

# FCC Radio Test Report

## FCC ID: 2AAWX-INPD90036

This report concerns (check one): ☒Original Grant ☐Class I Change ☐Class II Change

**Project No.** : 1604C097  
**Equipment** : Incase Keyboard Case  
**Model Name** : INPD90036  
**Applicant** : Incipio, LLC  
**Address** : 6001 Oak Canyon, Irvine CA 92618, US

**Date of Receipt** : Apr. 11, 2016  
**Date of Test** : Apr. 11, 2016 ~ May 06, 2016  
**Issued Date** : May 09, 2016  
**Tested by** : BTL Inc.

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### **Limitation**

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### REPORT ISSUED HISTORY

Issued No.	Description	Issued Date
BTL-FCCP-1-1604C097	Original Issue.	May 09, 2016

## 1. CERTIFICATION

Equipment : Incase Keyboard Case  
Brand Name : Incase  
Model Name : INPD90036  
Applicant : Incipio, LLC  
Manufacturer : Dongguan Siliten Electronics Co., Ltd.  
Address : Sijia Yewu Industrial Zone, Shijie Town, Dongguan City, Guangdong Province, China  
Factory : Dongguan Siliten Electronics Co., Ltd.  
Address : Sijia Yewu Industrial Zone, Shijie Town, Dongguan City, Guangdong Province, China  
Date of Test : Apr. 11, 2016 ~ May 06, 2016  
Test Sample : Engineering Sample  
Standard(s) : FCC Part15, Subpart C (15.247) / ANSI C63.10-2013

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-FCCP-1-1604C097) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s).

## 2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

Applied Standard(s): 47 CFR Part 15, Subpart C			
Standard(s) Section	Test Item	Judgment	Remark
15.207	Conducted Emission	PASS	
15.247(d)	Antenna conducted Spurious Emission	PASS	
15.247 (a)(1)	Hopping Channel Separation	PASS	
15.247(a)(1)	Bandwidth	PASS	
15.247 (b)(1)	Peak Output Power	PASS	
15.247(d) 15.209	Radiated Spurious Emission	PASS	
15.247 (a)(1)(iii)	Number of Hopping Frequency	PASS	
15.247 (a)(1)(iii)	Dwell Time	PASS	
15.205	Restricted Bands	PASS	
15.203	Antenna Requirement	PASS	

Note:

(1) "N/A" denotes test is not applicable in this test report



## 2.1 TEST FACILITY

The test facilities used to collect the test data in this report is at the location of No.3, Jinshagang 1st Road, Shixia, Dalang Town, Dongguan, Guangdong, China.

BTL's test firm number for FCC: 319330

## 2.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. The measurement instrumentation uncertainty considerations contained in CISPR 16-4-2.

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

### A. Conducted Measurement :

Test Site	Method	Measurement Frequency Range	U, (dB)
DG-C02	CISPR	150 KHz ~ 30MHz	2.32

### B. Radiated Measurement :

Test Site	Method	Measurement Frequency Range	Ant. H / V	U, (dB)
DG-CB03	CISPR	9KHz~30MHz	V	3.79
		9KHz~30MHz	H	3.57
		30MHz ~ 200MHz	V	3.82
		30MHz ~ 200MHz	H	3.78
		200MHz ~ 1,000MHz	V	4.10
		200MHz ~ 1,000MHz	H	4.06
		1GHz~18GHz	V	3.12
		1GHz~18GHz	H	3.68
		18GHz~40GHz	V	4.15
		18GHz~40GHz	H	4.14

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

### 3. GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

Equipment	Incase Keyboard Case	
Brand Name	Incase	
Model Name	INPD90036	
Model Difference	N/A	
Output Power (Max.)	Operation Frequency	2402~2480 MHz
	Modulation Technology	GFSK(1Mbps)
	Bit Rate of Transmitter	
	Output Power Max.	-2.56 dBm(1Mbps)
Power Source	1# Battery supplied. 2# Supplied from USB port. 3# DC Voltage supplied from AC/DC adapter (support unit).	
Power Rating	1# DC 3.7V 2# DC 5V 3# DC 5V	

Note:

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

## 2. Channel List:

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

## 3 Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	N/A	N/A	Printed	N/A	2

### 3.2 DESCRIPTION OF TEST MODES

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

Pretest Mode	Description
Mode 1	TX Mode <b>Note (1)</b>

The EUT system operated these modes were found to be the worst case during the pre-scanning test as following:

For Conducted Emission	
Final Test Mode	Description
Mode 1	TX Mode

For Radiated Emission	
Final Test Mode	Description
Mode 1	TX Mode <b>Note (1)</b>

**Note:**

(1) The measurements are performed at the high, middle, low available channels.

### 3.3 TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING

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

Test Software Version	BlueTool		
Frequency	2402 MHz	2441 MHz	2480 MHz
Parameters(1Mbps)	0	0	0

### 3.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



### 3.5 DESCRIPTION OF SUPPORT UNITS

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

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.
-	-	-	-	-	-

Item	Shielded Type	Ferrite Core	Length	Note
-	-	-	-	-

## 4. EMC EMISSION TEST

### 4.1 CONDUCTED EMISSION MEASUREMENT

#### 4.1.1 POWER LINE CONDUCTED EMISSION LIMITS (Frequency Range 150KHz-30MHz)

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 -0.50	66 to 56*	56 to 46*
0.50 -5.0	56	46
5.0 -30.0	60	50

Note:

- (1) The limit of " \* " decreases with the logarithm of the frequency
- (2) The test result calculated as following:  
 Measurement Value = Reading Level + Correct Factor  
 Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor(if use)  
 Margin Level = Measurement Value - Limit Value

The following table is the setting of the receiver

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

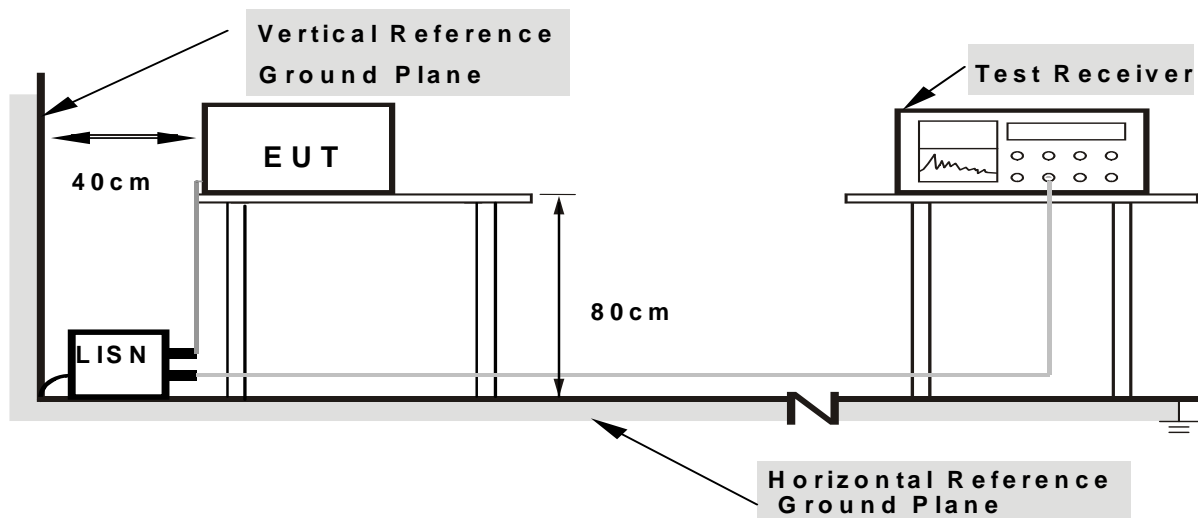
#### 4.1.2 TEST PROCEDURE

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

#### 4.1.3 DEVIATION FROM TEST STANDARD

No deviation

#### 4.1.4 TEST SETUP



**Note:** 1.Support units were connected to second LISN.  
 2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

#### 4.1.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical function (as a customer would normally use it), EUT was programmed to be in continuously transmitting/receiving data or hopping on mode.

#### 4.1.6 EUT TEST CONDITIONS

Temperature: 25°C  
 Relative Humidity: 55%  
 Test Voltage: AC 120V/60Hz

#### 4.1.7 TEST RESULTS

Please refer to the Attachment A.

Remark:

- (1) All readings are QP Mode value unless otherwise stated AVG in column of 'Note'. If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform in this case, a "\*" marked in AVG Mode column of Interference Voltage Measured.
- (2) Measuring frequency range from 150KHz to 30MHz.

## 4.2 RADIATED EMISSION MEASUREMENT

### 4.2.1 RADIATED EMISSION LIMITS (Frequency Range 9KHz -1000MHz)

In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
960~1000	500	3

### LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

Frequency (MHz)	dB(uV/m) (at 3 meters)	
	Peak	Average
Above 1000	74	54

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m) = 20log Emission level (uV/m).
- (4) The test result calculated as following:  
 Measurement Value = Reading Level + Correct Factor  
 Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use)  
 Margin Level = Measurement Value - Limit Value

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



Spectrum Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9KHz ~90KHz for PK/AVG detector
Start ~ Stop Frequency	90KHz ~110KHz for QP detector
Start ~ Stop Frequency	110KHz ~490KHz for PK/AVG detector
Start ~ Stop Frequency	490KHz ~30MHz for QP detector
Start ~ Stop Frequency	30MHz~1000MHz for QP detector

#### 4.2.2 TEST PROCEDURE

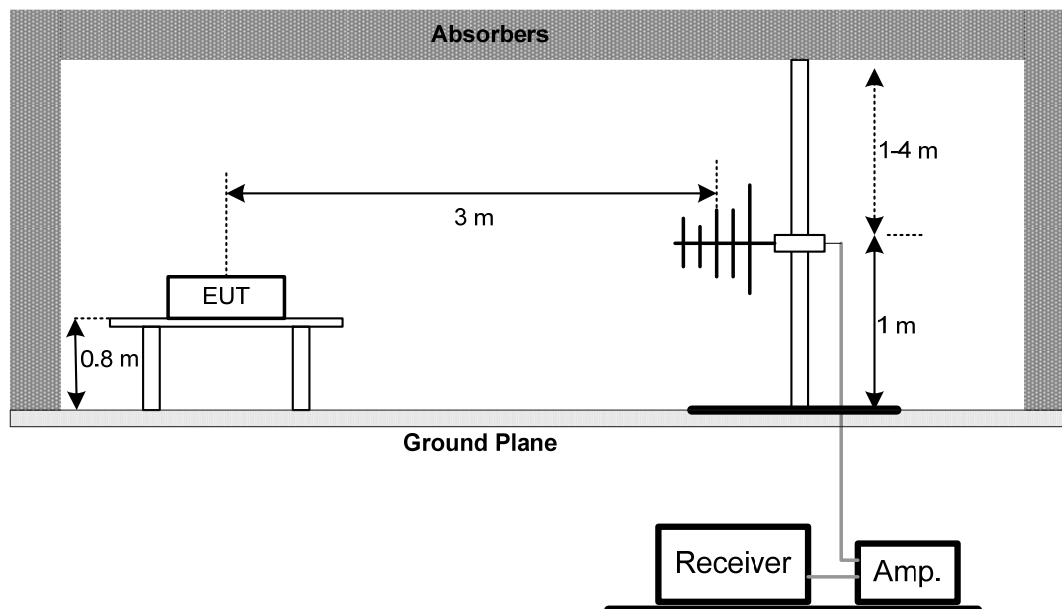
- The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
- The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1GHz)
- The height of the equipment or of the substitution antenna shall be 0.8 or 1.5 m, the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights find the maximum reading (used Bore sight function).
- The receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1GHz.
- The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform. (below 1GHz)
- All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn't perform. (above 1GHz)

#### 4.2.3 DEVIATION FROM TEST STANDARD

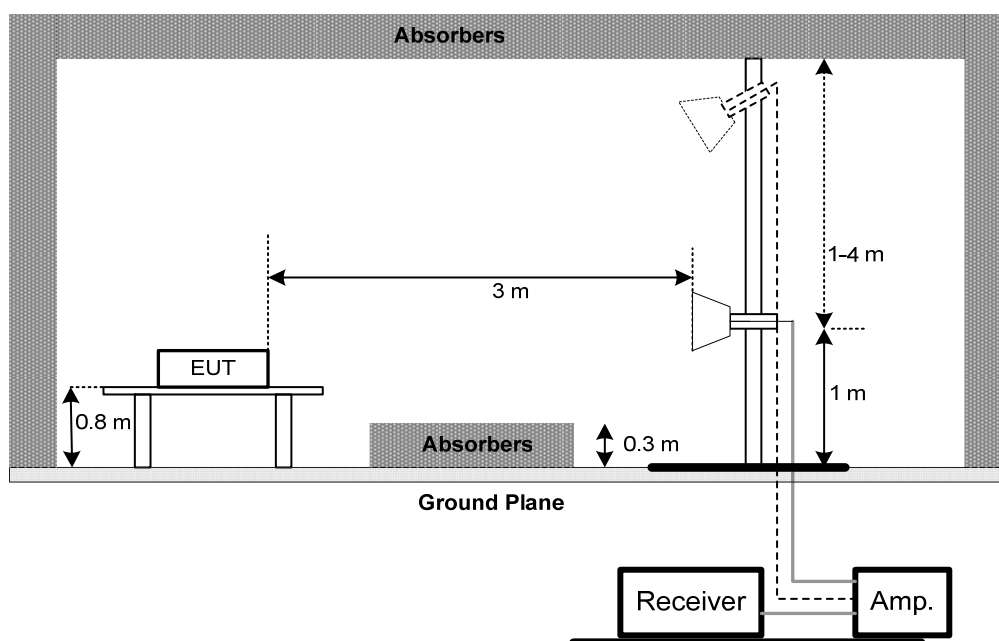
No deviation

#### 4.2.4 TEST SETUP

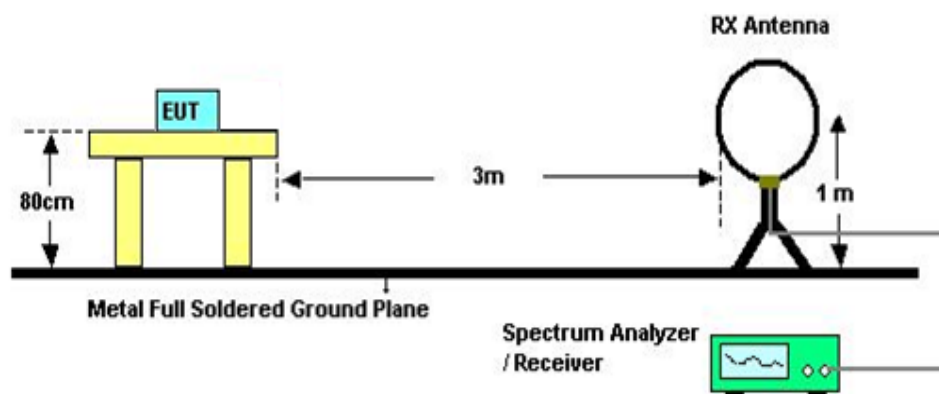
##### (A) Radiated Emission Test Set-Up Frequency Below 1 GHz



##### (B) Radiated Emission Test Set-Up Frequency Above 1 GHz



(C) For Radiated Emissions Below 30MHz



#### 4.2.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 4.1.5 unless otherwise a special operating condition is specified in the follows during the testing

#### 4.2.6 EUT TEST CONDITIONS

Temperature: 25°C

Relative Humidity: 55%

Test Voltage: DC 3.7V

#### 4.2.7 TEST RESULTS (9KHZ TO 30MHZ)

Please refer to the Attachment B

Remark:

- (1) The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.
- (2) Distance extrapolation factor =  $40 \log (\text{specific distance} / \text{test distance})$  (dB).
- (3) Limit line = specific limits (dBuV) + distance extrapolation factor.

#### **4.2.8 TEST RESULTS (30MHZ TO 1000 MHZ)**

Please refer to the Attachment C.

Remark:

- (1) All readings are Peak unless otherwise stated QP in column of 『Note』. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.
- (2) Measuring frequency range from 30MHz to 1000MHz.
- (3) If the peak scan value lower limit more than 20dB, then this signal data does not show in table.

#### **4.2.9 TEST RESULTS (ABOVE 1000 MHZ)**

Please refer to the Attachment D.

Remark:

- (1) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission
- (2) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.
- (3) EUT Orthogonal Axis:  
"X" - denotes Laid on Table; "Y" - denotes Vertical Stand; "Z" - denotes Side Stand
- (4) During the measurements above 1 GHz it is taken care of that the EUT is always within the 3 dB cone of radiation BW of the used antenna
- (5) No limit: This is fundamental signal, the judgment is not applicable.  
For fundamental signal judgment was referred to Peak output test.

## 5. NUMBER OF HOPPING CHANNEL

### 5.1 APPLIED PROCEDURES

FCC Part15 (15.247) , Subpart C			
Section	Test Item	Frequency Range (MHz)	Result
15.247(a)(1)(iii)	Number of Hopping Channel	2400-2483.5	PASS

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> Operating Frequency Range
RBW	100 KHz
VBW	100 KHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

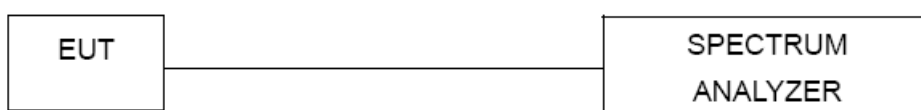
#### 5.1.1 TEST PROCEDURE

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- Spectrum Setting: RBW=100KHz, VBW=100KHz, Sweep time = Auto.

#### 5.1.2 DEVIATION FROM STANDARD

No deviation.

#### 5.1.3 TEST SETUP



#### 5.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.1.5 unless otherwise a special operating condition is specified in the follows during the testing.

#### 5.1.5 EUT TEST CONDITIONS

Temperature: 25°C  
 Relative Humidity: 55%  
 Test Voltage: DC 3.7V

#### 5.1.6 TEST RESULTS

Please refer to the Attachment E

## 6. AVERAGE TIME OF OCCUPANCY

### 6.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(1)(iii)	Average Time of Occupancy	0.4sec	2400-2483.5	PASS

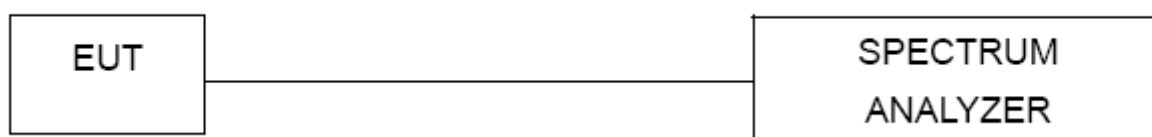
#### 6.1.1 TEST PROCEDURE

- The transmitter output (antenna port) was connected to the spectrum analyzer
- Set RBW of spectrum analyzer to 1MHz and VBW to 1MHz.
- Use a video trigger with the trigger level set to enable triggering only on full pulses.
- Sweep Time is more than once pulse time.
- Set the center frequency on any frequency would be measure and set the frequency span to zero span.
- Measure the maximum time duration of one single pulse.
- Set the EUT for DH5, DH3 and DH1 packet transmitting.
- Measure the maximum time duration of one single pulse.
- DH5 Packet permit maximum  $1600 / 79 / 6 = 3.37$  hops per second in each channel (5 time slots TX, 1 time slot RX). So, the dwell time is the time duration of the pulse times  $3.37 \times 31.6 = 106.6$  within 31.6 seconds.
- DH3 Packet permit maximum  $1600 / 79 / 4 = 5.06$  hops per second in each channel (3 time slots TX, 1 time slot RX). So, the dwell time is the time duration of the pulse times  $5.06 \times 31.6 = 160$  within 31.6 seconds.
- DH1 Packet permit maximum  $1600 / 79 / 2 = 10.12$  hops per second in each channel (1 time slot TX, 1 time slot RX). So, the dwell time is the time duration of the pulse times  $10.12 \times 31.6 = 320$  within 31.6 seconds.

#### 6.1.2 DEVIATION FROM STANDARD

No deviation.

#### 6.1.3 TEST SETUP



#### **6.1.4 EUT OPERATION CONDITIONS**

The EUT tested system was configured as the statements of 4.1.5 unless otherwise a special operating condition is specified in the follows during the testing.

#### **6.1.5 EUT TEST CONDITIONS**

Temperature: 25°C

Relative Humidity: 55%

Test Voltage: DC 3.7V

#### **6.1.6 TEST RESULTS**

Please refer to the Attachment F

## 7. HOPPING CHANNEL SEPARATION MEASUREMENT

### 7.1 APPLIED PROCEDURES / LIMIT

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

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth or Channel Separation
RBW	30 KHz
VBW	100 KHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

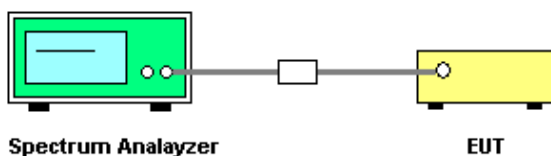
#### 7.1.1 TEST PROCEDURE

- a. The EUT must have its hopping function enabled
- b. 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

#### 7.1.2 DEVIATION FROM STANDARD

No deviation.

#### 7.1.3 TEST SETUP



#### 7.1.4 EUT TEST CONDITIONS

Temperature: 25°C  
 Relative Humidity: 55%  
 Test Voltage: DC 3.7V

#### 7.1.5 TEST RESULTS

Please refer to the Attachment G



## 8. BANDWIDTH TEST

### 8.1 APPLIED PROCEDURES

FCC Part15 (15.247) , Subpart C		
Section	Test Item	Frequency Range (MHz)
15.247(a)(2)	Bandwidth	2400-2483.5

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth or Channel Separation
RBW	30 KHz (20dB Bandwidth) / 30 KHz (Channel Separation)
VBW	100 KHz (20dB Bandwidth) / 100 KHz (Channel Separation)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

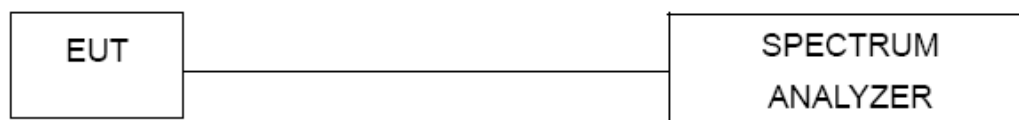
#### 8.1.1 TEST PROCEDURE

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- Spectrum Setting: RBW= 30KHz, VBW=100KHz, Sweep Time = Auto.

#### 8.1.2 DEVIATION FROM STANDARD

No deviation.

#### 8.1.3 TEST SETUP



#### 8.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.1.5 unless otherwise a special operating condition is specified in the follows during the testing.

#### 8.1.5 EUT TEST CONDITIONS

Temperature: 25°C  
 Relative Humidity: 55%  
 Test Voltage: DC 3.7V

#### 8.1.6 TEST RESULTS

Please refer to the Attachment H

## 9. PEAK OUTPUT POWER TEST

### 9.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(1)	Peak Output Power	1 Watt or 30dBm ( hopping channel >75) 0.125Watt or 21dBm (hopping channel <75	2400-2483.5	PASS

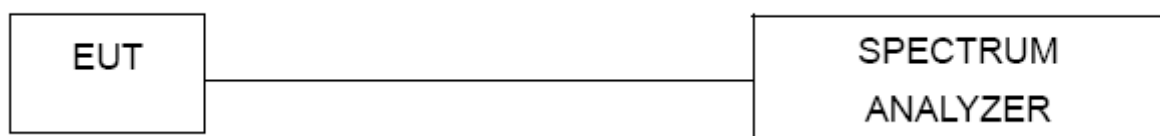
#### 9.1.1 TEST PROCEDURE

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- Spectrum Setting: RBW= 1MHz/3MHz, VBW= 1MHz/3MHz, Sweep time = Auto.

#### 9.1.2 DEVIATION FROM STANDARD

No deviation.

#### 9.1.3 TEST SETUP



#### 9.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.1.5 unless otherwise a special operating condition is specified in the follows during the testing.

#### 9.1.5 EUT TEST CONDITIONS

Temperature: 25°C  
Relative Humidity: 55%  
Test Voltage: DC 3.7V

#### 9.1.6 TEST RESULTS

Please refer to the Attachment I

## 10. ANTENNA CONDUCTED SPURIOUS EMISSION

### 10.1 APPLIED PROCEDURES / LIMIT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits.

#### 10.1.1 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- b. Spectrum Setting: RBW= 100KHz, VBW=100KHz, Sweep time = Auto.
- c. Offset=antenna gain+cable loss

#### 10.1.2 DEVIATION FROM STANDARD

No deviation.

#### 10.1.3 TEST SETUP



#### 10.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.1.5 unless otherwise a special operating condition is specified in the follows during the testing.

#### 10.1.5 EUT TEST CONDITIONS

Temperature: 25°C

Relative Humidity: 55%

Test Voltage: DC 3.7V

#### 10.1.6 TEST RESULTS

Please refer to the Attachment J

## 11. MEASUREMENT INSTRUMENTS LIST

Conducted Emission Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	LISN	EMCO	3816/2	0052765	Mar. 27, 2017
2	LISN	R&S	ENV216	101447	Mar. 27, 2017
3	Test Cable	emci	RG223(9KHz-30 MHz)	C_17	Mar. 10, 2017
4	EMI Test Receiver	R&S	ESCI	100382	Mar. 27, 2017
5	50Ω Terminator	SHX	TF2-3G-A	08122901	Mar. 27, 2017
6	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A

Radiated Emission Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Antenna	Schwarbeck	VULB9160	9160-3232	Mar. 27, 2017
2	Amplifier	HP	8447D	2944A09673	Nov. 09, 2016
3	Receiver	AGILENT	N9038A	MY52130039	Oct. 11, 2016
4	Test Cable	emci	LMR-400(30MHz-1GHz)	C-01	Jun. 28, 2016
5	Controller	CT	SC100	N/A	N/A
6	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
7	Antenna	ETS	3115	00075789	Mar. 27, 2017
8	Amplifier	Agilent	8449B	3008A02274	Nov. 01, 2016
9	Receiver	AGILENT	N9038A	MY52130039	Oct. 11, 2016
10	Test Cable	emci	EMC104-SM-S M-10000(1GHz-26.5GHz)	C-68	Jun. 28, 2016
11	Controller	CT	SC100	N/A	N/A
12	Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170319	Apr. 23, 2017
13	Active Loop Antenna	R&S	HFH2-Z2	830749/020	Sep. 07, 2016

Number of Hopping Channel					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP 40	100185	Oct. 11, 2016

Average Time of Occupancy					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP 40	100185	Oct. 11, 2016

Hopping Channel Separation Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP 40	100185	Oct. 11, 2016

Bandwidth					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP 40	100185	Oct. 11, 2016

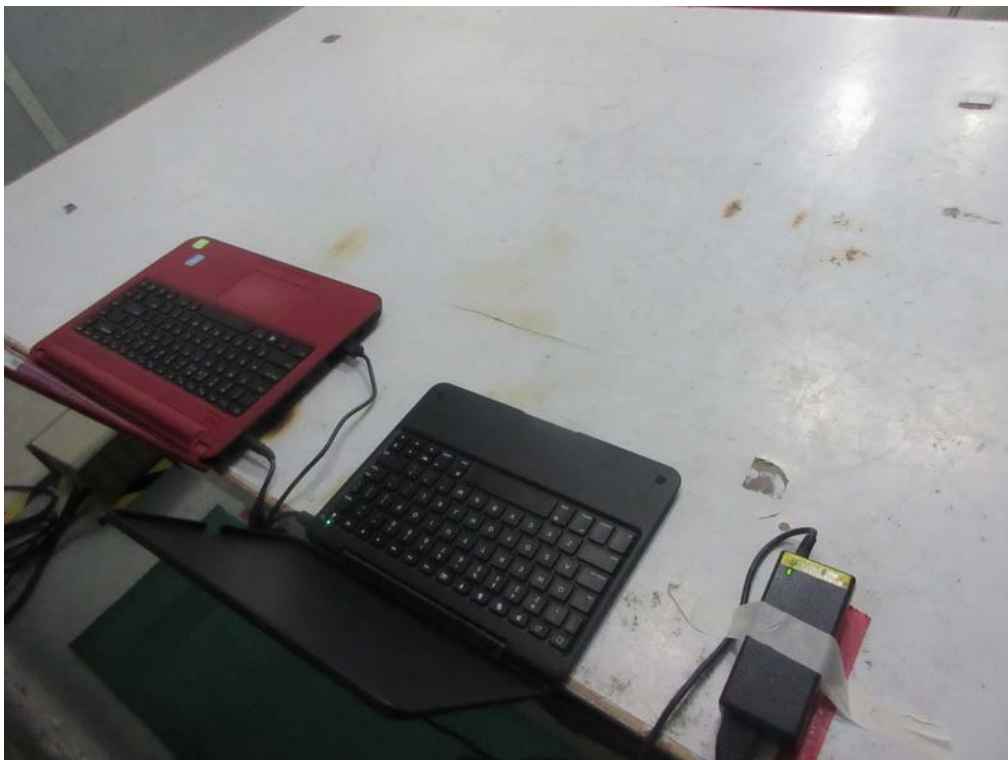
Peak Output Power					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP 40	100185	Oct. 11, 2016

Antenna Conducted Spurious Emission					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP 40	100185	Oct. 11, 2016

Remark: "N/A" denotes no model name, serial no. or calibration specified.  
All calibration period of equipment list is one year.

## 12. EUT TEST PHOTO

### Conducted Measurement Photos



## Radiated Measurement Photos

9KHz to 30MHz





## Radiated Measurement Photos

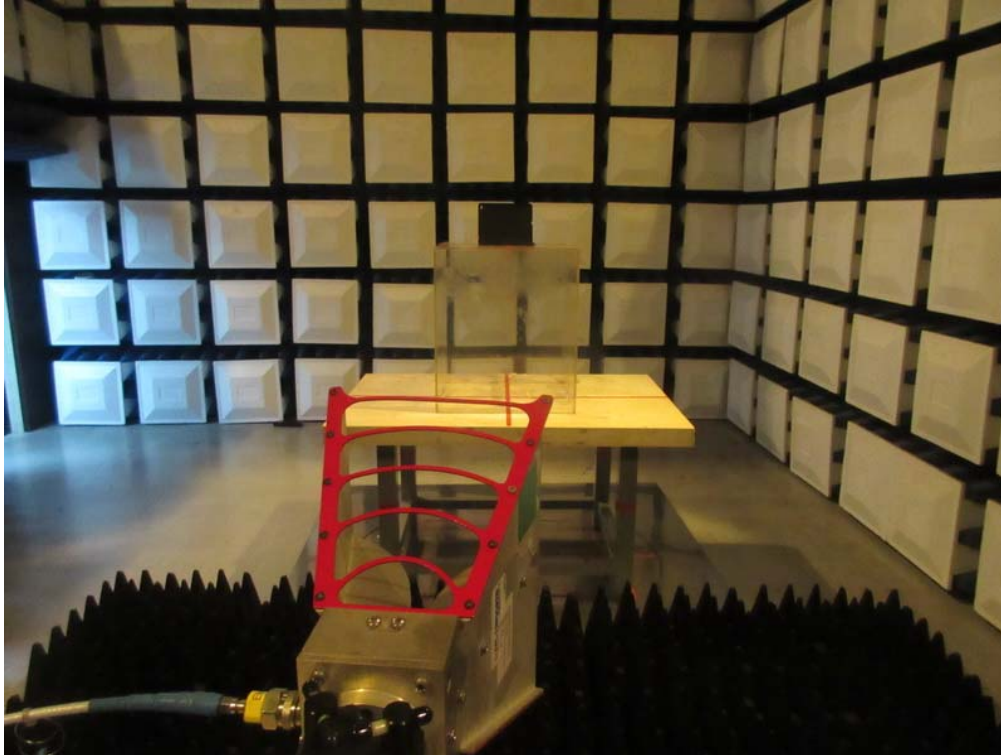
30MHz to 1000MHz





## Radiated Measurement Photos

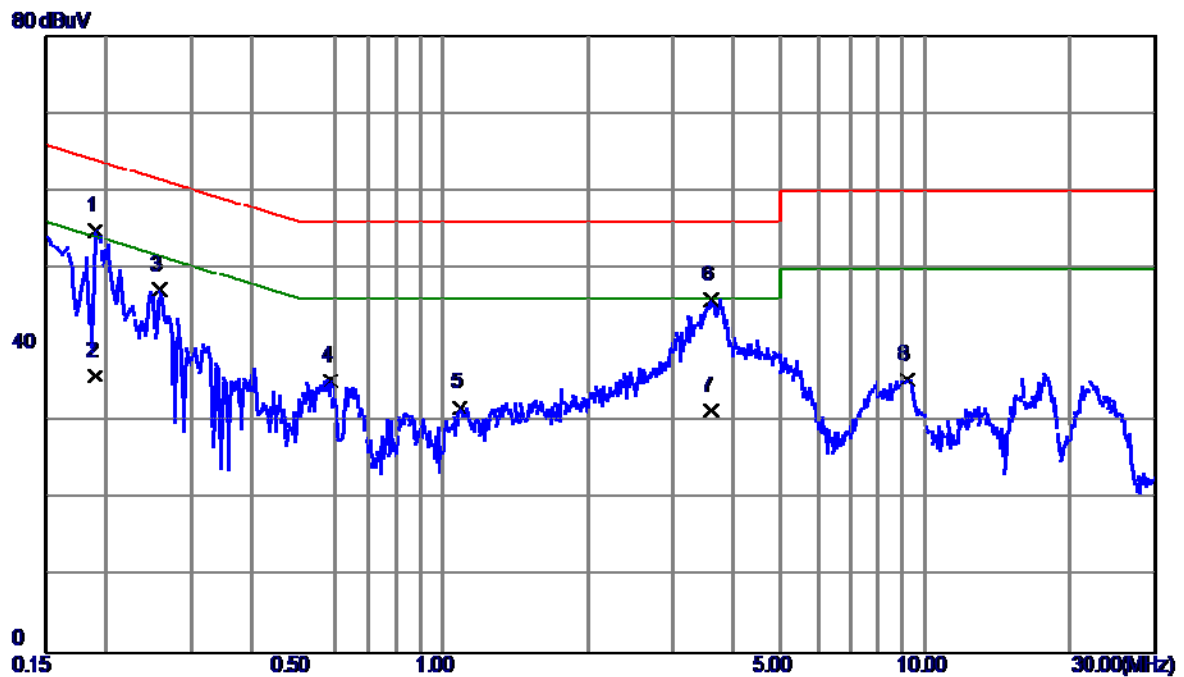
Above 1000MHz



## **ATTACHMENT A - CONDUCTED EMISSION**

Test Mode: TX Mode

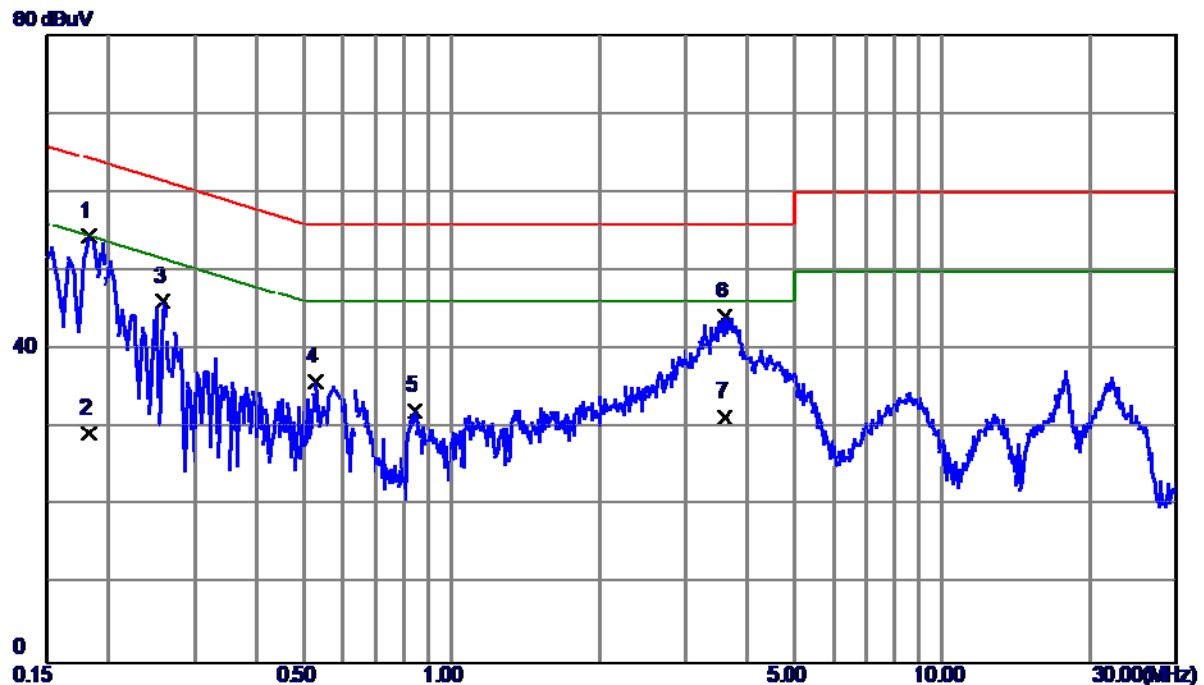
# Line



No.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1	0.1900	45.38	9.53	54.91	64.04	-9.13	Peak	
2	0.1900	26.54	9.53	36.07	54.04	-17.97	AVG	
3	0.2580	37.68	9.53	47.21	61.50	-14.29	Peak	
4	0.5860	25.71	9.64	35.35	56.00	-20.65	Peak	
5	1.0859	22.16	9.76	31.92	56.00	-24.08	Peak	
6	3.6100	35.80	10.15	45.95	56.00	-10.05	Peak	
7	3.6100	21.37	10.15	31.52	46.00	-14.48	AVG	
8	9.1700	25.31	10.20	35.51	60.00	-24.49	Peak	

Test Mode: TX Mode

### Neutral



No.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1	0.1819	44.90	9.47	54.37	64.40	-10.03	Peak	
2	0.1819	19.78	9.47	29.25	54.40	-25.15	AVG	
3	0.2580	36.49	9.53	46.02	61.50	-15.48	Peak	
4	0.5299	26.41	9.44	35.85	56.00	-20.15	Peak	
5	0.8420	22.62	9.59	32.21	56.00	-23.79	Peak	
6	3.6100	34.35	9.85	44.20	56.00	-11.80	Peak	
7	3.6100	21.46	9.85	31.31	46.00	-14.69	AVG	

## **ATTACHMENT B - RADIATED EMISSION (9KHZ-30MHZ)**

Test Mode:	TX Mode
------------	---------

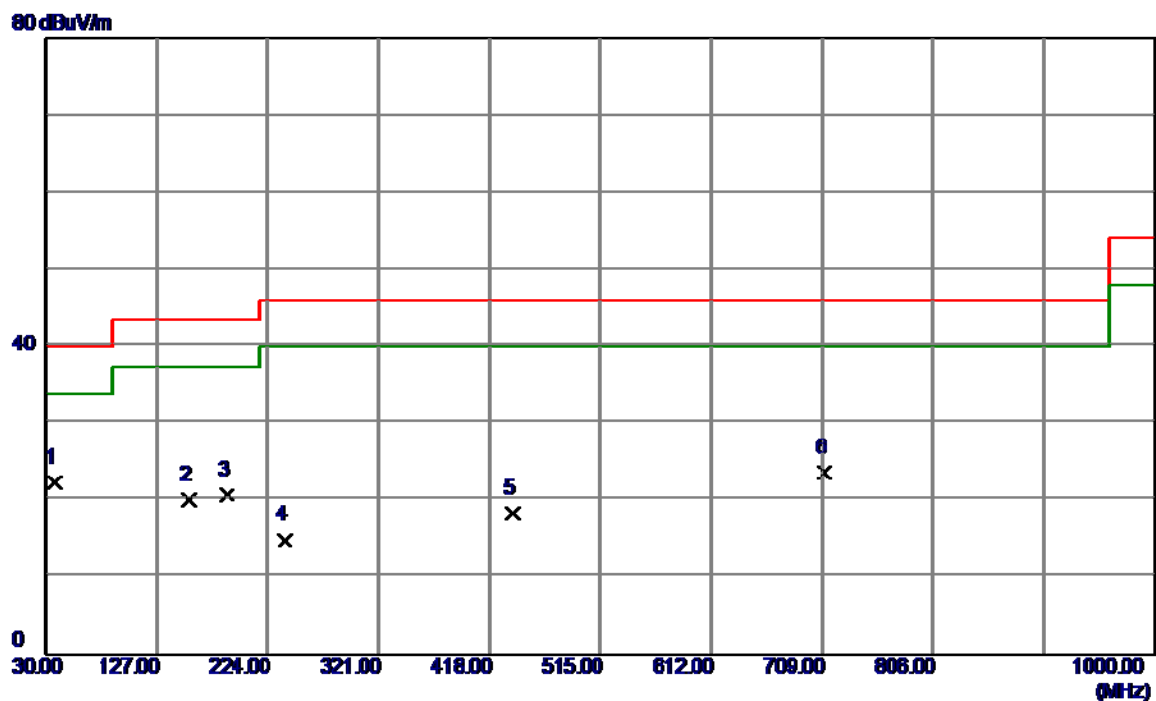
Frequency (MHz)	Ant 0°/90°	Read level dBuV/m	Factor (dB)	Measured(FS) (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Note
0.0099	0°	13.28	24.9397	38.2197	127.6915	-89.4719	AVG
0.0099	0°	14.34	24.9397	39.2797	147.6915	-108.4119	PEAK
0.0281	0°	6.73	23.7870	30.5170	118.6301	-88.1131	AVG
0.0281	0°	8.1	23.7870	31.8870	138.6301	-106.7431	PEAK
0.0352	0°	3.19	23.3373	26.5273	116.6734	-90.1460	AVG
0.0352	0°	5.46	23.3373	28.7973	136.6734	-107.8760	PEAK
0.0563	0°	1.2	22.2740	23.4740	112.5941	-89.1201	AVG
0.0563	0°	2.48	22.2740	24.7540	132.5941	-107.8401	PEAK
0.5058	0°	19.46	19.8186	39.2786	73.5246	-34.2461	QP
1.9535	0°	23.34	19.5047	42.8446	69.5400	-26.6954	QP

Frequency (MHz)	Ant 0°/90°	Read level dBuV/m	Factor (dB)	Measured(FS) (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Note
0.0122	90°	13.54	24.3000	37.8400	125.8770	-88.0370	AVG
0.0122	90°	14.67	24.3000	38.9700	145.8770	-106.9070	PEAK
0.0259	90°	7.53	23.9263	31.4563	119.3382	-87.8819	AVG
0.0259	90°	8.61	23.9263	32.5363	139.3382	-106.8019	PEAK
0.0452	90°	5.32	22.7040	28.0240	114.5015	-86.4775	AVG
0.0452	90°	6.2	22.7040	28.9040	134.5015	-105.5975	PEAK
0.0564	90°	1.63	22.2720	23.9020	112.5786	-88.6766	AVG
0.0564	90°	2.36	22.2720	24.6320	132.5786	-107.9466	PEAK
0.6212	90°	22.46	20.1878	42.6478	71.7396	-29.0918	QP
2.0545	90°	24.37	19.4673	43.8373	69.5400	-25.7027	QP

## **ATTACHMENT C - RADIATED EMISSION (30MHZ TO 1000MHZ)**

Test Mode: TX 2402MHz \_CH00\_1Mbps

## Vertical

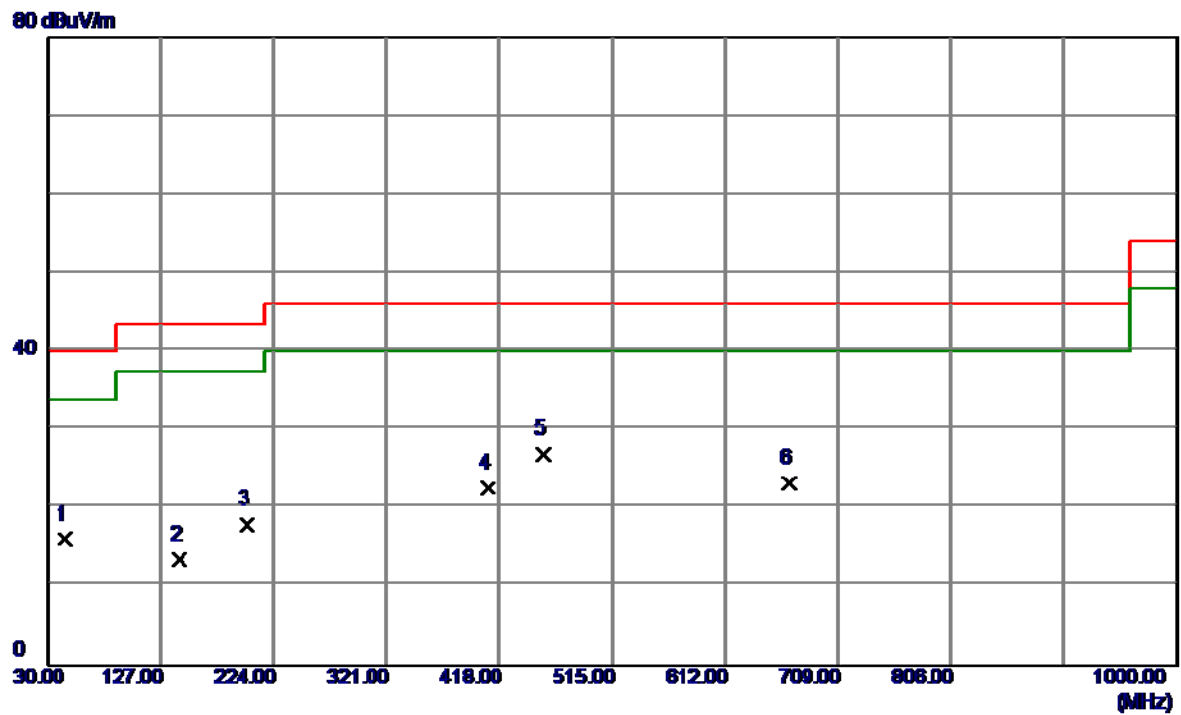


No.	Freq.	Reading	Correct	Measure	Limit	Margin		
	MHz	Level	Factor	ment			Detector	Comment
		dBuV/m	dB	dBuV/m	dBuV/m	dB		
1	37.7599	36.22	-13.88	22.34	40.00	-17.66	Peak	
2	155.1300	33.24	-13.15	20.09	43.50	-23.41	Peak	
3	188.1100	35.19	-14.38	20.81	43.50	-22.69	Peak	
4	238.5500	29.28	-14.32	14.96	46.00	-31.04	Peak	
5	438.3700	27.57	-9.11	18.46	46.00	-27.54	Peak	
6	710.9400	27.75	-4.05	23.70	46.00	-22.30	Peak	



Test Mode: TX 2402MHz \_CH00\_1Mbps

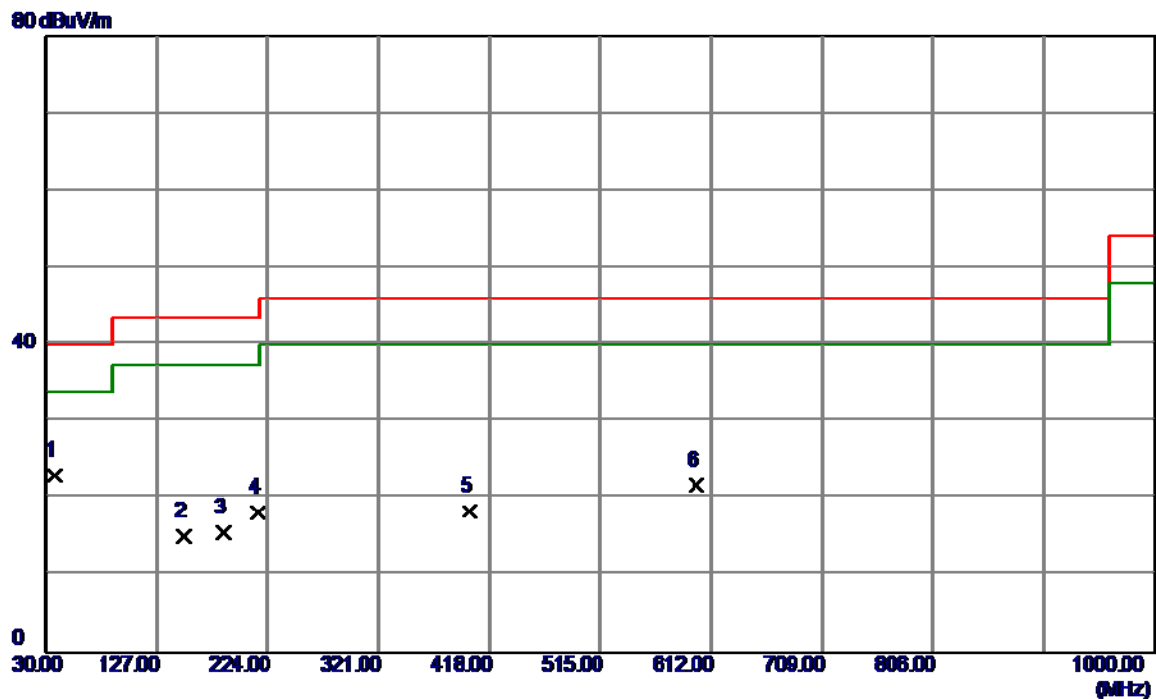
## Horizontal



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	45.5200	29.17	-13.09	16.08	40.00	-23.92	Peak	
2	143.4900	26.50	-13.03	13.47	43.50	-30.03	Peak	
3	201.6900	33.20	-15.29	17.91	43.50	-25.59	Peak	
4	408.3000	32.09	-9.47	22.62	46.00	-23.38	Peak	
5	455.8300	35.74	-8.89	26.85	46.00	-19.15	Peak	
6	667.2900	28.09	-4.85	23.24	46.00	-22.76	Peak	

Test Mode: TX 2441MHz \_CH39\_1Mbps

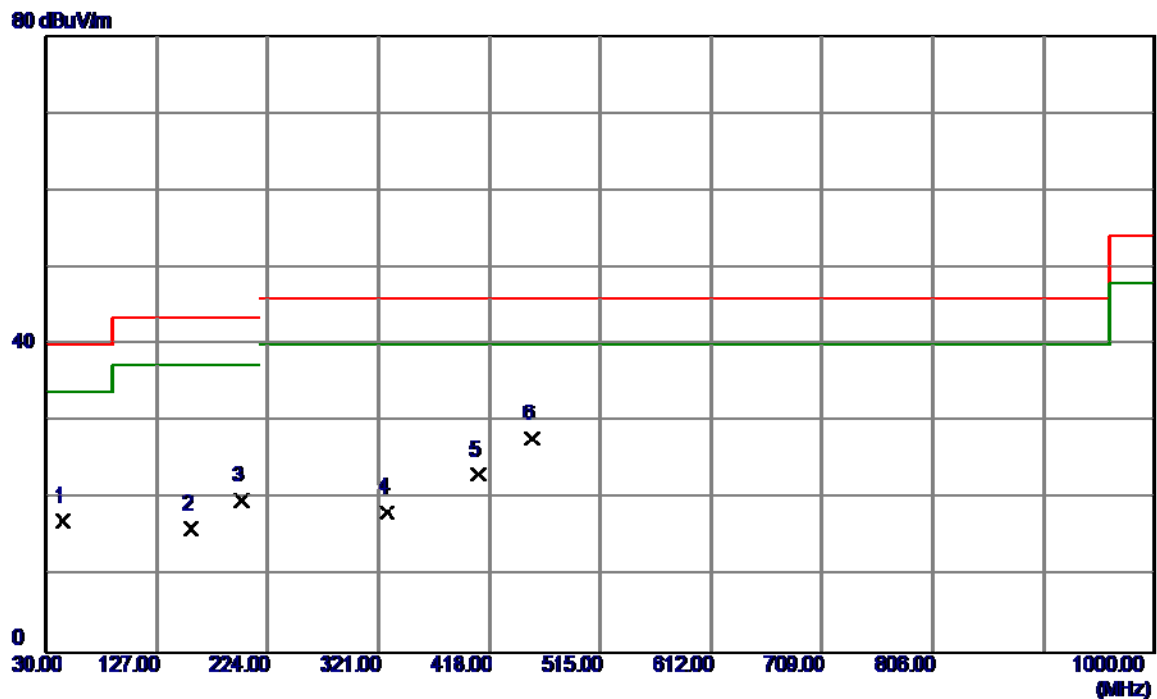
## Vertical



No.	Freq.	Reading	Correct	Measure	Limit	Margin		
	MHz	Level	Factor	ment			Detector	Comment
		dBuV/m	dB	dBuV/m	dBuV/m	dB		
1	37.7599	36.91	-13.88	23.03	40.00	-16.97	Peak	
2	150.2800	27.99	-12.80	15.19	43.50	-28.31	Peak	
3	185.2000	30.19	-14.47	15.72	43.50	-27.78	Peak	
4	215.2700	32.71	-14.51	18.20	43.50	-25.30	Peak	
5	400.5400	28.00	-9.56	18.44	46.00	-27.56	Peak	
6	599.3900	28.06	-6.28	21.78	46.00	-24.22	Peak	

Test Mode: TX 2441MHz \_CH39\_1Mbps

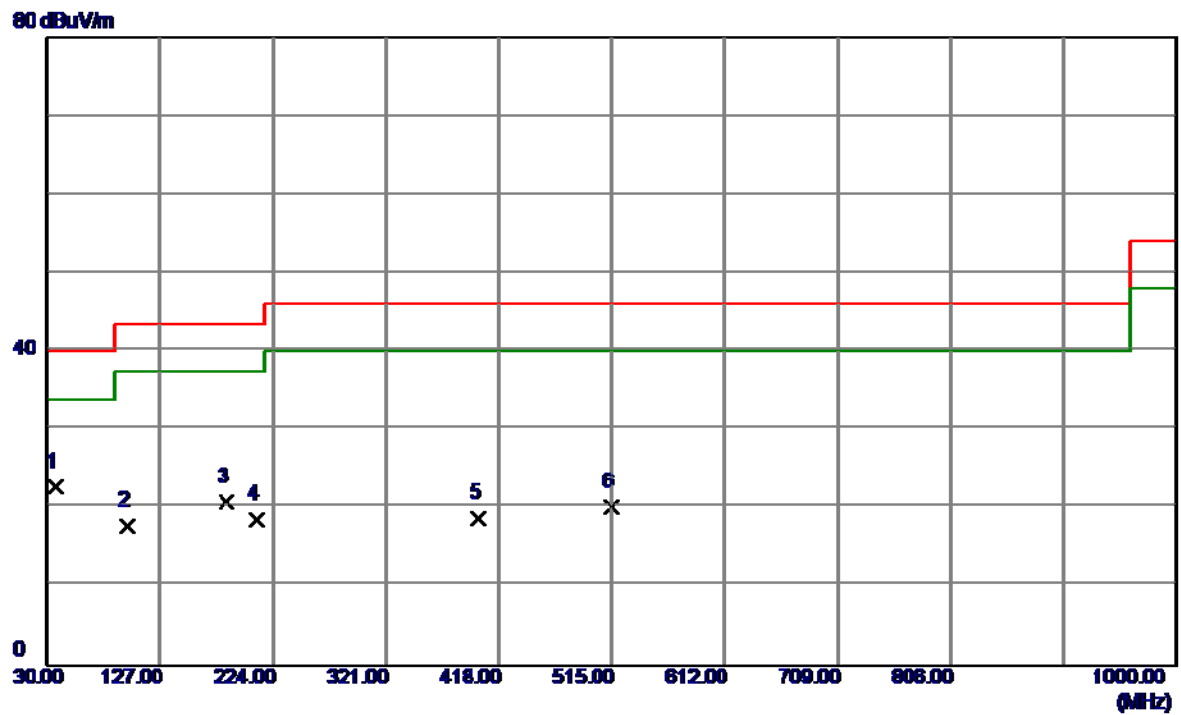
## Horizontal



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	45.5200	30.17	-13.09	17.08	40.00	-22.92	Peak	
2	157.0700	29.47	-13.28	16.19	43.50	-27.31	Peak	
3	201.6900	35.20	-15.29	19.91	43.50	-23.59	Peak	
4	328.7600	29.57	-11.32	18.25	46.00	-27.75	Peak	
5	408.3000	32.59	-9.47	23.12	46.00	-22.88	Peak	
6	455.8300	36.74	-8.89	27.85	46.00	-18.15	Peak	

Test Mode: TX 2480MHz \_CH78\_1Mbps

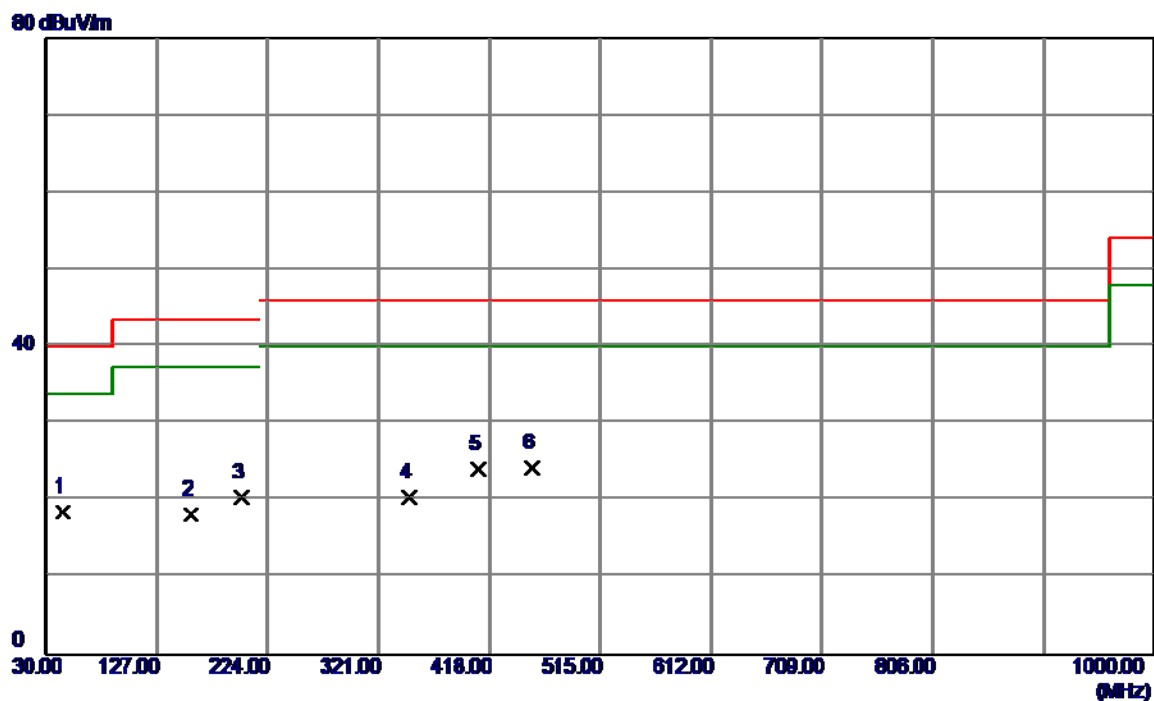
## Vertical



No.	Freq. MHz	Reading Level dBuV/m	Correct. Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	37.7599	36.54	-13.88	22.66	40.00	-17.34	Peak	
2	98.8700	35.37	-17.64	17.73	43.50	-25.77	Peak	
3	184.2300	35.32	-14.49	20.83	43.50	-22.67	Peak	
4	210.4200	32.74	-14.11	18.63	43.50	-24.87	Peak	
5	400.5400	28.33	-9.56	18.77	46.00	-27.23	Peak	
6	515.0000	28.16	-7.95	20.21	46.00	-25.79	Peak	

Test Mode: TX 2480MHz \_CH78\_1Mbps

## Horizontal

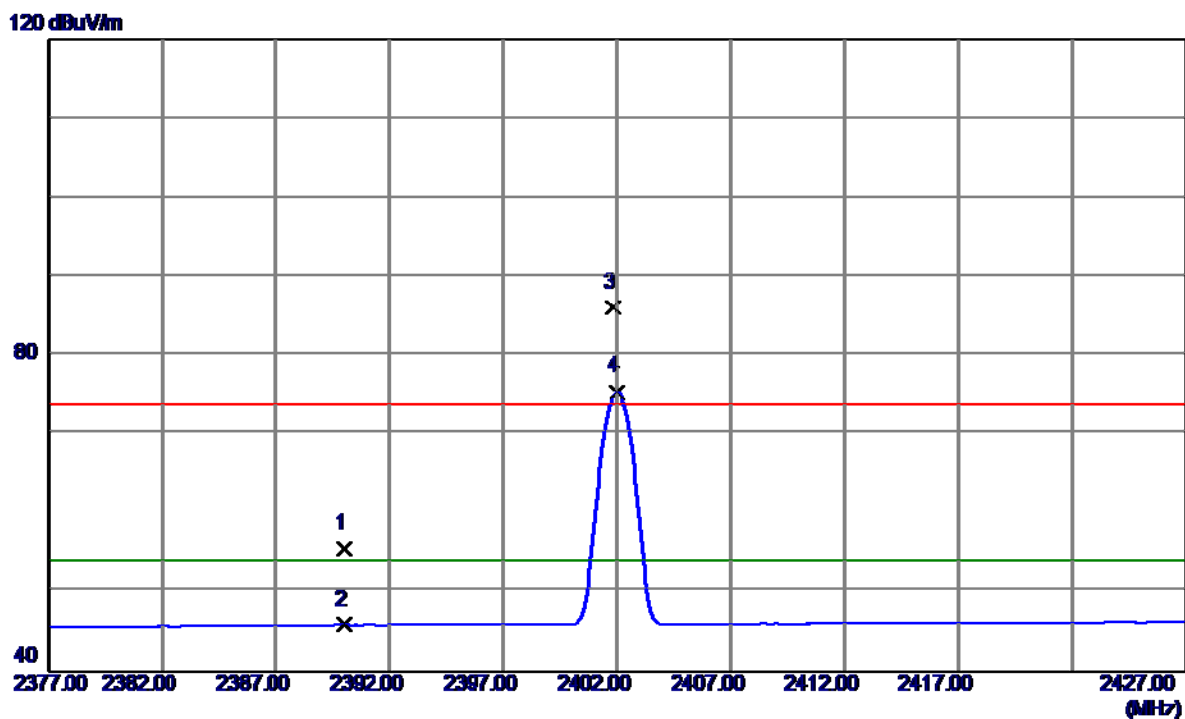


No.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Detector	Comment
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB		
1	45.5200	31.67	-13.09	18.58	40.00	-21.42	Peak	
2	157.0700	31.47	-13.28	18.19	43.50	-25.31	Peak	
3	201.6900	35.70	-15.29	20.41	43.50	-23.09	Peak	
4	348.1600	31.44	-10.95	20.49	46.00	-25.51	Peak	
5	408.3000	33.59	-9.47	24.12	46.00	-21.88	Peak	
6	455.8300	33.24	-8.89	24.35	46.00	-21.65	Peak	

## **ATTACHMENT D - RADIATED EMISSION (ABOVE 1000MHZ)**

Test Mode : TX 2402MHz \_CH00\_1Mbps

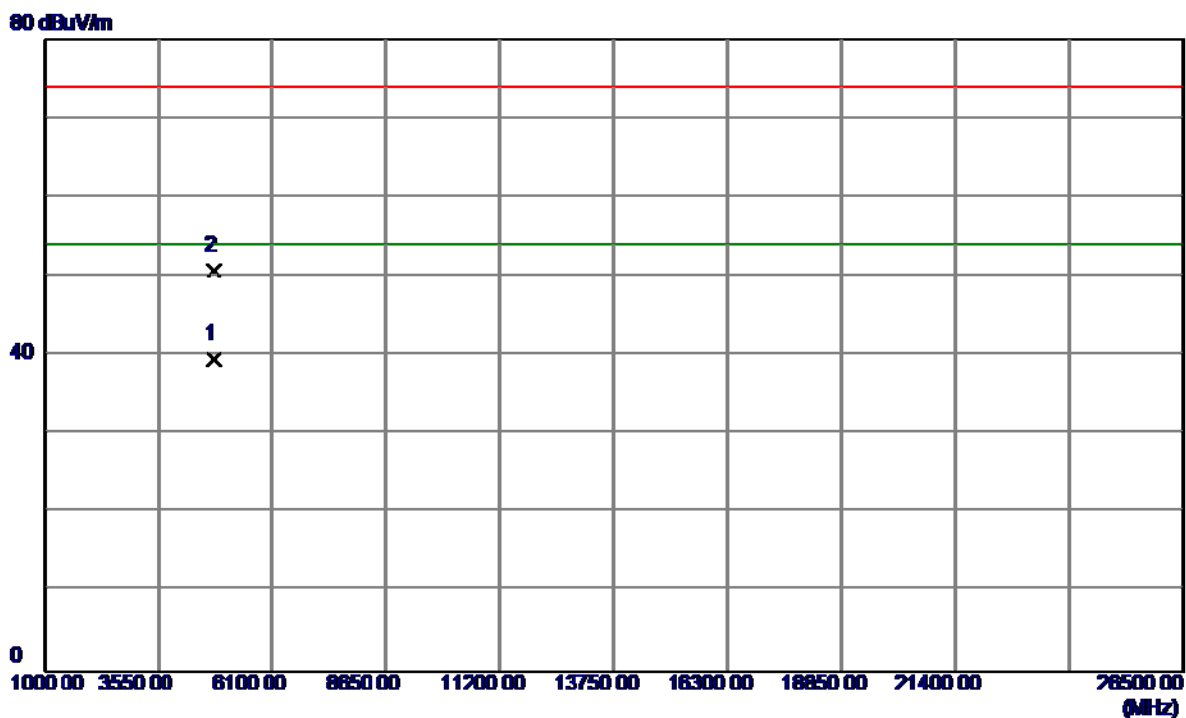
### Vertical



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	2390.0000	22.81	32.77	55.58	74.00	-18.42	Peak	
2	2390.0000	13.08	32.77	45.85	54.00	-8.15	AVG	
3	2401.8500	53.25	32.82	86.07	74.00	12.07	Peak	No Limit
4	2402.0000	42.62	32.82	75.44	54.00	21.44	AVG	No Limit

Test Mode :	TX 2402MHz _CH00_1Mbps
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### Vertical

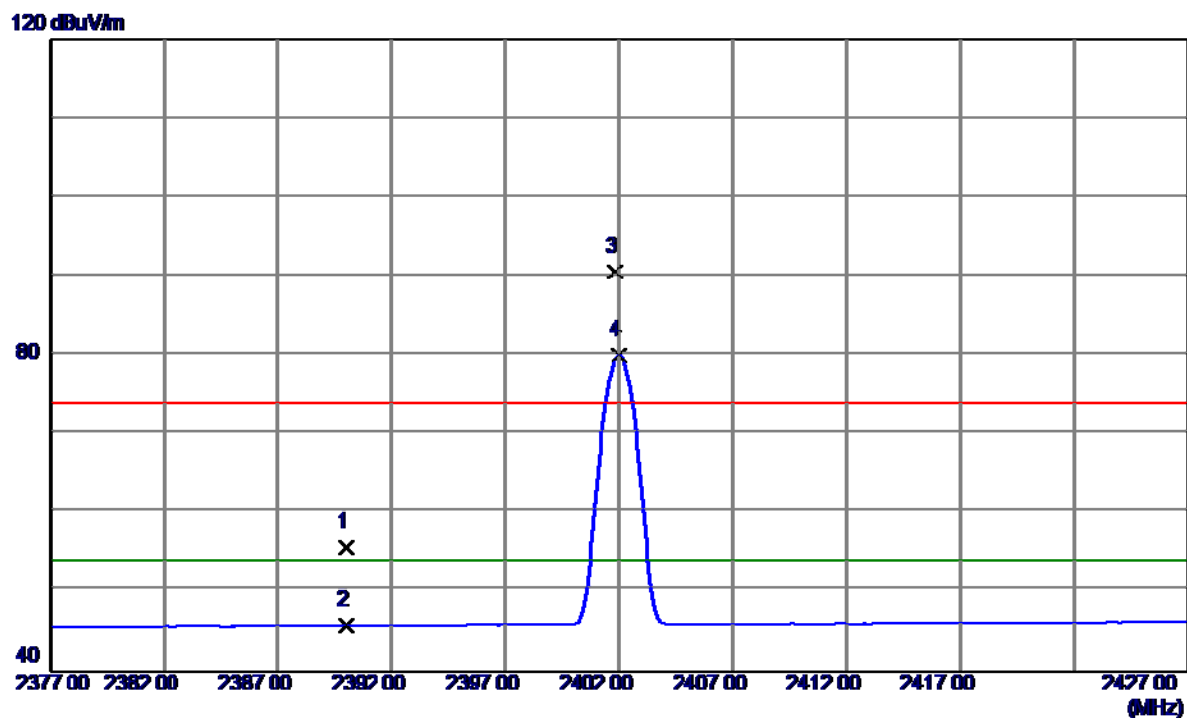


No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	4803.9700	34.97	4.62	39.59	54.00	-14.41	AVG	
2	4804.2799	46.04	4.62	50.66	74.00	-23.34	Peak	



Test Mode : TX 2402MHz \_CH00\_1Mbps

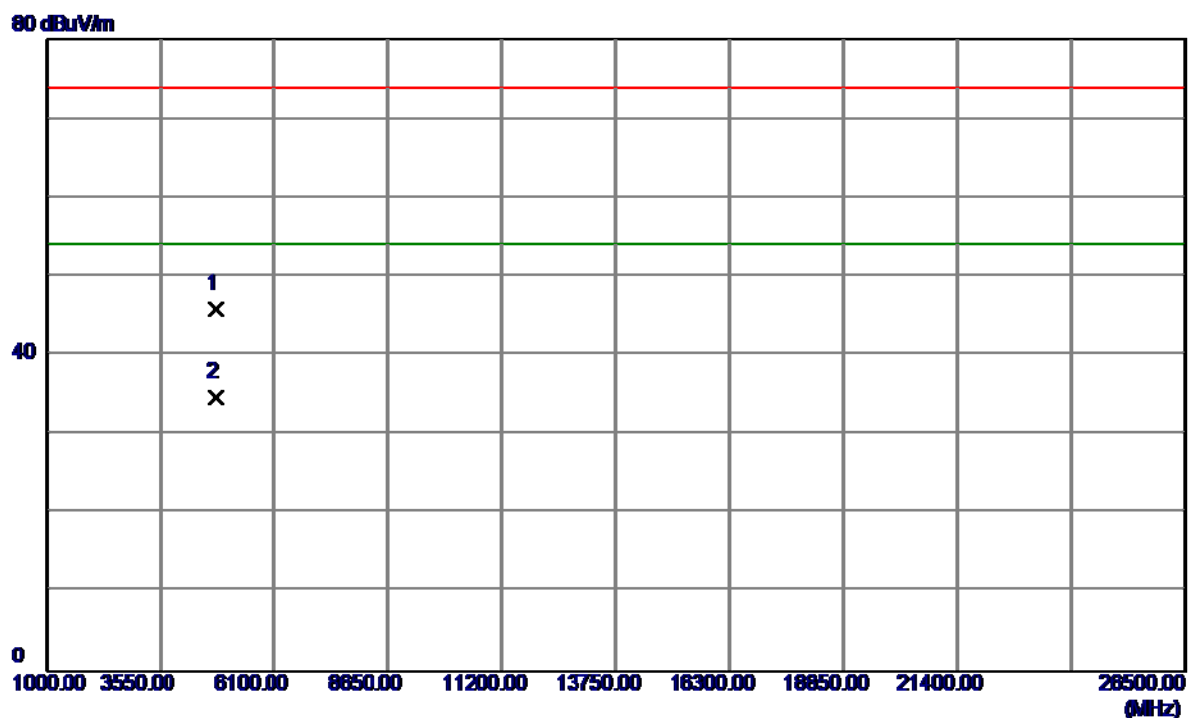
### Horizontal



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	2390.0000	22.96	32.77	55.73	74.00	-18.27	Peak	
2	2390.0000	13.01	32.77	45.78	54.00	-8.22	AVG	
3	2401.8500	57.81	32.82	90.63	74.00	16.63	Peak	No Limit
4	2402.0000	47.19	32.82	80.01	54.00	26.01	AVG	No Limit

Test Mode :	TX 2402MHz _CH00_1Mbps
-------------	------------------------

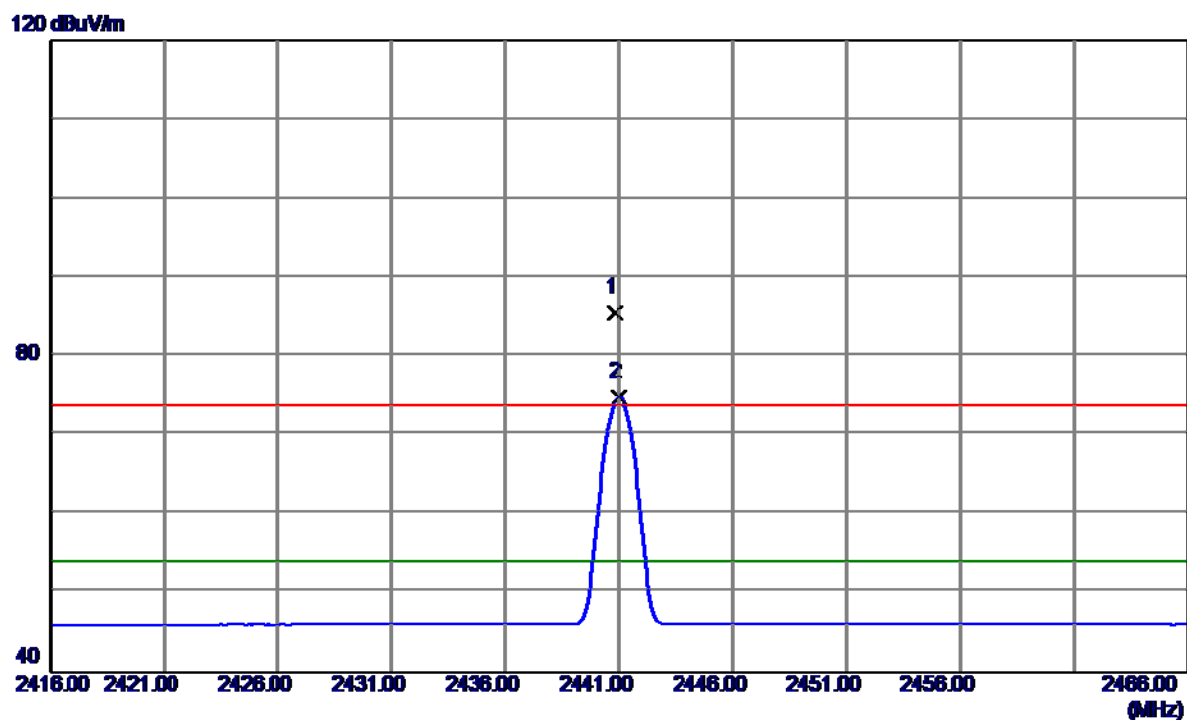
### Horizontal



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	4803.7799	41.33	4.61	45.94	74.00	-28.06	Peak	
2	4803.9800	30.04	4.62	34.66	54.00	-19.34	AVG	

Test Mode :	TX 2441MHz _CH39_ 1Mbps
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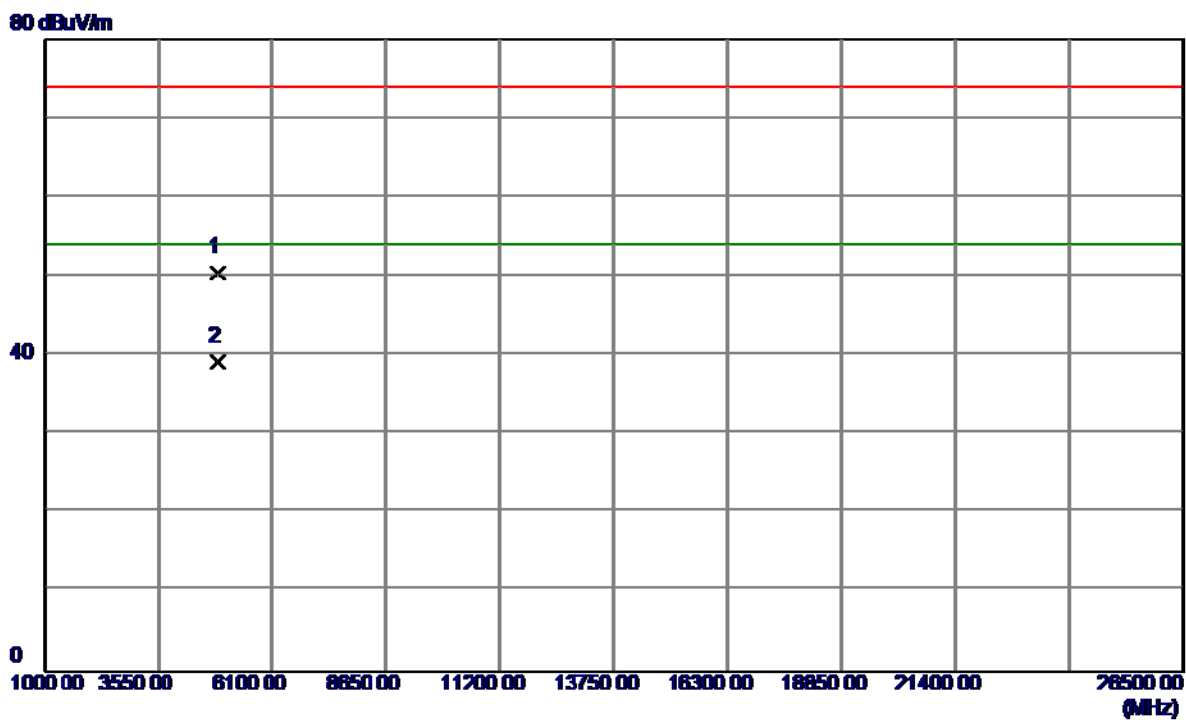
### Vertical



No.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	2440.8500	52.59	32.98	85.57	74.00	11.57	Peak	No Limit
2	2441.0000	41.96	32.98	74.94	54.00	20.94	AVG	No Limit

Test Mode :	TX 2441MHz _CH39_1Mbps
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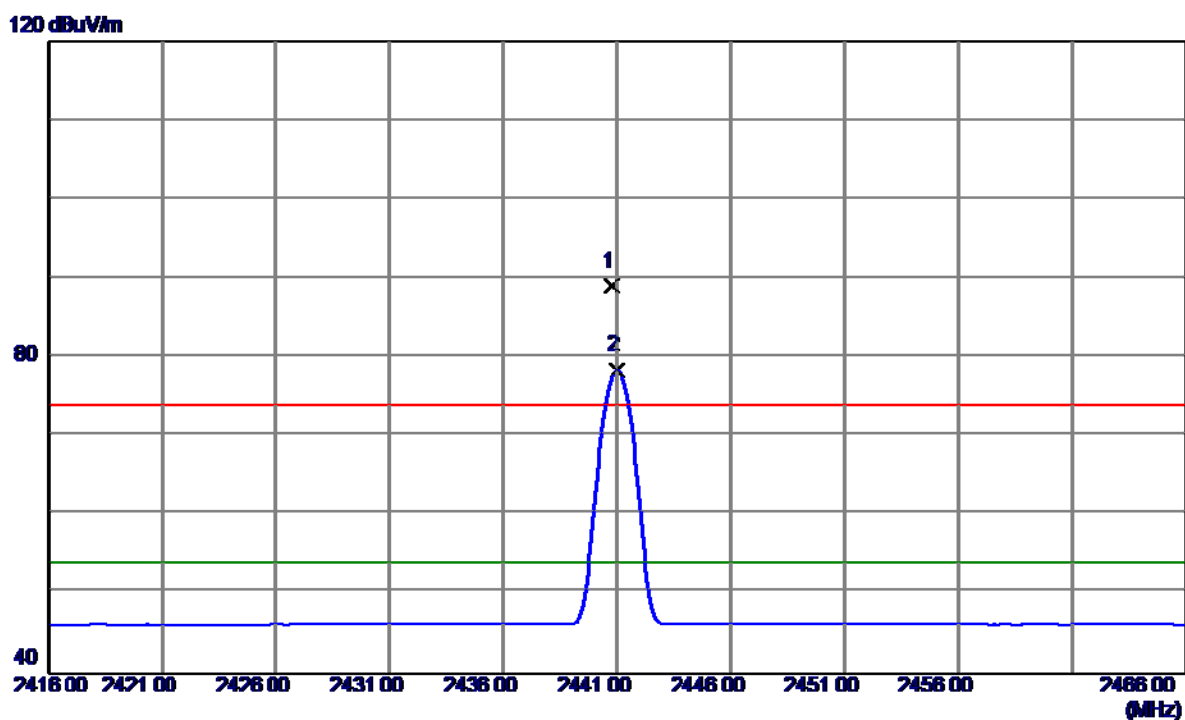
### Vertical



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	4882.1400	45.56	4.92	50.48	74.00	-23.52	Peak	
2	4882.3400	34.27	4.92	39.19	54.00	-14.81	AVG	

Test Mode : TX 2441MHz \_CH39\_1Mbps

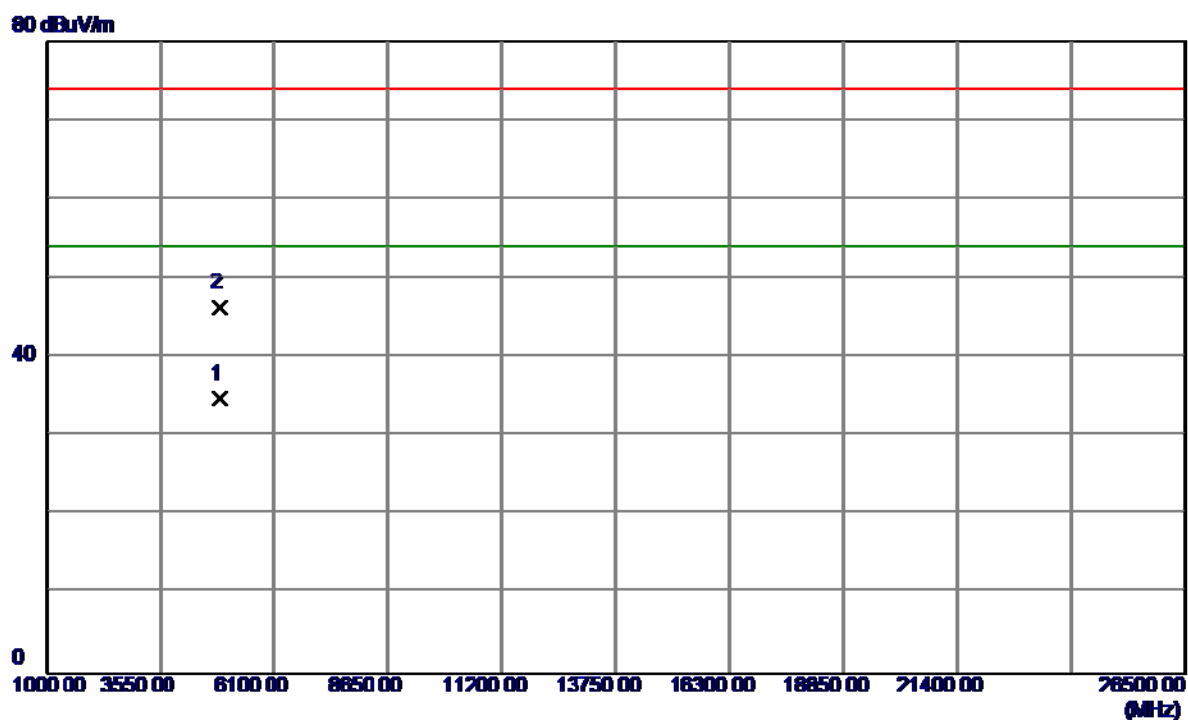
### Horizontal



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	2440.8000	56.00	32.98	88.98	74.00	14.98	Peak	No Limit
2	2441.0000	45.41	32.98	78.39	54.00	24.39	AVG	No Limit

Test Mode :	TX 2441MHz _CH39_1Mbps
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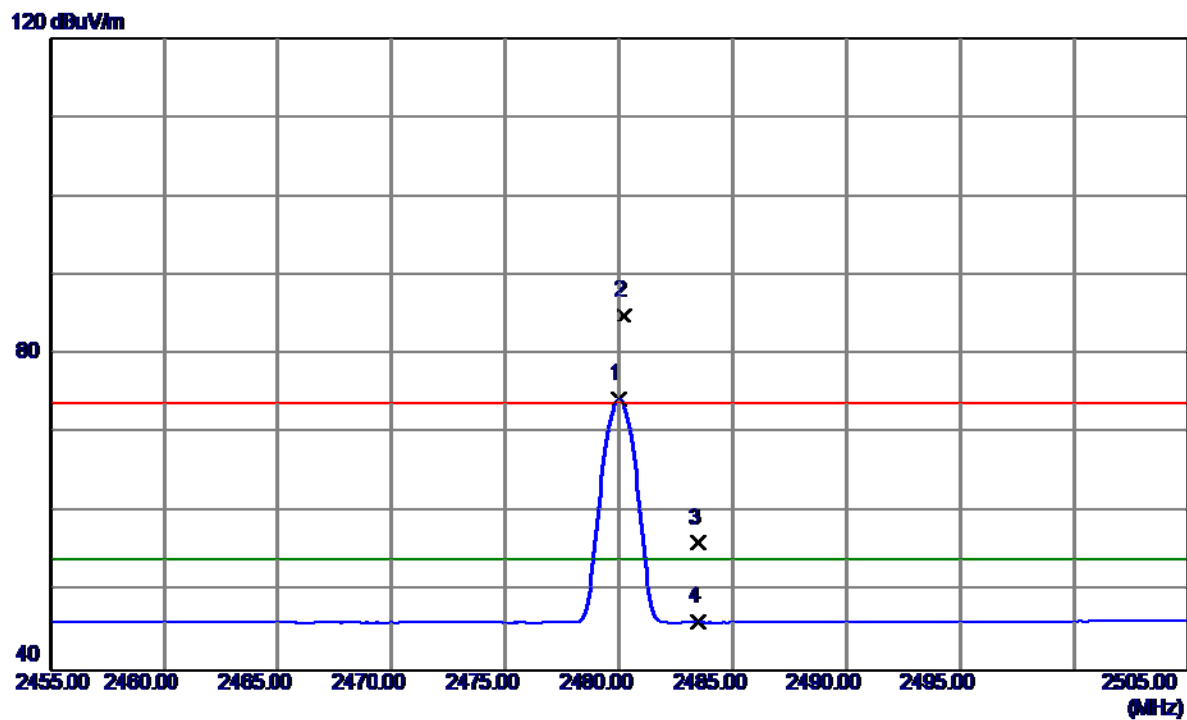
### Horizontal



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	4882.3900	29.84	4.92	34.76	54.00	-19.24	AVG	
2	4882.5099	41.34	4.92	46.26	74.00	-27.74	Peak	

Test Mode : TX 2480MHz \_CH78\_1Mbps

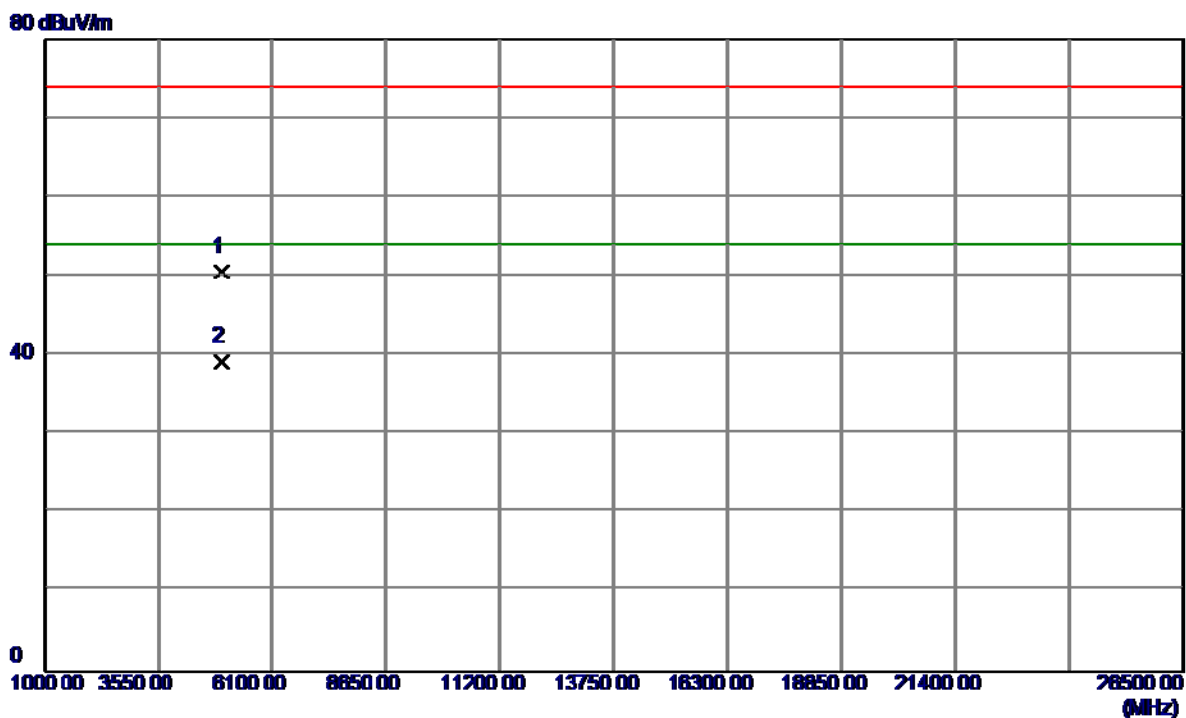
### Vertical



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	2480.0000	41.26	33.14	74.40	54.00	20.40	AVG	No Limit
2	2480.2000	51.88	33.14	85.02	74.00	11.02	Peak	No Limit
3	2483.5000	23.00	33.15	56.15	74.00	-17.85	Peak	
4	2483.5000	13.02	33.15	46.17	54.00	-7.83	AVG	

Test Mode :	TX 2480MHz _CH78_1Mbps
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### Vertical

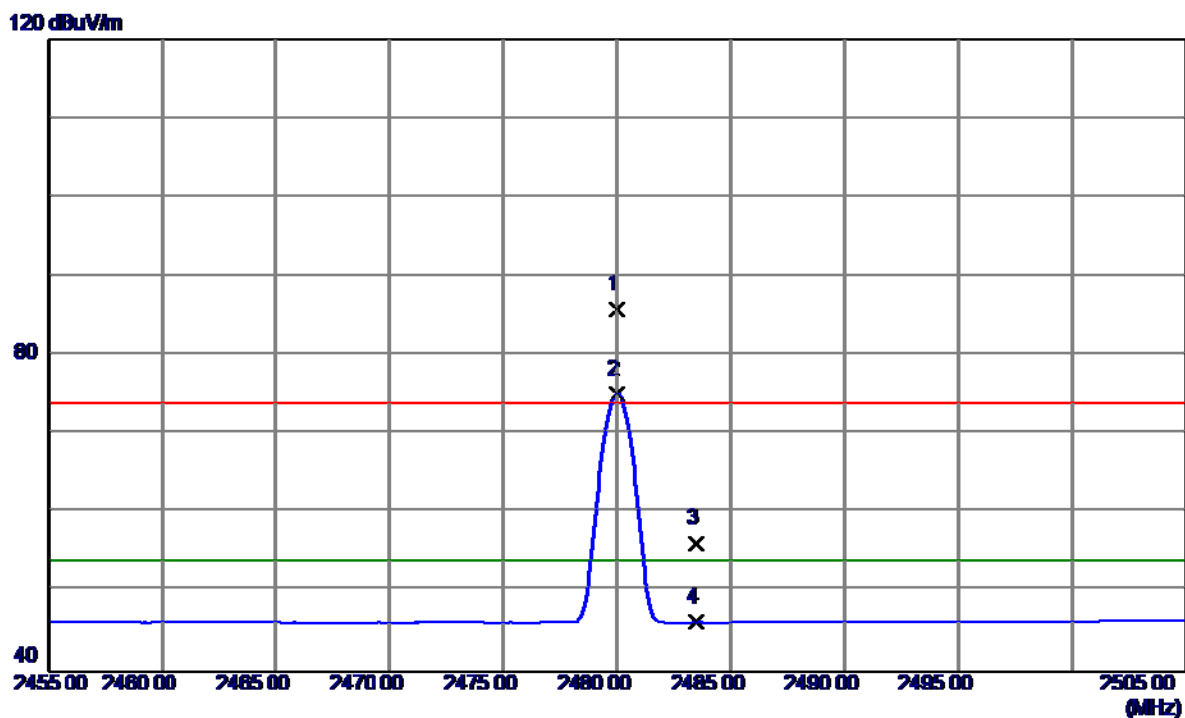


No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	4960.5700	45.38	5.23	50.61	74.00	-23.39	Peak	
2	4960.6500	33.96	5.23	39.19	54.00	-14.81	AVG	



Test Mode : TX 2480MHz \_CH78\_1Mbps

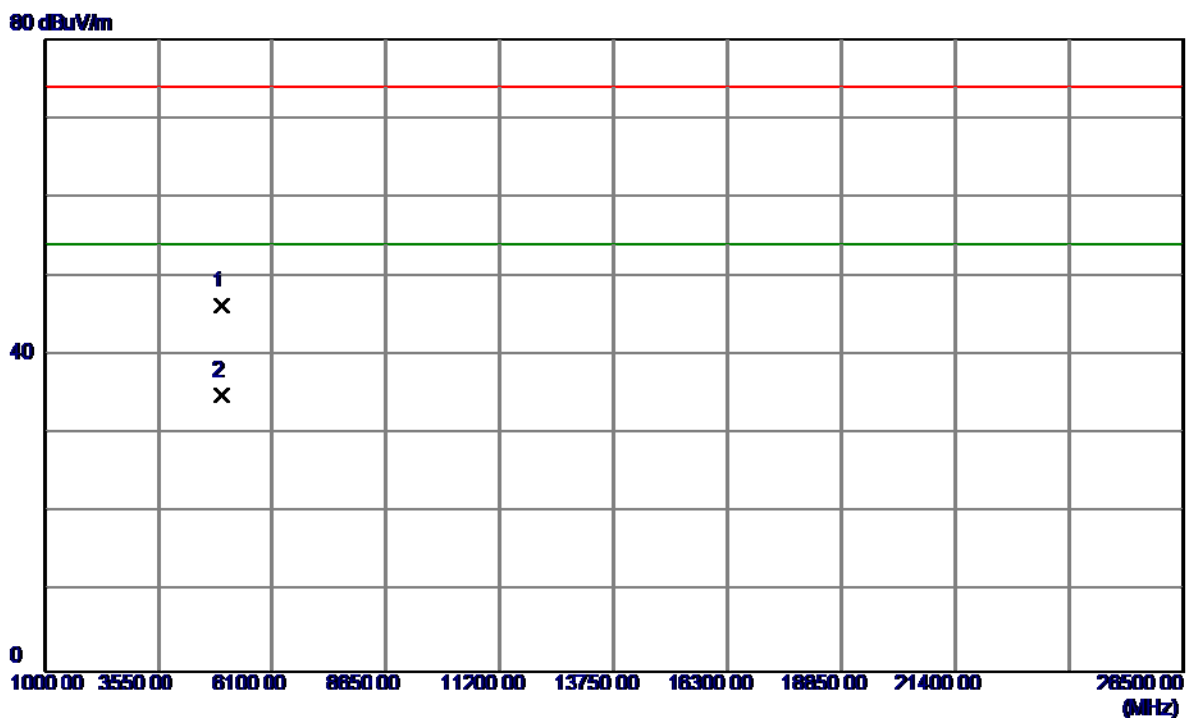
### Horizontal



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	2480.0000	52.56	33.14	85.70	74.00	11.70	Peak	No Limit
2	2480.0000	41.92	33.14	75.06	54.00	21.06	AVG	No Limit
3	2483.5000	23.07	33.15	56.22	74.00	-17.78	Peak	
4	2483.5000	13.01	33.15	46.16	54.00	-7.84	AVG	

Test Mode :	TX 2480MHz _CH78_1Mbps
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### Horizontal



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	4960.3100	41.03	5.23	46.26	74.00	-27.74	Peak	
2	4960.6800	29.58	5.23	34.81	54.00	-19.19	AVG	

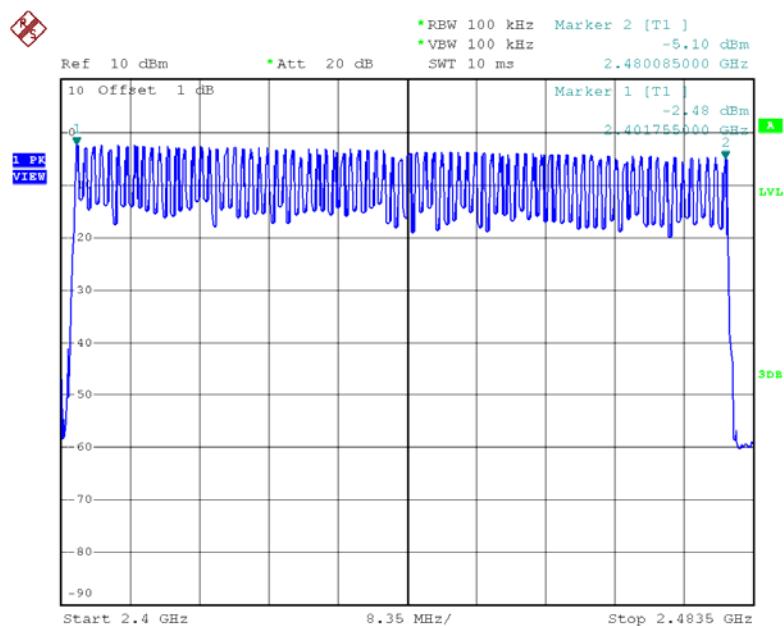
## **ATTACHMENT E - NUMBER OF HOPPING CHANNEL**

# Test Mode

# Hopping Mode\_1Mbps

Number of Hopping Channel

79



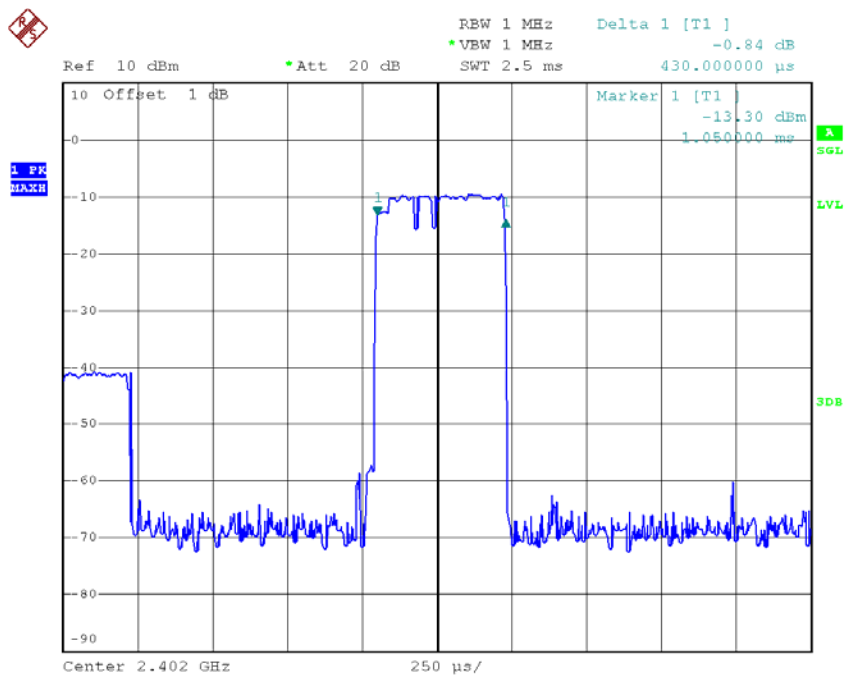
Date: 28.APR.2016 20:48:18

## **ATTACHMENT F - AVERAGE TIME OF OCCUPANCY**

Test Mode :	TX Mode_1Mbps
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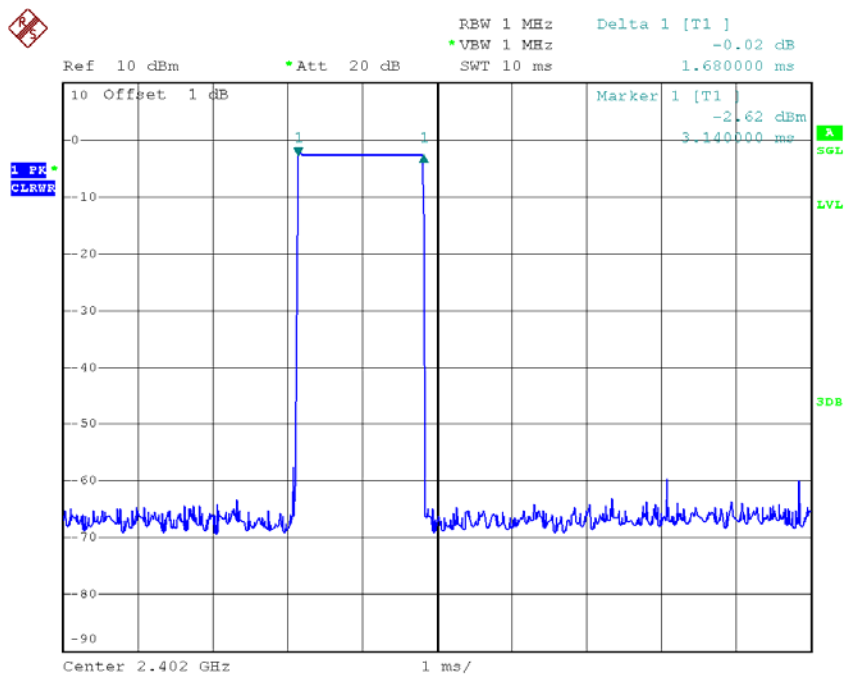
Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (s)	Limits (s)	Test Result
DH5	2402	2.9600	0.3157	0.4000	Pass
DH3	2402	1.6800	0.1792	0.4000	Pass
DH1	2402	0.4300	0.0459	0.4000	Pass
DH5	2441	2.9600	0.3157	0.4000	Pass
DH3	2441	1.6800	0.1792	0.4000	Pass
DH1	2441	0.4350	0.0464	0.4000	Pass
DH5	2480	2.9600	0.3157	0.4000	Pass
DH3	2480	1.6800	0.1792	0.4000	Pass
DH1	2480	0.4350	0.0464	0.4000	Pass

### CH00-DH1



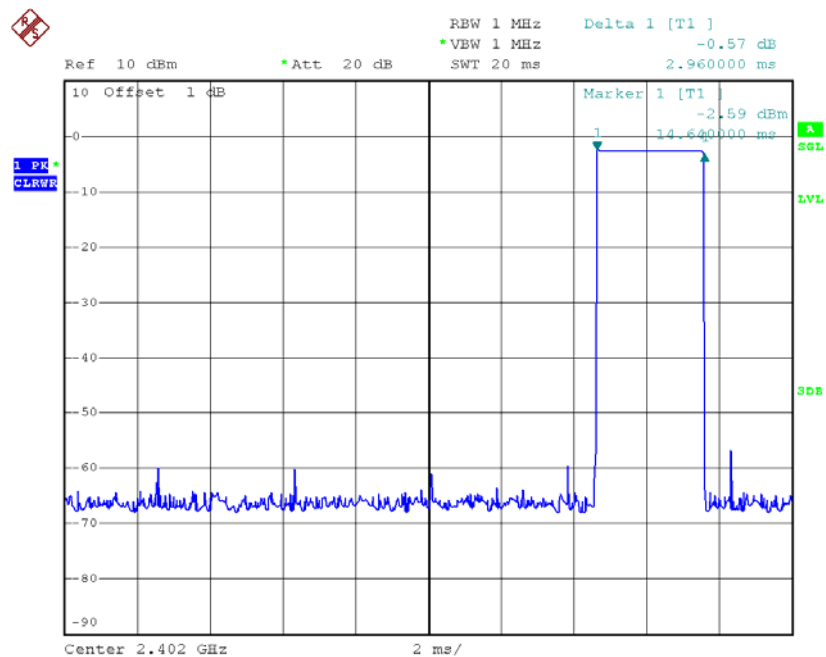
Date: 28.APR.2016 20:42:44

### CH00-DH3



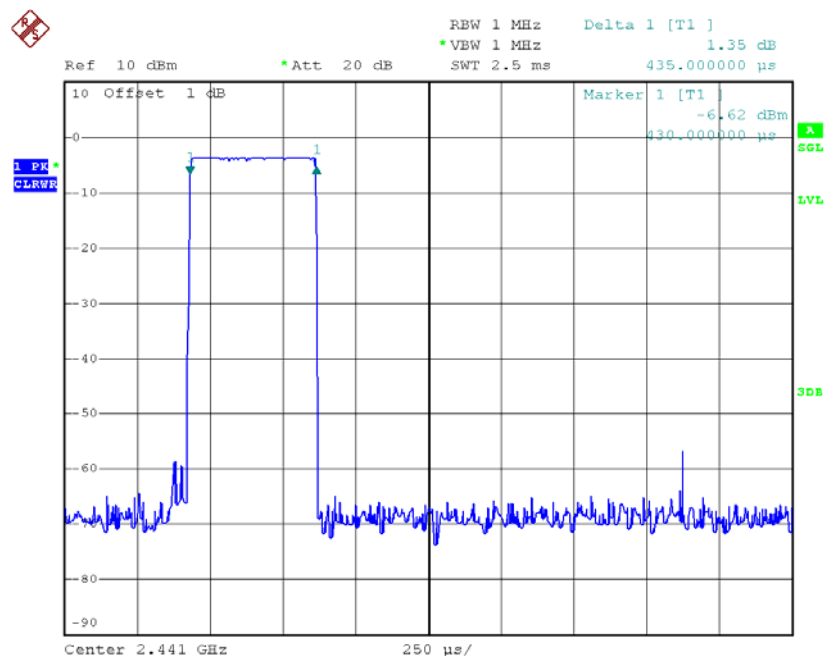
Date: 28.APR.2016 20:52:00

# CH00-DH5



Date: 28.APR.2016 20:52:30

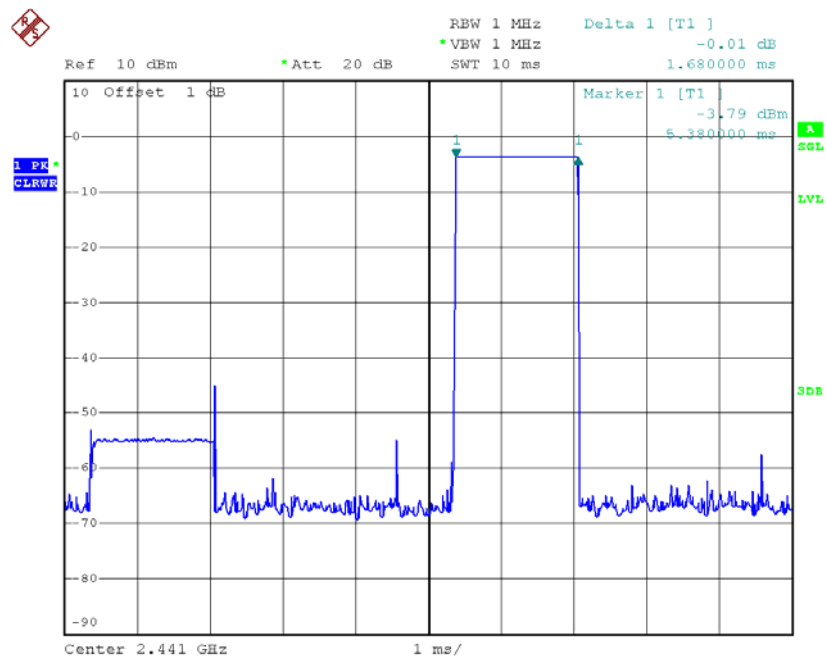
# CH39-DH1



Date: 28.APR.2016 20:43:01

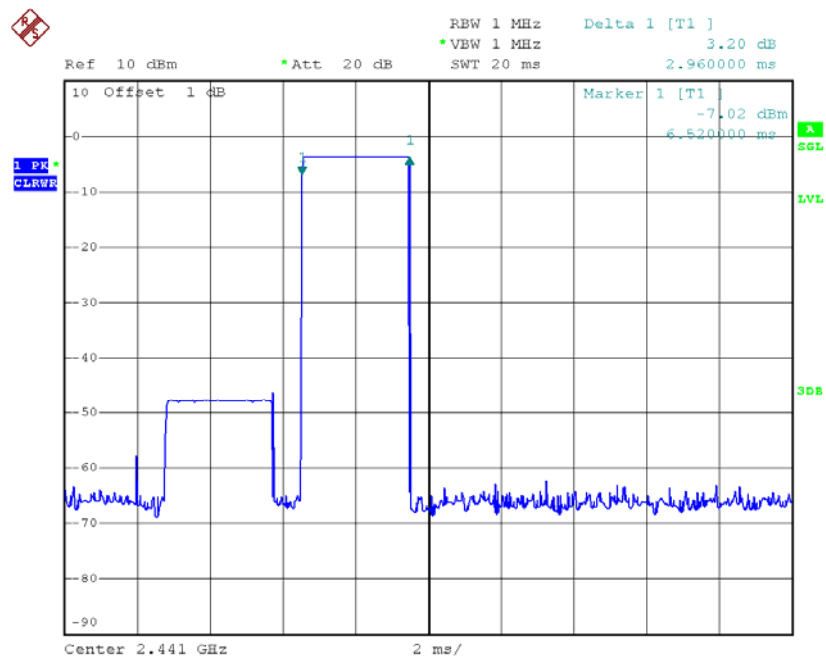


### CH39-DH3



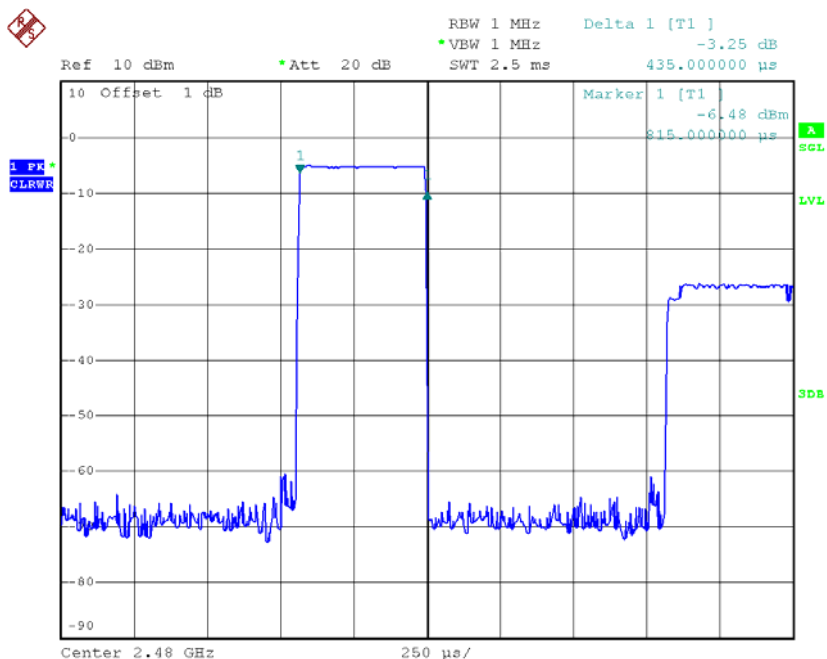
Date: 28.APR.2016 20:52:05

### CH39-DH5



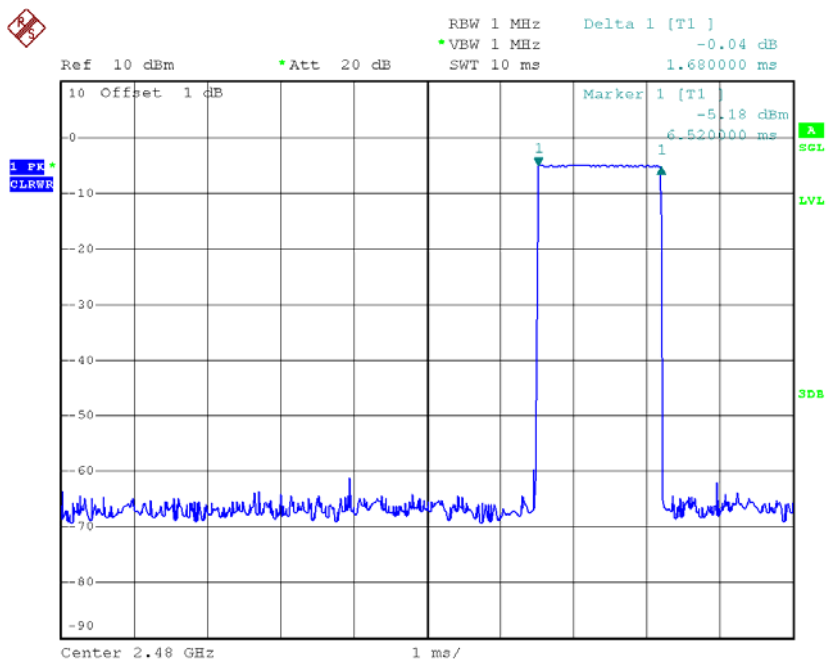
Date: 28.APR.2016 20:52:39

# CH78-DH1



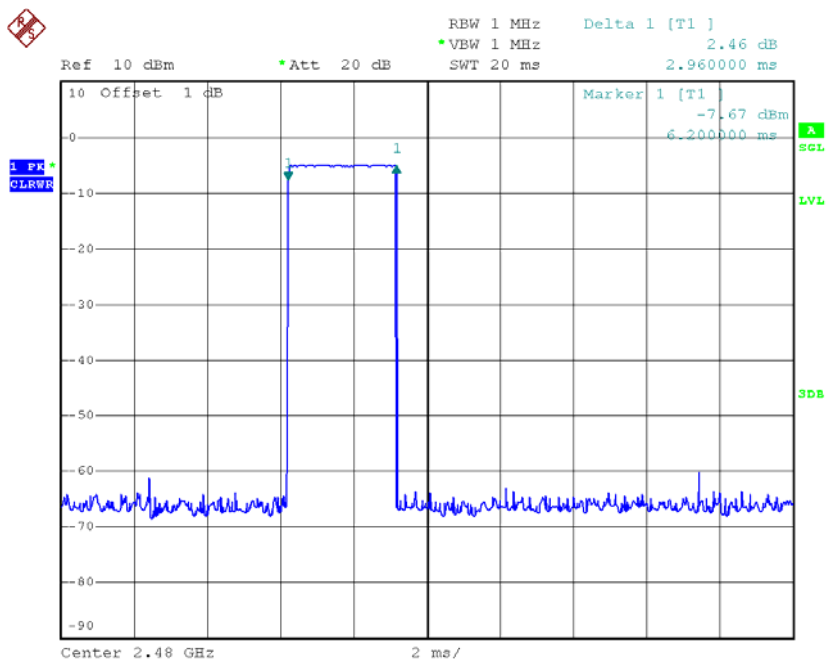
Date: 28.APR.2016 20:43:07

# CH78-DH3



Date: 28.APR.2016 20:52:12

# CH78-DH5

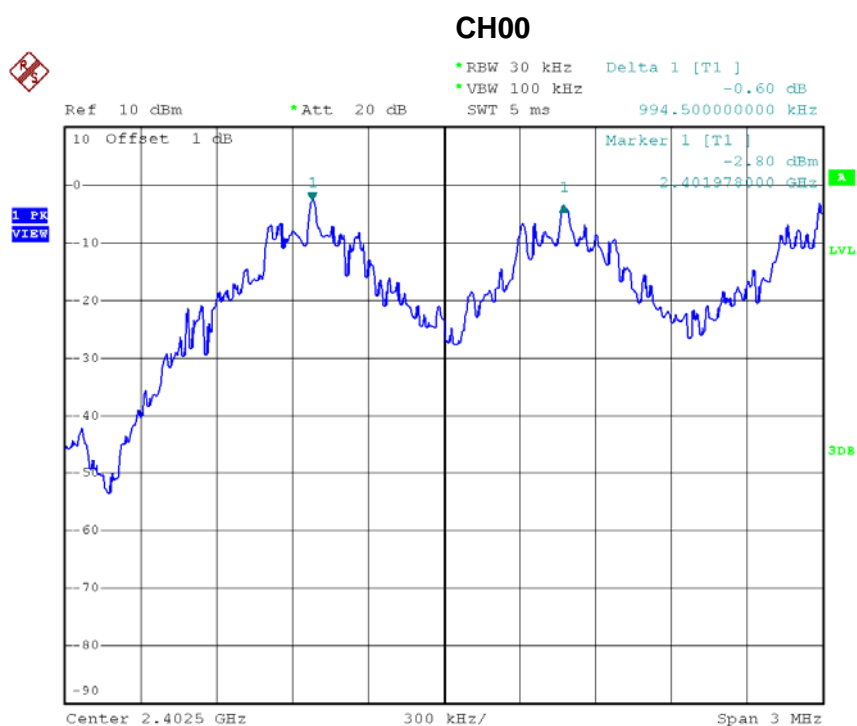


Date: 28.APR.2016 20:52:47

## **ATTACHMENT G - HOPPING CHANNEL SEPARATION MEASUREMENT**

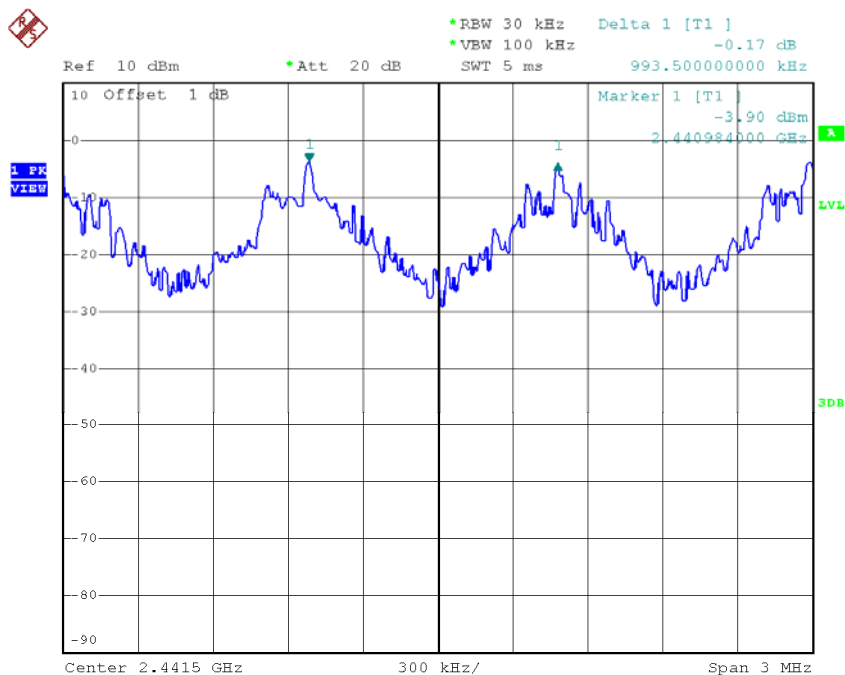
Test Mode :	Hopping on _1Mbps
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Frequency (MHz)	Channel Separation (MHz)	2/3 of 20dB Bandwidth (MHz)	Test Result
2402	0.995	0.693	Pass
2441	0.994	0.677	Pass
2480	1.008	0.681	Pass



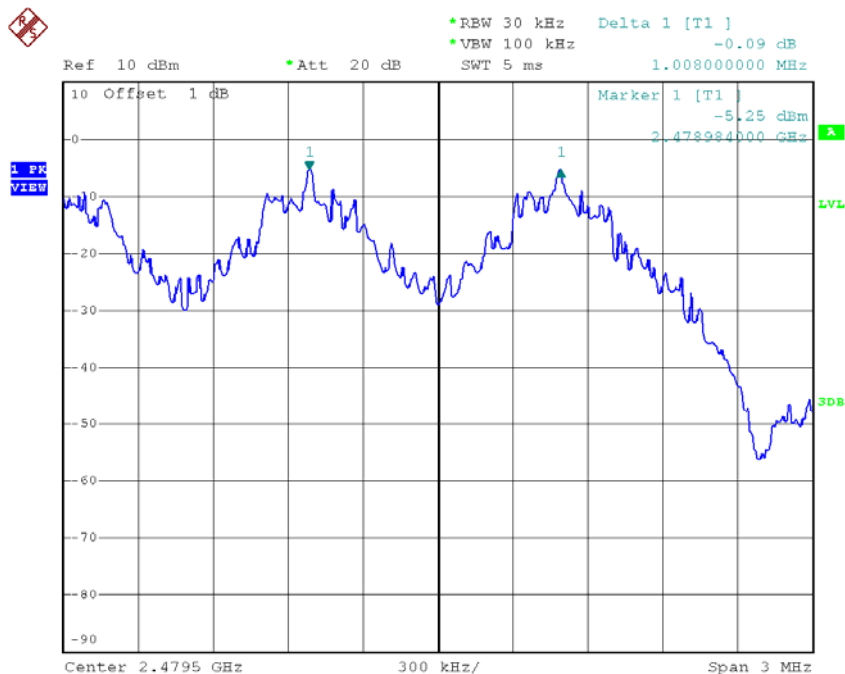
Date: 28.APR.2016 20:44:17

# CH39



Date: 28.APR.2016 20:45:25

# CH78

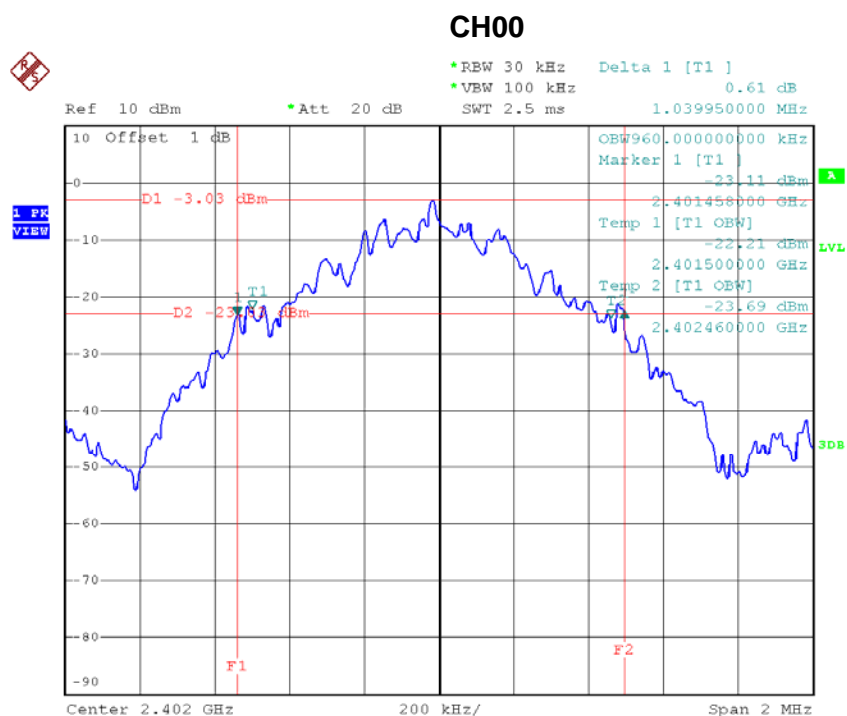


Date: 28.APR.2016 20:46:30

## **ATTACHMENT H - BANDWIDTH**

Test Mode :	TX Mode _1Mbps
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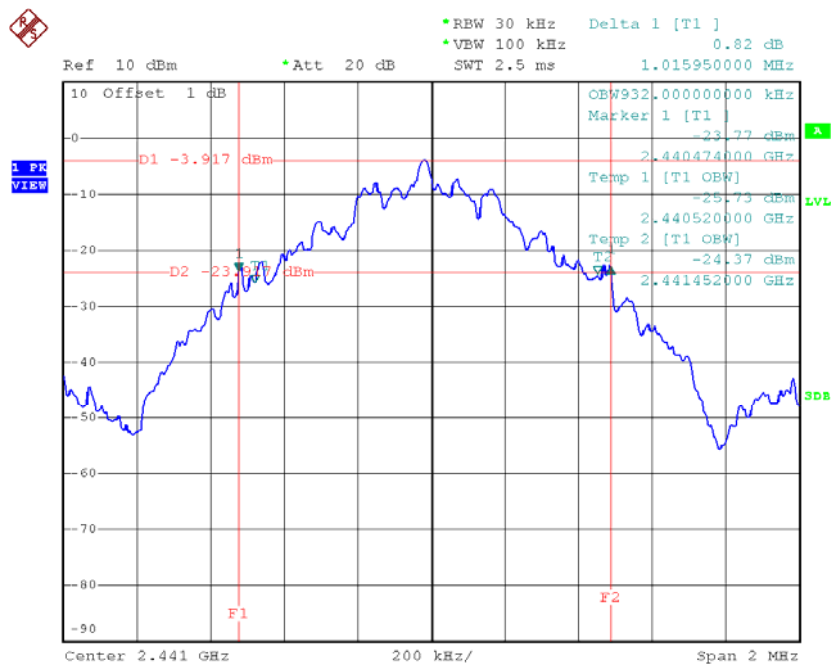
Frequency (MHz)	20dB Bandwidth (MHz)	99% Occupied BW (MHz)	Test Result
2402	1.040	0.960	Pass
2441	1.016	0.932	Pass
2480	1.022	0.956	Pass



Date: 28.APR.2016 20:39:36

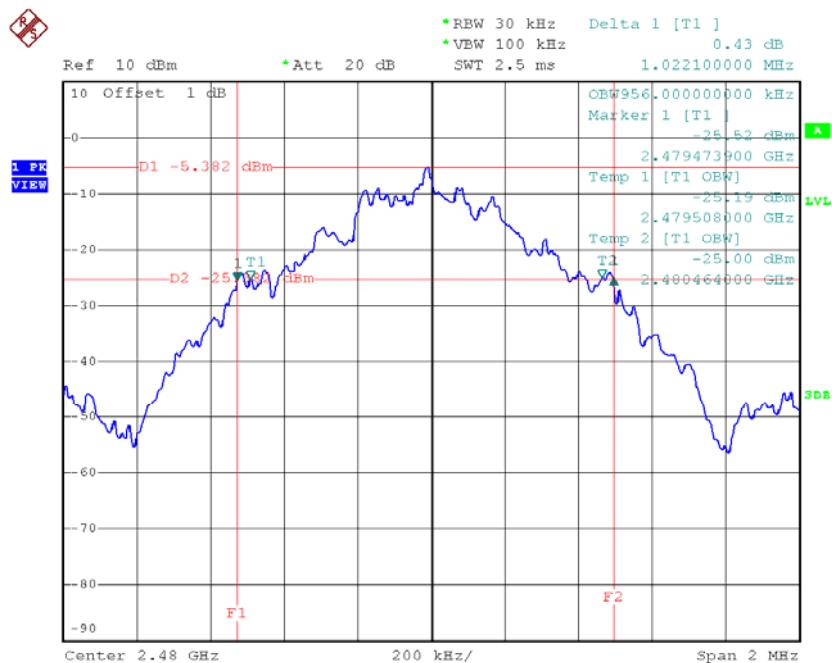


### CH39



Date: 28.APR.2016 20:41:04

### CH78

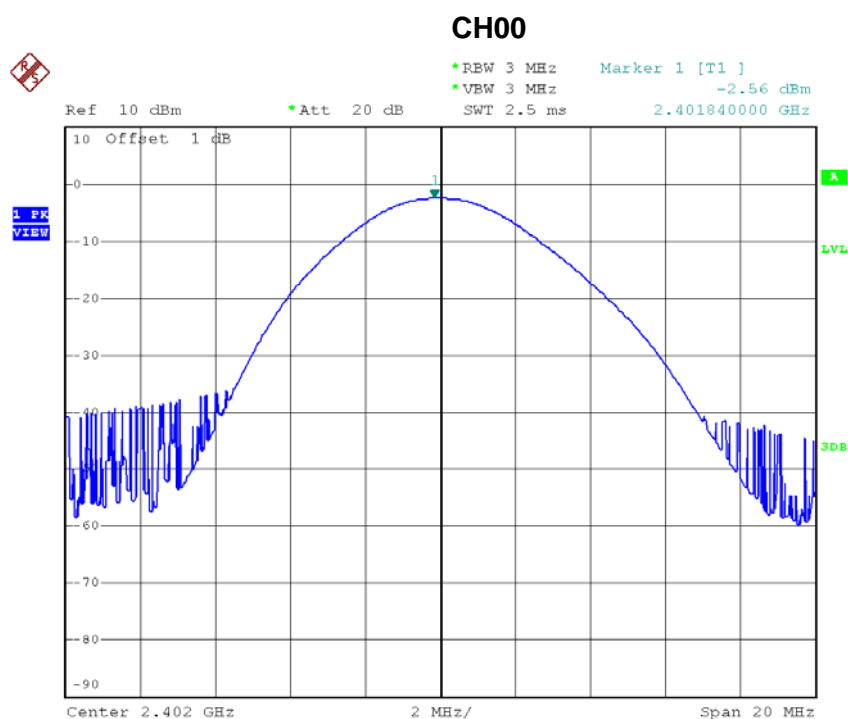


Date: 28.APR.2016 20:41:49

## **ATTACHMENT I - PEAK OUTPUT POWER**

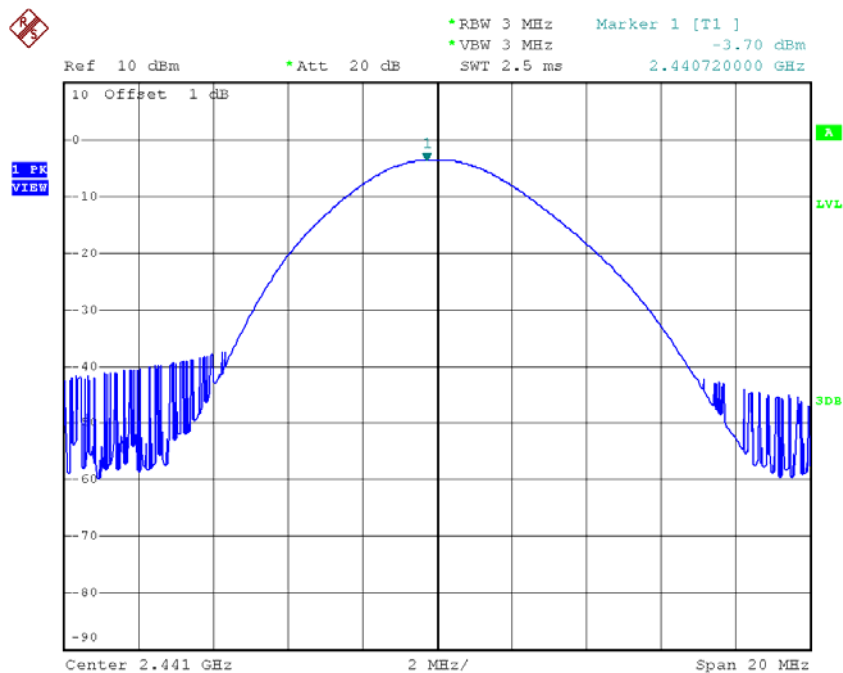
Test Mode :	TX Mode _1Mbps
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Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2402	-2.56	0.0006	30.00	1.00	Pass
2441	-3.70	0.0004	30.00	1.00	Pass
2480	-5.13	0.0003	30.00	1.00	Pass



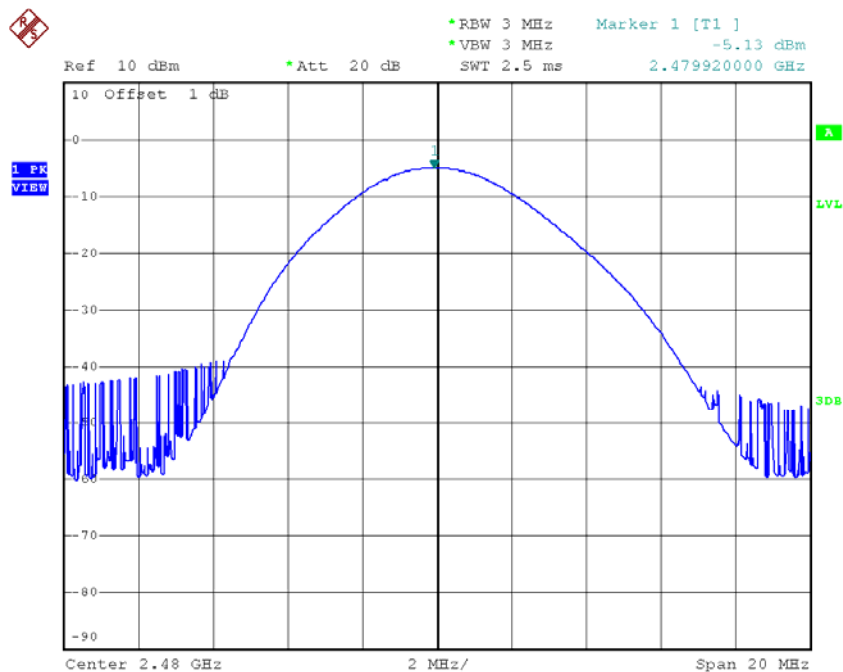
Date: 28.APR.2016 20:37:10

### CH39



Date: 28.APR.2016 20:37:31

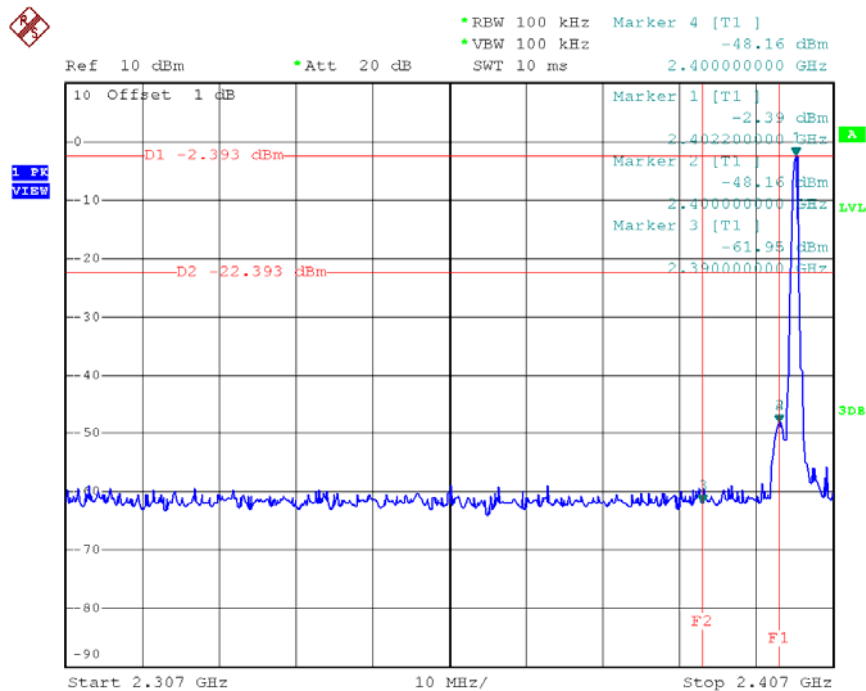
### CH78



Date: 28.APR.2016 20:38:02

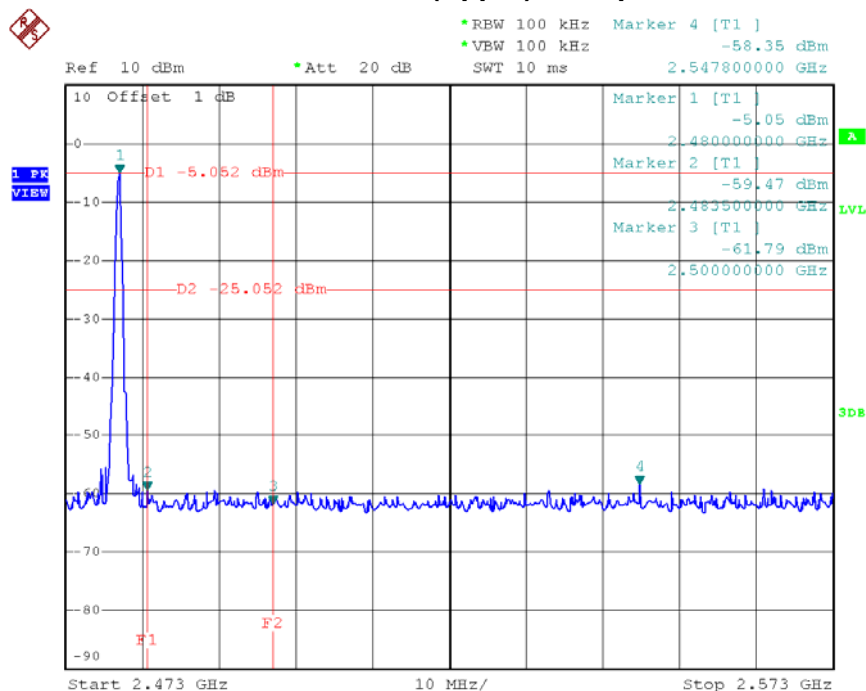
## **ATTACHMENT J - ANTENNA CONDUCTED SPURIOUS EMISSION**

### CH00 (Lower)\_1Mbps



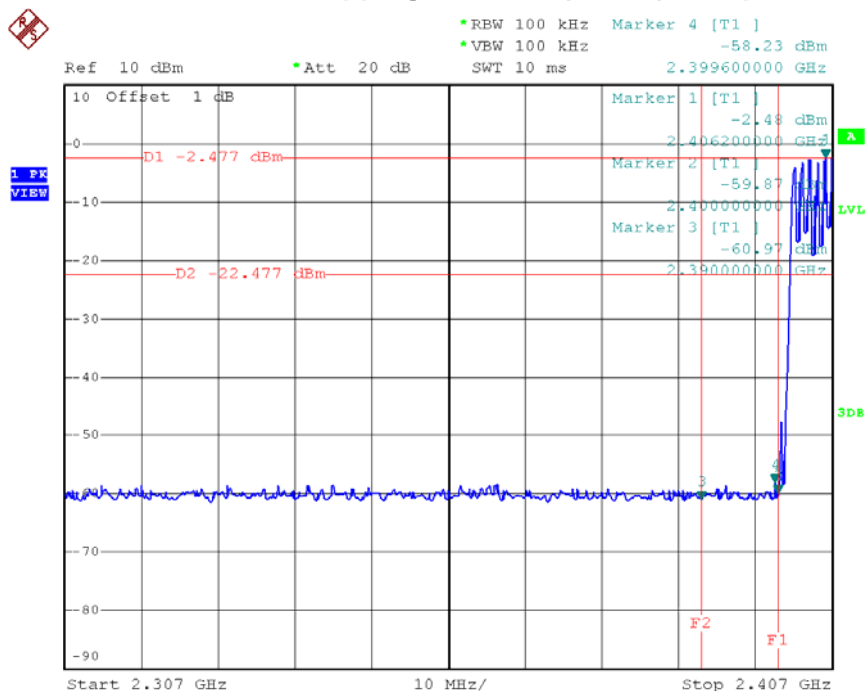
Date: 28.APR.2016 20:39:08

### CH78 (Upper)\_1Mbps



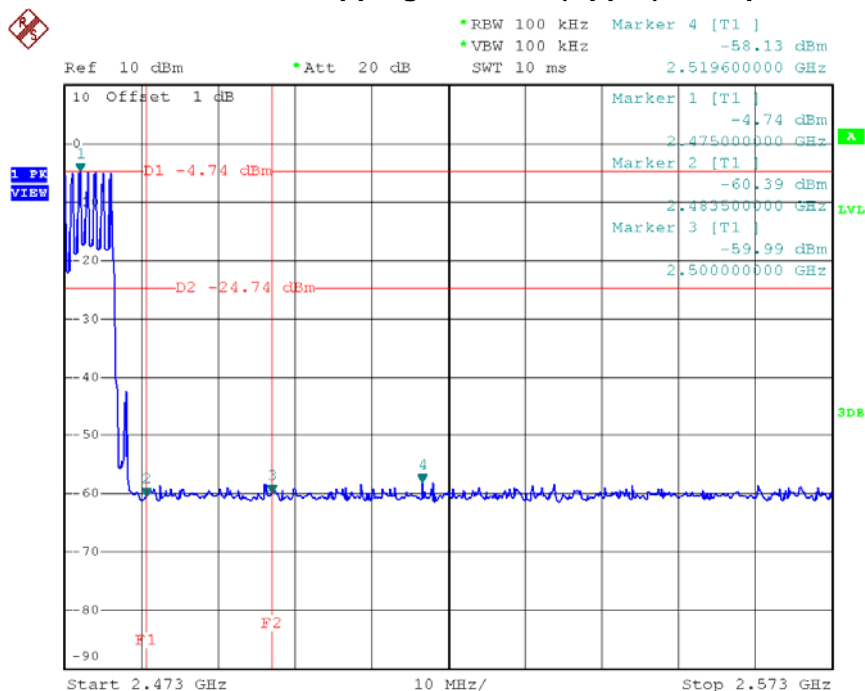
Date: 28.APR.2016 20:41:23

### CH00 Hopping on mode (Lower)\_1Mbps



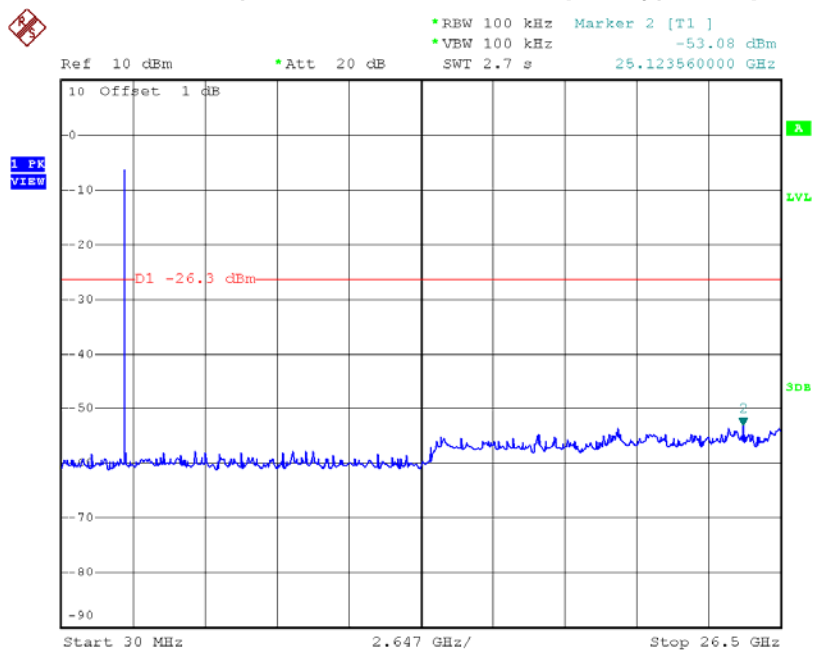
Date: 28.APR.2016 20:48:53

### CH78 Hopping on mode (Upper)\_1Mbps



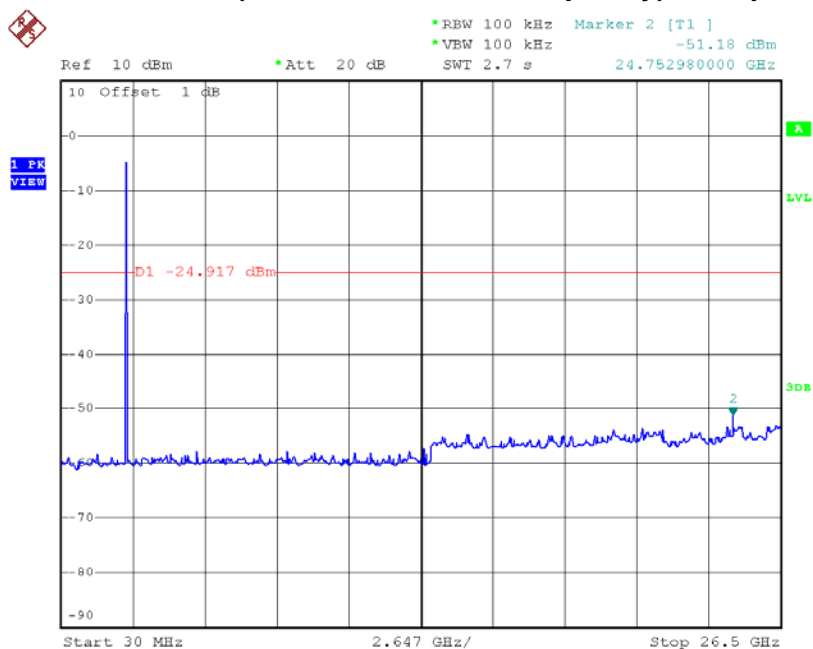
Date: 28.APR.2016 20:49:28

### CH00 (10 Harmonic of the frequency) \_1Mbps



Date: 28.APR.2016 20:39:53

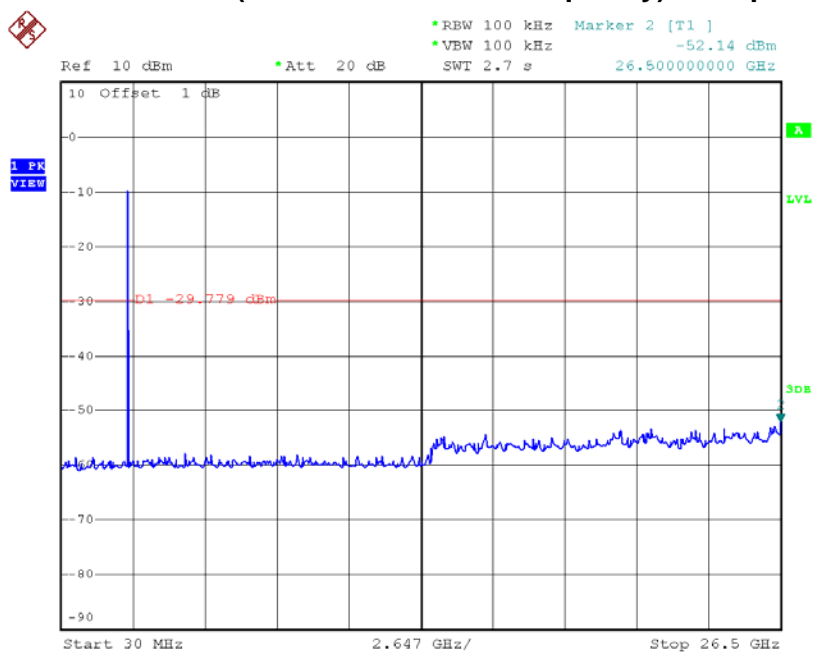
### CH39 (10 Harmonic of the frequency) \_1Mbps



Date: 28.APR.2016 20:40:39



# CH78 (10 Harmonic of the frequency) \_1Mbps



Date: 28.APR.2016 20:42:18