FCC Radio Test Report

FCC ID: TTUBEOP2

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

Project No.	:	1801C180
Equipment	:	Bluetooth Speaker
Test Model	:	Beoplay P2-1409
Series Model	:	N/A
Applicant	:	Bang & Olufsen a/s
Address	:	Peter Bangs Vej 15, 7600 Struer, Denmark

Date of Receipt	:	Jan. 23, 2018
Date of Test	:	Jan. 25, 2018 ~ Mar. 29, 2018
Issued Date	:	Apr. 03, 2018
Tested by	:	BTL Inc.

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NVLAP TESTING NVLAP LAB CODE 200788-0

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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.

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REPORT ISSUED HISTORY

Issued No.	Description	Issued Date
BTL-FCCP-2-1801C180	Original Issue.	Mar. 30, 2018
MDG1804003	Update the Brand Name.	Apr. 03, 2018

1. CERTIFICATION

Equipment	:	Bluetooth Speaker
Brand Name	:	Bang & Olufsen®
Test Model	:	Beoplay P2-1409
Series Model	:	N/A
Applicant	:	Bang & Olufsen a/s
Manufacturer	:	Bang & Olufsen a/s
Address	:	Peter Bangs Vej 15, 7600 Struer, Denmark
Factory	:	Eastech Electronics (Hui Yang) Co., Ltd.
Address	:	Dong Feng District,Xinxu,HuiYang,Huizhou,Guangdong,China
Date of Test	:	Jan. 25, 2018 ~ Mar. 29, 2018
Test Sample	:	Engineering Sample No. D180100638
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-2-1801C180) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of NVLAP according to the ISO-17025 quality assessment standard and technical standard(s).

Test results included in this report is only for the Buletooth LE part.

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: 854385
Designation number for FCC: CN5020

2.2 MEASUREMENT UNCERTAINTY

The measurement uncertainty figures shall be calculated according the methods described in the ETSI TR 100 028 and shall correspond to an expansion factor (coverage factor) k=1.96 or k=2(which provide confidence levels of respectively 90% and 95.45% in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)). Measurement Uncertainty for a Level of Confidence of 95 %, U=2xUc(y).

The BTL measurement uncertainty as below table:

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	Bluetooth Speaker	
Brand Name	Bang & Olufsen®	
Test Model	Beoplay P2-1409	
Series Model	N/A	
Model Difference	N/A	
Product Description	Operation Frequency	2402~2480 MHz
	Modulation Technology	GFSK(1Mbps)
	Bit Rate of Transmitter	
	Output Power (Max.)	-1.72 dBm (1Mbps)
Power Source	#1 Supplied from PC USB port. #2 Supplied from Li-ion Battery. Model:VDL553450-2S	
Power Rating	#1 DC 5V 3A #2 DC 7.4V 8.14Wh	

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)
1	N/A	N/A	Internal	N/A	4.32

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 **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:

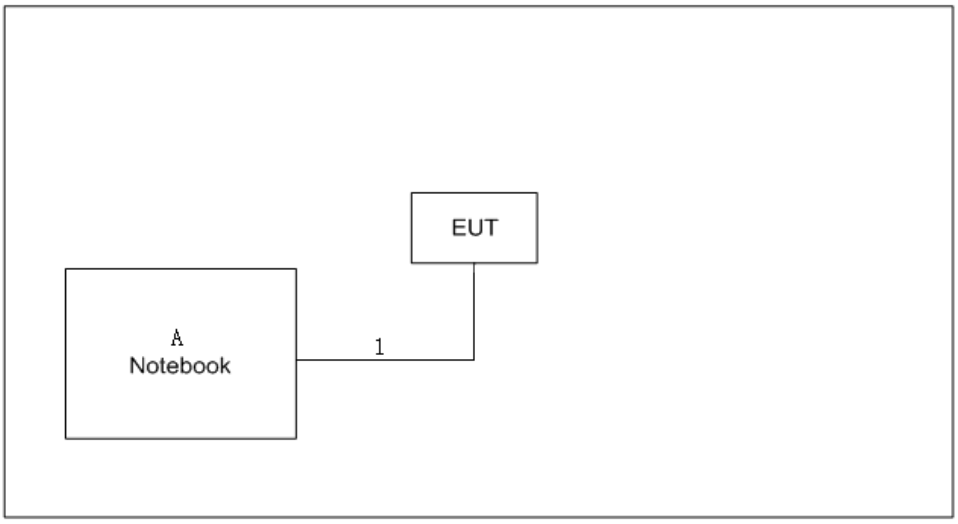
(1) The measurements are performed at the high, middle, low available channels.

3.3 TABLE OF PARAMETERS OF 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 BT LE

Test Software Version	Bluetest3		
Frequency (MHz)	2402	2440	2480
BT LE	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.
A	Notebook	Lenovo	DCSM	DOC	EB22953770

Item	Shielded Type	Ferrite Core	Length	Note
1	NO	NO	1 m	USB 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	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

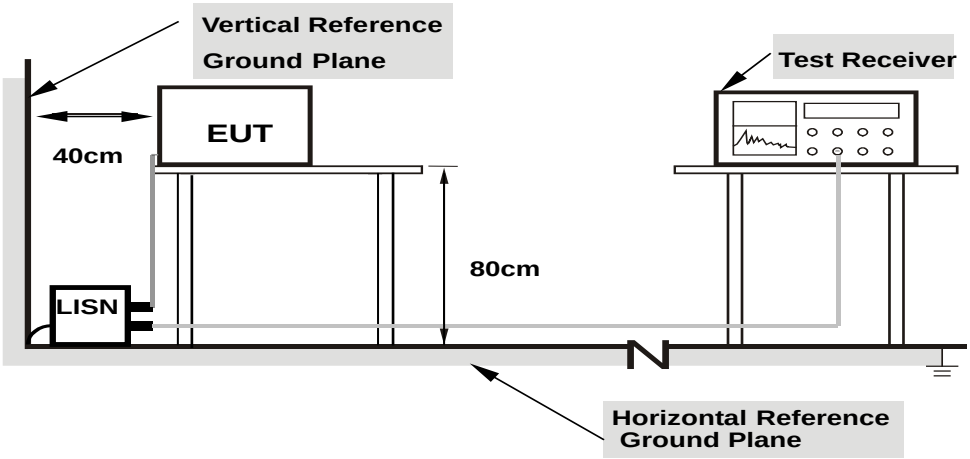
4.1.2 TEST PROCEDURE

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 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 Appendix 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

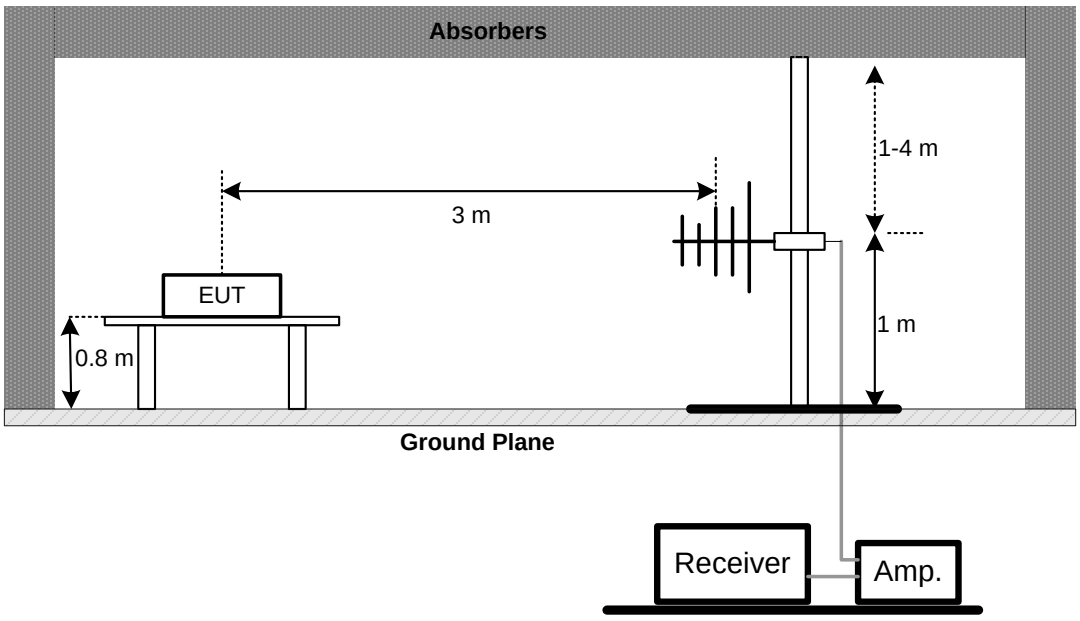
a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
b. The measuring distance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

4.2.3 DEVIATION FROM TEST STANDARD

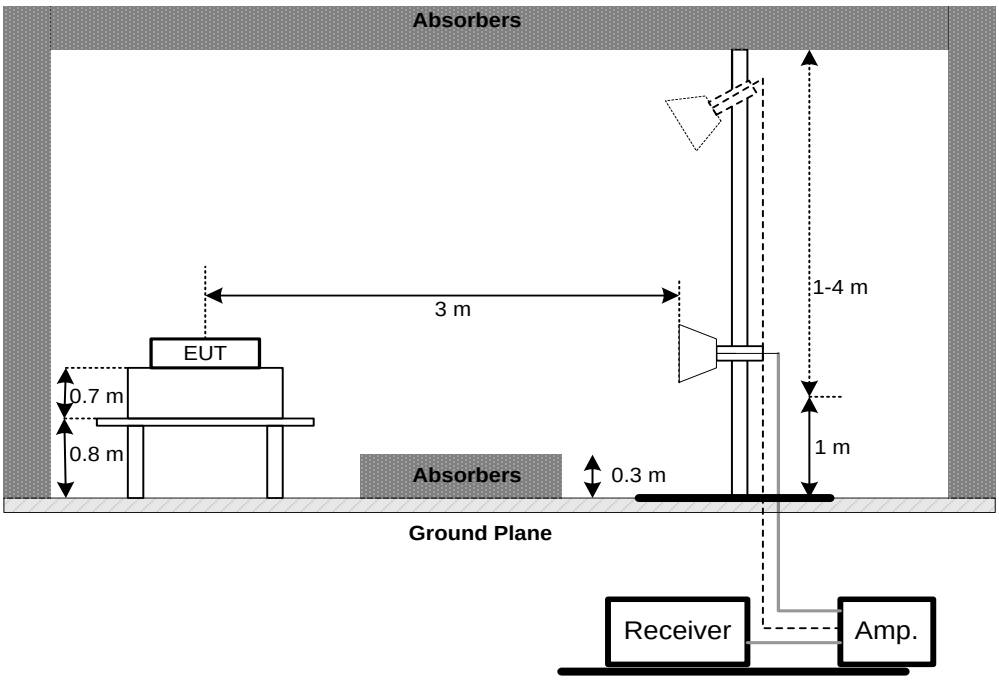
No deviation

4.2.4 TEST SETUP

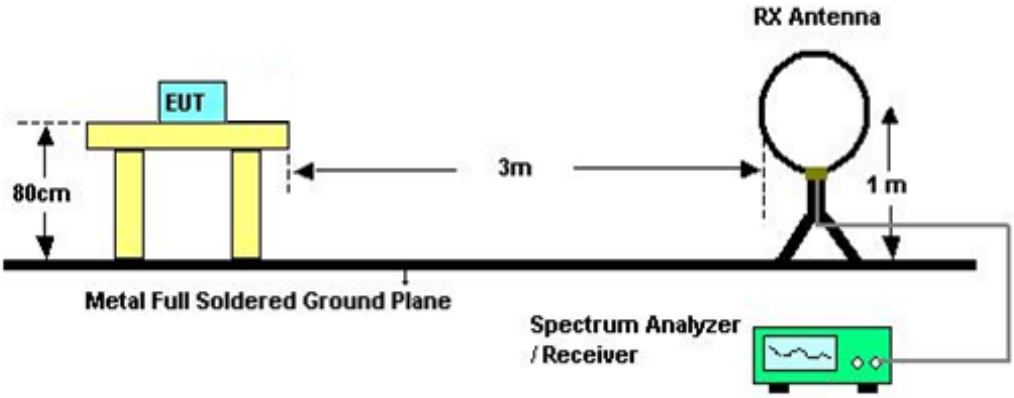
(A) Radiated Emission Test Set-Up Frequency Below 1 GHz



(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

4.2.7TEST RESULTS (9KHZ TO 30MHZ)

Please refer to the Appendix 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 (specific distance / test distance) (dB).
(3) Limit line = specific limits (dBuV) + distance extrapolation factor.

4.2.8TEST RESULTS (30MHZ TO 1000MHZ)

Please refer to the Appendix C.

4.2.9TEST RESULTS (ABOVE 1000MHZ)

Please refer to the Appendix 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	>= 500KHz (6dB bandwidth)	2400-2483.5	PASS

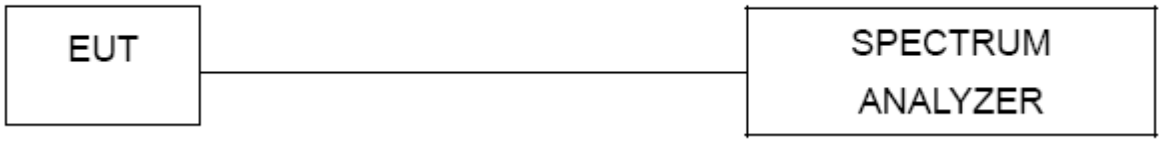
5.1.1 TEST PROCEDURE

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 = 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 Appendix 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

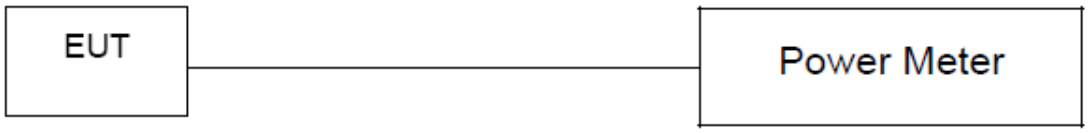
6.1.1 TEST PROCEDURE

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.

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 Appendix 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.

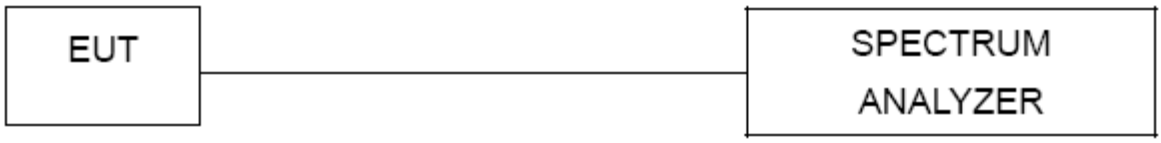
7.1.1 TEST PROCEDURE

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

7.1.6 TEST RESULTS

Please refer to the Appendix 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

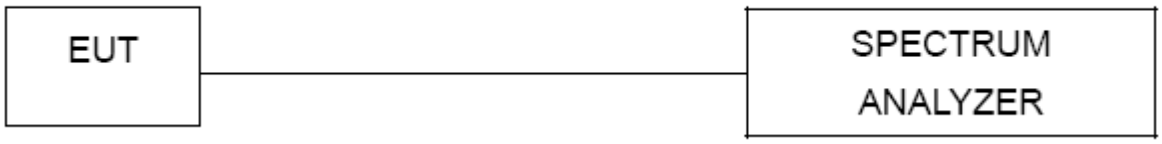
8.1.1 TEST PROCEDURE

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

8.1.6 TEST RESULTS

Please refer to the Appendix H.

9. MEASUREMENT INSTRUMENTS LIST

Conducted Emission Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	EMI Test Receiver	R&S	ESCI	100382	Mar. 11, 2019
2	LISN	EMCO	3816/2	52765	Mar. 11, 2019
3	50Ω Terminator	SHX	TF2-3G-A	8122901	Mar. 11, 2019
4	TWO-LINE V-NETWORK	R&S	ENV216	101447	Mar. 11, 2019
5	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
6	Cable		RG223	12m	Oct. 19, 2018

Radiated Emission Measurement - Below 1GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Antenna	Schwarbeck	VULB9160	9160-3232	Mar. 11, 2019
2	Amplifier	HP	8447D	2944A09673	Oct. 19, 2018
3	Receiver	Agilent	N9038A	MY52130039	Aug. 20, 2018
4	Cable	emci	LMR-400(30MHz-1 GHz)(8m+5m)	N/A	Jun. 26, 2018
5	Controller	CT	SC100	N/A	N/A
6	Controller	MF	MF-7802	MF780208416	N/A
7	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
8	Antenna	EM	EM-6876-1	230	Feb. 07, 2019

Radiated Emission Measurement - Above 1GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Double Ridged Guide Antenna	ETS	3115	75789	Mar. 11, 2019
2	Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170319	Jun. 08, 2018
3	Amplifier	Agilent	8449B	3008A02274	Mar. 11, 2019
4	Microwave Preamplifier With Adaptor	EMC INSTRUMENT	EMC2654045	980039 & HA01	Mar. 11, 2019
5	Receiver	Agilent	N9038A	MY52130039	Aug. 20, 2018
6	Controller	CT	SC100	N/A	N/A
7	Controller	MF	MF-7802	MF780208416	N/A
8	Cable	emci	EMC104-SM-SM-1 2000(12m)	N/A	Jun. 26, 2018
9	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	FSP40	100185	Aug. 20, 2018

Peak Output Power Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Power Meter	ANRITSU	ML2495A	1128009	Mar. 25, 2019
2	Pulse Power Sensor	ANRITSU	MA 2411B	1027500	Mar. 25, 2019

Antenna Conducted Spurious Emission Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP40	100185	Aug. 20, 2018

Power Spectral Density Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP40	100185	Aug. 20, 2018

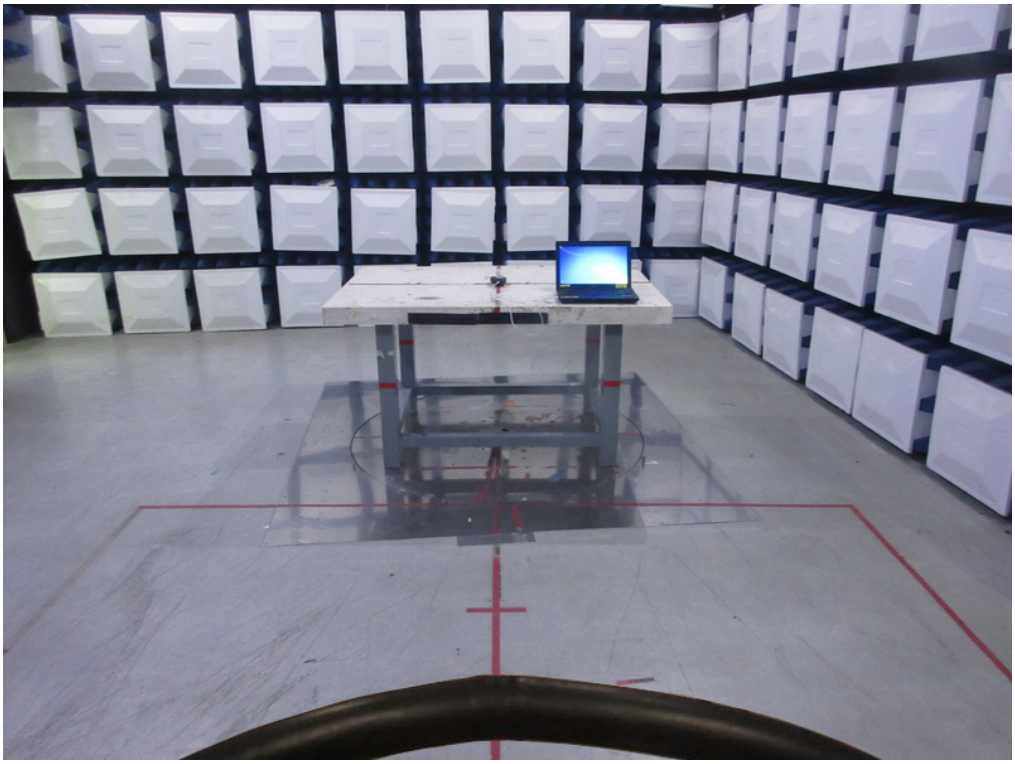
Remark: ”N/A” denotes no model name, serial no. or calibration specified.
All calibration period of equipment list is one year.

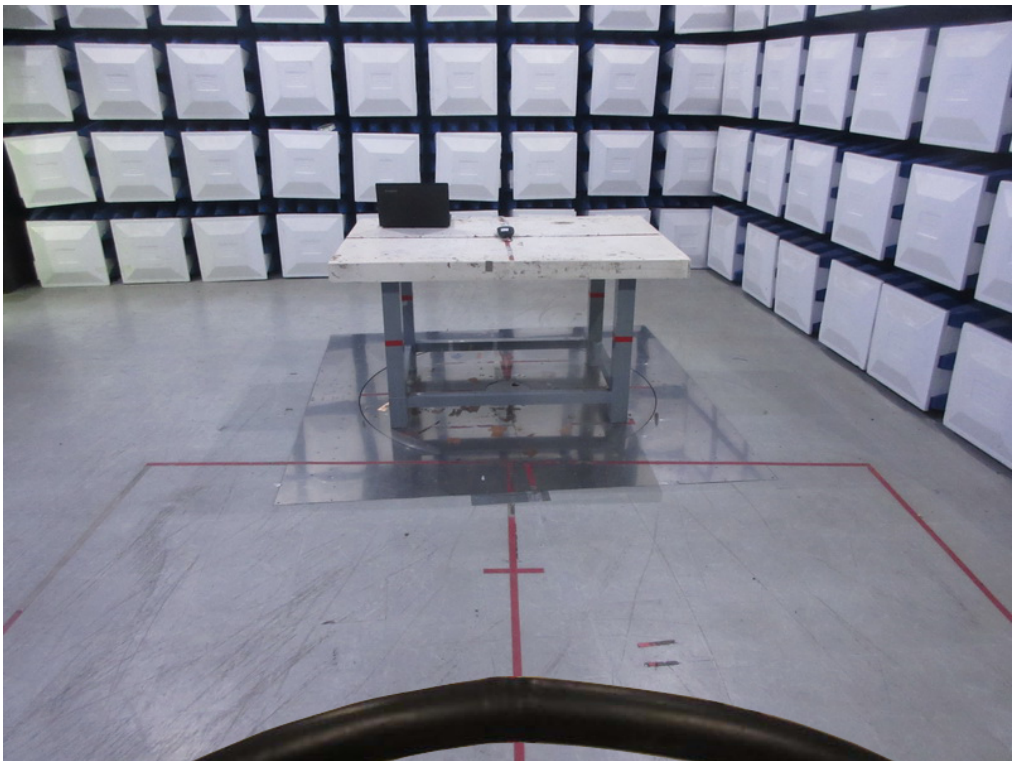
10. EUT TEST PHOTO

Conducted Measurement Photos

Radiated Measurement Photos

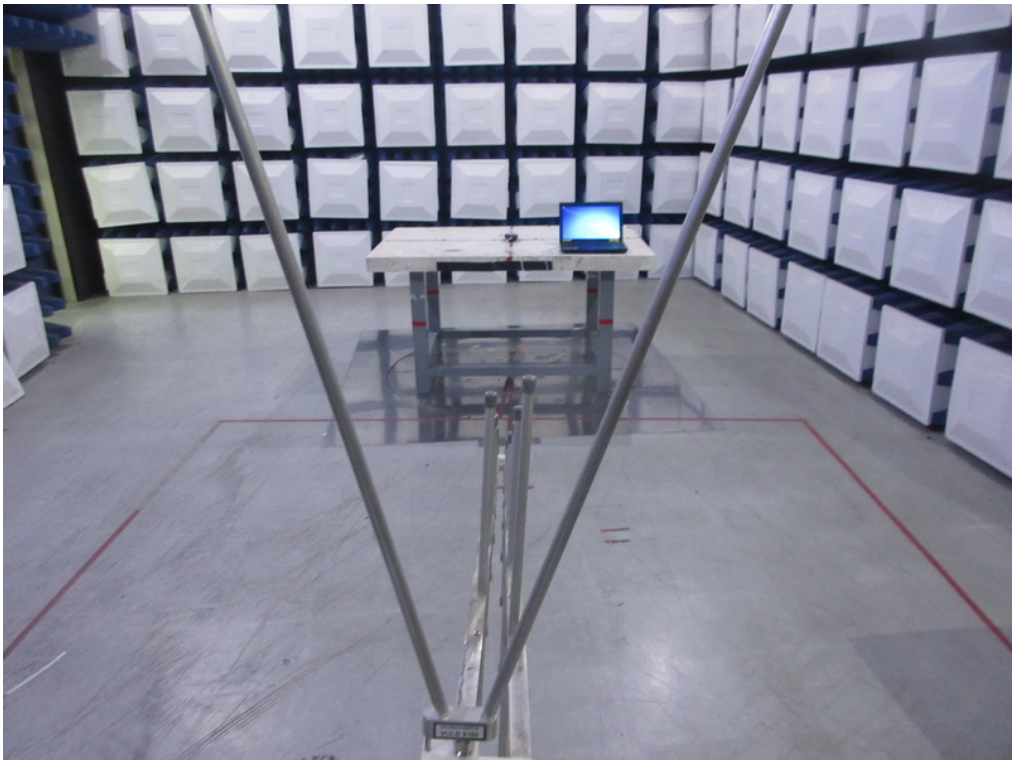
9KHz to 30MHz

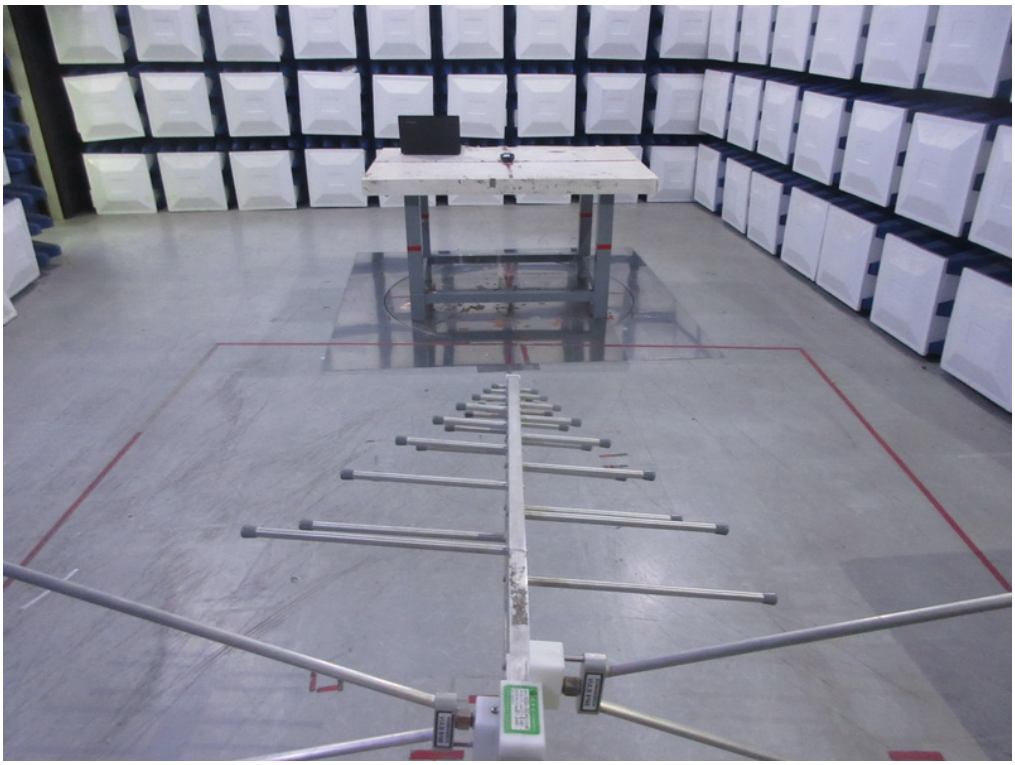




Radiated Measurement Photos

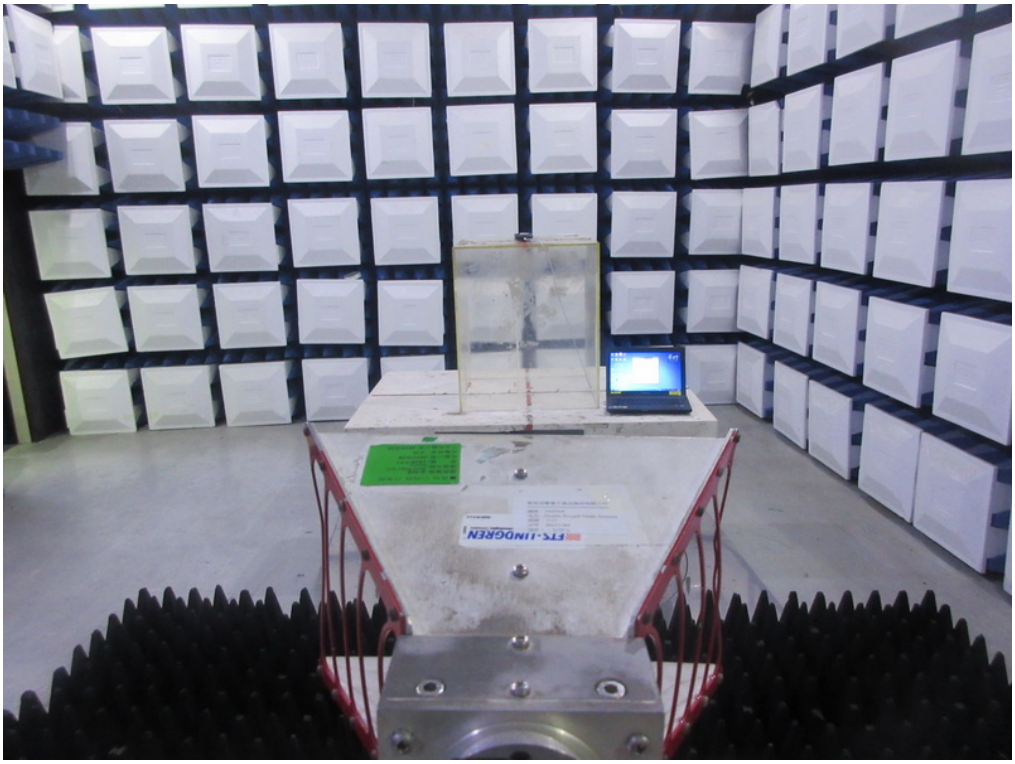
30MHz to 1000MHz

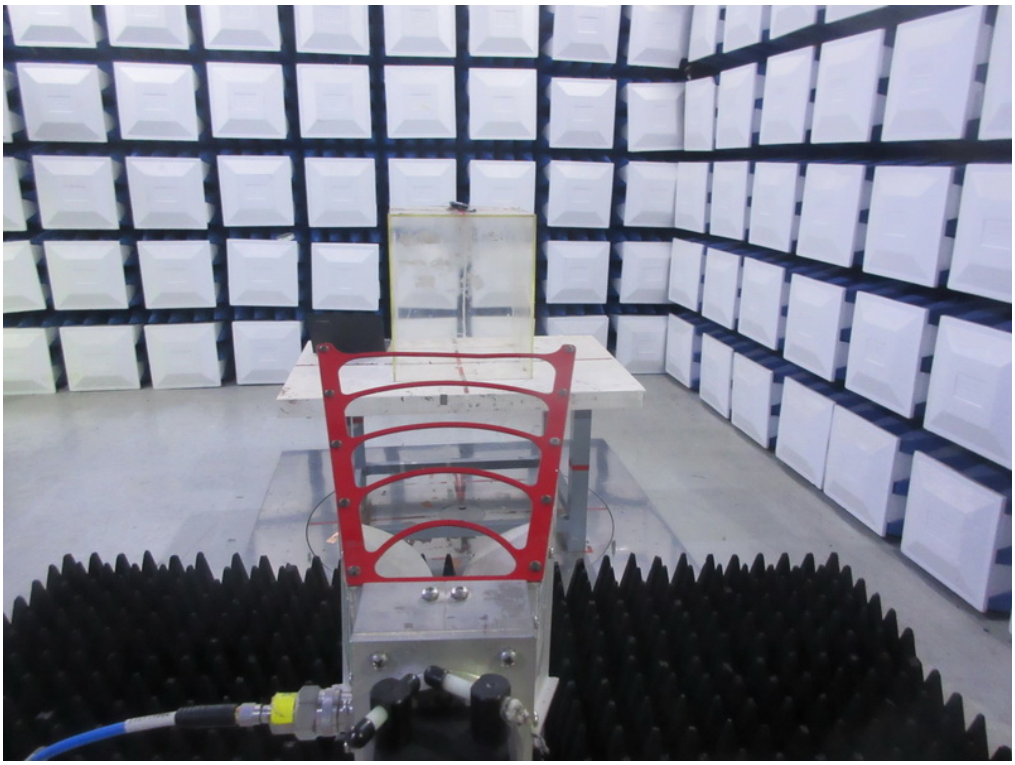




Radiated Measurement Photos

Above 1000MHz

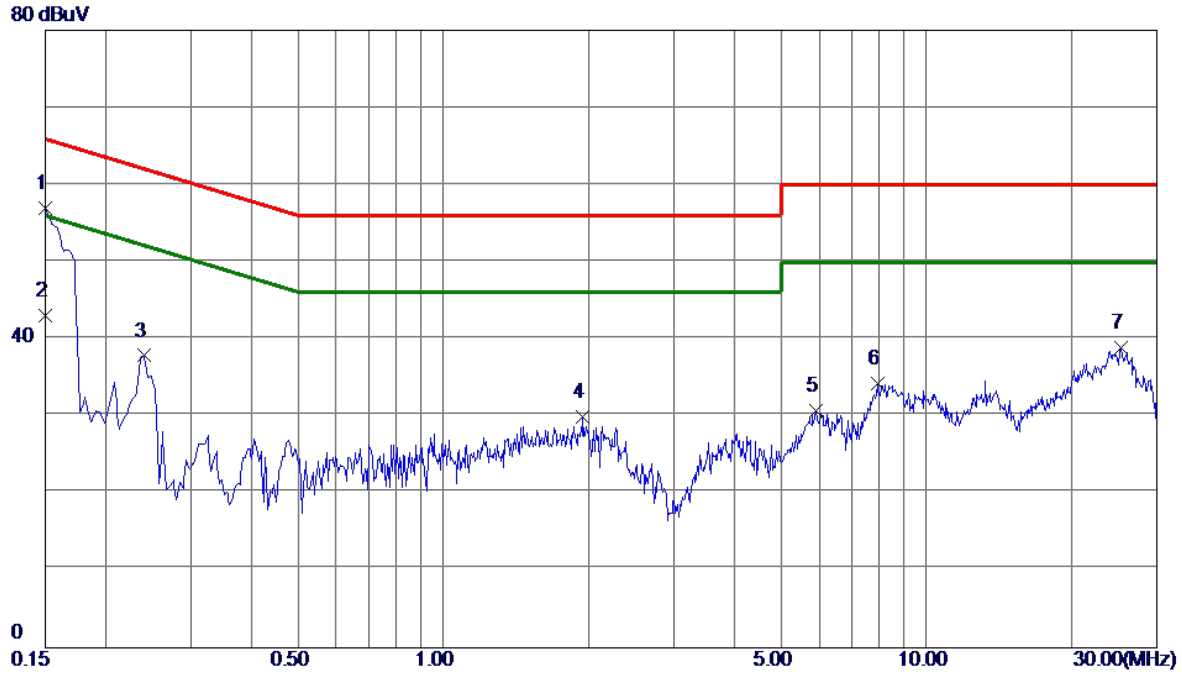




APPENDIX A - CONDUCTED EMISSION

Test Mode:	TX Mode

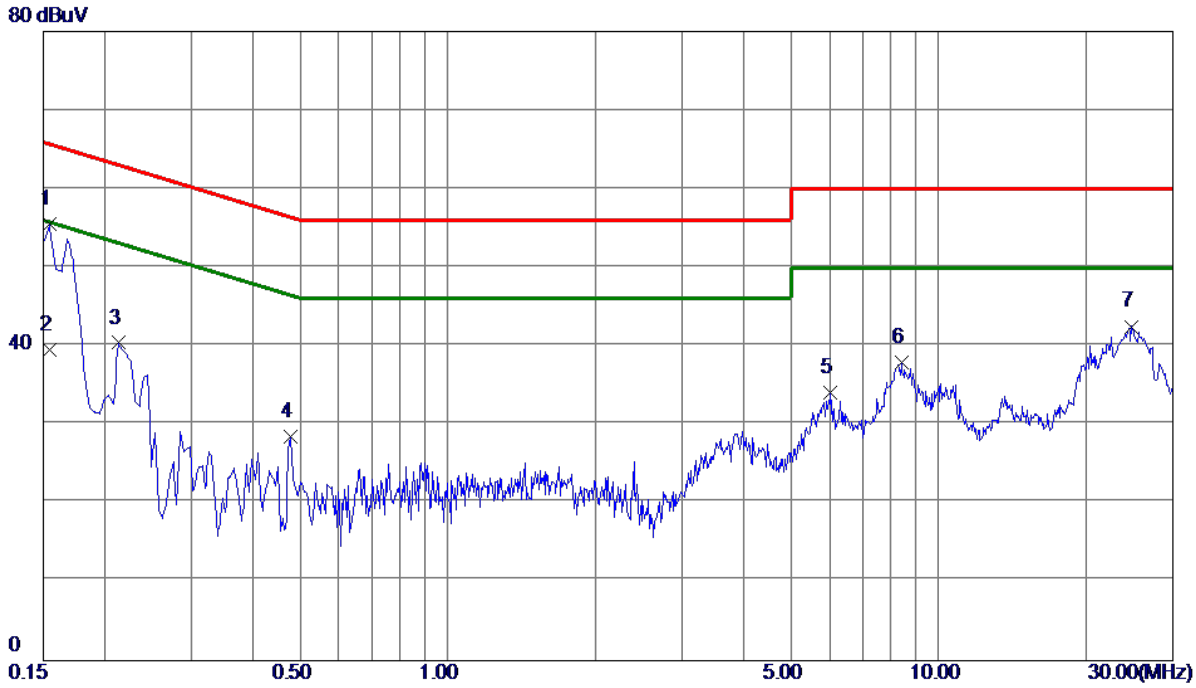
Line



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1 *	0.1500	47.20	9.79	56.99	66.00	-9.01	Peak	
2	0.1500	33.20	9.79	42.99	56.00	-13.01	AVG	
3	0.2400	28.08	9.76	37.84	62.10	-24.26	Peak	
4	1.9410	20.04	9.92	29.96	56.00	-26.04	Peak	
5	5.9190	20.56	10.14	30.70	60.00	-29.30	Peak	
6	7.9125	24.02	10.22	34.24	60.00	-25.76	Peak	
7	25.2600	28.02	10.80	38.82	60.00	-21.18	Peak	

Test Mode:	TX Mode

Neutral

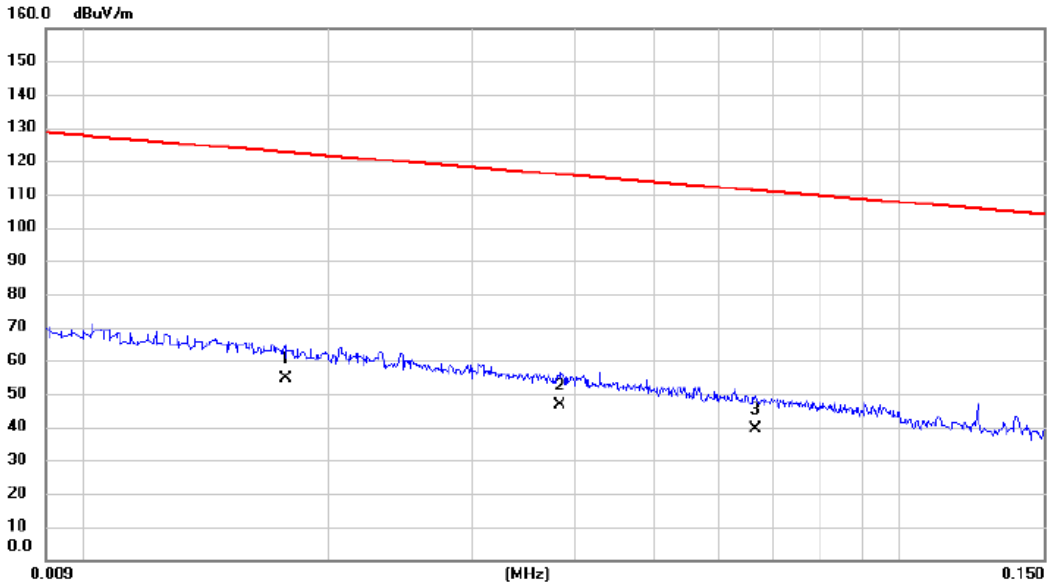


No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1 *	0.1545	45.79	9.68	55.47	65.75	-10.28	Peak	
2	0.1545	29.90	9.68	39.58	55.75	-16.17	AVG	
3	0.2130	30.71	9.69	40.40	63.09	-22.69	Peak	
4	0.4785	18.73	9.70	28.43	56.37	-27.94	Peak	
5	6.0270	24.07	10.07	34.14	60.00	-25.86	Peak	
6	8.3985	27.77	10.18	37.95	60.00	-22.05	Peak	
7	24.7515	31.54	10.94	42.48	60.00	-17.52	Peak	

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

Test Mode:	TX Mode

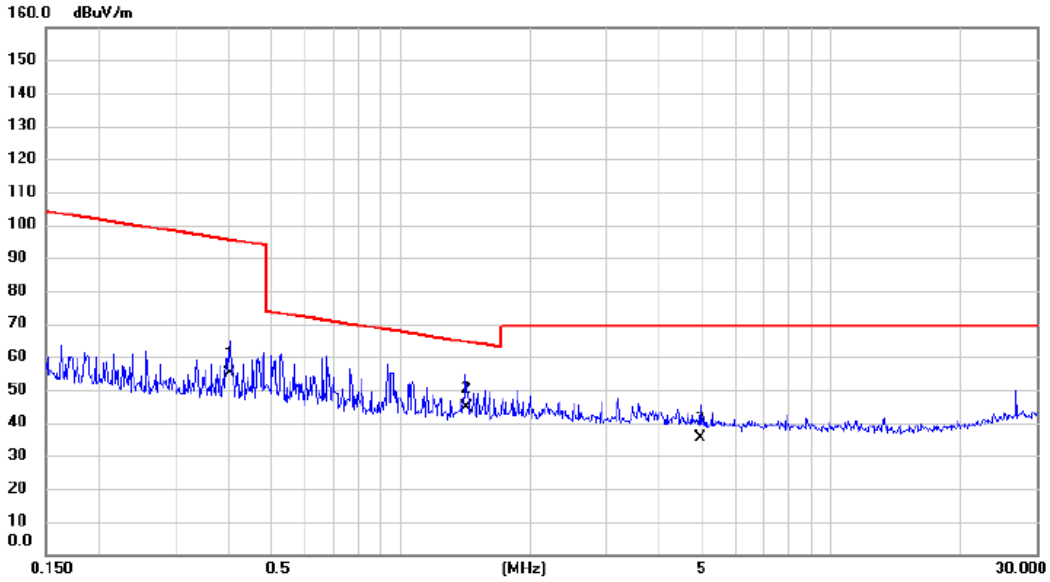
Ant 0°



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	0.0177	34.84	19.92	54.76	122.65	-67.89	AVG	
2		0.0384	27.60	19.07	46.67	115.92	-69.25	AVG	
3		0.0667	21.01	18.40	39.41	111.12	-71.71	AVG	

Test Mode:	TX Mode

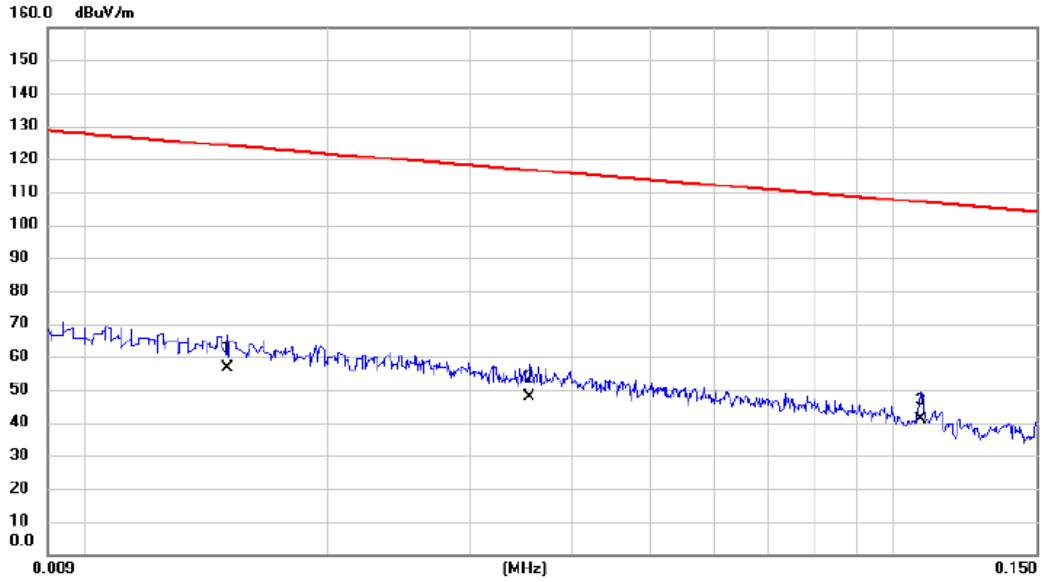
Ant 0°



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		0.4020	38.30	16.54	54.84	95.52	-40.68	AVG	
2	*	1.4182	28.99	15.73	44.72	64.57	-19.85	QP	
3		4.9782	20.84	14.38	35.22	69.54	-34.32	QP	

Test Mode:	TX Mode

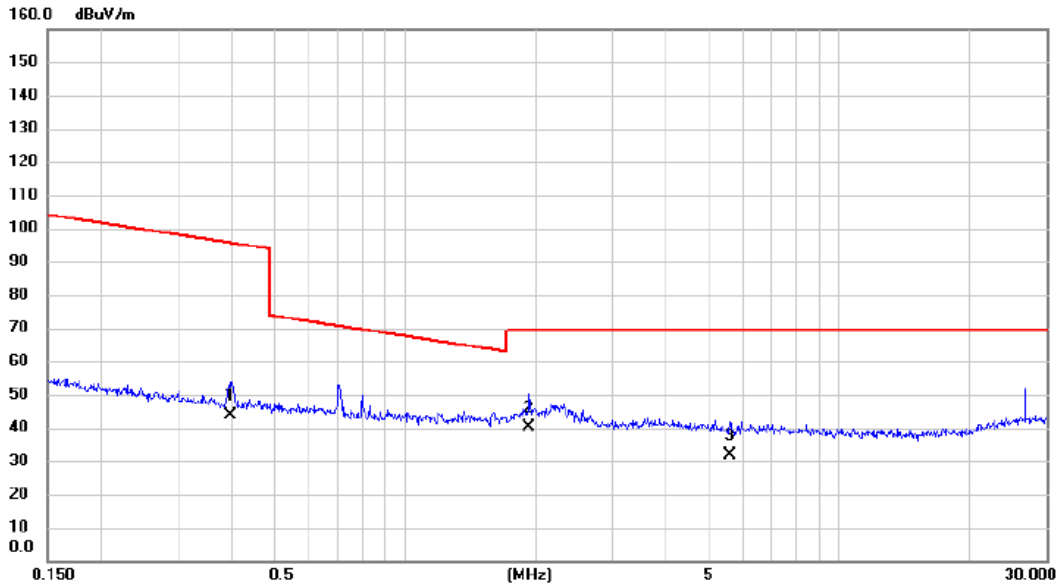
Ant 90°



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		0.0150	36.21	20.27	56.48	124.08	-67.60	AVG	
2		0.0355	28.76	19.16	47.92	116.60	-68.68	AVG	
3	*	0.1082	23.61	17.52	41.13	106.92	-65.79	QP	

Test Mode:	TX Mode

Ant 90°

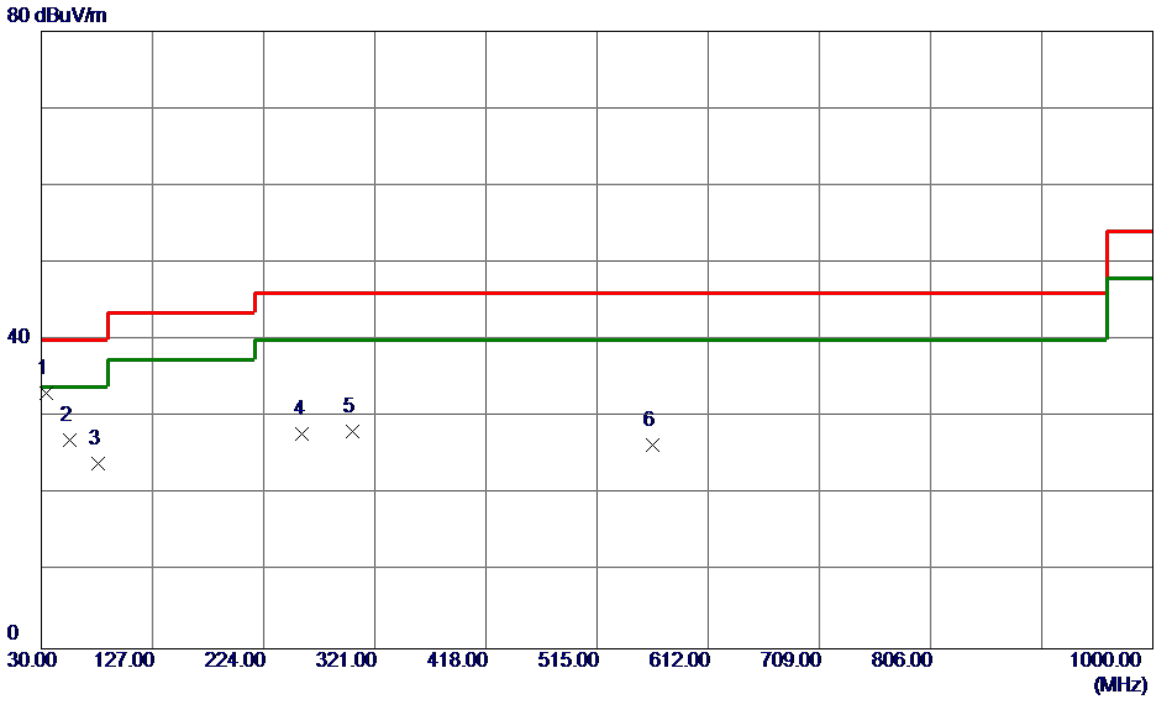


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		0.3976	27.24	16.54	43.78	95.62	-51.84	AVG	
2	*	1.9284	24.62	15.54	40.16	69.54	-29.38	QP	
3		5.5936	17.64	14.30	31.94	69.54	-37.60	QP	

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

Test Mode:	TX 2402MHz _CH00_1Mbps

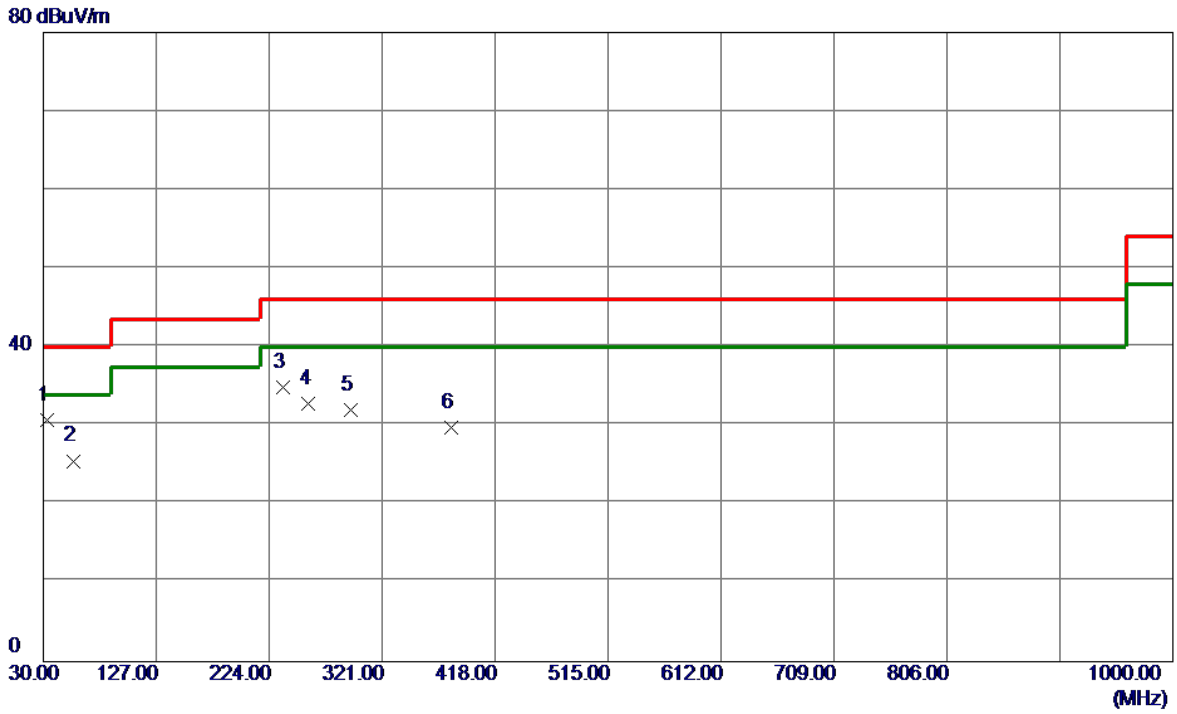
Vertical



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1 *	33.8800	46.46	-13.41	33.05	40.00	-6.95	Peak	
2	55.2200	39.23	-12.13	27.10	40.00	-12.90	Peak	
3	79.4700	40.69	-16.62	24.07	40.00	-15.93	Peak	
4	257.9500	41.31	-13.50	27.81	46.00	-18.19	Peak	
5	301.6000	38.69	-10.57	28.12	46.00	-17.88	Peak	
6	563.5000	30.63	-4.22	26.41	46.00	-19.59	Peak	

Test Mode:	TX 2402MHz _CH00_1Mbps

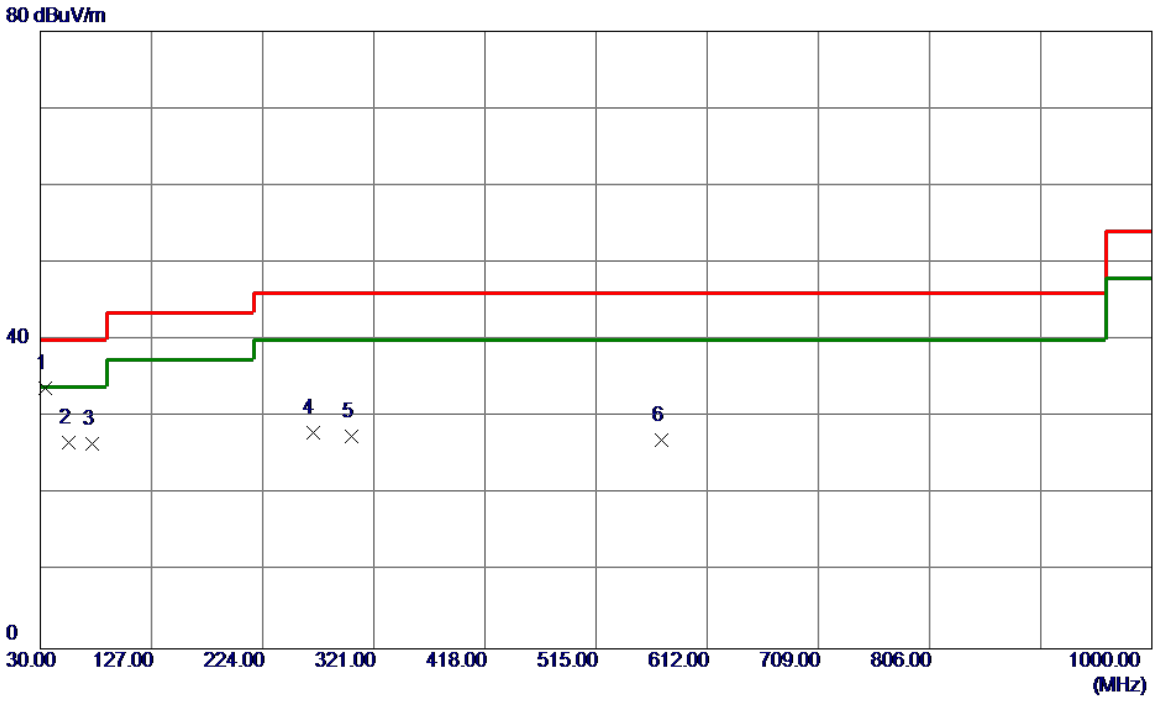
Horizontal



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1 *	32.9100	44.26	-13.57	30.69	40.00	-9.31	Peak	
2	56.1900	37.78	-12.26	25.52	40.00	-14.48	Peak	
3	235.6400	48.20	-13.29	34.91	46.00	-11.09	Peak	
4	257.9500	46.30	-13.50	32.80	46.00	-13.20	Peak	
5	293.8400	43.19	-11.25	31.94	46.00	-14.06	Peak	
6	380.1700	38.38	-8.63	29.75	46.00	-16.25	Peak	

Test Mode:	TX 2440MHz _CH19_1Mbps

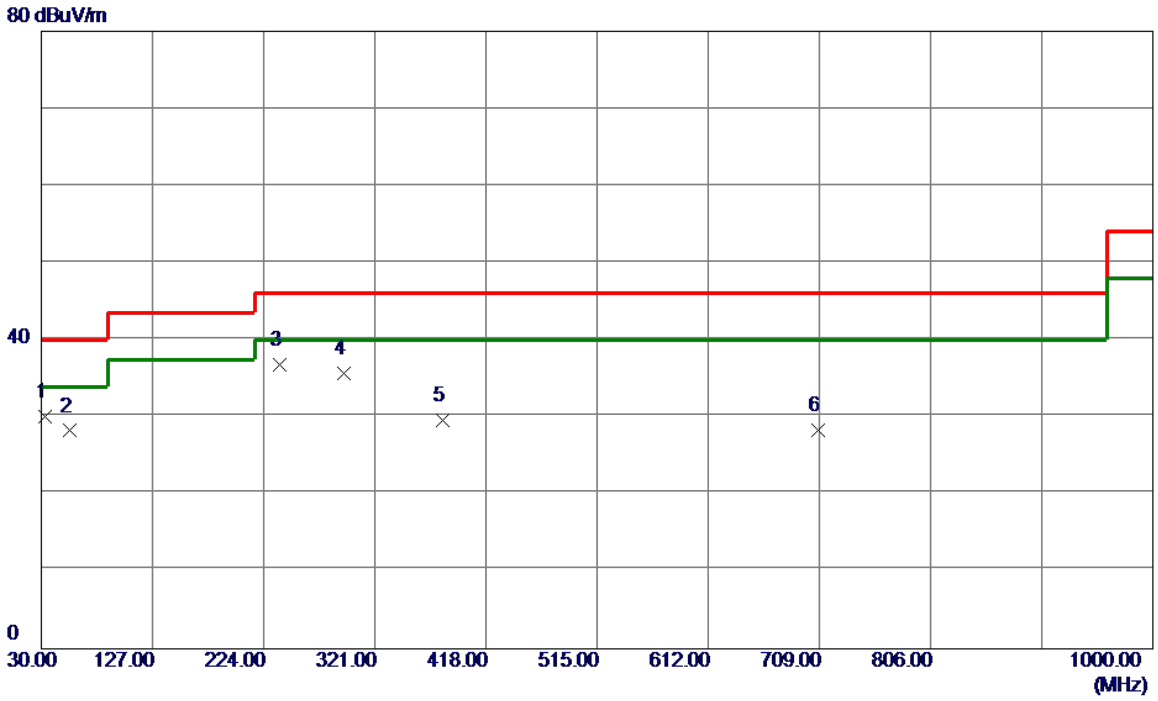
Vertical



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1 *	33.8800	47.23	-13.41	33.82	40.00	-6.18	Peak	
2	55.2200	38.78	-12.13	26.65	40.00	-13.35	Peak	
3	75.5899	42.29	-15.79	26.50	40.00	-13.50	Peak	
4	267.6500	40.90	-12.93	27.97	46.00	-18.03	Peak	
5	301.6000	38.10	-10.57	27.53	46.00	-18.47	Peak	
6	572.2300	31.18	-4.08	27.10	46.00	-18.90	Peak	

Test Mode:	TX 2440MHz _CH19_1Mbps

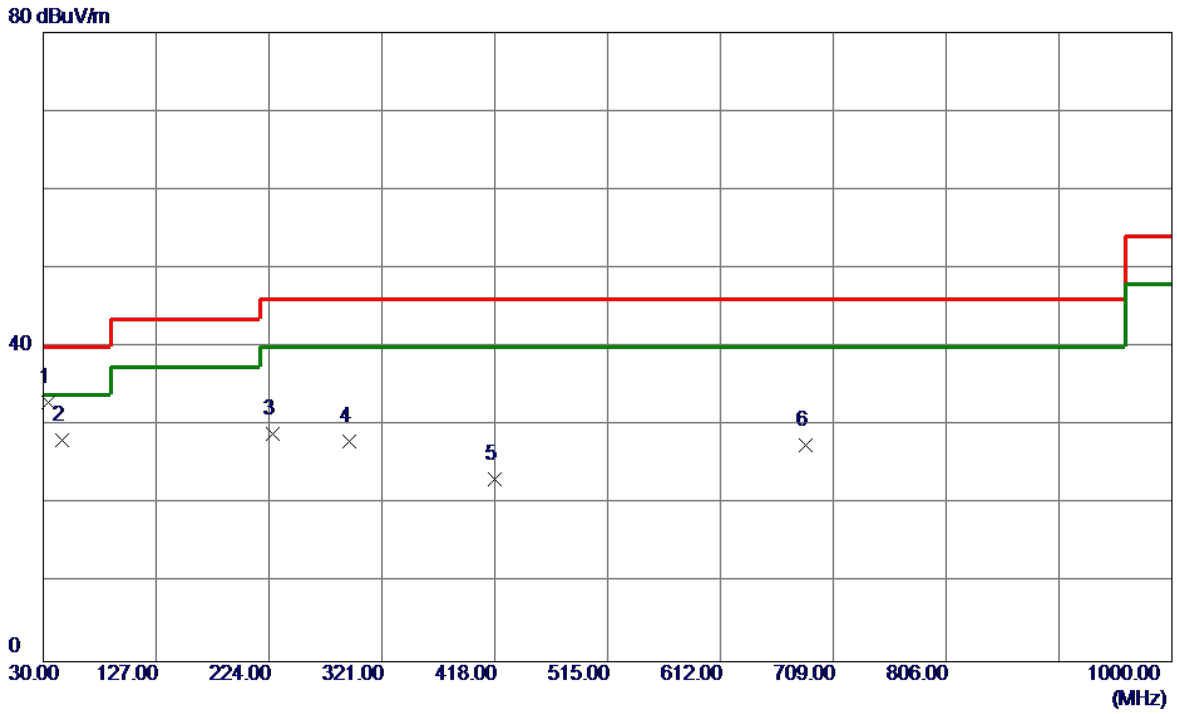
Horizontal



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	32.9100	43.69	-13.57	30.12	40.00	-9.88	Peak	
2	55.2200	40.37	-12.13	28.24	40.00	-11.76	Peak	
3 *	237.5800	50.10	-13.32	36.78	46.00	-9.22	Peak	
4	293.8400	46.95	-11.25	35.70	46.00	-10.30	Peak	
5	380.1700	38.22	-8.63	29.59	46.00	-16.41	Peak	
6	708.0300	29.09	-0.79	28.30	46.00	-17.70	Peak	

Test Mode:	TX 2480MHz _CH39_1Mbps

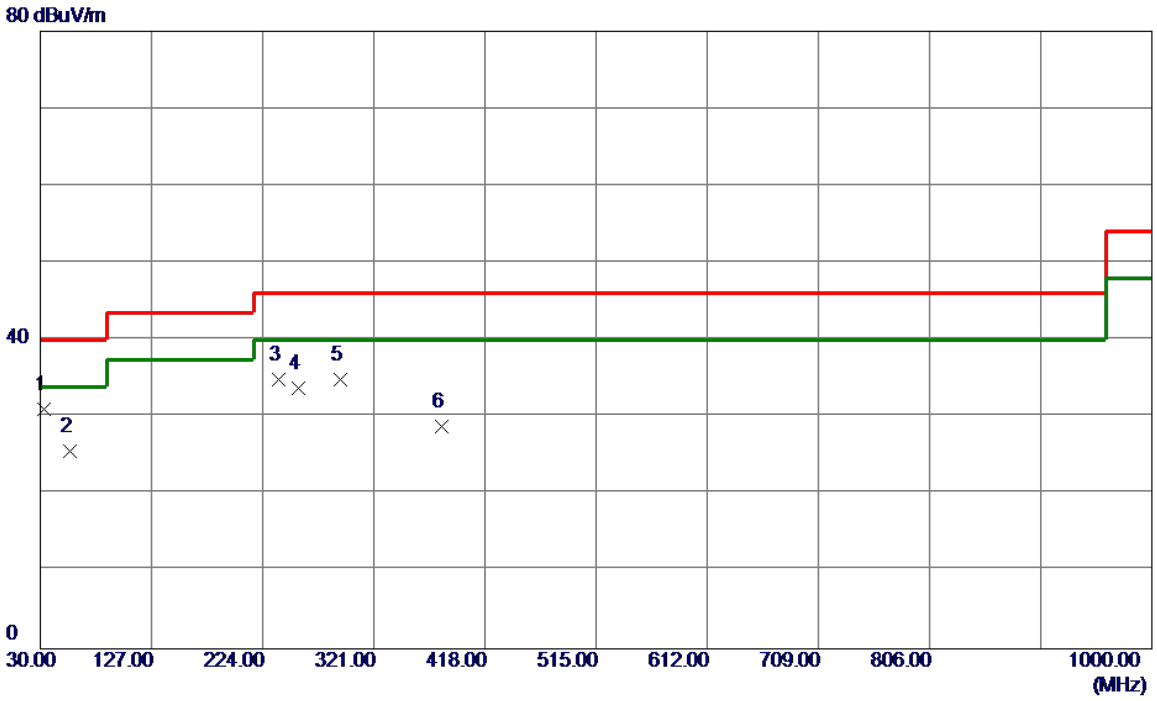
Vertical



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1 *	33.8800	46.44	-13.41	33.03	40.00	-6.97	Peak	
2	46.4900	40.02	-11.81	28.21	40.00	-11.79	Peak	
3	226.9100	42.32	-13.30	29.02	46.00	-16.98	Peak	
4	292.8700	39.28	-11.35	27.93	46.00	-18.07	Peak	
5	418.0000	30.87	-7.67	23.20	46.00	-22.80	Peak	
6	685.7199	28.87	-1.29	27.58	46.00	-18.42	Peak	

Test Mode:	TX 2480MHz _CH39_1Mbps

Horizontal

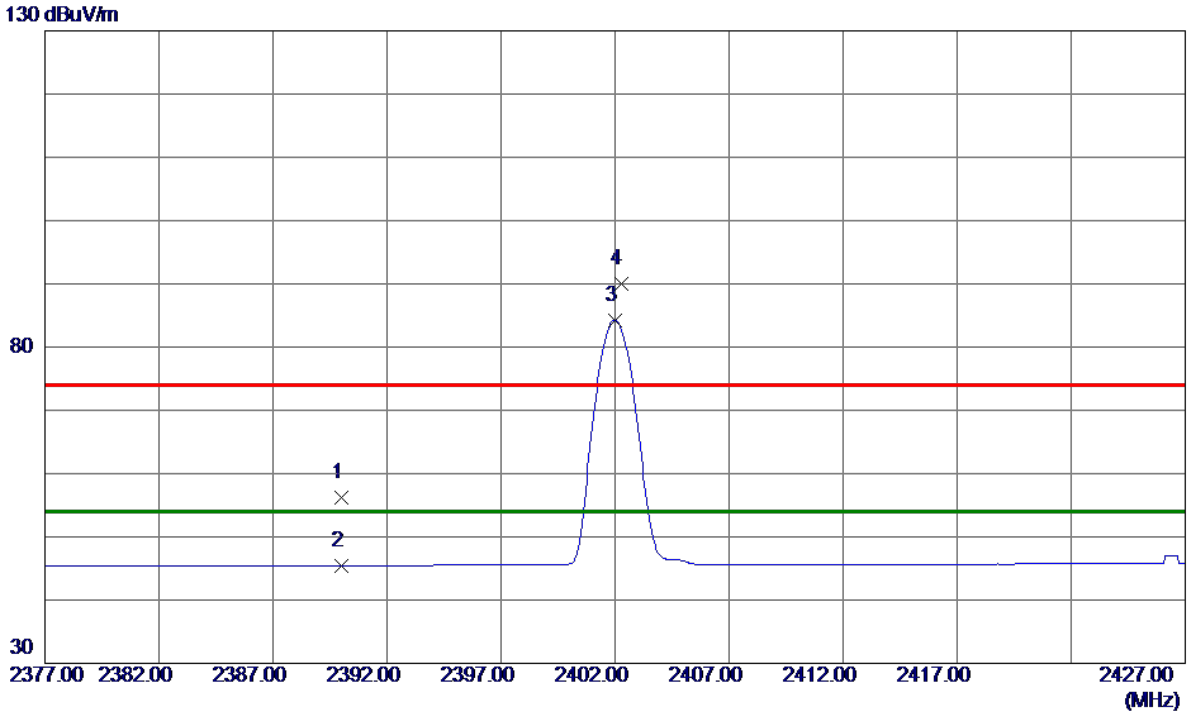


No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1 *	32.9100	44.56	-13.57	30.99	40.00	-9.01	Peak	
2	56.1900	37.88	-12.26	25.62	40.00	-14.38	Peak	
3	237.5800	48.20	-13.32	34.88	46.00	-11.12	Peak	
4	255.0400	47.10	-13.40	33.70	46.00	-12.30	Peak	
5	291.9000	46.39	-11.45	34.94	46.00	-11.06	Peak	
6	380.1700	37.49	-8.63	28.86	46.00	-17.14	Peak	

APPENDIX D - RADIATED EMISSION (ABOVE 1000MHZ)

Test Mode :	TX 2402MHz _CH00_1Mbps

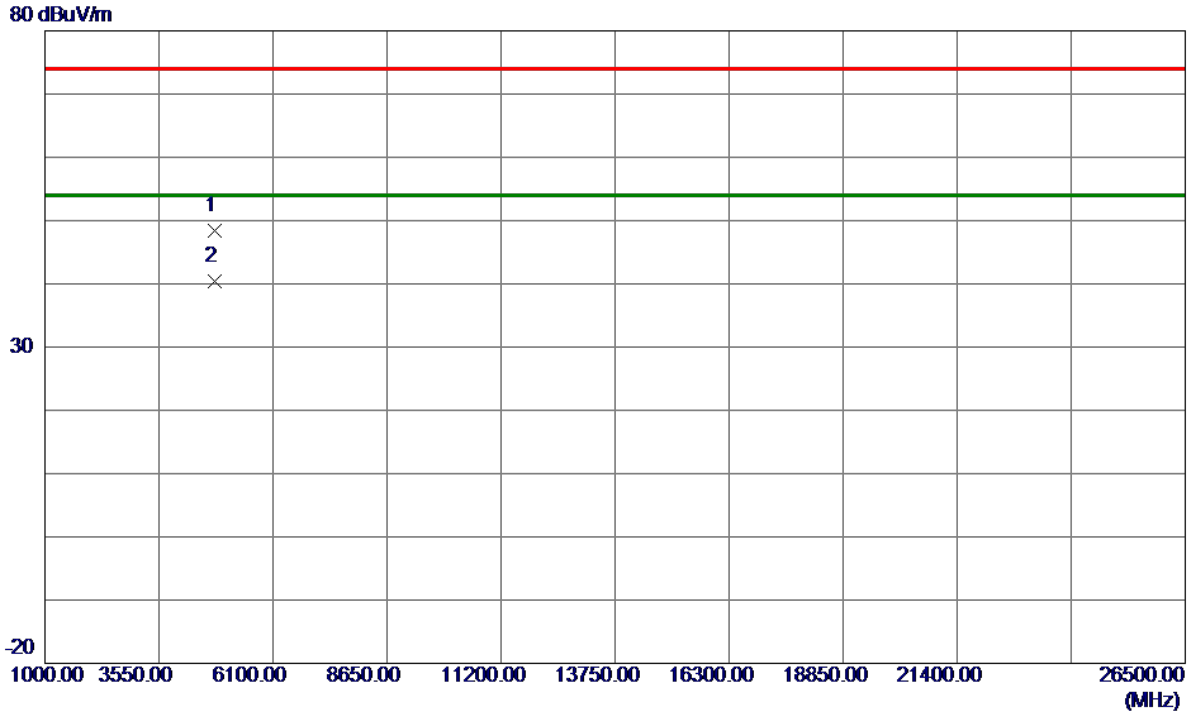
Vertical



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	2390.0000	22.68	33.50	56.18	74.00	-17.82	Peak	
2	2390.0000	11.95	33.50	45.45	54.00	-8.55	AVG	
3 *	2402.0000	50.63	33.56	84.19	54.00	30.19	AVG	No Limit
4	2402.2500	56.52	33.57	90.09	74.00	16.09	Peak	No Limit

Test Mode :	TX 2402MHz _CH00_1Mbps

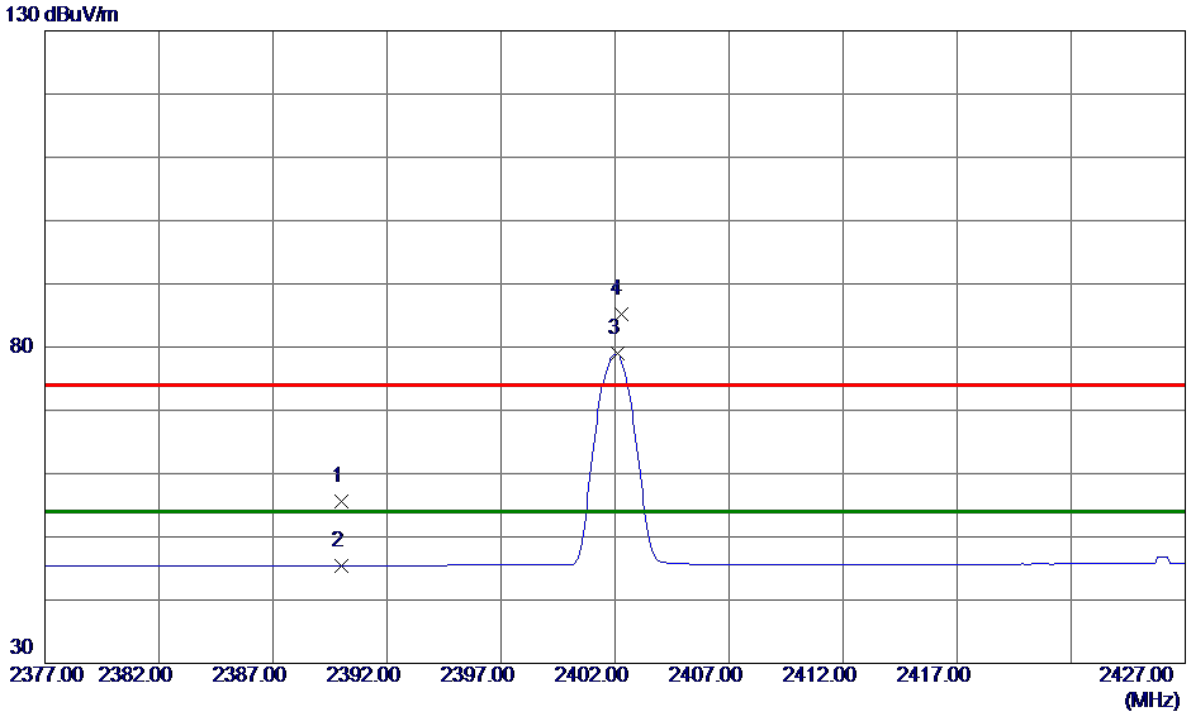
Vertical



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	4803.1600	41.90	6.46	48.36	74.00	-25.64	Peak	
2 *	4804.0000	34.02	6.46	40.48	54.00	-13.52	AVG	

Test Mode :	TX 2402MHz _CH00_1Mbps

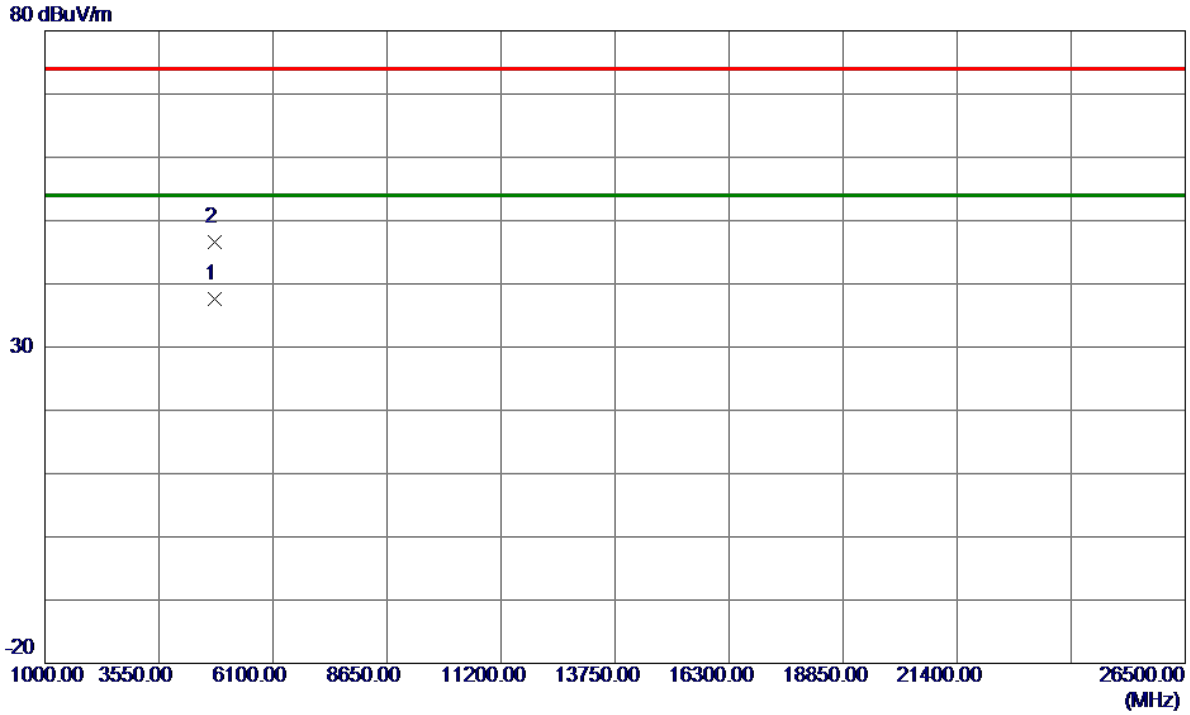
Horizontal



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	2390.0000	22.09	33.50	55.59	74.00	-18.41	Peak	
2	2390.0000	11.94	33.50	45.44	54.00	-8.56	AVG	
3 *	2402.1000	45.37	33.56	78.93	54.00	24.93	AVG	No Limit
4	2402.2500	51.63	33.57	85.20	74.00	11.20	Peak	No Limit

Test Mode :	TX 2402MHz _CH00_1Mbps

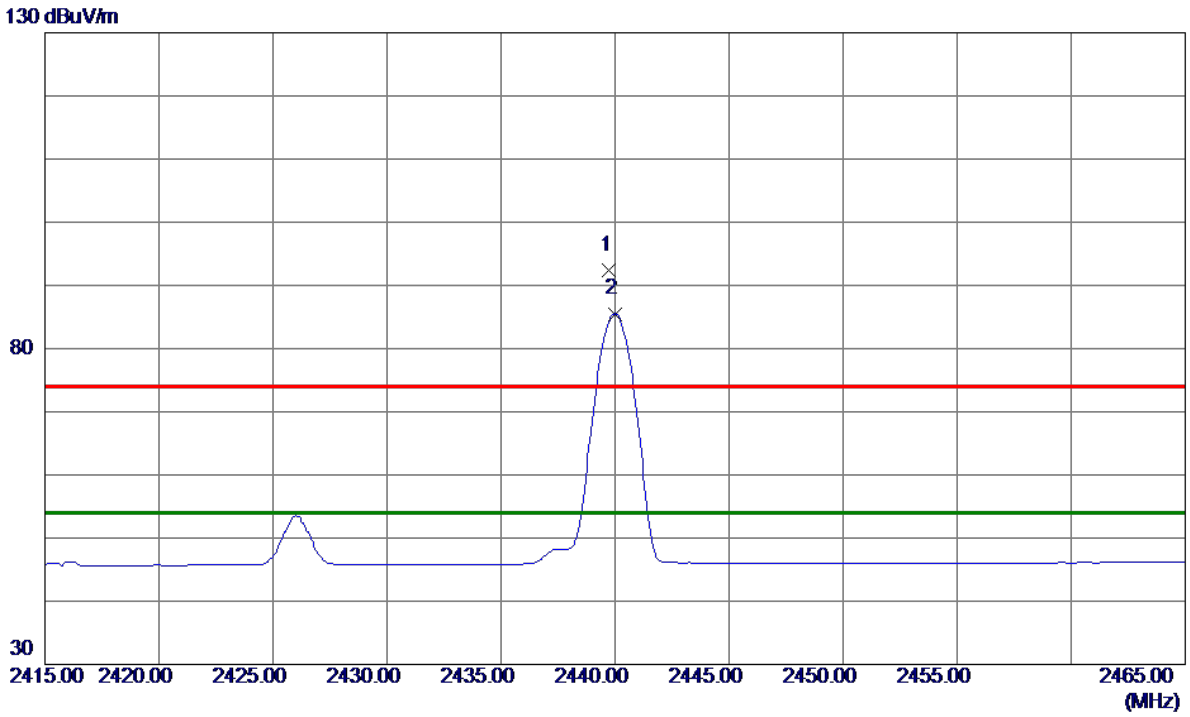
Horizontal



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1 *	4804.0900	31.21	6.46	37.67	54.00	-16.33	AVG	
2	4804.4500	40.20	6.47	46.67	74.00	-27.33	Peak	

Test Mode :	TX 2440MHz _CH19_1Mbps

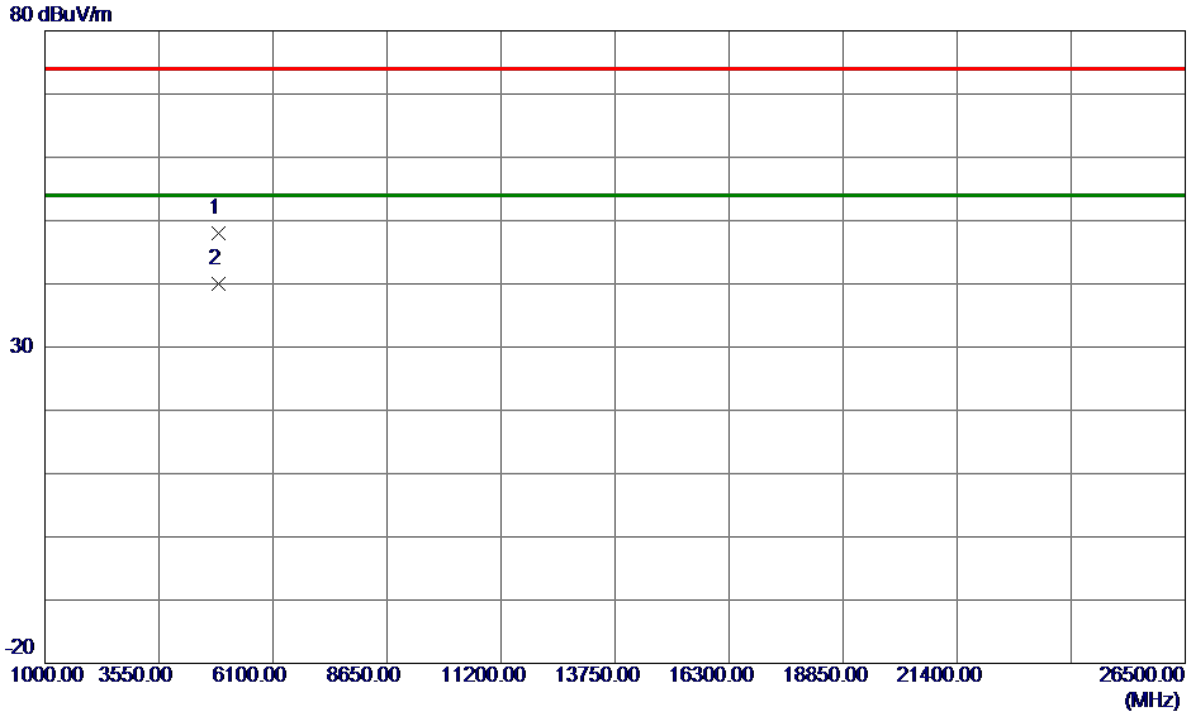
Vertical



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	2439.7500	58.58	33.76	92.34	74.00	18.34	Peak	No Limit
2 *	2440.0000	51.74	33.76	85.50	54.00	31.50	AVG	No Limit

Test Mode :	TX 2440MHz _CH19_1Mbps

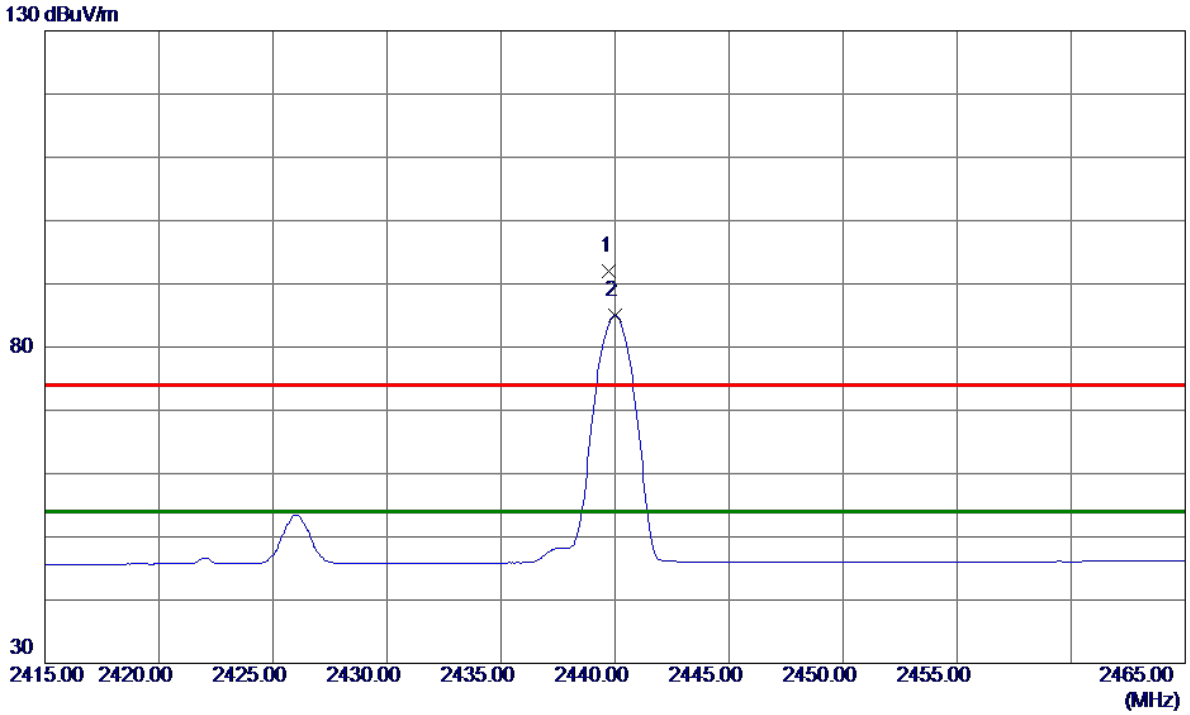
Vertical



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	4879.6500	41.20	6.71	47.91	74.00	-26.09	Peak	
2 *	4879.8500	33.20	6.71	39.91	54.00	-14.09	AVG	

Test Mode :	TX 2440MHz _CH19_1Mbps

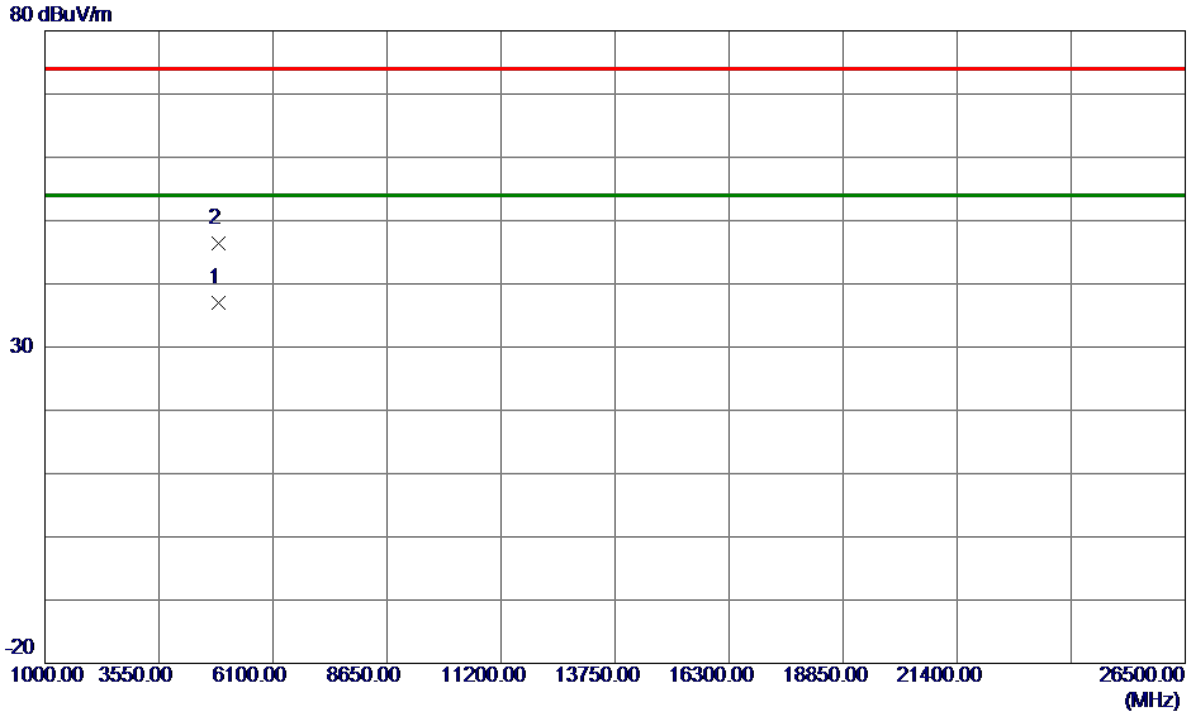
Horizontal



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	2439.7500	58.14	33.76	91.90	74.00	17.90	Peak	No Limit
2 *	2440.0000	51.21	33.76	84.97	54.00	30.97	AVG	No Limit

Test Mode :	TX 2440MHz _CH19_1Mbps

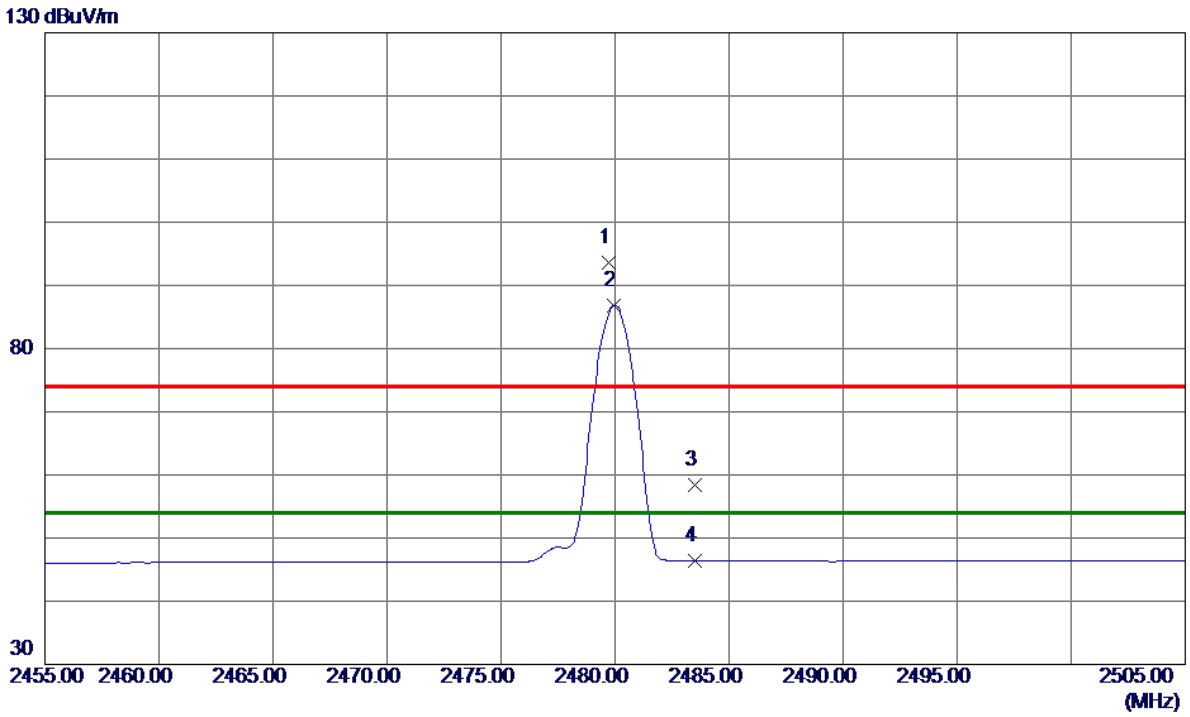
Horizontal



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1 *	4879.7400	30.20	6.71	36.91	54.00	-17.09	AVG	
2	4879.8100	39.60	6.71	46.31	74.00	-27.69	Peak	

Test Mode :	TX 2480MHz _CH39_1Mbps

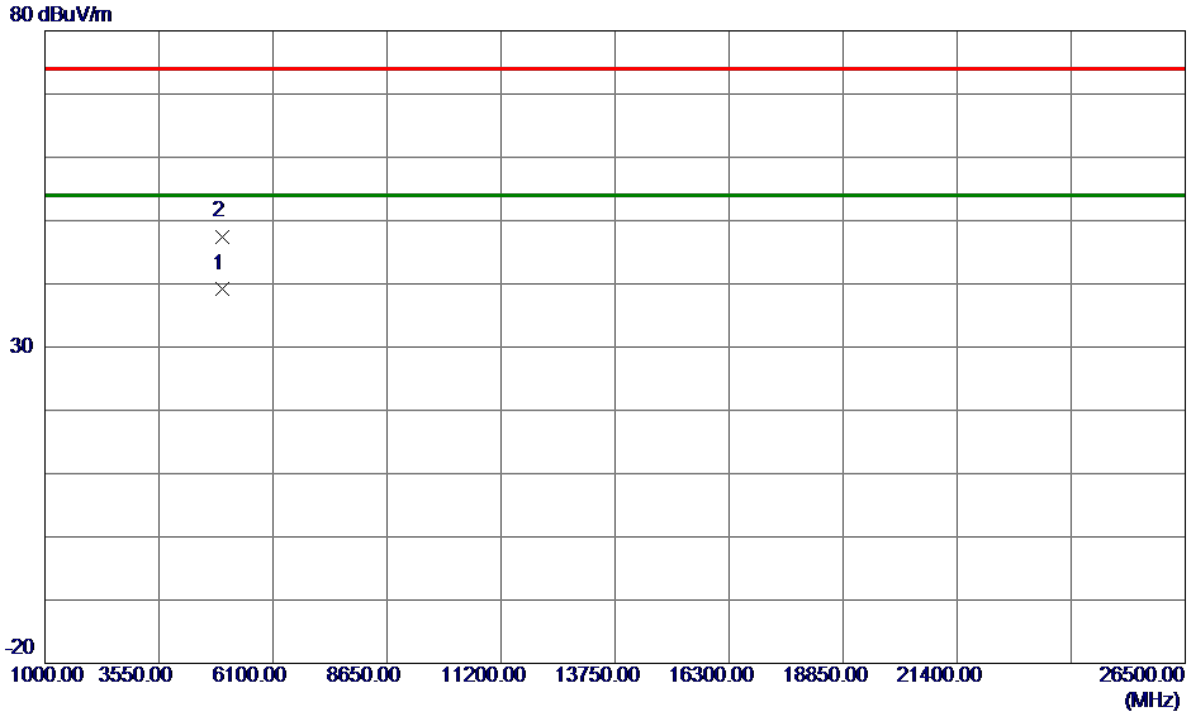
Vertical



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	2479.7000	59.69	33.97	93.66	74.00	19.66	Peak	No Limit
2 *	2479.9500	52.90	33.97	86.87	54.00	32.87	AVG	No Limit
3	2483.5000	24.35	33.98	58.33	74.00	-15.67	Peak	
4	2483.5000	12.43	33.98	46.41	54.00	-7.59	AVG	

Test Mode :	TX 2480MHz _CH39_1Mbps

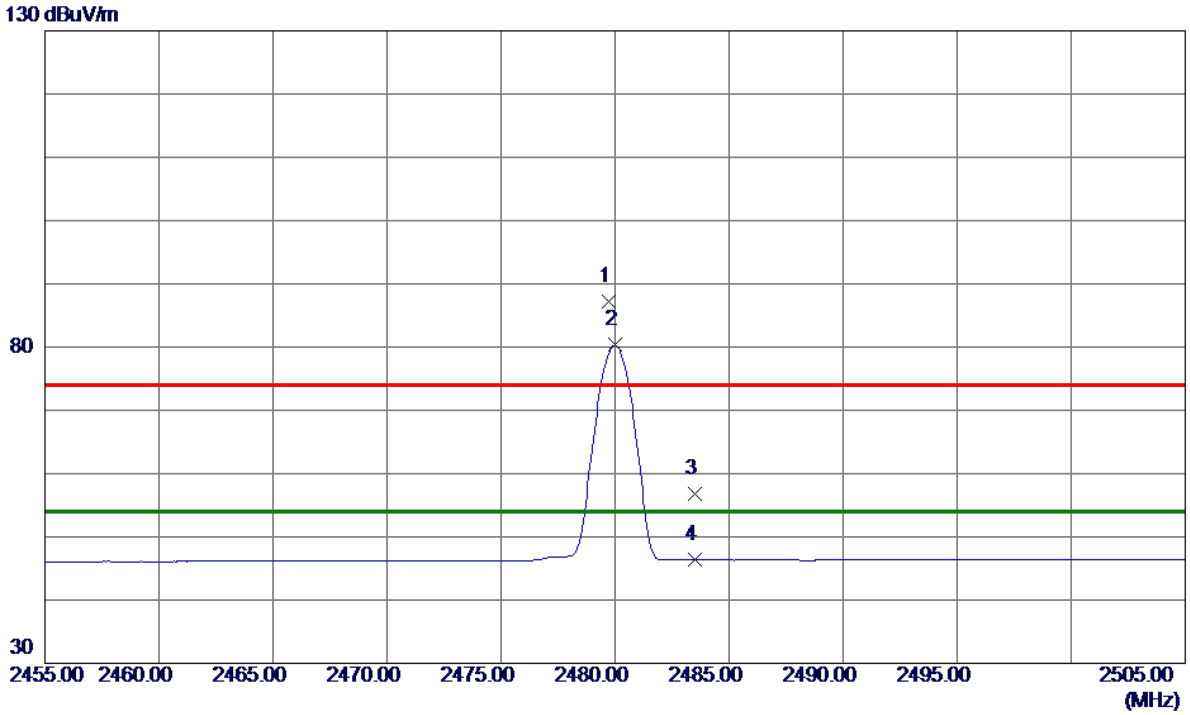
Vertical



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1 *	4959.7400	32.23	6.96	39.19	54.00	-14.81	AVG	
2	4959.8200	40.54	6.96	47.50	74.00	-26.50	Peak	

Test Mode :	TX 2480MHz _CH39_1Mbps

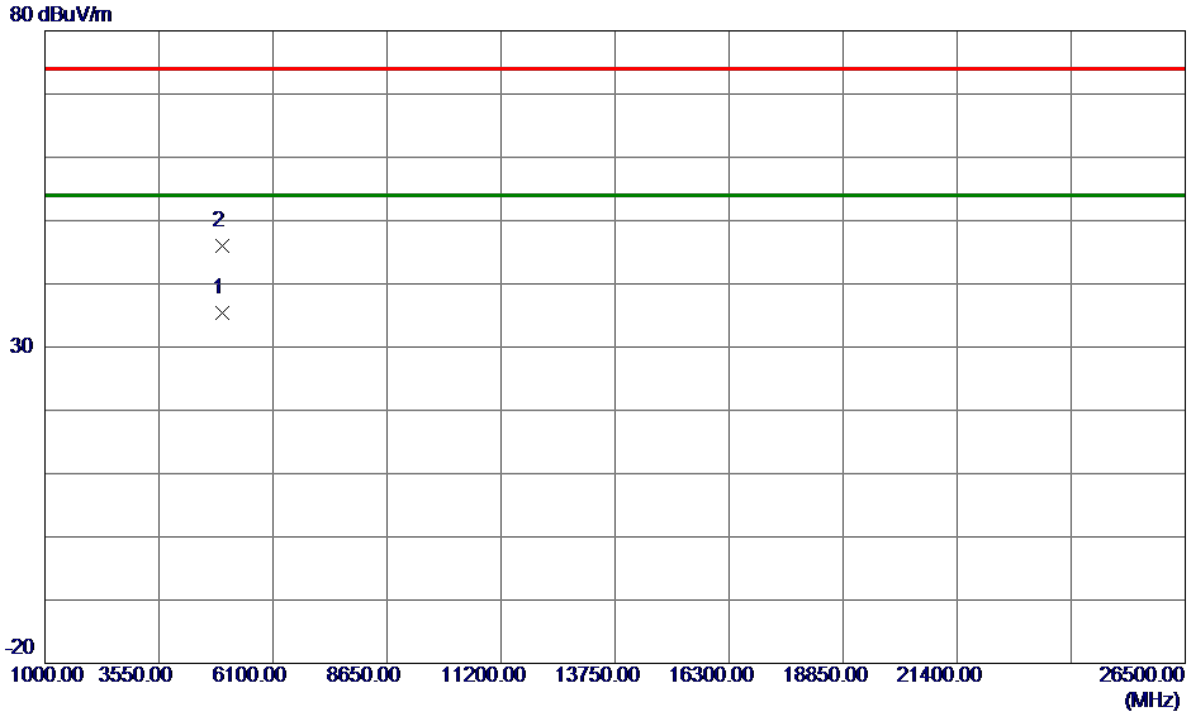
Horizontal



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	2479.7000	53.17	33.97	87.14	74.00	13.14	Peak	No Limit
2 *	2480.0000	46.35	33.97	80.32	54.00	26.32	AVG	No Limit
3	2483.5000	22.88	33.98	56.86	74.00	-17.14	Peak	
4	2483.5000	12.34	33.98	46.32	54.00	-7.68	AVG	

Test Mode :	TX 2480MHz _CH39_1Mbps

Horizontal



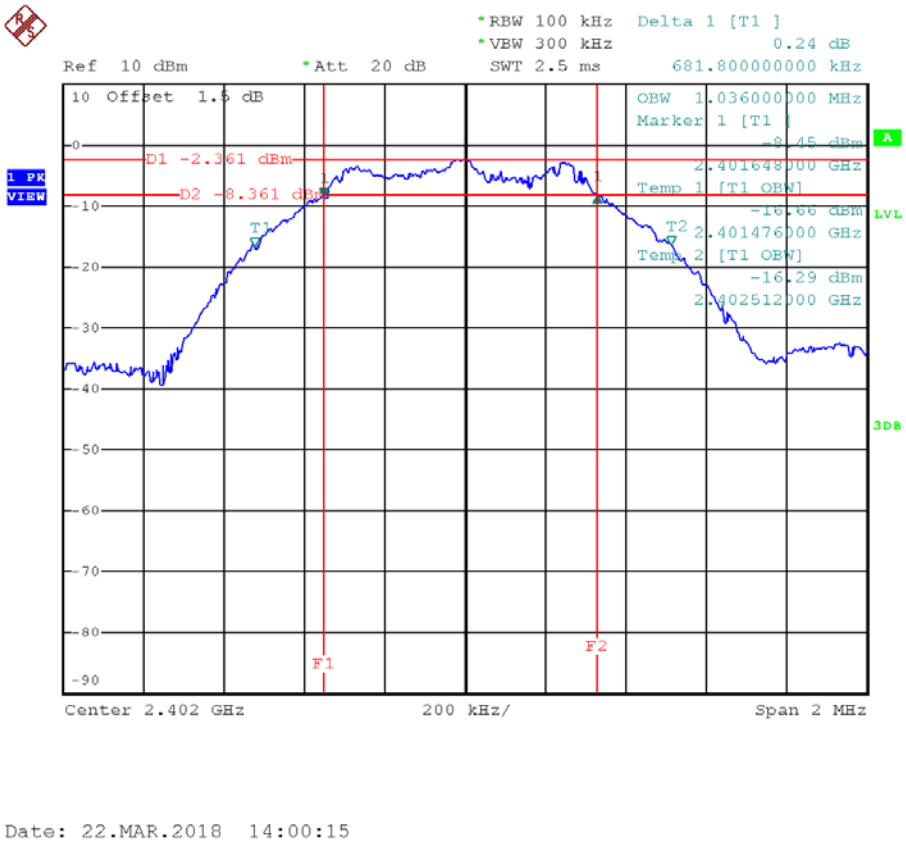
No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1 *	4959.8100	28.36	6.96	35.32	54.00	-18.68	AVG	
2	4959.8300	39.01	6.96	45.97	74.00	-28.03	Peak	

APPENDIX E - BANDWIDTH

Test Mode:	TX Mode

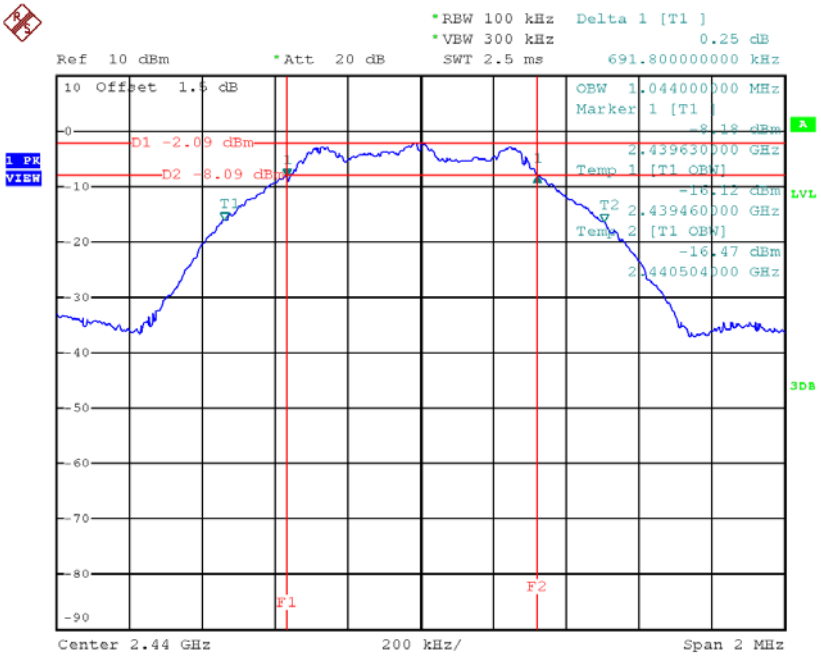
Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied BW (MHz)	Min. Limit (kHz)	Test Result
2402	0.682	1.036	500	Pass
2440	0.692	1.044	500	Pass
2480	0.688	1.040	500	Pass

TX CH00



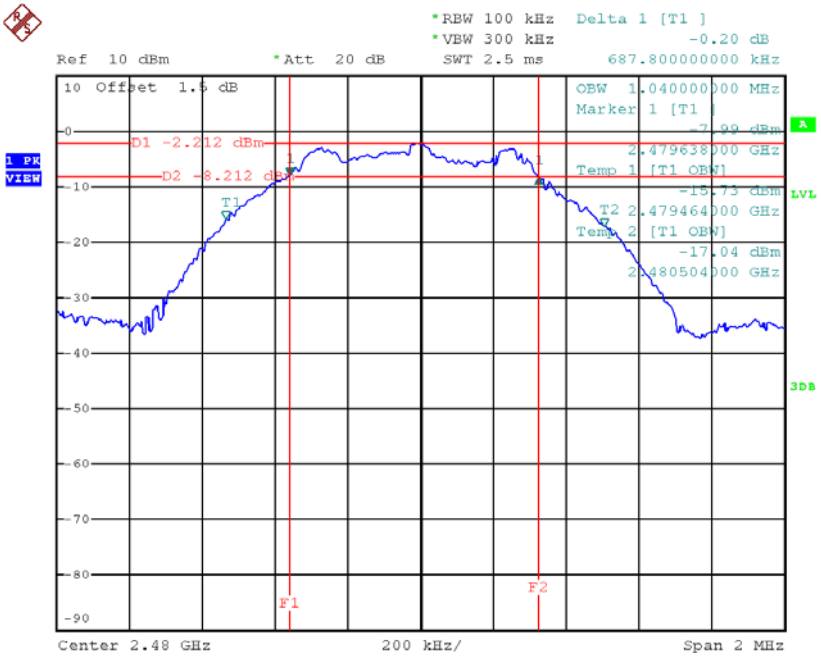
Date: 22.MAR.2018 14:00:15

TX CH19



Date: 22.MAR.2018 14:08:48

TX CH39



Date: 22.MAR.2018 14:03:25

APPENDIX F - MAXIMUM OUTPUT POWER TEST

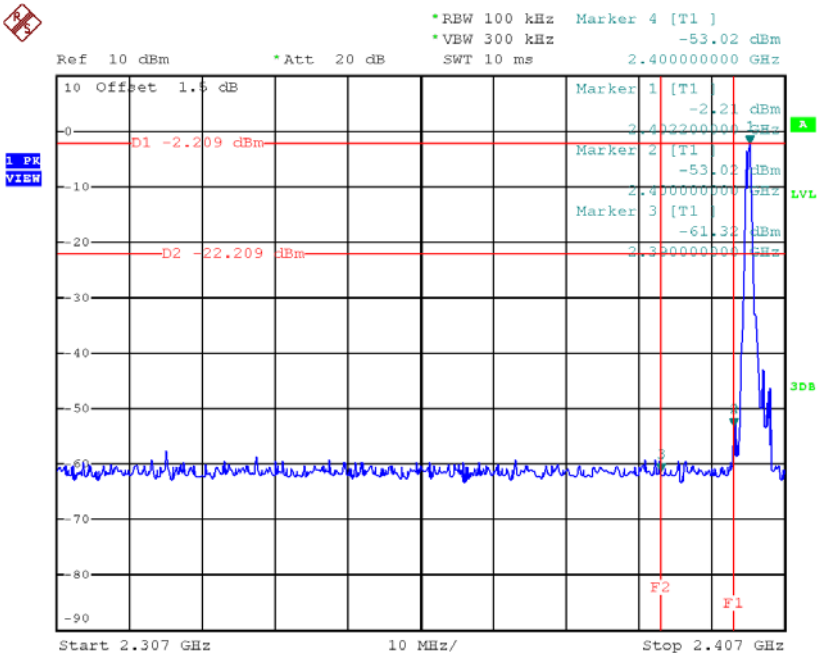
Test Mode :	CH00, CH19 , CH39 - 1Mbps

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2402	-2.04	0.0006	30.00	1.00	Pass
2440	-1.72	0.0007	30.00	1.00	Pass
2480	-1.93	0.0006	30.00	1.00	Pass

APPENDIX G - ANTENNA CONDUCTED SPURIOUS EMISSION

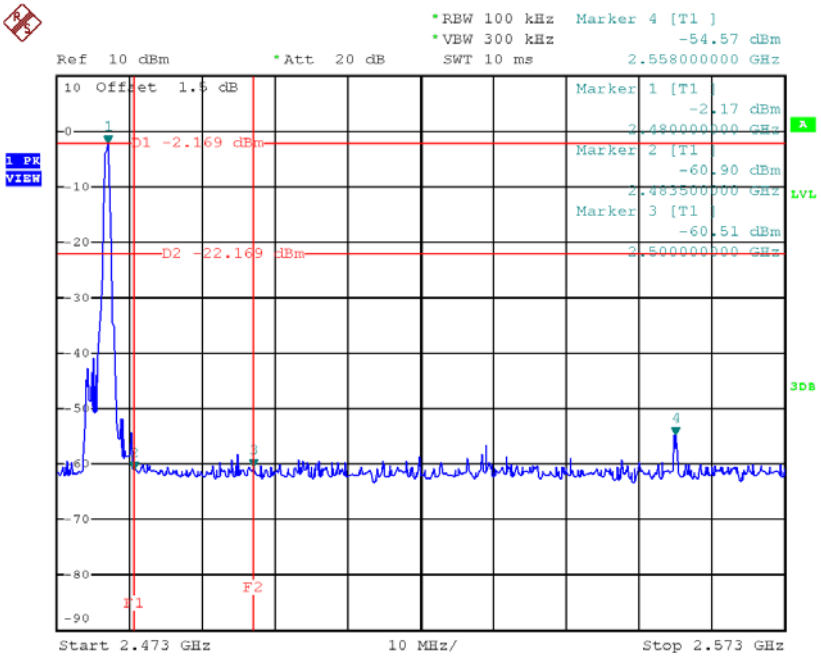
Test Mode :	CH00, CH19 , CH39 - 1Mbps

CH00 (Lower) - 1Mbps



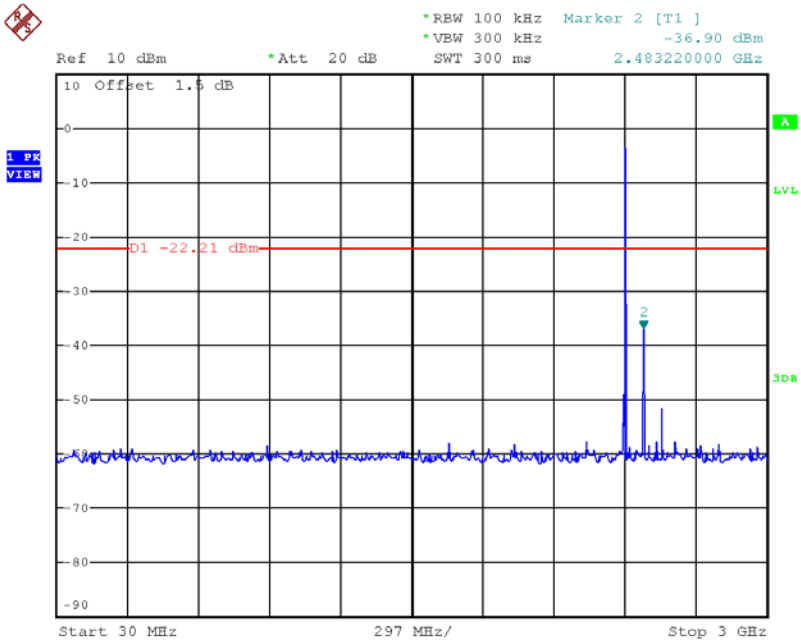
Date: 22.MAR.2018 14:00:23

CH39 (upper) - 1Mbps



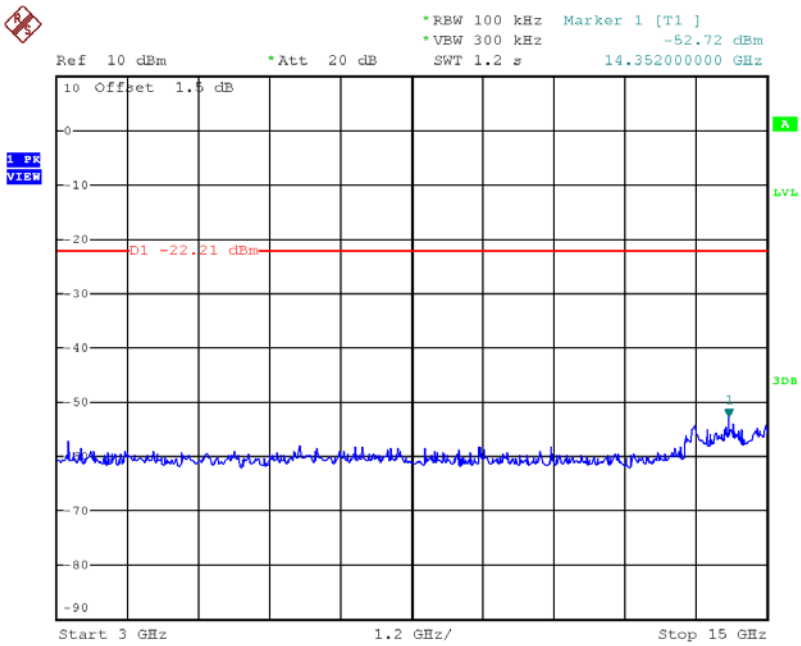
Date: 22.MAR.2018 14:03:33

CH00 (10 Harmonic of the frequency) 1



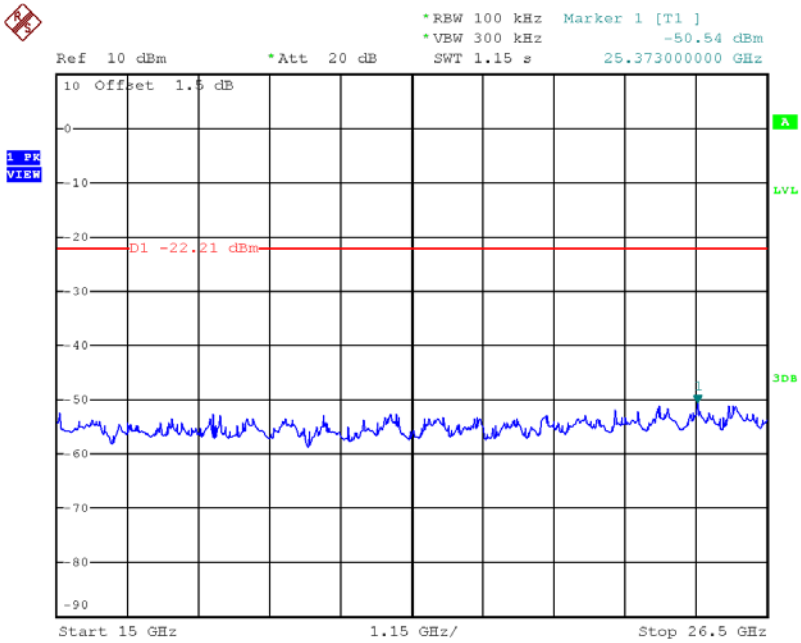
Date: 22.MAR.2018 14:00:36

CH00 (10 Harmonic of the frequency) 2



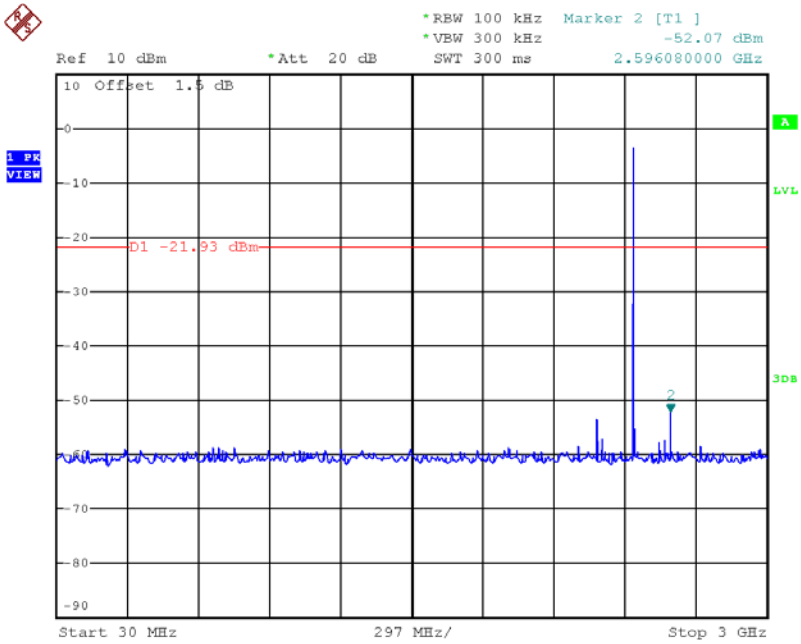
Date: 22.MAR.2018 14:00:44

CH00 (10 Harmonic of the frequency) 3



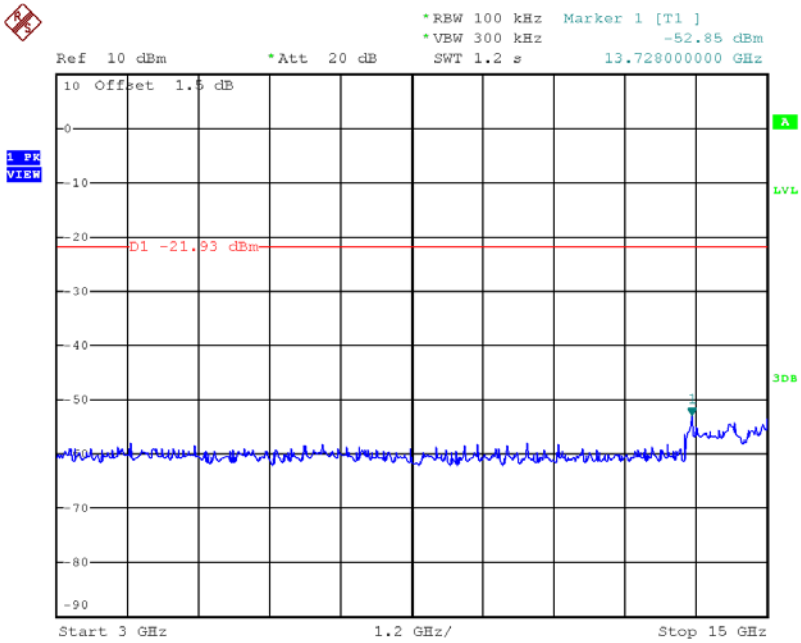
Date: 22.MAR.2018 14:00:51

CH19 (10 Harmonic of the frequency) 1



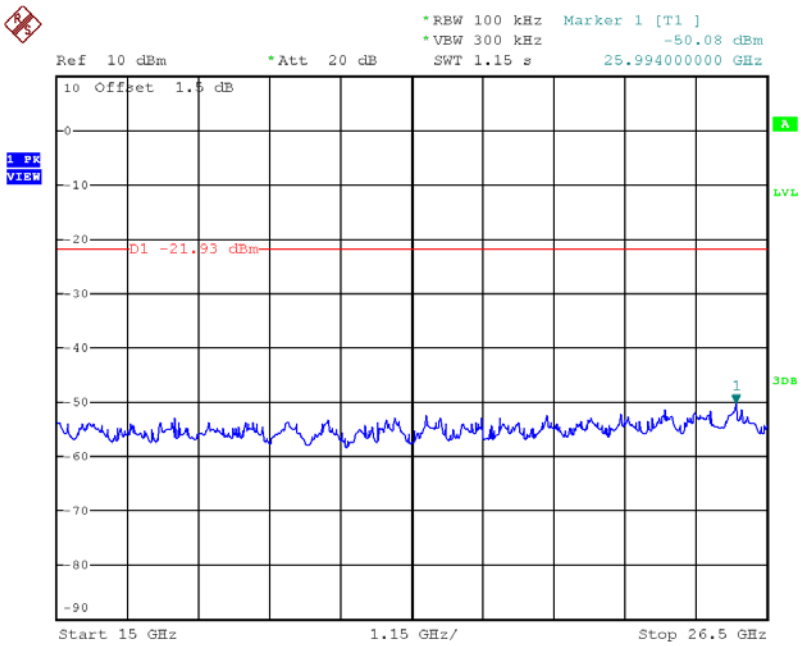
Date: 22.MAR.2018 14:09:02

CH19 (10 Harmonic of the frequency) 2



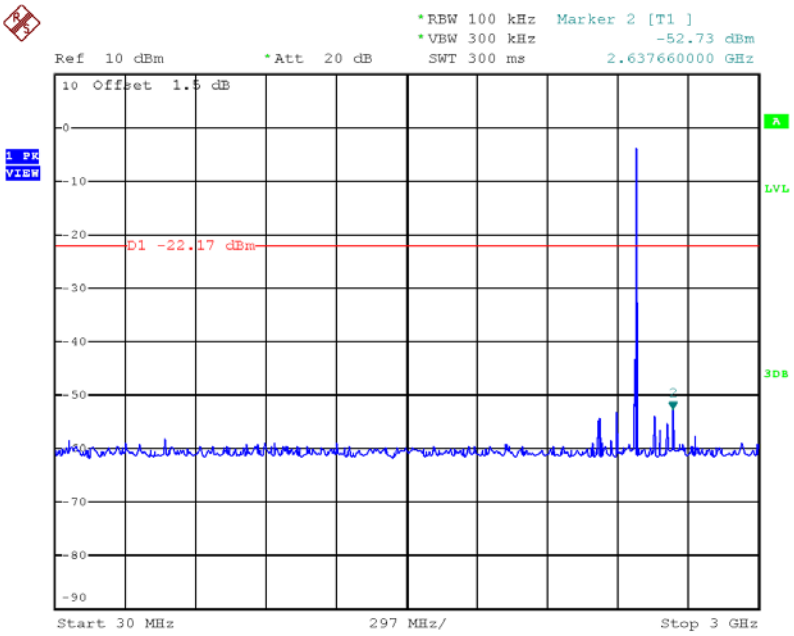
Date: 22.MAR.2018 14:09:09

CH19 (10 Harmonic of the frequency) 3



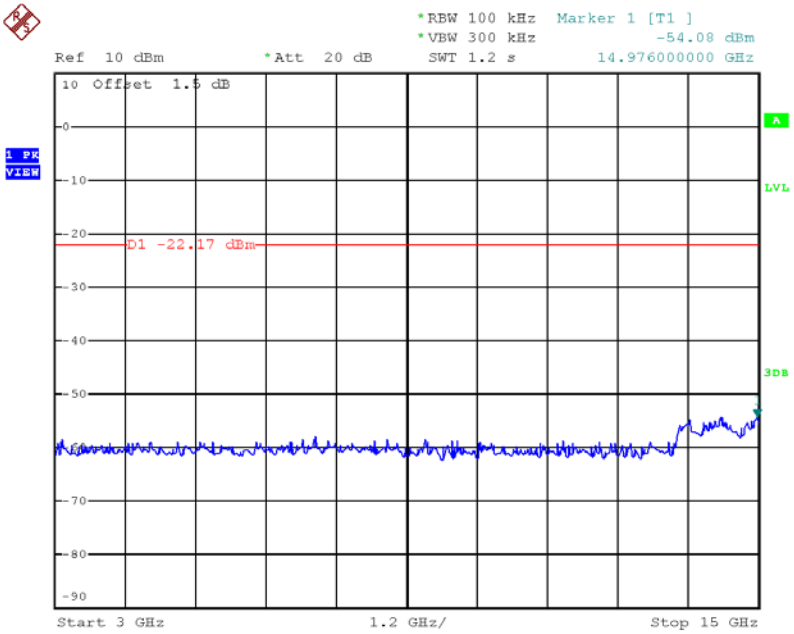
Date: 22.MAR.2018 14:09:17

CH39 (10 Harmonic of the frequency) 1



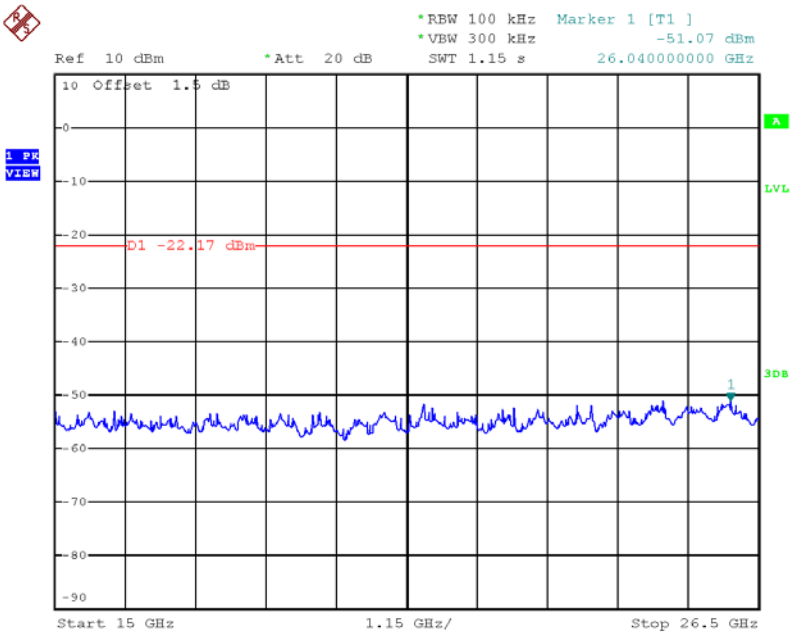
Date: 22.MAR.2018 14:03:46

CH39 (10 Harmonic of the frequency) 2



Date: 22.MAR.2018 14:03:54

CH39 (10 Harmonic of the frequency) 3



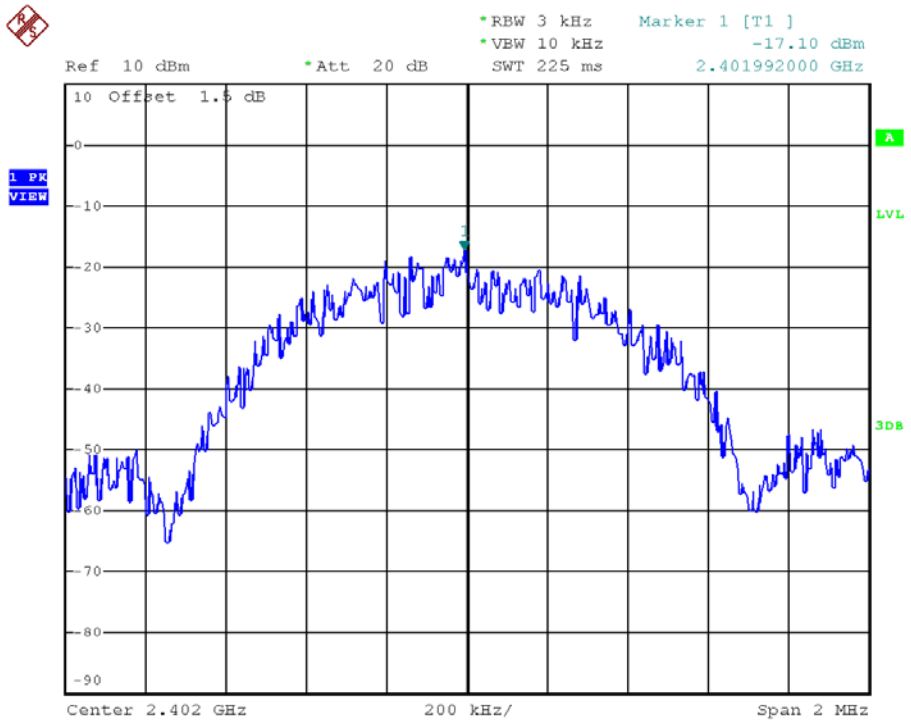
Date: 22.MAR.2018 14:04:02

APPENDIX H - POWER SPECTRAL DENSITY TEST

Test Mode:	CH00, CH19 , CH39 - 1Mbps

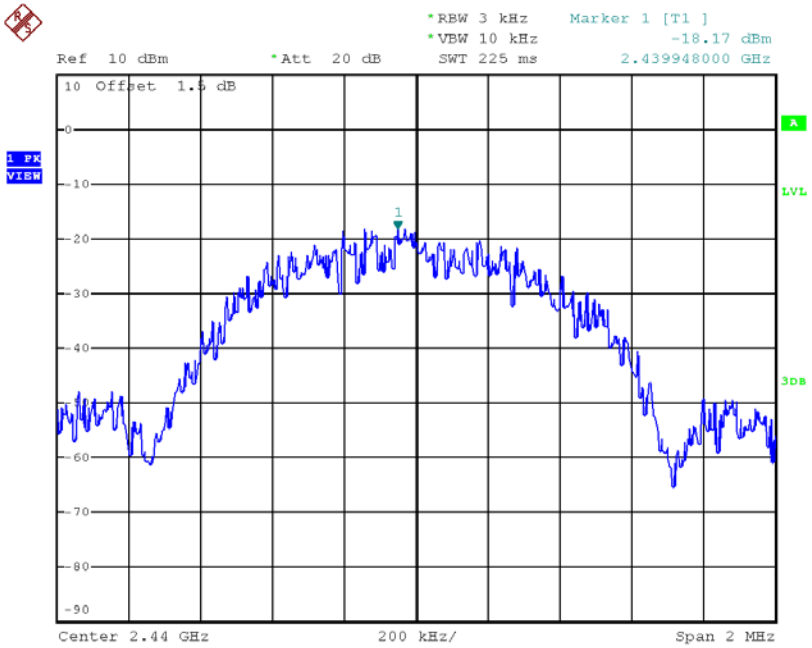
Frequency (MHz)	Power Density (dBm/3kHz)	Power Density (mW/3kHz)	Max. Limit (dBm/3kHz)	Test Result
2402	-17.100	0.019	8.00	Pass
2440	-18.170	0.015	8.00	Pass
2480	-18.220	0.015	8.00	Pass

TX CH00



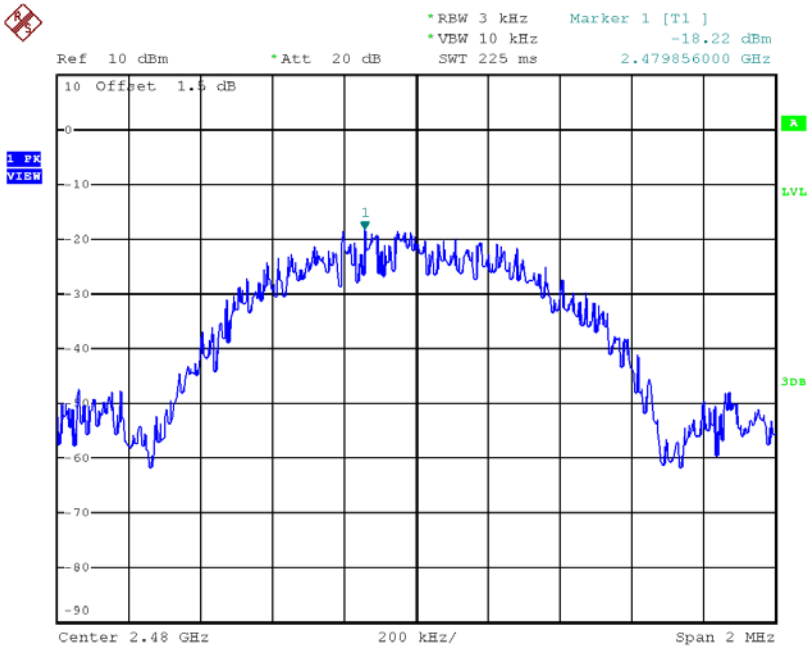
Date: 22.MAR.2018 14:00:58

TX CH19



Date: 22.MAR.2018 14:09:24

TX CH39



Date: 22.MAR.2018 14:04:08