

# FCC&IC Radio Test Report

## FCC ID: Q9DARBT0200

## IC: 4675A-ARBT0200

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

**Project No.** : 1601105  
**Equipment** : Aruba LS-BT20 Location Beacon  
**Model Name** : ARBT0200  
**Applicant for** : Aruba Networks, Inc.  
**Address for** : 1344 Crossman Ave. Sunnyvale, CA94089  
USA

**Date of Receipt** : Feb. 01, 2016  
**Date of Test** : Feb. 01, 2016 ~ Mar. 02, 2016  
**Issued Date** : Mar. 07, 2016  
**Tested by** : BTL Inc.

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# **B T L I N C .**

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## REPORT ISSUED HISTORY

Issued No.	Description	Issued Date
BTL-FICP-1-1601105	Original Issue.	Mar. 07, 2016

## 1. CERTIFICATION

Equipment : Aruba LS-BT20 Location Beacon  
Brand Name : Aruba  
Model Name : ARBT0200  
Applicant : Aruba Networks, Inc.  
Manufacturer : Sernet(SuZhou) Technologies Corporation  
Address : No. 8~9, Tangzhuang Road, SuZhou Industrial Park, Jiangsu 215000 P.R. China.  
Factory : Sernet(SuZhou) Technologies Corporation  
Address : No. 8~9, Tangzhuang Road, SuZhou Industrial Park, Jiangsu 215000 P.R. China.  
Date of Test : Feb. 01, 2016 ~ Mar. 02, 2016  
Test Sample : Engineering Sample  
Standard(s) : FCC Part15, Subpart C (15.247) / ANSI C63.10-2013  
RSS-247 Issue 1, May 2015  
RSS-GEN Issue 4, Nov 2014

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-FICP-1-1601105) 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):

<b>Applied Standard(s): FCC Part15 (15.247) , Subpart C Canada RSS-247 Issue 1, May 2015, RSS-GEN Issue 4, Nov 2014</b>				
Standard(s)	Section	Test Item	Judgment	Remark
15.207	RSS-GEN 8.8	Conducted Emission	N/A	NOTE(1)
15.247(d)	RSS-247 5.5	Antenna conducted Spurious Emission	PASS	
15.247(a)(2)	RSS-247 5.2 (1)	6dB Bandwidth	PASS	
15.247(b)(3)	RSS-247 5.4 (4)	Peak Output Power	PASS	
15.247(e)	RSS-247 5.2 (2)	Power Spectral Density	PASS	
15.203	-	Antenna Requirement	PASS	
15.209/15.205	RSS-247 5.5	Transmitter Radiated Emissions	PASS	

NOTE:

(1) "N/A" denotes test is not applicable to this device.

### 2.1 TEST FACILITY

#### **Radiated emission Test (Below 1 GHz):**

**CB11:** (VCCI RN: R-4260; FCC RN:949005; FCC DN:TW1082; IC Assigned Code:20088)

No. 68-1, Ln. 169, Sec.2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan

#### **Radiated emission Test (Above 1 GHz):**

**CB11:** (VCCI RN: G-868; FCC RN:949005; FCC DN:TW1082; IC Assigned Code:20088)

No. 68-1, Ln. 169, Sec.2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan

## 2.2 MEASUREMENT UNCERTAINTY

The measurement uncertainty is not specified by FCC rules and Canada Industry for reference only.

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%.

The measurement instrumentation uncertainty considerations contained in CISPR 16-4-2.

The BTL measurement uncertainty is less than the CISPR 16-4-2  $U_{\text{CISPR}}$  requirement.

### A. Radiated Measurement :

Test Site	Method	Measurement Frequency Range	U, (dB)
CB11 (3m)	CISPR	9kHz ~ 150kHz	4.00
		150kHz ~ 30MHz	4.00

Test Site	Method	Measurement Frequency Range	Ant. H / V	U, (dB)
CB11 (3m)	CISPR	30 MHz ~ 200 MHz	V	3.06
		30 MHz ~ 200 MHz	H	2.58
		200 MHz ~ 1, 000 MHz	V	3.50
		200 MHz ~ 1, 000 MHz	H	3.10

Test Site	Method	Measurement Frequency Range	Ant. H / V	U, (dB)
CB11 (3m)	CISPR	1GHz ~ 6GHz	V	4.14
		1GHz ~ 6GHz	H	4.14
		6GHz ~ 18GHz	V	5.34
		6GHz ~ 18GHz	H	5.34

Test Site	Method	Measurement Frequency Range	U, (dB)
CB11 (3m)	CISPR	18 ~ 26.5 GHz	4.66
		26.5 ~ 40 GHz	4.74

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

Our calculated Measurement Instrumentation Uncertainty is shown in the tables above. These are our  $U_{\text{lab}}$  values in CISPR 16-4-2 terminology.

Since Table 1 of CISPR 16-4-2 has values of measurement instrumentation uncertainty, called  $U_{\text{CISPR}}$ , as follows:

Conducted Disturbance (mains port) – 150 kHz – 30 MHz : 3.6 dB

Radiated Disturbance (electric field strength on an open area test site or alternative test site) – 30 MHz – 1000 MHz : 5.2 dB

It can be seen that our  $U_{\text{lab}}$  values are smaller than  $U_{\text{CISPR}}$ .



### 3. GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

Equipment	Aruba LS-BT20 Location Beacon	
Brand Name	Aruba	
Model Name	ARBT0200	
Model Difference	N/A	
Product Description	Operation Frequency	2402~2480 MHz
	Modulation Technology	GFSK(1Mbps)
	Bit Rate of Transmitter	
	Output Power (Max.)	1.96 dBm (1Mbps)
Power Source	Battery supplied.	
Power Rating	DC 3V (2 * CR2477, 1S2P)	

**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)
00	2402	20	2442
01	2404	21	2444
02	2406	22	2446
03	2408	23	2448
04	2410	24	2450
05	2412	25	2452
06	2414	26	2454
07	2416	27	2456
08	2418	28	2458
09	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

3. Table for Filed Antenna:

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	Note
1	Sercomm Corporation	N/A	Printed Ant	N/A	1.44	TX/RX

### 3.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generated from EUT, the test system was pre-scanning tested based on the consideration of following EUT operation mode or test configuration mode which possibly 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 Radiated Test	
Final Test Mode	Description
Mode 1	TX Mode <b>NOTE (1)</b>

Note:

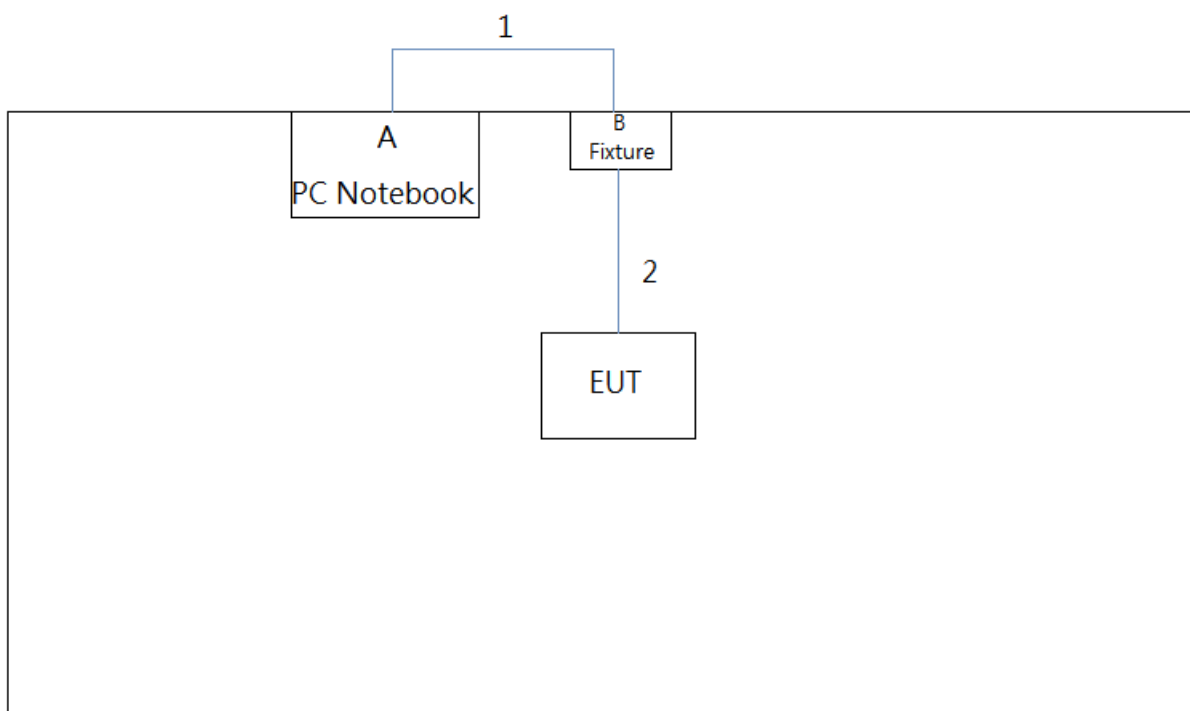
(1) The measurements are performed at the high, middle, low available channels.

### 3.3 TABLE OF PARAMETERS OF TEST 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 WLAN

Test Software Version	CSR		
Frequency (MHz)	2402	2440	2480
BT LE	2	2	2

### 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.
A	Notebook PC	ASUS	F9E	DOC	87N0AS230639299
B	Fixture	Foxconn	N/A	N/A	N/A

Item	Shielded Type	Ferrite Core	Length	Note
1	NO	NO	1m	USB Cable
2	NO	NO	0.05m	Data Cable

Note:

- (1) For detachable type I/O cable should be specified the length in m in 『Length』 column.

## 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 (dB $\mu$ V)	
	Quasi-peak	Average
0.15 -0.5	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 = Antenna Factor + Cable Loss - Amplifier Gain(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

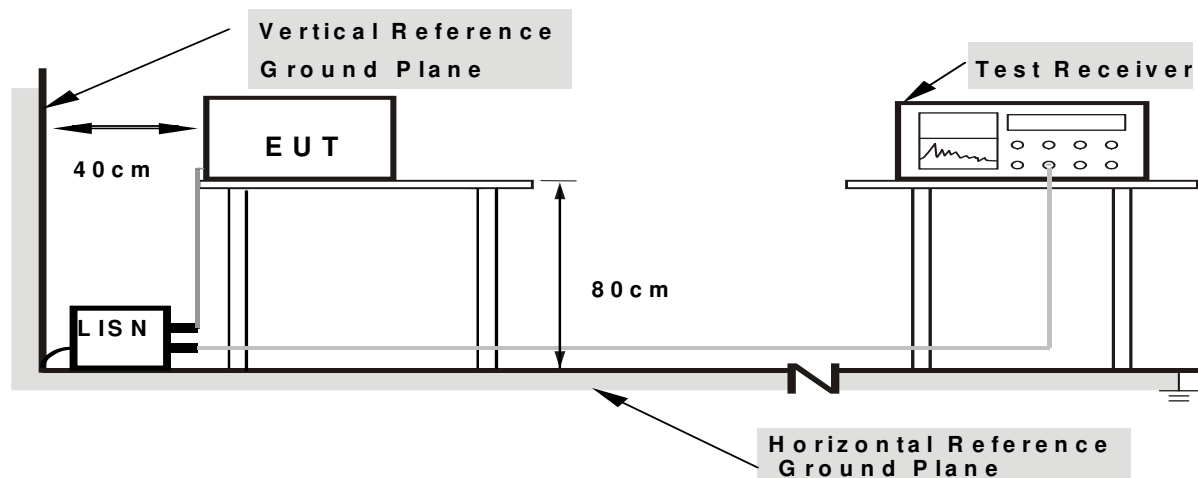
#### 4.1.2 TEST PROCEDURE

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

#### 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

1. The iPhone is installed APP (TI BLE Multitool).
2. The iPhone turns on Bluetooth and connects to EUT.
3. After connected, using APP (TI BLE Multitool) to control EUT.
4. When iPhone receives and shows data (from EUT) on panel, the setup is finished.

#### 4.1.6 EUT TEST CONDITIONS

Temperature: N/A  
 Relative Humidity: N/A  
 Test Voltage: N/A

#### 4.1.7 TEST RESULTS

**Please refer to the Attachment A.**

The EUT ONLY operates using a Battery; therefore the Conducted Emissions Test is N/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.
- (3) “ N/A” denotes test is not applicable to this device.

## 4.2 RADIATED EMISSION MEASUREMENT

### 4.2.1 RADIATED EMISSION LIMITS

In case the emission fall within the restricted band specified on 15.205(a) & RSS-247 5.5, then the 15.209(a) & RSS-Gen limit in the table below has to be followed.

#### LIMITS OF RADIATED EMISSION MEASUREMENT (9KHz-1000MHz)

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)	(dBuV/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)	RBW 1MHz VBW 3MHz peak detector for Pk value RMS detector for AV value

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

- a. 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)
- b. 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)
- c. The height of the equipment or of the substitution antenna shall be 0.8 m or 1.5m, the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. 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).
- e. 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.
- f. The initial step in collecting conducted 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.
- g. 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)
- h. 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)
- i. For the actual test configuration, please refer to the related Item - Block Diagram of system tested (please refer to 3.3).

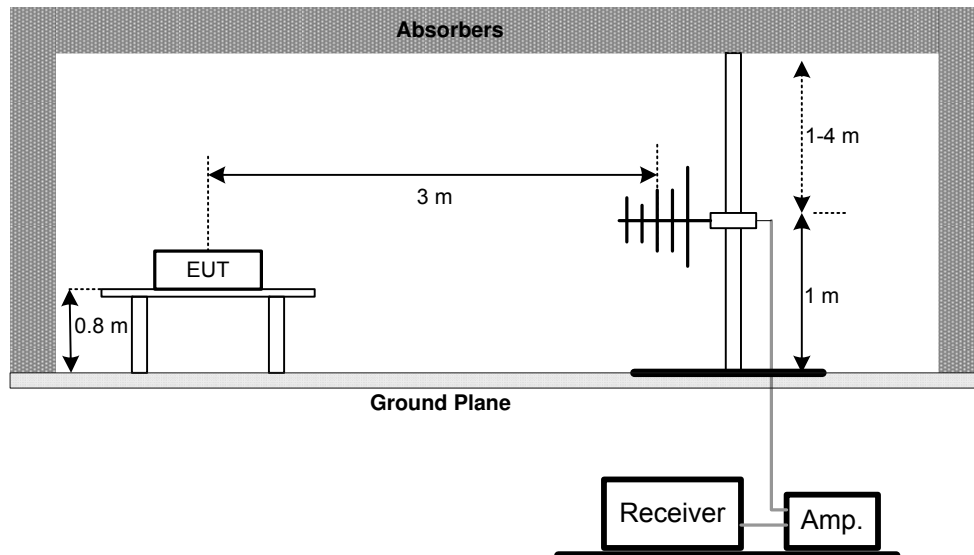
#### 4.2.3 DEVIATION FROM TEST STANDARD

No deviation

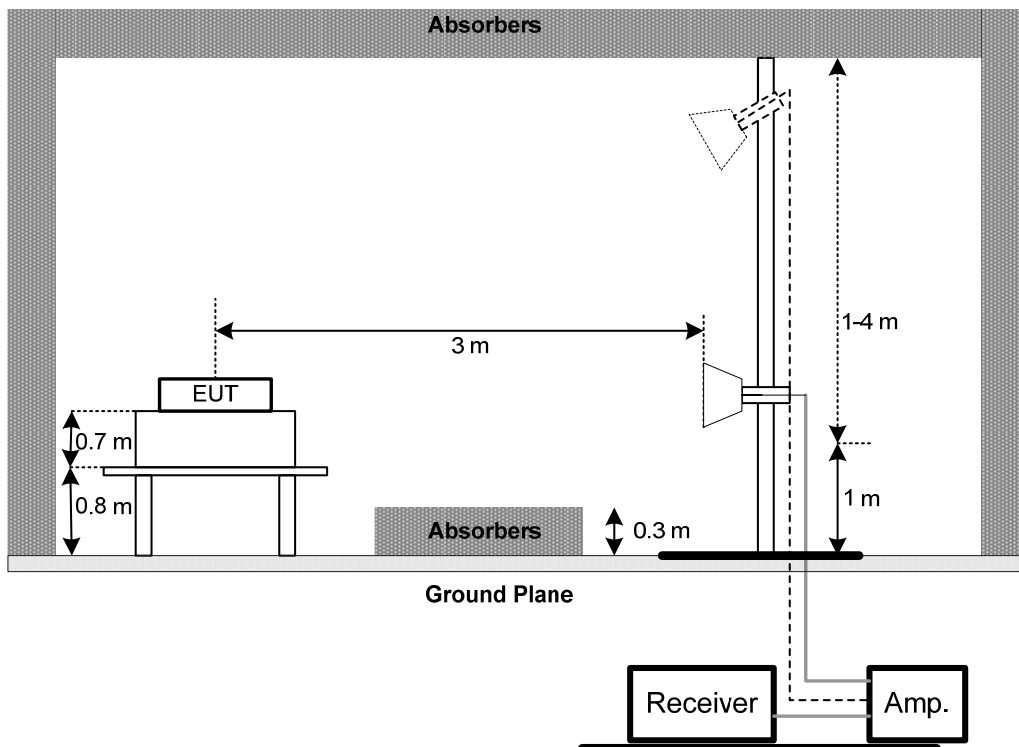


#### 4.2.4 TEST SETUP

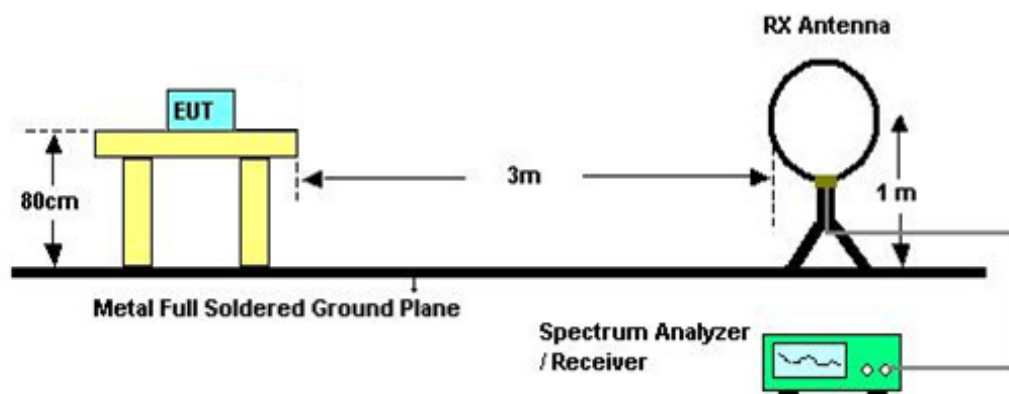
##### (A) Radiated Emission Test Set-Up Frequency Below 1 GHz



##### (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: 45%

Test Voltage: DC 3V

#### 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 (BETWEEN 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) 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) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission
- (3) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.
- (4) EUT Orthogonal Axis:  
"X" - denotes Laid on Table ; "Y" - denotes Vertical Stand ; "Z" - denotes Side Stand
- (5) 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
- (6) No limit: This is fundamental signal, the judgment is not applicable.  
For fundamental signal judgment was referred to Peak output test.

## 5. BANDWIDTH TEST

### 5.1 Applied procedures / limit

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2) RSS-GEN section 6.6 RSS-247 5.2 (1)	Bandwidth	$\geq 500\text{KHz}$ (6dB bandwidth)	2400-2483.5	PASS

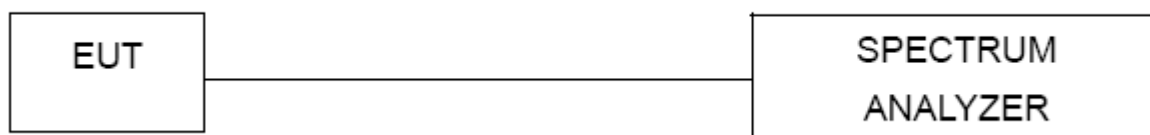
#### 5.1.1 TEST PROCEDURE

- 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=300KHz, Sweep time = 2.5 ms.

#### 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: 45%  
Test Voltage: DC 3V

#### 5.1.6 TEST RESULTS

Please refer to the Attachment E.

## 6. MAXIMUM OUTPUT POWER TEST

### 6.1 Applied procedures / limit

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3) RSS-247 5.4 (4)	Maximum Output Power	1 watt or 30dBm	2400-2483.5	PASS

#### 6.1.1 TEST PROCEDURE

- a. The EUT was directly connected to the power meter and antenna output port as show in the block diagram below,
- b. The maximum peak conducted output power was performed in accordance with method 9.1.2 of FCC KDB 558074 D01 DTS Meas Guidance v03r02.

#### 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. Transmit output power was measured while the host equipment supply voltage was varied from 85 % to 115 % of the nominal rated supply voltage. No change in transmit output power was observed.

#### 6.1.5 EUT TEST CONDITIONS

Temperature: 25°C  
Relative Humidity: 45%  
Test Voltage: DC 3V

#### 6.1.6 TEST RESULTS

Please refer to the Attachment F.

## 7. ANTENNA CONDUCTED SPURIOUS EMISSION

### 7.1 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 transmitter demonstrates compliance with the peak conducted power limits.

#### 7.1.1 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=300KHz, Sweep time = 10 ms.
- c. Offset=antenna gain+ cable loss

#### 7.1.2 DEVIATION FROM STANDARD

No deviation.

#### 7.1.3 TEST SETUP



#### 7.1.4 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.

#### 7.1.5 EUT OPERATION CONDITIONS

Temperature: 25°C  
 Relative Humidity: 45%  
 Test Voltage: DC 3V

#### 7.1.6 TEST RESULTS

**Please refer to the Attachment G.**

## 8. POWER SPECTRAL DENSITY TEST

### 8.1 Applied procedures / limit

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(e) RSS-247 5.2 (2)	Power Spectral Density	8 dBm (in any 3KHz)	2400-2483.5	PASS

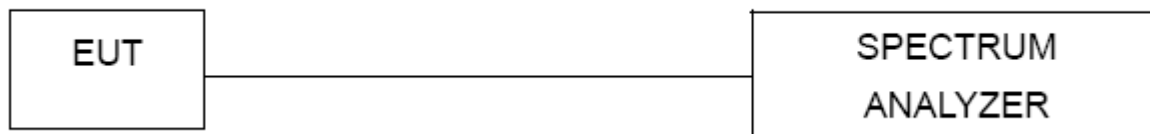
#### 8.1.1 TEST PROCEDURE

- 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=3KHz, VBW=10 KHz, 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: 45%  
 Test Voltage: DC 3V

#### 8.1.6 TEST RESULTS

Please refer to the Attachment H.

## 9. MEASUREMENT INSTRUMENTS LIST

Radiated Emission Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	Agilent	N9038A	MY51210215	Jun. 07, 2016
2	Horn Antenna	Schwarzbeck	BBHA 9120	D 546	Nov. 04, 2016
3	Microwave Pre_amplifier	HP	8447D	2944A08891	Mar. 08, 2016
4	Test Cable	EMCI	EMC104-SM-S M-5000	150302	Mar. 08, 2016
5	Test Cable	EMCI	EMC104-SM-S M-800	150305	Mar. 08, 2016
6	Test Cable	EMCI	EMC104-SM-S M-2500	150306	Mar. 08, 2016
7	Test Cable	EMCI	EMC8D-NM-N M-8000	150301	Mar. 08, 2016
8	Test Cable	EMCI	EMC8D-NM-N M-2500	150303	Mar. 08, 2016
9	Test Cable	EMCI	EMC8D-NM-N M-1000	150304	Mar. 08, 2016
10	Pre-Amplifier	Agilent	8449B	3008A02331	Jan. 23, 2017
11	Trilog-Broadband Antenna	Schwarzbeck	VULB9168	9168-364	Feb. 03, 2017
12	Loop Antenna	EMCO	6502	00042960	Nov. 15. 2016

6dB Bandwidth Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Jan. 17, 2017

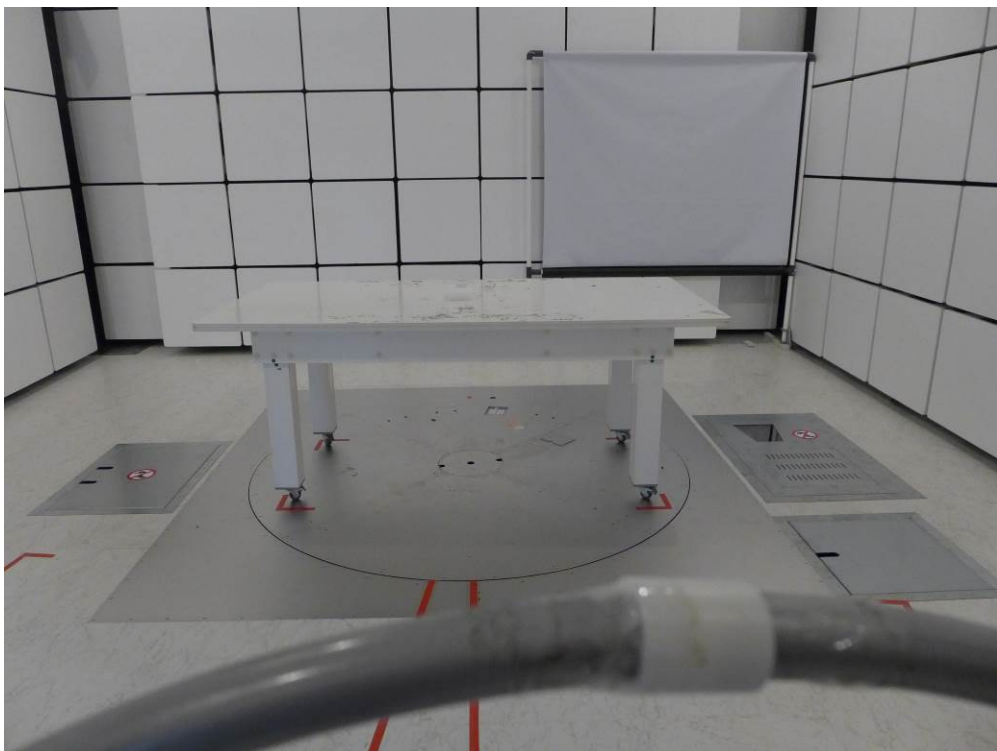
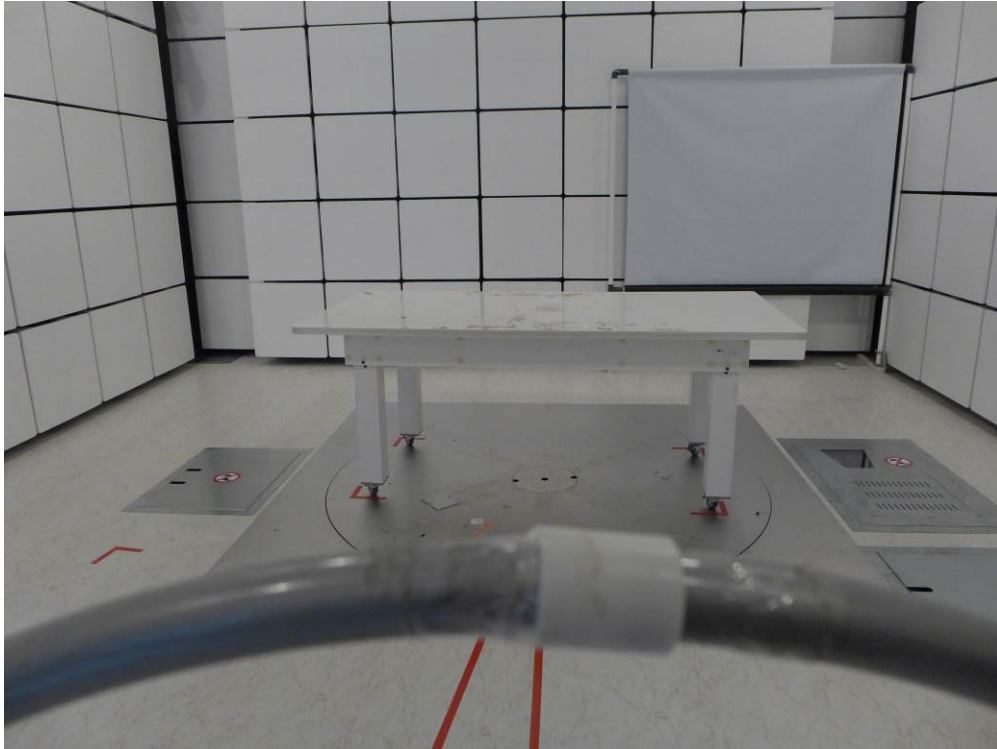
Peak Output Power Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Jan. 17, 2017

Antenna Conducted Spurious Emission Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Jan. 17, 2017



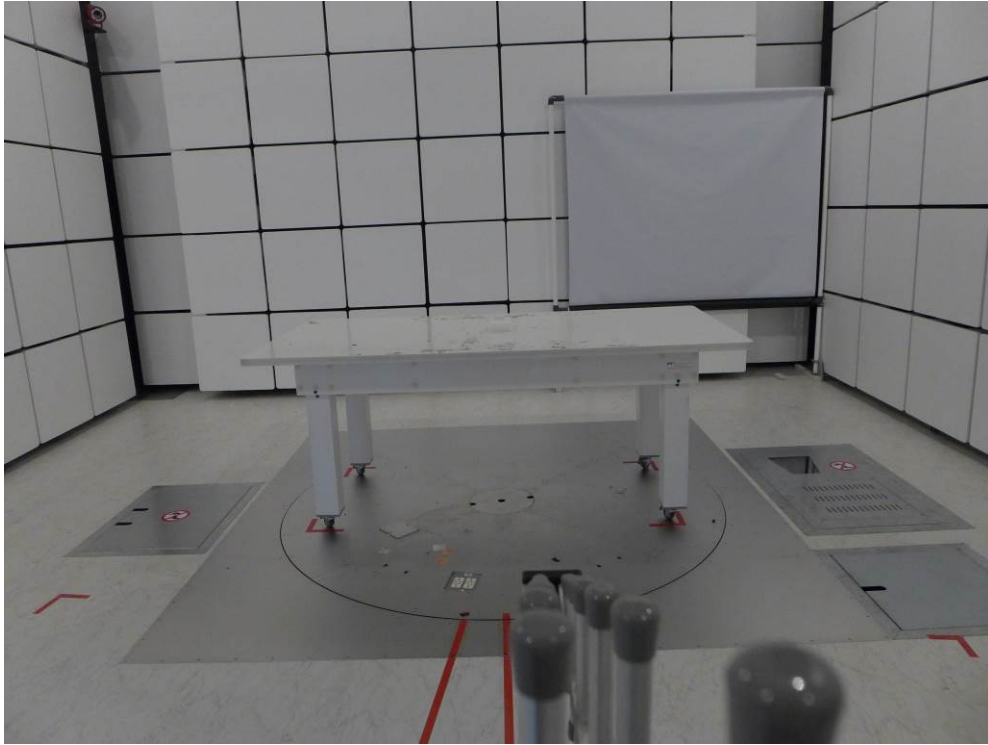
<b>Power Spectral Density Measurement</b>					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Jan. 17, 2017

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

**10. EUT TEST PHOTO****Radiated Measurement Photos****9K-30MHz**

## Radiated Measurement Photos

30MHz-1G



## Radiated Measurement Photos

### Above 1G





## ATTACHMENT A - CONDUCTED EMISSION

**Test Mode: N/A**

Note: "N/A" denotes test is not applicable to this device.

**ATTACHMENT B - RADIATED EMISSION (9KHZ TO 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
0.0150	0°	32.43	22.28	54.71	104.08	-49.38	AVG
0.0150	0°	43.26	22.28	65.54	124.08	-58.55	PK
0.0255	0°	33.25	22.01	55.26	99.47	-44.21	AVG
0.0255	0°	45.25	22.01	67.26	119.47	-52.21	PK
0.0366	0°	32.15	21.74	53.89	96.33	-42.45	AVG
0.0366	0°	46.23	21.74	67.97	116.33	-48.37	PK
0.0600	0°	32.11	21.24	53.35	92.04	-38.69	AVG
0.0600	0°	44.56	21.24	65.80	112.04	-46.24	PK
1.2650	0°	25.63	20.34	45.97	65.56	-19.60	QP
1.1353	0°	25.10	20.46	45.56	66.50	-20.94	QP

Frequency (MHz)	Ant 0°/90°	Read level dBuV/m	Factor (dB)	Measured(FS) (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Note
0.0132	90°	35.26	22.32	57.58	105.19	-47.61	AVG
0.0132	90°	43.23	22.32	65.55	125.19	-59.64	PK
0.0257	90°	34.21	22.01	56.22	99.41	-43.19	AVG
0.0257	90°	43.11	22.01	65.12	119.41	-54.29	PK
0.0345	90°	35.36	21.79	57.15	96.85	-39.70	AVG
0.0345	90°	42.22	21.79	64.01	116.85	-52.84	PK
0.0632	90°	36.22	21.19	57.41	91.59	-34.18	AVG
0.0632	90°	43.23	21.19	64.42	111.59	-47.17	PK
1.2510	90°	24.23	20.35	44.58	65.66	-21.08	QP
1.6500	90°	22.33	19.95	42.28	63.25	-20.97	QP

Remark:

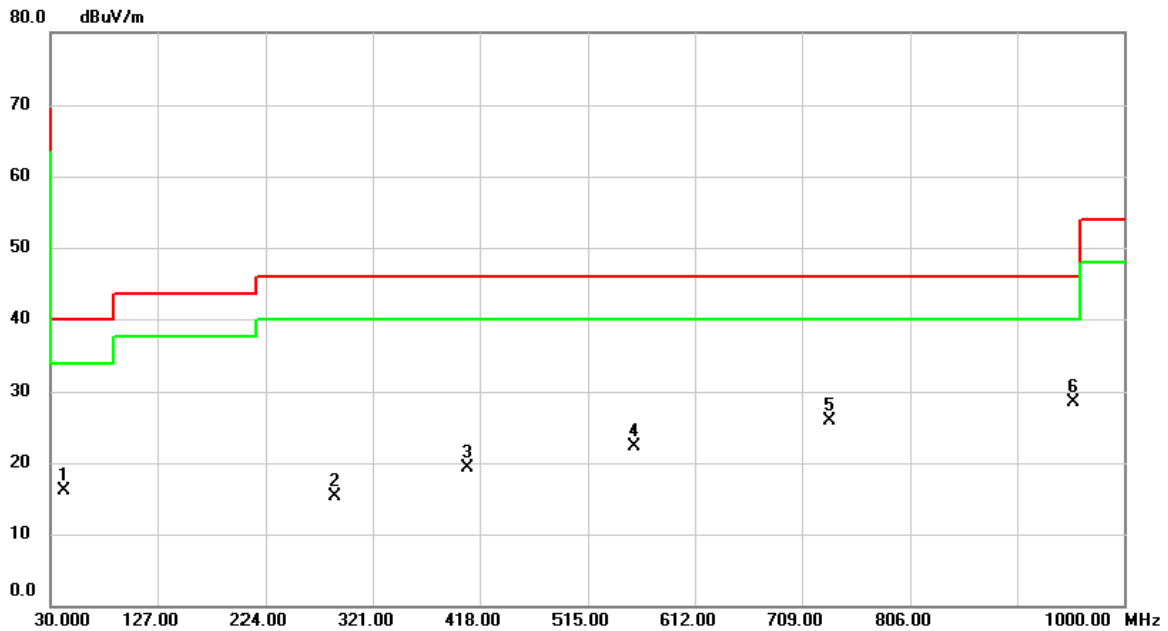
- (1) The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.
- (2) Distance extrapolation factor = 40 log (specific distance / test distance) (dB);
- (3) Limit line = specific limits (dBuV) + distance extrapolation factor.



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

Test Mode: TX 2402MHz -CH00 -1Mbps

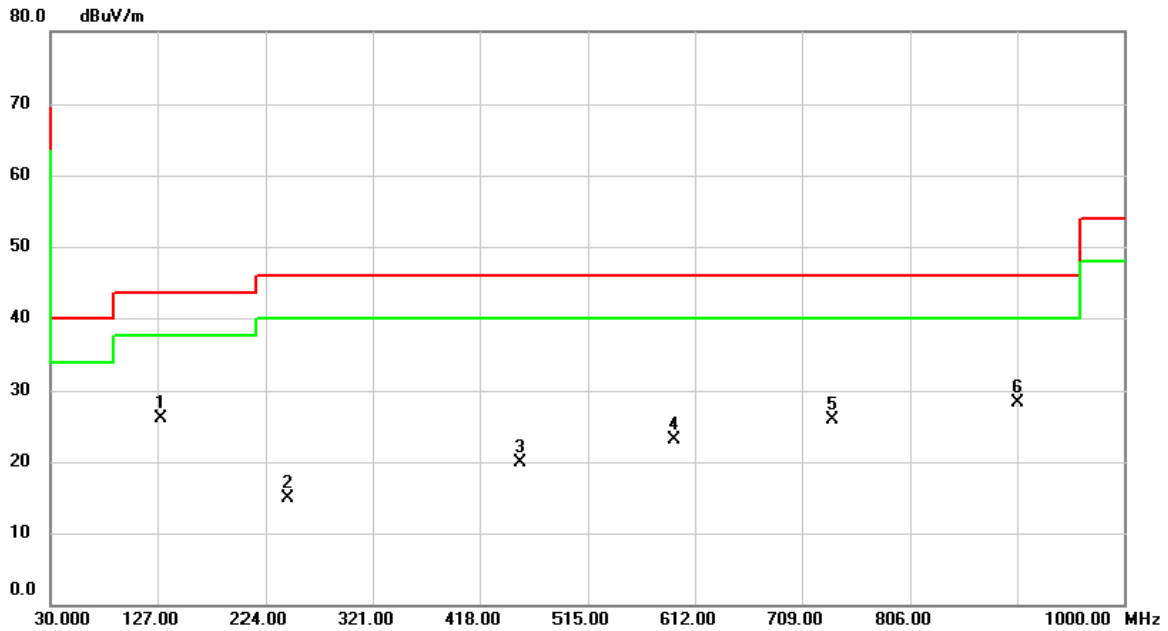
### Vertical



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		42.6100	30.23	-14.09	16.14	40.00	-23.86	peak	
2		286.0800	29.35	-14.05	15.30	46.00	-30.70	peak	
3		406.3600	29.97	-10.65	19.32	46.00	-26.68	peak	
4		557.6800	29.16	-6.88	22.28	46.00	-23.72	peak	
5		734.2200	29.45	-3.56	25.89	46.00	-20.11	peak	
6	*	953.4400	28.53	0.02	28.55	46.00	-17.45	peak	

Test Mode: TX 2402MHz -CH00 -1Mbps

### Horizontal

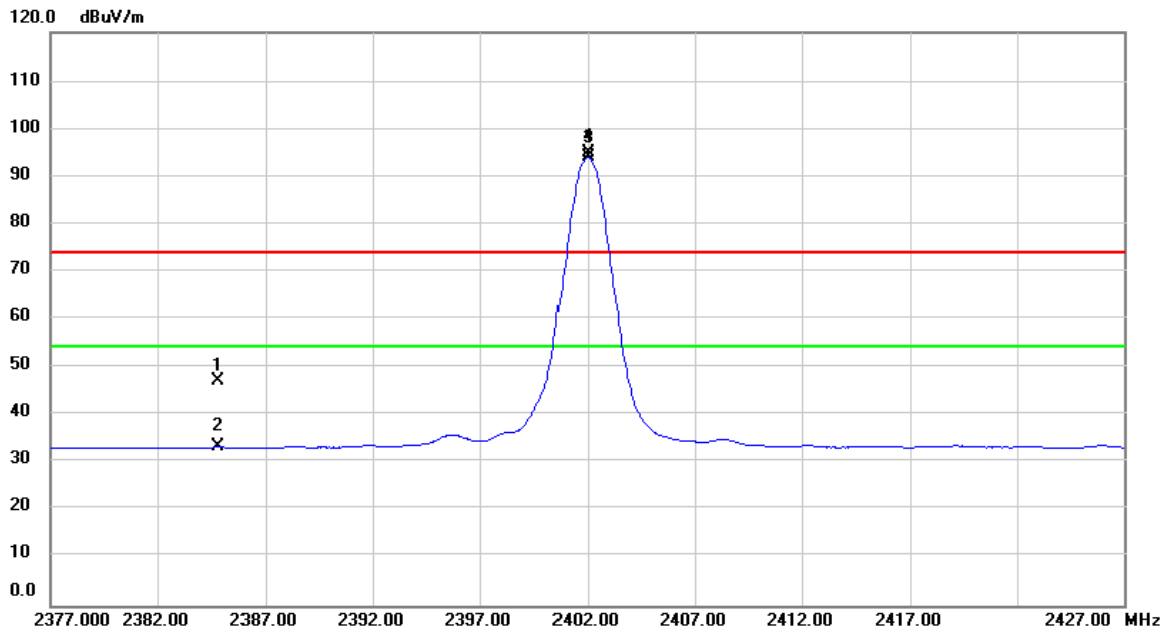


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	129.9100	41.54	-15.52	26.02	43.50	-17.48	peak	
2		244.3700	30.05	-15.23	14.82	46.00	-31.18	peak	
3		454.8600	29.33	-9.49	19.84	46.00	-26.16	peak	
4		593.5700	29.13	-5.98	23.15	46.00	-22.85	peak	
5		737.1300	29.33	-3.51	25.82	46.00	-20.18	peak	
6		903.0000	28.81	-0.55	28.26	46.00	-17.74	peak	

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

Orthogonal Axis :	X
Test Mode :	TX 2402MHz _CH00_1Mbps

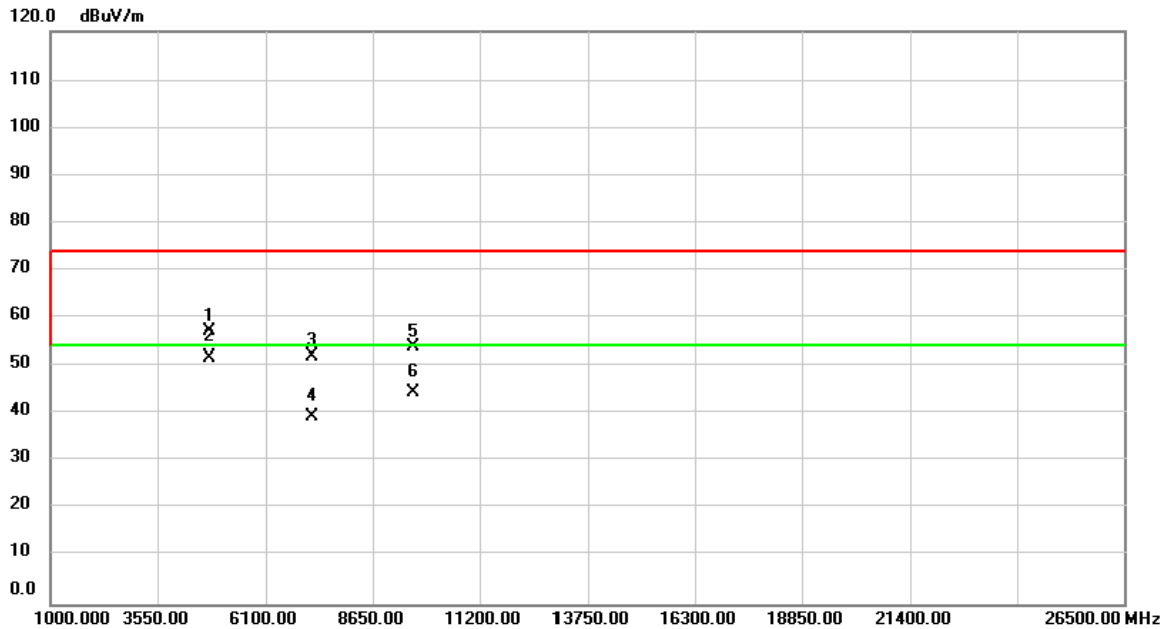
### Vertical



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		2384.850	14.81	32.46	47.27	74.00	-26.73	peak	
2		2384.850	0.95	32.46	33.41	54.00	-20.59	AVG	
3	X	2402.000	62.49	32.45	94.94	74.00	20.94	peak	No Limit
4	*	2402.000	61.52	32.45	93.97	54.00	39.97	AVG	No Limit

Orthogonal Axis :	X
Test Mode :	TX 2402MHz _CH00_1Mbps

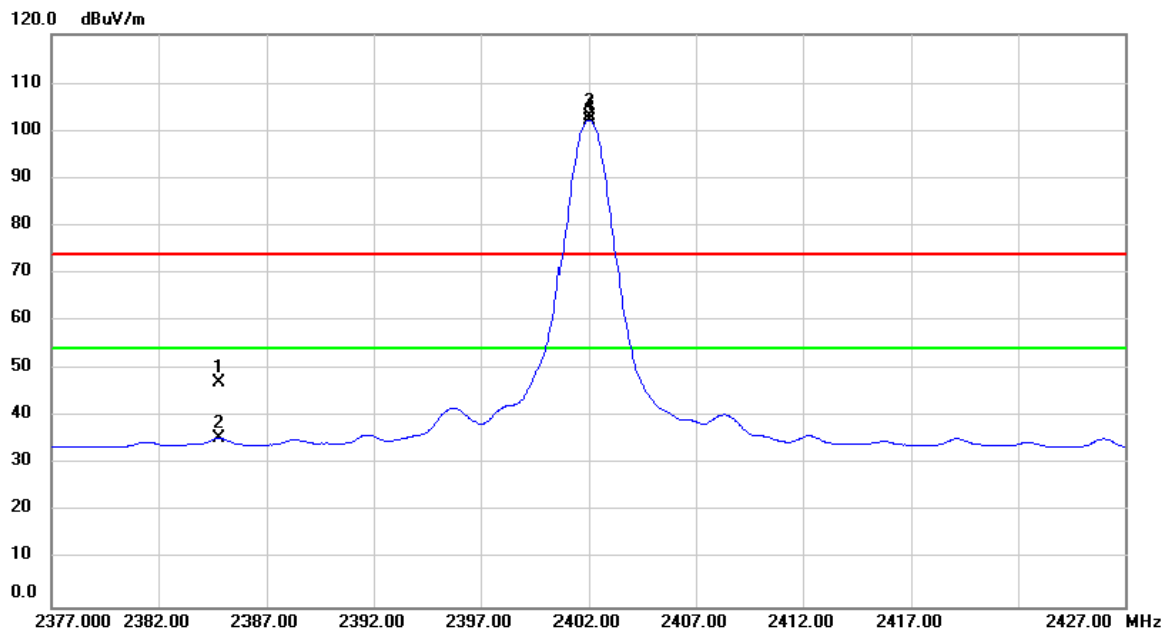
### Vertical



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4804.000	68.09	-10.81	57.28	74.00	-16.72	peak	
2	*	4804.000	62.71	-10.81	51.90	54.00	-2.10	AVG	
3		7206.000	56.90	-4.83	52.07	74.00	-21.93	peak	
4		7206.000	44.32	-4.83	39.49	54.00	-14.51	AVG	
5		9608.000	55.53	-1.64	53.89	74.00	-20.11	peak	
6		9608.000	46.13	-1.64	44.49	54.00	-9.51	AVG	

Orthogonal Axis :	X
Test Mode :	TX 2402MHz _CH00_1Mbps

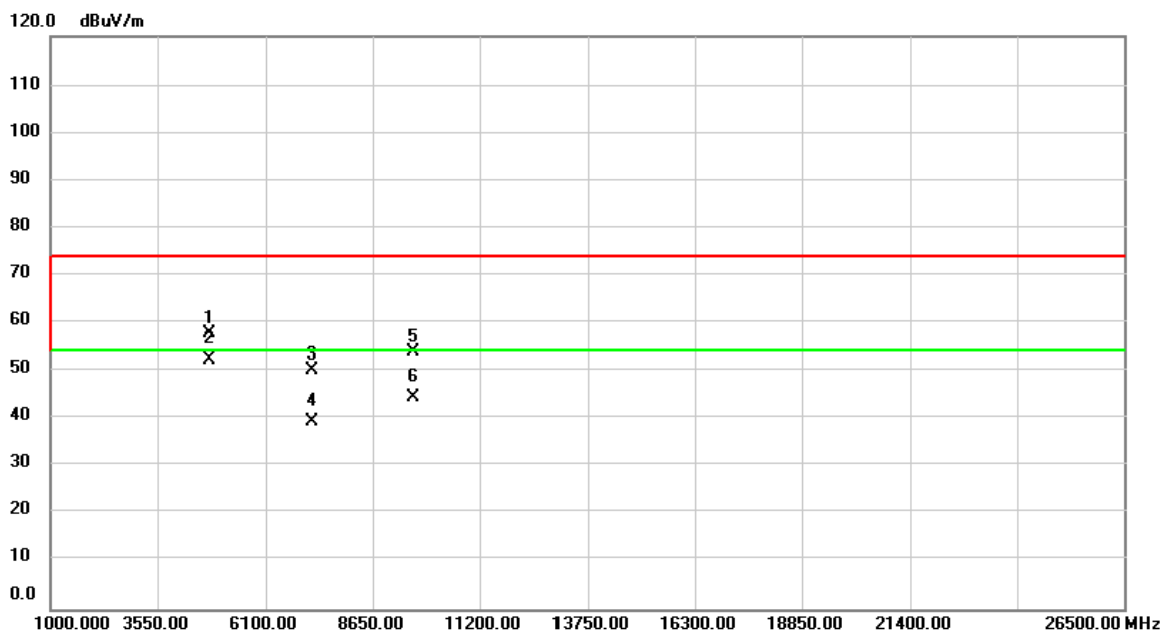
### Horizontal



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		2384.800	14.93	32.46	47.39	74.00	-26.61	peak	
2		2384.800	3.09	32.46	35.55	74.00	-38.45	peak	
3	*	2402.000	70.75	32.45	103.20	74.00	29.20	peak	No Limit
4	X	2402.000	69.81	32.45	102.26	74.00	28.26	peak	No Limit

Orthogonal Axis :	X
Test Mode :	TX 2402MHz _CH00_1Mbps

### Horizontal

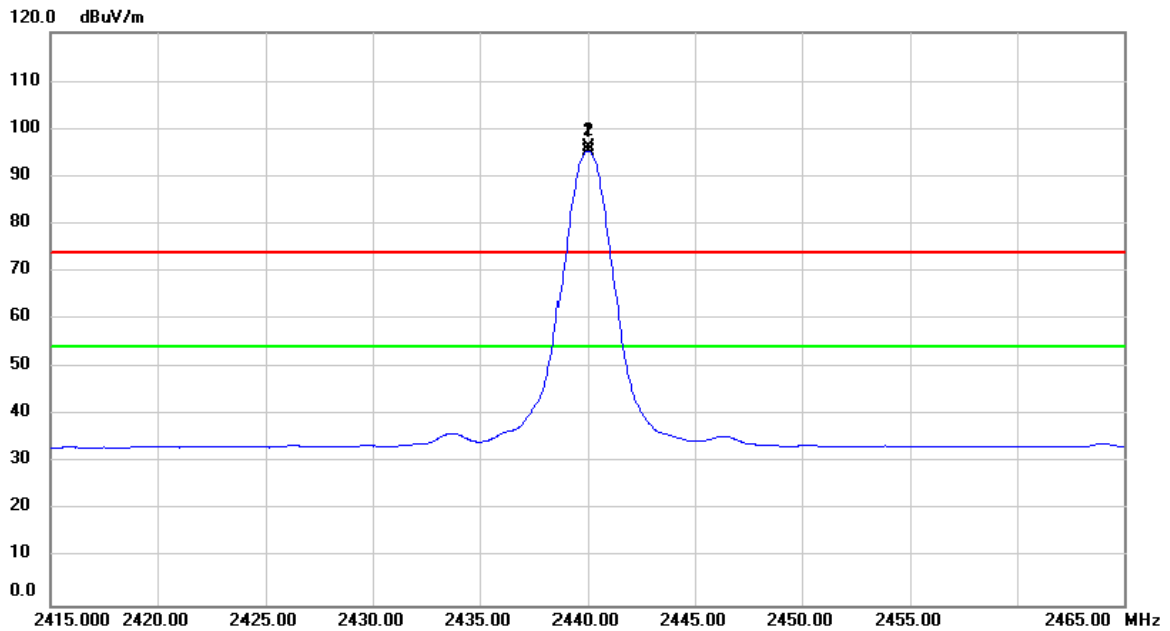


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4804.000	68.48	-10.81	57.67	74.00	-16.33	peak	
2	*	4804.000	63.19	-10.81	52.38	54.00	-1.62	AVG	
3		7206.000	55.23	-4.83	50.40	74.00	-23.60	peak	
4		7206.000	44.26	-4.83	39.43	54.00	-14.57	AVG	
5		9608.000	55.46	-1.64	53.82	74.00	-20.18	peak	
6		9608.000	46.12	-1.64	44.48	54.00	-9.52	AVG	



Orthogonal Axis :	X
Test Mode :	TX 2440MHz_CH19_1Mbps

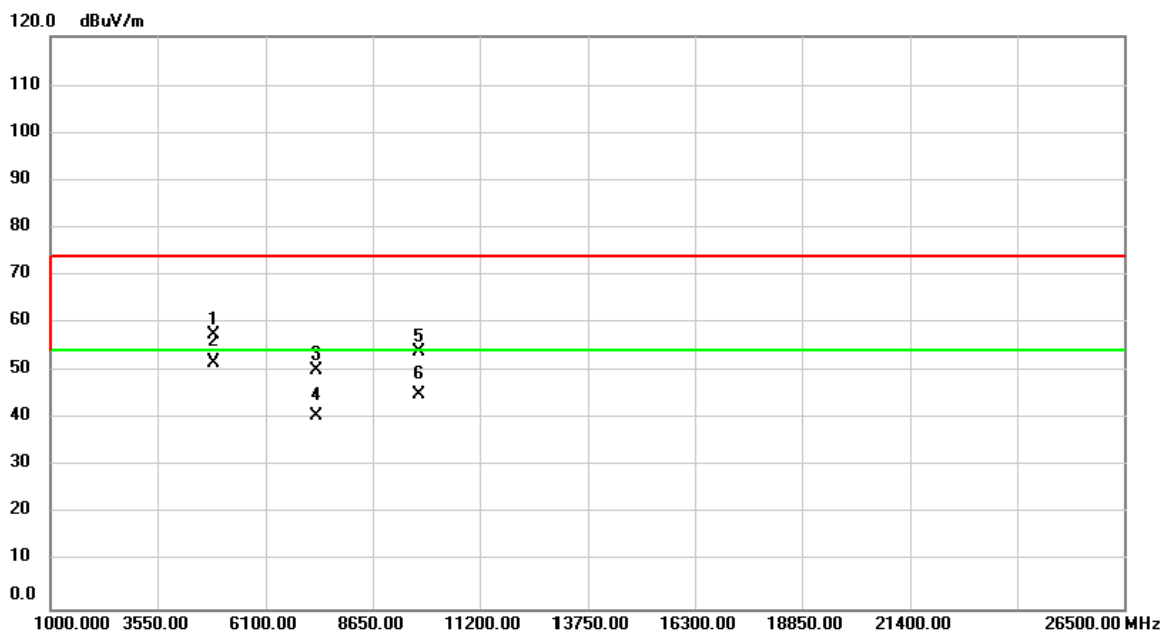
### Vertical



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	X	2440.000	63.81	32.47	96.28	74.00	22.28	peak	No Limit
2	*	2440.000	62.84	32.47	95.31	54.00	41.31	AVG	No Limit

Orthogonal Axis :	X
Test Mode :	TX 2440MHz _CH19_1Mbps

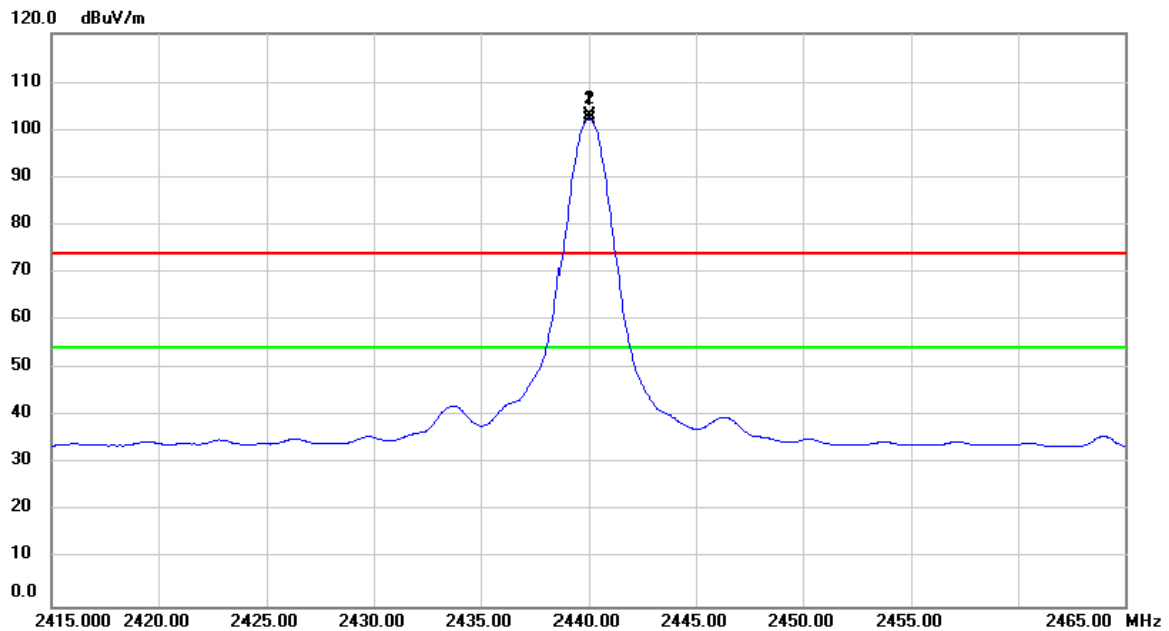
### Vertical



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4880.000	68.01	-10.65	57.36	74.00	-16.64	peak	
2	*	4880.000	62.50	-10.65	51.85	54.00	-2.15	AVG	
3		7320.000	55.05	-4.75	50.30	74.00	-23.70	peak	
4		7320.000	45.34	-4.75	40.59	54.00	-13.41	AVG	
5		9760.000	54.80	-1.05	53.75	74.00	-20.25	peak	
6		9760.000	46.13	-1.05	45.08	54.00	-8.92	AVG	

Orthogonal Axis :	X
Test Mode :	TX 2440MHz _CH19_1Mbps

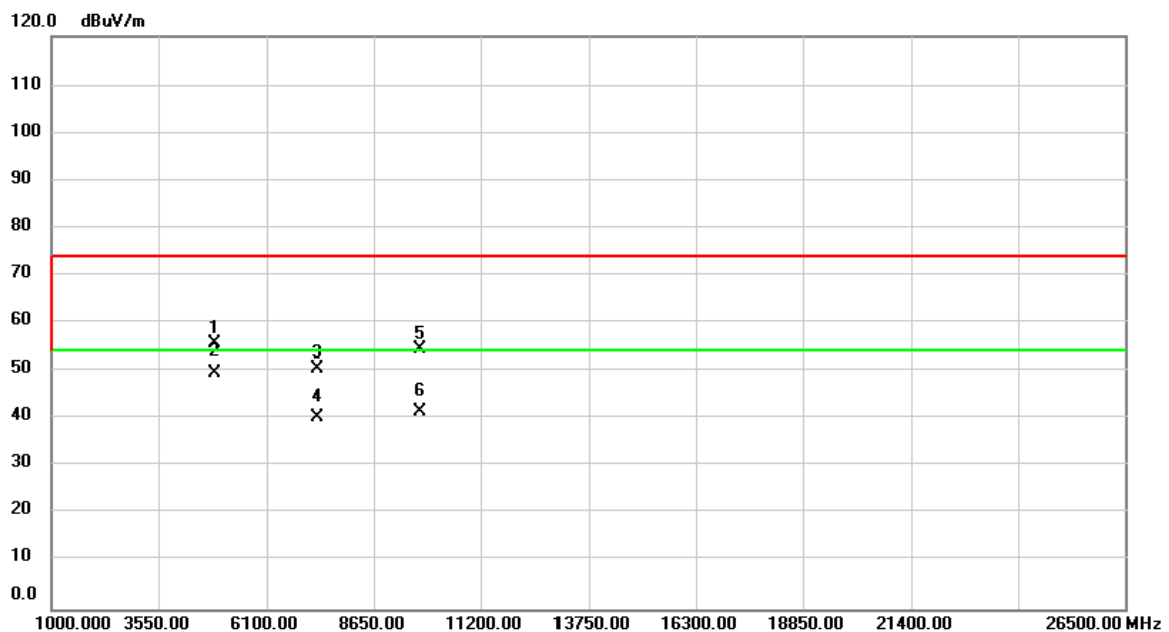
### Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB		
1	X	2440.000	70.62	32.47	103.09	74.00	29.09	peak	No Limit
2	*	2440.000	69.76	32.47	102.23	54.00	48.23	AVG	No Limit

Orthogonal Axis :	X
Test Mode :	TX 2440MHz _CH19_1Mbps

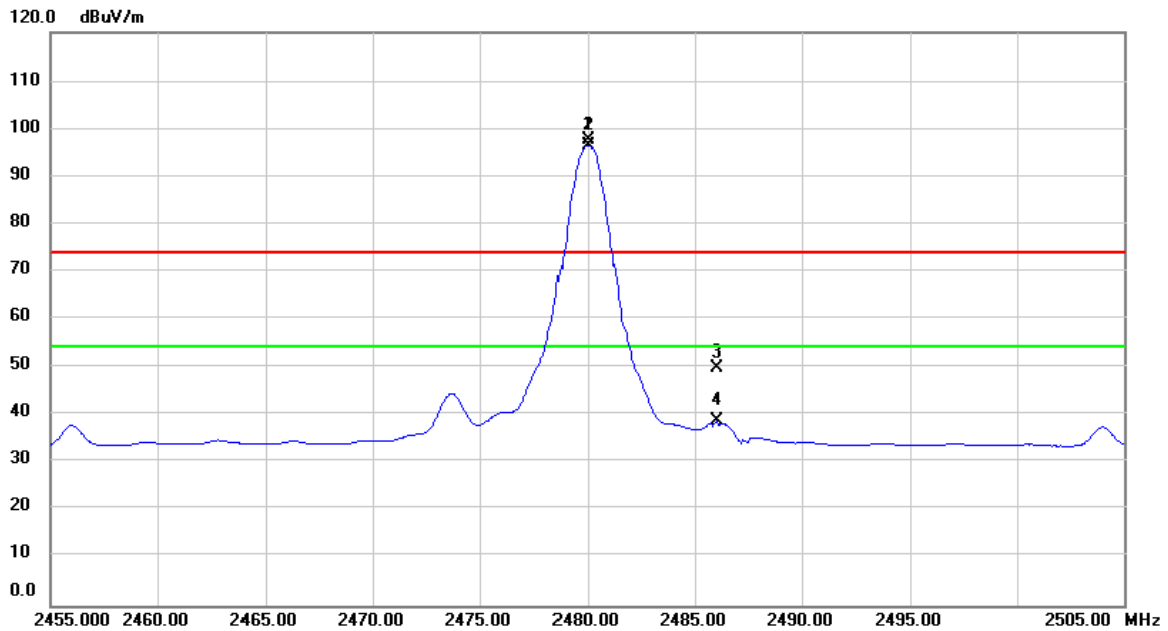
### Horizontal



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4880.000	66.33	-10.65	55.68	74.00	-18.32	peak	
2	*	4880.000	60.43	-10.65	49.78	54.00	-4.22	AVG	
3		7320.000	55.41	-4.75	50.66	74.00	-23.34	peak	
4		7320.000	45.11	-4.75	40.36	54.00	-13.64	AVG	
5		9760.000	55.45	-1.05	54.40	74.00	-19.60	peak	
6		9760.000	42.48	-1.05	41.43	54.00	-12.57	AVG	

Orthogonal Axis :	X
Test Mode :	TX 2480MHz _CH39_1Mbps

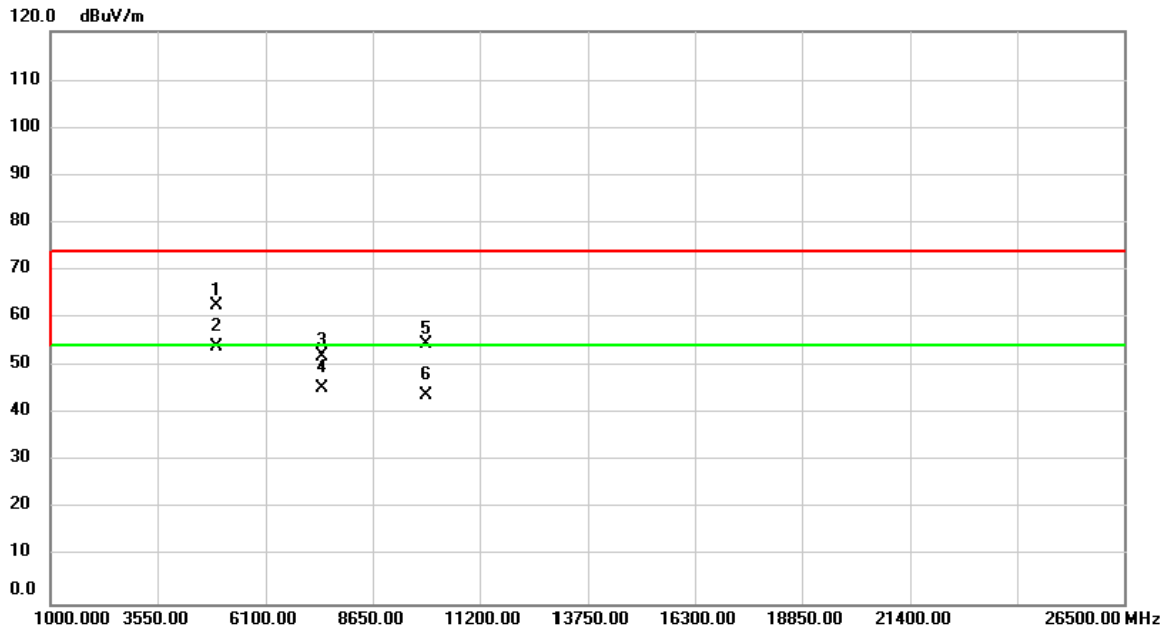
### Vertical



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	X	2480.000	65.23	32.50	97.73	74.00	23.73	peak	
2	*	2480.000	64.08	32.50	96.58	54.00	42.58	AVG	
3		2486.050	17.58	32.51	50.09	74.00	-23.91	peak	
4		2486.050	6.33	32.51	38.84	54.00	-15.16	AVG	

Orthogonal Axis :	X
Test Mode :	TX 2480MHz _CH39_1Mbps

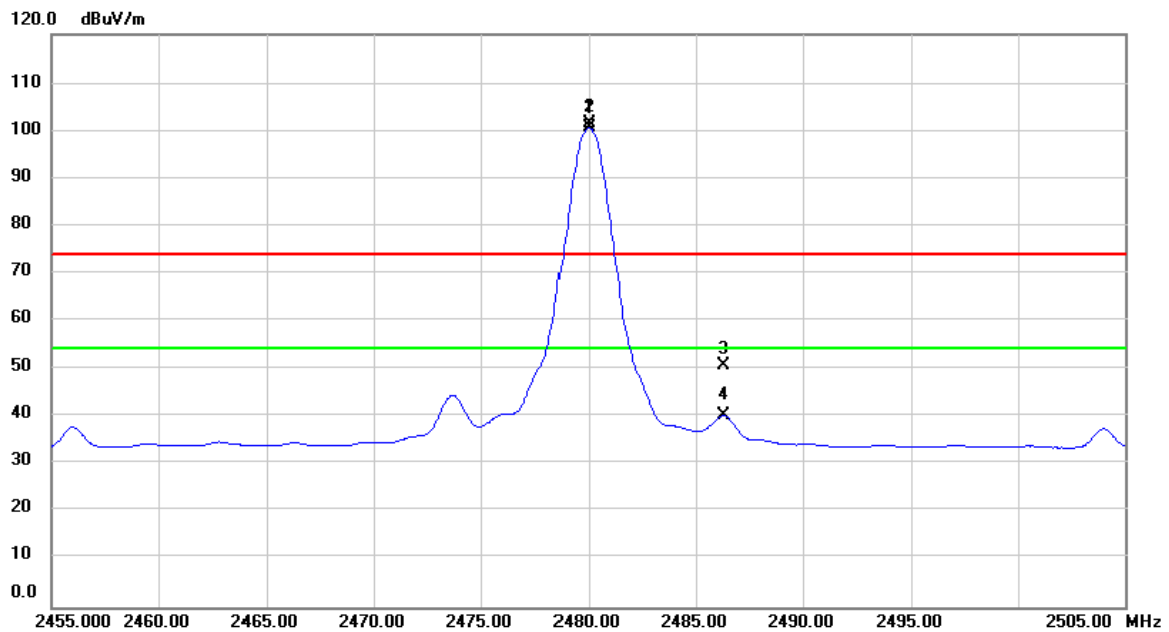
### Vertical



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4960.000	72.98	-10.50	62.48	74.00	-11.52	peak	
2	*	4960.000	64.32	-10.50	53.82	54.00	-0.18	AVG	
3		7440.000	56.86	-4.73	52.13	74.00	-21.87	peak	
4		7440.000	50.13	-4.73	45.40	54.00	-8.60	AVG	
5		9920.000	54.97	-0.65	54.32	74.00	-19.68	peak	
6		9920.000	44.49	-0.65	43.84	54.00	-10.16	AVG	

Orthogonal Axis :	X
Test Mode :	TX 2480MHz _CH39_1Mbps

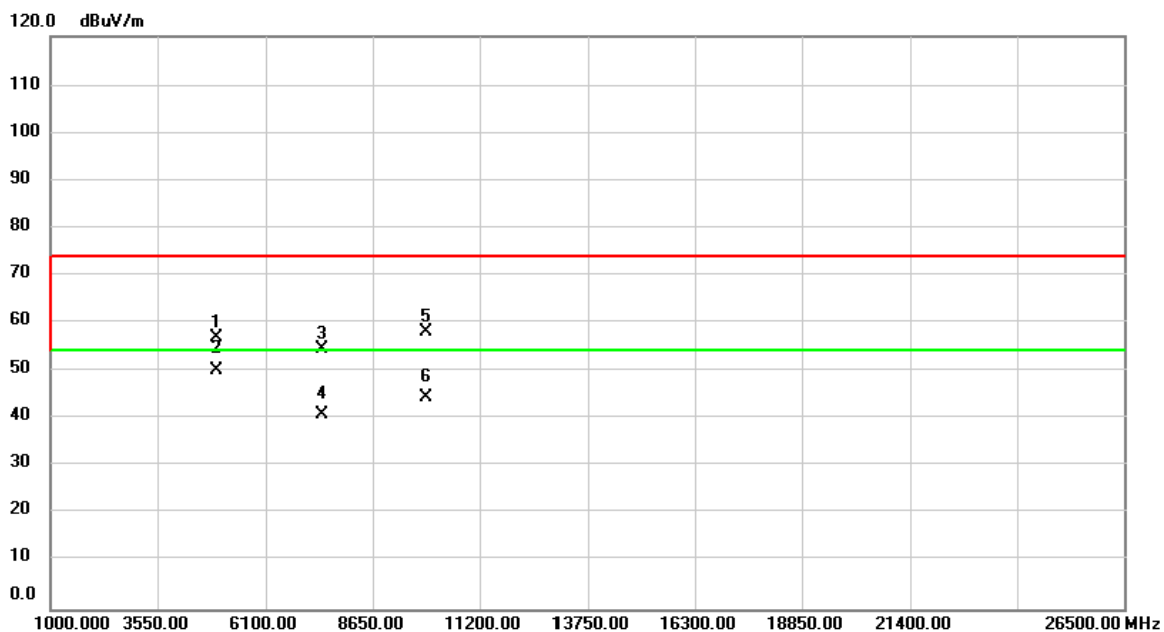
### Horizontal



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	X	2480.000	69.03	32.50	101.53	74.00	27.53	peak	No Limit
2	*	2480.000	68.08	32.50	100.58	54.00	46.58	AVG	No Limit
3		2486.300	18.23	32.51	50.74	74.00	-23.26	peak	
4		2486.300	7.73	32.51	40.24	54.00	-13.76	AVG	

Orthogonal Axis :	X
Test Mode :	TX 2480MHz _CH39_1Mbps

### Horizontal



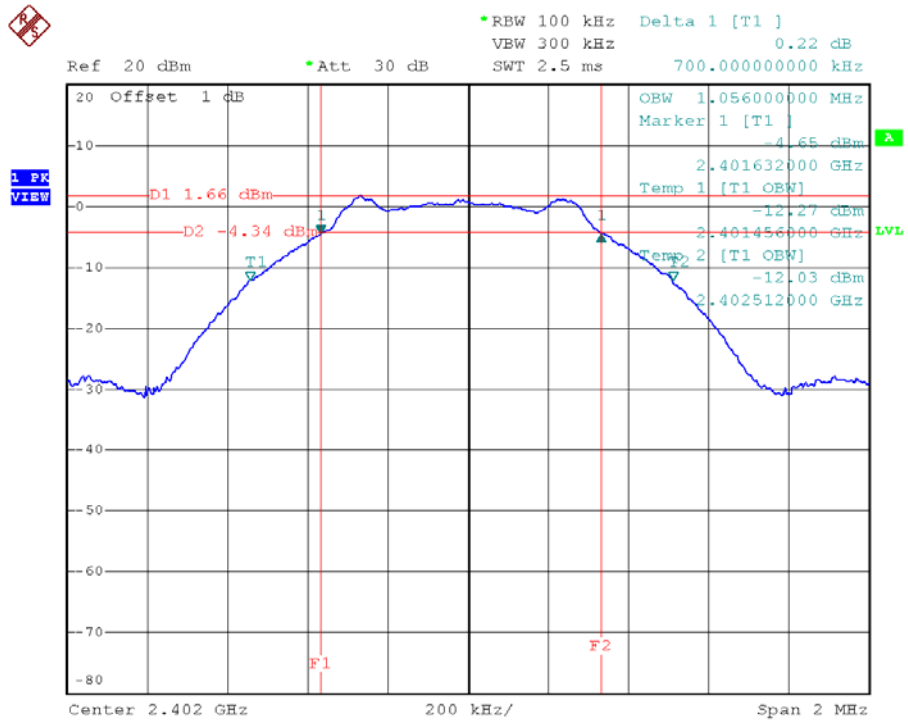
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4960.000	67.21	-10.50	56.71	74.00	-17.29	peak	
2	*	4960.000	60.85	-10.50	50.35	54.00	-3.65	AVG	
3		7440.000	59.05	-4.73	54.32	74.00	-19.68	peak	
4		7440.000	45.64	-4.73	40.91	54.00	-13.09	AVG	
5		9920.000	58.62	-0.65	57.97	74.00	-16.03	peak	
6		9920.000	45.33	-0.65	44.68	54.00	-9.32	AVG	



## ATTACHMENT E - BANDWIDTH

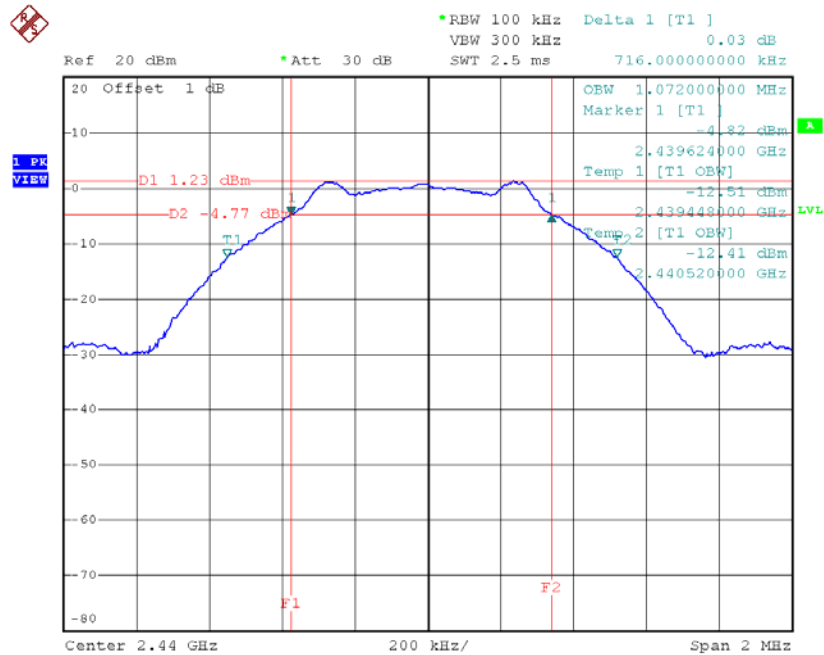
Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied BW (MHz)	Min. Limit (kHz)	Test Result
2402	0.700	1.056	500	Complies
2440	0.716	1.072	500	Complies
2480	0.720	1.076	500	Complies

### TX CH00



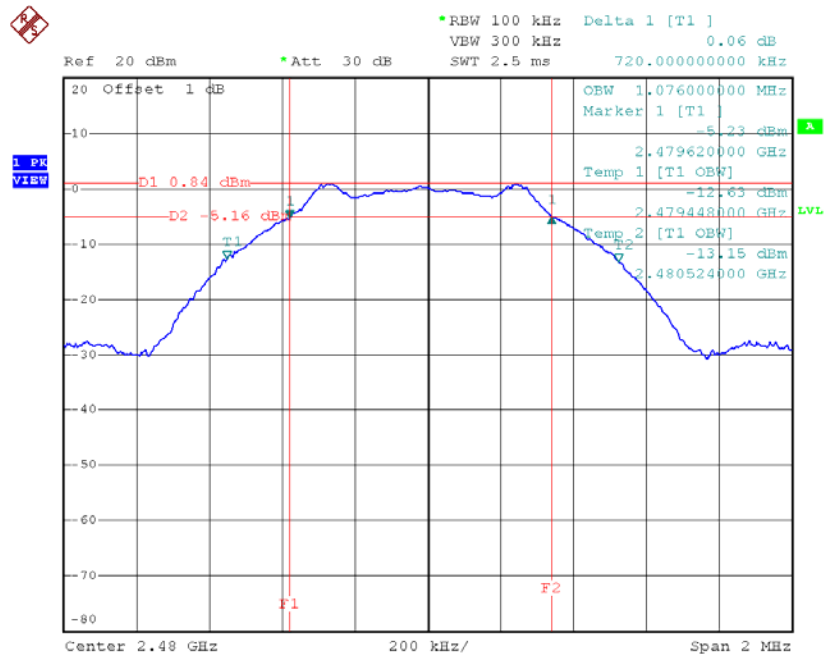
Date: 30.JAN.2016 11:55:36

### TX CH19



Date: 30.JAN.2016 11:59:42

### TX CH39



Date: 30.JAN.2016 12:02:25

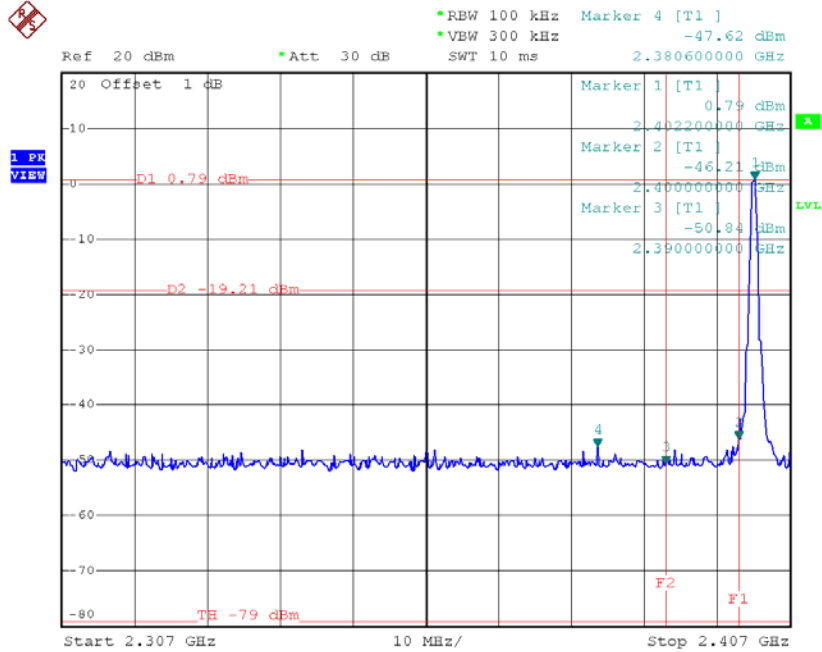
## ATTACHMENT F - MAXIMUM OUTPUT POWER TEST

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (Watt)	Max. Limit (dBm)	Max. Limit (Watt)	Test Result
2402	1.96	0.0016	30.00	1.00	Complies
2440	1.67	0.0015	30.00	1.00	Complies
2480	1.44	0.0014	30.00	1.00	Complies

**ATTACHMENT G - ANTENNA CONDUCTED SPURIOUS  
EMISSION**

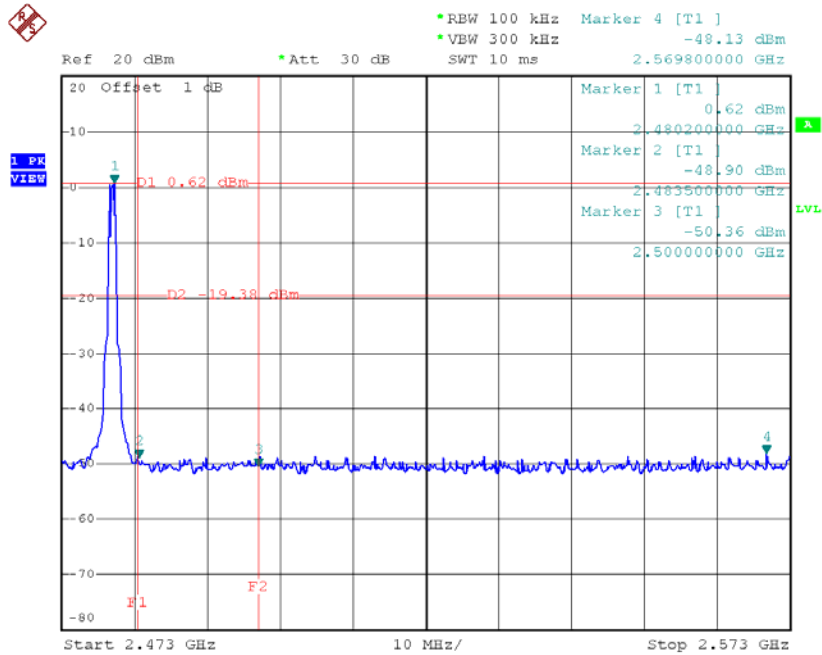
Test Mode : CH00, CH19 , CH39 - 1Mbps

### CH00 (Lower) - 1Mbps



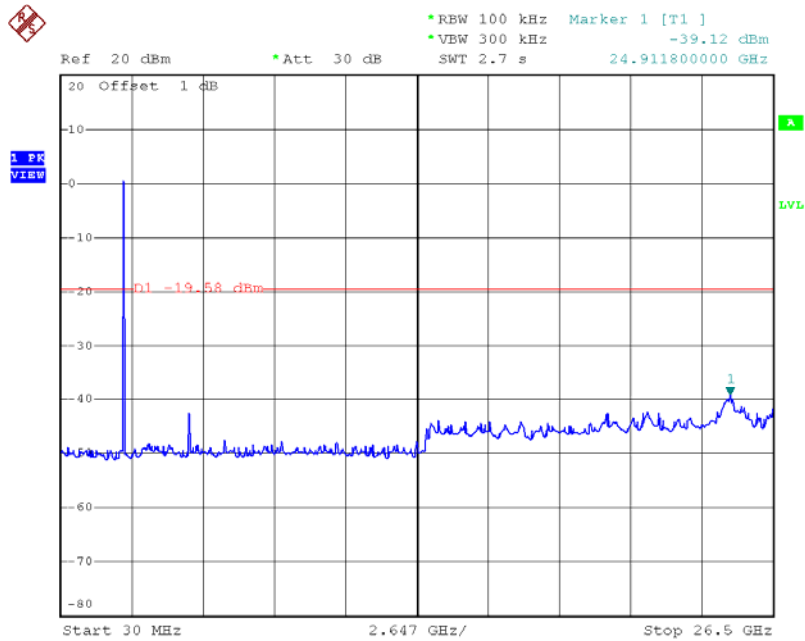
Date: 30.JAN.2016 13:19:14

### CH39 (upper) - 1Mbps



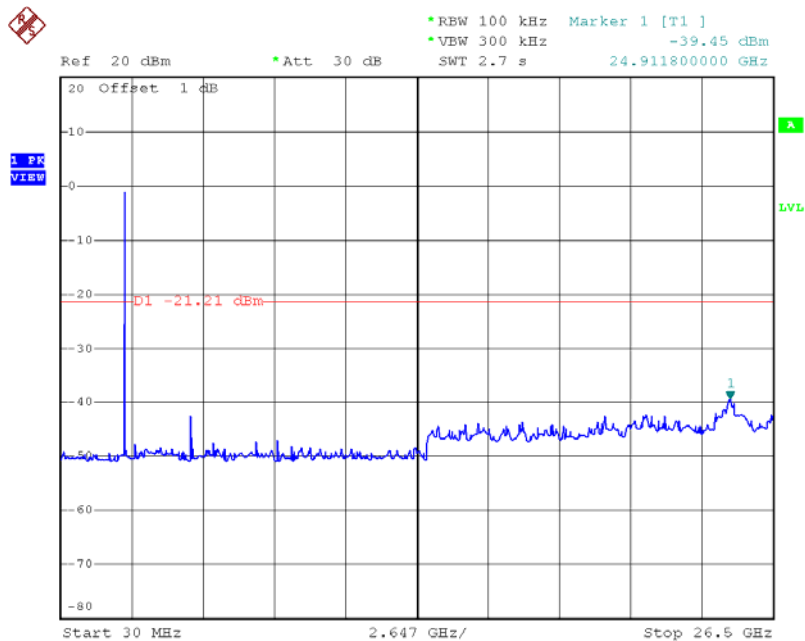
Date: 30.JAN.2016 13:22:28

### CH00 (10 Harmonic of the frequency)



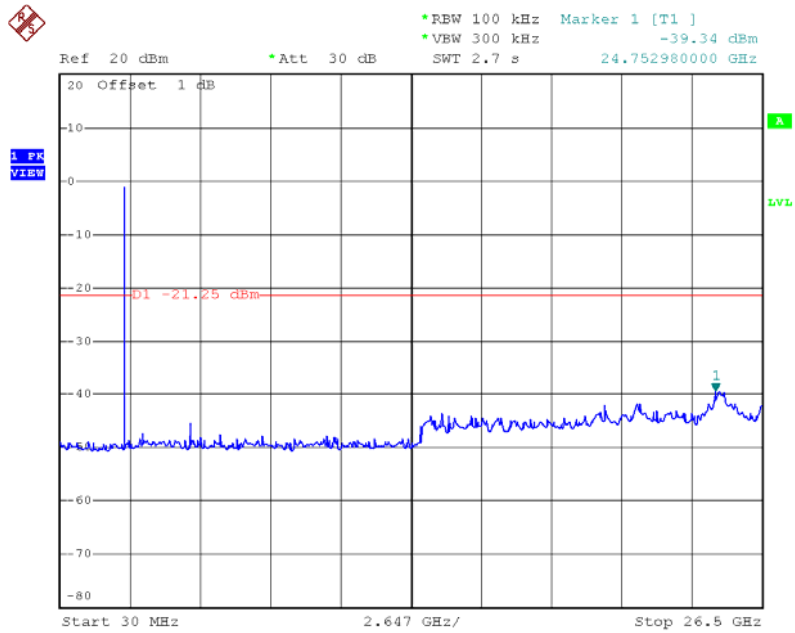
Date: 30.JAN.2016 12:08:13

### CH19 (10 Harmonic of the frequency)



Date: 30.JAN.2016 12:09:10

### CH39 (10 Harmonic of the frequency)



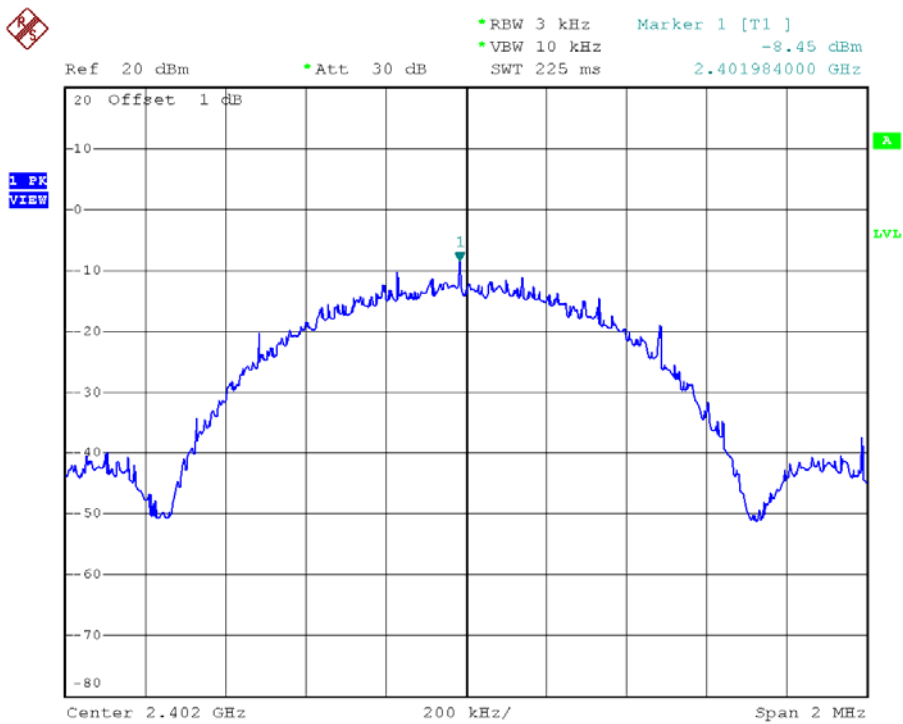
Date: 30.JAN.2016 12:10:23



## **ATTACHMENT H - POWER SPECTRAL DENSITY TEST**

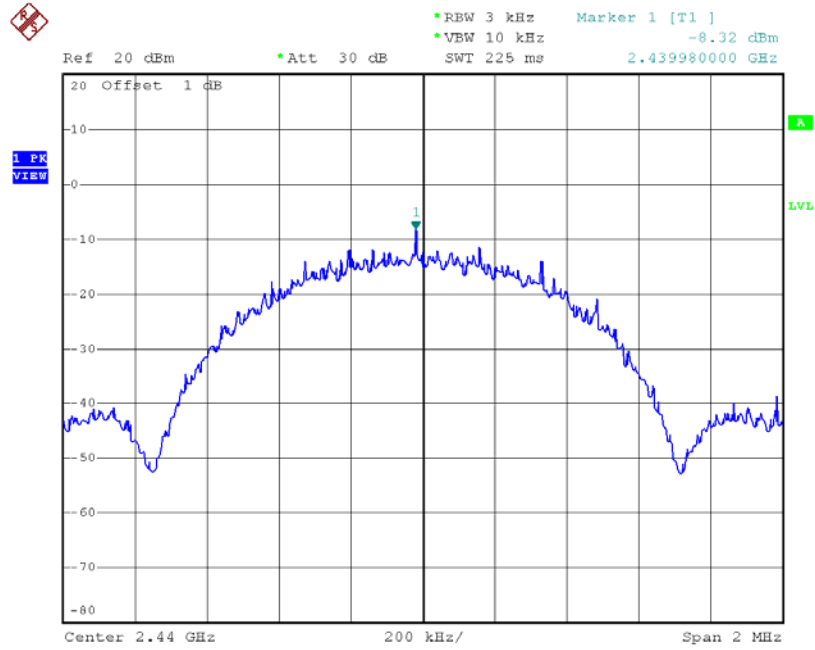
Frequency (MHz)	Power Density (dBm)	Max. Limit (dBm)	Result
2402	-8.45	8	Complies
2440	-8.32	8	Complies
2480	-7.55	8	Complies

### TX CH00



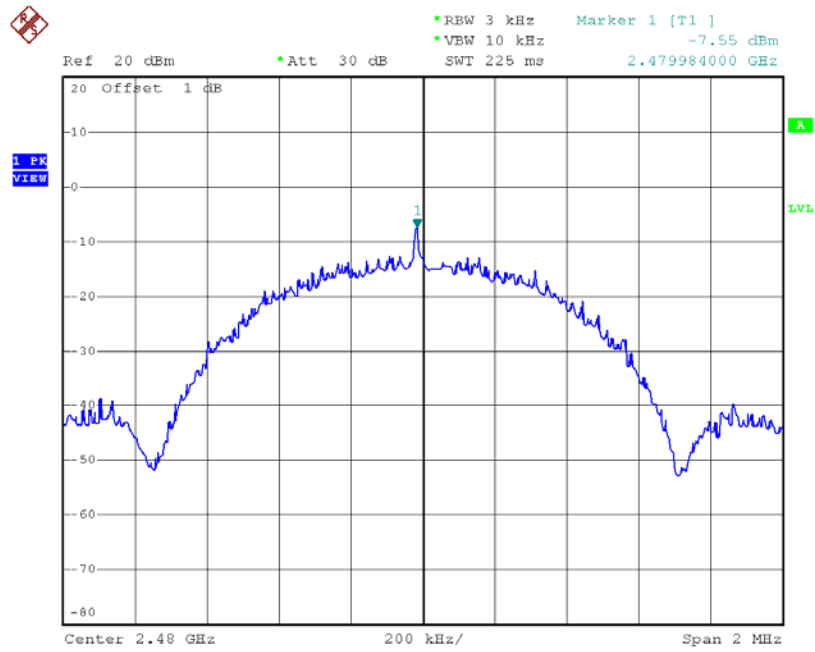
Date: 30.JAN.2016 12:05:39

### TX CH19



Date: 30.JAN.2016 12:05:01

### TX CH39



Date: 30.JAN.2016 12:03:50