FCC Radio Test Report

FCC ID: SLB-SG70

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

Project No.	:	1711068
Equipment	:	Solar Gateway
Test Model	:	SG-70
Series Model	:	N/A
Applicant	:	SINBON Electronics Co., Ltd
Address	:	4F-13, No.79, Sec.1, Hsin Tai Wu Rd., Hsi Chih, New Taipei City, 22101 Taiwan

Date of Receipt	:	Nov. 17, 2017
Date of Test	:	Nov. 17, 2017 ~ Nov. 24, 2017
Issued Date	:	Nov. 28, 2017
Tested by	:	BTL Inc.

Testing Engineer : (Kay Wu)

Technical Manager : (James Chiu)

Authorized Signatory : (Andy Chiu)

BTL INC.

No.18, Ln. 171, Sec. 2, Jiuzong Rd.,
Neihu Dist., Taipei City, Taiwan (R.O.C.)
TEL:+886-2-2657-3299 FAX: +886-2-2657-3331

Testing Laboratory
0659

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).

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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

Table of Contents Page

REPORT ISSUED HISTORY

Issued No.	Description	Issued Date
BTL-FCCP-1-1711068	Original Issue.	Nov. 28, 2017

1. CERTIFICATION

Equipment	:	Solar Gateway
Brand Name	:	SINBON
Test Model	:	SG-70
Series Model	:	N/A
Applicant	:	SINBON Electronics Co., Ltd
Manufacturer	:	SINBON Electronics Co., Ltd
Address	:	4F-13, No.79, Sec.1, Hsin Tai Wu Rd., Hsi Chih, New Taipei City, 22101 Taiwan
Factory	:	Jiangyin SINBON Electronics Co., Ltd
Address	:	No.288,Chengjiang Middle Rd.,Jiangyin Economic Development Zone,Jiangsu Province,China
Date of Test	:	Nov. 17, 2017 ~ Nov. 24, 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 in compliance with the requirement of the relative standards by BTL Inc.
The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-FCCP-1-1711068) 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 Emissions	PASS	
15.247(d)	Antenna conducted Spurious Emissions	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	
15.209/15.205	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:

Conducted emission Test:

C05: (VCCI RN: C-4742; FCC RN:965108; FCC DN:TW1082)
No. 68-1, Ln. 169, Sec.2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan

Radiated emission Test (Below 1 GHz):

CB15: (FCC RN:674415; FCC DN:TW0659)
No. 68-1, Ln. 169, Sec.2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan

Radiated emission Test (Above 1 GHz):

CB15: (FCC RN:674415; FCC DN:TW0659)
No. 68-1, Ln. 169, Sec.2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan

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 ± 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 emission test:

Test Site	Method	Measurement Frequency Range	U,(dB)
C05	CISPR	150 kHz ~ 30MHz	2.68

B. Radiated emission test:

Test Site	Method	Measurement Frequency Range	U,(dB)
CB15 (3m)	CISPR	9kHz ~ 150kHz	2.82
		150kHz ~ 30MHz	2.58

Test Site	Method	Measurement Frequency Range	Ant. H / V	U,(dB)
CB15 (3m)	CISPR	30MHz ~ 200MHz	V	4.20
		30MHz ~ 200MHz	H	3.64
		200MHz ~ 1,000MHz	V	4.56
		200MHz ~ 1,000MHz	H	3.90

Test Site	Method	Measurement Frequency Range	Ant. H / V	U,(dB)
CB15 (3m)	CISPR	1GHz ~ 6GHz	V	4.46
		1GHz ~ 6GHz	H	4.40
		6GHz ~ 18GHz	V	3.88
		6GHz ~ 18GHz	H	4.00

Test Site	Method	Measurement Frequency Range	U,(dB)
CB15 (1m)	CISPR	18 ~ 26.5 GHz	4.62
		26.5 ~ 40 GHz	5.12

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Equipment	Solar Gateway	
Brand Name	SINBON	
Test Model	SG-70	
Series Model	N/A	
Model Difference	N/A	
Power Source	DC Voltage supplied from POE adapter	
Power Rating	I/P: AC 100-240V, 50-60Hz, 0.55A O/P: DC 48V, 0.5A	
Products Covered	1 * POE adapter(optional): ALFA / A OE48v-1G	
Product Description	Operation Frequency	2405~2475 MHz
	Modulation Technology	O-QPSK
	Bit Rate of Transmitter	250Kbps
	Output Power (Max.)	14.85 dBm

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)
11	2405	19	2445
12	2410	20	2450
13	2415	21	2455
14	2420	22	2460
15	2425	23	2465
16	2430	24	2470
17	2435	25	2475
18	2440		

3. Table for Filed Antenna:

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	Joymax	IWX-1511RSXX-999	Dipole	Reverse SMA	5

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 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 TEST SOFTWARE

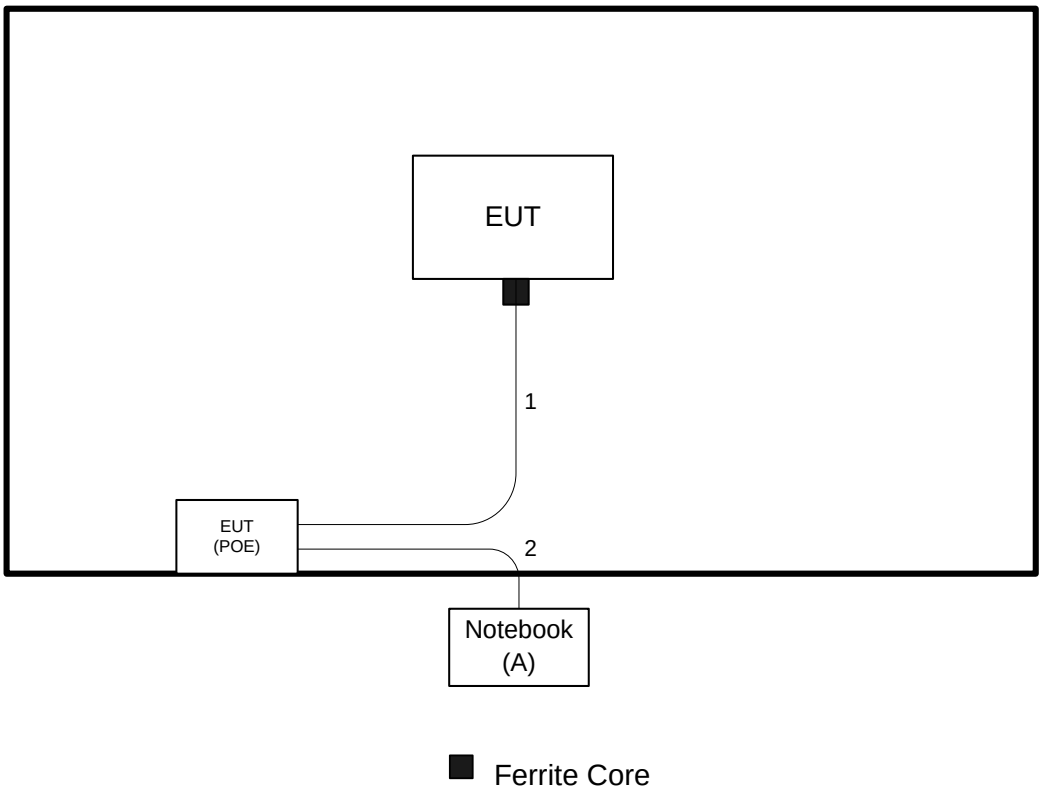
SG-70 Zigbee operation mode: The EUT transmitting mode be controlled via NB, USB cable & test fixture, the setup equipments will be removed after EUT transmitting normally.

3.4 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 IEEE 802.15.4.

Test Software Version	Putty		
Frequency (MHz)	2405	2440	2475
IEEE 802.15.4	2	2	2

3.5 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



3.6 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	ASUS	X450J	QDS-BRCM1063	N/A

Item	Shielded Type	Ferrite Core	Length	Note
1	NO	YES	1.0m	RJ45
2	NO	NO	4.0m	RJ45

Item	Equipment	Mfr/Brand	Model/Type No.	SPEC.	Note
-	Ferrite Core	KING CORE ELECTRONICS INC.	KCF-130-B	31.5±1.0mm* 31.0±1.0mm* 32.5±1.0mm	N/A

Note:

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

4. EMC EMISSIONS TEST

4.1 CONDUCTED EMISSIONS MEASUREMENT

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

Frequency of Emissions (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 = 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

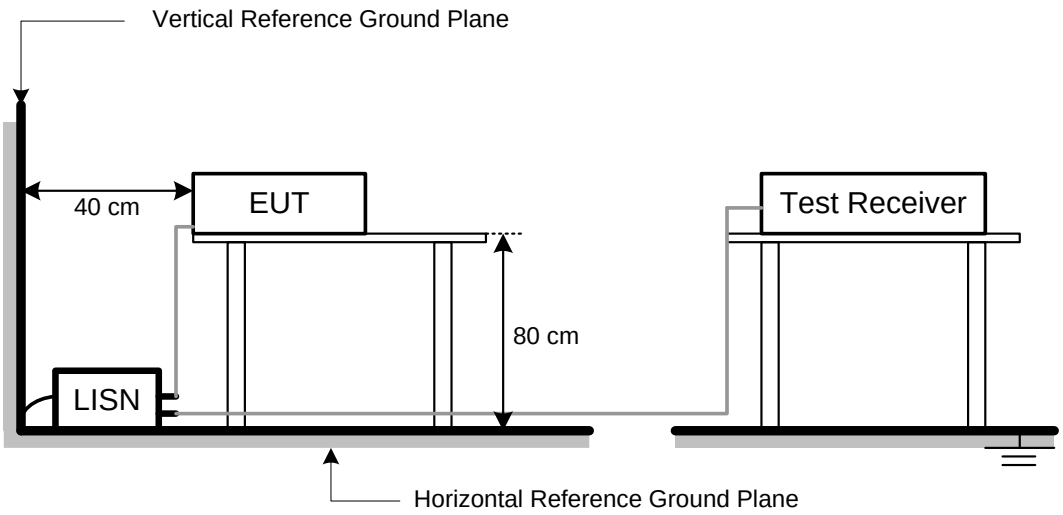
4.1.2 TEST PROCEDURE

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 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



4.1.5 EUT OPERATING CONDITIONS

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

4.1.6 EUT TEST CONDITIONS

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

4.1.7 TEST RESULTS

Please refer to the 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 EMISSIONS MEASUREMENT

4.2.1 RADIATED EMISSIONS 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 EMISSIONS 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 EMISSIONS 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 15, Subpart C.

(2) The tighter limit applies at the band edges.

(3) Emissions level (dBuV/m)=20log Emissions 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 (Emissions in restricted band)	RBW 1MHz VBW 3MHz peak detector for Pk value RMS detector for AV value

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW (Emissions in restricted band)	1MHz / 3MHz for Peak, 1MHz / 1/T for Average

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

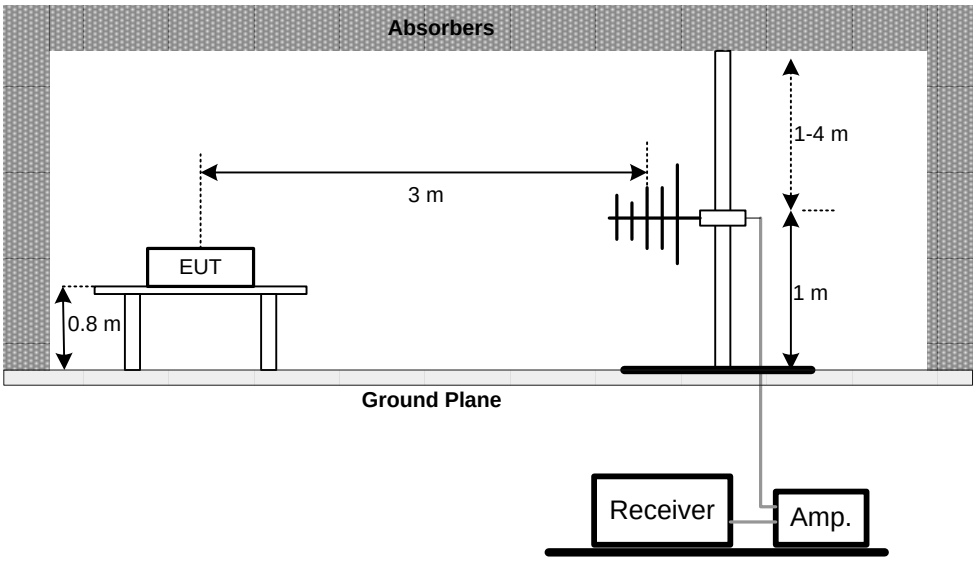
a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
b. The measuring distance 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 1.5 m, the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
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

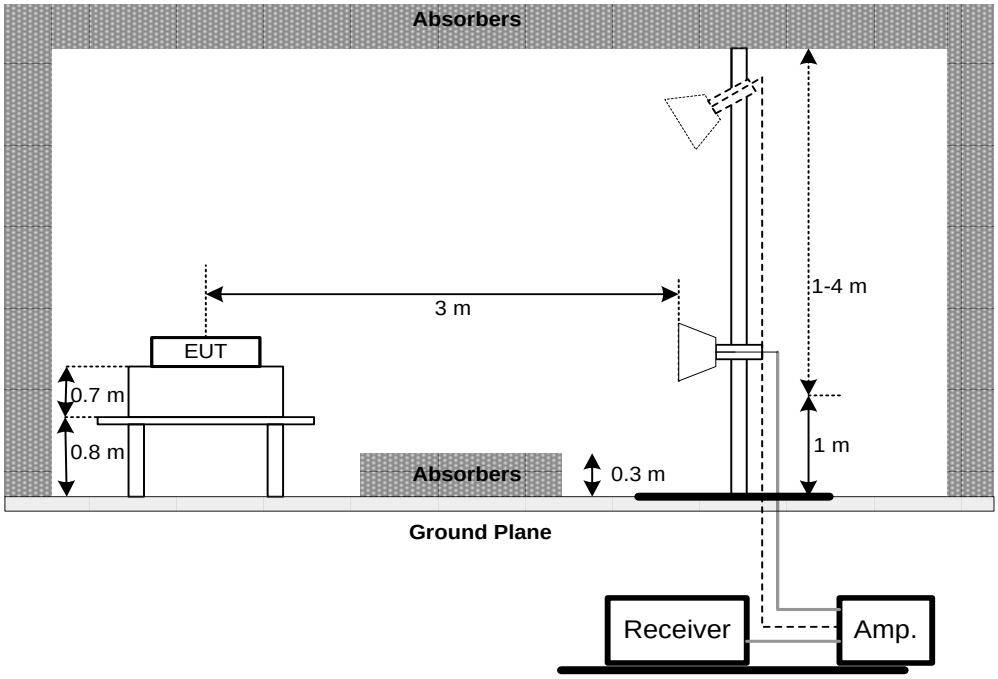
No deviation

4.2.4 TEST SETUP

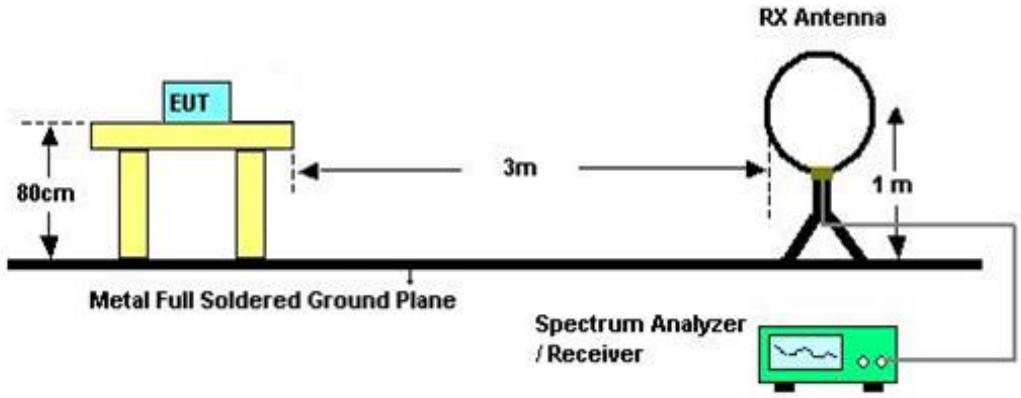
(A) Radiated Emissions Test Set-Up Frequency Below 1 GHz



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



(C) For radiated emissions below 30MHz



4.2.5 EUT TEST CONDITIONS

Temperature: 23°C / 25°C
Relative Humidity: 70% / 45%
Test Voltage: AC 120V/60Hz

4.2.6TEST 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.

4.2.7TEST RESULTS (BETWEEN 30MHZ TO 1000 MHZ)

Please refer to the Appendix C.

Remark:

(1) Measuring frequency range from 30MHz to 1000MHz.
(2) If the peak scan value lower limit more than 20dB, then this signal data does not show in table.

4.2.8TEST RESULTS (ABOVE 1000 MHZ)

Please refer to the Appendix D.

Remark:

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

5. 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: 25°C
Relative Humidity: 55%
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

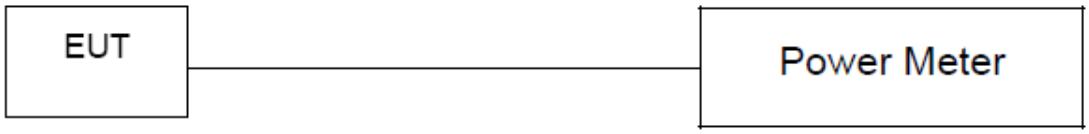
6.1.1 TEST PROCEDURE

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 v03r05.

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: 55%
Test Voltage: AC 120V/60Hz

6.1.6 TEST RESULTS

Please refer to the Appendix F.

7. ANTENNA CONDUCTED SPURIOUS EMISSIONS

7.1 APPLIED PROCEDURES / LIMIT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

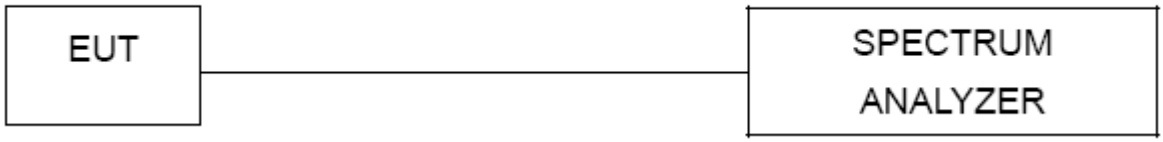
7.1.1 TEST PROCEDURE

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: 25°C
Relative Humidity: 55%
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

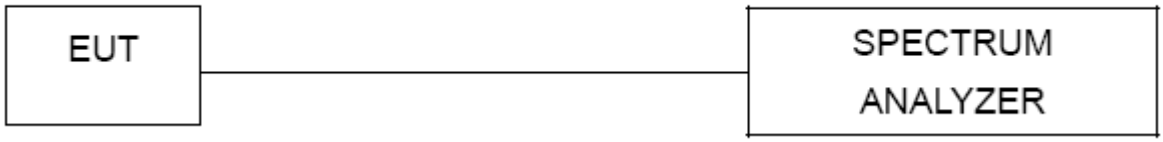
8.1.1 TEST PROCEDURE

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

8.1.6 TEST RESULTS

Please refer to the Appendix H.

9. MEASUREMENT INSTRUMENTS LIST

Conducted Emissions Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	TWO-LINE V-NETWORK	R&S	ENV216	101050	Jan. 25, 2018
2	Test Cable	TIMES	CFD300-NL	C02	Jun. 14, 2018
3	EMI Test Receiver	R&S	ESR7	101433	Dec. 09, 2017
4	Measurement Software	EZ	EZ_EMC (Version NB-03A)	N/A	N/A

Radiated Emissions Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Preamplifier	EMCI	012645B	980267	Feb. 28, 2018
2	Preamplifier	EMCI	EMC02325	980217	Dec. 29, 2017
3	Test Cable	EMCI	EMC104-SM-SM-8000	8m	Jan. 04, 2018
4	Test Cable	EMCI	EMC104-SM-SM-800	150207	Jan. 04, 2018
5	Test Cable	EMCI	EEMC104-SM-SM-3000	151205	Jan. 04, 2018
6	MXE EMI Receiver	Agilent	N9038A	MY55420127	Jan. 09, 2018
7	Signal Analyzer	Agilent	N9010A	MY52220990	Feb. 22, 2018
8	Loop Ant	EMCI	LPA600	274	May 04, 2018
9	Horm Ant	SCHWARZBECK	BBHA 9120D	9120D-1342	Feb. 28, 2018
10	Horm Ant	Schwarzbeck	BBHA 9170	187	Dec. 07, 2017
11	Trilog-Broadband Antenna	Schwarzbeck	VULB 9168	9168-548	Jan. 16, 2018
12	5dB Attenuator	EMCI	EMCI-N-6-05	AT-N0623	Jan. 16, 2018

6dB Bandwidth Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	R&S/FSP30	100854	May 25, 2018

Peak Output Power Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	R&S/FSP30	100854	May 25, 2018
2	Power Meter	Anritsu	ML2495A	1128008	Aug. 16, 2018
3	Power Sensor	Anritsu	MA2411B	1126001	Aug. 16, 2018

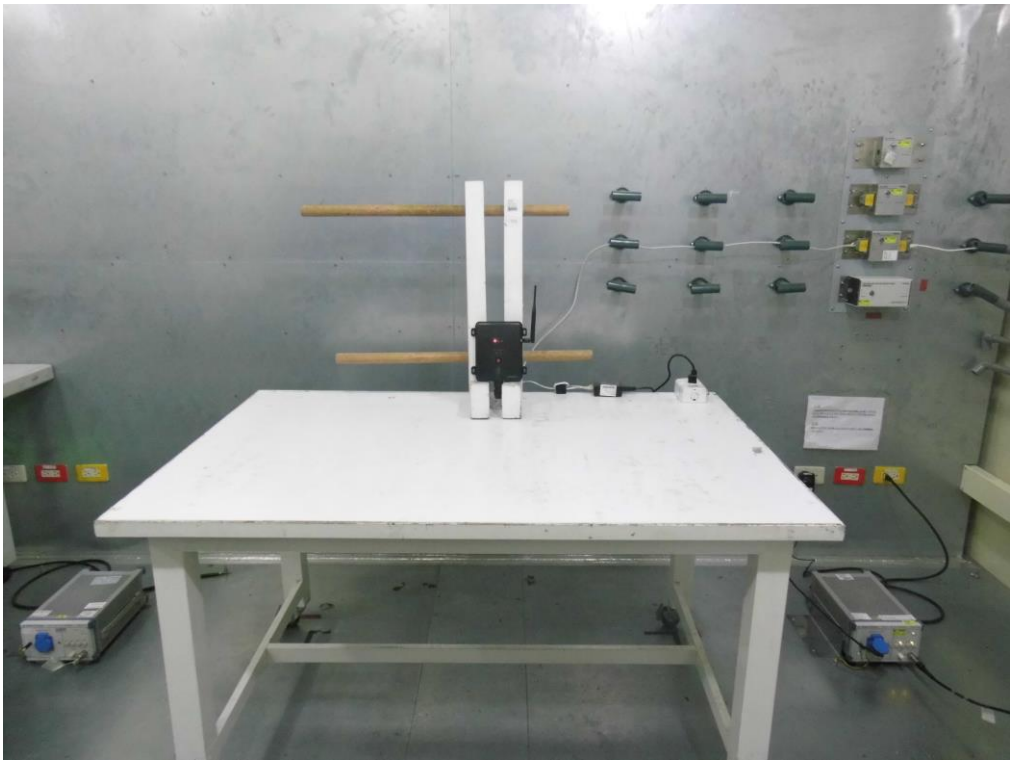
Antenna Conducted Spurious Emissions Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	R&S/FSP30	100854	May 25, 2018

Power Spectral Density Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	R&S/FSP30	100854	May 25, 2018

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

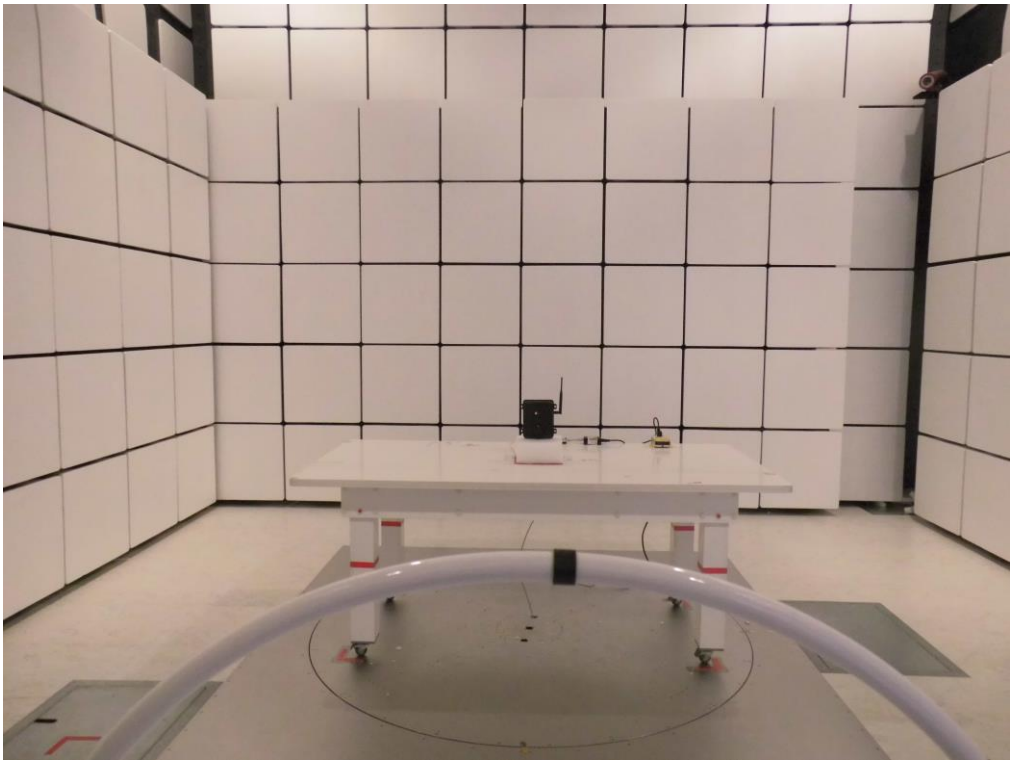
10. EUT TEST PHOTO

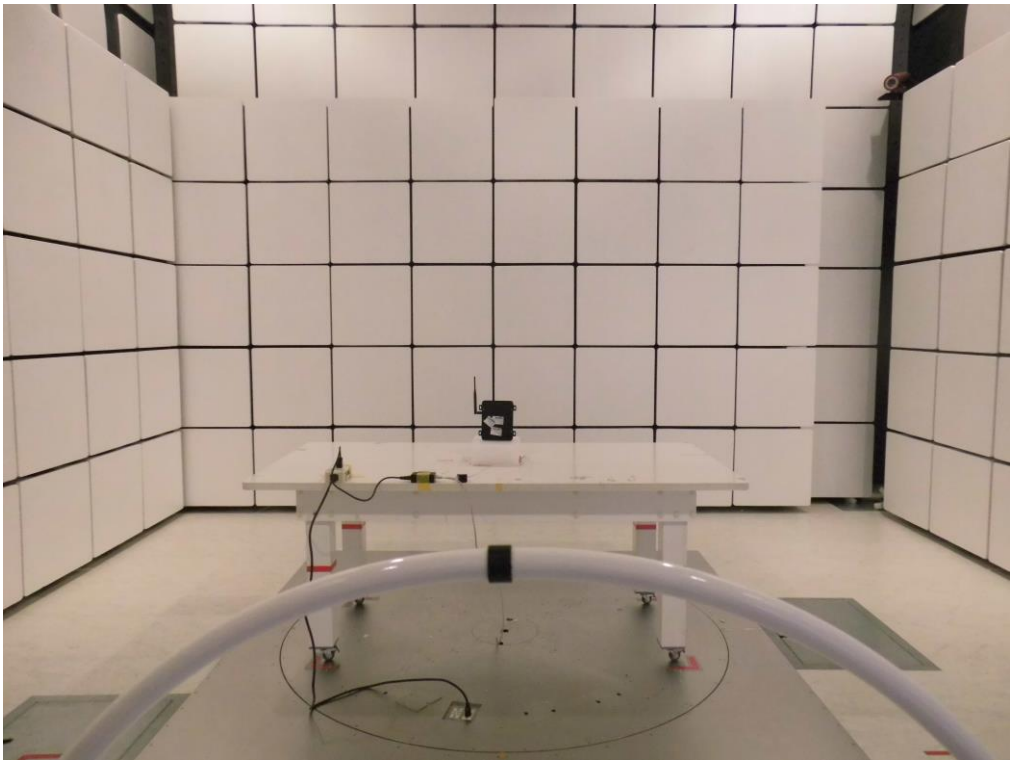
Conducted Measurement Photos



Radiated Measurement Photos

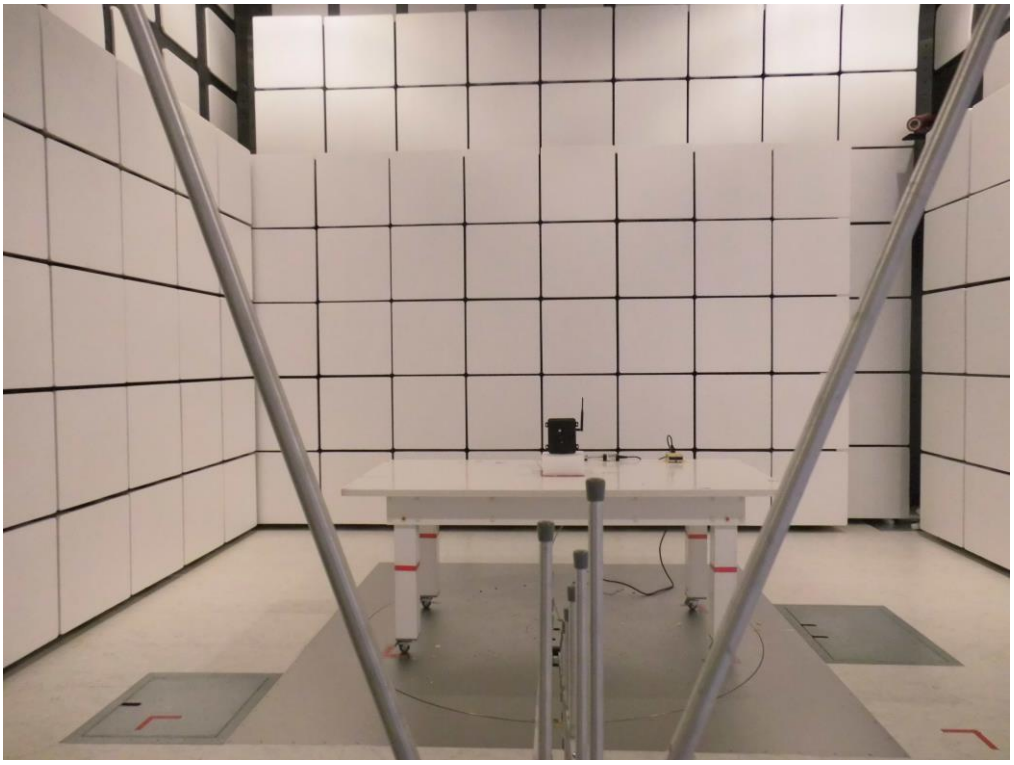
9KHz to 30MHz

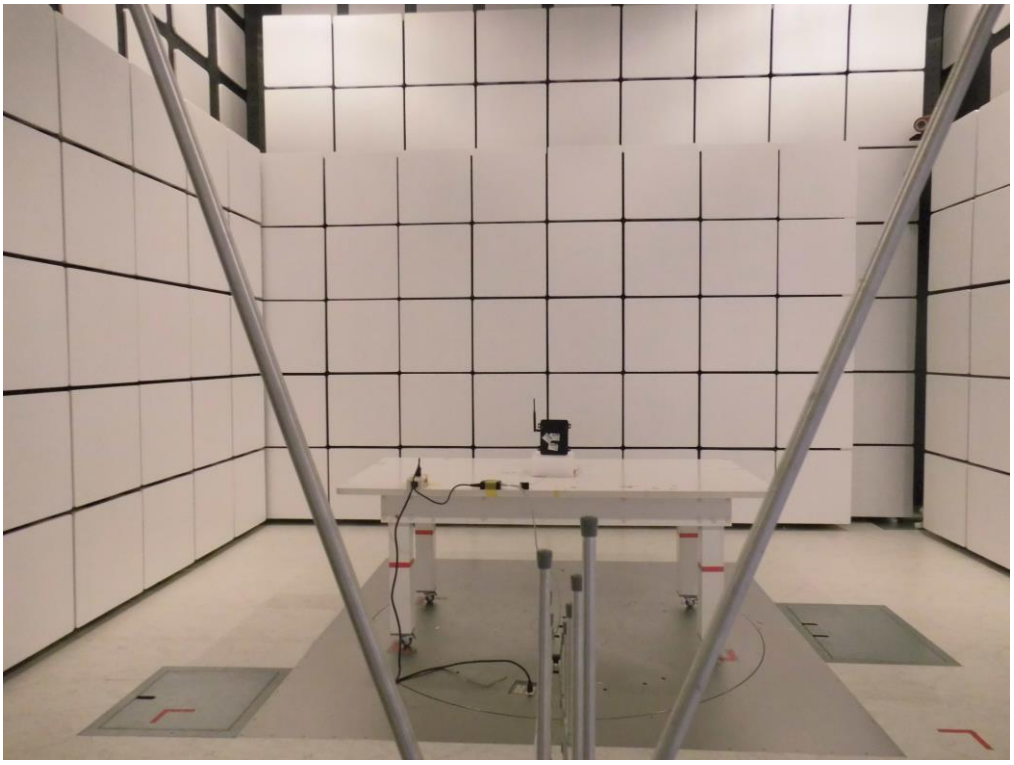




Radiated Measurement Photos

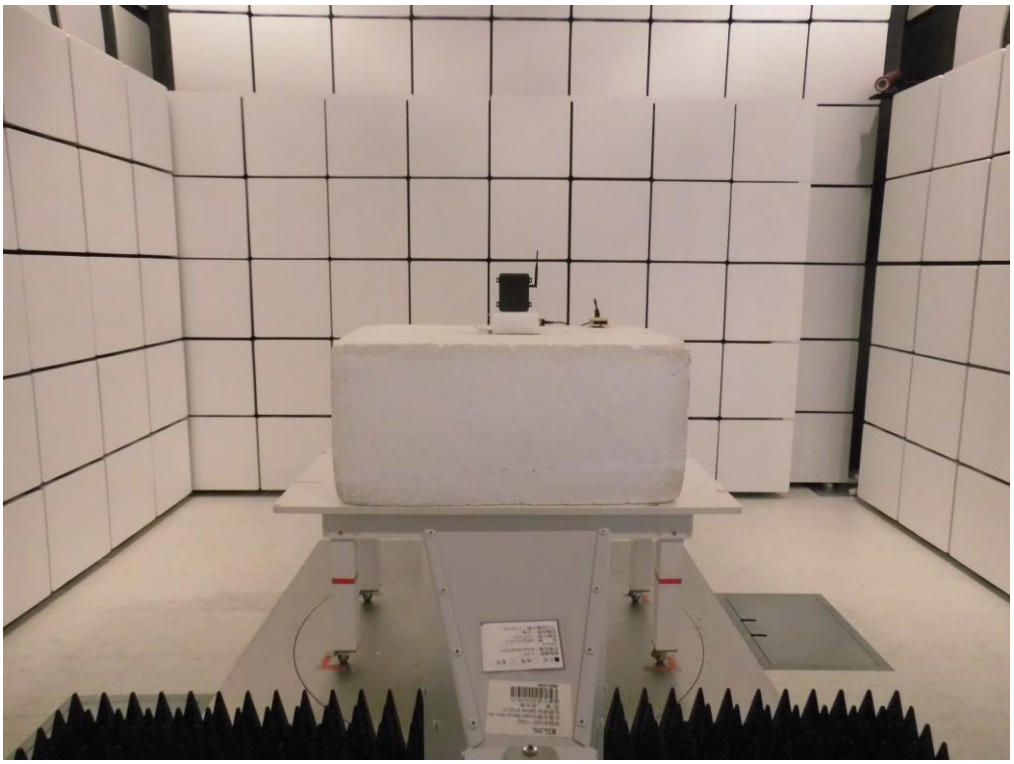
30M to 1000MHz

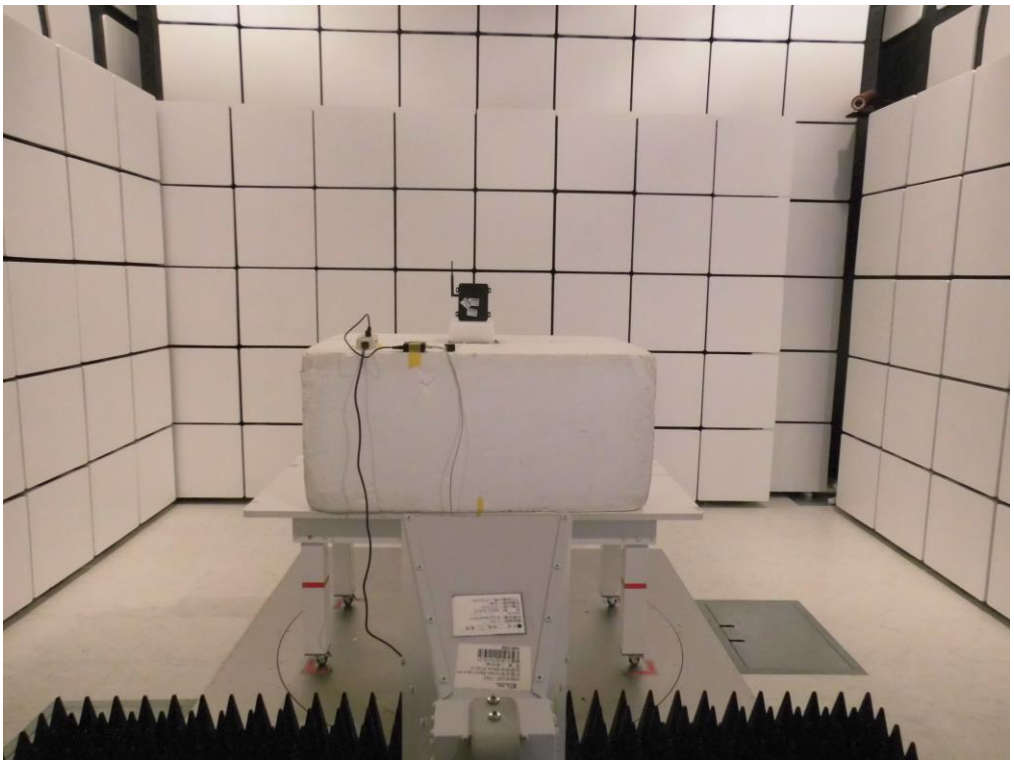




Radiated Measurement Photos

Above 1000MHz

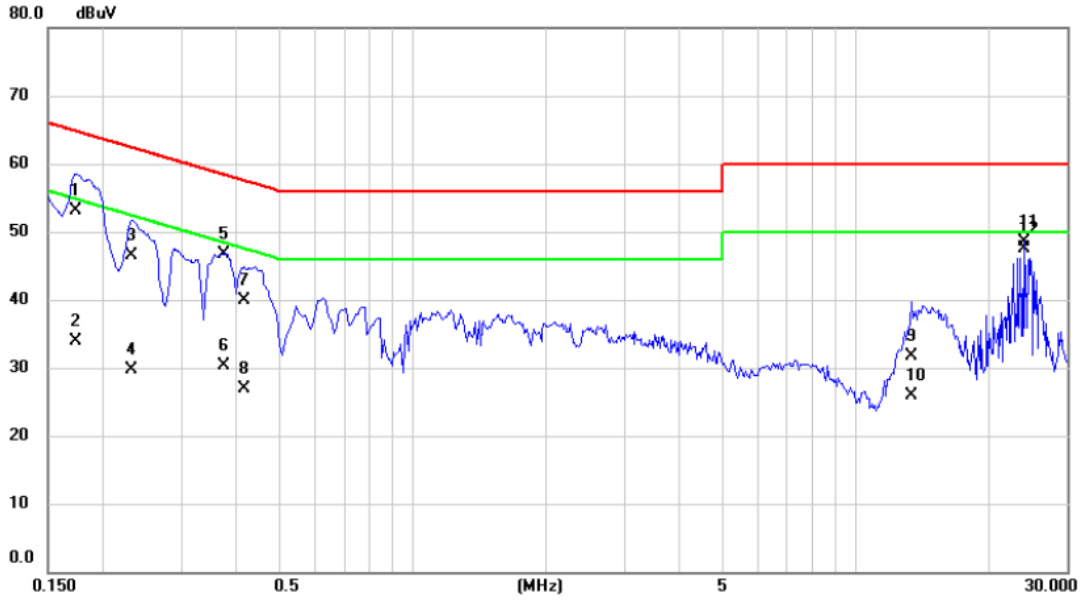




APPENDIX A - CONDUCTED EMISSIONS

Test Mode:	TX Mode

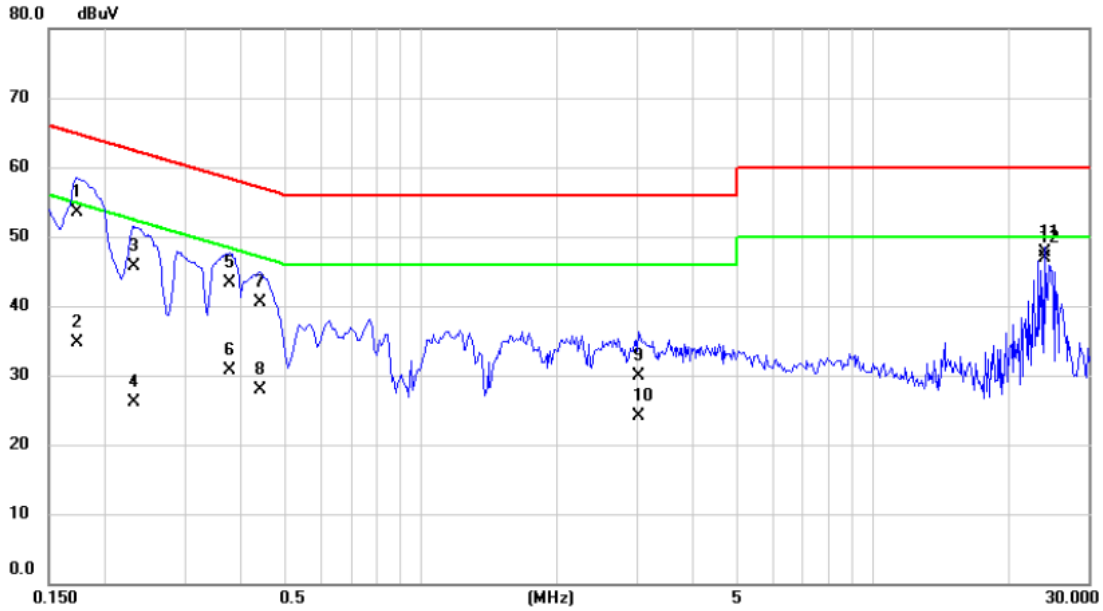
Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1731	43.30	9.72	53.02	64.81	-11.79	QP	
2		0.1731	24.20	9.72	33.92	54.81	-20.89	AVG	
3		0.2320	36.70	9.72	46.42	62.38	-15.96	QP	
4		0.2320	19.90	9.72	29.62	52.38	-22.76	AVG	
5		0.3747	37.00	9.73	46.73	58.40	-11.67	QP	
6		0.3747	20.50	9.73	30.23	48.40	-18.17	AVG	
7		0.4174	30.20	9.74	39.94	57.50	-17.56	QP	
8		0.4174	17.20	9.74	26.94	47.50	-20.56	AVG	
9		13.3500	21.80	9.98	31.78	60.00	-28.22	QP	
10		13.3500	15.90	9.98	25.88	50.00	-24.12	AVG	
11		24.0000	38.50	9.92	48.42	60.00	-11.58	QP	
12	*	24.0000	37.60	9.92	47.52	50.00	-2.48	AVG	

Test Mode:	TX Mode

Neutral

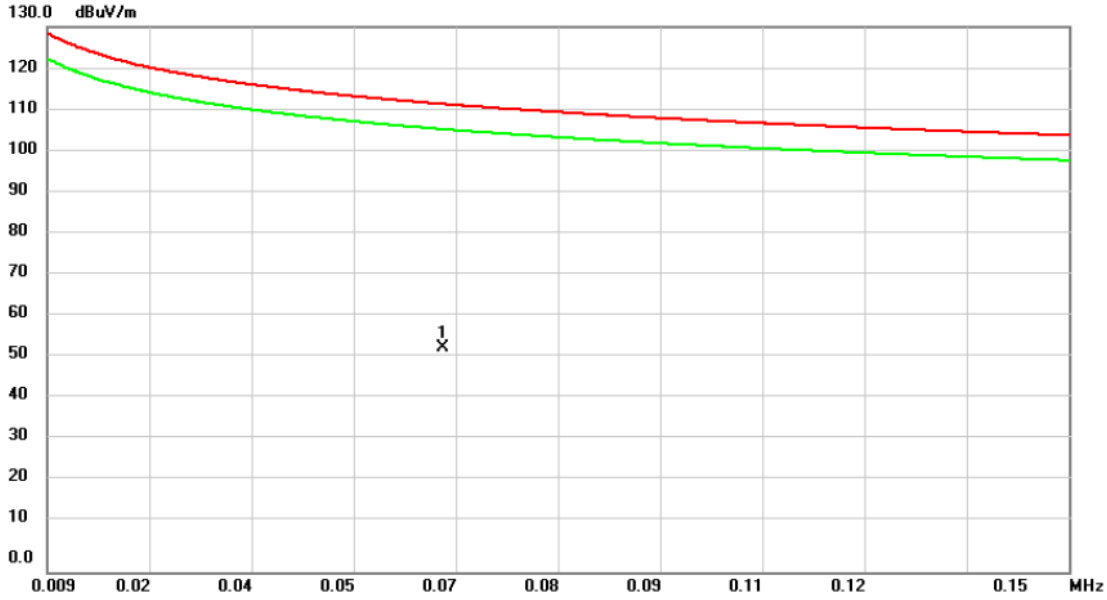


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1731	43.90	9.65	53.55	64.81	-11.26	QP	
2		0.1731	25.10	9.65	34.75	54.81	-20.06	AVG	
3		0.2312	36.00	9.66	45.66	62.41	-16.75	QP	
4		0.2312	16.40	9.66	26.06	52.41	-26.35	AVG	
5		0.3782	33.60	9.67	43.27	58.32	-15.05	QP	
6		0.3782	21.00	9.67	30.67	48.32	-17.65	AVG	
7		0.4412	30.90	9.68	40.58	57.04	-16.46	QP	
8		0.4412	18.30	9.68	27.98	47.04	-19.06	AVG	
9		3.0290	20.10	9.74	29.84	56.00	-26.16	QP	
10		3.0290	14.40	9.74	24.14	46.00	-21.86	AVG	
11		24.0000	37.70	10.01	47.71	60.00	-12.29	QP	
12	*	24.0000	36.80	10.01	46.81	50.00	-3.19	AVG	

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

Test Mode:	TX Mode

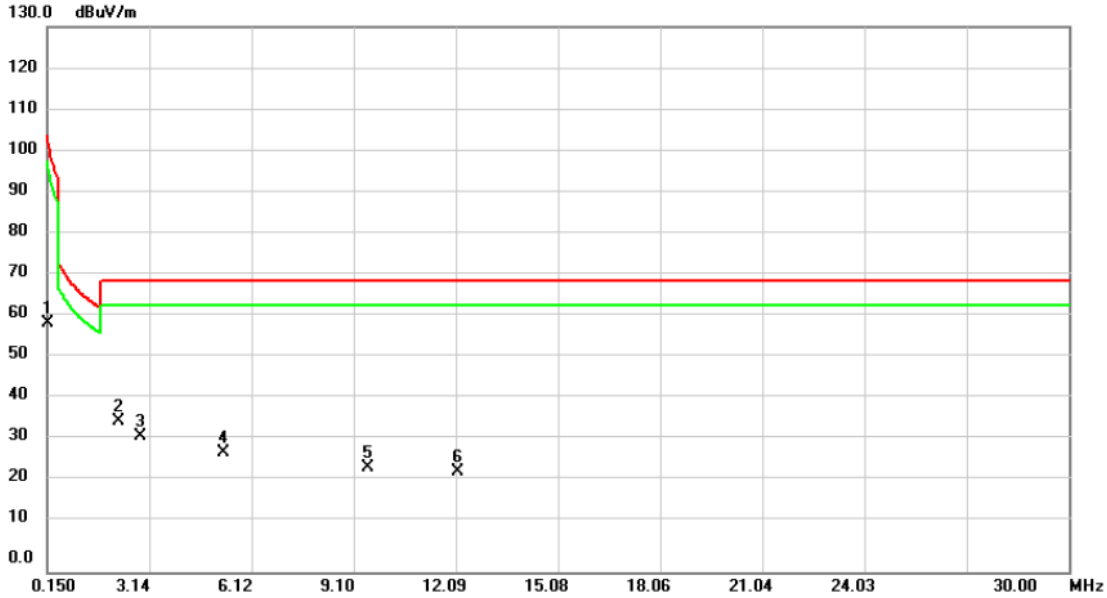
90



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	0.0637	40.61	12.75	53.36	111.52	-58.16	peak	

Test Mode:	TX Mode

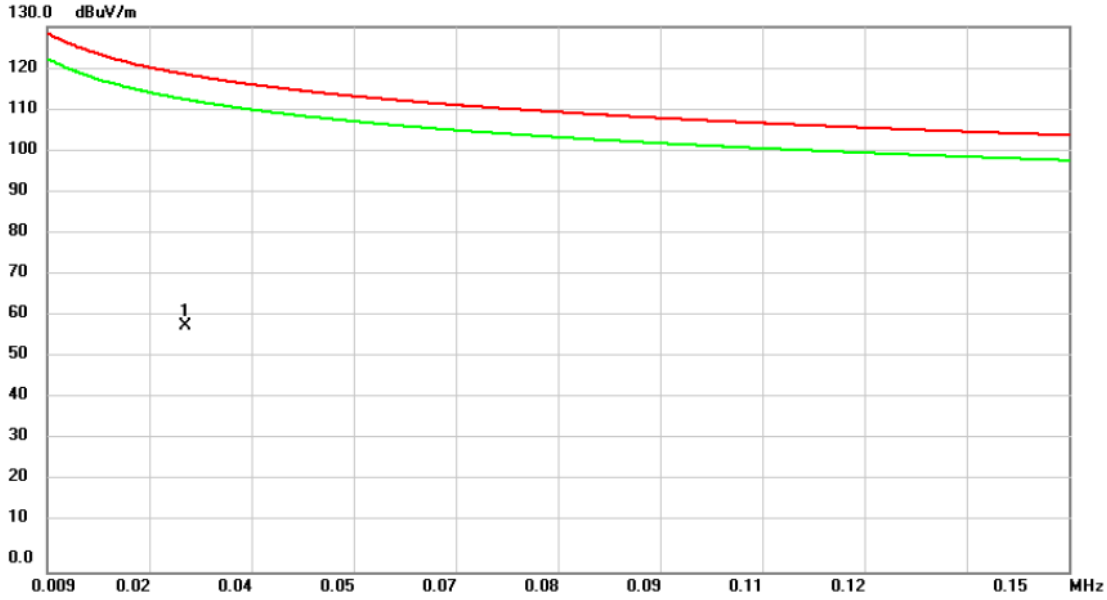
90



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		0.1500	47.16	12.03	59.19	104.08	-44.89	peak	
2	*	2.2395	24.62	11.44	36.06	69.54	-33.48	peak	
3		2.8664	21.25	11.16	32.41	69.54	-37.13	peak	
4		5.2842	16.97	11.39	28.36	69.54	-41.18	peak	
5		9.5228	13.44	11.31	24.75	69.54	-44.79	peak	
6		12.1493	12.61	11.24	23.85	69.54	-45.69	peak	

Test Mode:	TX Mode

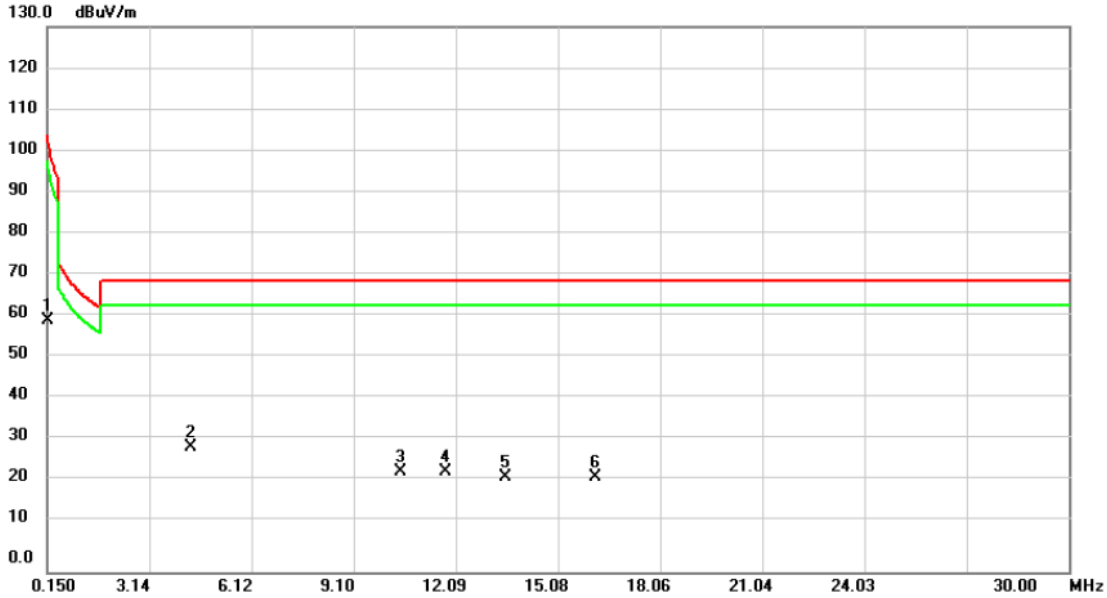
0



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	0.0280	43.17	15.55	58.72	118.66	-59.94	peak	

Test Mode:	TX Mode

0

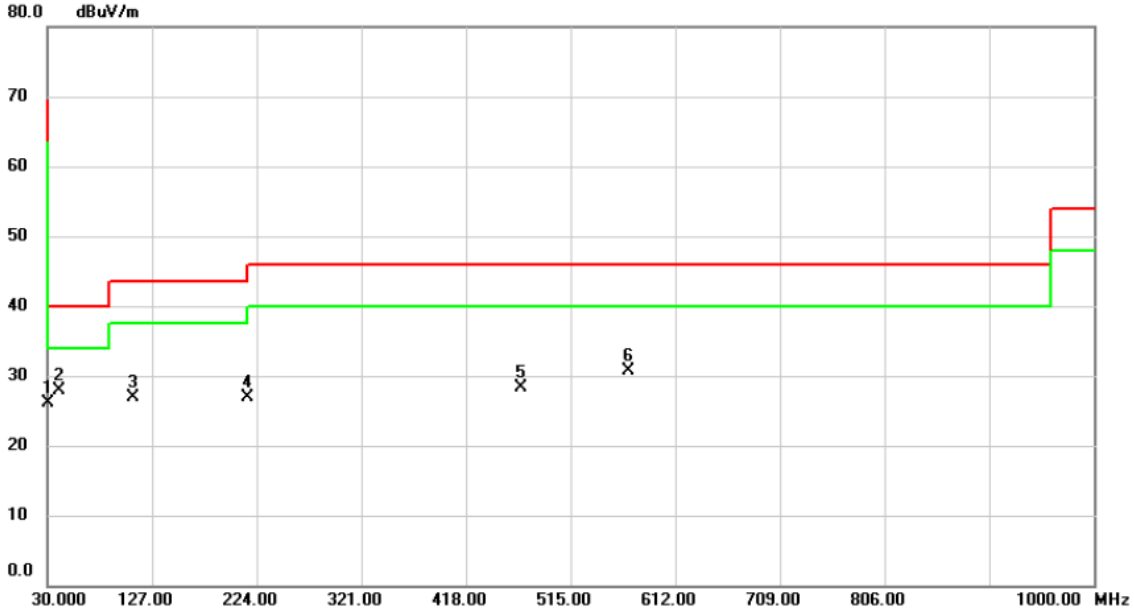


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		0.1500	47.93	12.03	59.96	104.08	-44.12	peak	
2	*	4.3290	18.38	11.30	29.68	69.54	-39.86	peak	
3		10.4780	12.56	11.29	23.85	69.54	-45.69	peak	
4		11.7911	12.65	11.25	23.90	69.54	-45.64	peak	
5		13.5228	11.24	11.19	22.43	69.54	-47.11	peak	
6		16.1794	11.63	11.11	22.74	69.54	-46.80	peak	

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

Test Mode:	TX Mode 2475MHz

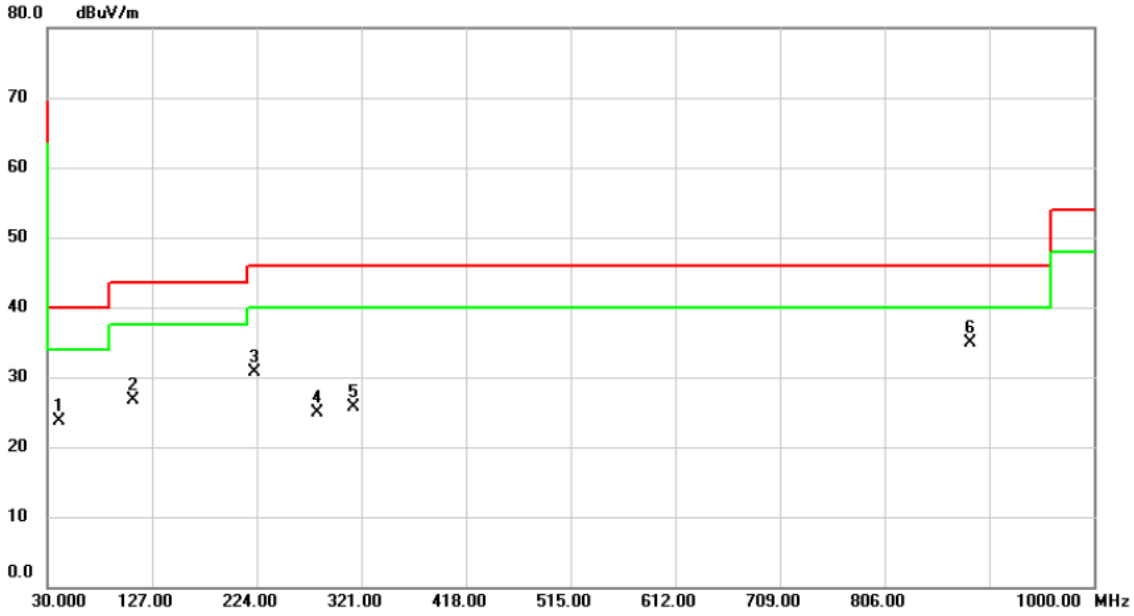
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		30.9700	35.28	-9.13	26.15	40.00	-13.85	peak	
2	*	40.6700	36.37	-8.51	27.86	40.00	-12.14	peak	
3		109.5400	37.74	-10.85	26.89	43.50	-16.61	peak	
4		215.2700	37.74	-10.87	26.87	43.50	-16.63	peak	
5		469.4100	31.64	-3.24	28.40	46.00	-17.60	peak	
6		568.3500	32.02	-1.24	30.78	46.00	-15.22	peak	

Test Mode:	TX Mode 2475MHz

Horizontal

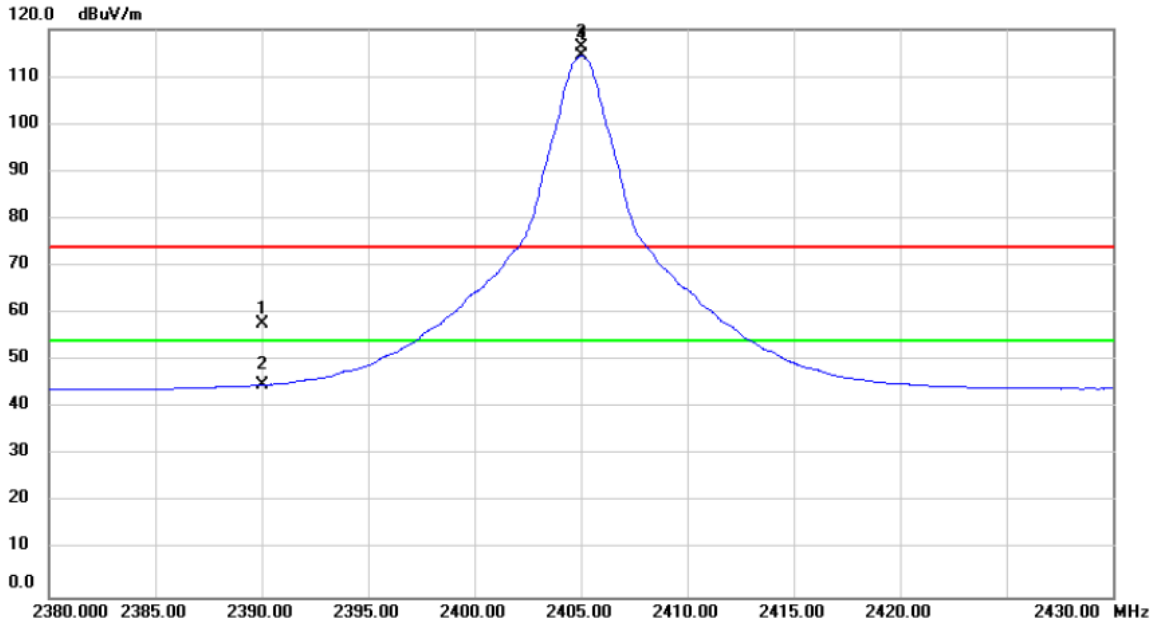


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		40.6700	32.31	-8.51	23.80	40.00	-16.20	peak	
2		109.5400	37.56	-10.85	26.71	43.50	-16.79	peak	
3		222.0600	41.29	-10.68	30.61	46.00	-15.39	peak	
4		280.2600	32.97	-8.02	24.95	46.00	-21.05	peak	
5		313.2400	32.78	-7.17	25.61	46.00	-20.39	peak	
6	*	885.5400	30.97	3.86	34.83	46.00	-11.17	peak	

APPENDIX D - RADIATED EMISSIONS (ABOVE 1000MHZ)

Orthogonal Axis :	X
Test Mode :	TX 2405MHz

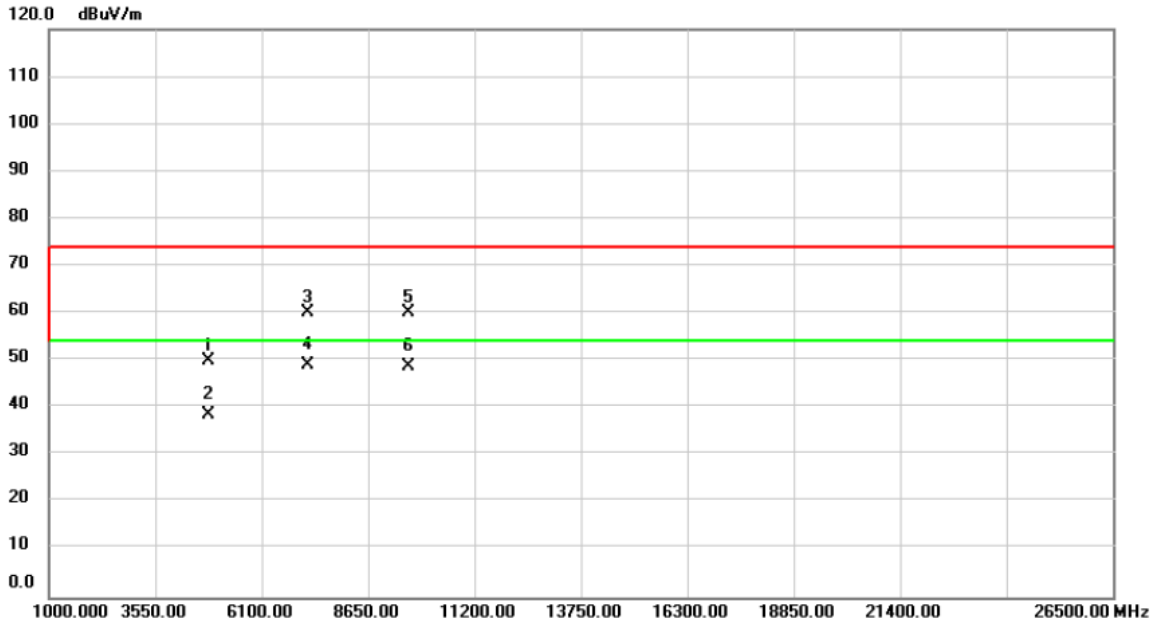
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2390.000	26.55	31.06	57.61	74.00	-16.39	peak	
2		2390.000	13.85	31.06	44.91	54.00	-9.09	AVG	
3	X	2405.000	85.19	31.12	116.31	74.00	42.31	peak	No Limit
4	*	2405.000	83.29	31.12	114.41	54.00	60.41	AVG	No Limit

Orthogonal Axis :	X
Test Mode :	TX 2405MHz

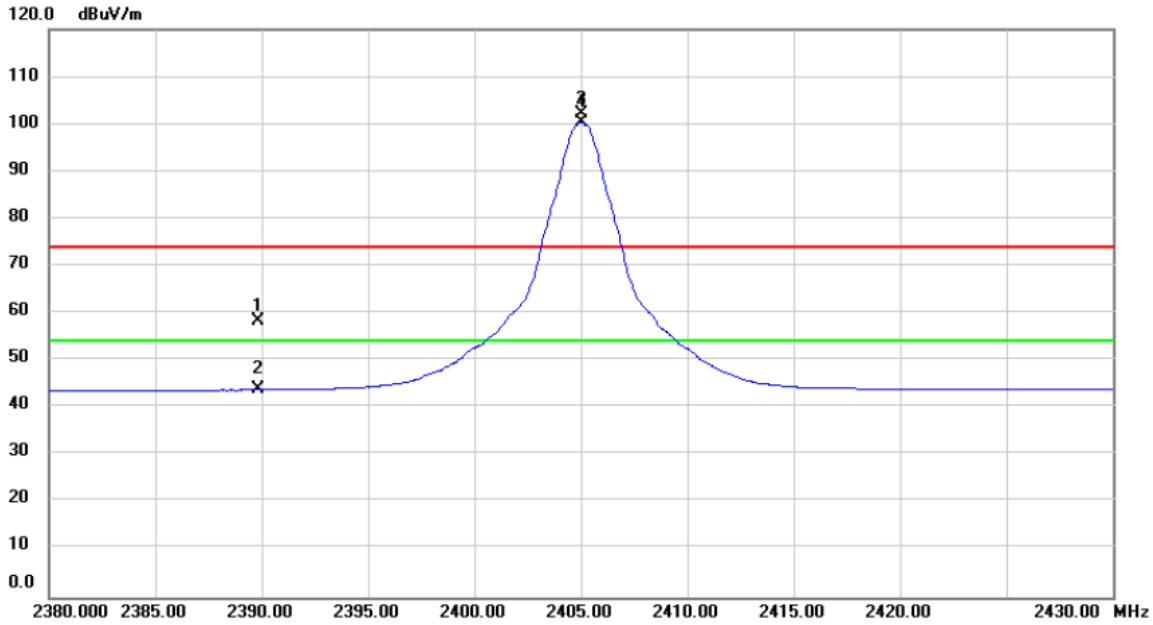
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4810.000	61.39	-11.39	50.00	74.00	-24.00	peak	
2		4810.000	49.92	-11.39	38.53	54.00	-15.47	AVG	
3		7215.000	65.78	-5.48	60.30	74.00	-13.70	peak	
4	*	7215.000	54.63	-5.48	49.15	54.00	-4.85	AVG	
5		9620.000	59.85	0.42	60.27	74.00	-13.73	peak	
6		9620.000	48.21	0.42	48.63	54.00	-5.37	AVG	

Orthogonal Axis :	X
Test Mode :	TX 2405MHz

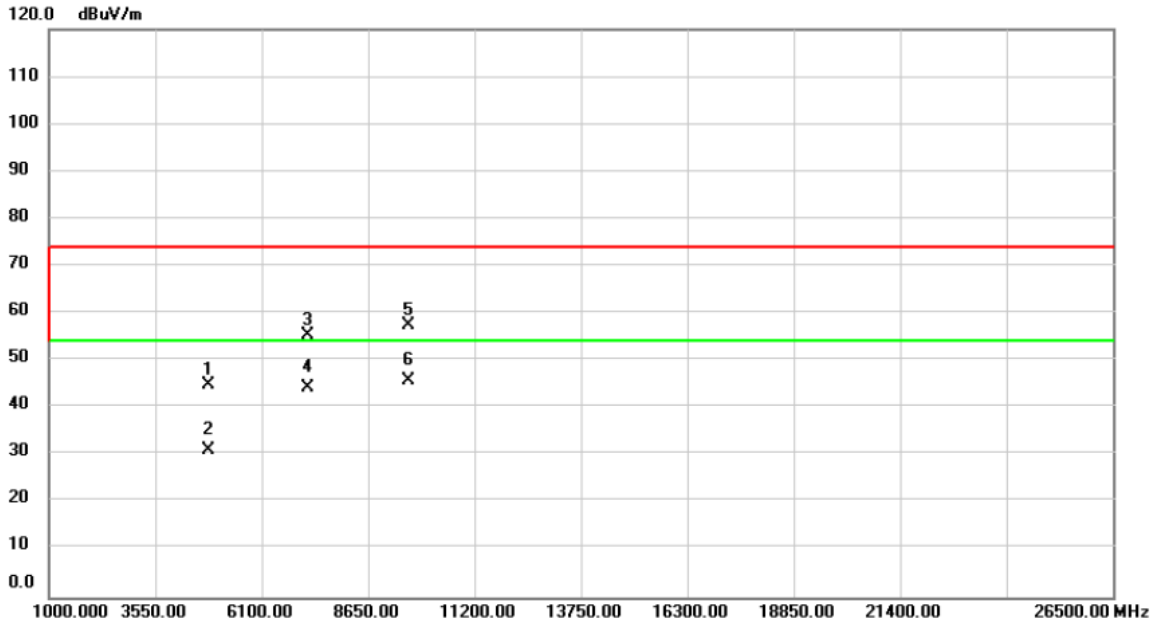
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2389.850	27.15	31.06	58.21	74.00	-15.79	peak	
2		2389.850	12.78	31.06	43.84	54.00	-10.16	AVG	
3	X	2405.000	71.14	31.12	102.26	74.00	28.26	peak	No Limit
4	*	2405.000	69.36	31.12	100.48	54.00	46.48	AVG	No Limit

Orthogonal Axis :	X
Test Mode :	TX 2405MHz

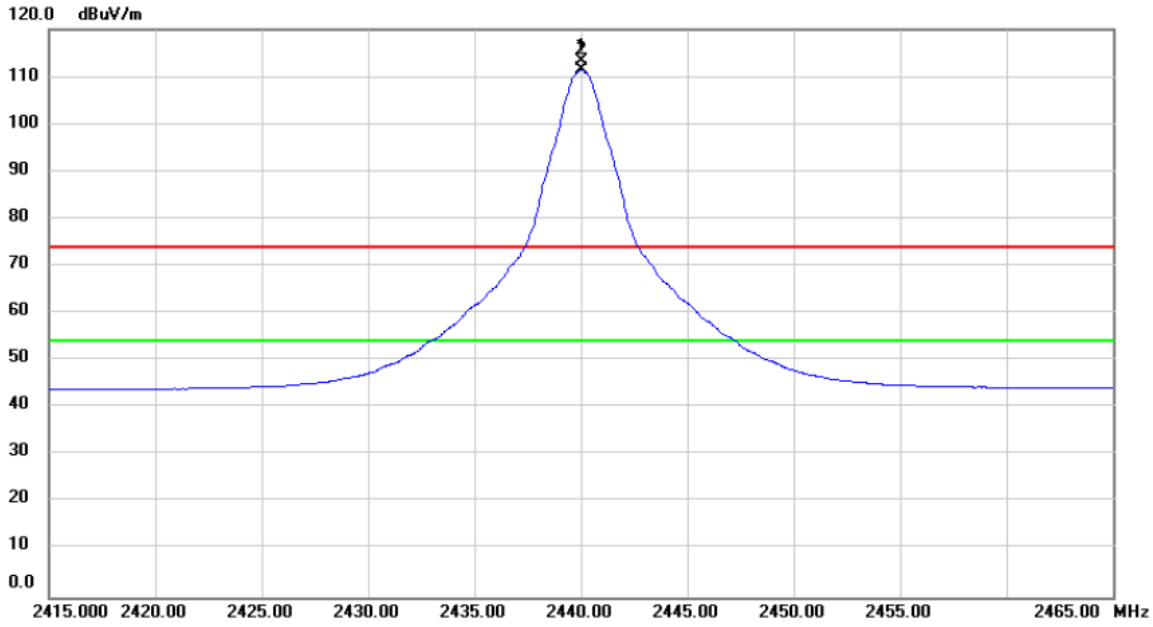
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4810.000	56.16	-11.39	44.77	74.00	-29.23	peak	
2		4810.000	42.52	-11.39	31.13	54.00	-22.87	AVG	
3		7215.000	60.78	-5.48	55.30	74.00	-18.70	peak	
4		7215.000	49.77	-5.48	44.29	54.00	-9.71	AVG	
5		9620.000	57.02	0.42	57.44	74.00	-16.56	peak	
6	*	9620.000	45.31	0.42	45.73	54.00	-8.27	AVG	

Orthogonal Axis :	X
Test Mode :	TX 2440MHz

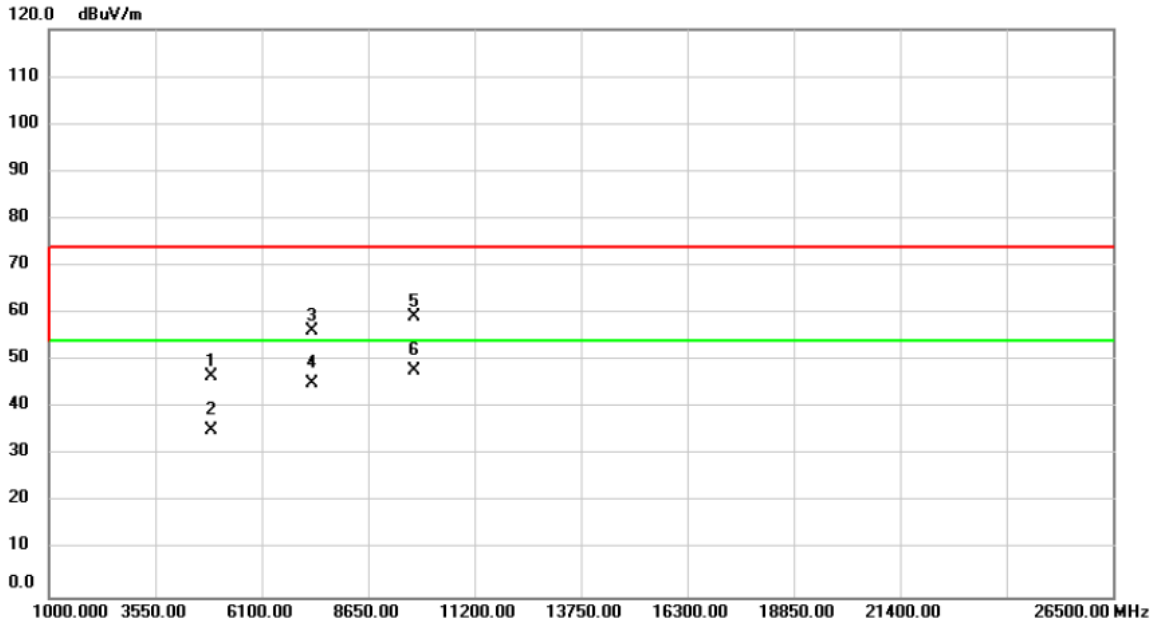
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	X	2440.000	82.02	31.25	113.27	74.00	39.27	peak	No Limit
2	*	2440.000	80.18	31.25	111.43	54.00	57.43	AVG	No Limit

Orthogonal Axis :	X
Test Mode :	TX 2440MHz

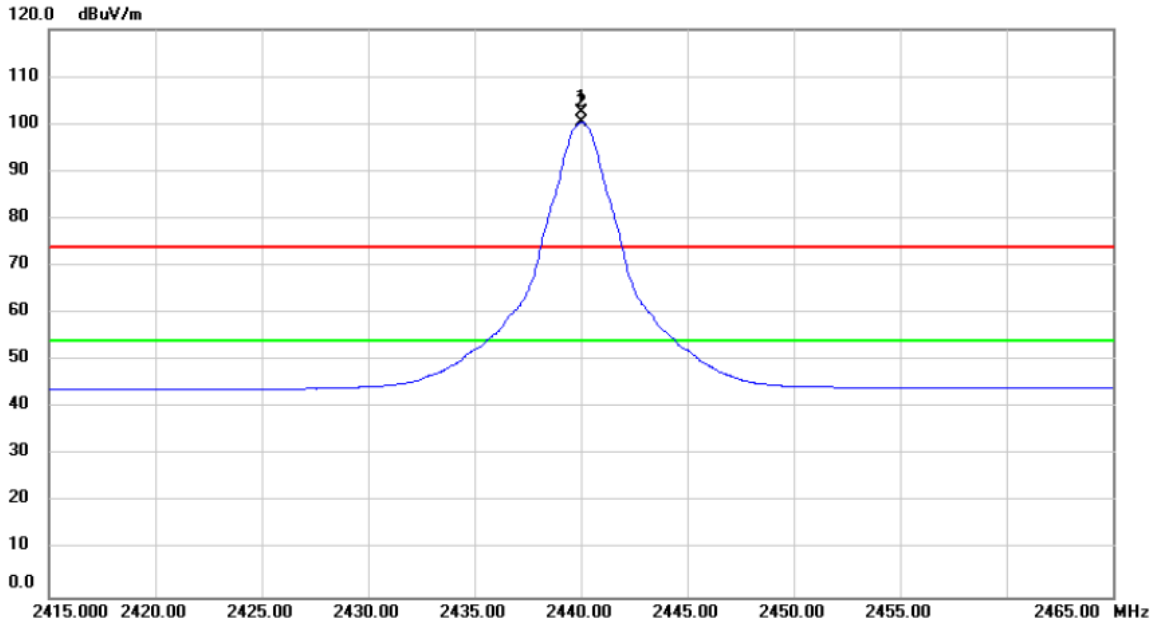
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4880.000	57.79	-11.28	46.51	74.00	-27.49	peak	
2		4880.000	46.49	-11.28	35.21	54.00	-18.79	AVG	
3		7320.000	61.31	-5.10	56.21	74.00	-17.79	peak	
4		7320.000	50.31	-5.10	45.21	54.00	-8.79	AVG	
5		9760.000	58.26	0.95	59.21	74.00	-14.79	peak	
6	*	9760.000	46.90	0.95	47.85	54.00	-6.15	AVG	

Orthogonal Axis :	X
Test Mode :	TX 2440MHz

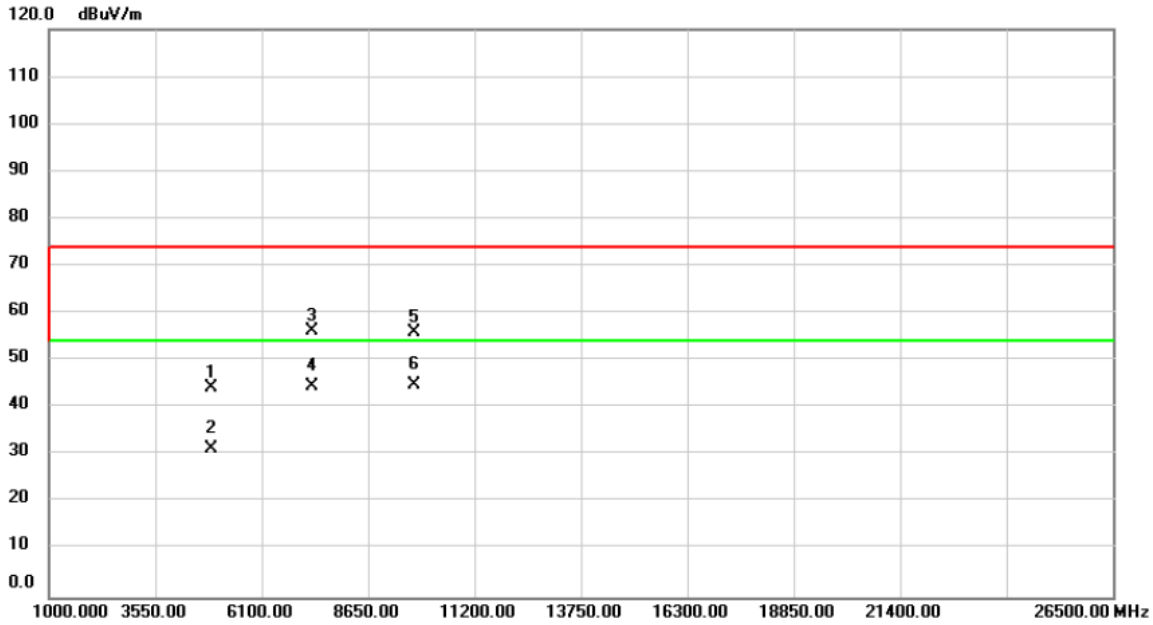
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	X	2440.000	71.11	31.25	102.36	74.00	28.36	peak	No Limit
2	*	2440.000	69.09	31.25	100.34	54.00	46.34	AVG	No Limit

Orthogonal Axis :	X
Test Mode :	TX 2440MHz

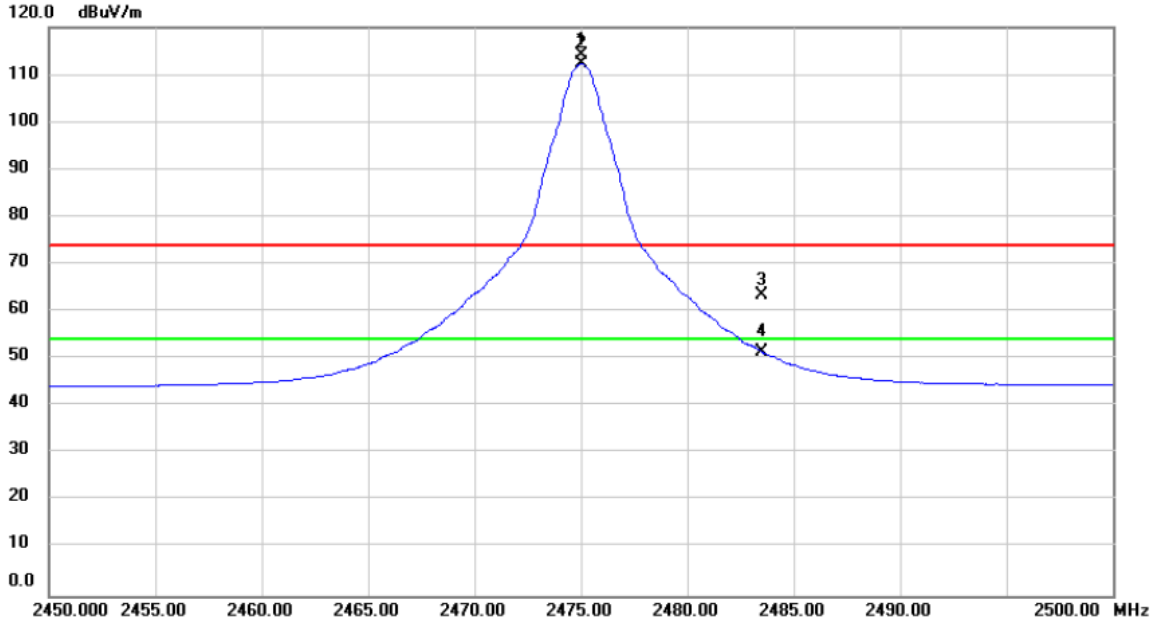
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4880.000	55.67	-11.28	44.39	74.00	-29.61	peak	
2		4880.000	42.63	-11.28	31.35	54.00	-22.65	AVG	
3		7320.000	61.31	-5.10	56.21	74.00	-17.79	peak	
4		7320.000	49.76	-5.10	44.66	54.00	-9.34	AVG	
5		9760.000	55.02	0.95	55.97	74.00	-18.03	peak	
6	*	9760.000	43.77	0.95	44.72	54.00	-9.28	AVG	

Orthogonal Axis :	X
Test Mode :	TX 2475MHz

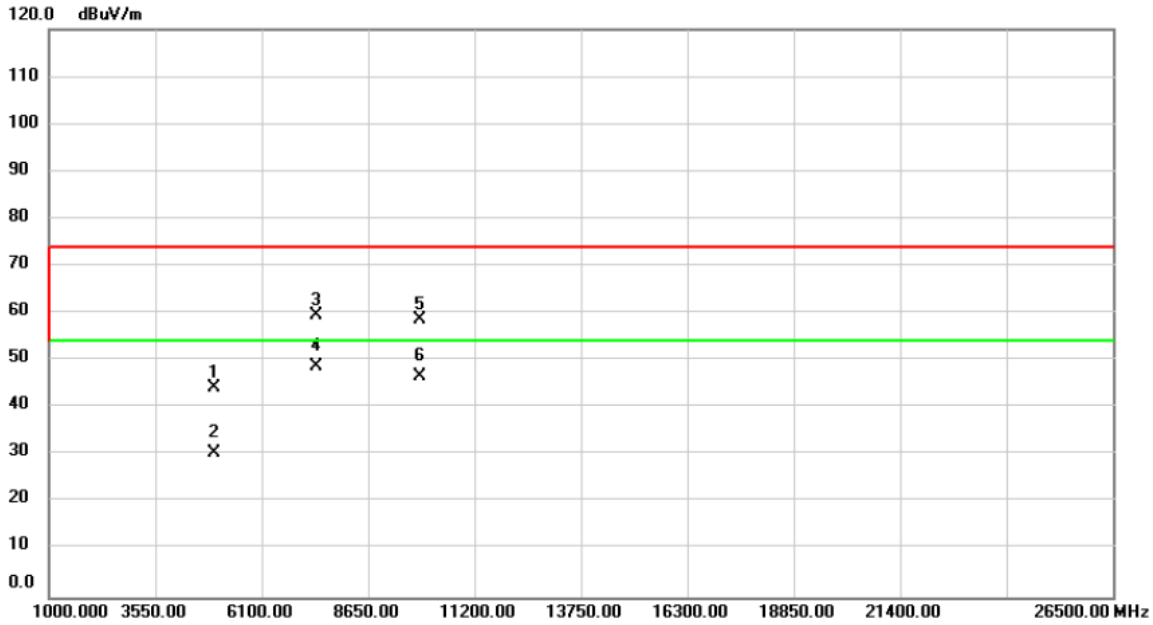
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	X	2475.000	82.92	31.38	114.30	74.00	40.30	peak	No Limit
2	*	2475.000	80.89	31.38	112.27	54.00	58.27	AVG	No Limit
3		2483.500	32.08	31.41	63.49	74.00	-10.51	peak	
4		2483.500	20.09	31.41	51.50	54.00	-2.50	AVG	

Orthogonal Axis :	X
Test Mode :	TX 2475MHz

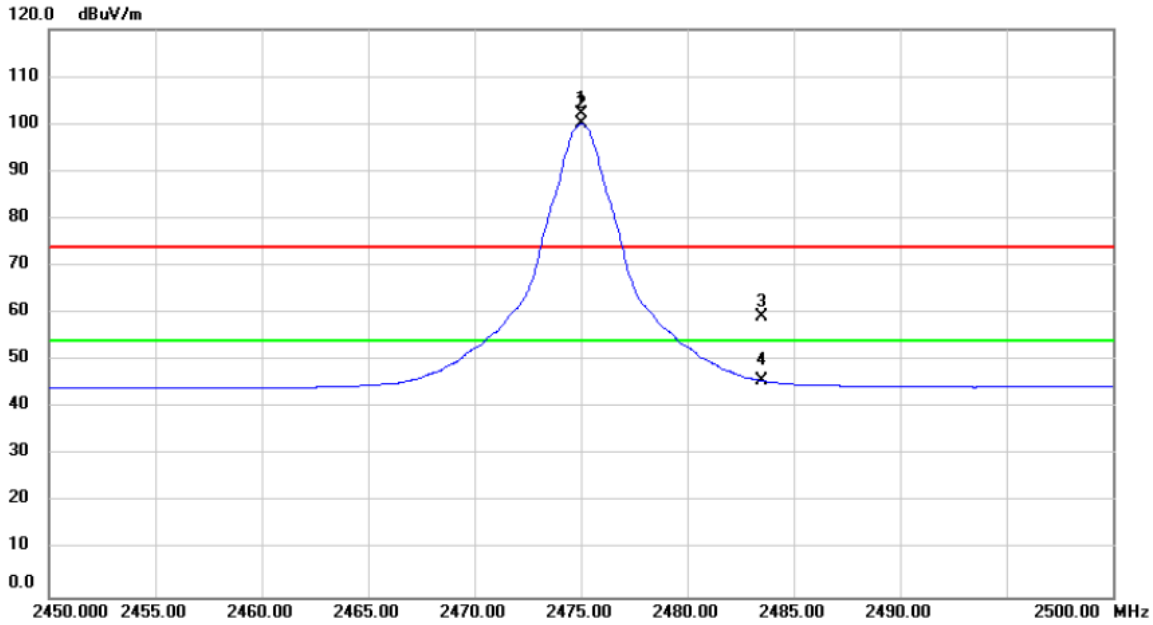
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4950.000	55.53	-11.17	44.36	74.00	-29.64	peak	
2		4950.000	41.74	-11.17	30.57	54.00	-23.43	AVG	
3		7425.000	64.22	-4.74	59.48	74.00	-14.52	peak	
4	*	7425.000	53.38	-4.74	48.64	54.00	-5.36	AVG	
5		9900.000	57.10	1.46	58.56	74.00	-15.44	peak	
6		9900.000	45.29	1.46	46.75	54.00	-7.25	AVG	

Orthogonal Axis :	X
Test Mode :	TX 2475MHz

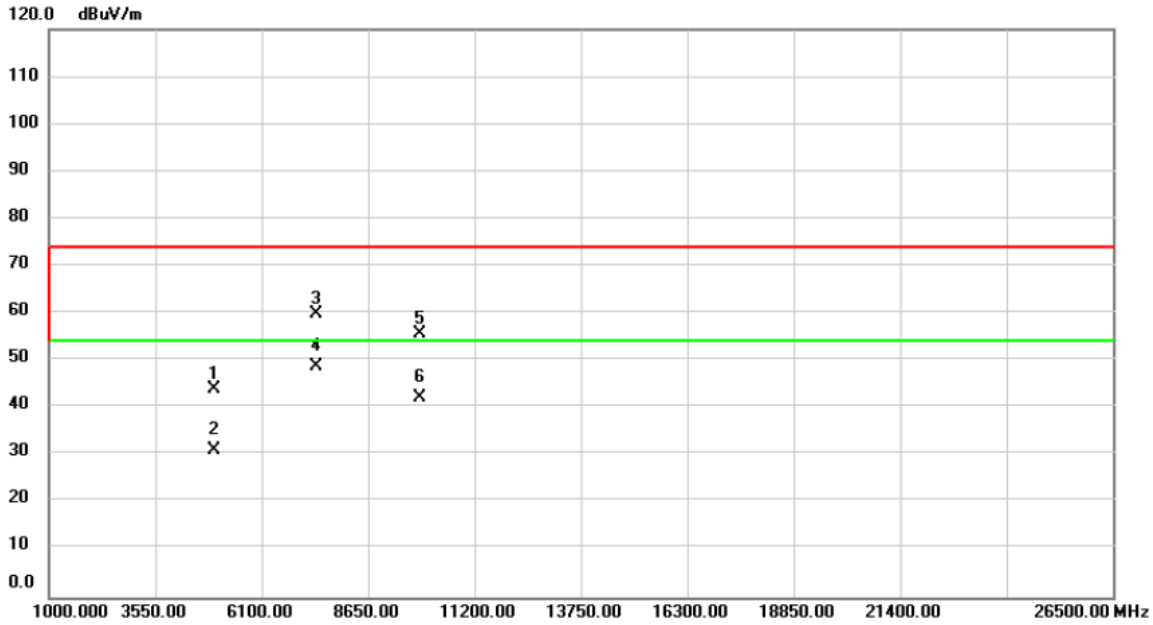
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	X	2475.000	70.68	31.38	102.06	74.00	28.06	peak	No Limit
2	*	2475.000	68.59	31.38	99.97	54.00	45.97	AVG	No Limit
3		2483.500	27.75	31.41	59.16	74.00	-14.84	peak	
4		2483.500	14.33	31.41	45.74	54.00	-8.26	AVG	

Orthogonal Axis :	X
Test Mode :	TX 2475MHz

Horizontal

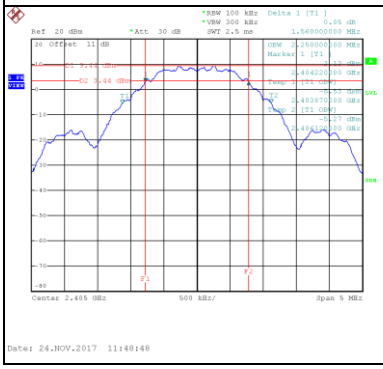
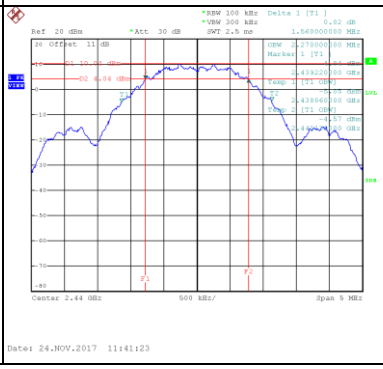
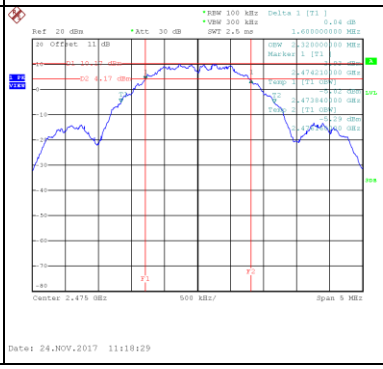


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4950.000	55.24	-11.17	44.07	74.00	-29.93	peak	
2		4950.000	42.23	-11.17	31.06	54.00	-22.94	AVG	
3		7425.000	64.62	-4.74	59.88	74.00	-14.12	peak	
4	*	7425.000	53.55	-4.74	48.81	54.00	-5.19	AVG	
5		9900.000	54.15	1.46	55.61	74.00	-18.39	peak	
6		9900.000	40.73	1.46	42.19	54.00	-11.81	AVG	

APPENDIX E - BANDWIDTH

Test Mode :	TX Mode

Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied BW (MHz)	Min. Limit (kHz)
2405	1.56	2.25	500
2440	1.56	2.27	500
2475	1.60	2.32	500

Mode 2405	Mode 2440	Mode 2475
		

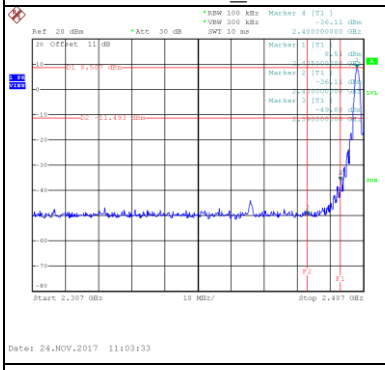
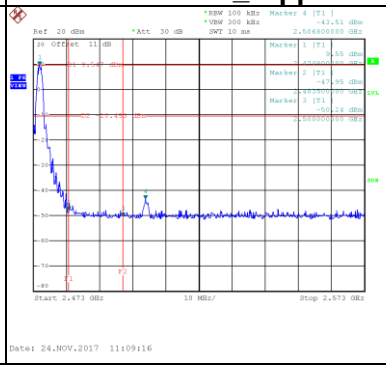
APPENDIX F - MAXIMUM OUTPUT POWER TEST

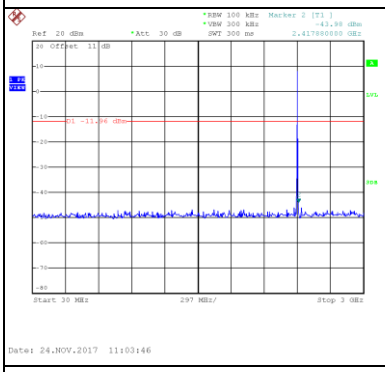
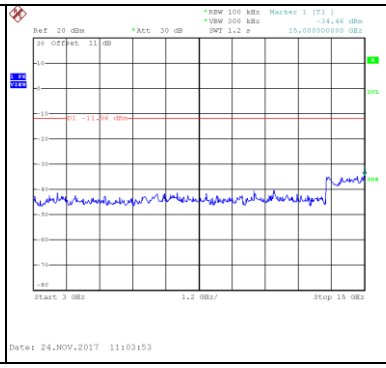
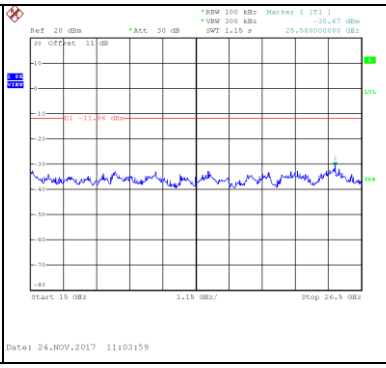
Test Mode :	TX Mode

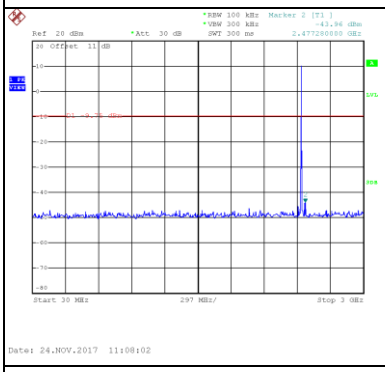
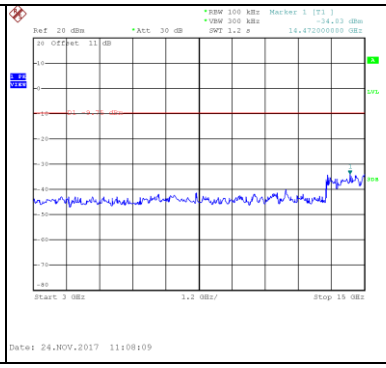
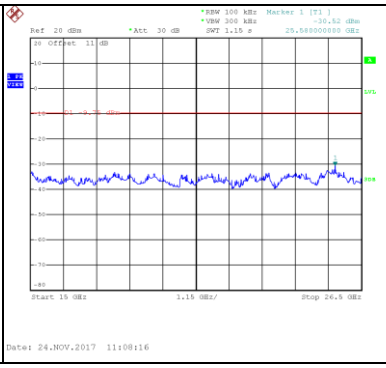
Frequency (MHz)	Conducted Power (dBm)	Conducted Power (Watt)	Max. Limit (dBm)	Max. Limit (Watt)
2405	13.43	0.0220	30.00	1.00
2440	14.28	0.0268	30.00	1.00
2475	14.85	0.0305	30.00	1.00

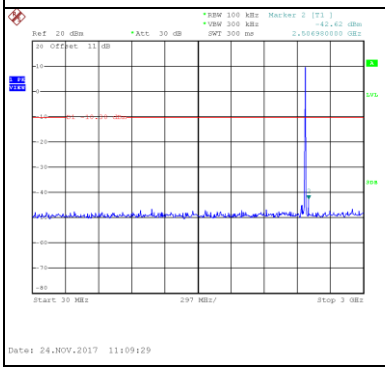
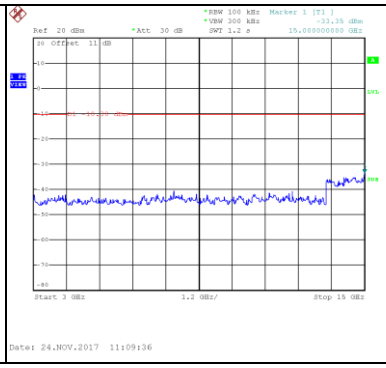
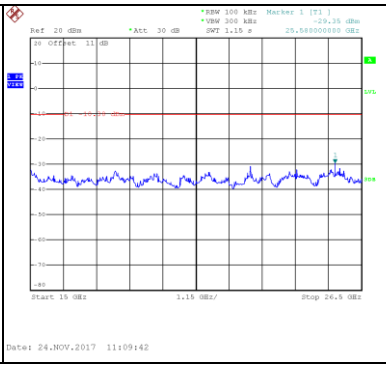
APPENDIX G - ANTENNA CONDUCTED SPURIOUS EMISSIONS

Test Mode :	TX Mode

2405 MHz_ Lower	2475 MHz_ Upper	
		

2405 MHz – 10 Harmonics		
		

2440 MHz – 10 Harmonics		
		

2475 MHz – 10 Harmonics		
		

APPENDIX H - POWER SPECTRAL DENSITY TEST

Test Mode :	TX Mode

Frequency (MHz)	Power Density (dBm)	Max. Limit (dBm)
2405	0.00	8
2440	-0.20	8
2475	1.11	8

Mode 2405	Mode 2440	Mode 2475