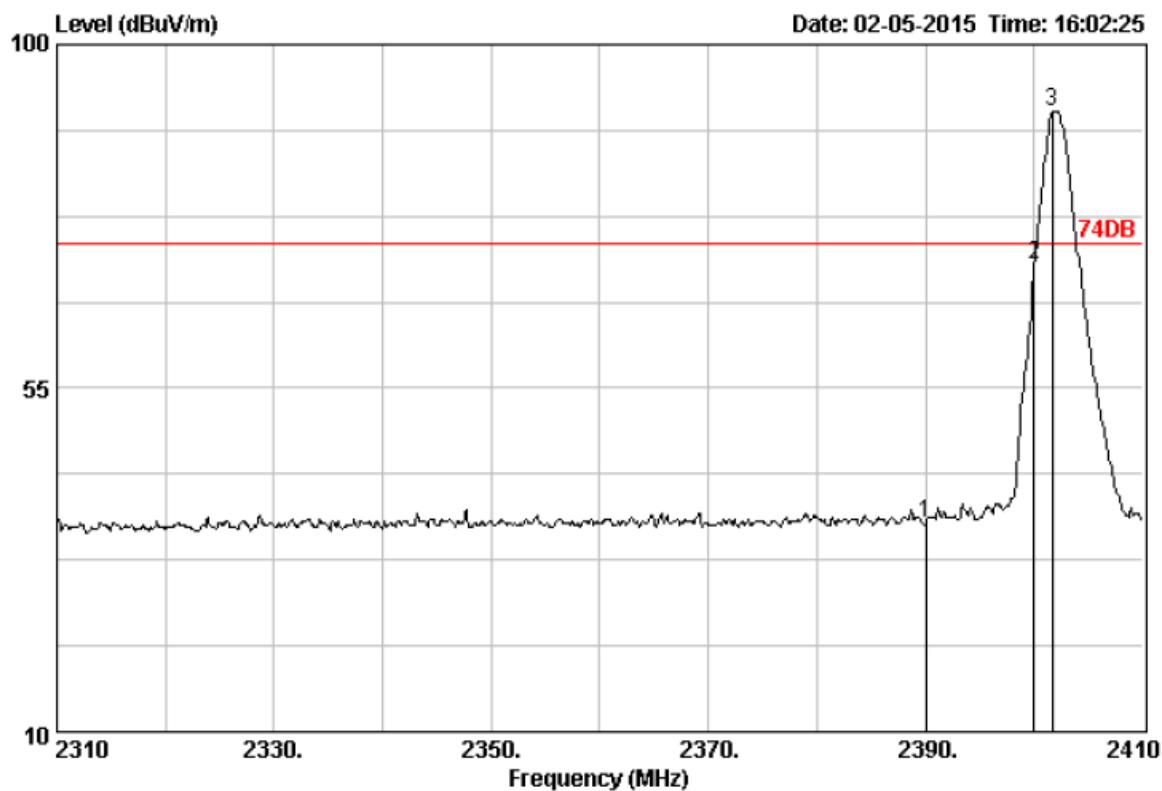
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Vertical
EUT: Handsets	Power: By Battery
Note: Mode 1: Transmit at channel 2480MHz by DH5	



Site no. : 3m Chamber Data no. : 532  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : VERTICAL  
 Limit : 54DB  
 Env. / Ins. : 23\*C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission			
				Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
<hr/>							
1 2479.85	28.93	4.70	81.28	79.53	54.00	-25.53	Average
2 2483.50	28.93	4.70	44.07	42.32	54.00	11.68	Average

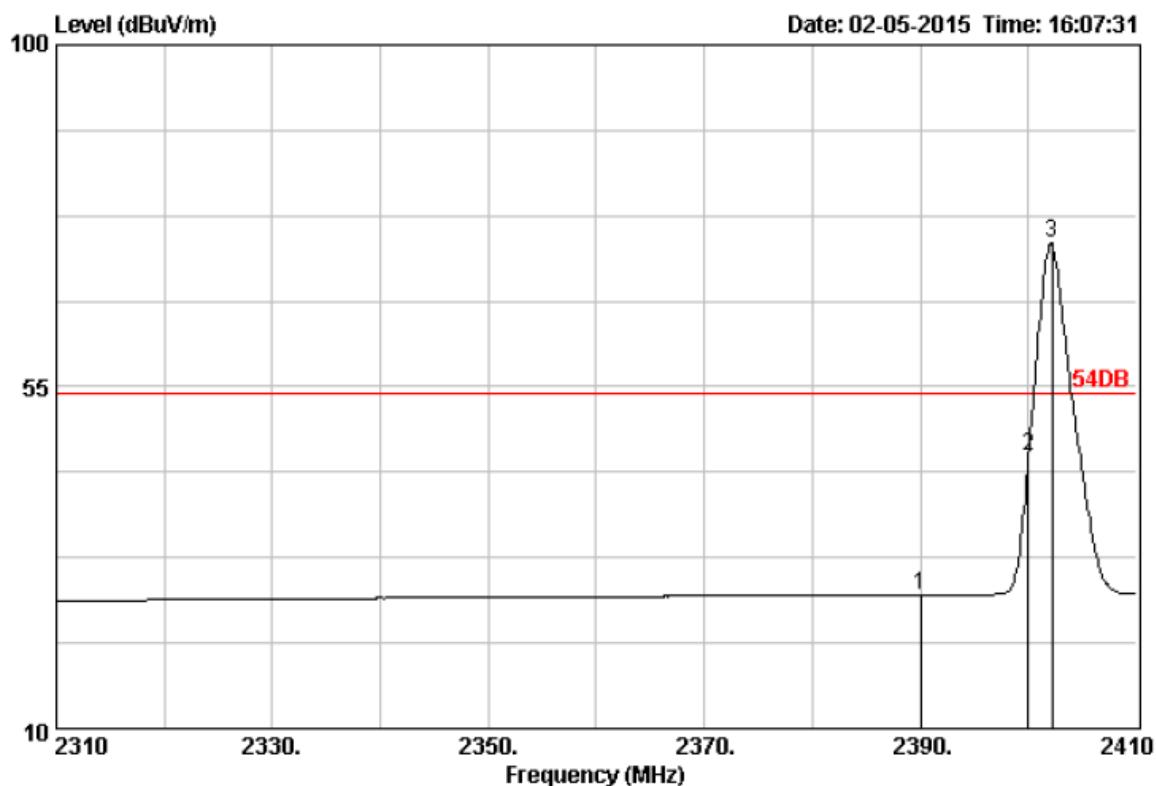
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Horizontal
EUT: Handsets	Power: By Battery
Note: Mode 2: Transmit at channel 2402MHz by 2DH5	



Site no. : 3m Chamber Data no. : 534  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : HORIZONTAL  
 Limit : 74DB  
 Env. / Ins. : 23\*C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission				Remark
				Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)		
1 2390.00	28.78	4.61	39.40	37.43	74.00	36.57	Peak	
2 2400.00	28.78	4.61	73.06	71.09	74.00	2.91	Peak	
3 2401.70	28.78	4.61	93.11	91.14	74.00	-17.14	Peak	

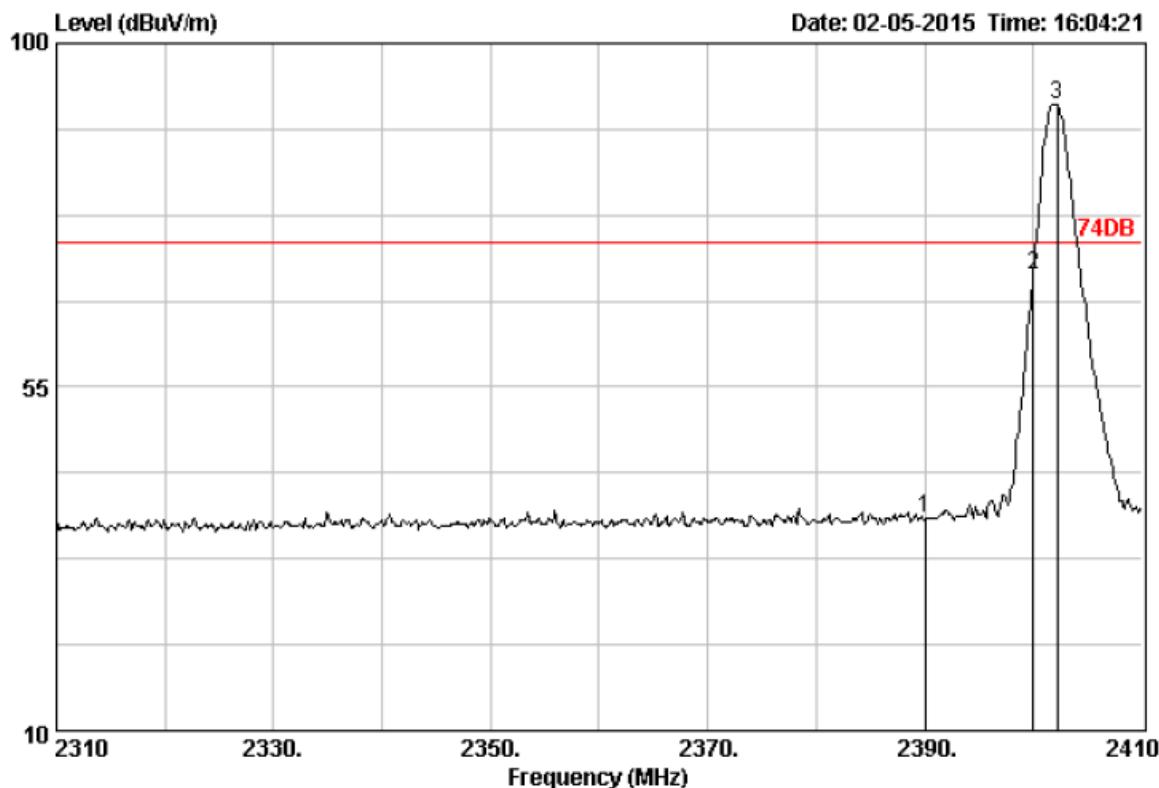
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Horizontal
EUT: Handsets	Power: By Battery
Note: Mode 2: Transmit at channel 2402MHz by 2DH5	



Site no. : 3m Chamber Data no. : 536  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : HORIZONTAL  
 Limit : 54DB  
 Env. / Ins. : 23°C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission			
				Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
<hr/>							
1 2390.00	28.78	4.61	29.56	27.59	54.00	26.41	Average
2 2400.00	28.78	4.61	47.72	45.75	54.00	8.25	Average
3 2402.20	28.78	4.61	75.85	73.88	54.00	-19.88	Average

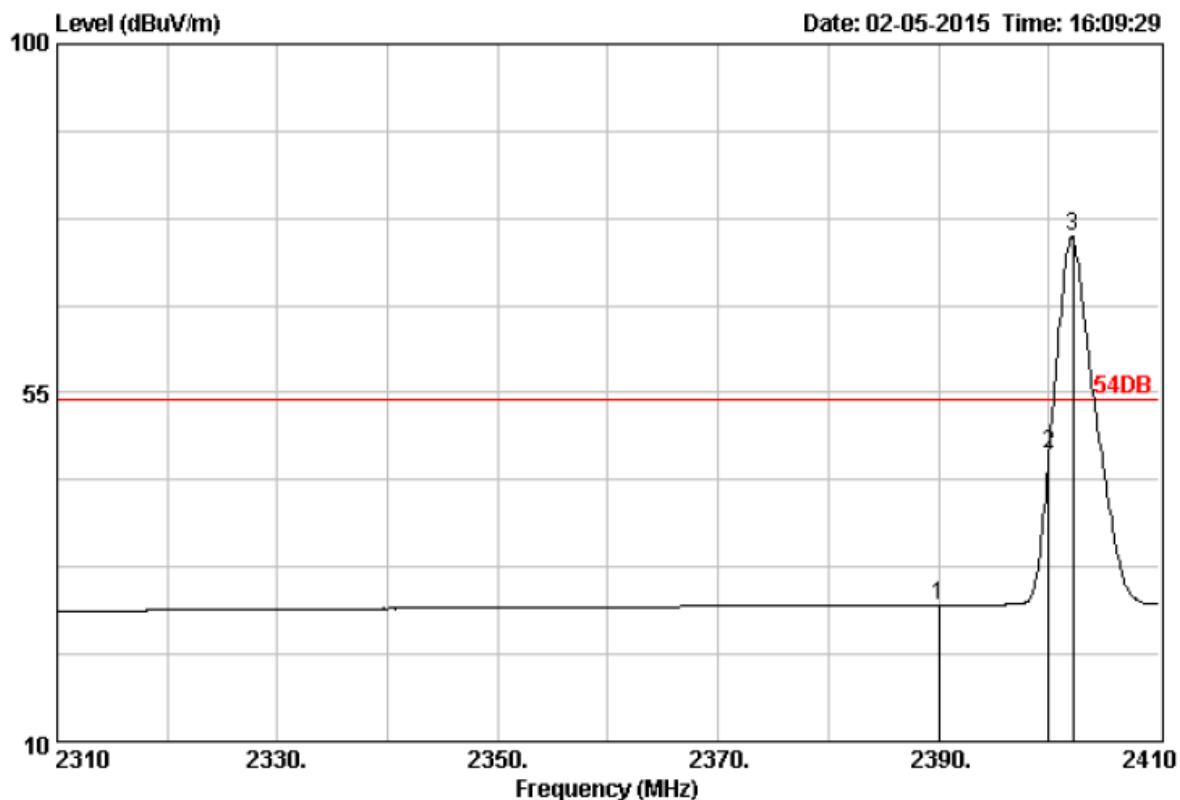
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Vertical
EUT: Handsets	Power: By Battery
Note: Mode 2: Transmit at channel 2402MHz by 2DH5	



Site no. : 3m Chamber Data no. : 535  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : VERTICAL  
 Limit : 74DB  
 Env. / Ins. : 23°C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. (dB)	Cable (dB)	Emission				
			Factor	Loss	Reading (dBuV)	Level (dBuV/m)	Limits (dBuV/m)
<hr/>							
1 2390.00	28.78	4.61	39.71	37.74	74.00	36.26	Peak
2 2400.00	28.78	4.61	71.76	69.79	74.00	4.21	Peak
3 2402.20	28.78	4.61	94.07	92.10	74.00	-18.10	Peak

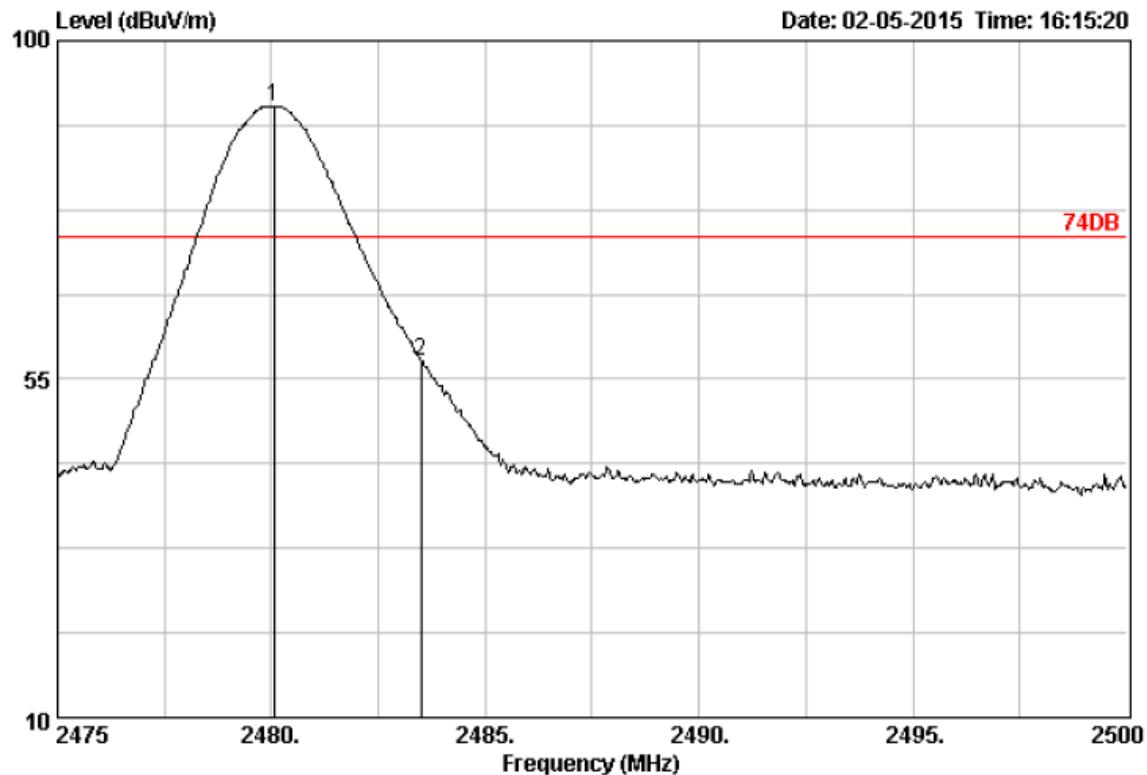
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Vertical
EUT: Handsets	Power: By Battery
Note: Mode 2: Transmit at channel 2402MHz by 2DH5	



Site no. : 3m Chamber Data no. : 537  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : VERTICAL  
 Limit : 54DB  
 Env. / Ins. : 23°C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission			
				Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1 2390.00	28.78	4.61	29.57	27.60	54.00	26.40	Average
2 2400.00	28.78	4.61	49.02	47.05	54.00	6.95	Average
3 2402.20	28.78	4.61	77.09	75.12	54.00	-21.12	Average

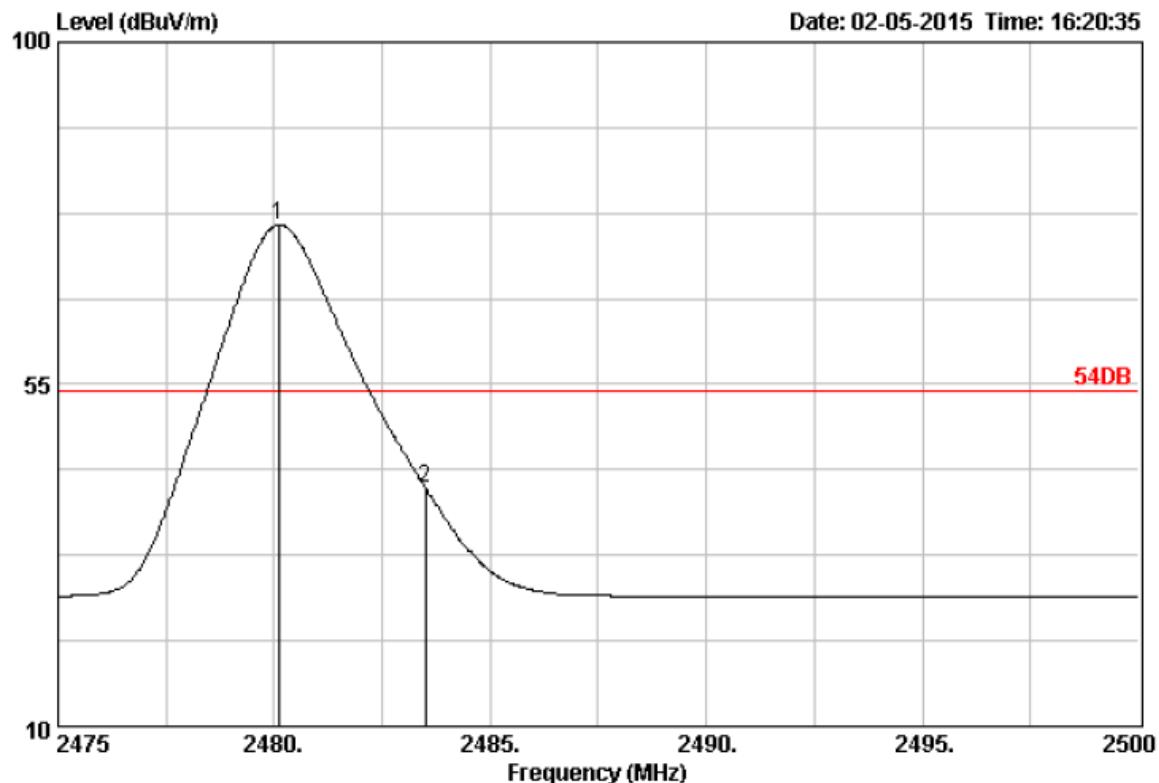
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Horizontal
EUT: Handsets	Power: By Battery
Note: Mode 2: Transmit at channel 2480MHz by 2DH5	



Site no. : 3m Chamber Data no. : 539  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : HORIZONTAL  
 Limit : 74DB  
 Env. / Ins. : 23°C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Emission				
			Reading (dBuV)	Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
<hr/>							
1 2480.05	28.93	4.70	93.03	91.28	74.00	-17.28	Peak
2 2483.50	28.93	4.70	59.24	57.49	74.00	16.51	Peak

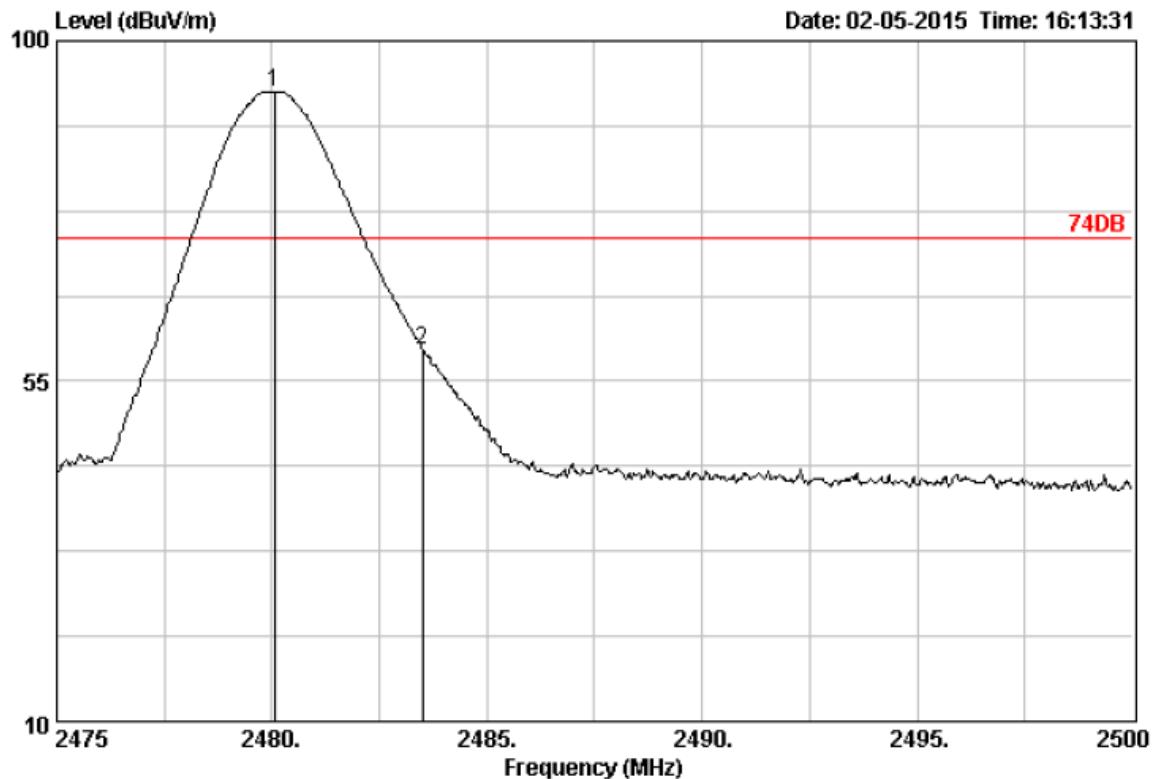
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Horizontal
EUT: Handsets	Power: By Battery
Note: Mode 2: Transmit at channel 2480MHz by 2DH5	



Site no. : 3m Chamber Data no. : 541  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : HORIZONTAL  
 Limit : 54DB  
 Env. / Ins. : 23°C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Emission					Remark
			Reading (dBuV)	Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)		
<hr/>								
1 2480.10	28.93	4.70	77.73	75.98	54.00	-21.98	Average	
2 2483.50	28.93	4.70	43.08	41.33	54.00	12.67	Average	

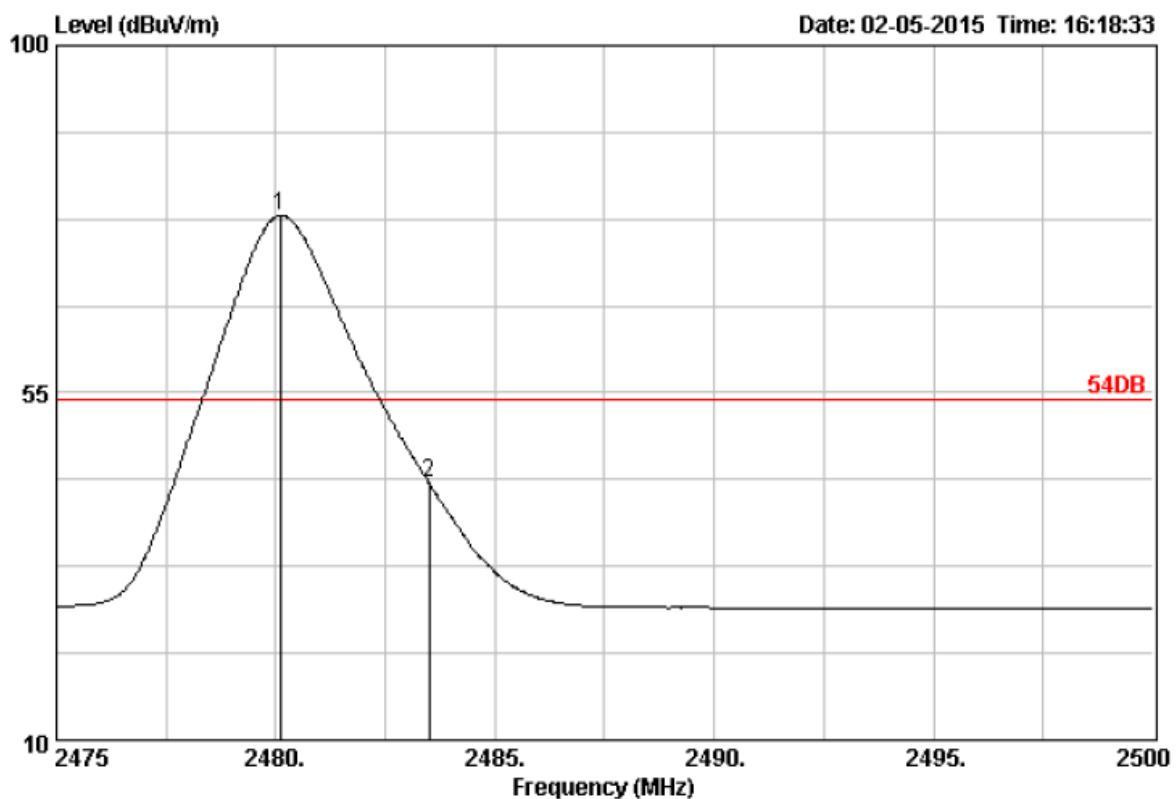
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Vertical
EUT: Handsets	Power: By Battery
Note: Mode 2: Transmit at channel 2480MHz by 2DH5	



Site no. : 3m Chamber Data no. : 538  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : VERTICAL  
 Limit : 74DB  
 Env. / Ins. : 23°C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission			
				Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
<hr/>							
1 2480.05	28.93	4.70	95.08	93.33	74.00	-19.33	Peak
2 2483.50	28.93	4.70	60.98	59.23	74.00	14.77	Peak

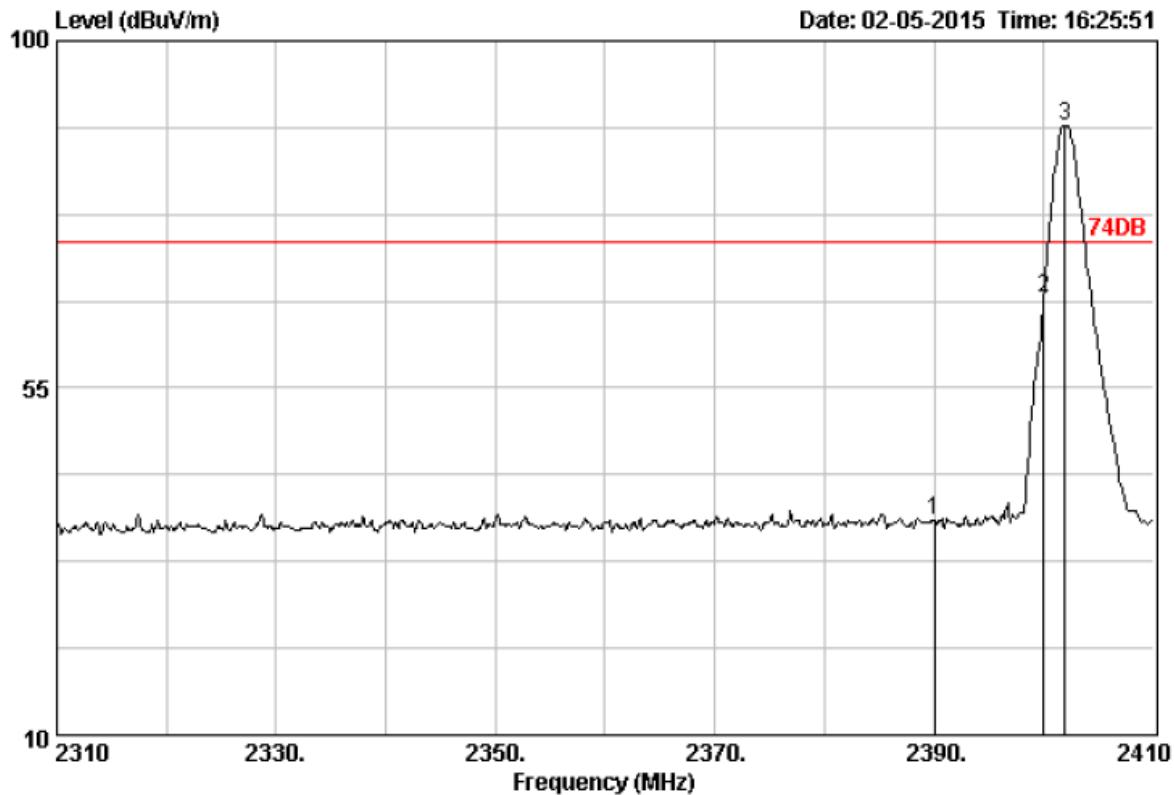
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Vertical
EUT: Handsets	Power: By Battery
Note: Mode 2: Transmit at channel 2480MHz by 2DH5	



Site no. : 3m Chamber Data no. : 540  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : VERTICAL  
 Limit : 54DB  
 Env. / Ins. : 23°C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Emission				
			Reading (dBuV)	Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
<hr/>							
1 2480.10	28.93	4.70	79.75	78.00	54.00	-24.00	Average
2 2483.50	28.93	4.70	45.00	43.25	54.00	10.75	Average

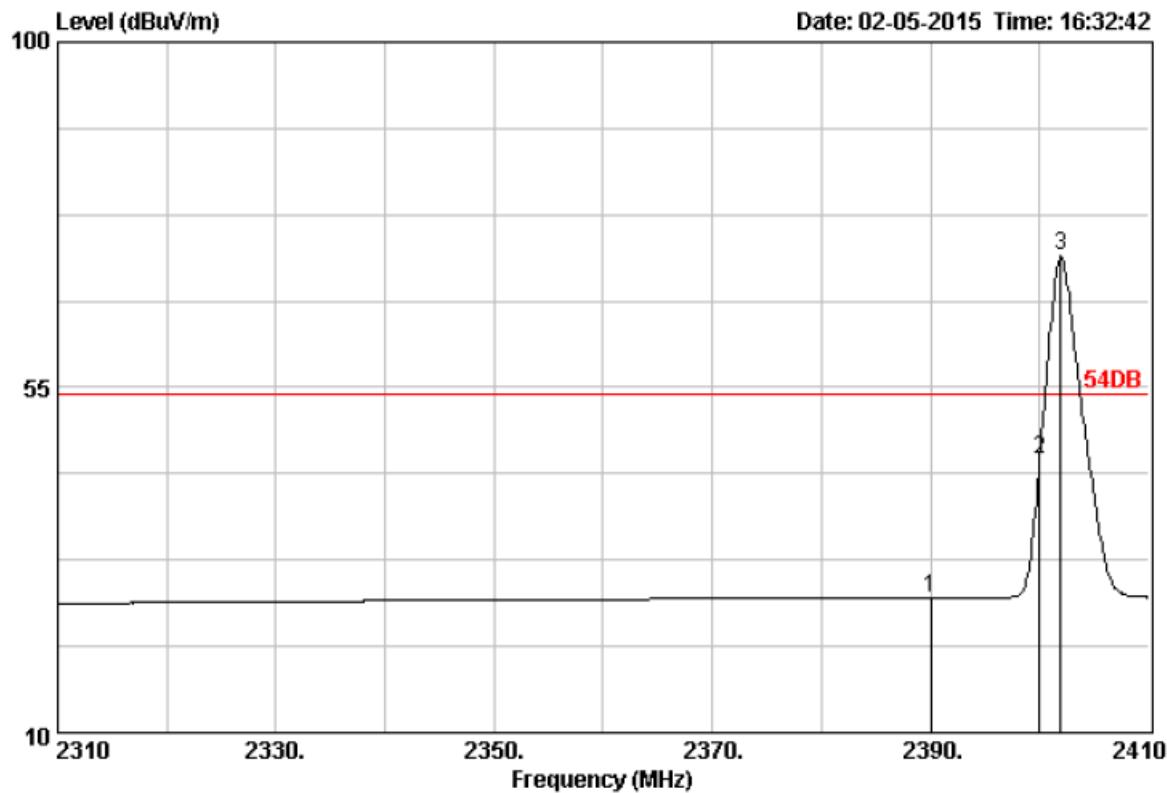
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Horizontal
EUT: Handsets	Power: By Battery
Note: Mode 3: Transmit at channel 2402MHz by 3DH5	



Site no. : 3m Chamber Data no. : 542  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : HORIZONTAL  
 Limit : 74DB  
 Env. / Ins. : 23\*C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission			
				Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1 2390.00	28.78	4.61	39.68	37.71	74.00	36.29	Peak
2 2400.00	28.78	4.61	68.67	66.70	74.00	7.30	Peak
3 2401.90	28.78	4.61	88.95	88.98	74.00	-14.98	Peak

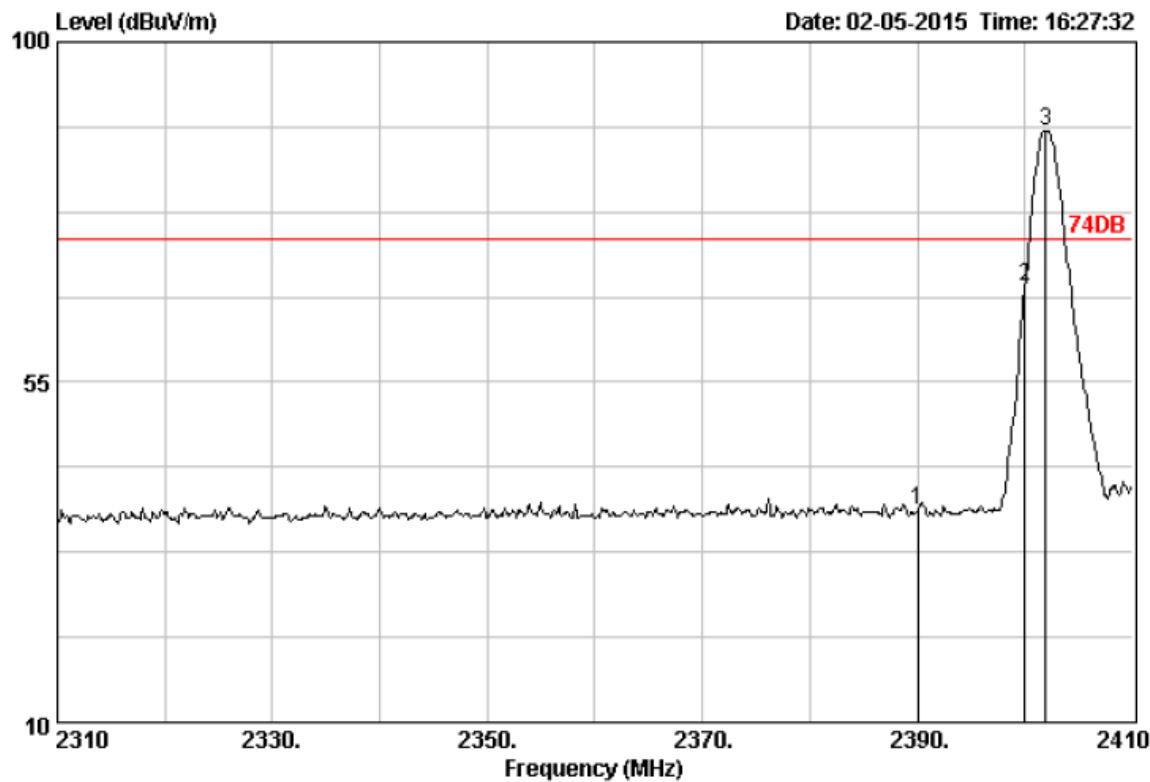
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Horizontal
EUT: Handsets	Power: By Battery
Note: Mode 3: Transmit at channel 2402MHz by 3DH5	



Site no. : 3m Chamber Data no. : 546  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : HORIZONTAL  
 Limit : 54DB  
 Env. / Ins. : 23°C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission			
				Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1 2390.00	28.78	4.61	29.58	27.61	54.00	26.39	Average
2 2400.00	28.78	4.61	47.65	45.68	54.00	8.32	Average
3 2401.90	28.78	4.61	74.04	72.07	54.00	-18.07	Average

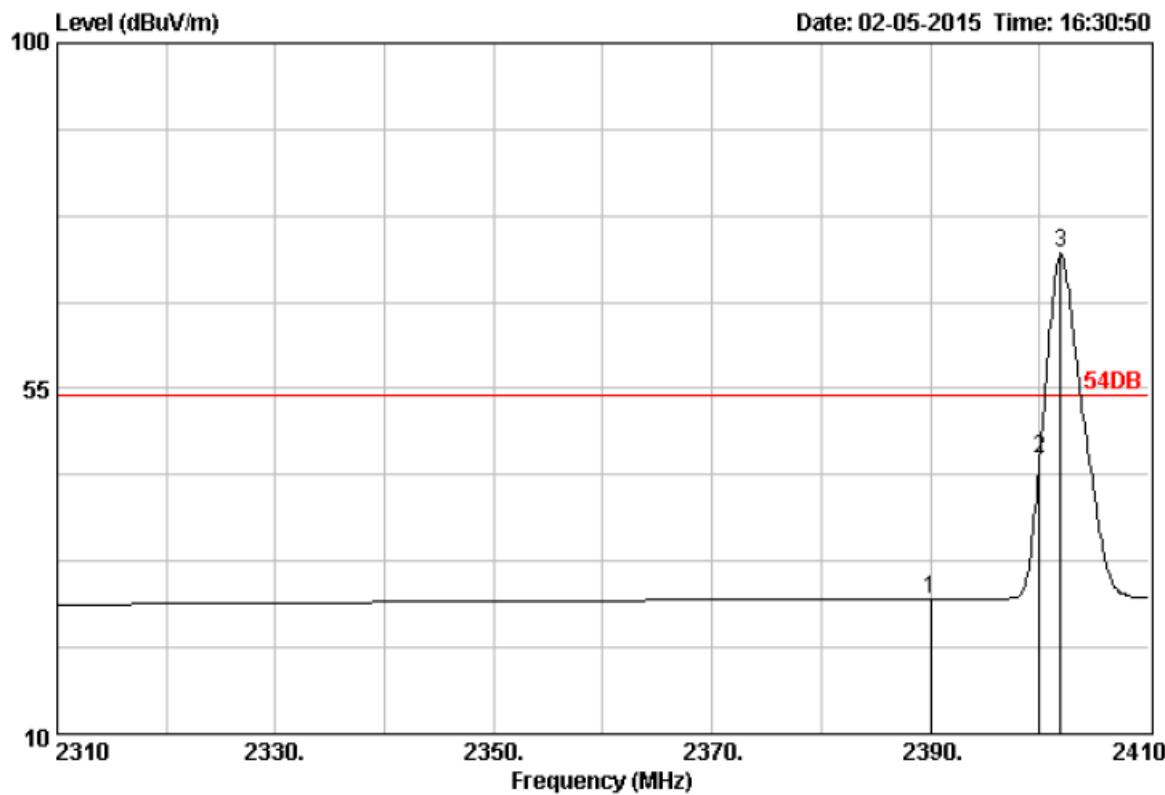
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Vertical
EUT: Handsets	Power: By Battery
Note: Mode 3: Transmit at channel 2402MHz by 3DH5	



Site no. : 3m Chamber Data no. : 544  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : VERTICAL  
 Limit : 74DB  
 Env. / Ins. : 23\*C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Emission				
			Reading (dBuV)	Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
<hr/>							
1 2390.00	28.78	4.61	39.95	37.98	74.00	36.02	Peak
2 2400.00	28.78	4.61	69.73	67.76	74.00	6.24	Peak
3 2401.90	28.78	4.61	90.25	88.28	74.00	-14.28	Peak

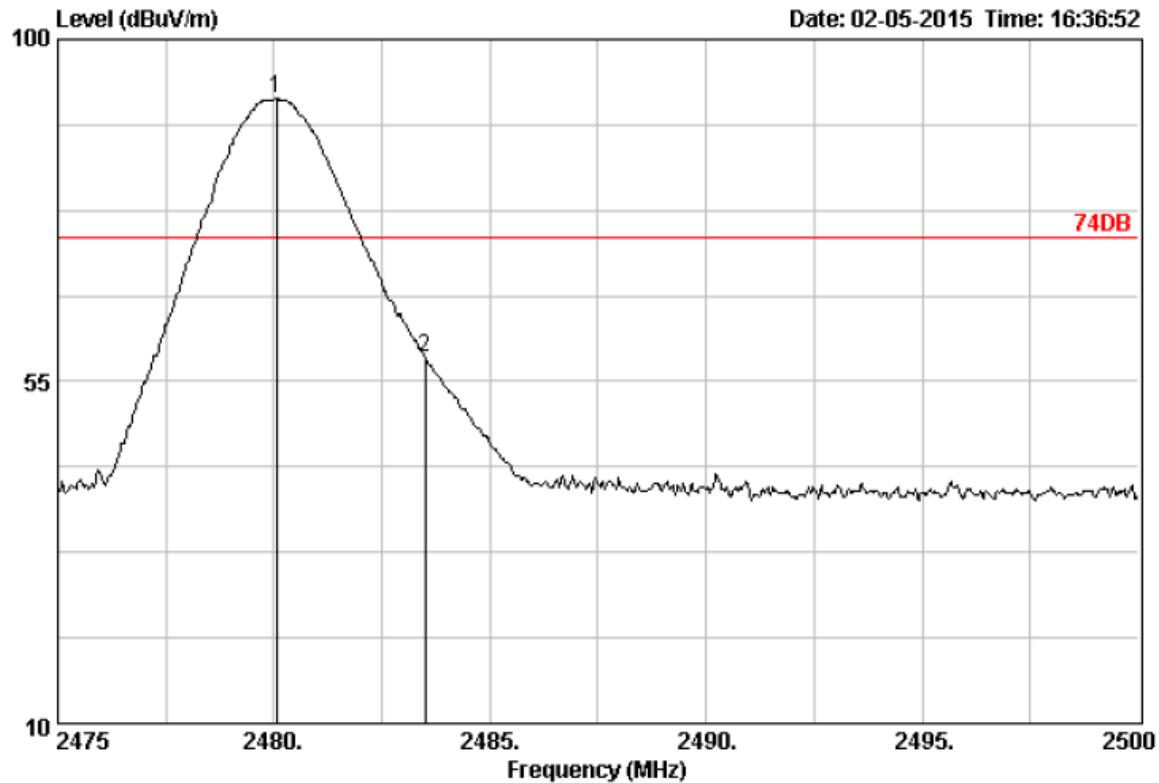
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Vertical
EUT: Handsets	Power: By Battery
Note: Mode 3: Transmit at channel 2402MHz by 3DH5	



Site no. : 3m Chamber Data no. : 545  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : VERTICAL  
 Limit : 54DB  
 Env. / Ins. : 23°C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Emission				
			Reading (dBuV)	Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
<hr/>							
1 2390.00	28.78	4.61	29.58	27.61	54.00	26.39	Average
2 2400.00	28.78	4.61	47.87	45.90	54.00	8.10	Average
3 2401.90	28.78	4.61	74.59	72.62	54.00	-18.62	Average

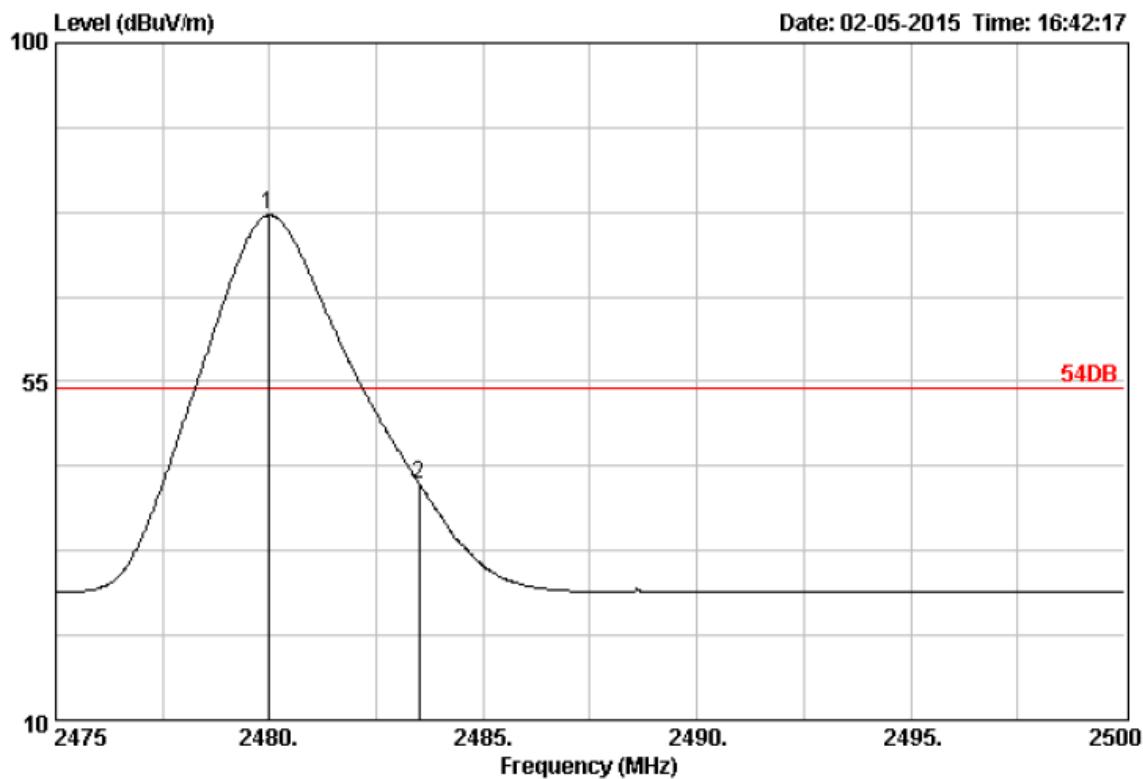
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Horizontal
EUT: Handsets	Power: By Battery
Note: Mode 3: Transmit at channel 2480MHz by 3DH5	



Site no. : 3m Chamber Data no. : 548  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : HORIZONTAL  
 Limit : 74DB  
 Env. / Ins. : 23°C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission			
				Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1 2480.05	28.93	4.70	93.87	92.12	74.00	-18.12	Peak
2 2483.50	28.93	4.70	59.94	58.19	74.00	15.81	Peak

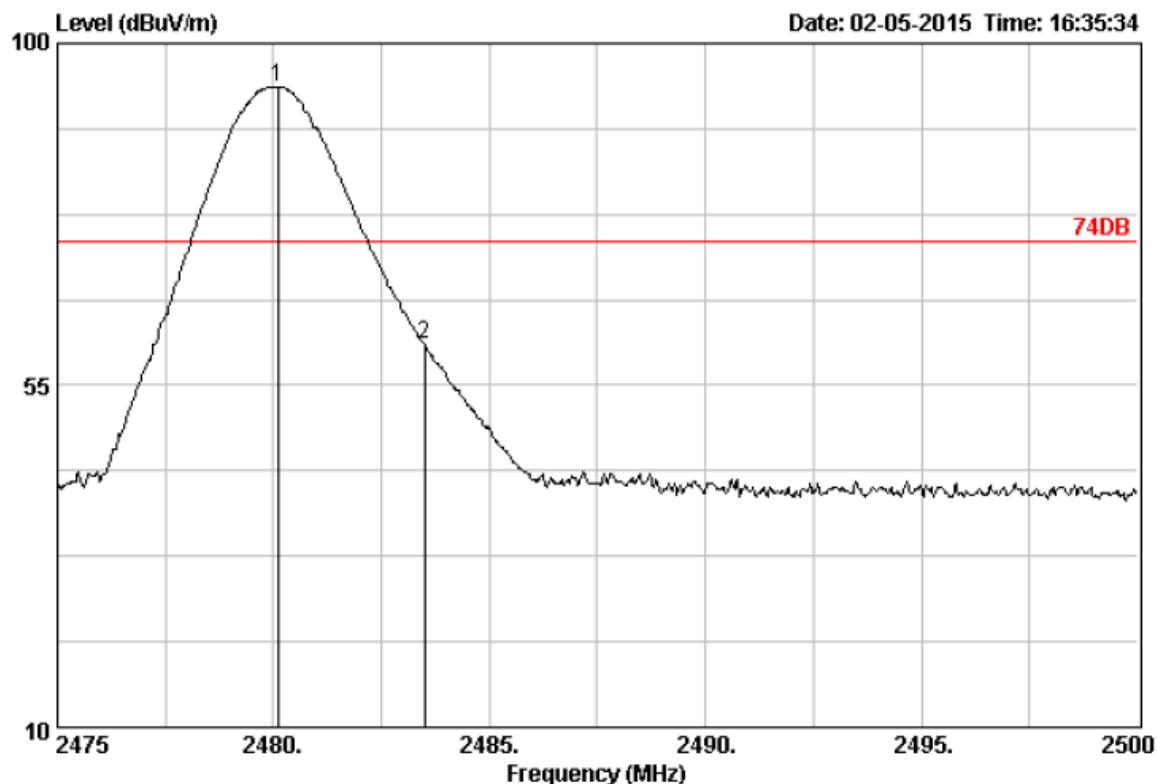
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Horizontal
EUT: Handsets	Power: By Battery
Note: Mode 3: Transmit at channel 2480MHz by 3DH5	



Site no. : 3m Chamber Data no. : 550  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : HORIZONTAL  
 Limit : 54DB  
 Env. / Ins. : 23\*C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission			Remark
				Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	
1 2479.98	28.93	4.70	78.88	77.13	54.00	-23.13	Average
2 2483.50	28.93	4.70	43.12	41.37	54.00	12.63	Average

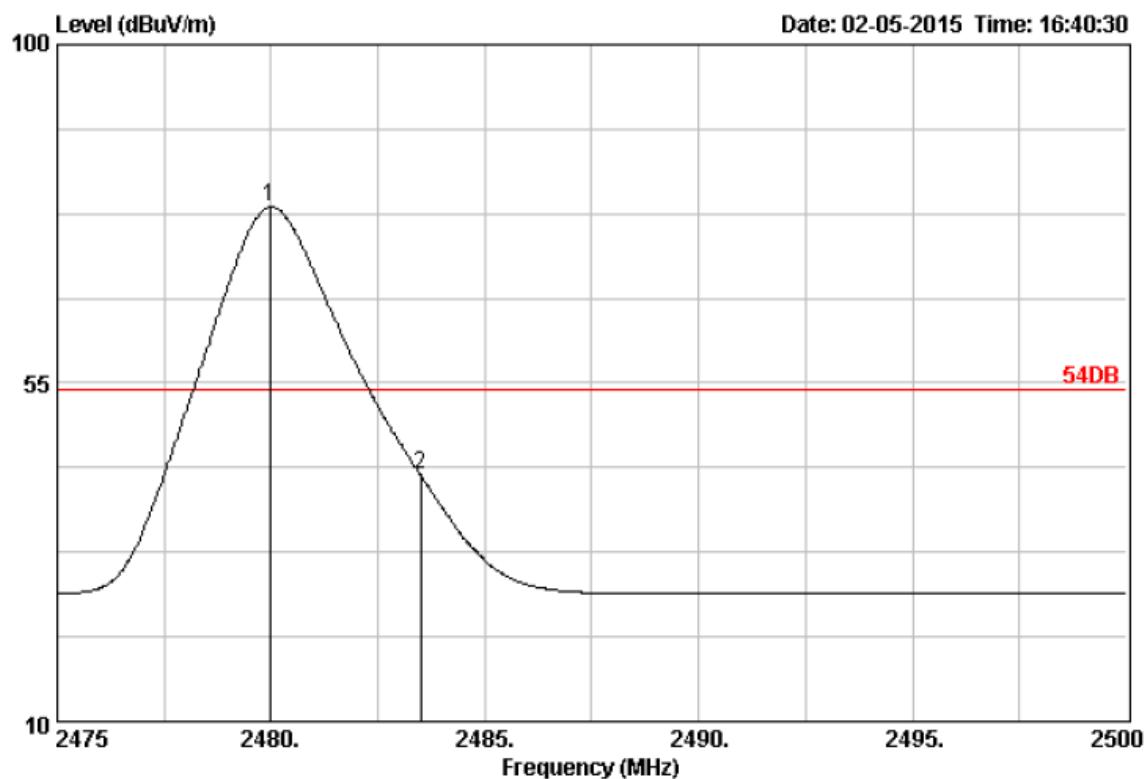
Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Vertical
EUT: Handsets	Power: By Battery
Note: Mode 3: Transmit at channel 2480MHz by 3DH5	



Site no. : 3m Chamber Data no. : 547  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : VERTICAL  
 Limit : 74DB  
 Env. / Ins. : 23\*C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission			Remark
				Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	
1 2480.10	28.93	4.70	95.97	94.22	74.00	-20.22	Peak
2 2483.50	28.93	4.70	62.14	60.39	74.00	13.61	Peak

Engineer: Nice	
Site: AC5	Time: 2015/02/05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_DRH-118(1-18GHz)	Polarity: Vertical
EUT: Handsets	Power: By Battery
Note: Mode 3: Transmit at channel 2480MHz by 3DH5	



Site no. : 3m Chamber Data no. : 549  
 Dis. / Ant. : 3m DRH-118 Ant. pol. : VERTICAL  
 Limit : 54DB  
 Env. / Ins. : 23°C/54%  
 Engineer :  
 EUT :  
 Power :  
 M/N :  
 Test Mode :

Freq. (MHz)	Ant. Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission			
				Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
<hr/>							
1 2479.98	28.93	4.70	80.18	78.43	54.00	-24.43	Average
2 2483.50	28.93	4.70	44.48	42.73	54.00	11.27	Average

## 4.6. Frequency Separation

### TEST CONFIGURATION



### TEST PROCEDURE

According to ANSI C63.10: 2009.

The EUT must have its hopping function enabled.

Use the following spectrum analyzer settings:

Span = wide enough to capture the peaks of two adjacent channels

Resolution (or IF) Bandwidth (RBW)  $\geq 1\%$  of the span

Video (or Average) Bandwidth VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

### LIMIT

According to 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the  $2/3 \times 20$ dB bandwidth of the hopping channel, whichever is greater.

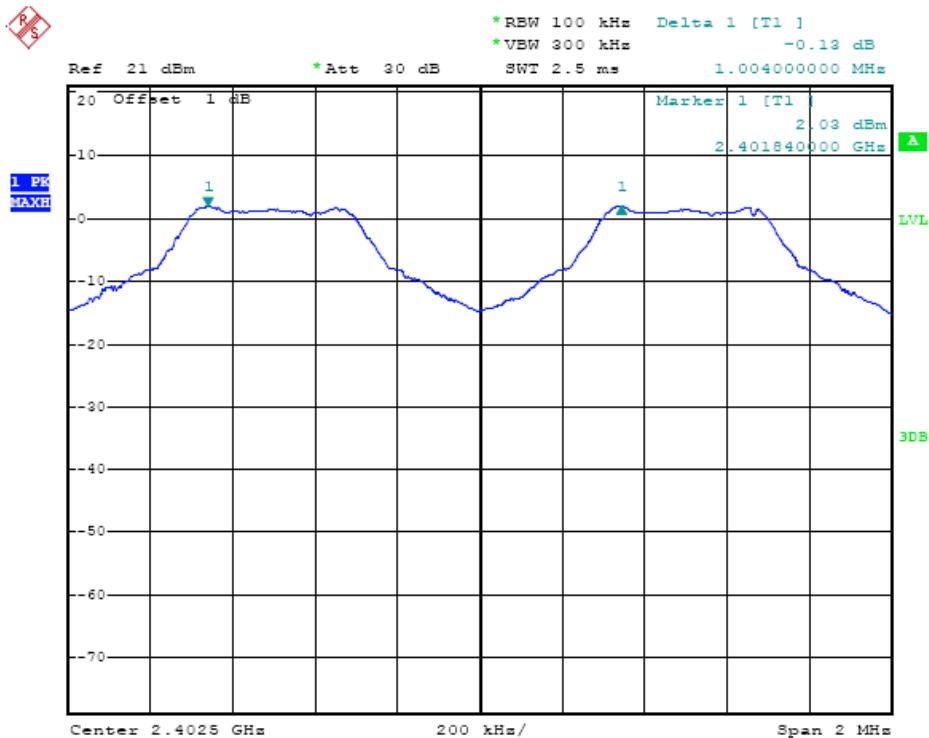
### TEST RESULTS

#### DH5 Mode:

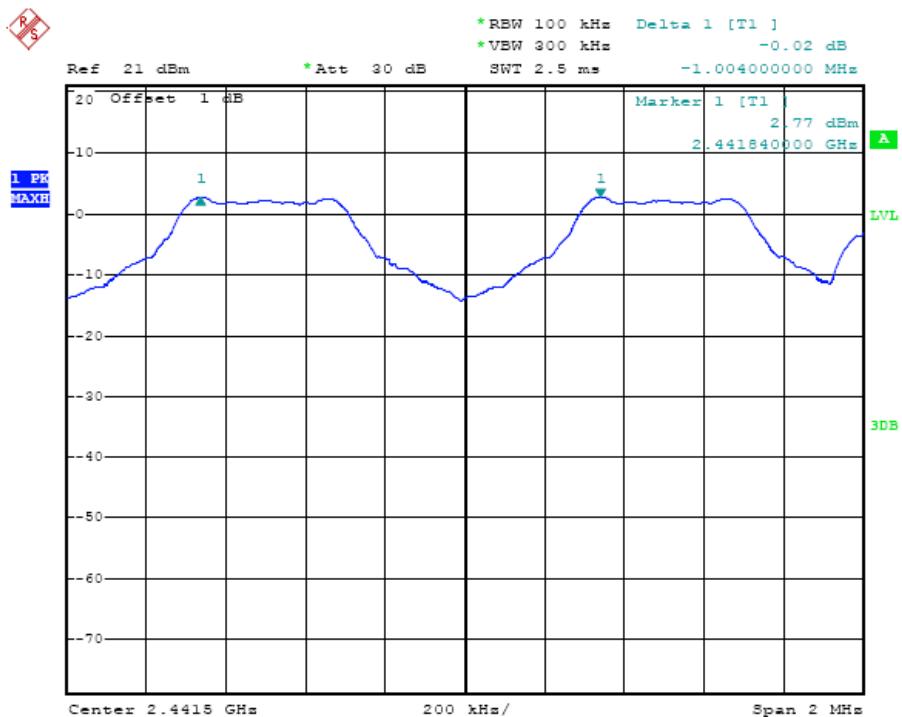
Channel	Channel Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
Low Channel	2402	1.004	25KHz or $2/3 \times 20$ dB bandwidth	Pass
Adjacency Channel	2403			
Mid Channel	2441	1.004	25KHz or $2/3 \times 20$ dB bandwidth	Pass
Adjacency Channel	2442			
High Channel	2480	1.004	25KHz or $2/3 \times 20$ dB bandwidth	Pass
Adjacency Channel	2479			

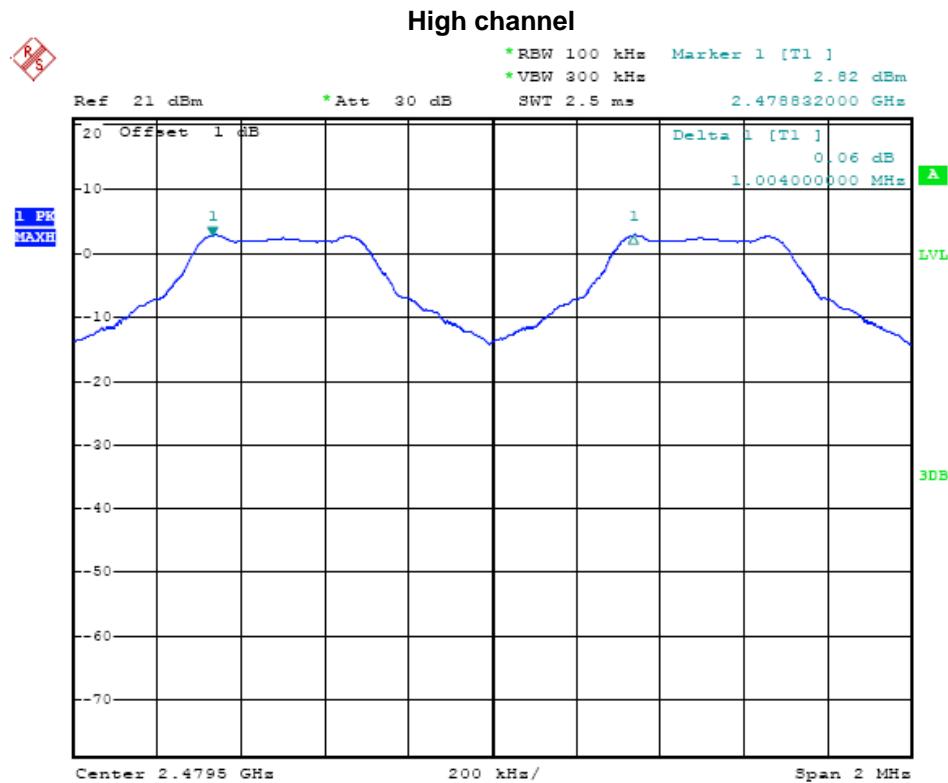
### Photos of Frequency separation Measurement

#### Low channel



#### Middle channel



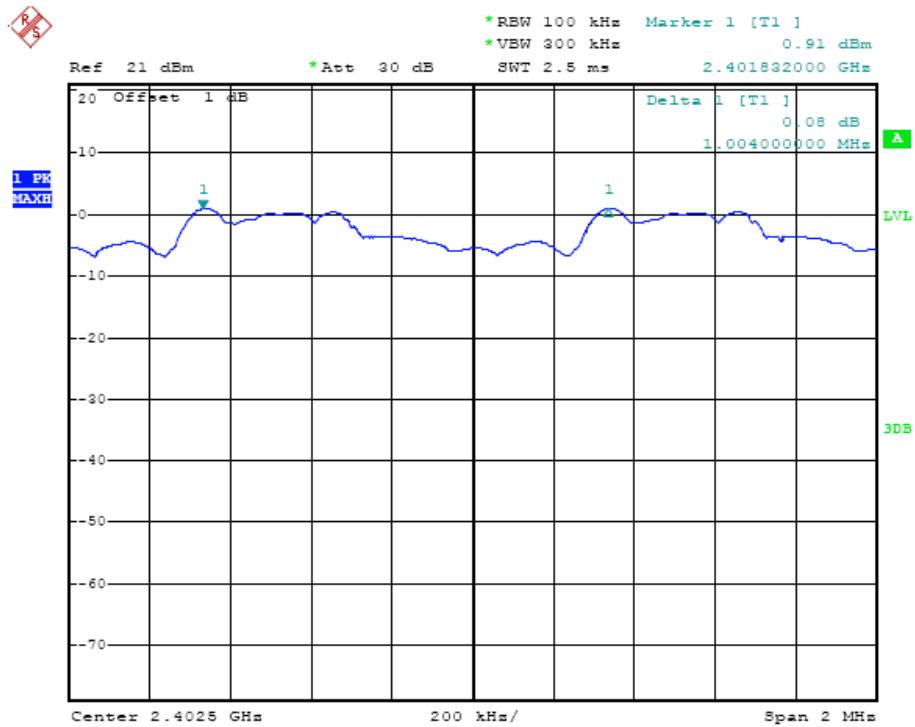


#### 2DH5 Mode:

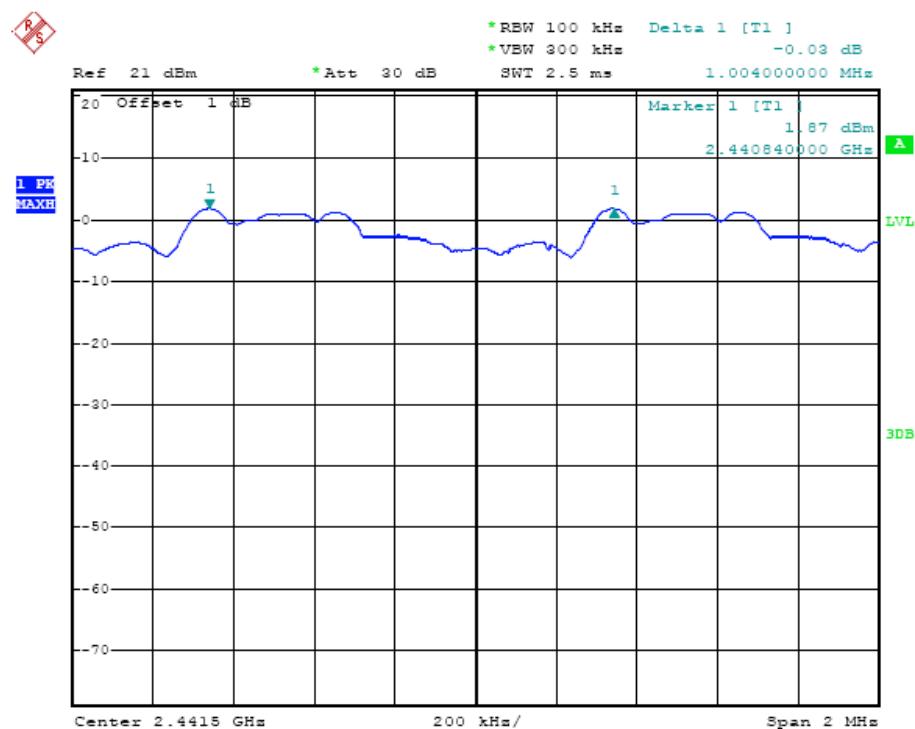
Channel	Channel Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
Low Channel	2402			
Adjacency Channel	2403	1.004	25KHz or 2/3*20dB bandwidth	Pass
Mid Channel	2441			
Adjacency Channel	2442	1.004	25KHz or 2/3*20dB bandwidth	Pass
High Channel	2480			
Adjacency Channel	2479	1.004	25KHz or 2/3*20dB bandwidth	Pass

### Photos of Frequency separation Measurement

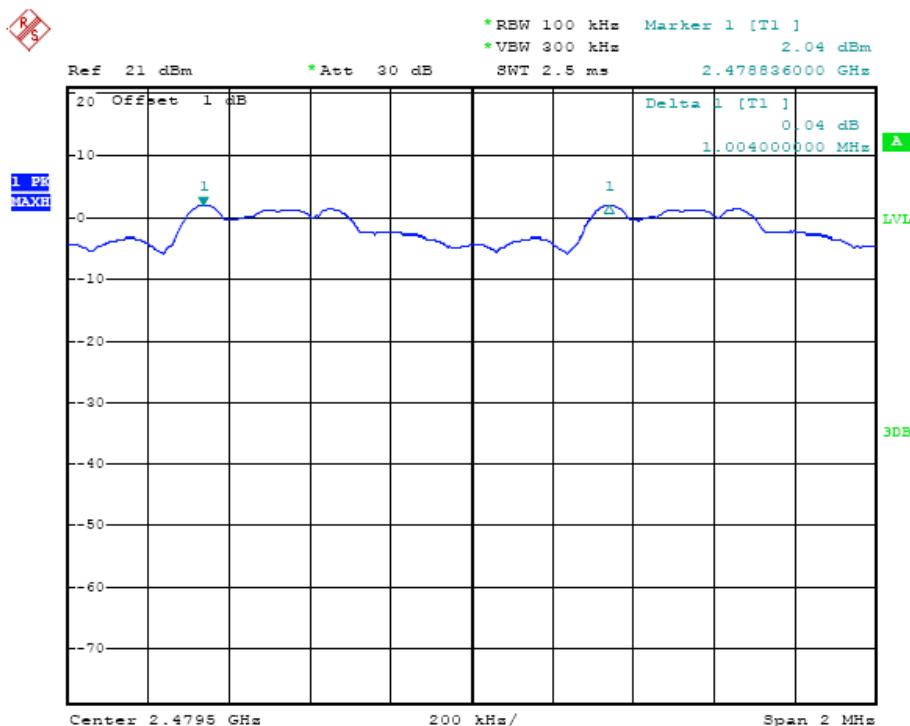
#### Low channel



#### Middle channel



## High channel

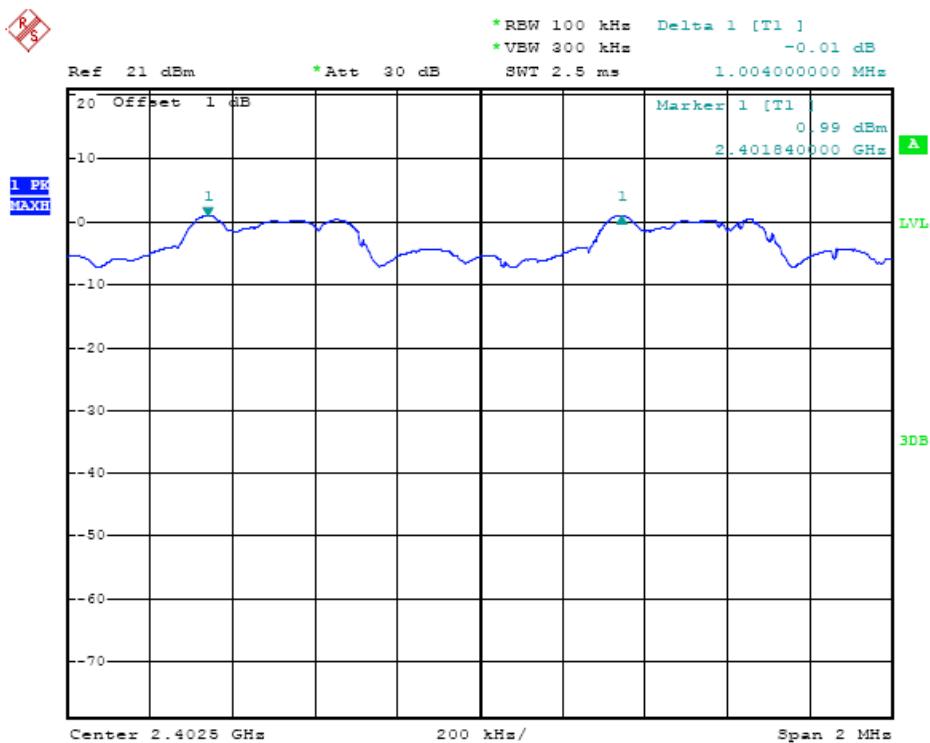


## 3DH5 Mode:

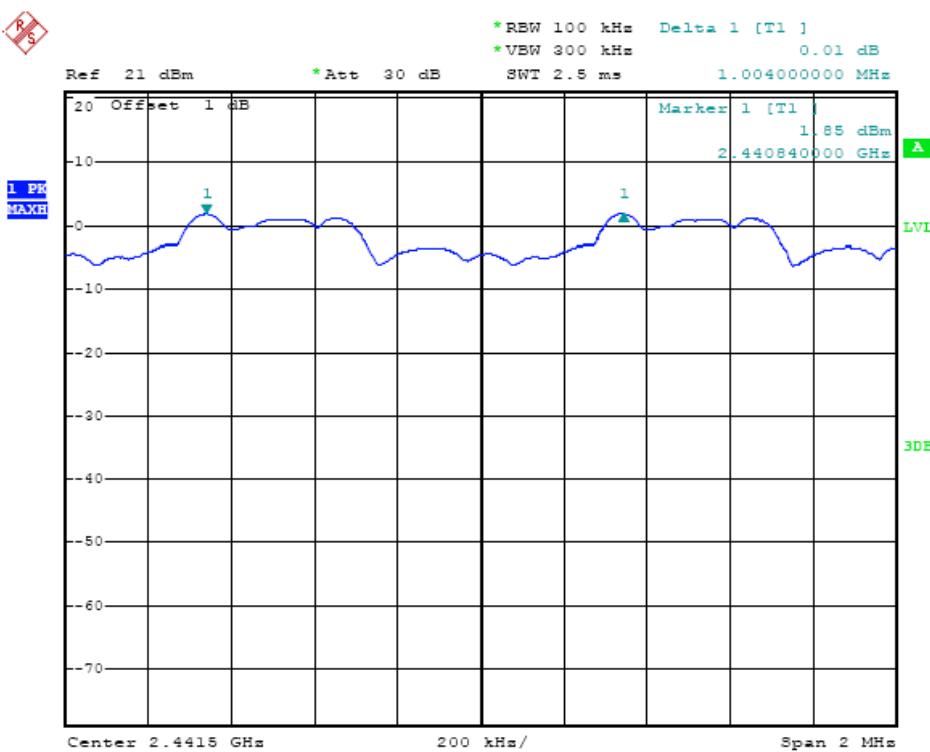
Channel	Channel Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
Low Channel	2402	1.004	25KHz or 2/3*20dB bandwidth	Pass
Adjacency Channel	2403			
Mid Channel	2441	1.004	25KHz or 2/3*20dB bandwidth	Pass
Adjacency Channel	2442			
High Channel	2480	1.004	25KHz or 2/3*20dB bandwidth	Pass
Adjacency Channel	2479			

### Photos of Frequency separation Measurement

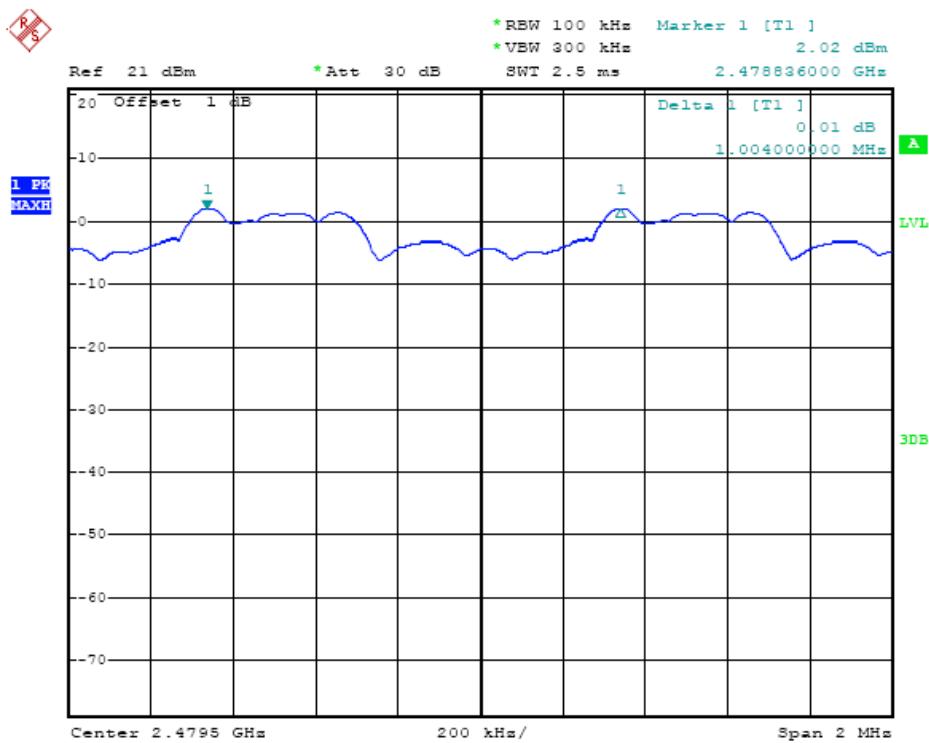
#### Low channel



#### Middle channel

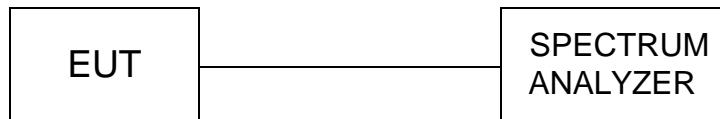


## High channel



## 4.7. Number of hopping frequency

### TEST CONFIGURATION



### TEST PROCEDURE

According to ANSI C63.10: 2009.

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

Allow the trace to stabilize. It may prove necessary to bread the span up to sections, in order to clearly show all of the hopping frequencies.

### LIMIT

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

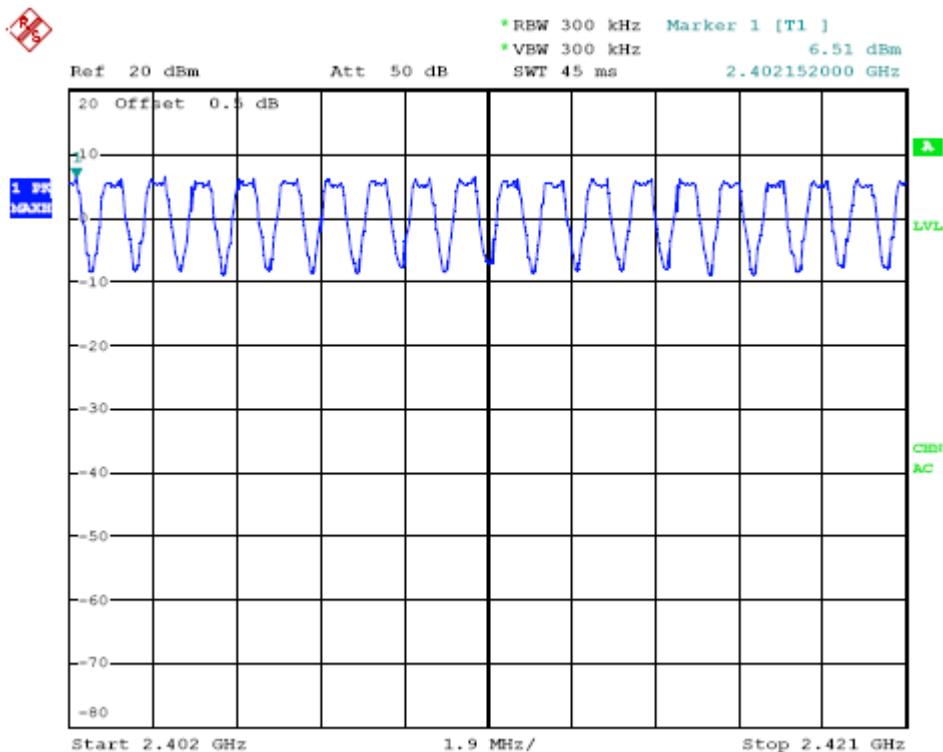
### TEST RESULTS

DH5 Mode:

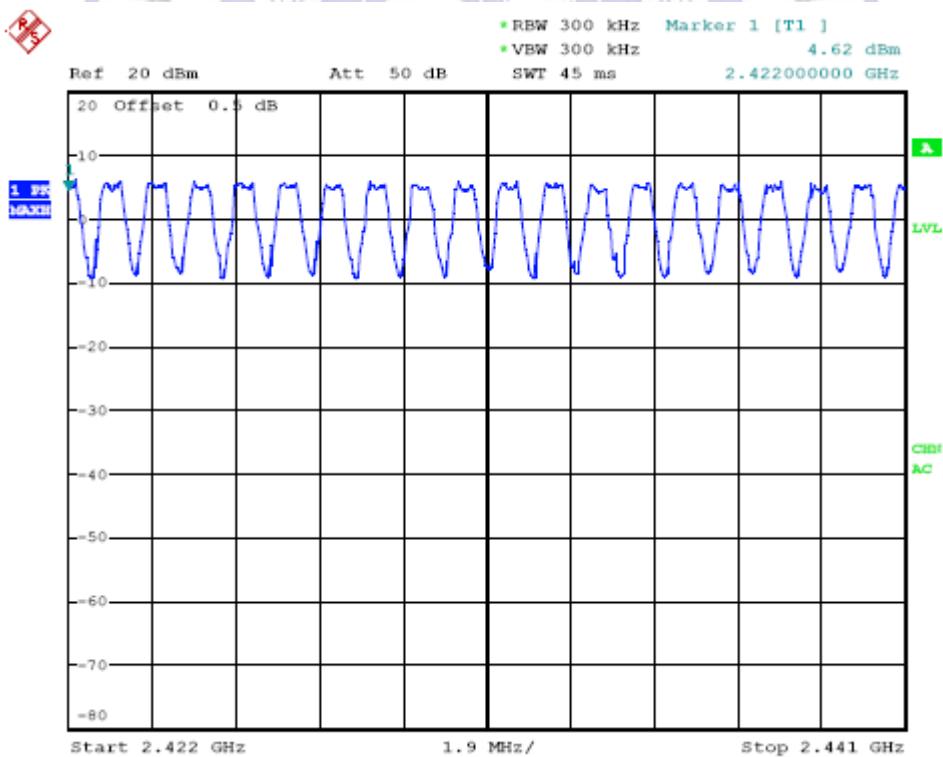
Hopping Channel Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	$\geq 15$

Photos of Number of hopping channel Measurement

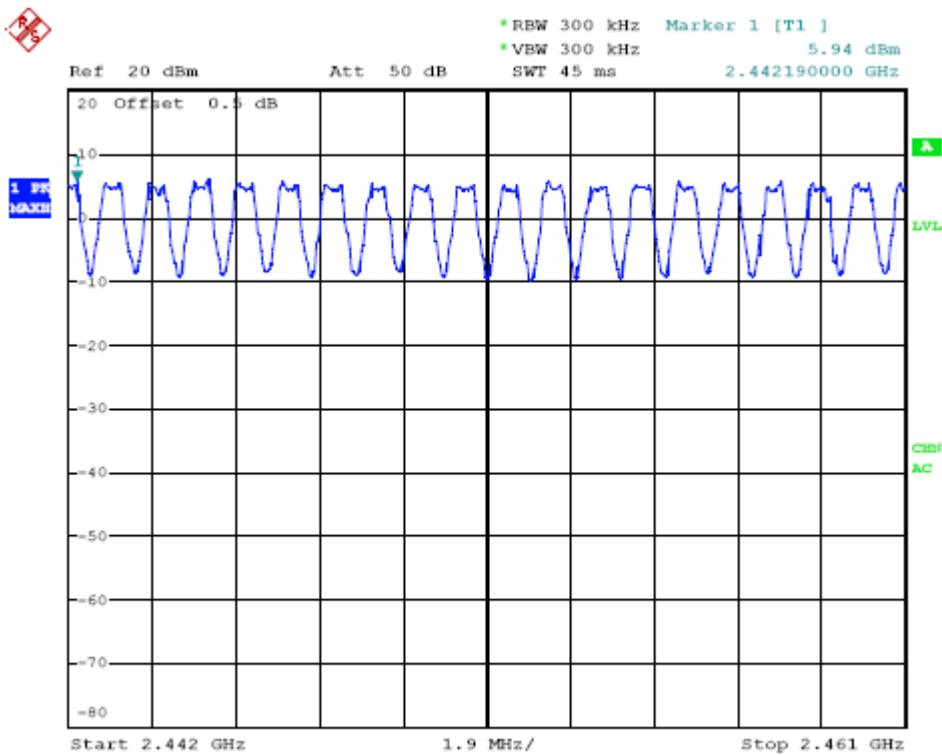
2402-2421MHz



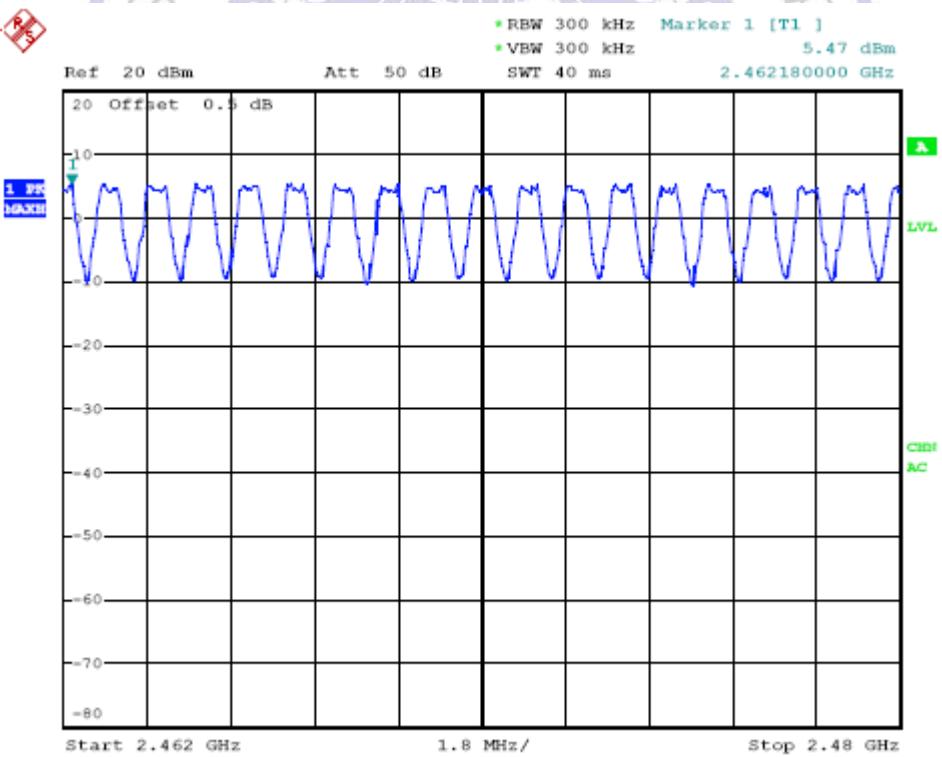
2422-2441MHz



## 2442-2461MHz

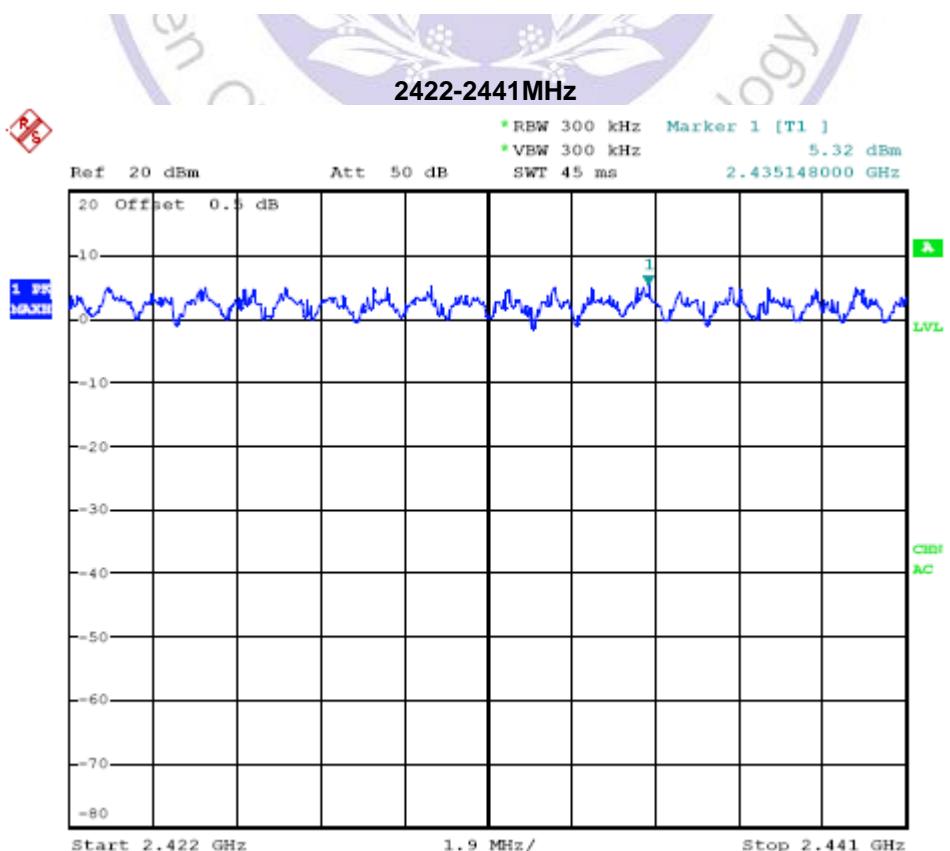
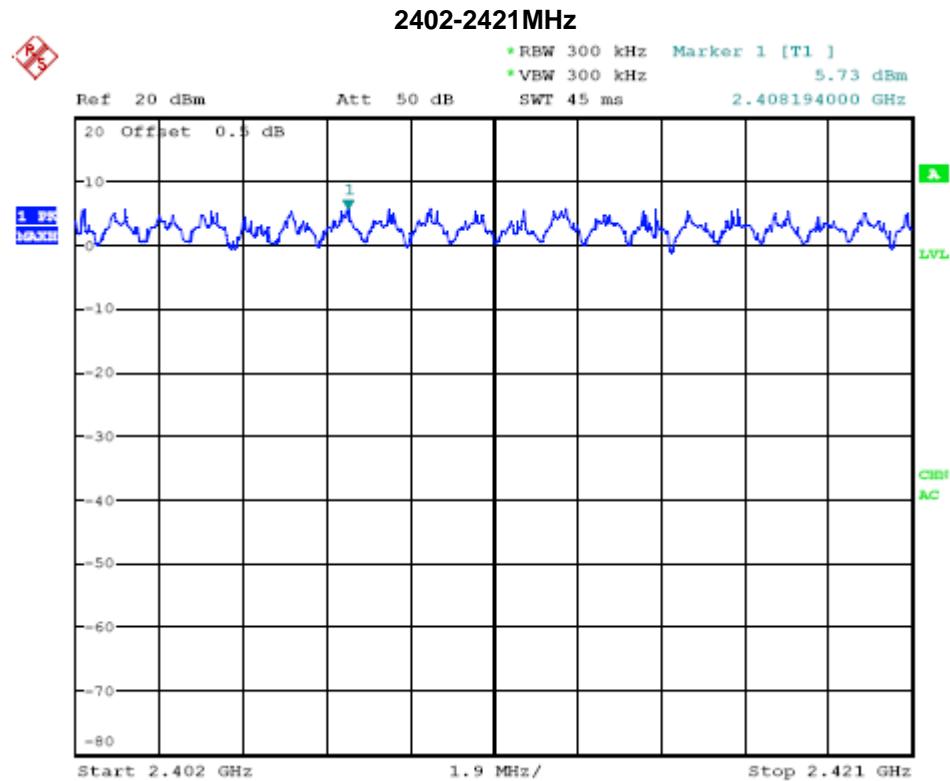


## 2462-2480MHz

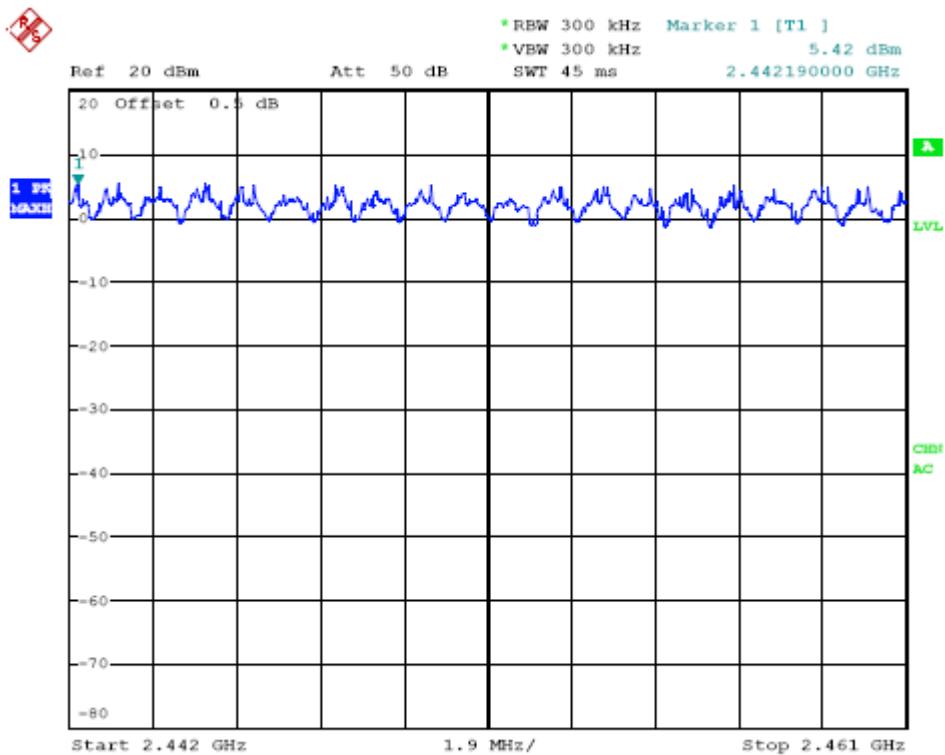


## 2DH5 Mode:

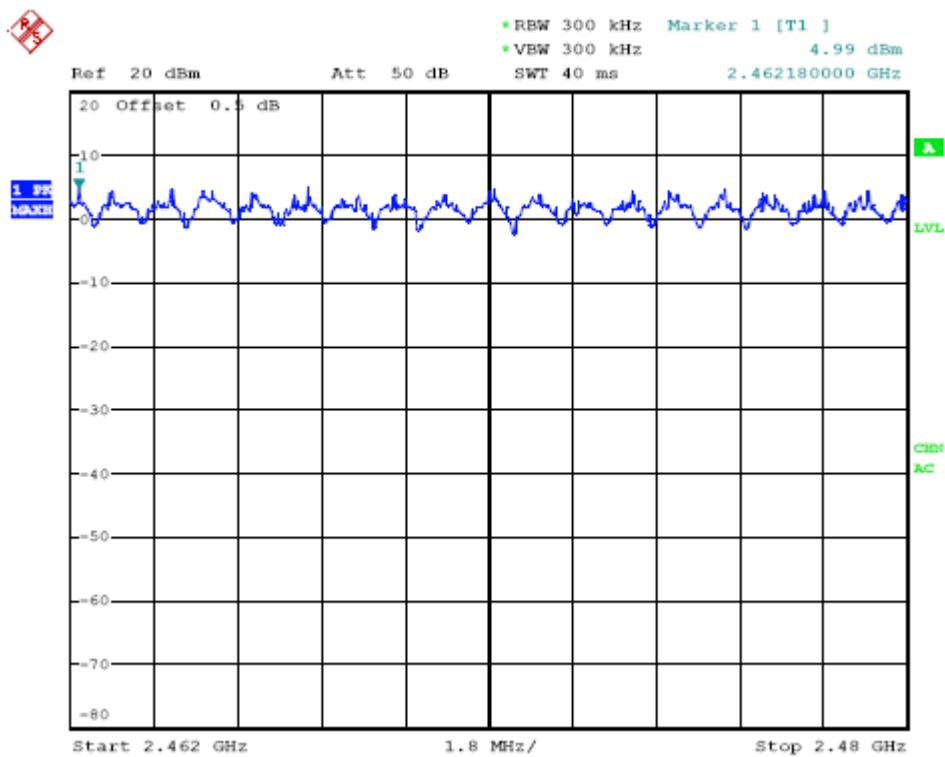
Hopping Channel Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	≥15

Photos of Number of hopping channel Measurement

## 2442-2461MHz



## 2462-2480MHz

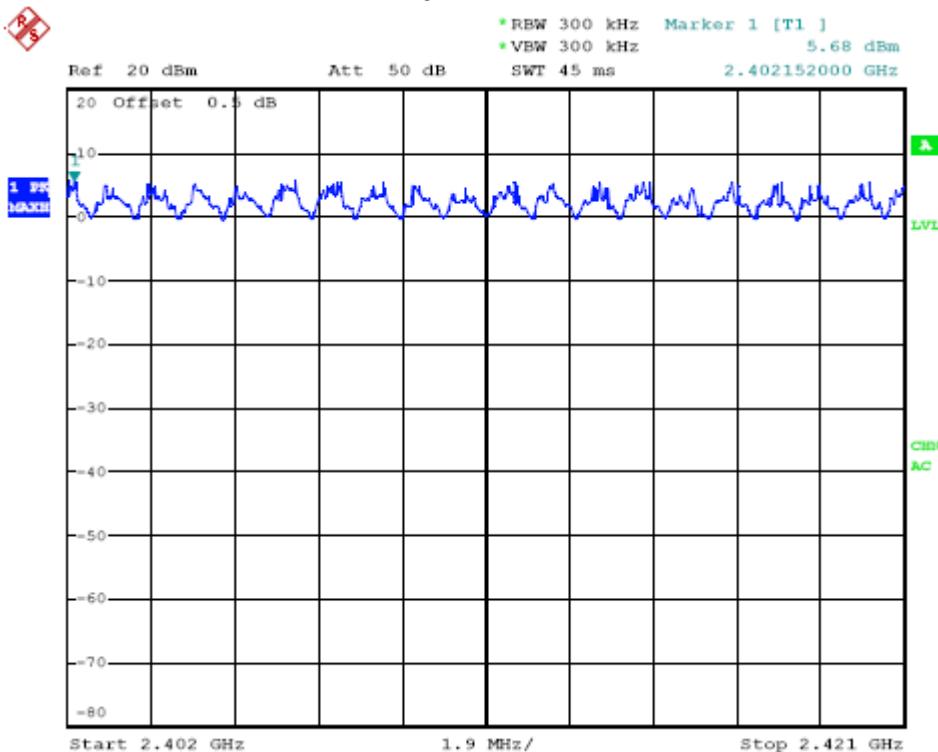


## 3DH5 Mode:

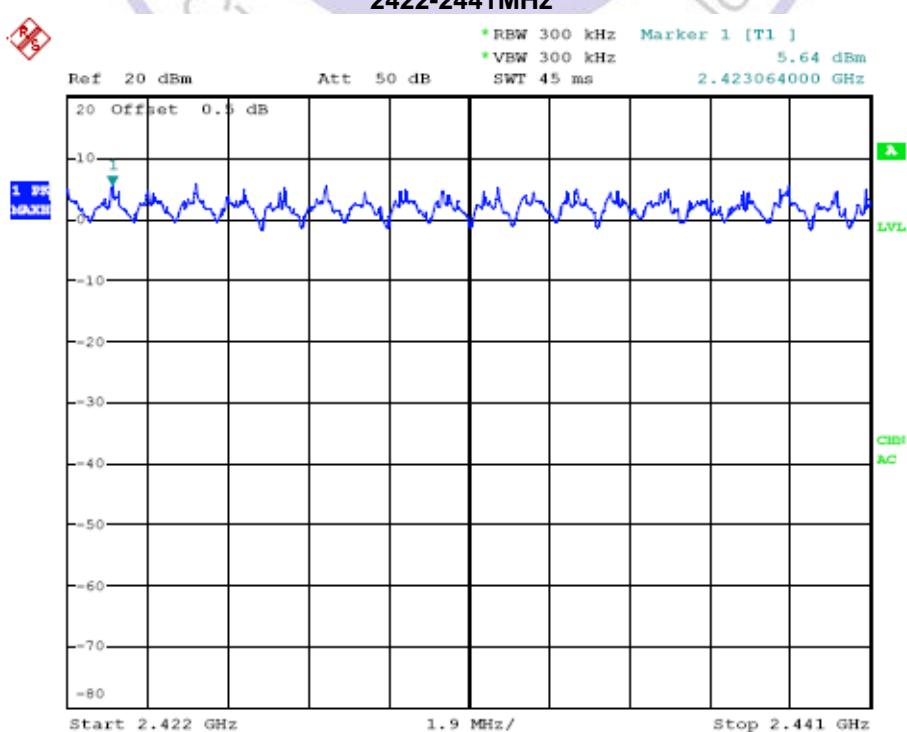
Hopping Channel Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	$\geq 15$

Photos of Number of hopping channel Measurement

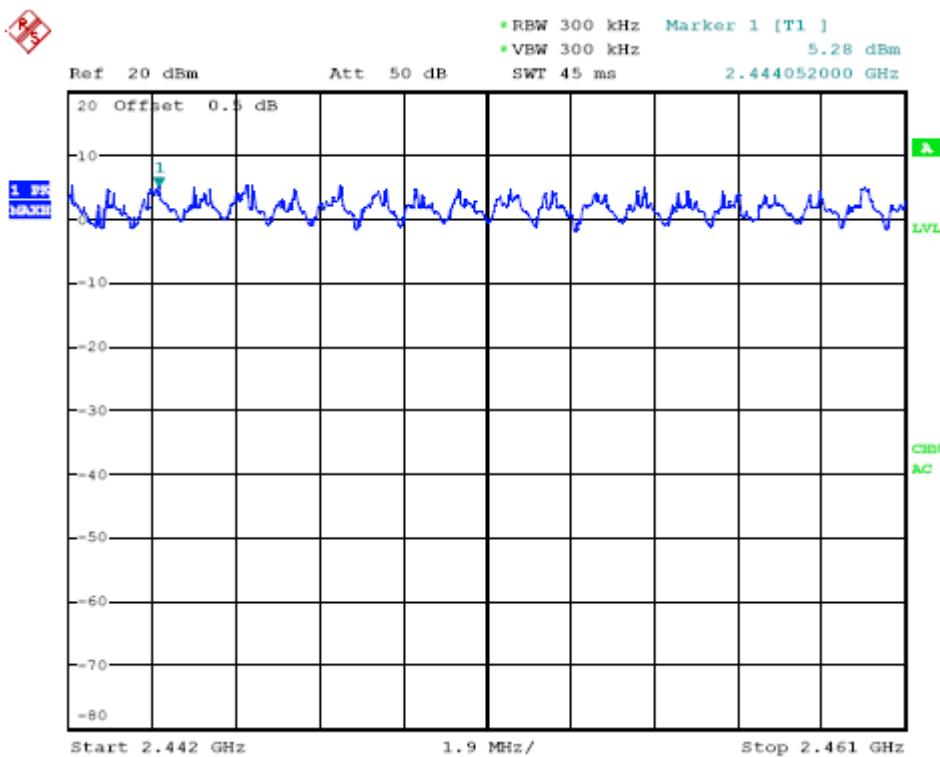
## 2402-2421MHz



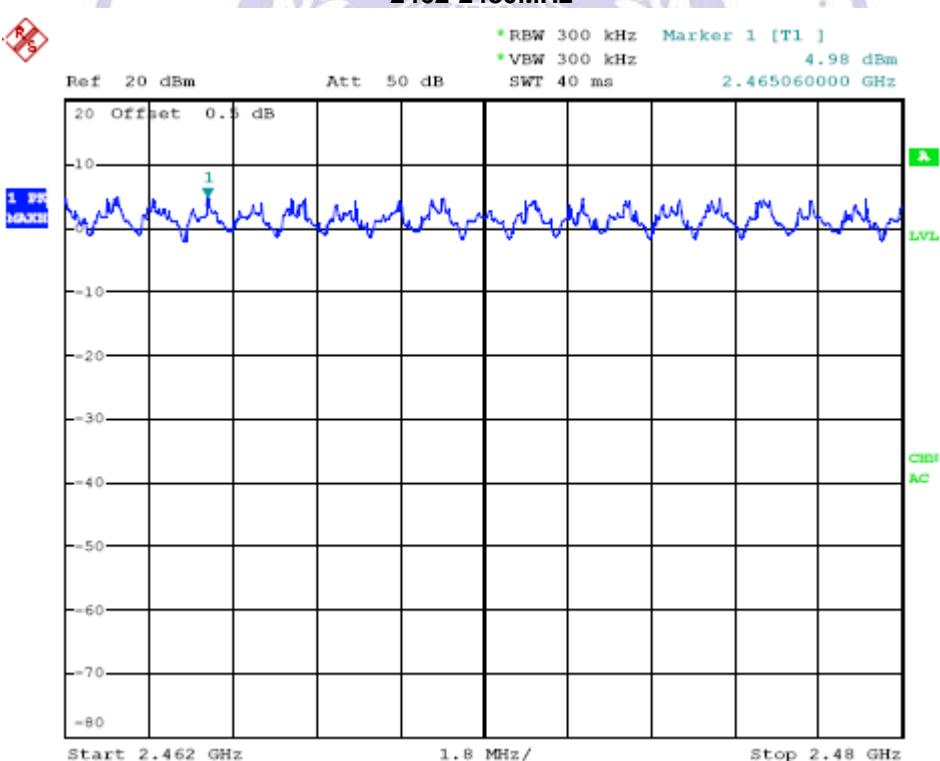
## 2422-2441MHz



## 2442-2461MHz

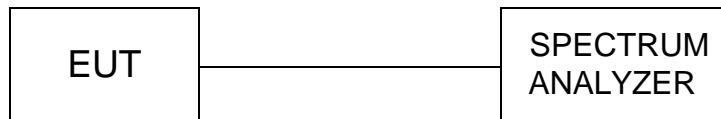


## 2462-2480MHz



## 4.8. Time Of Occupancy(Dwell Time)

### TEST CONFIGURATION



### TEST PROCEDURE

According to ANSI C63.10: 2009.

The EUT must have its hopping function enabled.

Use the following spectrum analyzer settings:

Span = zero span, centered on a hopping channel

RBW = 1MHz

VBW  $\geq$  RBW

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

Detector function = peak

Trace = max hold

If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.

### LIMIT

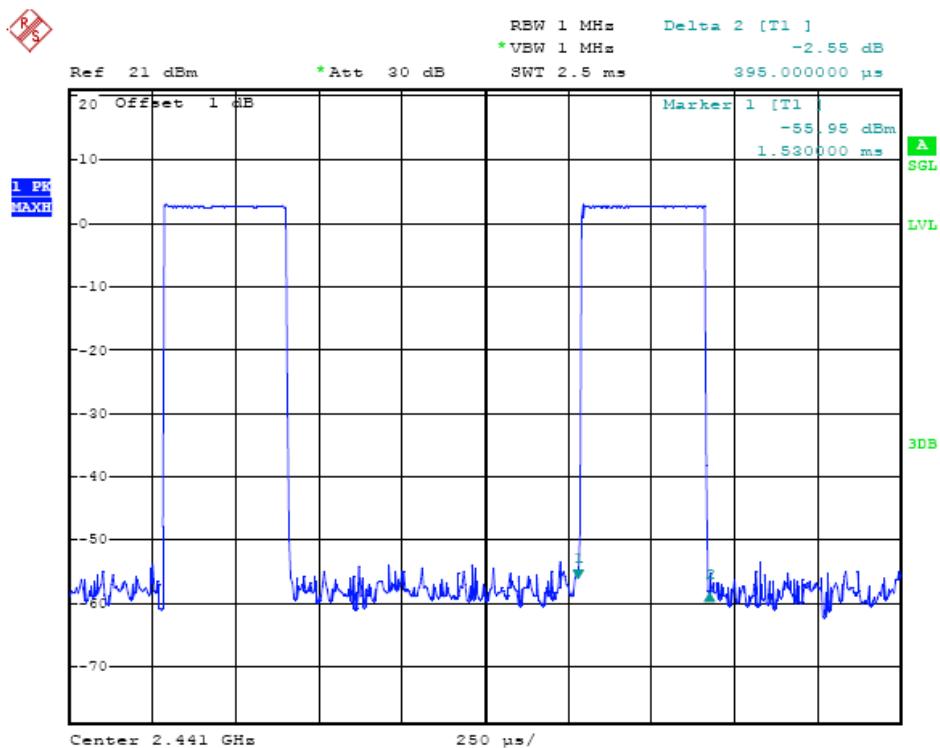
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

### TEST RESULTS

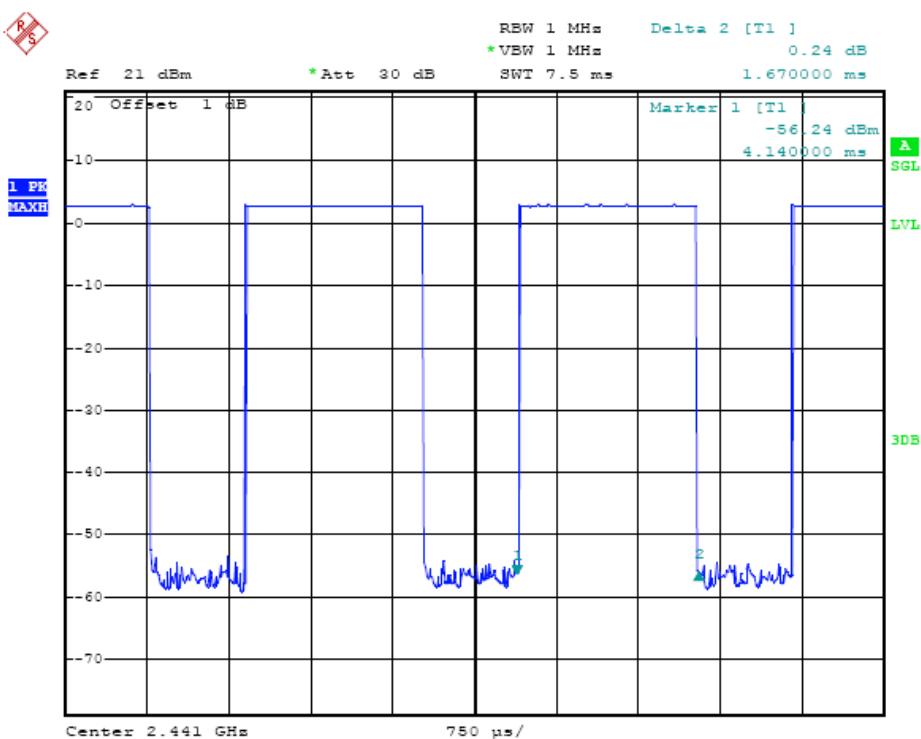
Rate	Mode	Pulse Width (ms)	Dwell Time (S)	Limit (S)	Result
3Mbps	3DH1	0.395	0.1264	0.4	Pass
	3DH3	1.670	0.2672	0.4	Pass
	3DH5	2.930	0.3125	0.4	Pass
<b>Note:</b>					
DH1: Dwell time=Pulse time (ms) $\times$ (1600 $\div$ 2 $\div$ 79) $\times$ 31.6 Second					
DH3: Dwell time=Pulse time (ms) $\times$ (1600 $\div$ 4 $\div$ 79) $\times$ 31.6 Second					
DH5: Dwell time=Pulse time (ms) $\times$ (1600 $\div$ 6 $\div$ 79) $\times$ 31.6 Second					

Photos of Dwell Time Measurement:

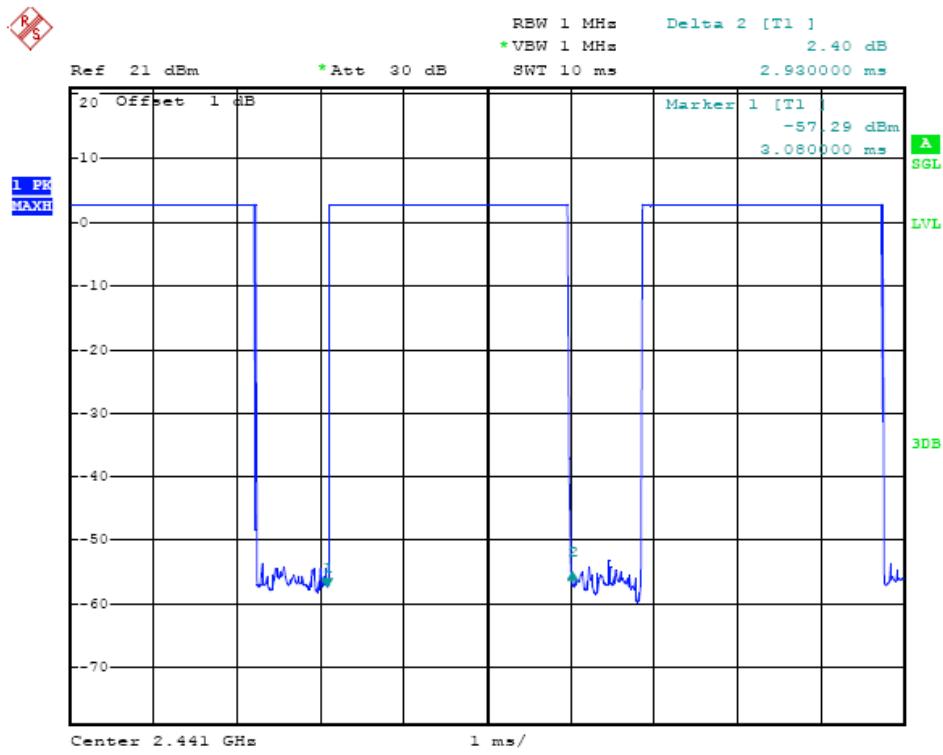
3DH1



3DH3

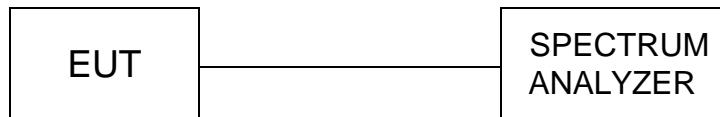


3DH5



## 4.9. Spurious RF Conducted Emissions

### TEST CONFIGURATION



### TEST PROCEDURE

According to ANSI C63.10: 2009.

The EUT must have its hopping function enabled.

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100KHz, VBW  $\geq$  RBW, Sweep =auto, Detector function = peak, Trace = max hold

Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this section.

### LIMIT

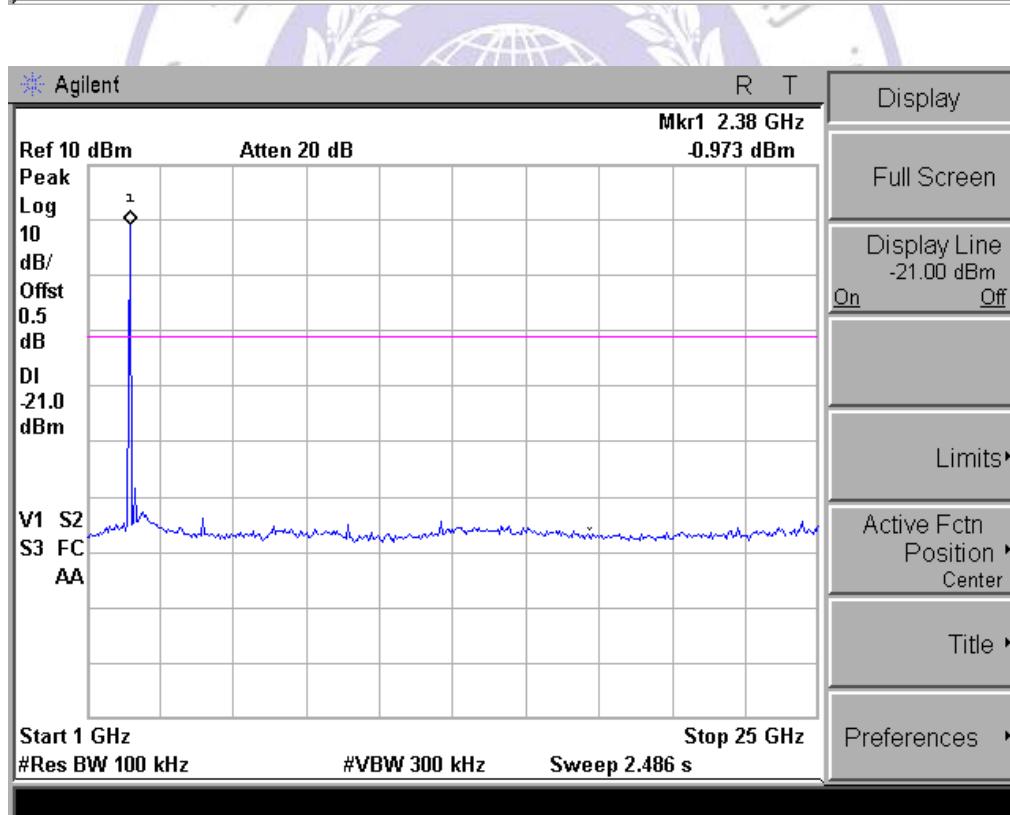
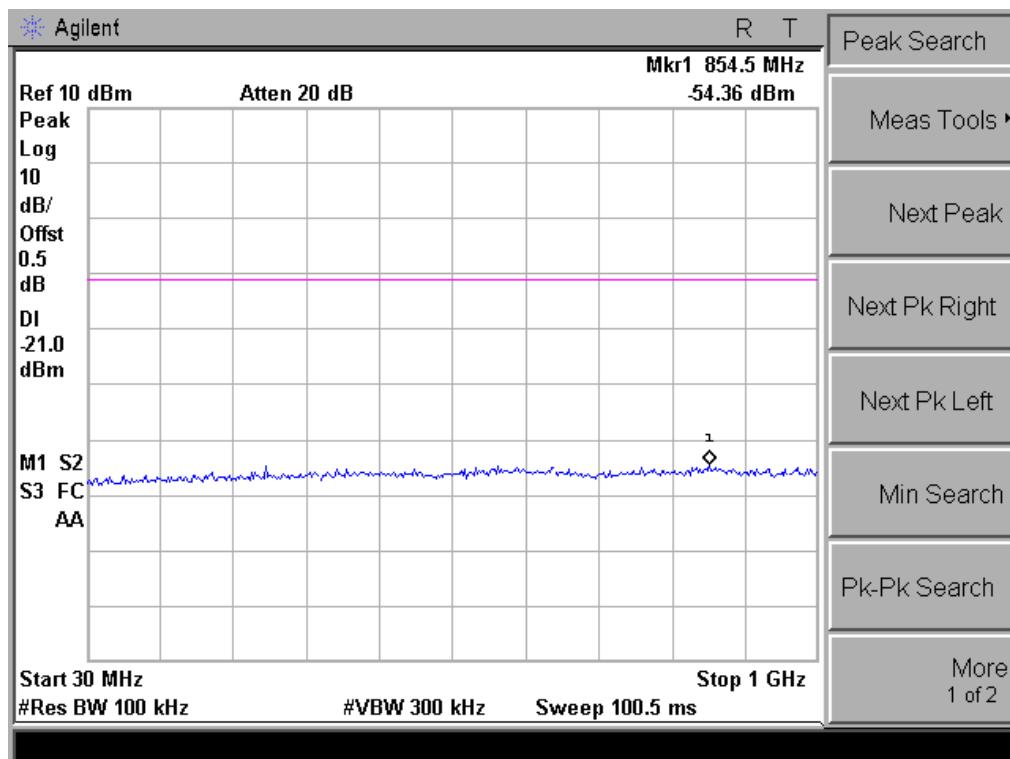
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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 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, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) of FCC part 15 is not required.

### TEST RESULT

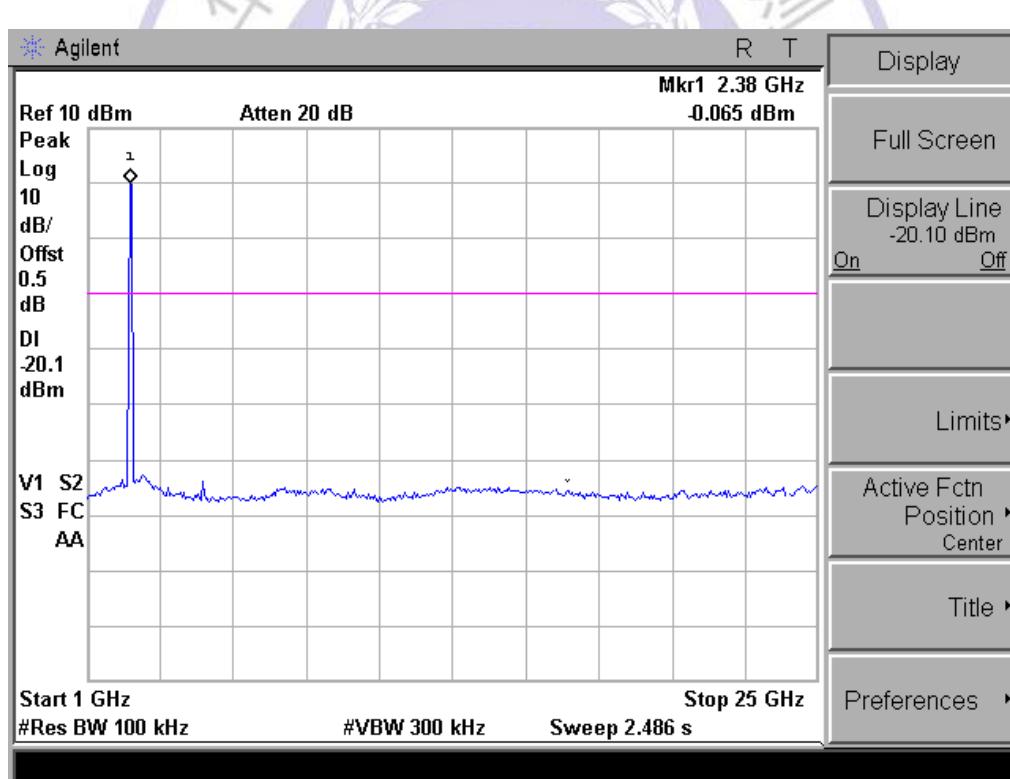
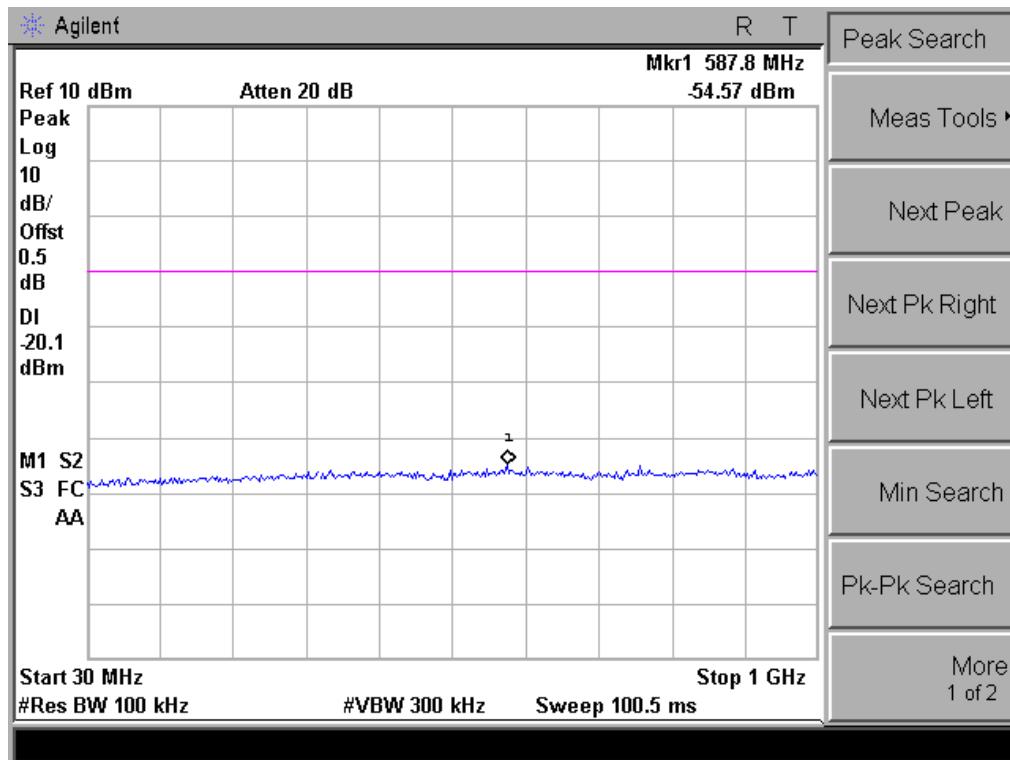
See next pages.

## DH5 Mode:

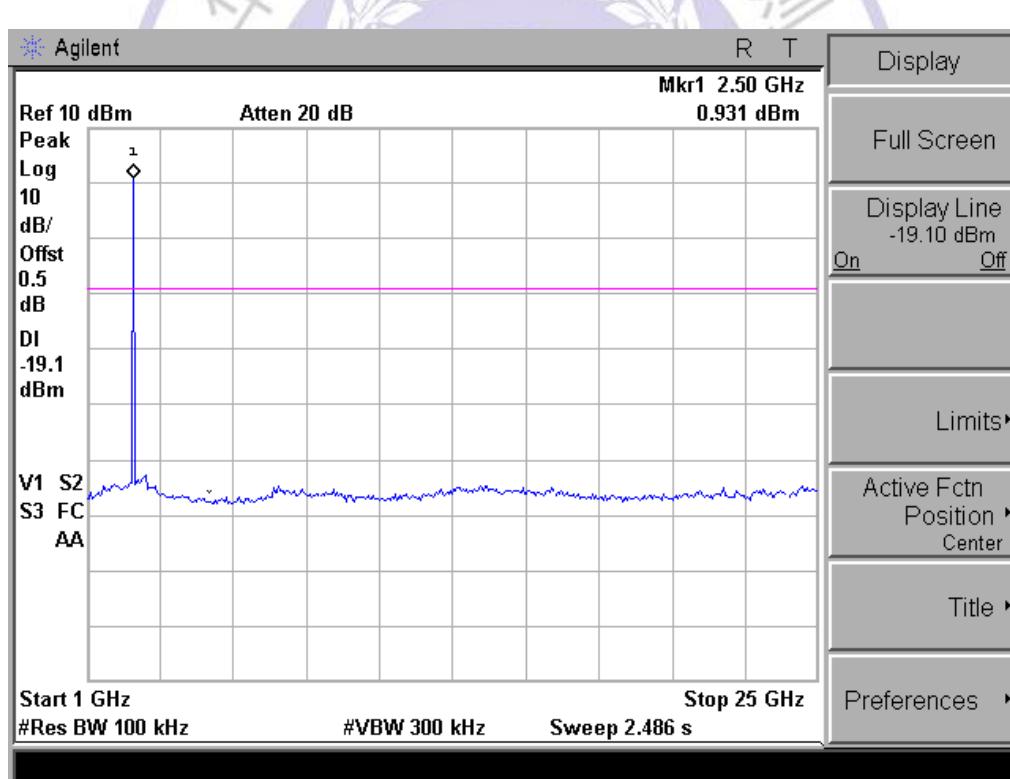
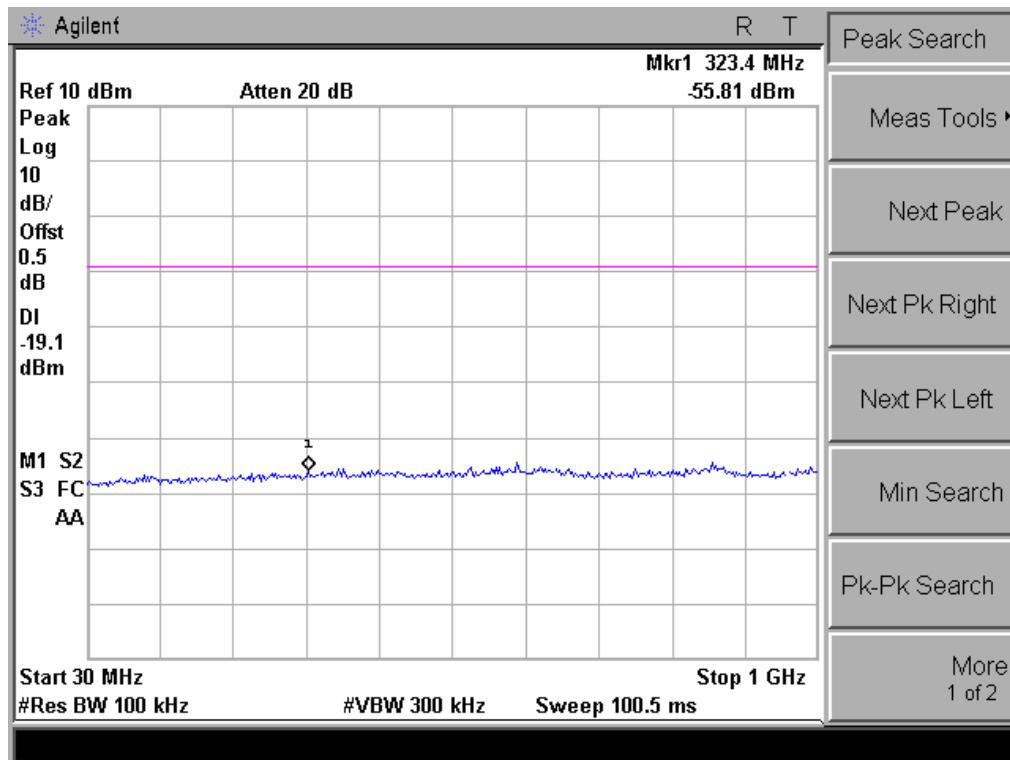
## Low Channel



## Middle Channel

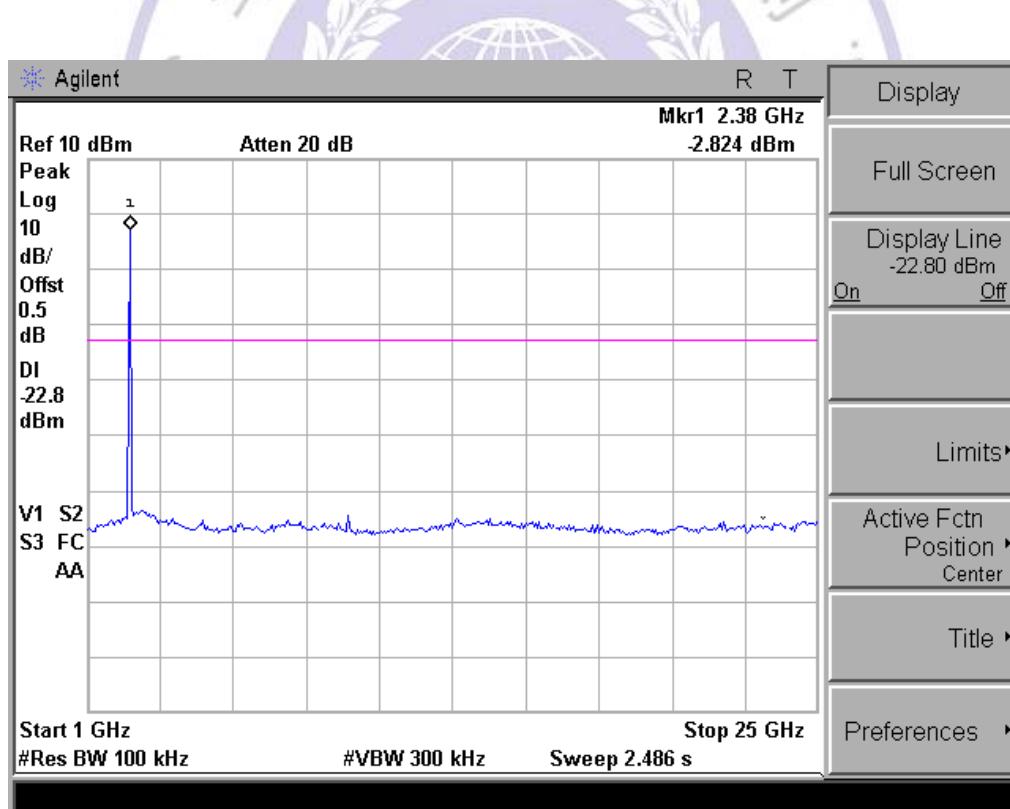
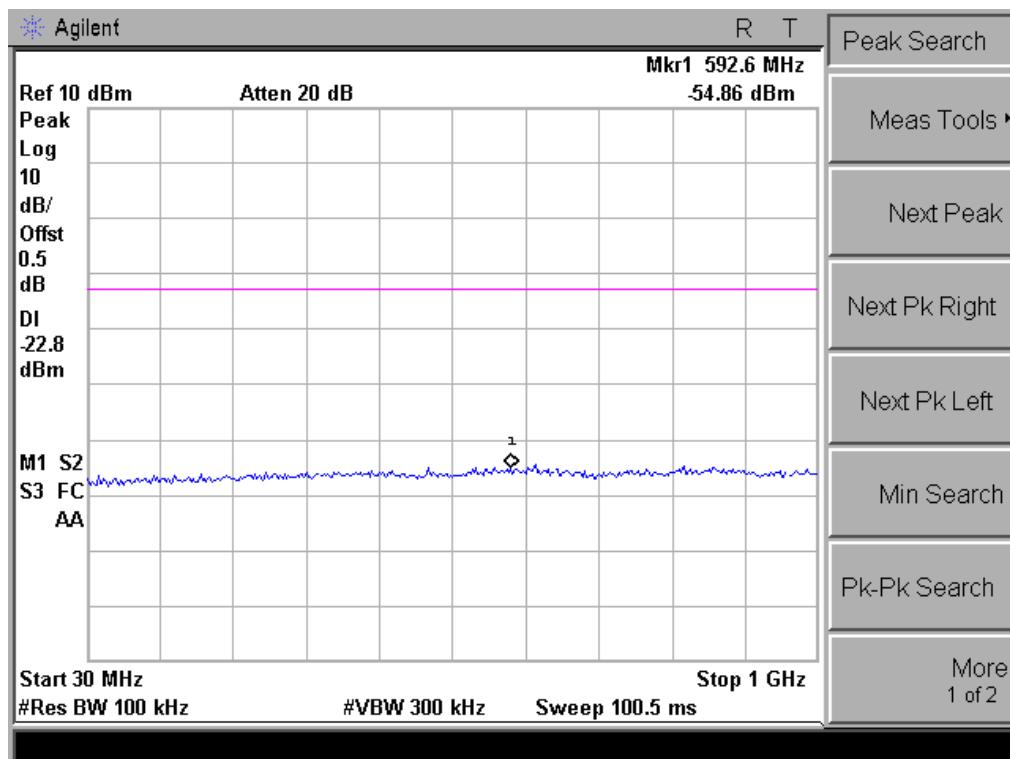


## High Channel

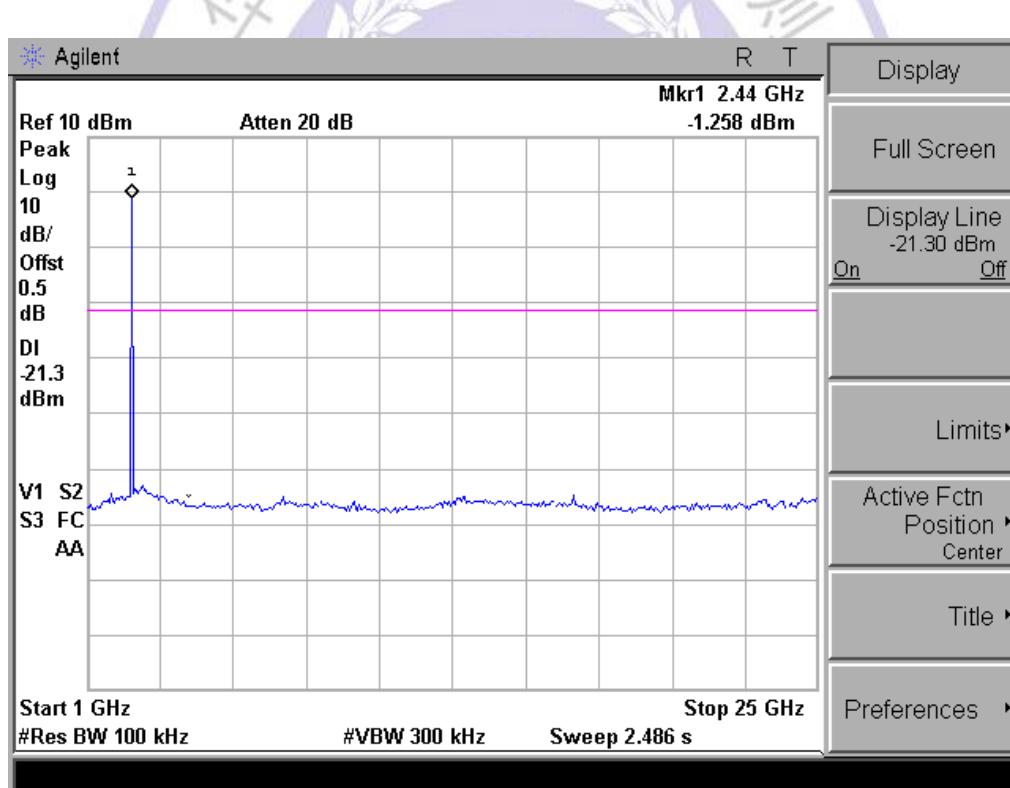
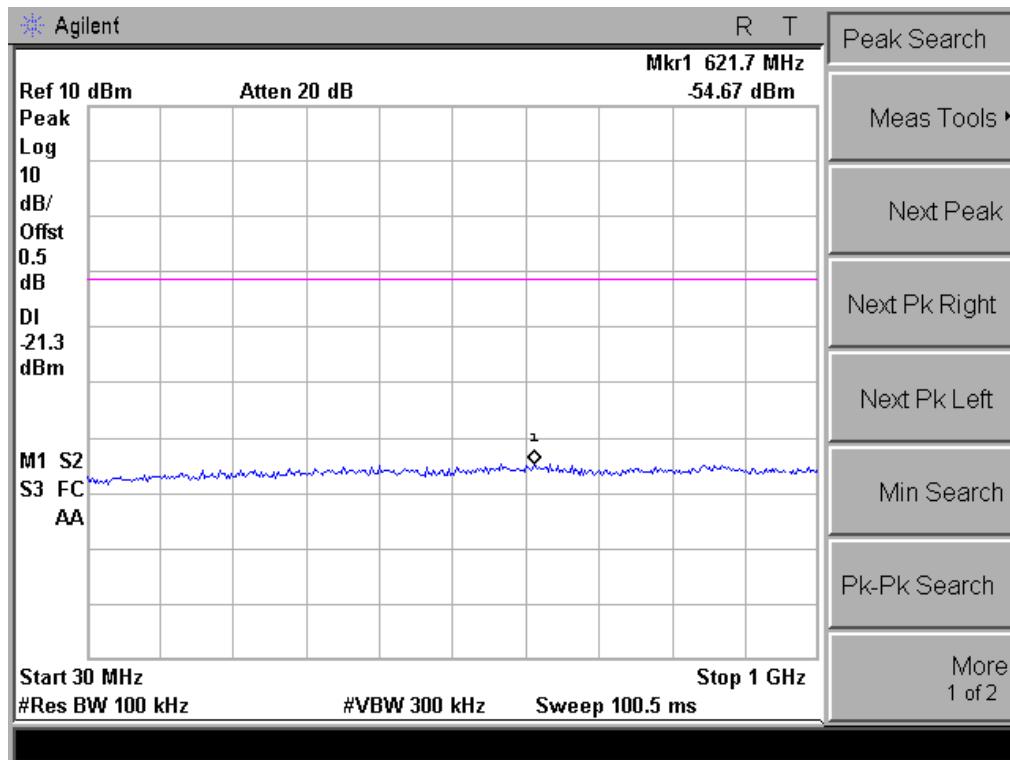


## 2DH5 Mode:

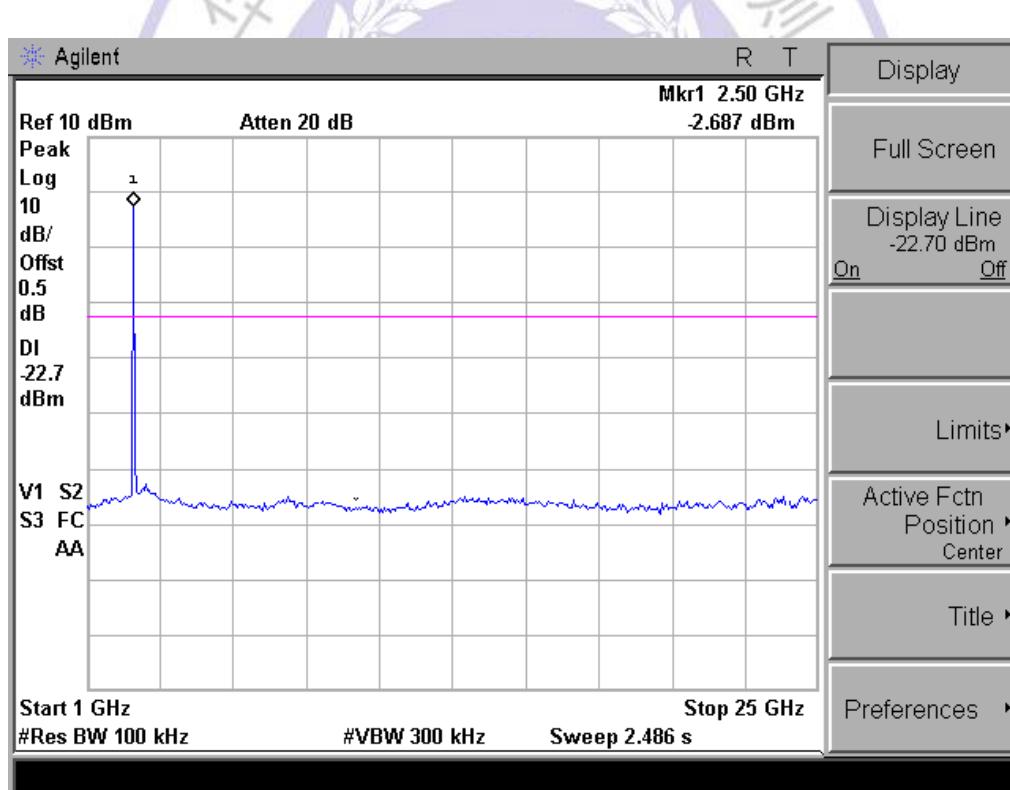
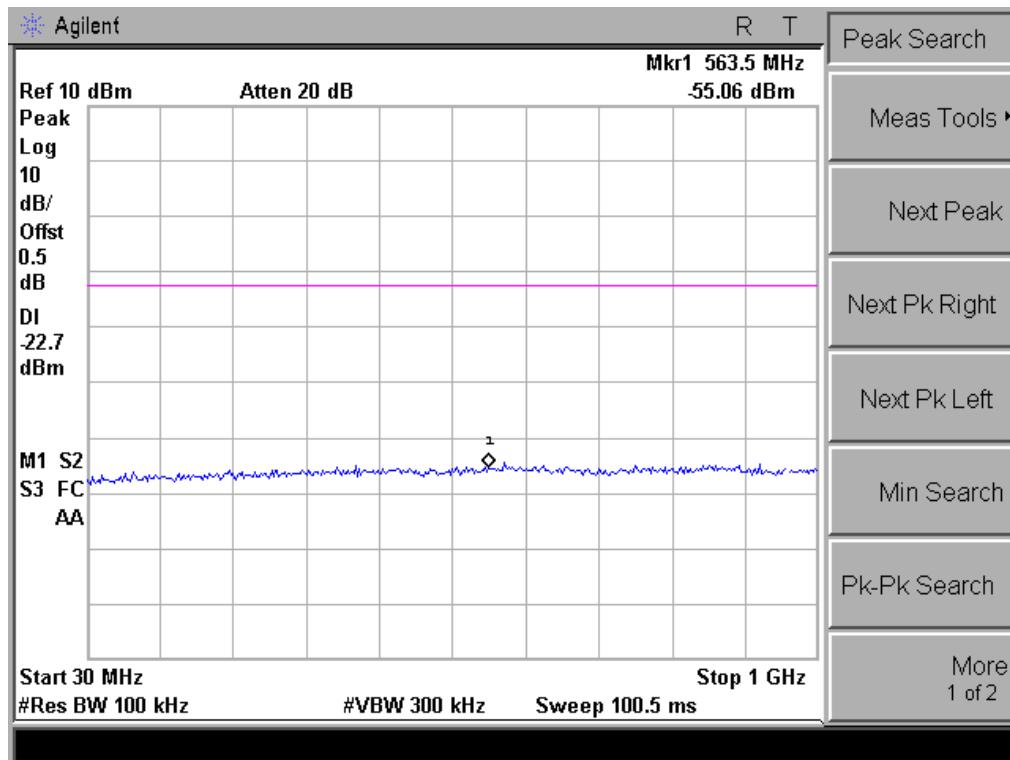
## Low Channel



## Middle Channel

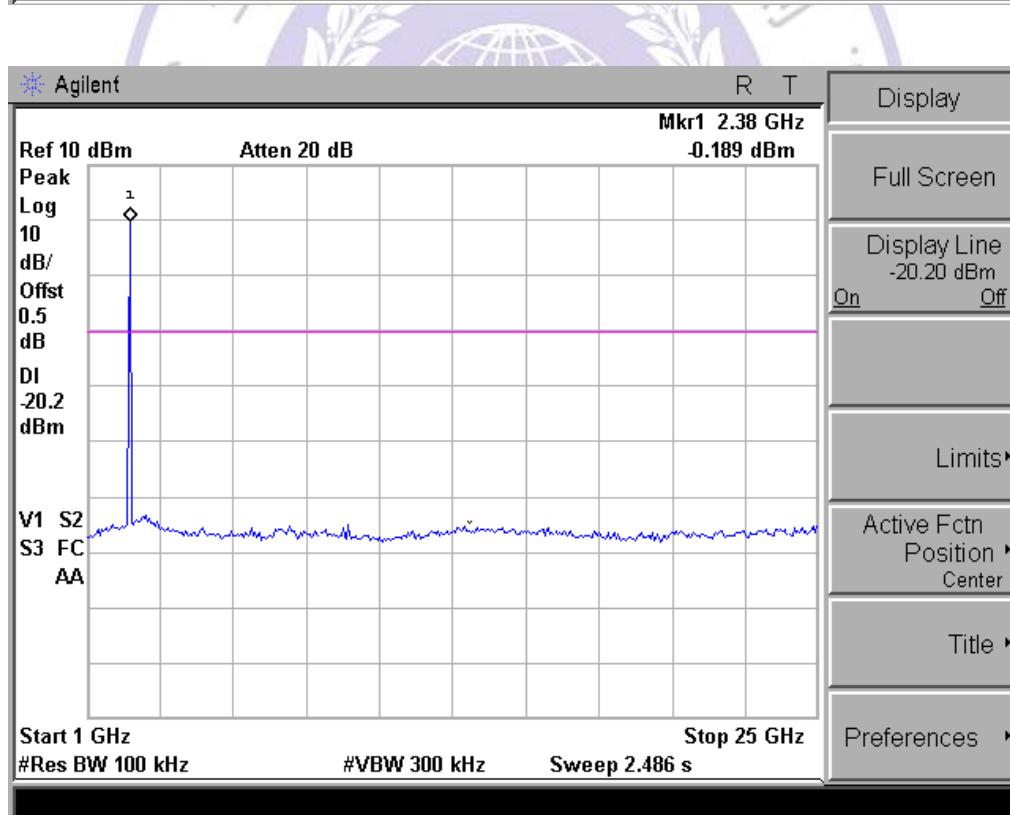
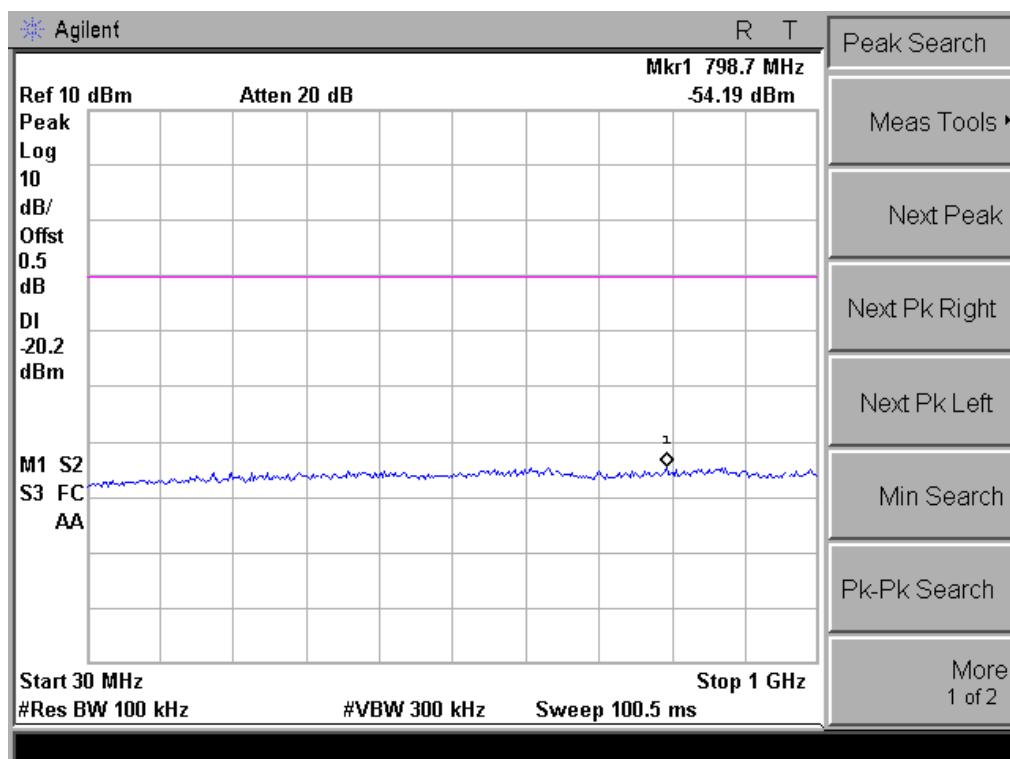


## High Channel

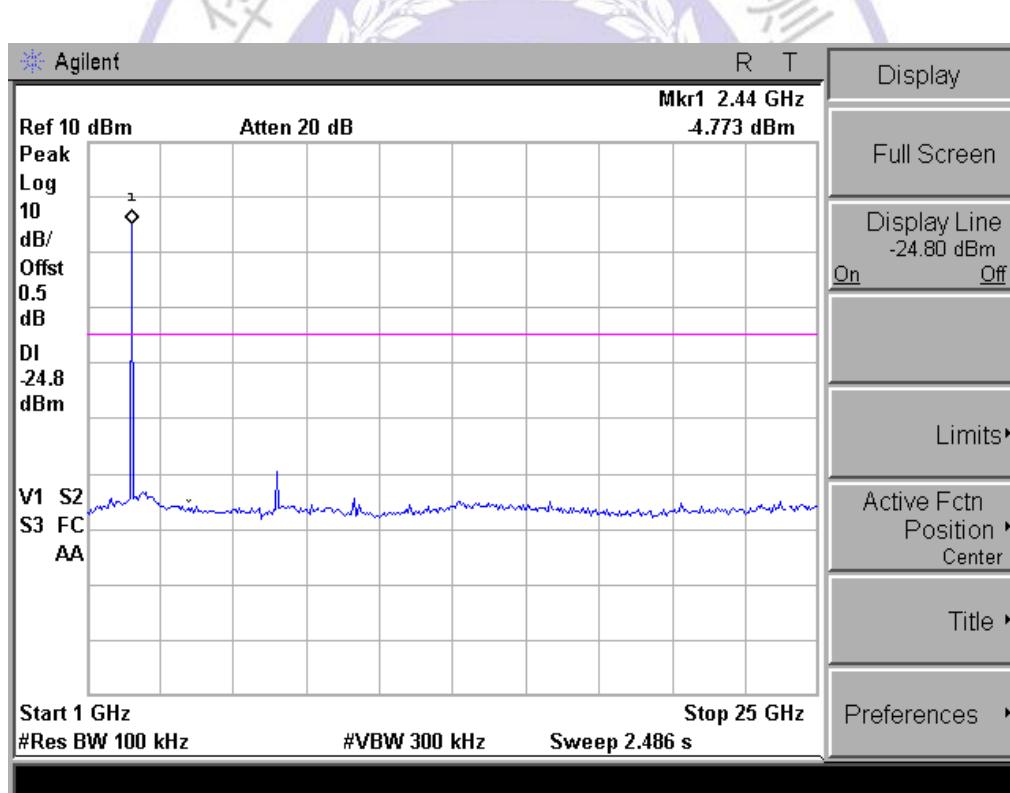
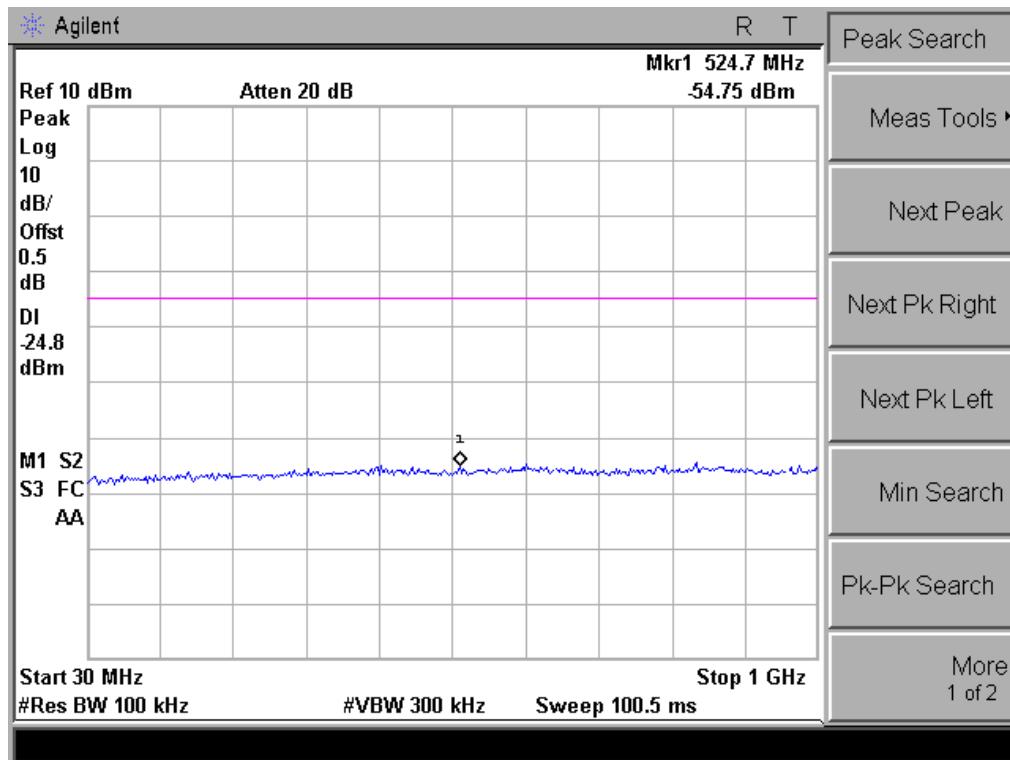


3DH5 Mode:

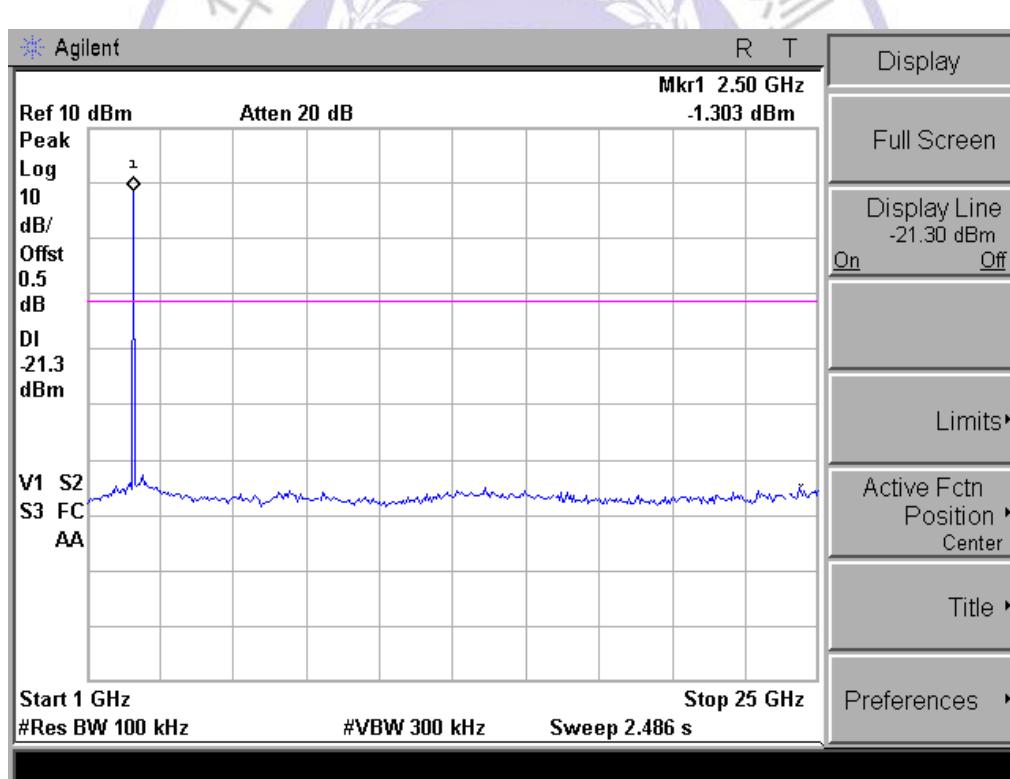
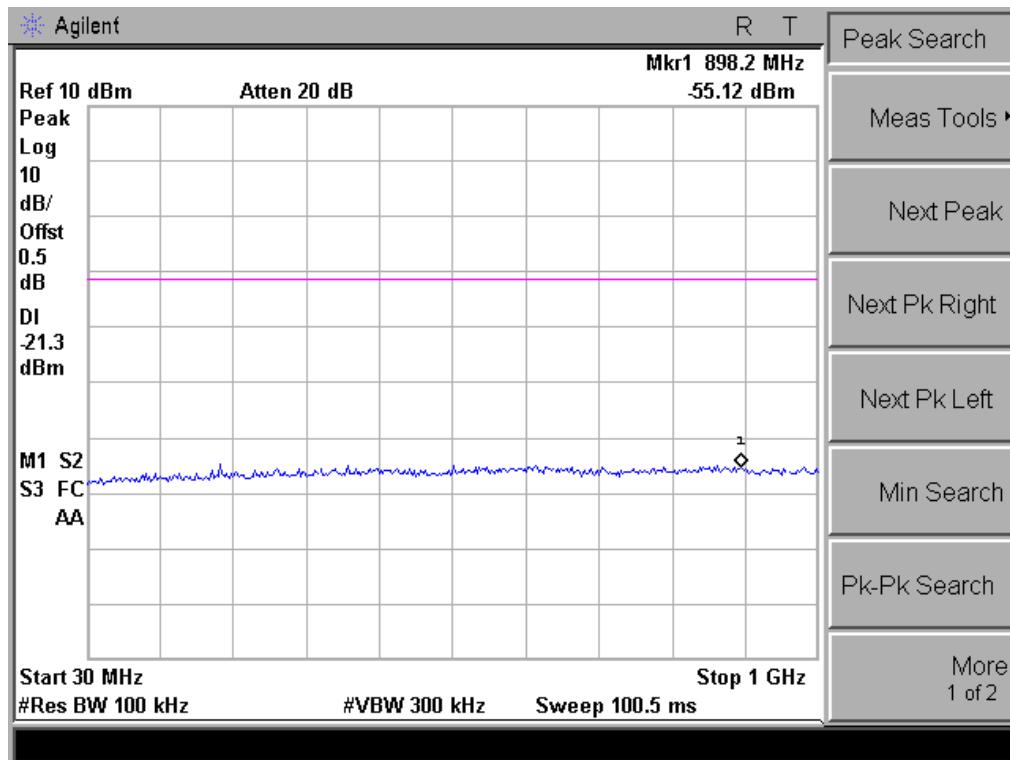
## Low Channel



## Middle Channel



## High Channel



## 4.10. Antenna Requirement

### Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

### Refer to statement below for compliance.

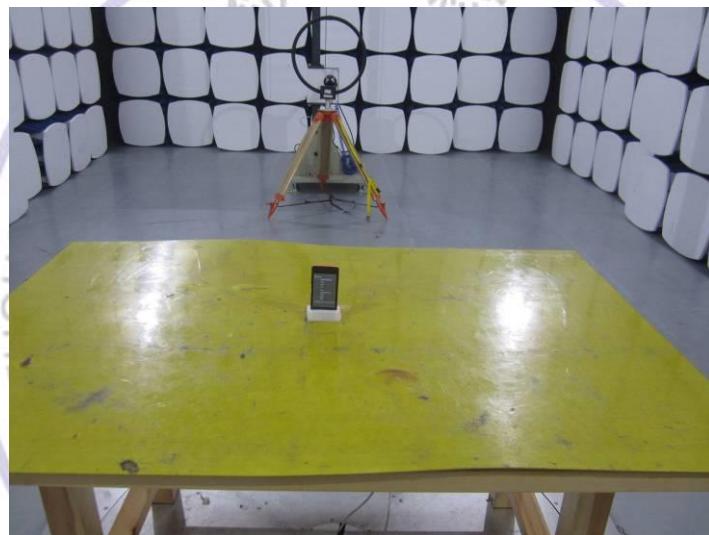
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

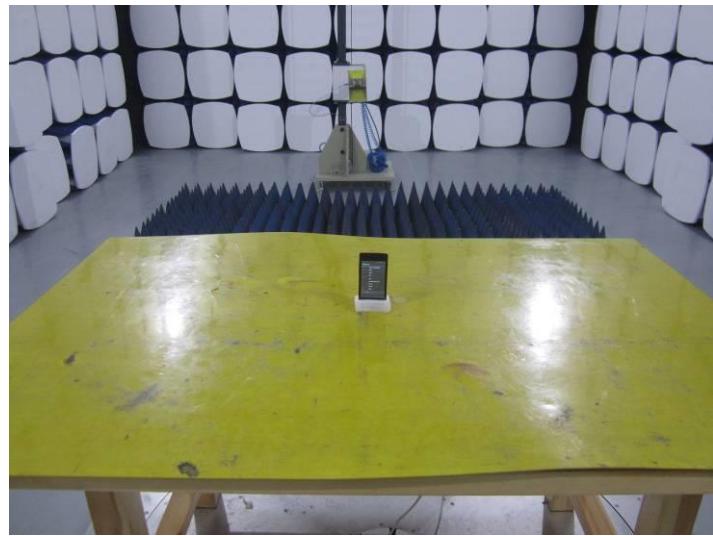
### Antenna Connected Construction

The antenna used in this product is a internal Antenna, The directional gains of antenna used for transmitting is 0.84 dBi.



## 5. Test Setup Photos of the EUT



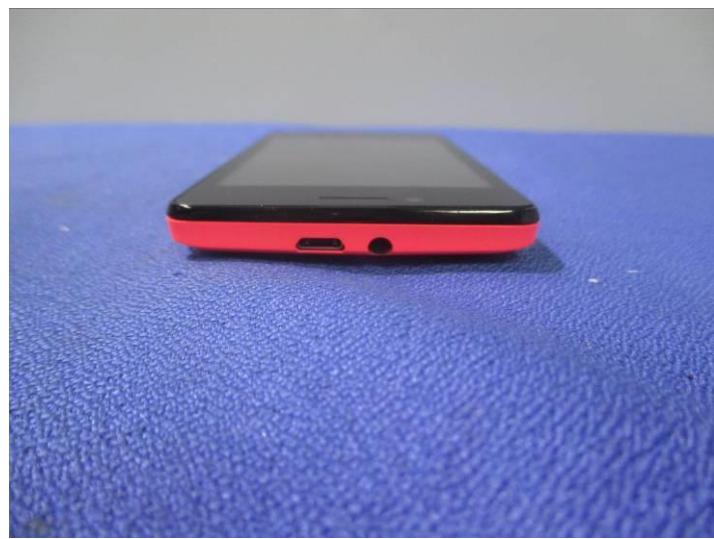


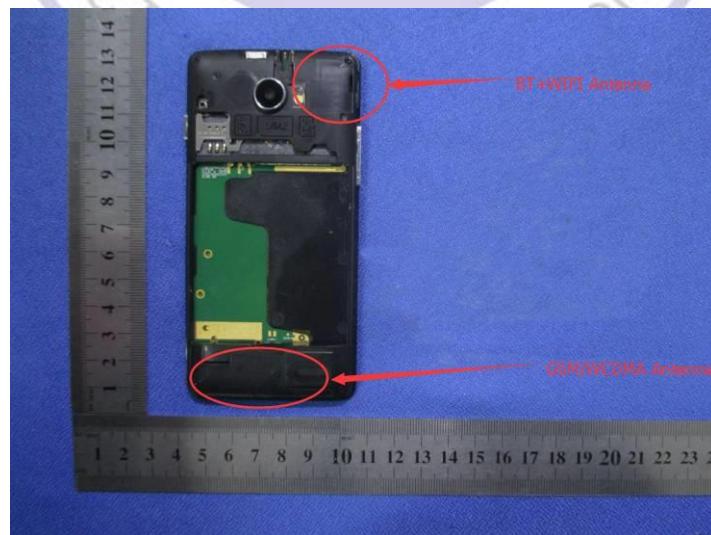
## 6. External and Internal Photos of the EUT

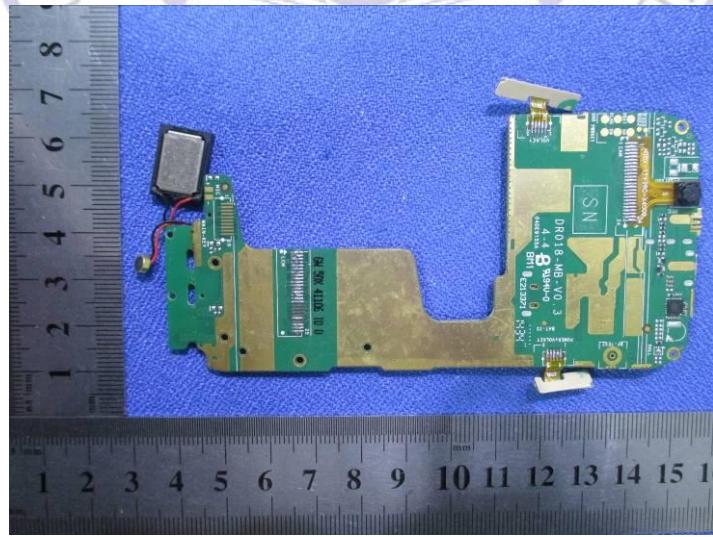
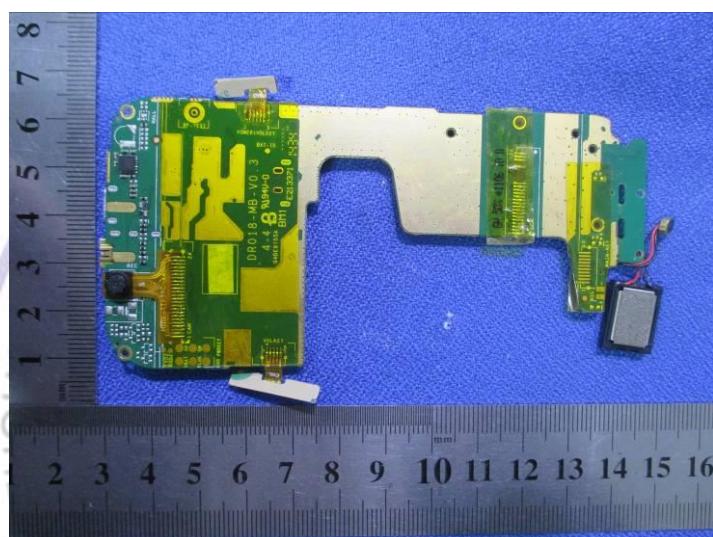
### External Photos of EUT

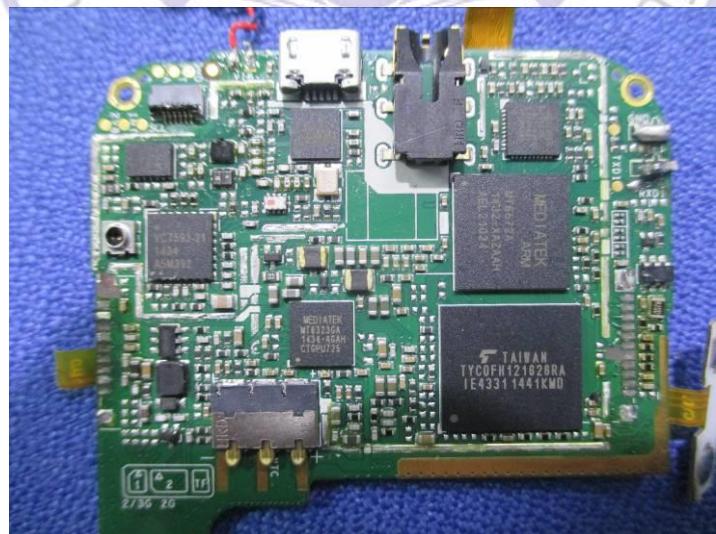
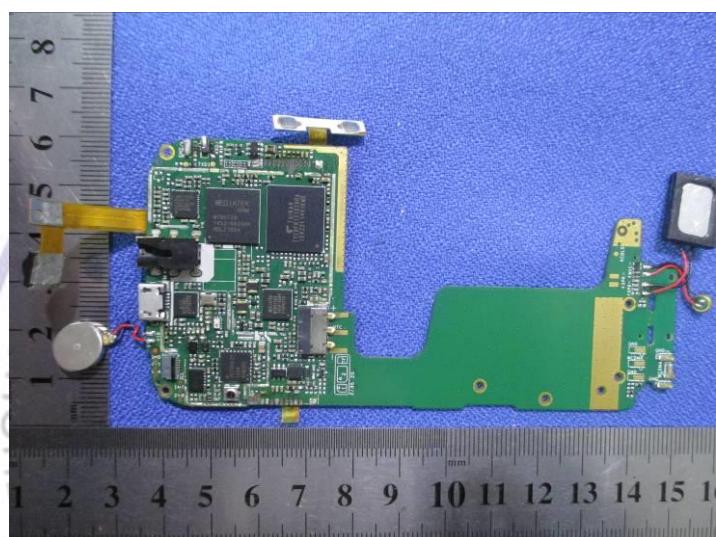
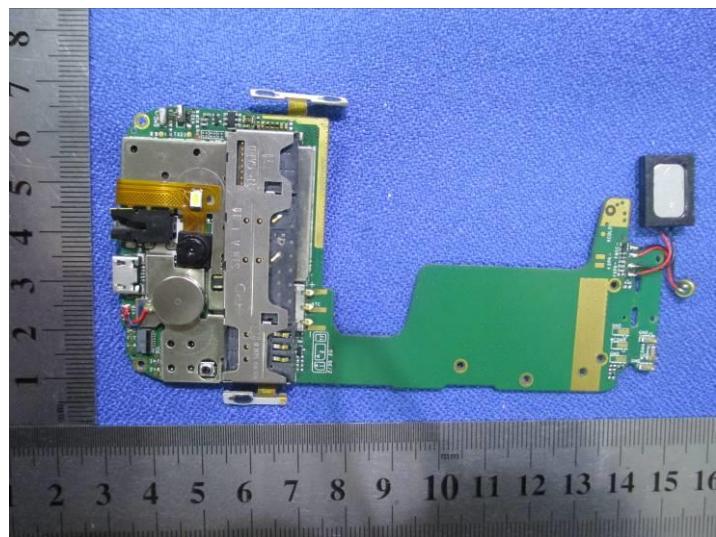






Internal Photos of EUT





.....End of Report.....