

FCC Radio Test Report

FCC ID: 2AFG6-RK3399

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

Project No. : 1703C059
Equipment : Android Module
Model Name : RK3399
Applicant : Guangzhou Shirui Electronics Co.,Ltd
Address : 192 Kezhu Road, Sciencetech Park, Guangzhou
Economic & Technology Development District,
Guangzhou,Guangdong,China

Date of Receipt : Mar. 08, 2017
Date of Test : Mar. 08, 2017 ~ Apr. 20, 2017
Issued Date : Apr. 21, 2017
Tested by : BTL Inc.

Testing Engineer

: Shawn Xiao
(Shawn Xiao)

Technical Manager

: David Mao
(David Mao)

Authorized Signatory

: Steven Lu
(Steven Lu)

B T L I N C .

No.3, Jinshagang 1st Road, Shixia, Dalang Town, Dongguan,
Guangdong, China.

TEL: +86-769-8318-3000 FAX: +86-769-8319-6000

Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

BTL's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **BTL** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

BTL's report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

This report is the confidential property of the client. As a mutual protection to the clients, the public and **BTL-self**, extracts from the test report shall not be reproduced except in full with **BTL's** authorized written approval.

BTL's laboratory quality assurance procedures are in compliance with the **ISO Guide 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

Table of Contents	Page
1 . CERTIFICATION	6
2 . SUMMARY OF TEST RESULTS	7
2.1 TEST FACILITY	8
2.2 MEASUREMENT UNCERTAINTY	8
3 . GENERAL INFORMATION	9
3.1 GENERAL DESCRIPTION OF EUT	9
3.2 DESCRIPTION OF TEST MODES	10
3.3 TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING	10
3.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED	11
3.5 DESCRIPTION OF SUPPORT UNITS	11
4 . EMC EMISSION TEST	12
4.1 CONDUCTED EMISSION MEASUREMENT	12
4.1.1 POWER LINE CONDUCTED EMISSION LIMITS	12
4.1.2 TEST PROCEDURE	12
4.1.3 DEVIATION FROM TEST STANDARD	12
4.1.4 TEST SETUP	13
4.1.5 EUT OPERATING CONDITIONS	13
4.1.6 EUT TEST CONDITIONS	13
4.1.7 TEST RESULTS	13
4.2 RADIATED EMISSION MEASUREMENT	14
4.2.1 RADIATED EMISSION LIMITS	14
4.2.2 TEST PROCEDURE	15
4.2.3 DEVIATION FROM TEST STANDARD	15
4.2.4 TEST SETUP	16
4.2.5 EUT OPERATING CONDITIONS	17
4.2.6 EUT TEST CONDITIONS	17
4.2.7 TEST RESULTS (9KHZ TO 30MHZ)	17
4.2.8 TEST RESULTS (30MHZ TO 1000 MHZ)	17
4.2.9 TEST RESULTS (ABOVE 1000 MHZ)	17
5 . BANDWIDTH TEST	18
5.1 APPLIED PROCEDURES / LIMIT	18
5.1.1 TEST PROCEDURE	18
5.1.2 DEVIATION FROM STANDARD	18
5.1.3 TEST SETUP	18
5.1.4 EUT OPERATION CONDITIONS	18
5.1.5 EUT TEST CONDITIONS	18
5.1.6 TEST RESULTS	18

Table of Contents	Page
6 . MAXIMUM OUTPUT POWER TEST	19
6.1 APPLIED PROCEDURES / LIMIT	19
6.1.1 TEST PROCEDURE	19
6.1.2 DEVIATION FROM STANDARD	19
6.1.3 TEST SETUP	19
6.1.4 EUT OPERATION CONDITIONS	19
6.1.5 EUT TEST CONDITIONS	19
6.1.6 TEST RESULTS	19
7 . ANTENNA CONDUCTED SPURIOUS EMISSION	20
7.1 APPLIED PROCEDURES / LIMIT	20
7.1.1 TEST PROCEDURE	20
7.1.2 DEVIATION FROM STANDARD	20
7.1.3 TEST SETUP	20
7.1.4 EUT OPERATION CONDITIONS	20
7.1.5 EUT OPERATION CONDITIONS	20
7.1.6 TEST RESULTS	20
8 . POWER SPECTRAL DENSITY TEST	21
8.1 APPLIED PROCEDURES / LIMIT	21
8.1.1 TEST PROCEDURE	21
8.1.2 DEVIATION FROM STANDARD	21
8.1.3 TEST SETUP	21
8.1.4 EUT OPERATION CONDITIONS	21
8.1.5 EUT TEST CONDITIONS	21
8.1.6 TEST RESULTS	21
9 . MEASUREMENT INSTRUMENTS LIST	22
10 . EUT TEST PHOTO	24
ATTACHMENT A - CONDUCTED EMISSION	28
ATTACHMENT B - RADIATED EMISSION (9KHZ TO 30MHZ)	31
ATTACHMENT C - RADIATED EMISSION (30MHZ TO 1000MHZ)	36
ATTACHMENT D - RADIATED EMISSION (ABOVE 1000MHZ)	43
ATTACHMENT E - BANDWIDTH	56
ATTACHMENT F - MAXIMUM OUTPUT POWER TEST	59
ATTACHMENT G - ANTENNA CONDUCTED SPURIOUS EMISSION	60
ATTACHMENT H - POWER SPECTRAL DENSITY TEST	67

REPORT ISSUED HISTORY

Issued No.	Description	Issued Date
BTL-FICP-1-1703C059	Original Issue.	Apr. 21, 2017

1. CERTIFICATION

Equipment : Android Module
Brand Name : SEEWO
Model Name : RK3399
Applicant : Guangzhou Shirui Electronics Co.,Ltd
Manufacturer : Guangzhou Shirui Electronics Co.,Ltd
Address : 192 Kezhu Road, Sciencetech Park, Guangzhou Economic & Technology
Development District, Guangzhou,Guangdong,China
Date of Test : Mar. 09, 2017 ~ Apr. 20, 2017
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-2-1703C059) 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): FCC Part15 (15.247) , 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)(2)	6dB Bandwidth	PASS	
15.247(b)(3)	Peak Output Power	PASS	
15.247(e)	Power Spectral Density	PASS	
15.203	Antenna Requirement	PASS	
15.247(d)/ 15.205/ 15.209	Transmitter Radiated Emissions	PASS	

NOTE:

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

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

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	Android Module	
Brand Name	SEEWO	
Model Name	RK3399	
Model Difference	N/A	
Product Description	Operation Frequency	2402~2480 MHz
	Modulation Technology	GFSK(1Mbps)
	Bit Rate of Transmitter	
	Output Power (Max.)	4.92 dBm (1Mbps)
Power Source	DC voltage supplied from AC/DC adapter.(Support Unit)	
Power Rating	12/19V 1.5A	

Note:

- For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
- 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)
1	N/A	N/A	Dipole	N/A	2.55

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 NOTE (1)

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

For Conducted Test	
Final Test Mode	Description
Mode 1	TX Mode

For Radiated Test	
Final Test Mode	Description
Mode 1	TX Mode NOTE (1)

Note:

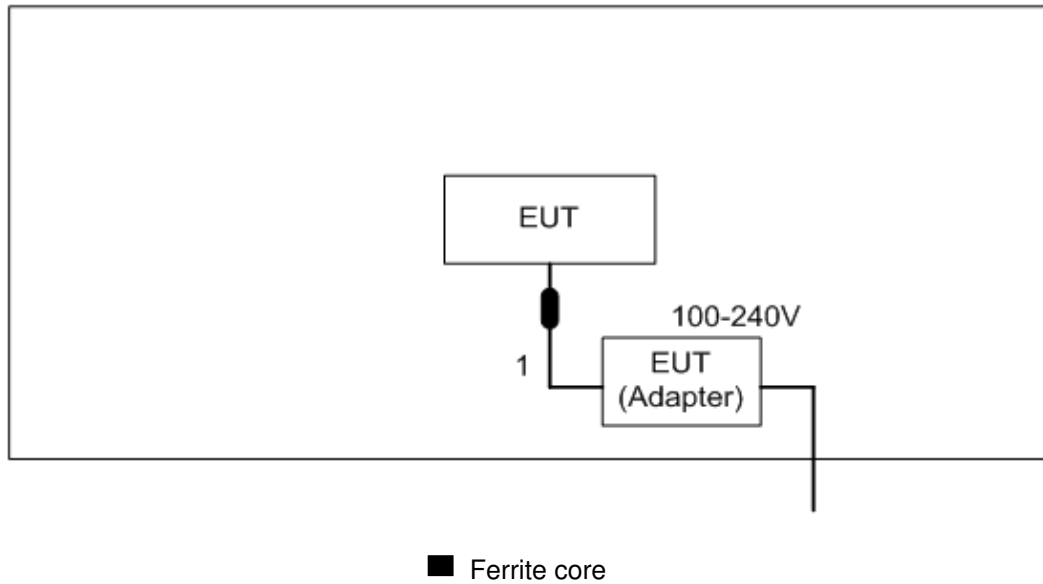
(1) The measurements are performed at the high, middle, low available channels.

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 BT LE

Test Software Version	RFtest		
Frequency (MHz)	2402	2440	2480
BT LE	N/A	N/A	N/A

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
1	NO	YES	1.5 m	DC Cable

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 -0.5	66 to 56*	56 to 46*
0.50 -5.0	56	46
5.0 -30.0	□0	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

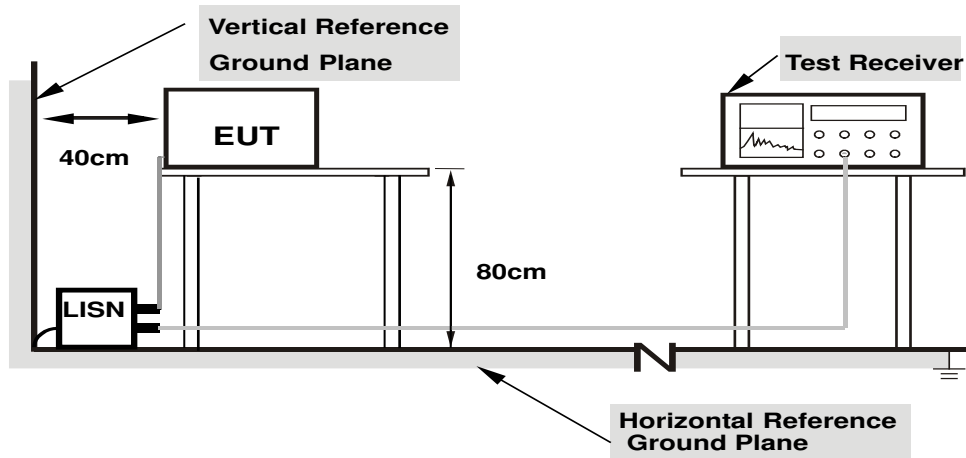
4.1.2 TEST PROCEDURE

- 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 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

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

4.1.6 EUT TEST CONDITIONS

Temperature: 24°C Relative Humidity: 60% 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.
- (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), then the 15.209(a) 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

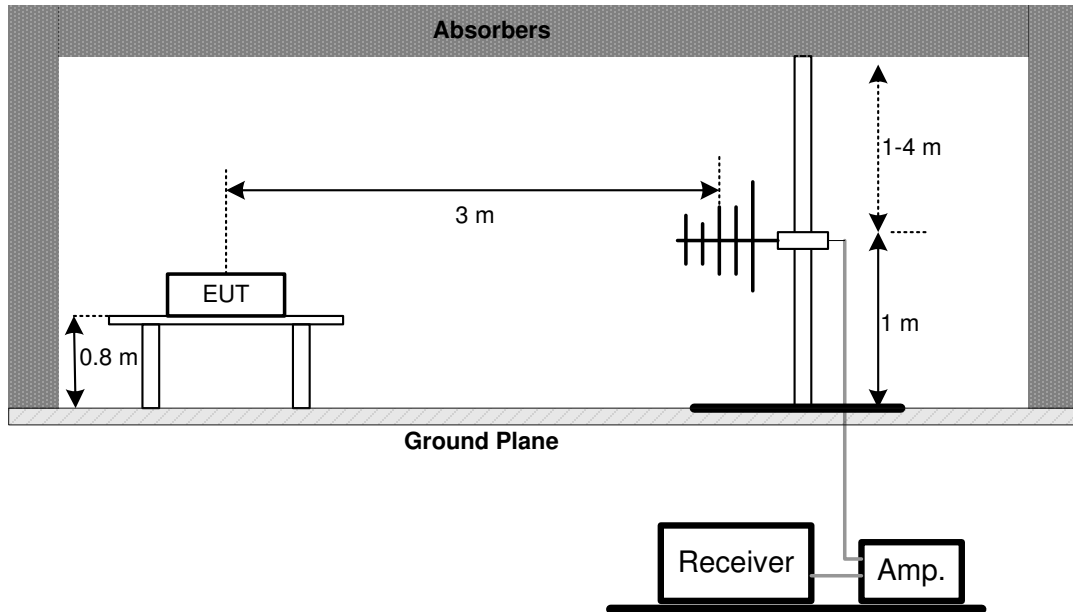
- The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
- The measuring distance of 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 0.8m 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.
- 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)
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

4.2.3 DEVIATION FROM TEST STANDARD

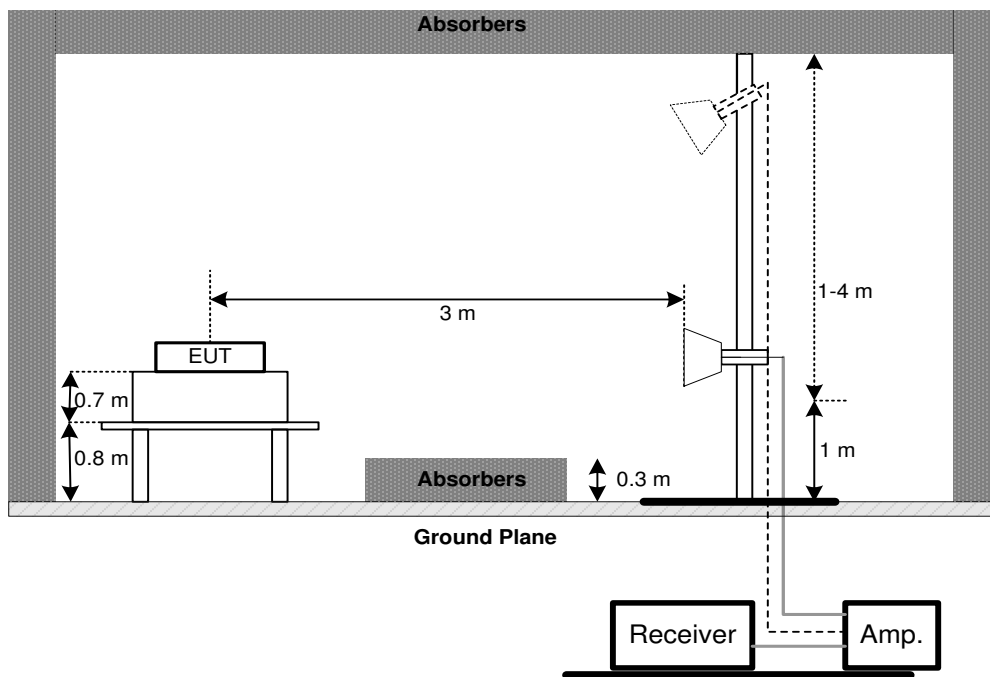
No deviation

4.2.4 TEST SETUP

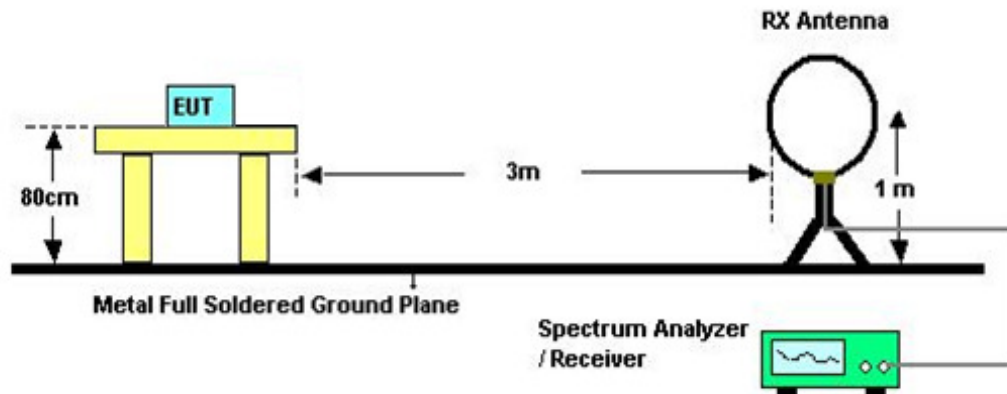
(A) Radiated Emission Test Set-Up Frequency Below 1 GHz



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



(C) For radiated emissions below 30MHz



4.2.5 EUT OPERATING CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

4.2.6 EUT TEST CONDITIONS

Temperature: 22°C Relative Humidity: 56% Test Voltage: AC 120V/60Hz

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.

4.2.9 TEST RESULTS (ABOVE 1000 MHZ)

Please refer to the Attachment D.

Remark:

- (1) 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)	Bandwidth	$\geq 500\text{KHz}$ (6dB bandwidth)	2400-2483.5	PASS

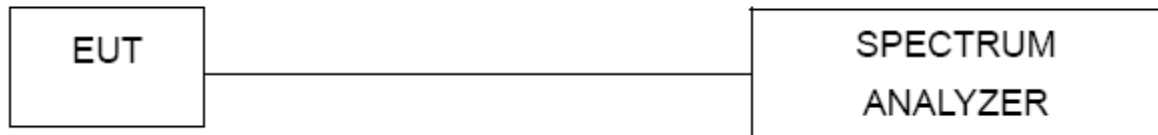
5.1.1 TEST PROCEDURE

- 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: 24°C Relative Humidity: 60% Test Voltage: AC 120V/60Hz

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)	Maximum Output Power	1 watt or 30dBm	2400-2483.5	PASS

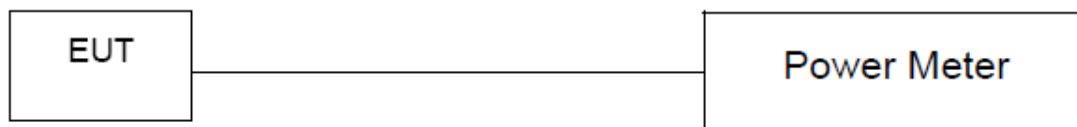
6.1.1 TEST PROCEDURE

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

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: 24°C Relative Humidity: 60% Test Voltage: AC 120V/60Hz

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 the transmitter demonstrates compliance with the peak conducted power limits.

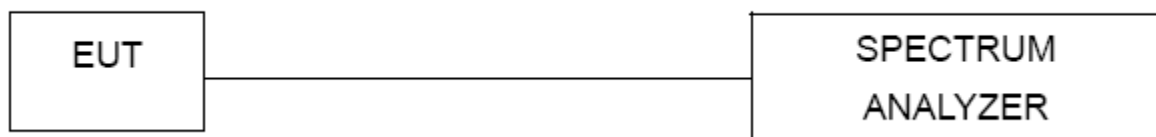
7.1.1 TEST PROCEDURE

- 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 = 10 ms.
- 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: 24°C Relative Humidity: 60% Test Voltage: AC 120V/60Hz

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)	Power Spectral Density	8 dBm (in any 3KHz)	2400-2483.5	PASS

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=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: 24°C Relative Humidity: 60% Test Voltage: AC 120V/60Hz

8.1.6 TEST RESULTS

Please refer to the Attachment H.

9. 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-30M Hz)	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. 26, 2017
5	Control	CT	SC100	N/A	N/A
6	Position Control	MF	MF-7802	MF780208416	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. 26, 2017
11	Controller	CT	SC100	N/A	N/A
12	Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170319	Apr. 23, 2017
13	Microwave Preamplifier With Adaptor	EMC INSTRUMENT	EMC2654045	980039 & HA01	Mar. 27, 2017
14	Active Loop Antenna	R&S	HFH2-Z2	830749/020	Sep. 06, 2017
15	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A

6dB Bandwidth Measurement					
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 Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Power Meter	ANRITSU	ML2495A	1128009	Mar. 27, 2017
2	Pulse Power Sensor	ANRITSU	MA 2411B	1027500	Mar. 27, 2017

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

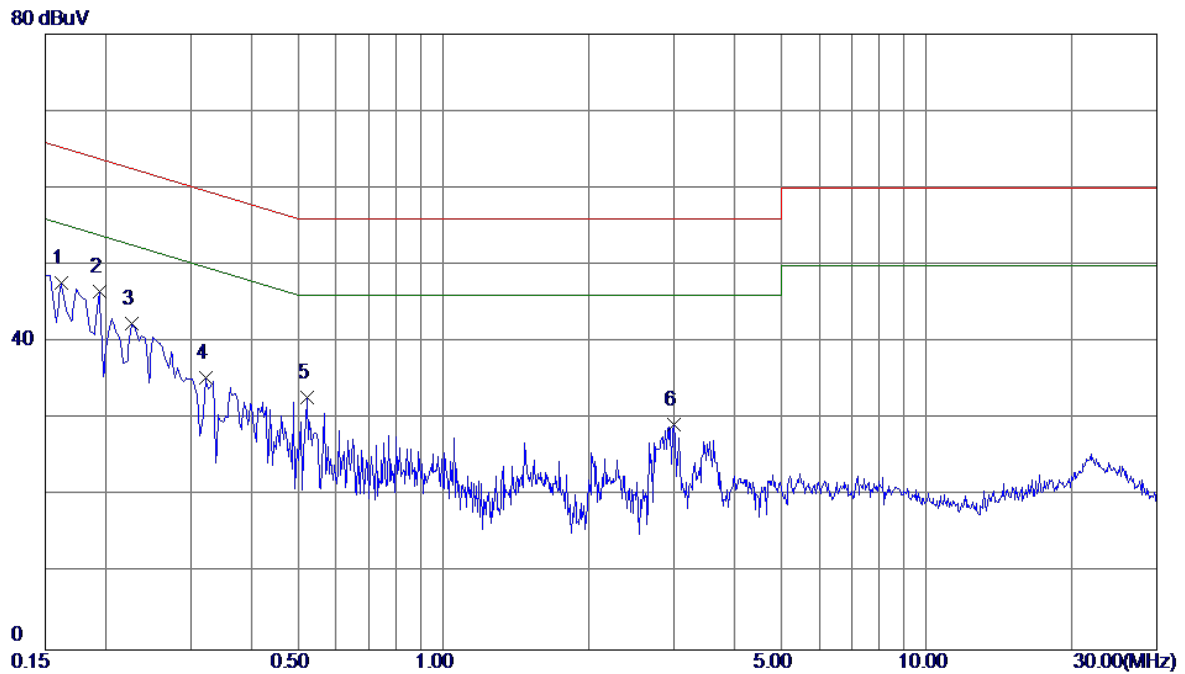
Power Spectral Density Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP 40	100185	Oct. 11, 2016

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

ATTACHMENT A - CONDUCTED EMISSION

Test Mode: TX Mode

Line

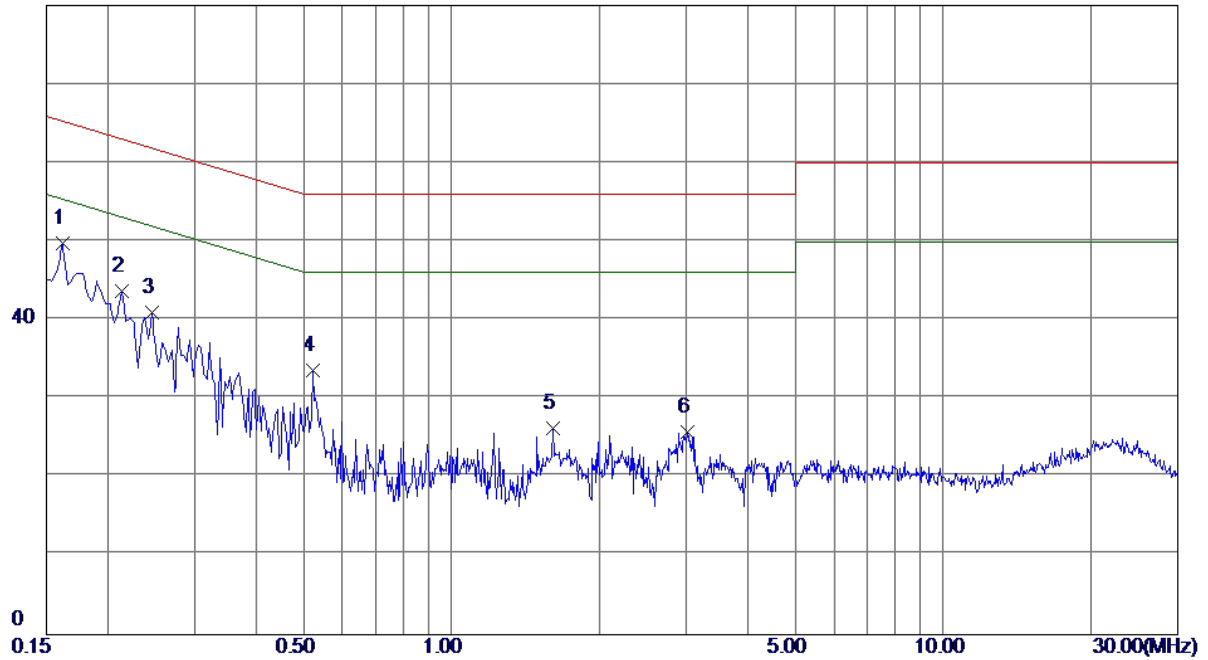


No.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1	0.1620	38.09	9.57	47.66	65.36	-17.70	Peak	
2 *	0.1940	36.95	9.57	46.52	63.86	-17.34	Peak	
3	0.2260	32.80	9.57	42.37	62.60	-20.23	Peak	
4	0.3220	25.74	9.58	35.32	59.66	-24.34	Peak	
5	0.5220	23.14	9.69	32.83	56.00	-23.17	Peak	
6	3.0059	19.09	10.26	29.35	56.00	-26.65	Peak	

Test Mode: TX Mode

Neutral

80 dBuV

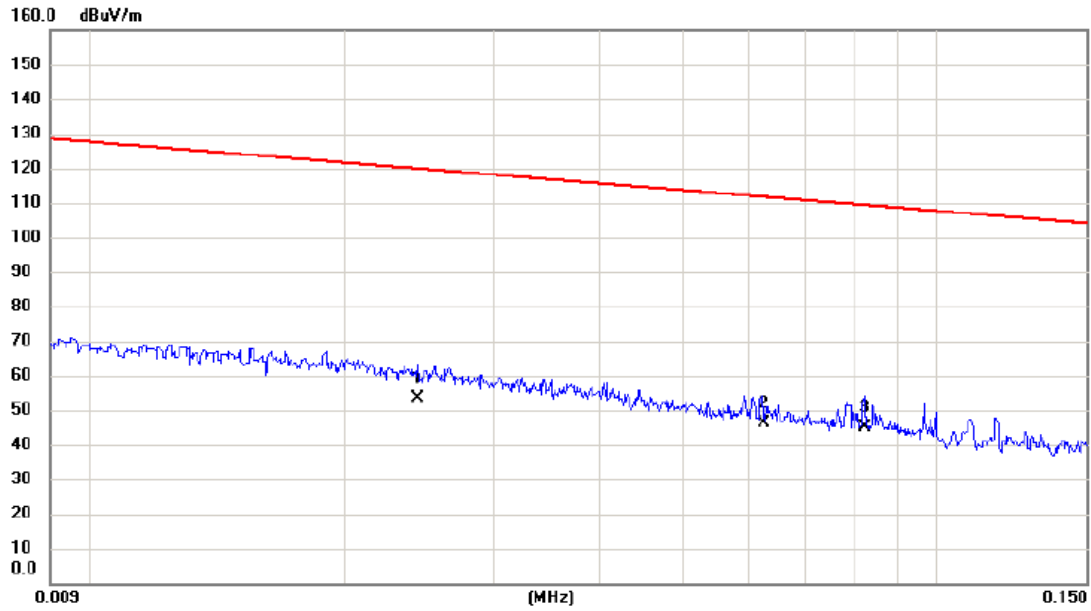


No.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1 *	0.1620	40.22	9.51	49.73	65.36	-15.63	Peak	
2	0.2140	34.09	9.57	43.66	63.05	-19.39	Peak	
3	0.2460	31.34	9.57	40.91	61.89	-20.98	Peak	
4	0.5220	24.06	9.49	33.55	56.00	-22.45	Peak	
5	1.6060	16.48	9.78	26.26	56.00	-29.74	Peak	
6	3.0180	15.78	9.96	25.74	56.00	-30.26	Peak	

ATTACHMENT B - RADIATED EMISSION (9KHZ TO 30MHZ)

Test Mode: TX Mode

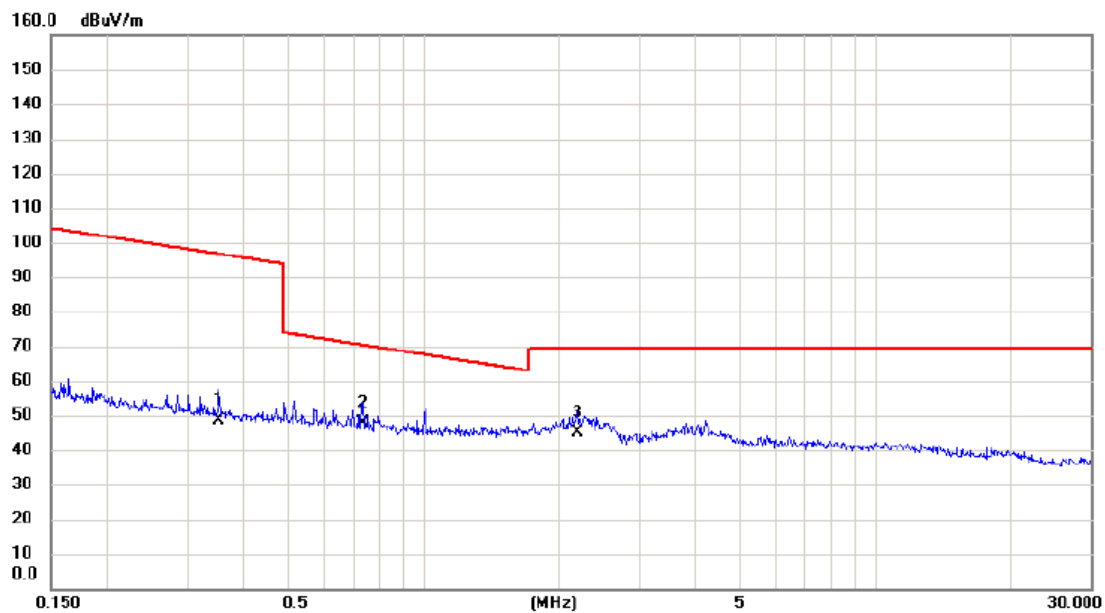
Ant 0°



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1		0.0244	30.33	22.98	53.31	119.86	-66.55	AVG	
2		0.0624	26.44	19.68	46.12	111.70	-65.58	AVG	
3	*	0.0820	25.83	19.22	45.05	109.33	-64.28	AVG	

Test Mode: TX Mode

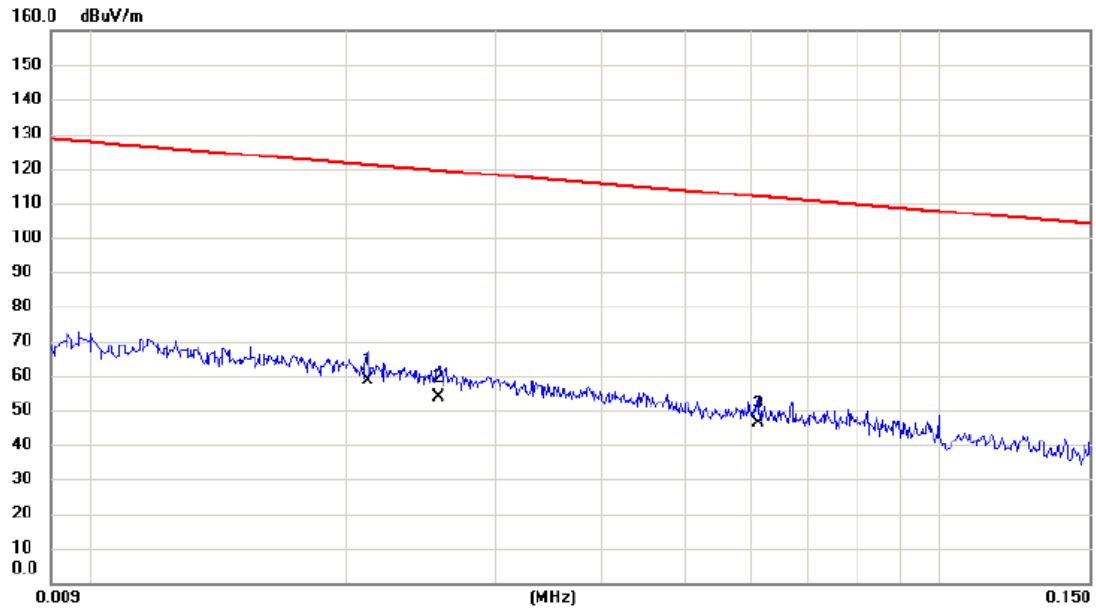
Ant 0°



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1		0.3520	29.96	18.54	48.50	96.67	-48.17	AVG	
2	*	0.7313	29.47	18.46	47.93	70.32	-22.39	QP	
3		2.1898	27.45	17.66	45.11	69.54	-24.43	QP	

Test Mode: TX Mode

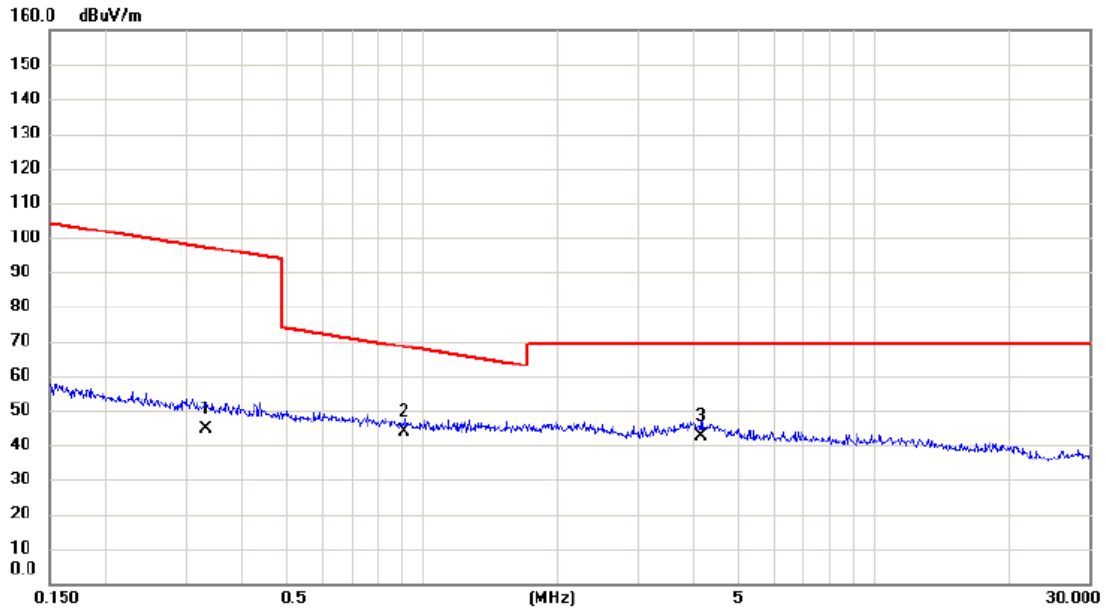
Ant 90°



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	0.0212	35.43	23.37	58.80	121.08	-62.28	AVG	
2		0.0257	30.91	22.82	53.73	119.41	-65.68	AVG	
3		0.0610	26.36	19.70	46.06	111.90	-65.84	AVG	

Test Mode: TX Mode

Ant 90°

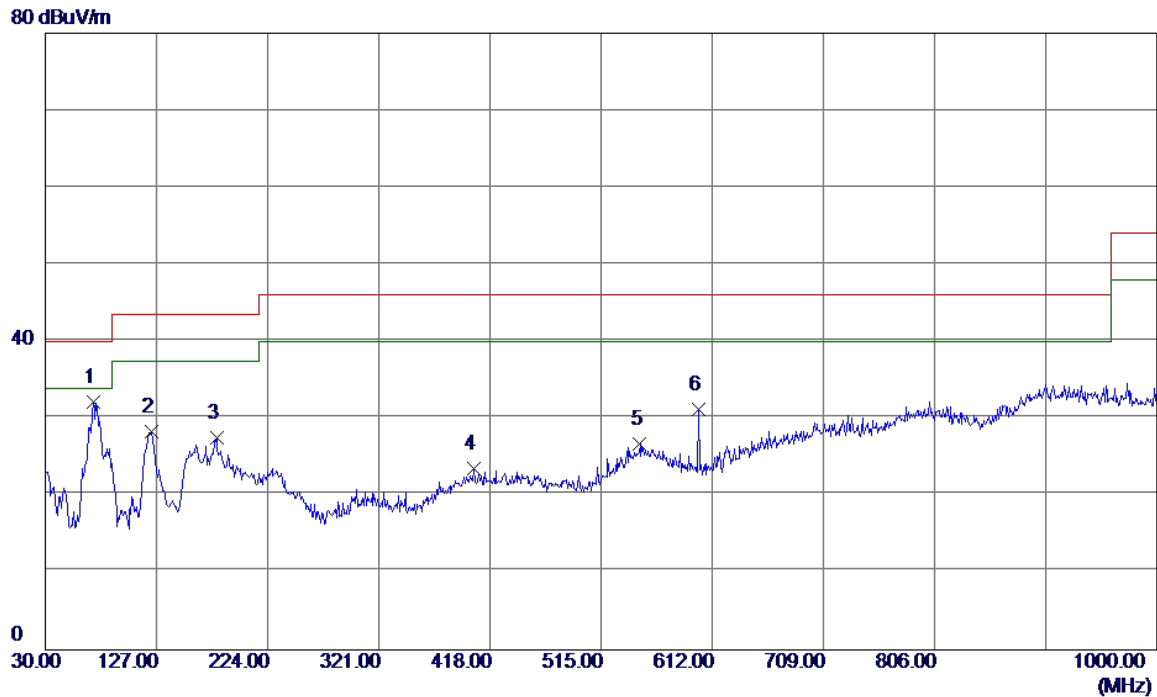


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1		0.3321	26.23	18.56	44.79	97.18	-52.39	AVG	
2	*	0.9136	25.87	17.96	43.83	68.39	-24.56	QP	
3		4.1356	24.06	18.48	42.54	69.54	-27.00	QP	

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

Test Mode: TX 2402MHz _CH00_1Mbps

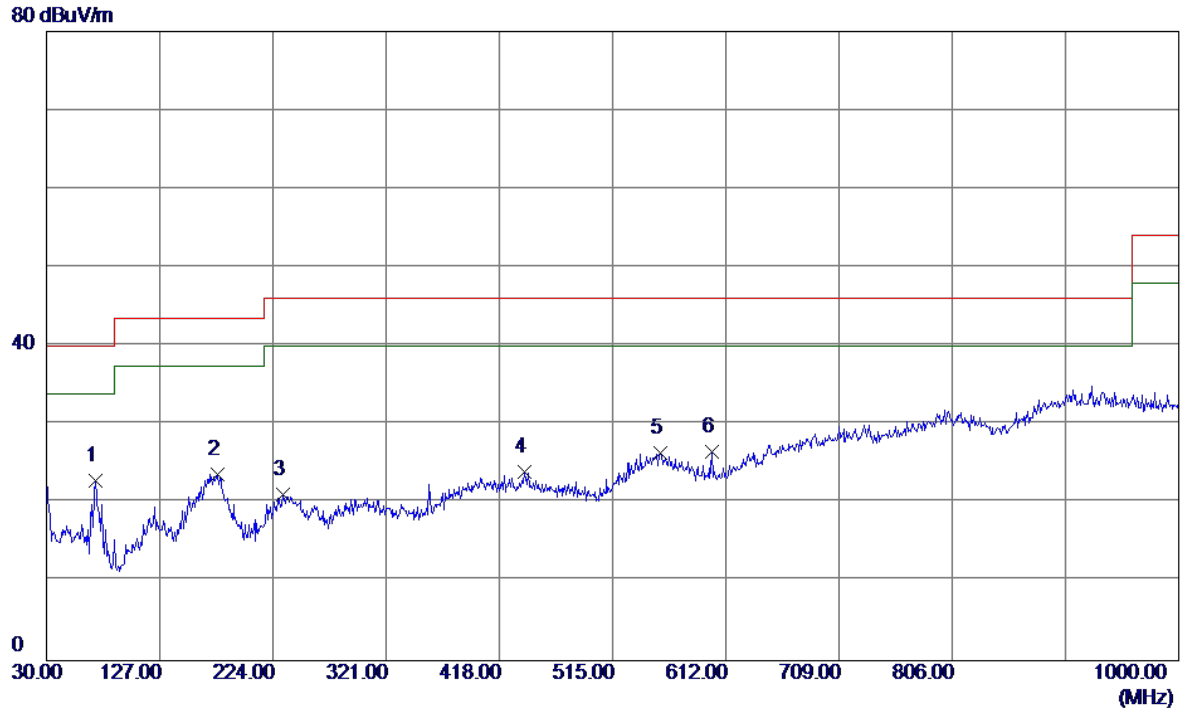
Vertical



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1 *	71.7100	48.66	-16.55	32.11	40.00	-7.89	Peak	
2	123.1200	41.46	-13.11	28.35	43.50	-15.15	Peak	
3	179.3800	40.30	-12.80	27.50	43.50	-16.00	Peak	
4	404.4200	31.36	-7.80	23.56	46.00	-22.44	Peak	
5	548.9500	31.33	-4.65	26.68	46.00	-19.32	Peak	
6	600.3600	38.30	-7.04	31.26	46.00	-14.74	Peak	

Test Mode:	TX 2402MHz _CH00_ 1Mbps
------------	-------------------------

Horizontal

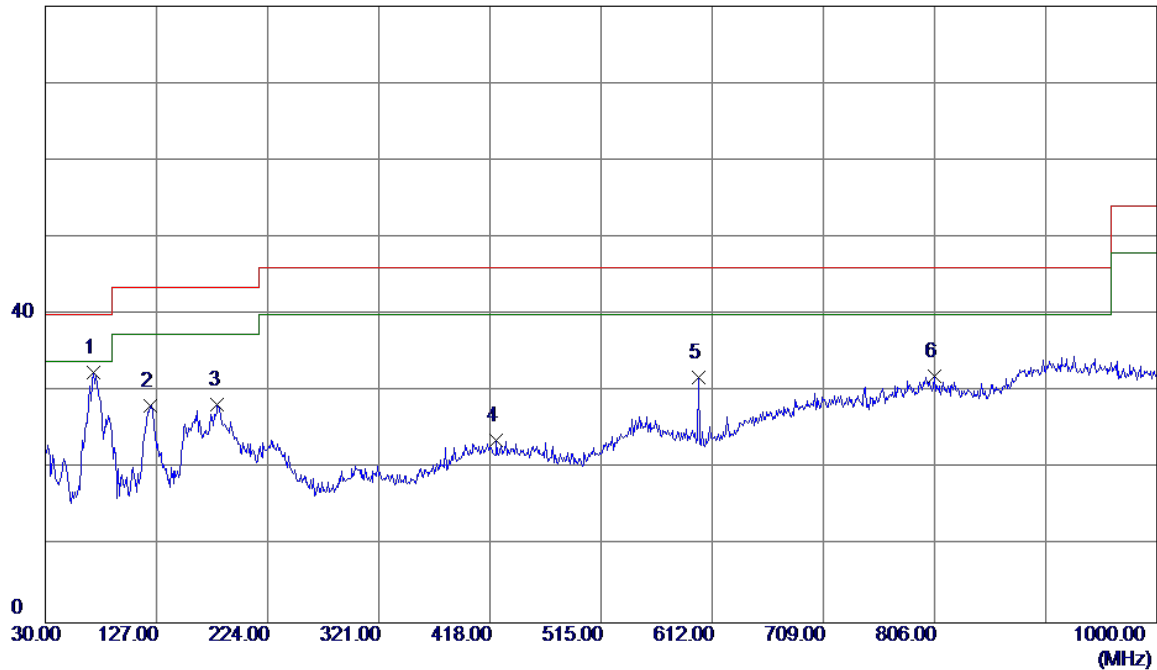


No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1 *	71.7100	39.47	-16.55	22.92	40.00	-17.08	Peak	
2	176.4700	36.35	-12.63	23.72	43.50	-19.78	Peak	
3	232.7300	34.61	-13.48	21.13	46.00	-24.87	Peak	
4	439.3400	31.99	-7.95	24.04	46.00	-21.96	Peak	
5	555.7400	31.16	-4.83	26.33	46.00	-19.67	Peak	
6	600.3600	33.57	-7.04	26.53	46.00	-19.47	Peak	

Test Mode: TX 2440MHz _CH19_1Mbps

Vertical

80 dBuV/m

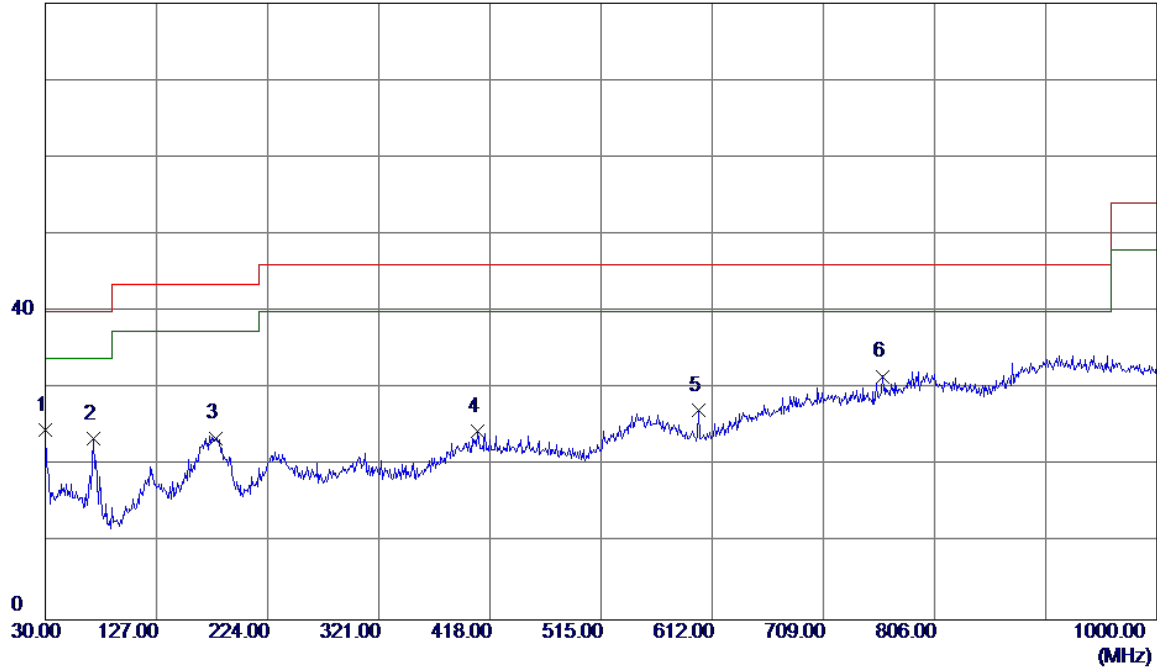


No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1 *	71.7100	48.99	-16.55	32.44	40.00	-7.56	Peak	
2	121.1800	41.50	-13.33	28.17	43.50	-15.33	Peak	
3	180.3500	41.13	-12.88	28.25	43.50	-15.25	Peak	
4	423.8200	31.49	-7.88	23.61	46.00	-22.39	Peak	
5	600.3600	38.84	-7.04	31.80	46.00	-14.20	Peak	
6	806.0000	31.92	0.08	32.00	46.00	-14.00	Peak	

Test Mode: TX 2440MHz _CH19_1Mbps

Horizontal

80 dBuV/m

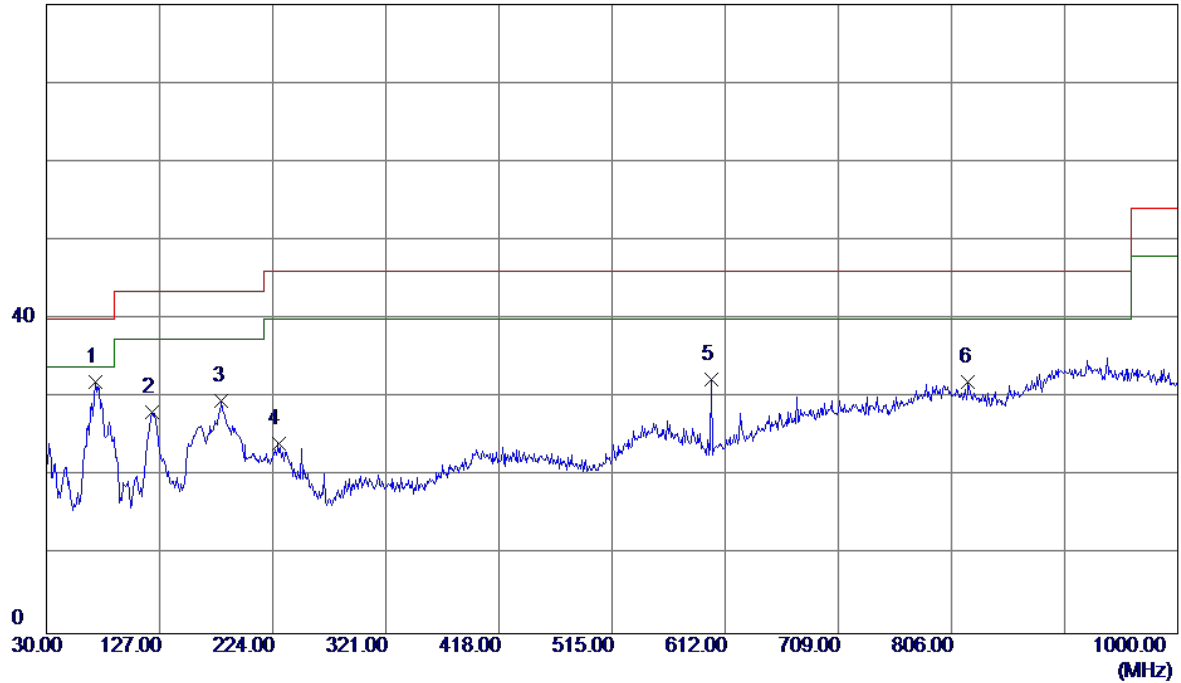


No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	30.0000	38.61	-14.03	24.58	40.00	-15.42	Peak	
2	71.7100	40.03	-16.55	23.48	40.00	-16.52	Peak	
3	178.4100	36.34	-12.74	23.60	43.50	-19.90	Peak	
4	407.3299	32.33	-7.81	24.52	46.00	-21.48	Peak	
5	600.3600	34.24	-7.04	27.20	46.00	-18.80	Peak	
6 *	760.4099	33.11	-1.51	31.60	46.00	-14.40	Peak	

Test Mode: TX 2480MHz _CH39_1Mbps

Vertical

80 dBuV/m

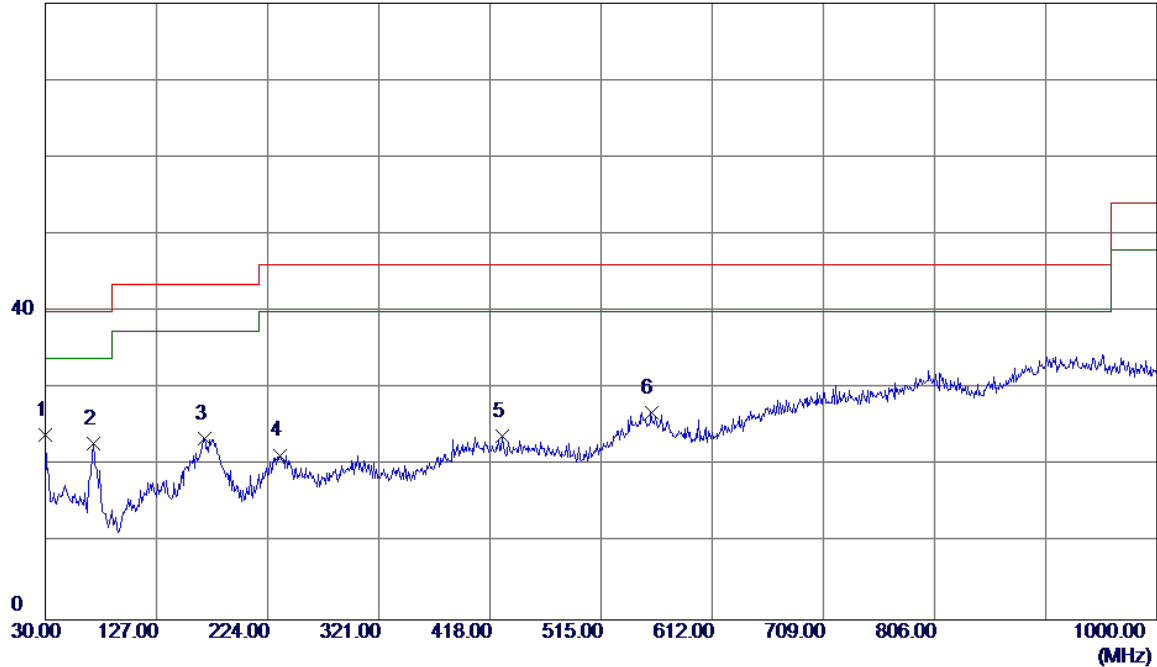


No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1 *	71.7100	48.59	-16.55	32.04	40.00	-7.96	Peak	
2	120.2100	41.57	-13.43	28.14	43.50	-15.36	Peak	
3	180.3500	42.50	-12.88	29.62	43.50	-13.88	Peak	
4	228.8500	37.59	-13.47	24.12	46.00	-21.88	Peak	
5	600.3600	39.32	-7.04	32.28	46.00	-13.72	Peak	
6	820.5500	32.36	-0.36	32.00	46.00	-14.00	Peak	

Test Mode: TX 2480MHz _CH39_1Mbps

Horizontal

80 dBuV/m



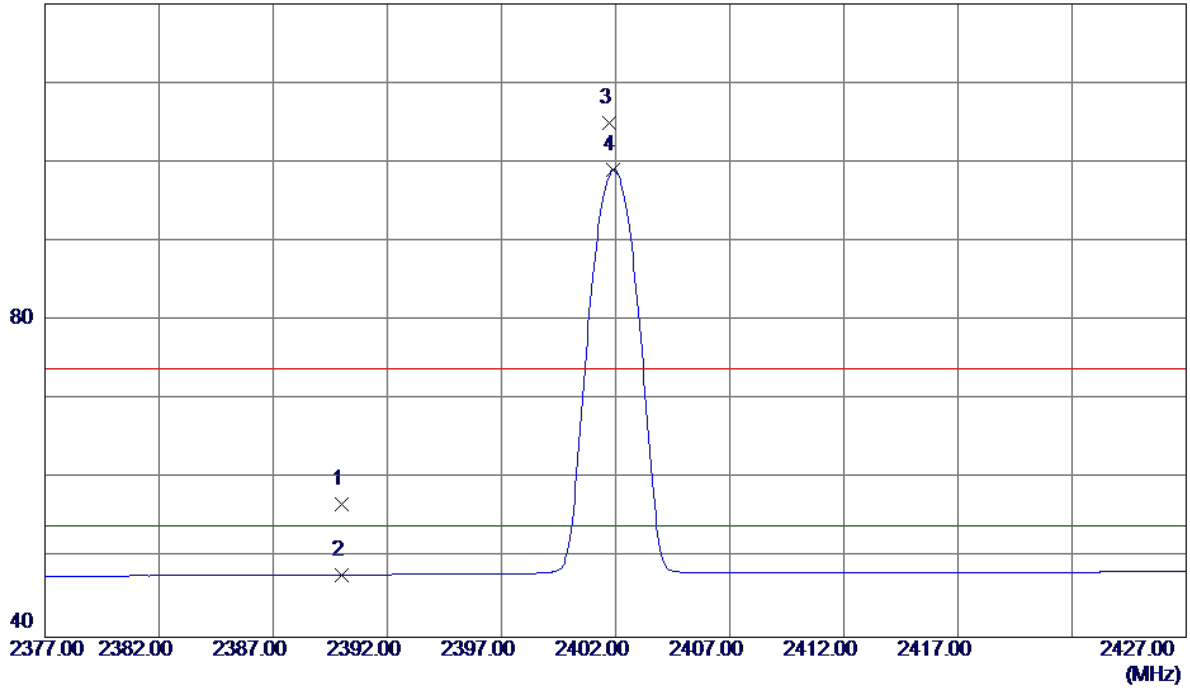
No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1 *	30.0000	38.08	-14.03	24.05	40.00	-15.95	Peak	
2	71.7100	39.47	-16.55	22.92	40.00	-17.08	Peak	
3	168.7100	35.73	-12.23	23.50	43.50	-20.00	Peak	
4	234.6700	34.92	-13.56	21.36	46.00	-24.64	Peak	
5	428.6700	31.81	-7.91	23.90	46.00	-22.10	Peak	
6	558.6500	31.85	-4.98	26.87	46.00	-19.13	Peak	

ATTACHMENT D - RADIATED EMISSION (ABOVE 1000MHZ)

Test Mode : TX 2402MHz _CH00_1Mbps

Vertical

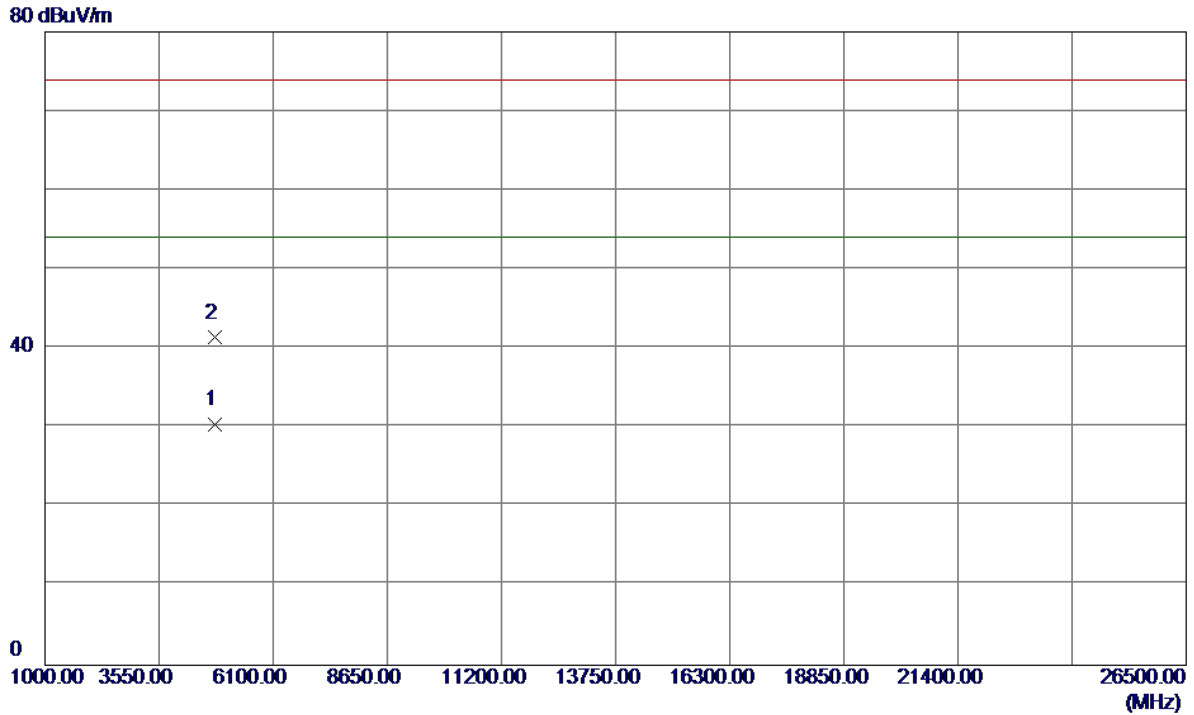
120 dBuV/m



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	2390.0000	23.75	33.01	56.76	74.00	-17.24	Peak	
2	2390.0000	14.85	33.01	47.86	54.00	-6.14	AVG	
3	2401.7000	71.97	33.06	105.03	74.00	31.03	Peak	No Limit
4 *	2401.9000	65.99	33.06	99.05	54.00	45.05	AVG	No Limit

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

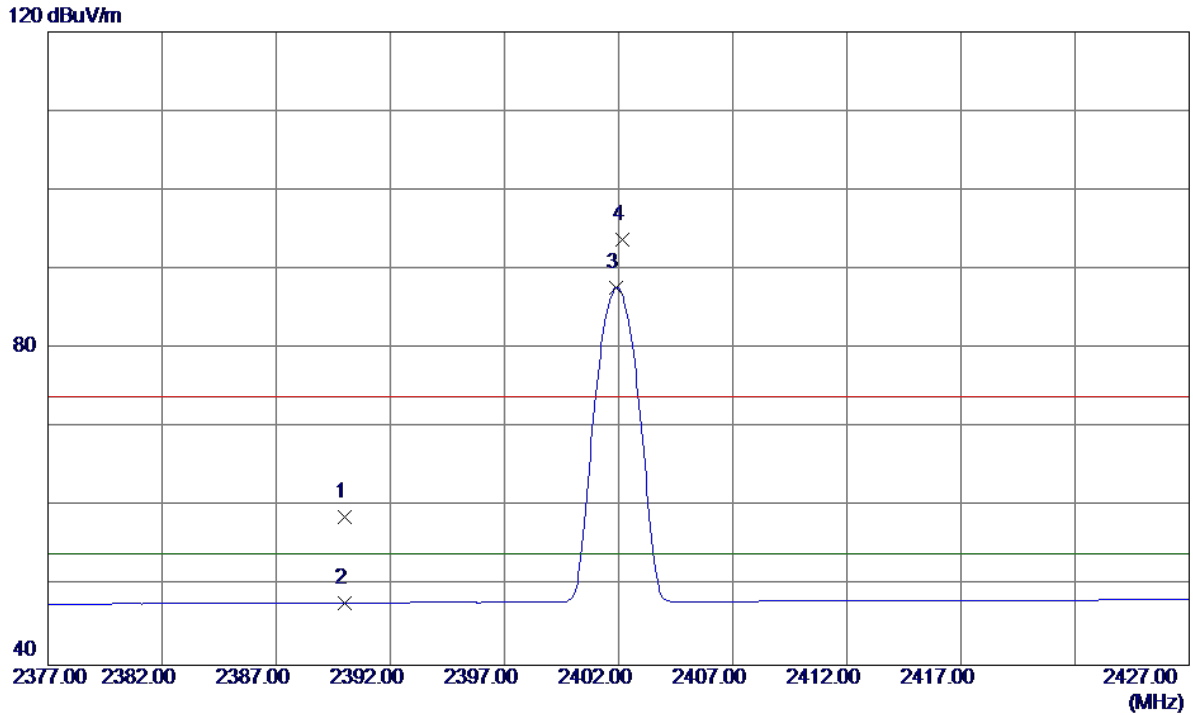
Vertical



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1 *	4803.6549	25.60	4.77	30.37	54.00	-23.63	AVG	
2	4804.1250	36.59	4.77	41.36	74.00	-32.64	Peak	

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

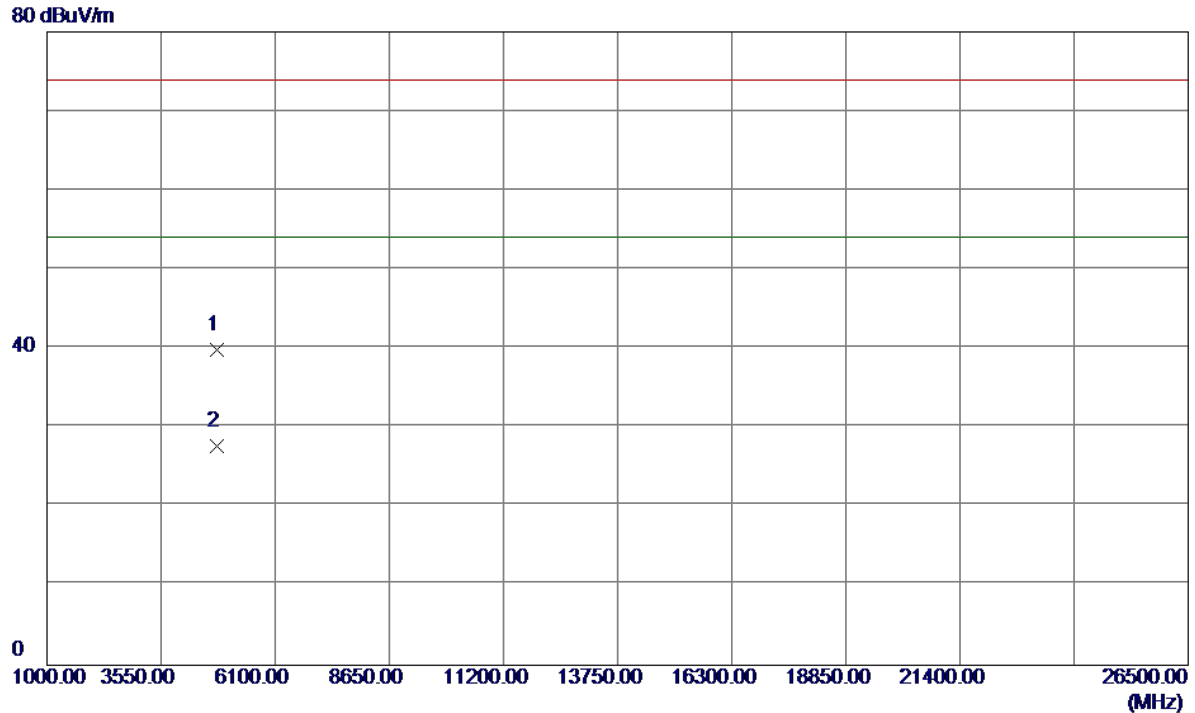
Horizontal



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	2390.0000	25.76	33.01	58.77	74.00	-15.23	Peak	
2	2390.0000	14.84	33.01	47.85	54.00	-6.15	AVG	
3 *	2401.9000	54.65	33.06	87.71	54.00	33.71	AVG	No Limit
4	2402.1500	60.77	33.06	93.83	74.00	19.83	Peak	No Limit

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

Horizontal

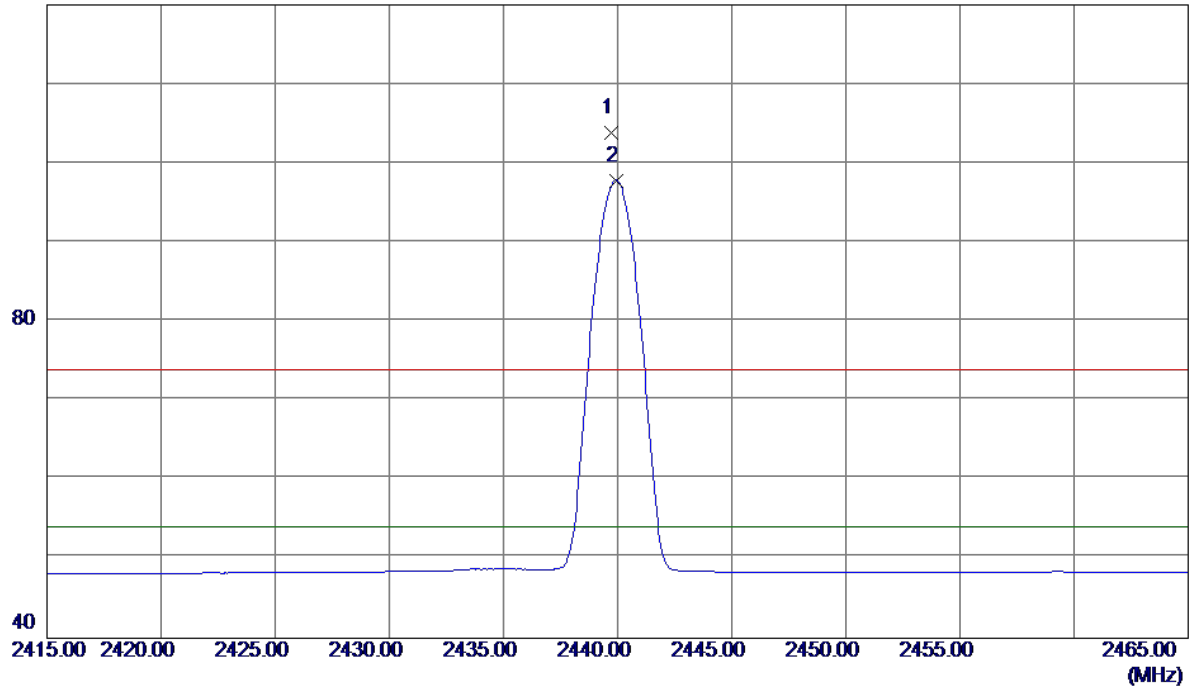


No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	4804.0000	35.06	4.77	39.83	74.00	-34.17	Peak	
2 *	4804.0000	22.86	4.77	27.63	54.00	-26.37	AVG	

Test Mode : TX 2440MHz _CH19_ 1Mbps

Vertical

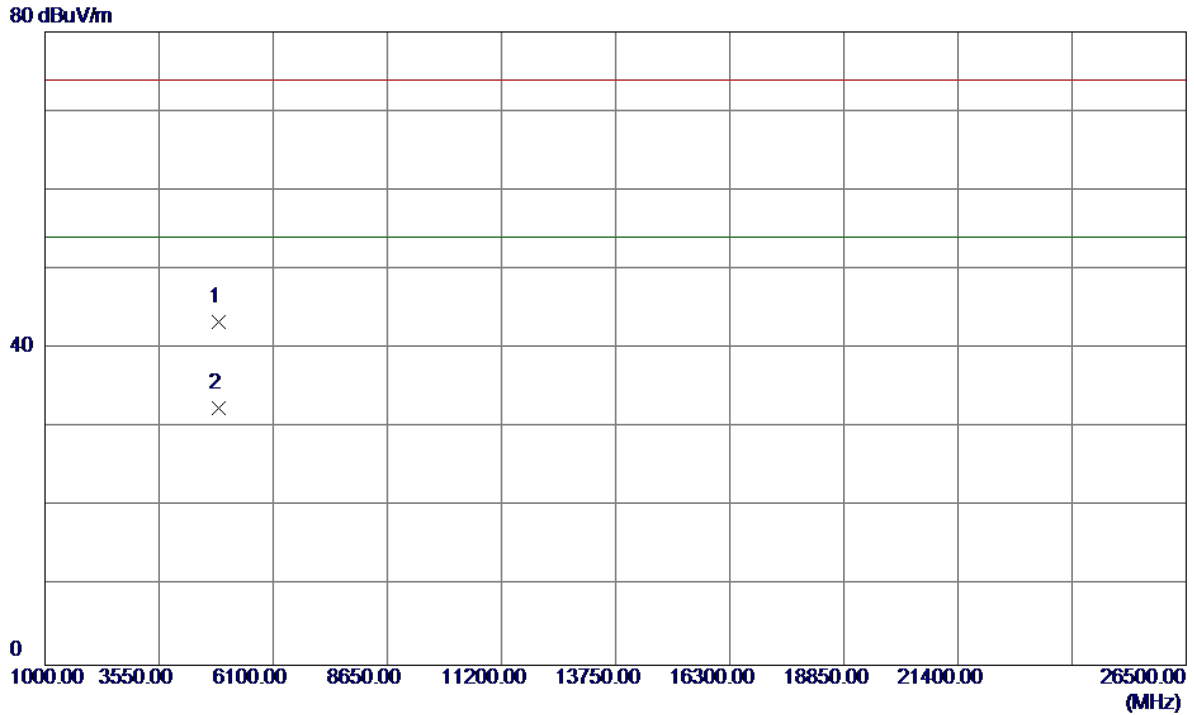
120 dBuV/m



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	2439.7000	70.59	33.22	103.81	74.00	29.81	Peak	No Limit
2 *	2439.9500	64.62	33.22	97.84	54.00	43.84	AVG	No Limit

Test Mode :	TX 2440MHz _CH19_1Mbps
-------------	------------------------

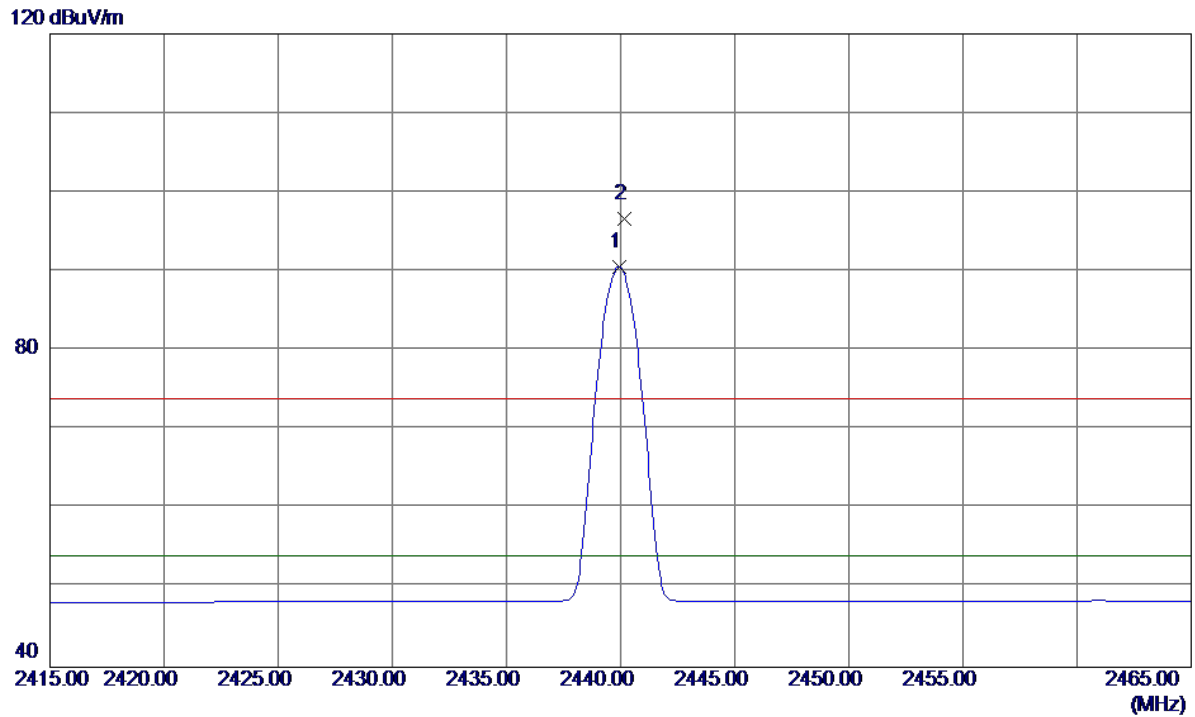
Vertical



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	4879.5650	38.28	5.09	43.37	74.00	-30.63	Peak	
2 *	4879.6050	27.35	5.09	32.44	54.00	-21.56	AVG	

Test Mode : TX 2440MHz _CH19_1Mbps

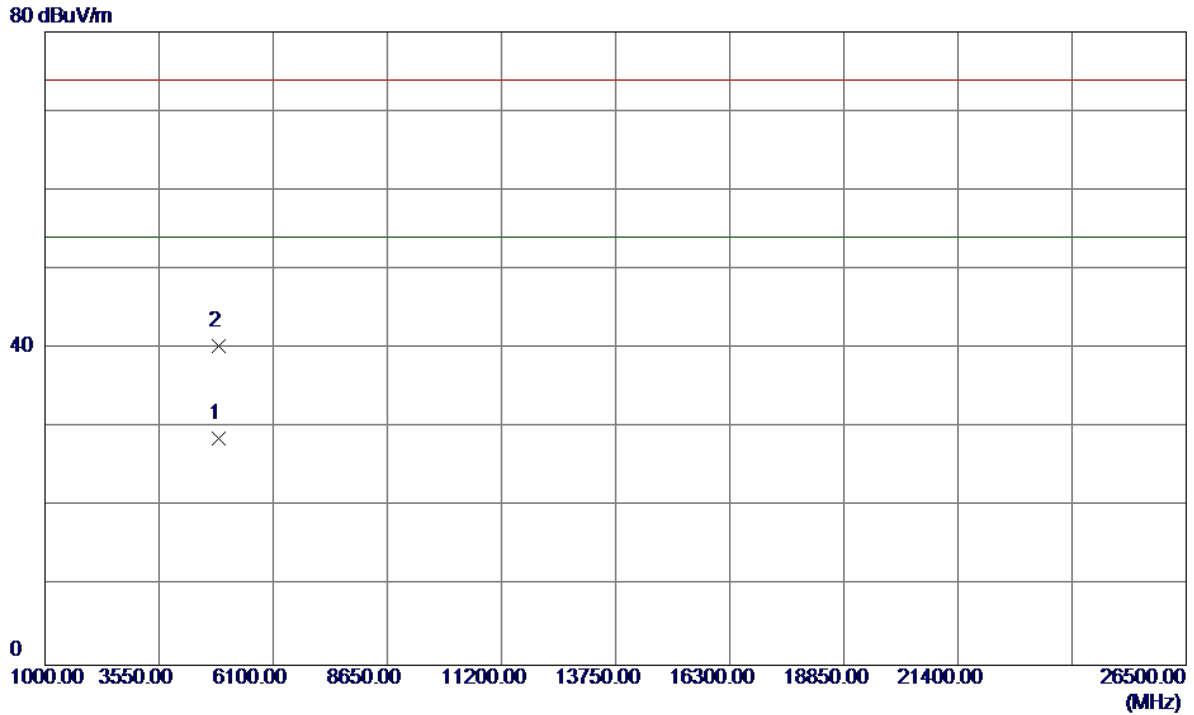
Horizontal



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1 *	2439.9500	57.38	33.22	90.60	54.00	36.60	AVG	No Limit
2	2440.1500	63.35	33.22	96.57	74.00	22.57	Peak	No Limit

Test Mode :	TX 2440MHz _CH19_1Mbps
-------------	------------------------

Horizontal

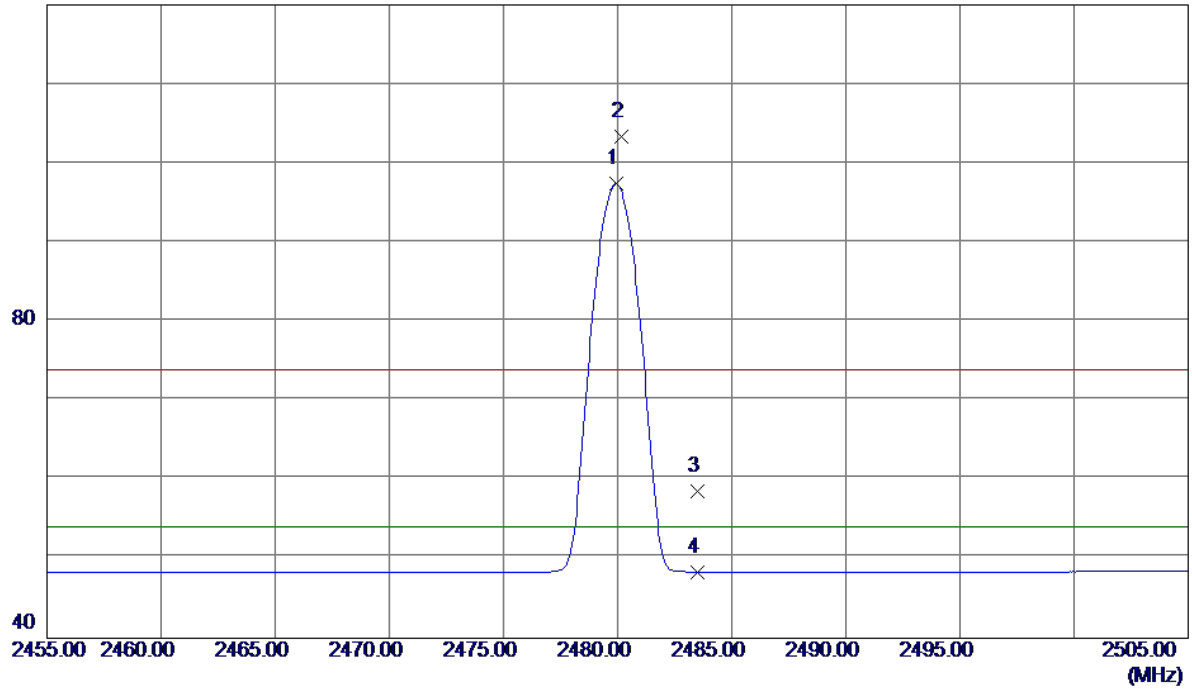


No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1 *	4879.5050	23.52	5.09	28.61	54.00	-25.39	AVG	
2	4880.1750	35.24	5.09	40.33	74.00	-33.67	Peak	

Test Mode : TX 2480MHz _CH39_1Mbps

Vertical

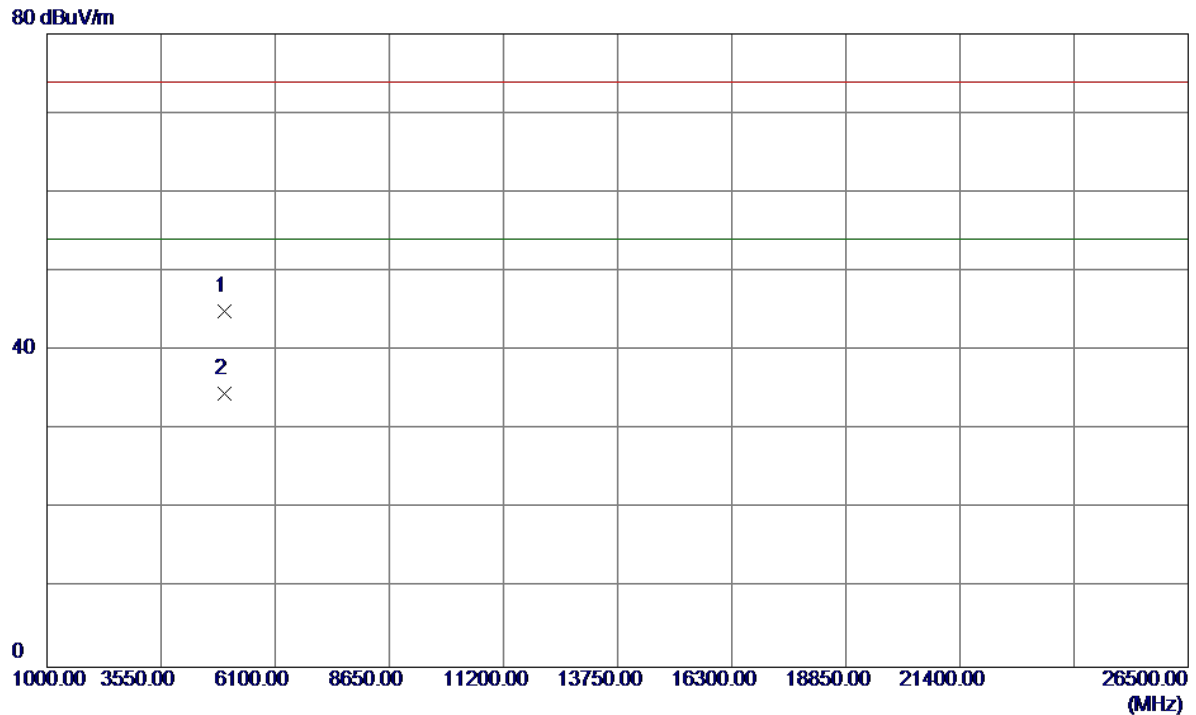
120 dBuV/m



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1 *	2479.9500	63.99	33.39	97.38	54.00	43.38	AVG	No Limit
2	2480.1500	69.95	33.39	103.34	74.00	29.34	Peak	No Limit
3	2483.5000	25.13	33.40	58.53	74.00	-15.47	Peak	
4	2483.5000	14.97	33.40	48.37	54.00	-5.63	AVG	

Test Mode :	TX 2480MHz _CH39_1Mbps
-------------	------------------------

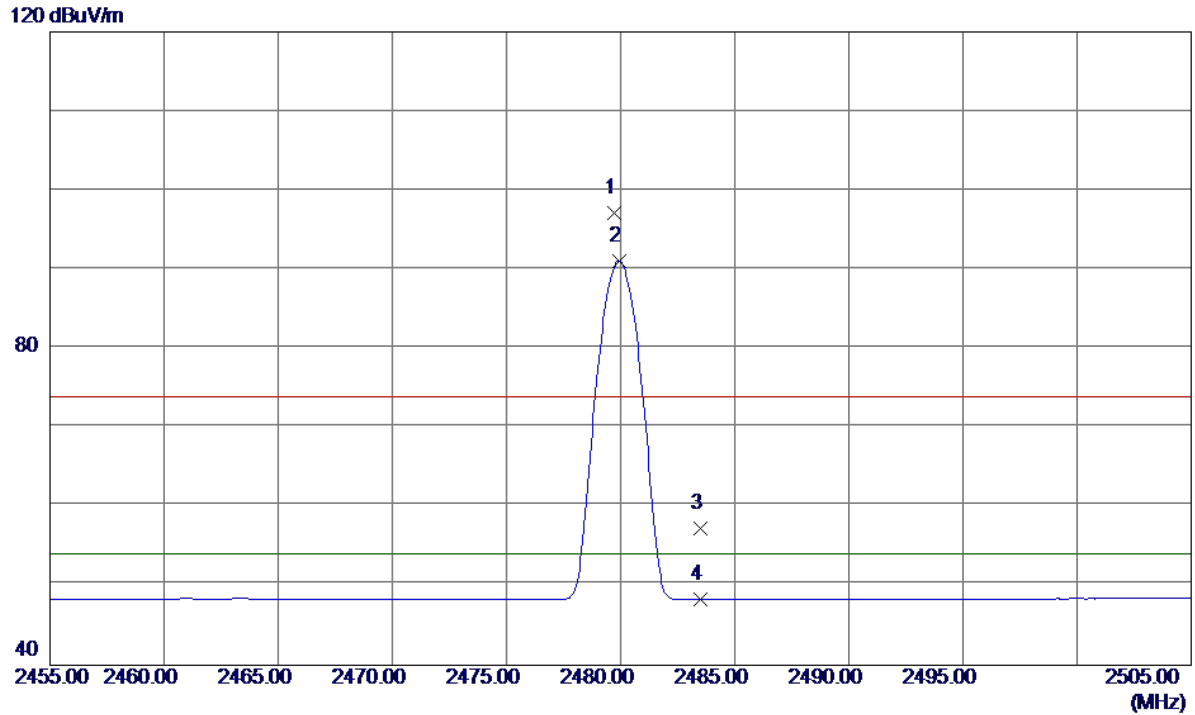
Vertical



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	4959.5000	39.59	5.43	45.02	74.00	-28.98	Peak	
2 *	4959.6700	29.18	5.43	34.61	54.00	-19.39	AVG	

Test Mode : TX 2480MHz _CH39_1Mbps

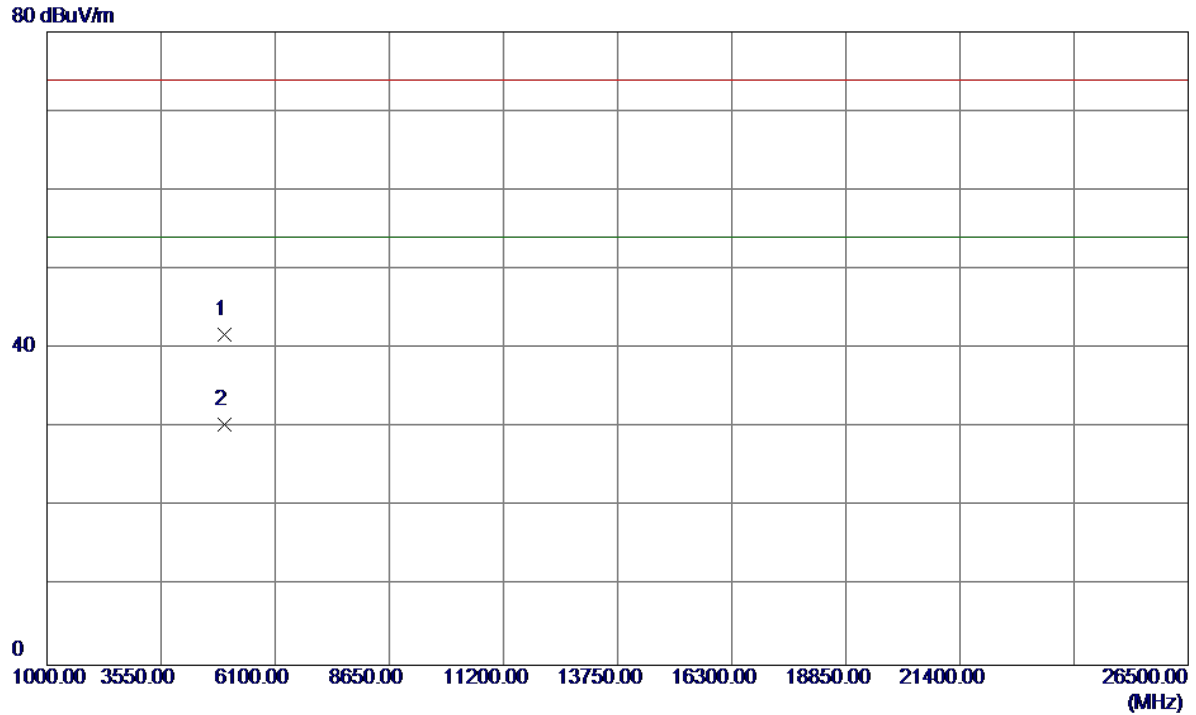
Horizontal



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	2479.7000	63.66	33.39	97.05	74.00	23.05	Peak	No Limit
2 *	2479.9500	57.66	33.39	91.05	54.00	37.05	AVG	No Limit
3	2483.5000	23.84	33.40	57.24	74.00	-16.76	Peak	
4	2483.5000	14.89	33.40	48.29	54.00	-5.71	AVG	

Test Mode :	TX 2480MHz _CH39_1Mbps
-------------	------------------------

Horizontal



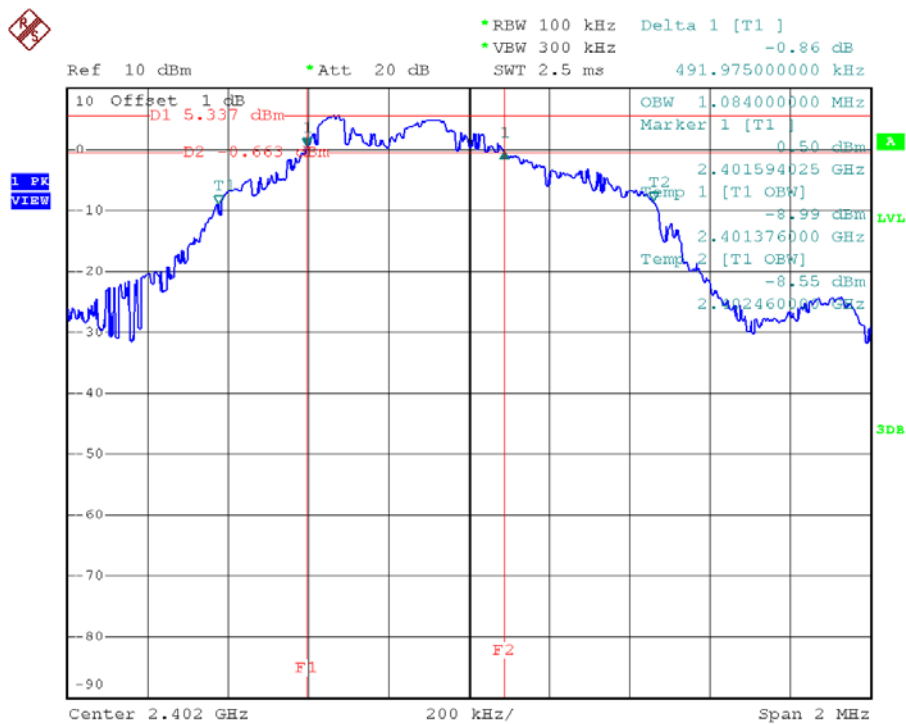
No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	4959.3600	36.35	5.43	41.78	74.00	-32.22	Peak	
2 *	4959.5200	24.92	5.43	30.35	54.00	-23.65	AVG	

ATTACHMENT E - BANDWIDTH

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

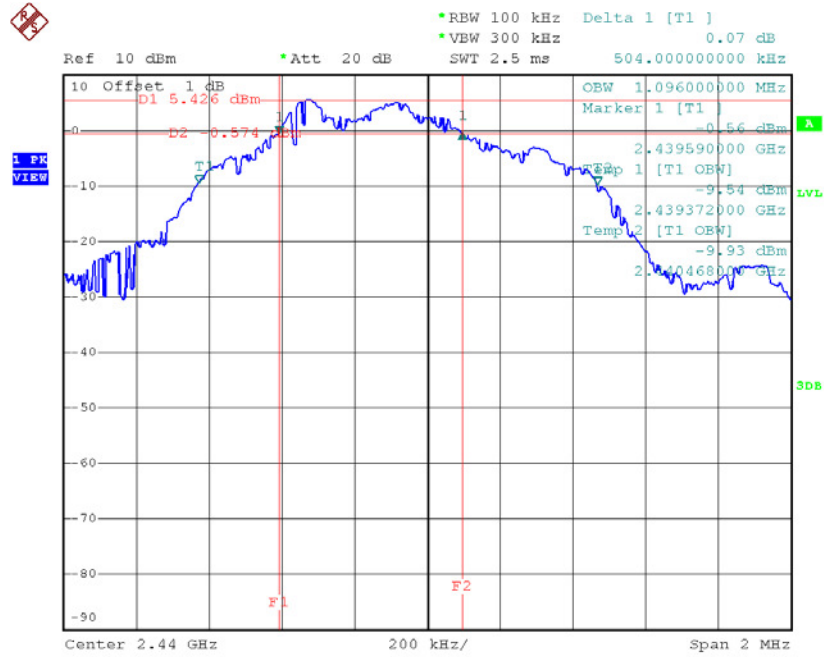
Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied BW (MHz)	Min. Limit (kHz)	Test Result
2402	0.492	1.084	500	Pass
2440	0.504	1.096	500	Pass
2480	0.504	1.096	500	Pass

TX CH00



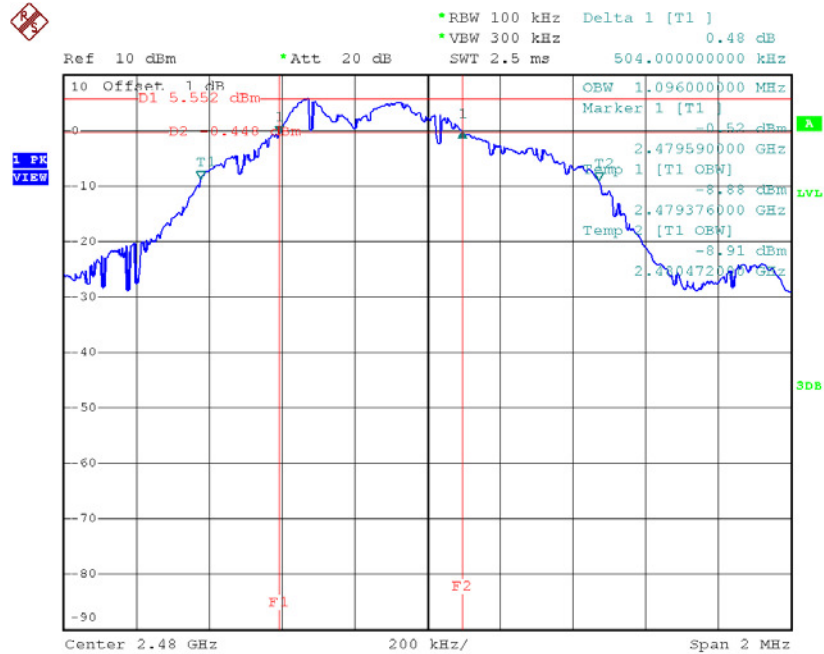
Date: 20.MAR.2017 10:16:05

TX CH19



Date: 20.MAR.2017 10:22:53

TX CH39



Date: 20.MAR.2017 10:26:06

ATTACHMENT F - MAXIMUM OUTPUT POWER TEST

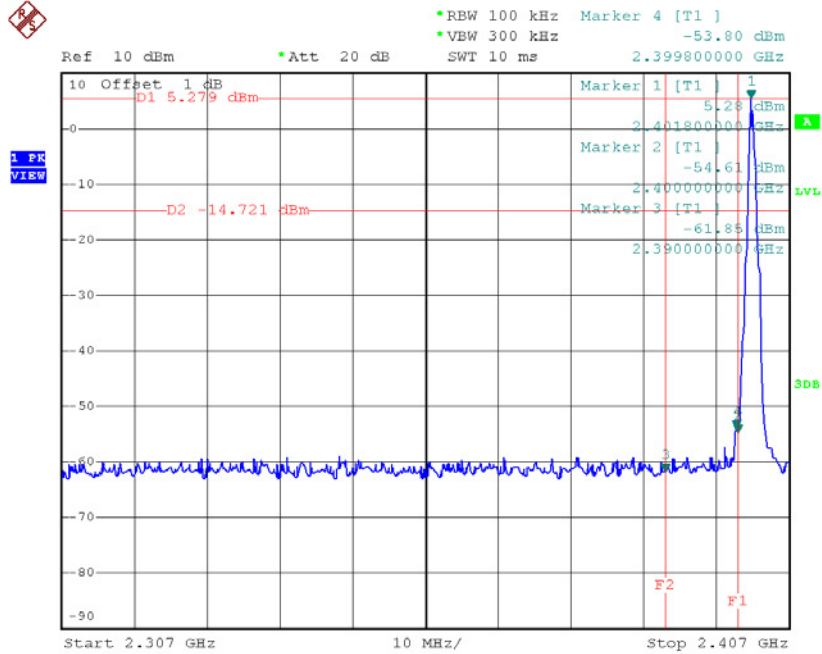
Test Mode :	CH00, CH19 , CH39 - 1Mbps
-------------	---------------------------

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2402	4.40	0.00275	30.00	1.00	Pass
2440	4.92	0.00310	30.00	1.00	Pass
2480	3.59	0.00229	30.00	1.00	Pass

ATTACHMENT G - ANTENNA CONDUCTED SPURIOUS EMISSION

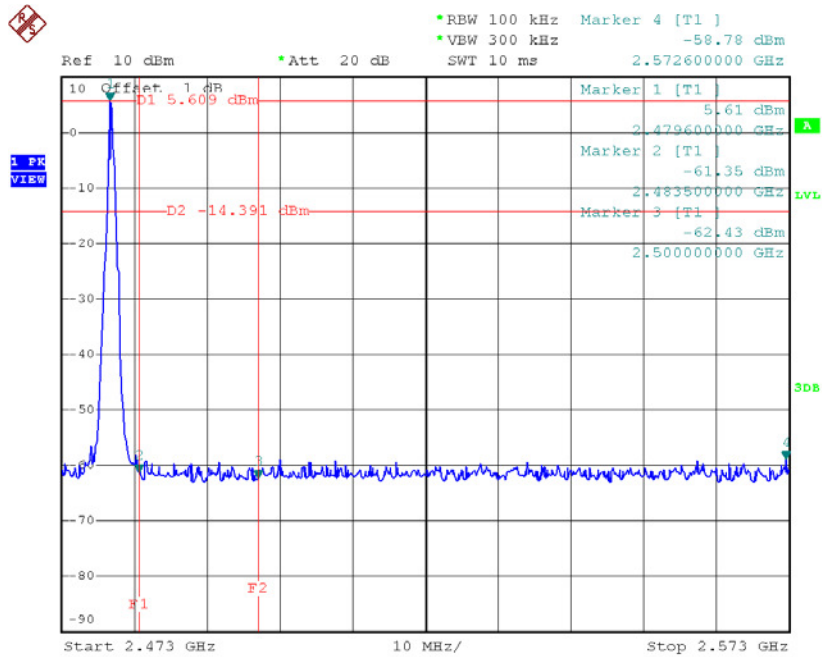
Test Mode : CH00, CH19 , CH39 - 1Mbps

CH00 (Lower) - 1Mbps



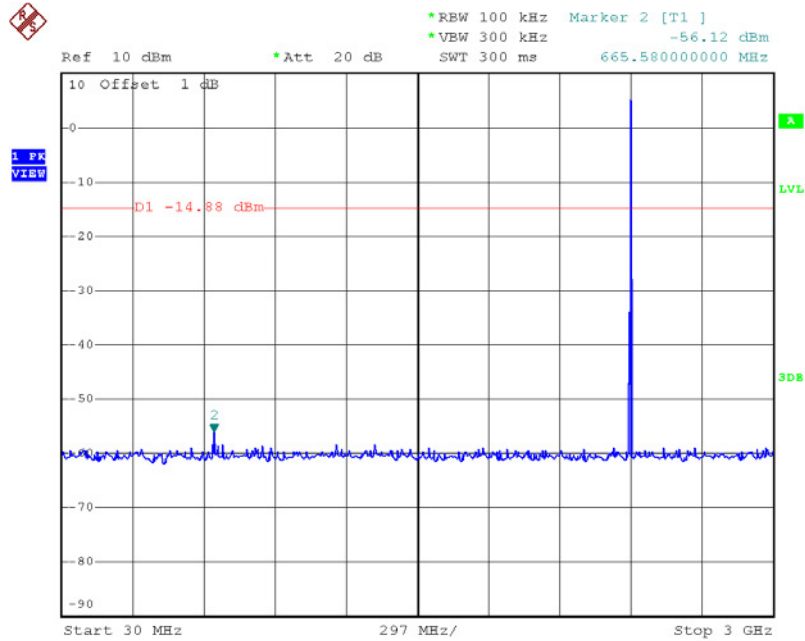
Date: 20.MAR.2017 10:16:13

CH39 (upper) - 1Mbps



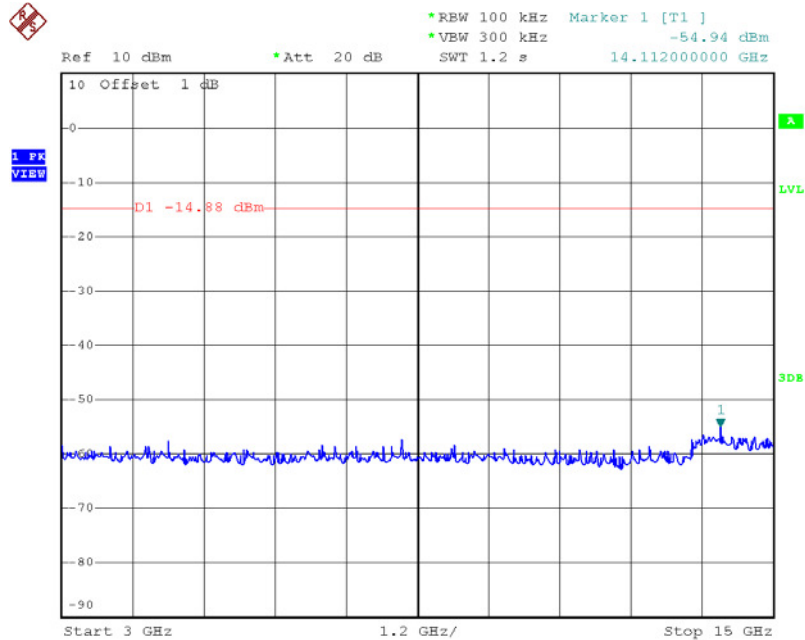
Date: 20.MAR.2017 10:26:15

CH00 (10 Harmonic of the frequency) 1



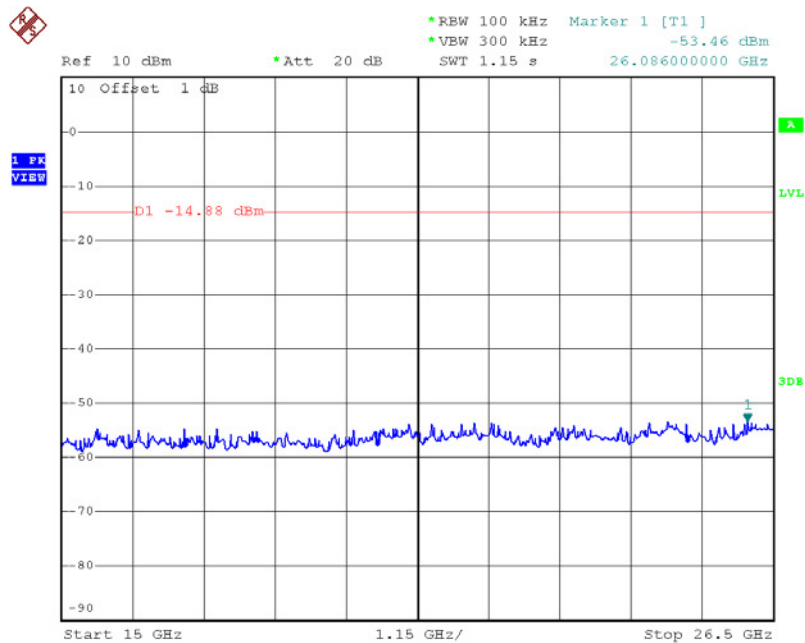
Date: 20.MAR.2017 10:16:29

CH00 (10 Harmonic of the frequency) 2



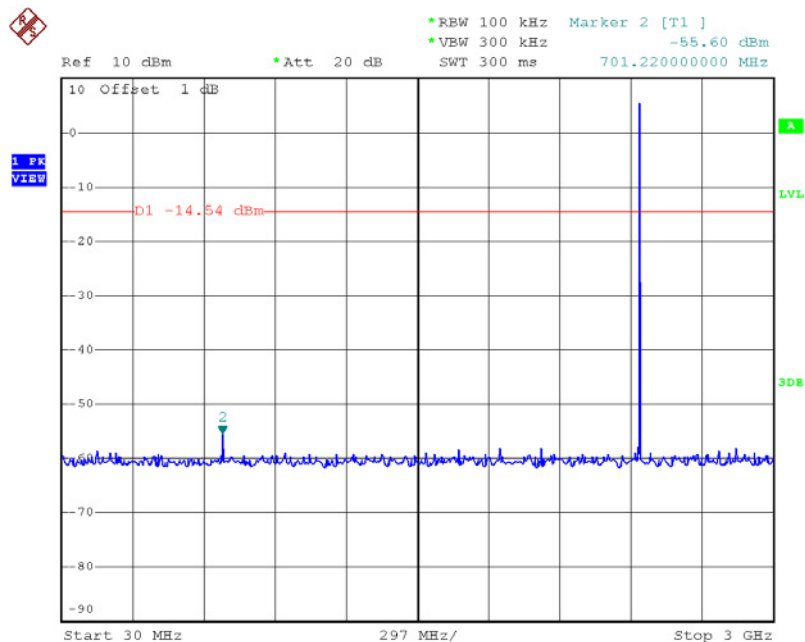
Date: 20.MAR.2017 10:16:38

CH00 (10 Harmonic of the frequency) 3



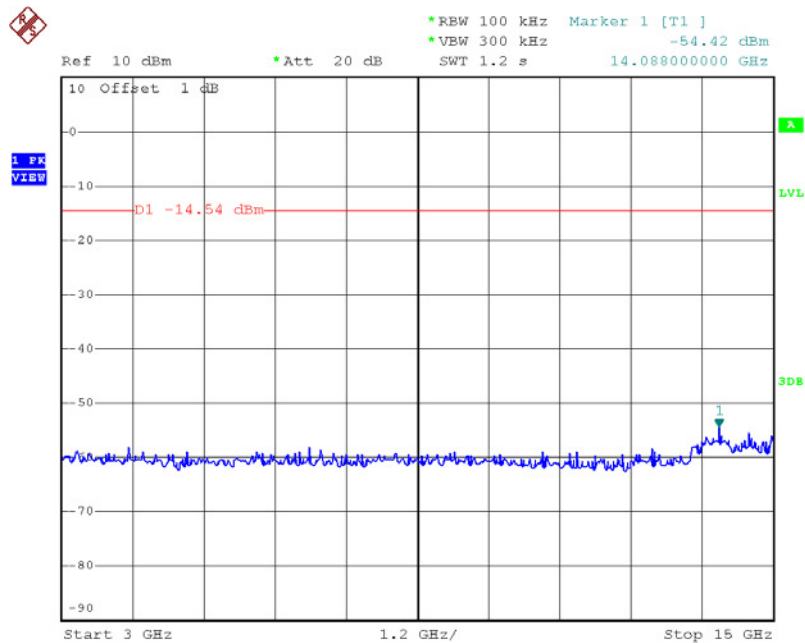
Date: 20.MAR.2017 10:16:46

CH19 (10 Harmonic of the frequency) 1



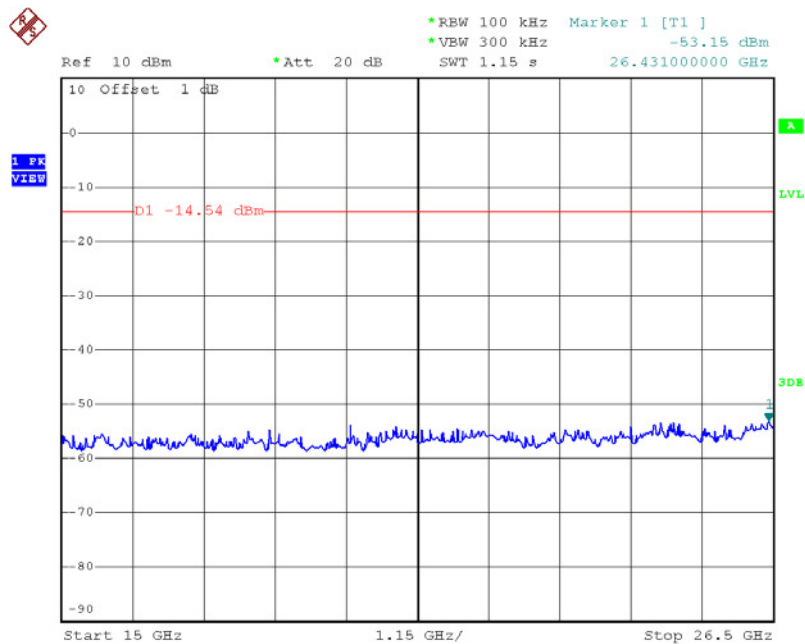
Date: 20.MAR.2017 10:23:07

CH19 (10 Harmonic of the frequency) 2



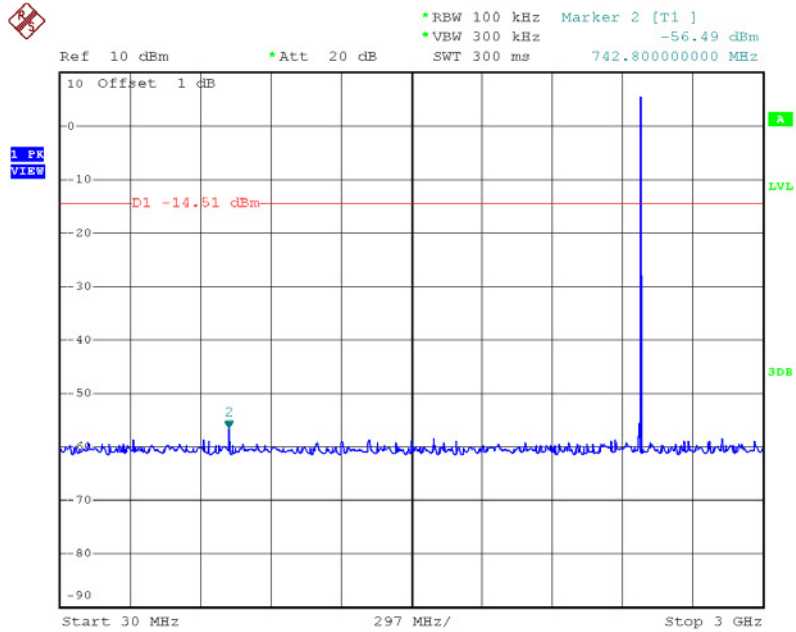
Date: 20.MAR.2017 10:23:15

CH19 (10 Harmonic of the frequency) 3



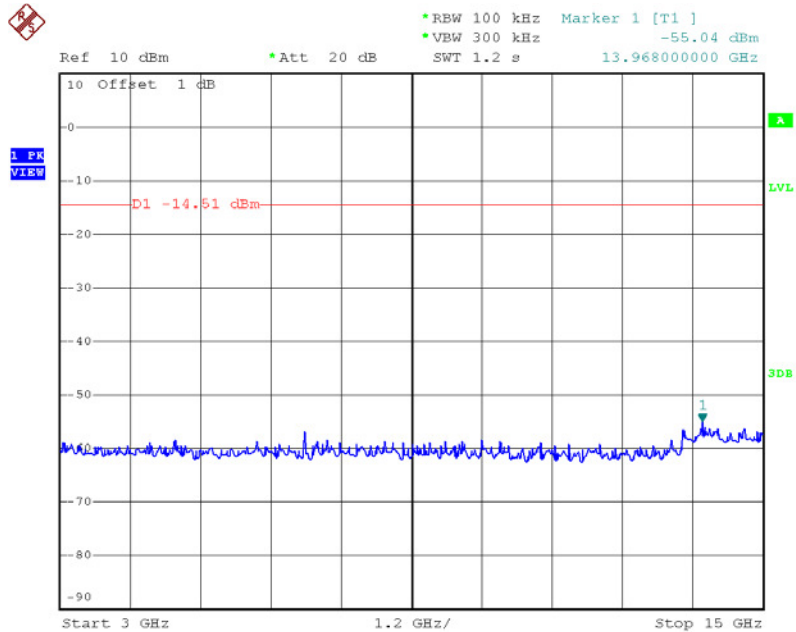
Date: 20.MAR.2017 10:23:24

CH39 (10 Harmonic of the frequency) 1



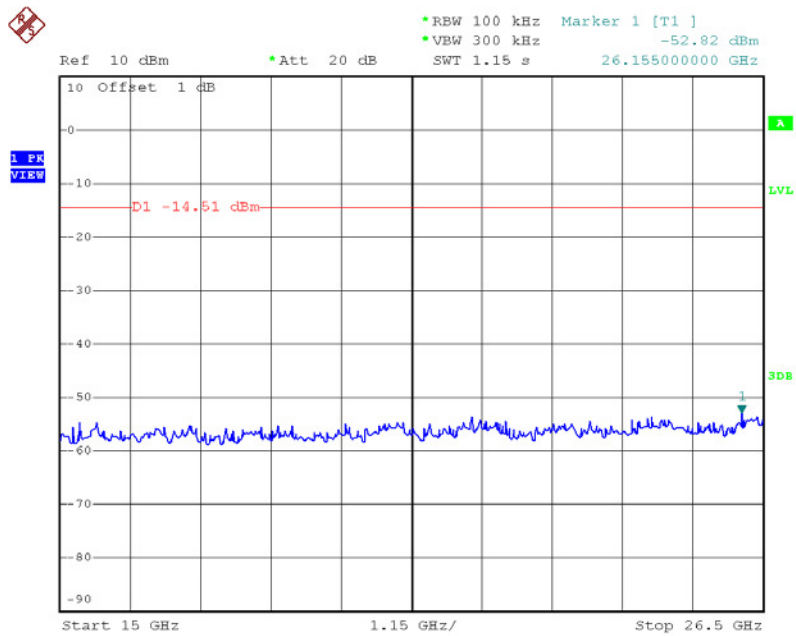
Date: 20.MAR.2017 10:26:28

CH39 (10 Harmonic of the frequency) 2



Date: 20.MAR.2017 10:26:37

CH39 (10 Harmonic of the frequency) 3



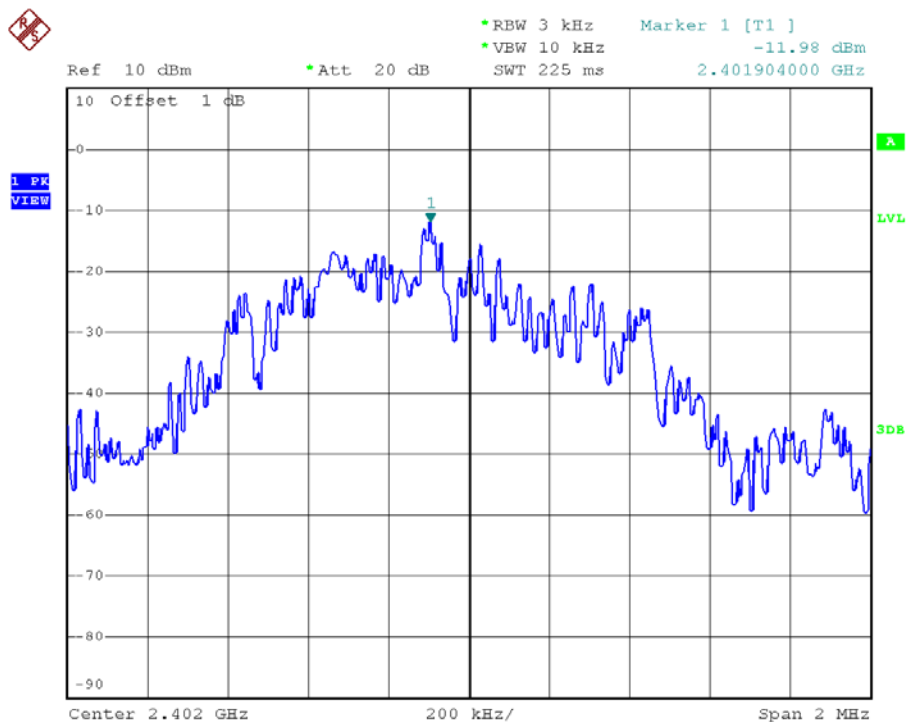
Date: 20.MAR.2017 10:26:45

ATTACHMENT H - POWER SPECTRAL DENSITY TEST

Test Mode:	CH00, CH19 , CH39 - 1Mbps
------------	---------------------------

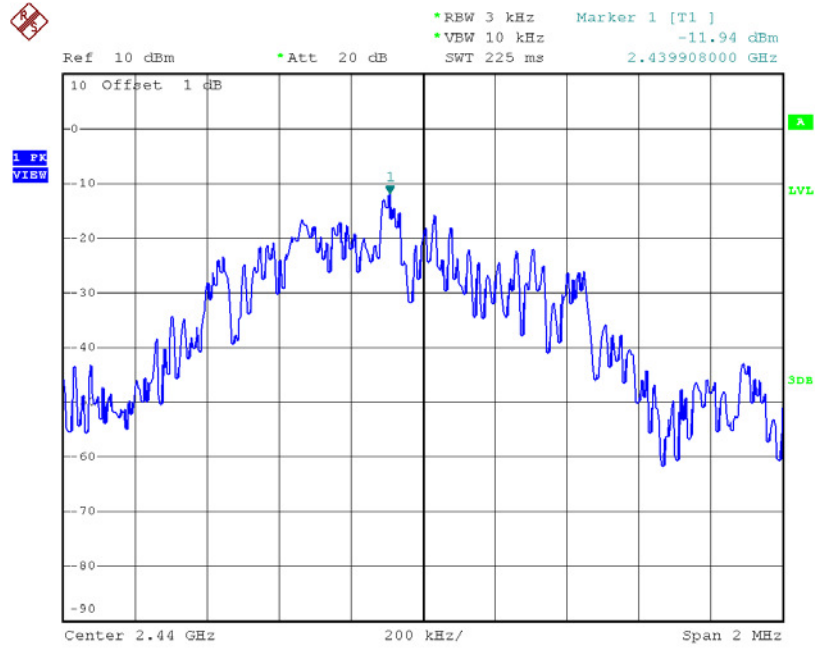
Frequency (MHz)	Power Density (dBm/3kHz)	Power Density (mW/3kHz)	Max. Limit (dBm/3kHz)	Test Result
2402	-11.980	0.063	8.00	Pass
2440	-11.940	0.064	8.00	Pass
2480	-11.750	0.067	8.00	Pass

TX CH00



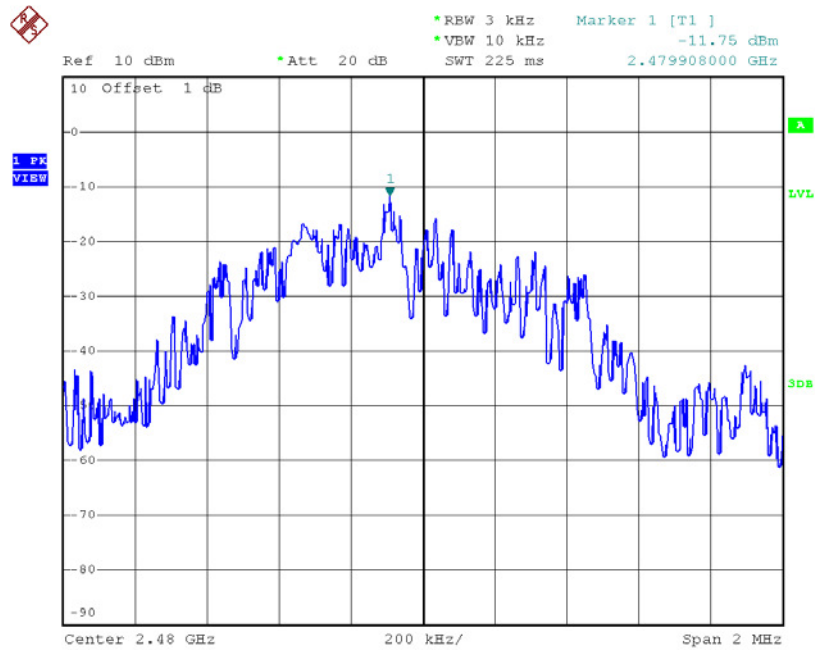
Date: 20.MAR.2017 10:21:31

TX CH19



Date: 20.MAR.2017 10:23:30

TX CH39



Date: 20.MAR.2017 10:26:51