

Radio Test Report

Report No.: STS2404026W01

Issued for

Maddalena S.p.A.

Via G.B. Maddalena 2/4 33040 Povoletto - Udine - Italy

Product Name: MLW-AU915

Brand Name:  **maddalena**
METERING EXPERTISE

Model Name: E-BULK

Series Model(s): N/A

FCC ID: 2BFX9E-BULK

Test Standards: FCC Part 15.249


The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Shenzhen STS Test Services Co., Ltd.



TEST REPORT

Applicant's Name: Maddalena S.p.A.
 Address.....: Via G.B. Maddalena 2/4 33040 Povoletto - Udine - Italy
Manufacturer's Name: Maddalena S.p.A.
 Address.....: Via G.B. Maddalena 2/4 33040 Povoletto - Udine - Italy

Product Description

Product Name: MLW-AU915
 Brand Name:  **maddalena**
METERING EXPERTISE
 Model Name.....: E-BULK
 Series Model(s).....: N/A
Test Standards.....: FCC Part 15.249
 Test Procedure.....: ANSI C63.10-2020

This device described above has been tested by STS, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.
 The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Shenzhen STS Test Services Co., Ltd.

Date of Test.....:
 Date of receipt of test item.....: 09 Apr. 2024
 Date of performance of tests ..: 09 Apr. 2024 ~ 24 Apr. 2024
 Date of Issue.....: 24 Apr. 2024
 Test Result: **Pass**

Testing Engineer :

Aaron Bu

(Aaron Bu)

Technical Manager :

Chris Chen

(Chris Chen)

Authorized Signatory :

Bovey Yang

(Bovey Yang)





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Revision History

Rev.	Issue Date	Report No.	Effect Page	Contents
00	24 Apr. 2024	STS2404026W01	ALL	Initial Issue



1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part 15.249 , Subpart C			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	Pass	
15.203	Antenna Requirement	Pass	
15.249	Radiated Spurious Emission	Pass	
15.249	Radiated Band Edge Emission	Pass	
15.249	Field Strength of fundamental	Pass	
15.215(c)	20dB Bandwidth	Pass	

NOTE:

- (1) 'N/A' denotes test is not applicable in this Test Report.
- (2) All tests are according to ANSI C63.10-2020.



1.1 TEST FACTORY

SHENZHEN STS TEST SERVICES CO., LTD

Add. :101, Building B, Zhuoke Science Park, No.190 Chongqing Road, ZhanChengShequ, Fuhai Sub-District, Bao'an District, Shenzhen, Guang Dong, China

FCC test Firm Registration Number: 625569

IC test Firm Registration Number: 12108A

A2LA Certificate No.: 4338.01


1.2 MEASUREMENT UNCERTAINTY

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 %**.

No.	Item	Uncertainty
1	RF output power, conducted	$\pm 0.755\text{dB}$
2	Unwanted Emissions, conducted	$\pm 2.874\text{dB}$
3	All emissions, radiated 9K-30MHz	$\pm 3.80\text{dB}$
4	All emissions, radiated 30M-1GHz	$\pm 4.18\text{dB}$
5	All emissions, radiated 1G-6GHz	$\pm 4.90\text{dB}$
6	All emissions, radiated >6G	$\pm 5.24\text{dB}$
7	Conducted Emission (9KHz-150KHz)	$\pm 2.19\text{dB}$
8	Conducted Emission (150KHz-30MHz)	$\pm 2.53\text{dB}$
9	Occupied Channel Bandwidth	$\pm 3.5\%$
10	Power Spectral Density, conducted	$\pm 1.245\text{dB}$
11	Duty Cycle	$\pm 3.2\%$

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	MLW-AU915
Brand Name	 maddalena METERING EXPERTISE
Model Name	E-BULK
Series Model(s)	N/A
Model Difference	N/A
Product Description	The EUT is a MLW-AU915.
	Operation Frequency: 915.2-927.4Mhz
	Modulation Type: GFSK
	Antenna Designation: NB IOT external rubber rod waterproof integrated antenna
	Antenna Gain(Peak): 4.07dBi
Based on the application, features, or specification exhibited in User Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User Manual.	
Rating	Input: DC 3.6V
Connecting I/O Port(s)	Please refer to the Note 1.
Hardware version number	MLW PV1.3
Software version number	HAC-MLW-F14H_V1.03

Note:

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

2.

Channel List							
Chan nel	Frequency (MHz)	Cha nnel	Frequency (MHz)	Chan nel	Frequency (MHz)	Chan nel	Frequency (MHz)
0	915.2	16	918.4	32	921.6	48	924.8
1	915.4	17	918.6	33	921.8	49	925
2	915.6	18	918.8	34	922	50	925.2
3	915.8	19	919	35	922.2	51	925.4
4	916	20	919.2	36	922.4	52	925.6
5	916.2	21	919.4	37	922.6	53	925.8
6	916.4	22	919.6	38	922.8	54	926
7	916.6	23	919.8	39	923	55	926.2
8	916.8	24	920	40	923.2	56	926.4
9	917	25	920.2	41	923.4	57	926.6
10	917.2	26	920.4	42	923.6	58	926.8
11	917.4	27	920.6	43	923.8	59	927
12	917.6	28	920.8	44	924	60	927.2
13	917.8	29	921	45	924.2	61	927.4
14	918	30	921.2	46	924.4	--	--
15	918.2	31	921.4	47	924.6	--	--

3.

Test channel List		
Test Channel	EUT Channel	Test Frequency (MHz)
lowest	CH00	915.2
middle	CH30	921.2
highest	CH61	927.4

Note: The antenna information refer the manufacturer provide report, applicable only to the tested sample identified in the report.

For conducted test items and radiated spurious emissions

Each of these EUT operation mode(s) or test configuration mode(s) mentioned below was evaluated respectively.

Pretest Mode	Description	Data/Modulation
Mode 1	TX/CH00	GFSK
Mode 2	TX/CH30	GFSK
Mode 3	TX/CH61	GFSK

Note:

(1) All above mode have been measurement, only worst data was reported.

2.3 TEST SOFTWARE AND POWER LEVEL

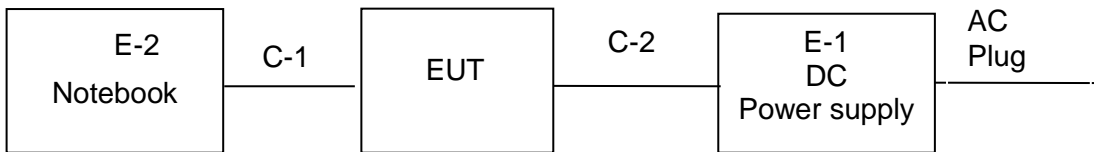
During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level.

RF Function	Type	Mode Or Modulation type	ANT Gain(dBi)	Power Class	Software For Testing
Other SRD	915MHz	GFSK	4.07	2	HAC-MLW-C-T1T2

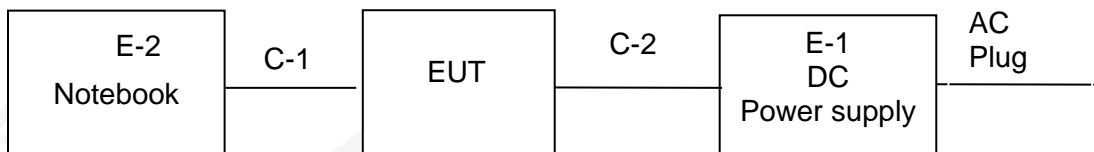
2.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

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.

Radiated Spurious Emission Test



Conducted Emission Test



2.5 DESCRIPTION OF NECESSARY ACCESSORIES AND 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.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
N/A	N/A	N/A	N/A	N/A	N/A

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
E-1	Power supply	Zhaoxin	RXN 605D	N/A	N/A
E-2	Notebook	LENOVO	Think Pad E470	N/A	N/A
C-1	USB Cable	N/A	N/A	150cm	N/A

Note:

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



2.6 EQUIPMENTS LIST FOR ALL TEST ITEMS
RF RADIATION TEST EQUIPMENT

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
Temperature & Humidity	SW-108	SuWei	N/A	2024.03.15	2025.03.14
Pre-Amplifier(0.1M-3GHz)	EM	EM330	060665	2024.02.23	2025.02.22
Pre-Amplifier(1G-18GHz)	SKET	LNPA-01018G-45	SK2018080901	2023.09.26	2024.09.25
Pre-Amplifier(18G-40GHz)	SKET	LNPA_1840-50	SK2018101801	2024.02.23	2025.02.22
Active loop Antenna	ZHINAN	ZN30900C	16035	2023.02.28	2025.02.27
Bilog Antenna	TESEQ	CBL6111D	34678	2022.09.30	2024.09.29
Horn Antenna	SCHWARZBECK	BBHA 9120D	02014	2023.09.24	2025.09.23
Horn Antenna	A-INFOMW	LB-180400-KF	J211020657	2023.10.10	2025.10.09
Positioning Controller	MF	MF-7802	MF-780208587	N/A	N/A
Signal Analyzer	R&S	FSV 40-N	101823	2023.09.26	2024.09.25
Switch Control Box	N/A	N/A	N/A	N/A	N/A
Filter Box	BALUN Technology	SU319E	BL-SZ1530051	N/A	N/A
Antenna Mast	MF	MFA-440H	N/A	N/A	N/A
Turn Table	MF	SC100_1	60531	N/A	N/A
AC Power Source	APC	KDF-11010G	F214050035	N/A	N/A
DC power supply	HONGSHENGFENG	DPS-305AF	17064939	2023.09.26	2024.09.25
Test SW	EZ-EMC	Ver.STSLAB-03A1 RE			
Conduction Test equipment					
Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2023.09.25	2024.09.24
LISN	R&S	ENV216	101242	2023.09.25	2024.09.24
LISN	EMCO	3810/2NM	23625	2023.09.25	2024.09.24
Temperature & Humidity	SW-108	SuWei	N/A	2023.09.25	2024.09.24
Test SW	EZ-EMC	Ver.STSLAB-03A1 CE			
RF Connected Test					
Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Signal Analyzer	Agilent	N9020A	MY51510623	2024.02.23	2025.02.22
Temperature & Humidity	SW-108	SuWei	N/A	2024.03.15	2025.03.14
Test SW	MW	MTS 8310_2.0.0.0			

3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table.

FREQUENCY (MHz)	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of “ * ” marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

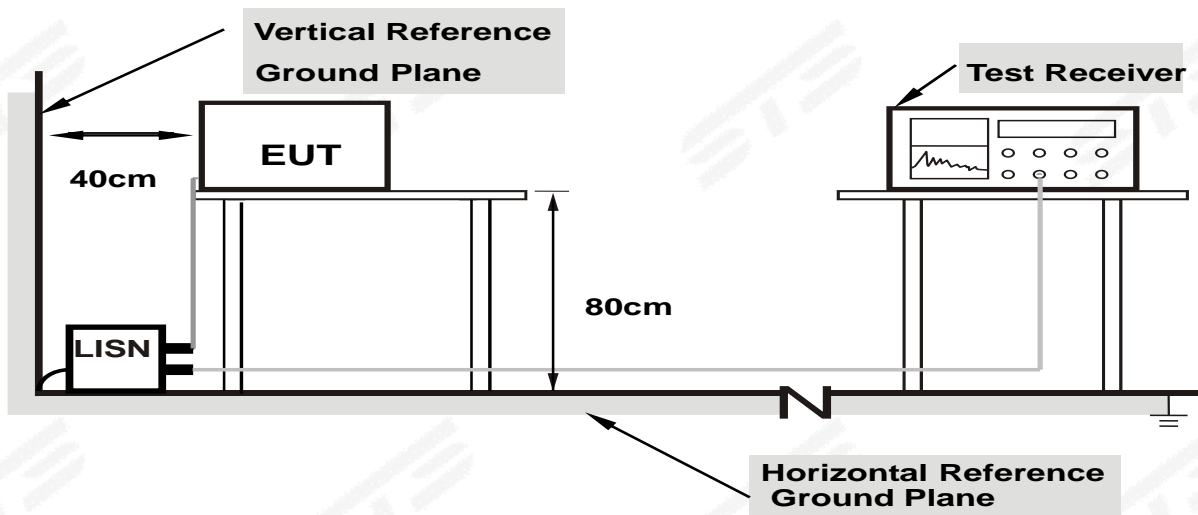
The following table is the setting of the receiver

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

3.1.2 TEST PROCEDURE

- a. The EUT is 0.8 m from the horizontal ground plane and 0.4 m from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments are powered from additional LISN(s). The LISN provides 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 is at least 80 cm from the nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.1.3 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 cm from other units and other metal planes support.

3.1.4 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.

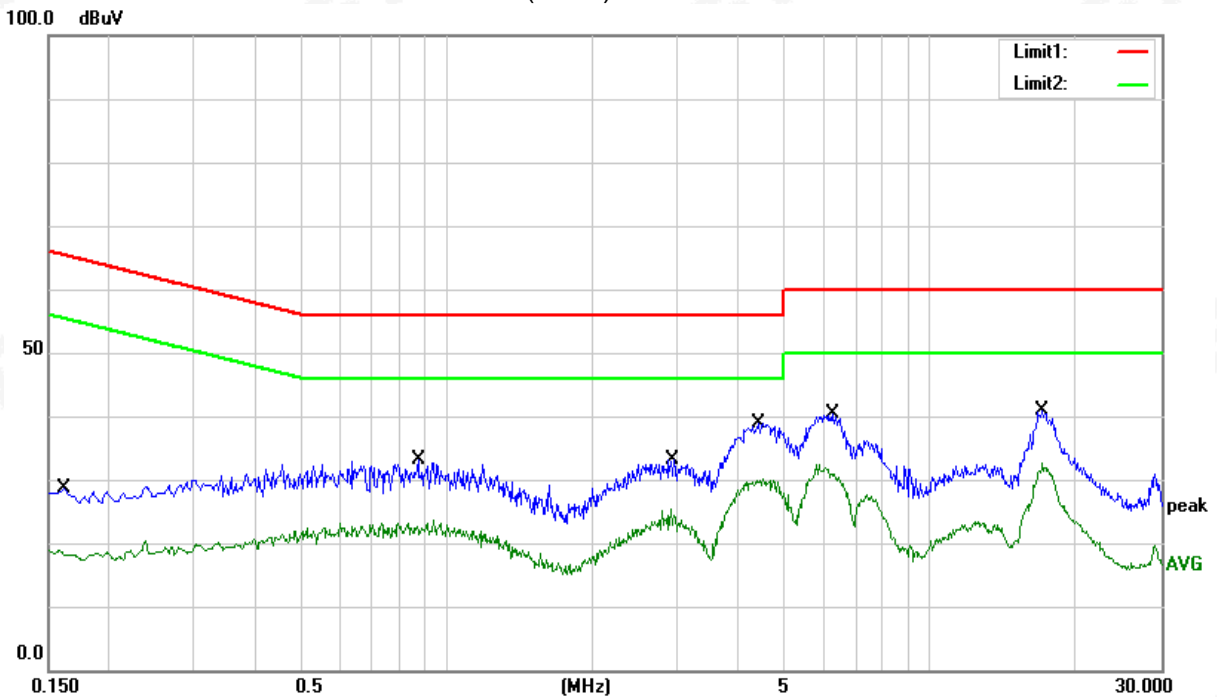
3.1.5 TEST RESULT

Temperature:	25.1(C)	Relative Humidity:	59%RH
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	Mode 1		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1620	8.82	19.78	28.60	65.36	-36.76	QP
2	0.1620	-0.86	19.78	18.92	55.36	-36.44	AVG
3	0.8740	13.27	19.79	33.06	56.00	-22.94	QP
4	0.8740	3.74	19.79	23.53	46.00	-22.47	AVG
5	2.9500	13.25	19.83	33.08	56.00	-22.92	QP
6	2.9500	5.50	19.83	25.33	46.00	-20.67	AVG
7	4.4180	19.02	19.83	38.85	56.00	-17.15	QP
8	4.4180	10.42	19.83	30.25	46.00	-15.75	AVG
9	6.2780	20.58	19.80	40.38	60.00	-19.62	QP
10	6.2780	12.46	19.80	32.26	50.00	-17.74	AVG
11	17.0660	20.50	20.44	40.94	60.00	-19.06	QP
12	17.0660	12.17	20.44	32.61	50.00	-17.39	AVG

Remark:

1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result =Reading + Factor)–Limit
3. Factor=LISN factor+Cable loss+Limiter (10dB)

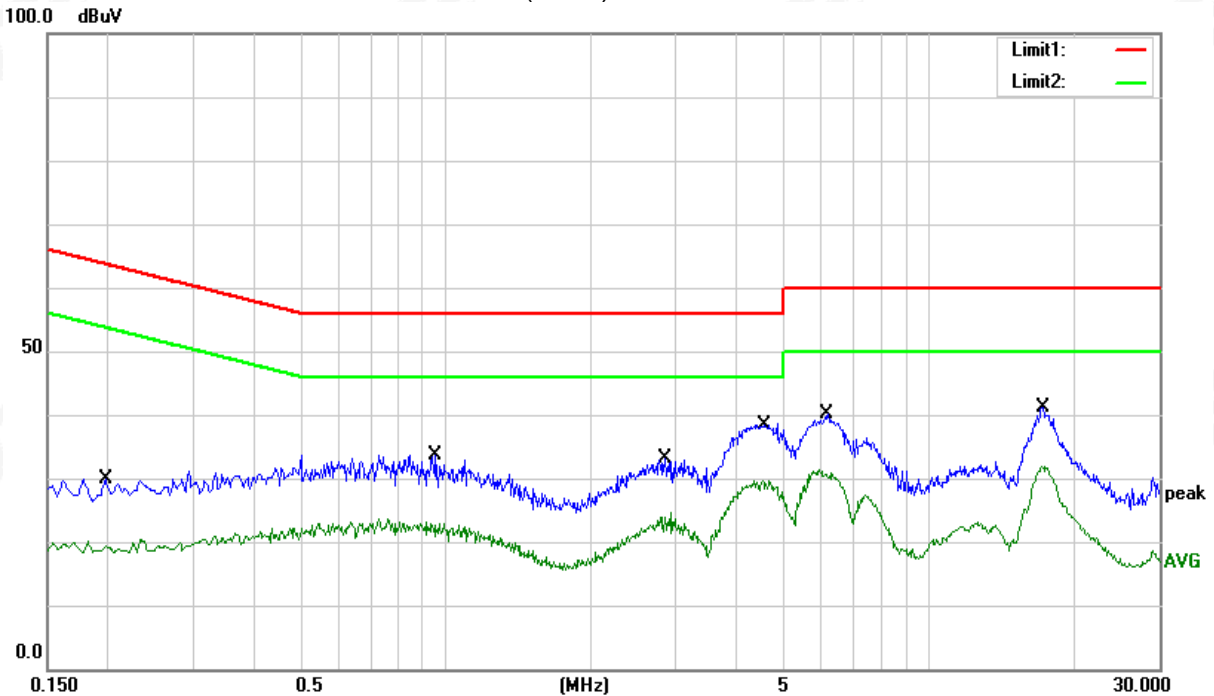


Temperature:	25.1(C)	Relative Humidity:	59%RH
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	Mode 1		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1980	10.17	19.77	29.94	63.69	-33.75	QP
2	0.1980	0.54	19.77	20.31	53.69	-33.38	AVG
3	0.9580	13.89	19.78	33.67	56.00	-22.33	QP
4	0.9580	3.31	19.78	23.09	46.00	-22.91	AVG
5	2.8500	13.34	19.83	33.17	56.00	-22.83	QP
6	2.8500	4.90	19.83	24.73	46.00	-21.27	AVG
7	4.5860	18.66	19.83	38.49	56.00	-17.51	QP
8	4.5860	9.84	19.83	29.67	46.00	-16.33	AVG
9	6.2060	20.21	19.80	40.01	60.00	-19.99	QP
10	6.2060	11.46	19.80	31.26	50.00	-18.74	AVG
11	17.2500	20.78	20.45	41.23	60.00	-18.77	QP
12	17.2500	11.47	20.45	31.92	50.00	-18.08	AVG

Remark:

1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result =Reading + Factor)–Limit
3. Factor=LISN factor+Cable loss+Limiter (10dB)



3.2 RADIATED EMISSION MEASUREMENT

3.2.1 RADIATED EMISSION LIMITS

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on Part 15.249 and the Part 15.209(a) limit in the table below has to be followed.

Standard FCC 15.209

Frequencies (MHz)	Field Strength (micровolts/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
Above 1000	Other:74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	3

Standard FCC 15.249

Frequency of Emission (MHz)	Field Strength of fundamental (millivolts /meter)	Field Strength of Harmonics (microvolts/meter)
900~928	50	500
2400~2483.5	50	500
5725~5875	50	500
24000~242500	250	2500

Notes:

- (1) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.
- (2) Emission level (dBuV/m) =20log Emission level (uV/m).

LIMITS OF RESTRICTED FREQUENCY BANDS

FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (GHz)
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7



6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

Spectrum Parameter	Setting
Detector	Peak/AV
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB (emission in restricted band)	>20BW
VB (emission in restricted band)	=3xRB

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~90kHz / RB 200Hz for PK & AV
	90kHz~110kHz / RB 200Hz for QP
	110kHz~490kHz / RB 200Hz for PK & AV
	490kHz~30MHz / RB 9kHz for QP
	30MHz~1000MHz / RB 120kHz for QP

3.2.2 TEST PROCEDURE

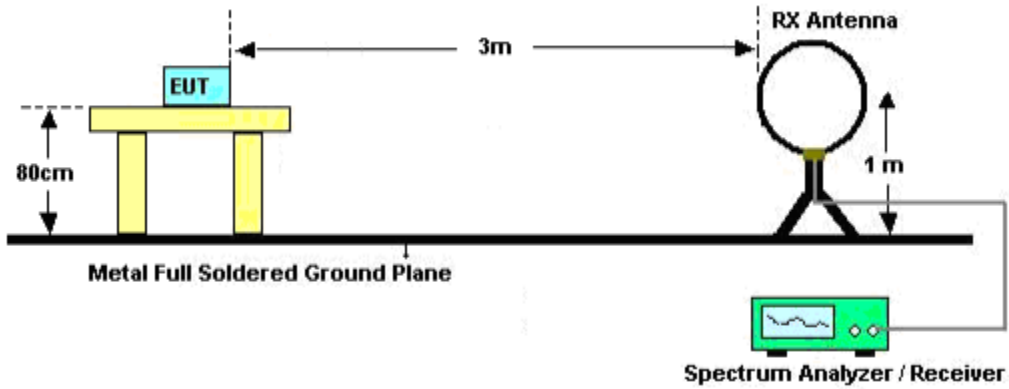
- a. The measuring distance of 3m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation (Below 1GHz)
- b. The measuring distance of 3m 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 test antenna shall vary between 1m to 4m. Both horizontal and vertical polarization of the antenna are set to make the measurement.
- d. The initial step in collecting radiated emission data is a receive peak detector mode. Pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- e. All readings are peak unless otherwise stated QP in column of Note. Peak denoted that the Peak reading complies with the QP limits and then QP Mode measurement didn't perform (Below 1GHz)
- f. All readings are Peak mode value unless otherwise stated AVG in column of Note. If the Peak mode measured value complies with the Peak limits and lower than AVG Limits, the EUT shall be deemed to meet Peak & AVG limits and then only Peak mode was measured, but AVG mode didn't perform. (Above 1GHz)
- g. For the actual test configuration, please refer to the related Item –EUT Test Photos.
Note: Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axes. The worst case emissions were reported.

3.2.3 DEVIATION FROM TEST STANDARD

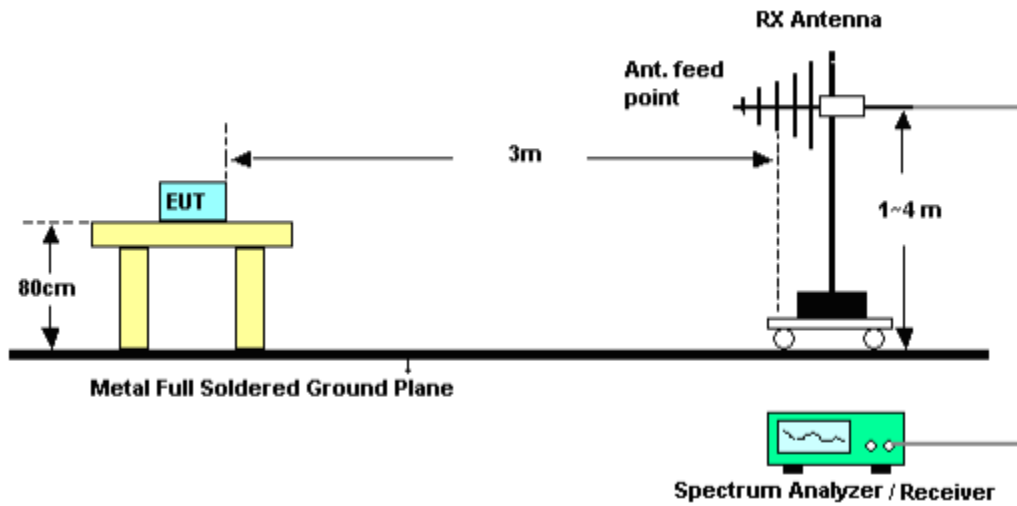
No deviation

3.2.4 TEST SETUP

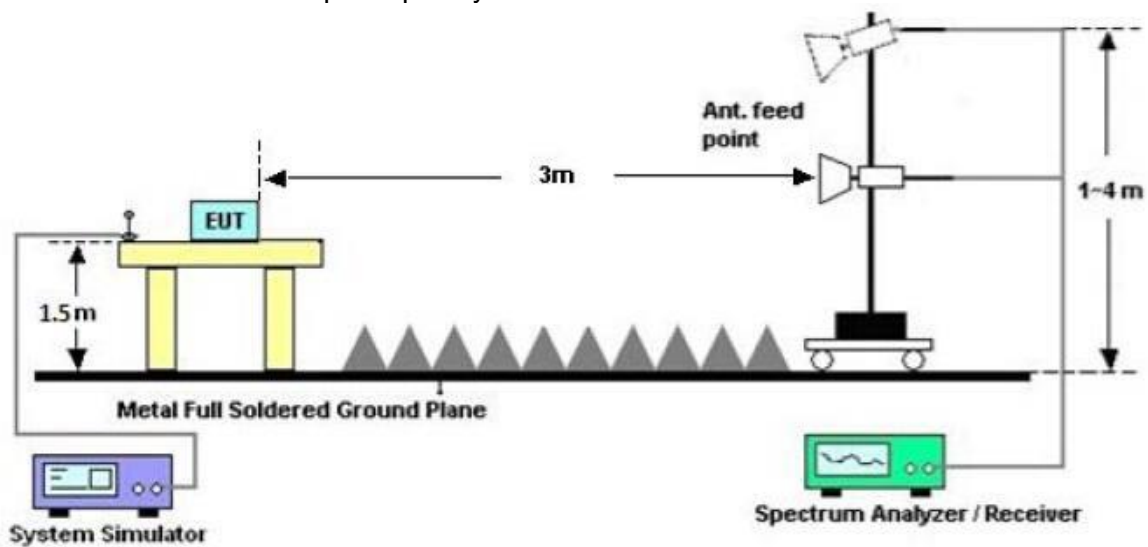
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz





3.2.5 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

Margin=PL-PK L or AL- AV L; Margin only shown the worst case.

Where

PR = Peak Reading

AR = Average Reading

PL = Peak Level

AL = Average Level

AF = Antenna Factor

PK L = Peak Limit

AV L = AV Limit

For example

Frequency (MHz)	PR (dBμV/m)	AR (dBμV/m)	AF (dB)	PL (dBμV/m)	AL (dBμV/m)	PK L (dBμV/m)	AV L (dBμV/m)	Margin (dB)
2178	40.23	30.31	9.83	50.06	40.14	74.00	54.00	-13.86

3.2.6 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

Below 30 MHz

Temperature:	23.1(C)	Relative Humidity:	60%RH
Test Voltage:	DC 3.6V	Polarization:	---
Test Mode:	TX Mode		

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	PASS
--	--	--	--	PASS

NOTE:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance}/\text{test distance})$ (dB);

Limit line = specific limits(dBuv) + distance extrapolation factor.

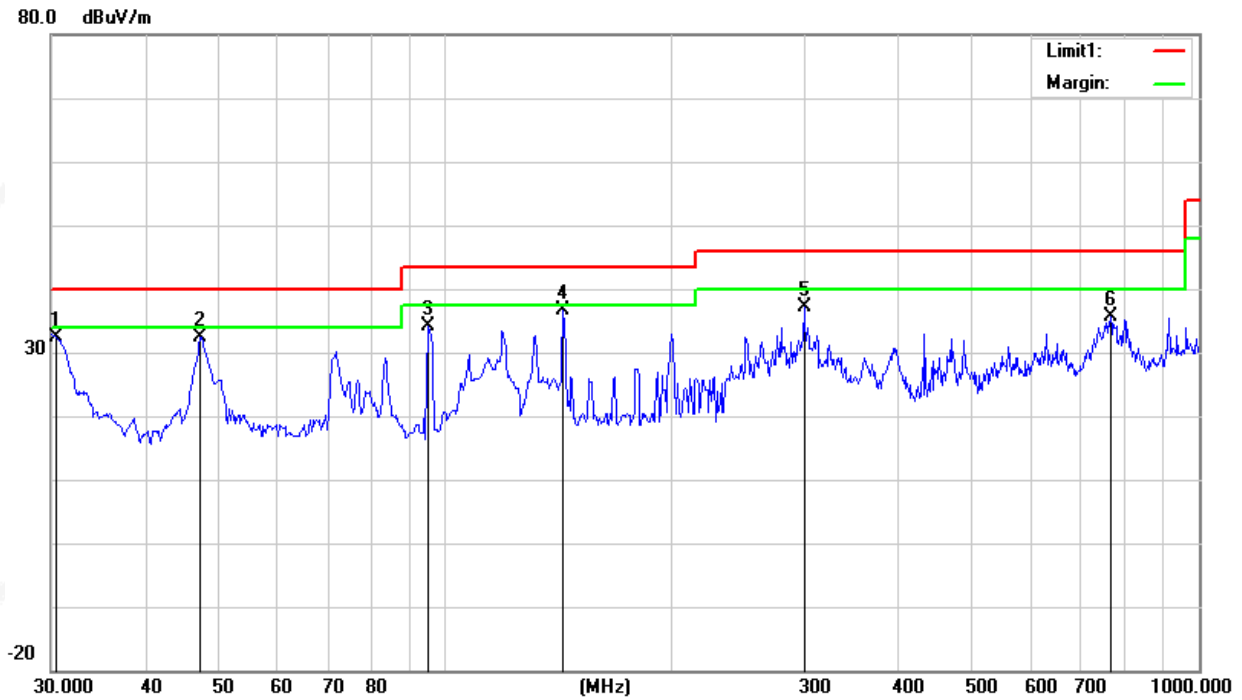
Between 30MHz – 1000 MHz Radiation Spurious

Temperature:	23.1(C)	Relative Humidity:	60%RH
Test Voltage:	DC 3.6V	Phase:	Horizontal
Test Mode:	Mode 1~3 (Mode 2 worst mode)		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	30.5306	45.38	-13.12	32.26	40.00	-7.74	peak
2	47.4600	54.35	-21.92	32.43	40.00	-7.57	peak
3	94.9900	55.02	-20.78	34.24	43.50	-9.26	peak
4	143.4900	54.88	-18.23	36.65	43.50	-6.85	peak
5	299.6600	51.85	-14.82	37.03	46.00	-8.97	peak
6	765.2600	37.86	-2.25	35.61	46.00	-10.39	peak

Remark:

1. Margin = Result (Result =Reading + Factor)–Limit
2. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

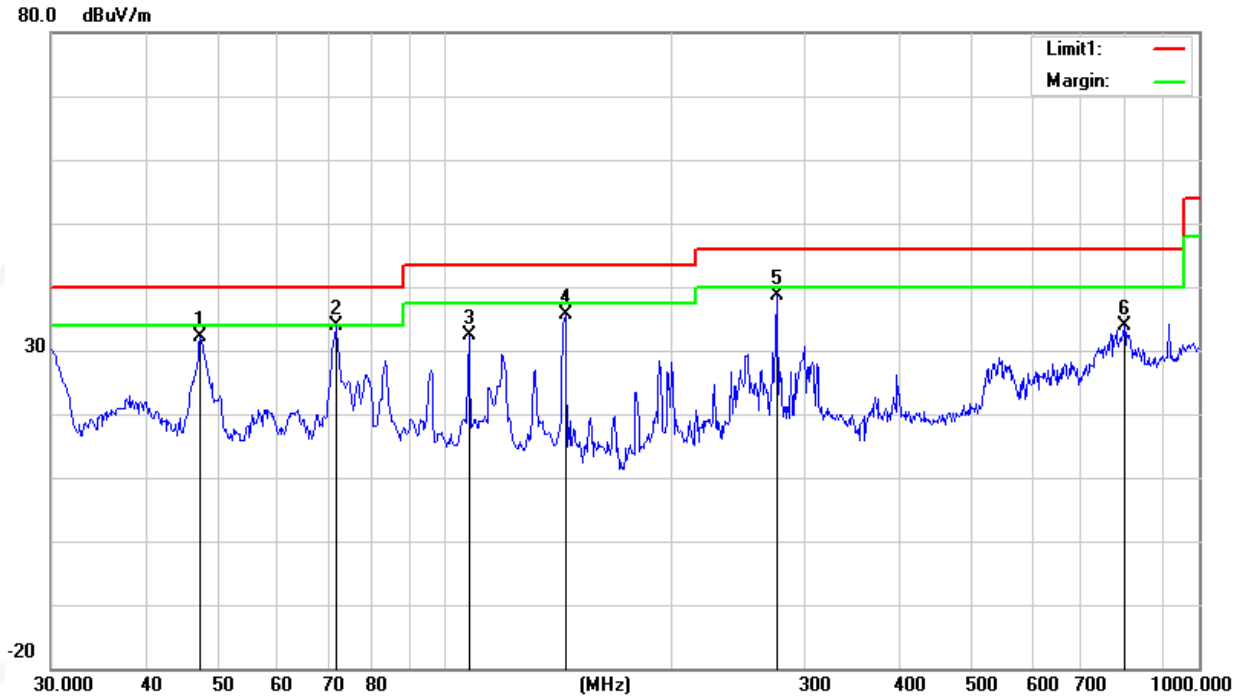


Temperature:	23.1(C)	Relative Humidity:	60%RH
Test Voltage:	DC 3.6V	Phase:	Vertical
Test Mode:	Mode 1~3 (Mode 2 worst mode)		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	47.4600	53.97	-21.92	32.05	40.00	-7.95	peak
2	71.7100	58.51	-24.56	33.95	40.00	-6.05	peak
3	107.6000	51.76	-19.32	32.44	43.50	-11.06	peak
4	144.4600	53.84	-18.29	35.55	43.50	-7.95	peak
5	275.4100	54.09	-15.46	38.63	46.00	-7.37	peak
6	798.2400	36.00	-2.03	33.97	46.00	-12.03	peak

Remark:

- Margin = Result (Result =Reading + Factor)–Limit
- Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

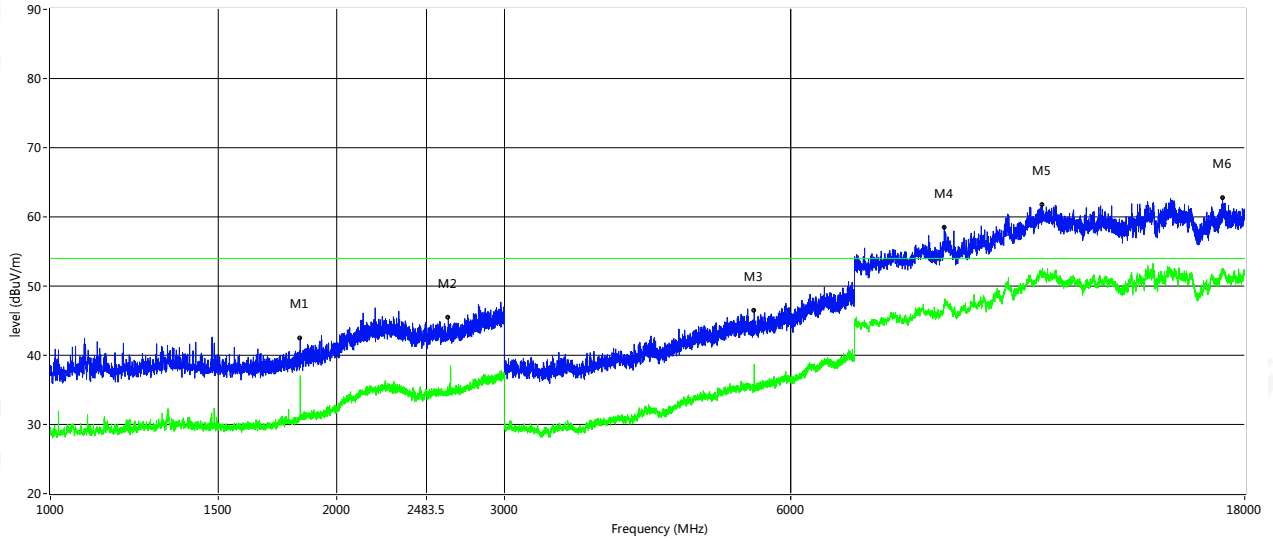




Above 1G Radiation Spurious

915.2MHz
Horizontal

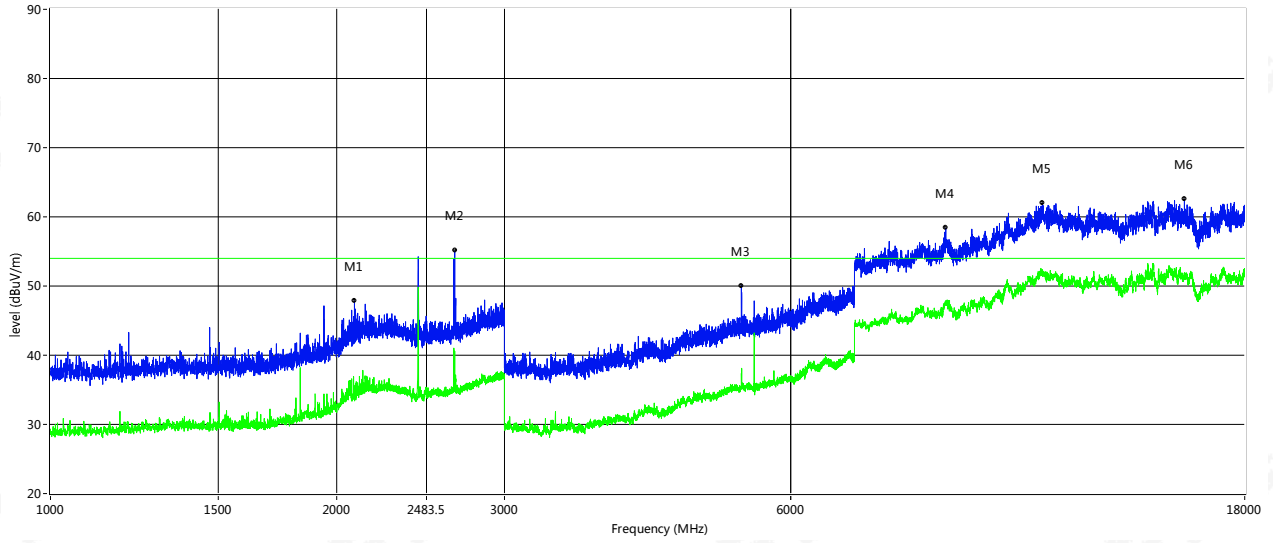
RE_FCC Test Case_FCC 15C 1GHz-18GHz



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	Table (o)	Height (cm)	Verdict
1830.500	42.41	37.05	0.44	74.0	54.0	-16.95	310.20	100	Pass
2619.500	45.39	34.55	4.21	74.0	54.0	-19.45	110.70	100	Pass
5491.000	46.44	38.72	-5.02	74.0	54.0	-15.28	123.50	100	Pass
8699.500	58.49	47.06	5.15	74.0	54.0	-6.94	171.80	100	Pass
11034.250	61.75	52.26	10.04	74.0	54.0	-1.74	160.40	100	Pass
17059.500	62.74	52.49	10.19	74.0	54.0	-1.51	311.70	100	Pass

Vertical

RE_FCC Test Case_FCC 15C 1GHz-18GHz



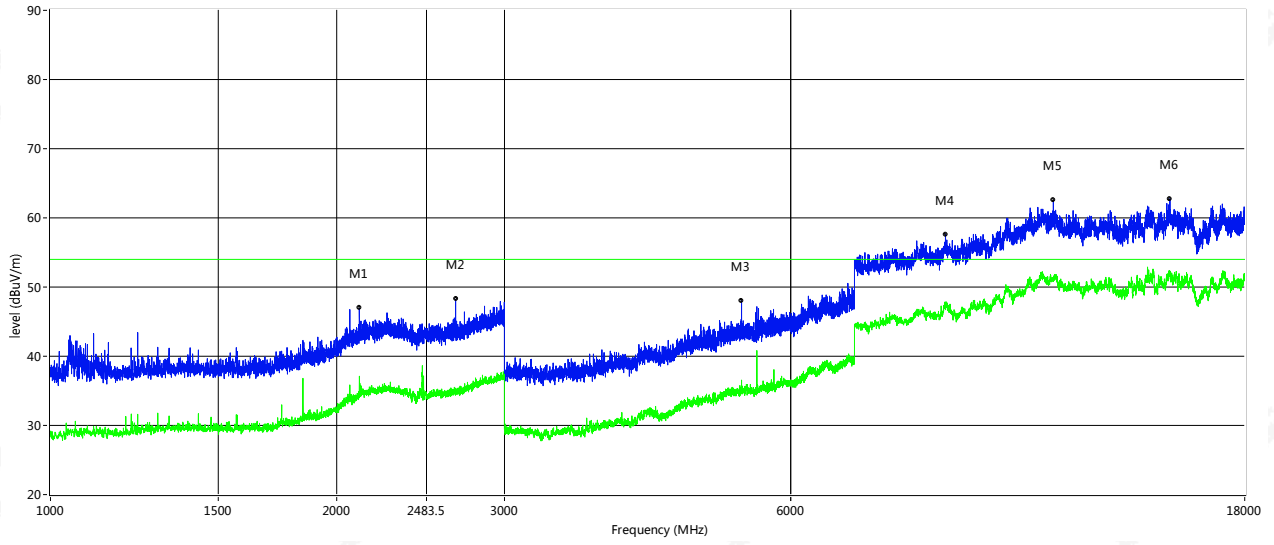
Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	Table (o)	Height (cm)	Verdict
2087.000	47.85	35.54	3.54	74.0	54.0	-18.46	360.00	100	Pass
2660.000	55.08	40.58	4.51	74.0	54.0	-13.42	303.60	100	Pass
5324.000	50.06	37.37	-4.95	74.0	54.0	-16.63	230.80	100	Pass
8729.750	58.41	47.29	5.07	74.0	54.0	-6.71	218.60	100	Pass
11031.500	62.02	52.38	10.05	74.0	54.0	-1.62	139.60	100	Pass
15555.250	62.58	51.71	10.76	74.0	54.0	-2.29	66.10	100	Pass



921.2MHz

Horizontal

RE_FCC Test Case_FCC 15C 1GHz-18GHz



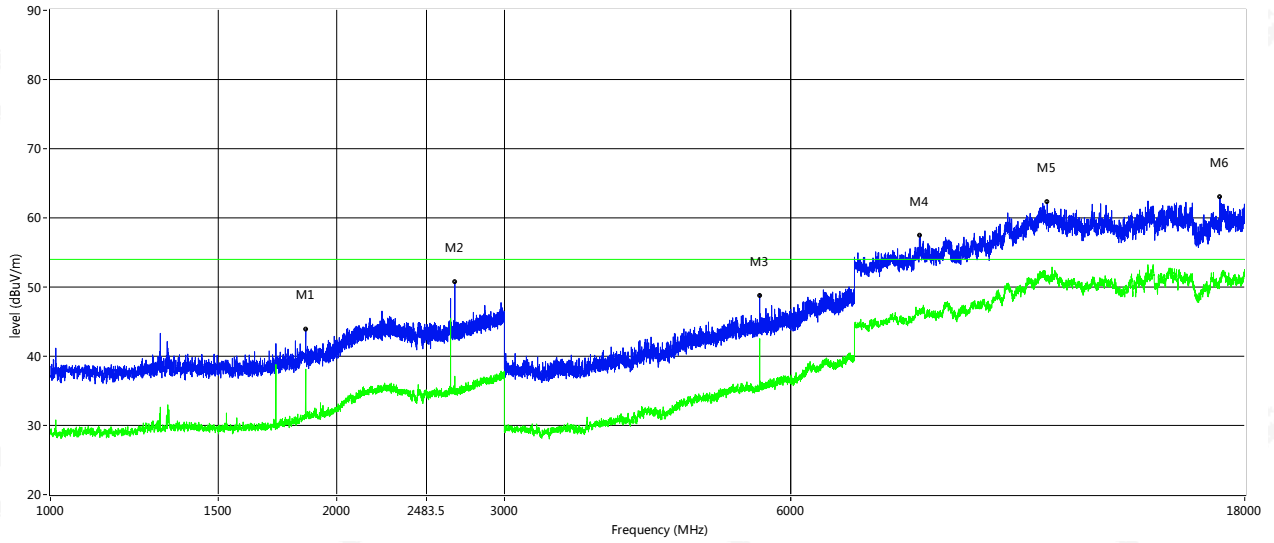
Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	Table (o)	Height (cm)	Verdict
2111.500	46.93	35.78	3.98	74.0	54.0	-18.22	267.00	100	Pass
2666.000	48.25	35.24	4.50	74.0	54.0	-18.76	153.30	100	Pass
5326.000	48.03	36.56	-4.94	74.0	54.0	-17.44	134.70	100	Pass
8724.250	57.64	47.60	5.08	74.0	54.0	-6.40	356.00	100	Pass
11325.750	62.56	51.27	9.58	74.0	54.0	-2.73	303.70	100	Pass
15019.000	62.78	52.31	10.38	74.0	54.0	-1.69	236.00	100	Pass



927.4MHz

Horizontal

RE_FCC Test Case_FCC 15C 1GHz-18GHz

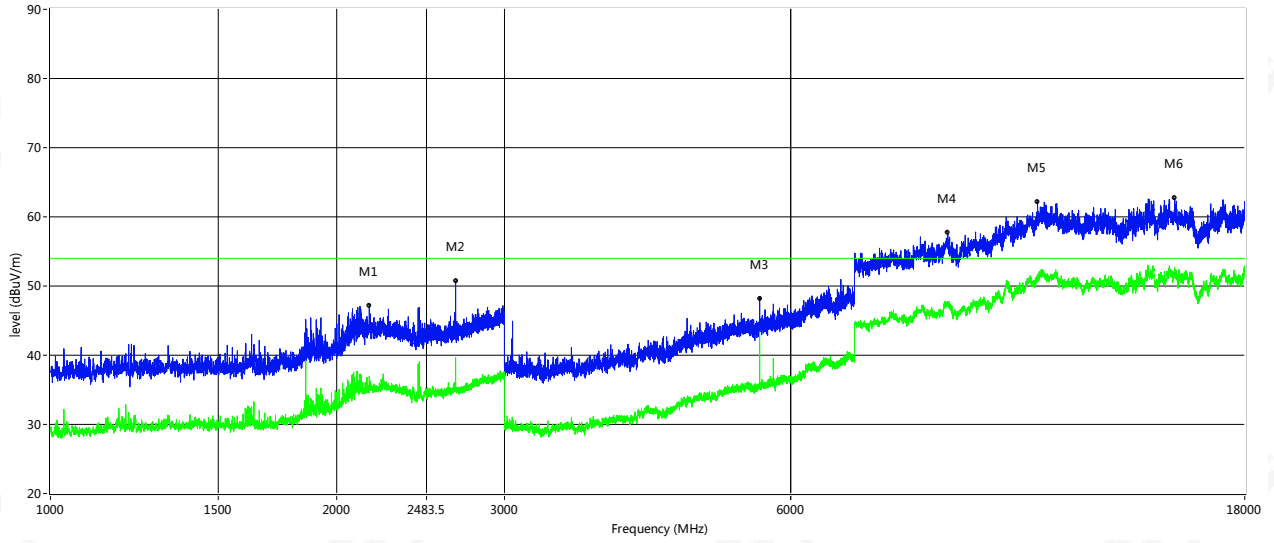


Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	Table (o)	Height (cm)	Verdict
1855.000	43.83	38.12	0.79	74.0	54.0	-15.88	242.20	100	Pass
2661.000	50.72	37.11	4.51	74.0	54.0	-16.89	297.50	100	Pass
5565.000	48.78	42.54	-4.41	74.0	54.0	-11.46	260.00	100	Pass
8204.500	57.44	46.19	4.20	74.0	54.0	-7.81	117.20	100	Pass
11160.750	62.26	51.70	9.63	74.0	54.0	-2.30	73.30	100	Pass
16952.250	62.97	51.25	9.77	74.0	54.0	-2.75	6.60	100	Pass



Vertical

RE_FCC Test Case_FCC 15C 1GHz-18GHz



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	Table (o)	Height (cm)	Verdict
2163.000	47.11	36.99	4.50	74.0	54.0	-17.01	229.40	100	Pass
2666.000	50.72	39.66	4.50	74.0	54.0	-14.34	117.40	100	Pass
5564.000	48.21	43.38	-4.42	74.0	54.0	-10.62	318.20	100	Pass
8773.750	57.65	46.47	4.93	74.0	54.0	-7.53	0.10	100	Pass
10902.250	62.19	51.17	9.47	74.0	54.0	-2.83	76.30	100	Pass
15195.000	62.68	52.43	11.01	74.0	54.0	-1.57	241.70	100	Pass



Duty cycle

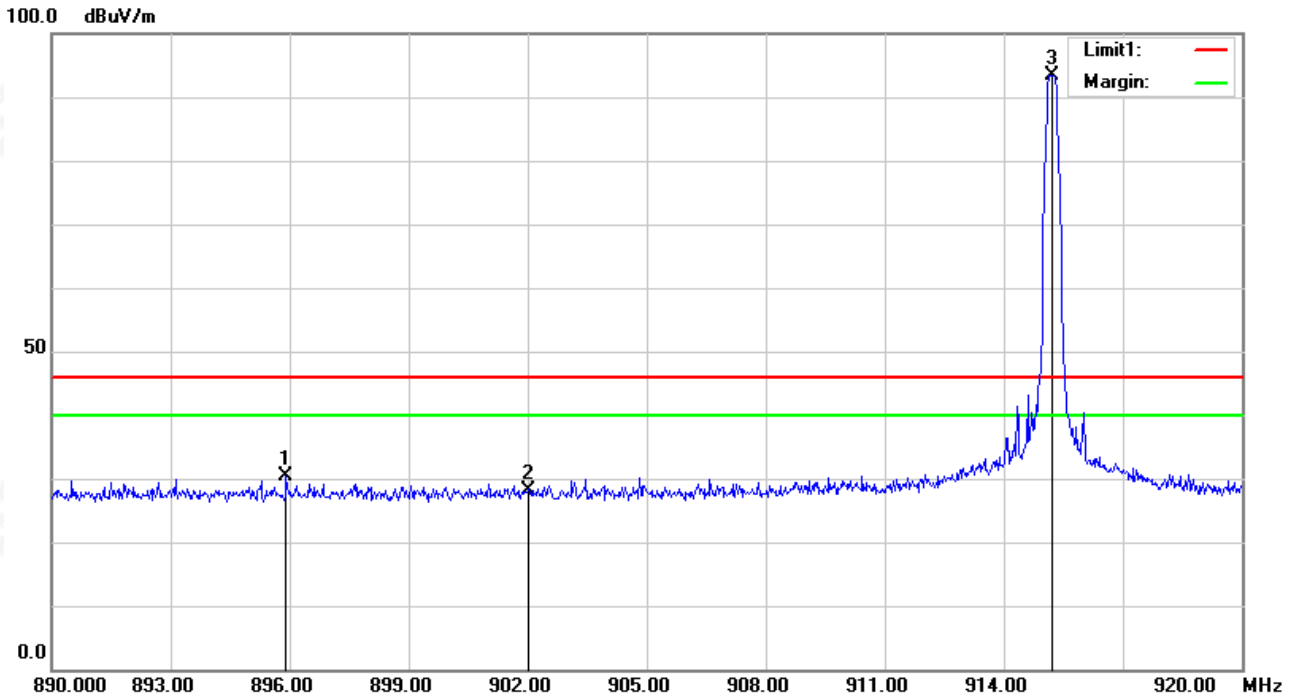


Ton (ms)	Tp (ms)	Duty cycle(%)	Duty Factor
615	1005	61.19%	4.27

Note: Duty Factor=20*LOG10(1/(Ton/Tp))

(Radiation Band edge)

915.2MHz
Horizontal

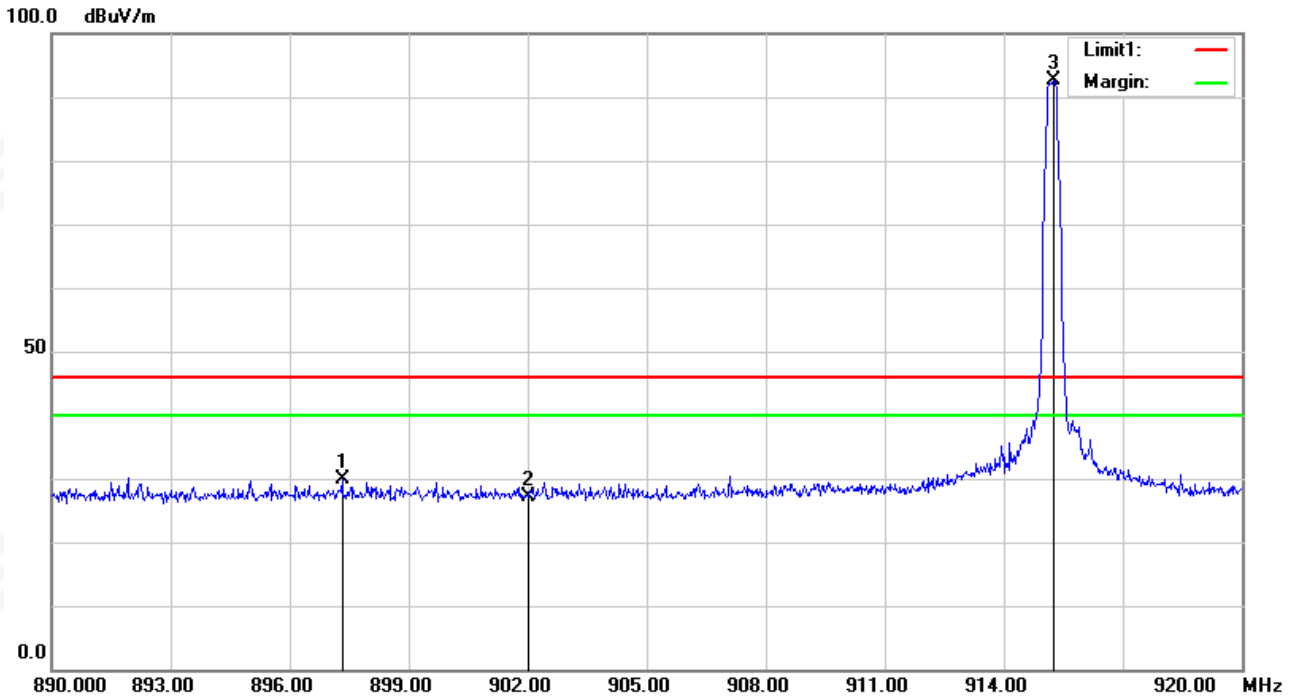


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	895.9100	31.02	-0.55	30.47	46.00	-15.53	peak
2	902.0000	28.45	-0.40	28.05	46.00	-17.95	peak

Fundamental Frequency

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Duty cycle Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
3	915.2000	93.48	-0.10	-	93.38	114.00	-20.62	peak
3	915.2000	93.48	-0.10	4.27	89.11	94.00	-4.89	AVG

Vertical

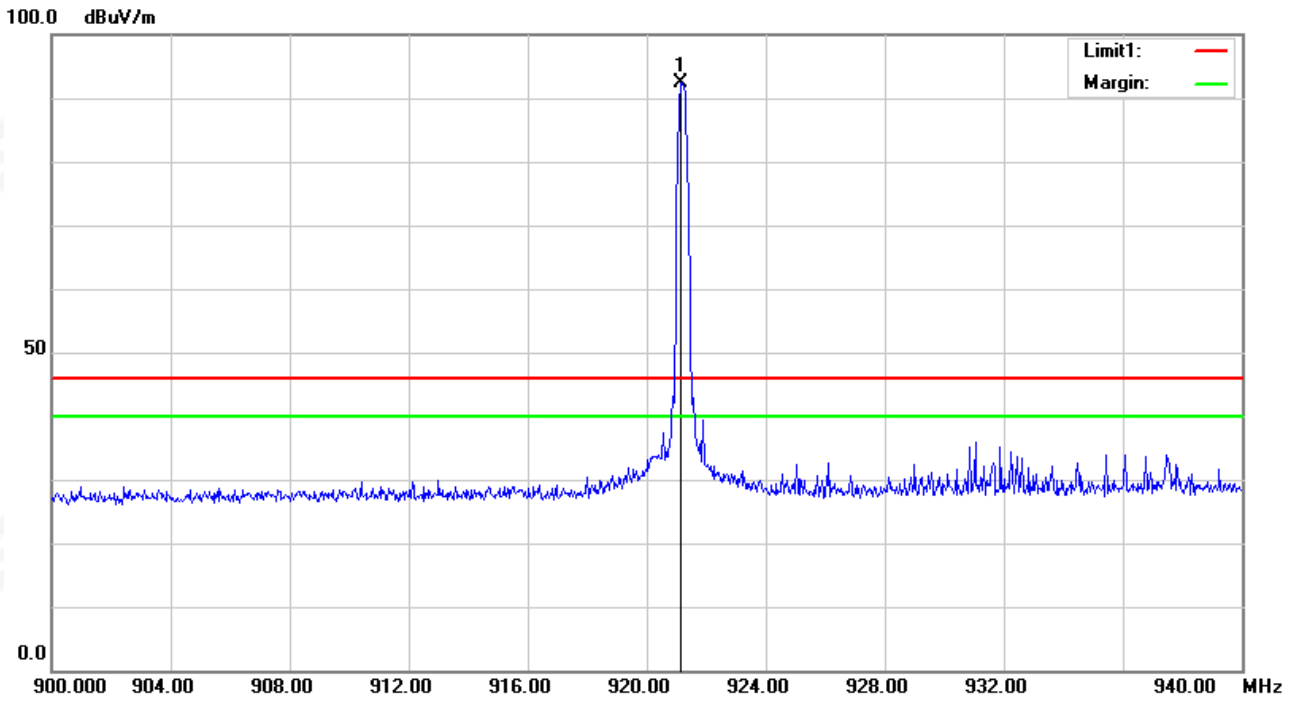


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	897.3200	30.29	-0.51	29.78	46.00	-16.22	peak
2	902.0000	27.63	-0.40	27.23	46.00	-18.77	peak

Fundamental Frequency

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Duty cycle Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
3	915.2000	92.68	-0.10	-	92.58	114.00	-21.42	peak
3	915.2000	92.68	-0.10	4.27	88.31	94.00	-5.69	AVG

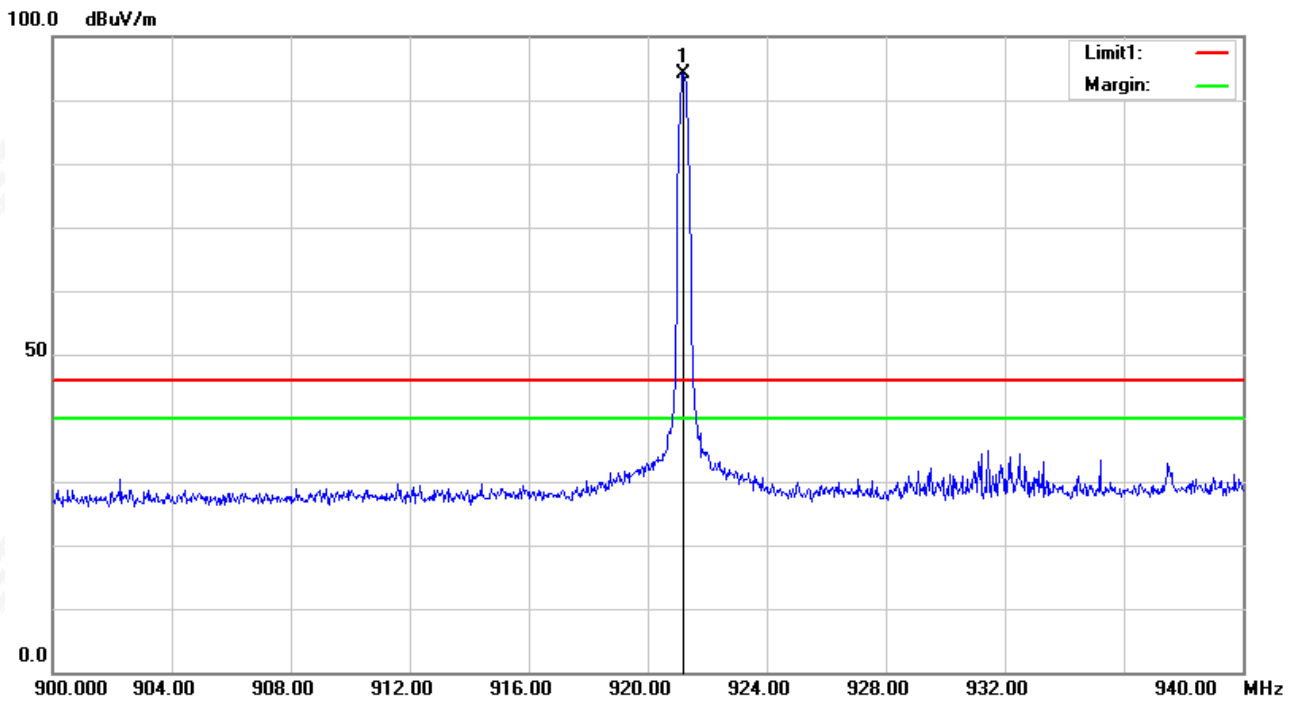
921.2MHz
Horizontal



Fundamental Frequency

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Duty cycle Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	921.2000	92.35	0.05	-	92.40	114.00	-21.60	peak
1	921.2000	92.35	0.05	4.27	88.13	94.00	-5.87	AVG

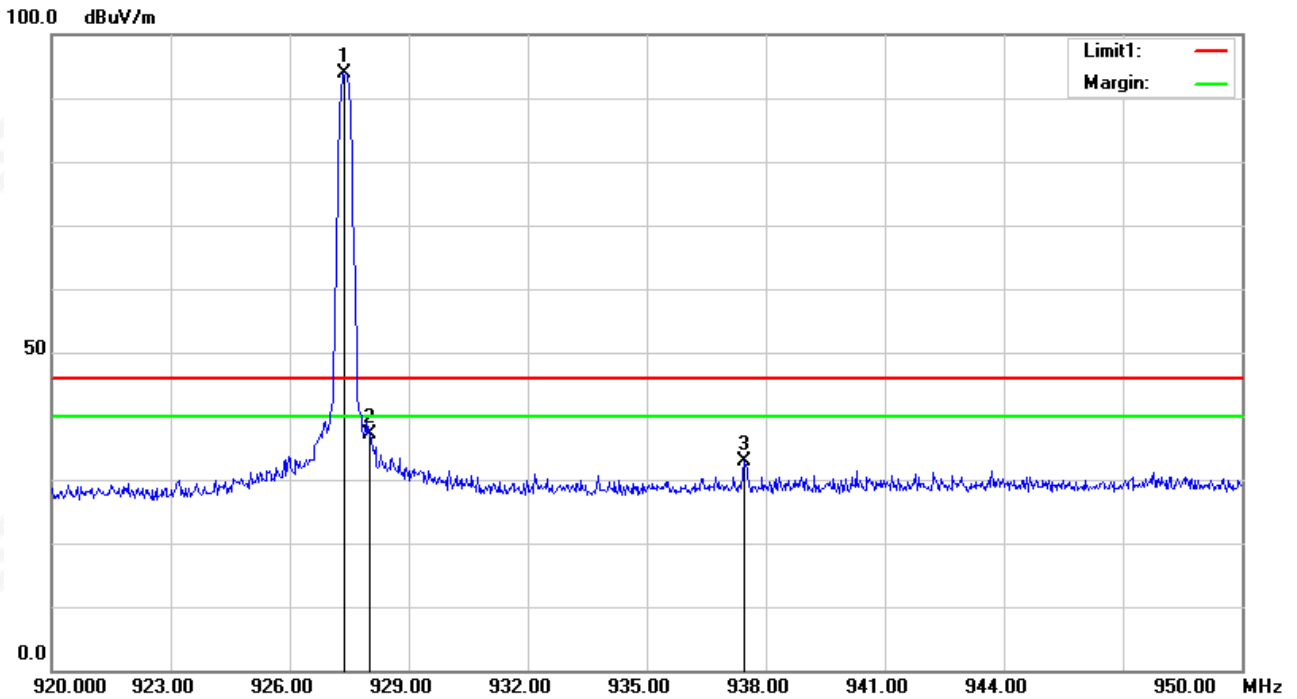
Vertical



Fundamental Frequency

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Duty cycle Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	921.2000	93.99	0.05	-	94.04	114.00	-19.96	peak
1	921.2000	93.99	0.05	4.27	89.77	94.00	-4.23	AVG

927.4MHz
Horizontal

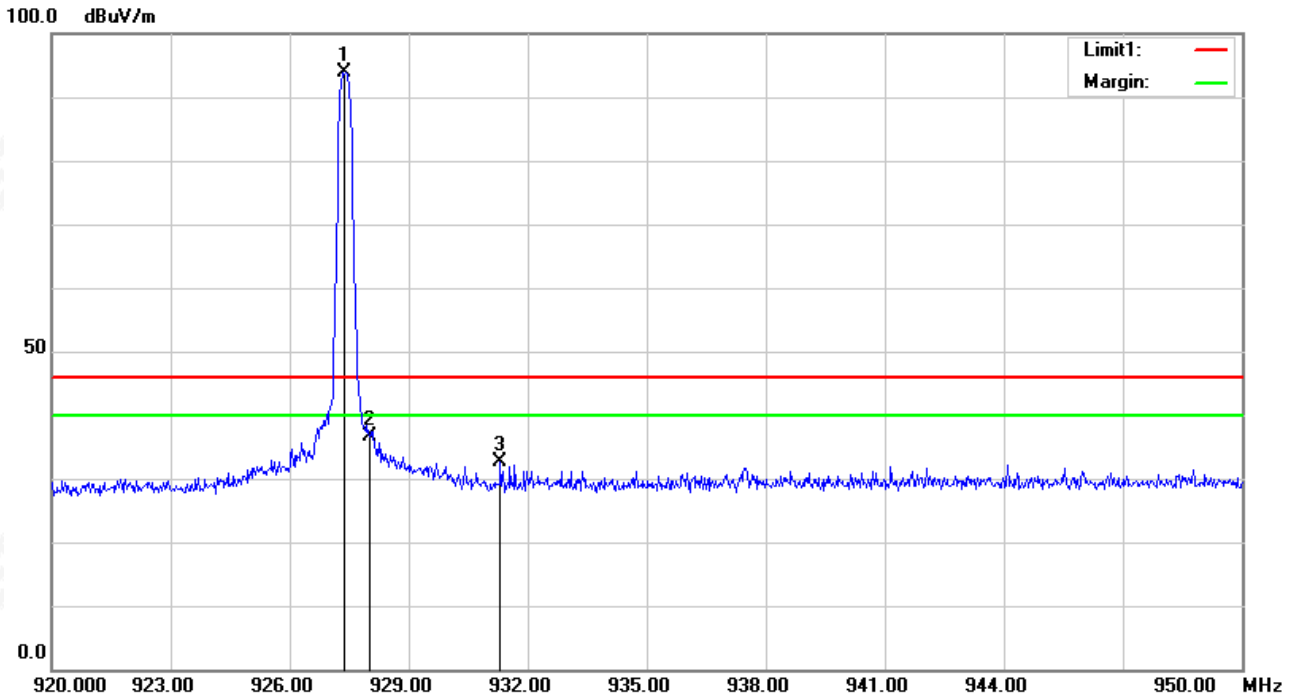


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
2	928.0000	36.58	0.43	37.01	46.00	-8.99	peak
3	937.4600	31.70	1.17	32.87	46.00	-13.13	peak

Fundamental Frequency

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Duty cycle Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	927.4000	93.43	0.40	-	93.83	114.00	-20.17	peak
1	927.4000	93.43	0.40	4.27	89.56	94.00	-4.44	AVG

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
2	928.0000	36.16	0.43	36.59	46.00	-9.41	peak
3	931.3100	32.08	0.65	32.73	46.00	-13.27	peak

Fundamental Frequency

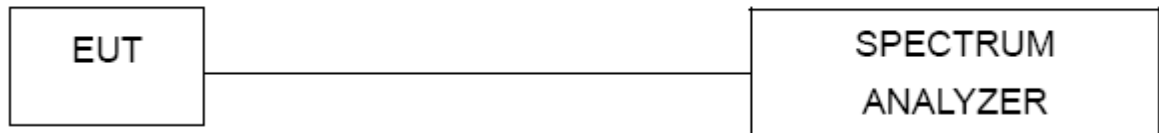
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Duty cycle Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	927.4000	93.48	0.40	-	93.88	114.00	-20.12	peak
1	927.4000	93.48	0.40	4.27	89.61	94.00	-4.39	AVG

4. BANDWIDTH TEST

4.1 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= 1% to 5% OBW, VBW \geq RBW, Sweep time = Auto.

4.2 TEST SETUP



4.3 EUT OPERATION CONDITIONS

TX mode.

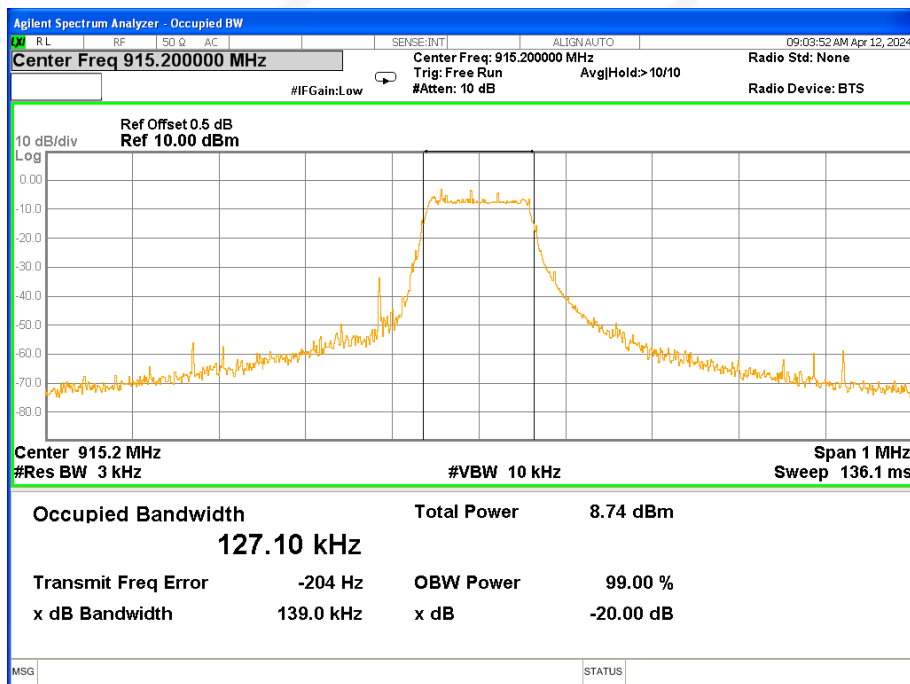


4.4 TEST RESULTS

Temperature:	25°C	Relative Humidity:	50%
Test Voltage:	DC 3.6V		

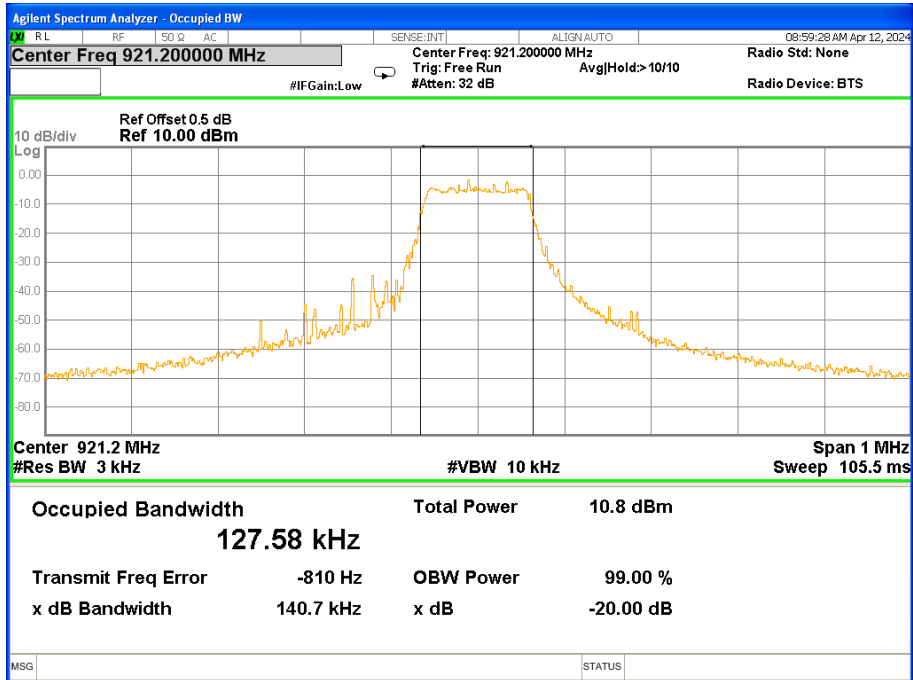
Test Channel	Frequency(MHz)	20 dB Bandwidth(KHz)
CH00	915.2	139
CH30	921.2	140.7
CH61	927.4	143

CH00

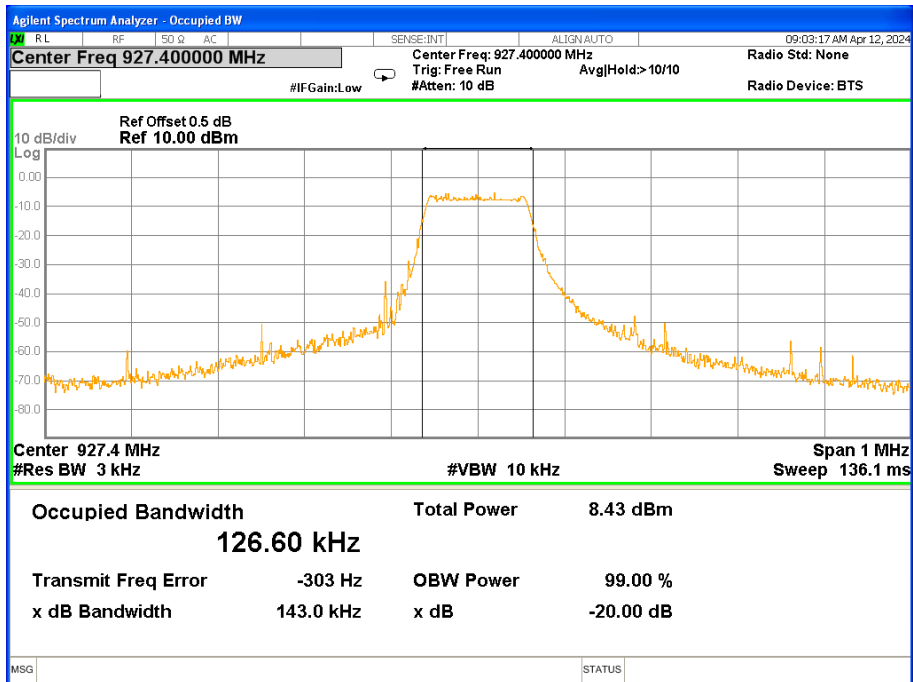




CH30



CH61





5. ANTENNA REQUIREMENT

5.1 STANDARD REQUIREMENT

According to the FCC Part 15 Paragraph 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

5.2 EUT ANTENNA

The EUT antenna is NB IOT external rubber rod waterproof integrated Antenna. It conforms to the standard requirements.



APPENDIX- PHOTOS OF TEST SETUP

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

*****END OF THE REPORT*****