



# FCC RADIO TEST REPORT

Applicant : BROWAN Communications Inc.  
Address : No.15-1, Zhonghua Rd.,Hsinchu Industrial Park,  
Hukou, Hsinchu, Taiwan, 30352.  
Equipment : LoRa Module  
Model No. : WMDS-183G2  
Trade Name : BROWAN  
FCC ID. : 2AAS9-WMDS183G2

**I HEREBY CERTIFY THAT :**

The sample was received on May. 10, 2023 and the testing was completed on Jun. 15, 2023 at CerpPASS Technology Corp. The test result refers exclusively to the test presented test model / sample. Without written approval of CerpPASS Technology Corp., the test report shall not be reproduced except in full.

Approved by:

Mark Liao / Supervisor

Laboratory Accreditation:

CerpPASS Technology Corporation Test Laboratory





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### History of this test report

Report No.	Issued Date	Description
22050020-TRFCC01	Aug. 03, 2022	Original
22050020-TRFCC02-A	Sep. 15, 2022	1. 125K & 500K report separately 2. Revise MPE data 3. Revise Model No 4. Revise Antenna 4 Gain
23050134-TRFCC02	Jun. 17, 2023	Add USB IC



# 1. Summary of Test Procedure and Test Results

## 1.1 Applicable Standards

**ANSI C63.10:2013**

**FCC Rules and Regulations Part 15 Subpart C §15.247**

FCC Rule	Description of Test	Result
15.203	. Antenna Requirement	PASS
15.207	. AC Power Line Conducted Emission	PASS
15.209 15.205	. Radiated Spurious Emission	PASS
15.247(d)	. Conducted Spurious Emission	PASS
15.247(a)(1)	. Channel Carrier Frequencies Separation	PASS
15.247(a)(1)	. 20dB Bandwidth	PASS
15.247(a)(1)	. Dwell Time	PASS
15.247(b)	. Number of Hopping Channels	PASS
15.247(b)	. Peak Output Power Measurement Data	PASS

\*The lab has reduced the uncertainty risk factor from test equipment, environment and staff technicians which according to the standard on contract. Therefore, the test result will only be determined by standard requirement, measurement uncertainty evaluation is not considered.

\*The difference is list below:

1. Add USB IC

\* After engineering evaluation, the following item need to retested:

1. Radiated Spurious Emission(30MHz ~ 1GHz)
2. Conducted Spurious Emission
3. 6dB Bandwidth
4. Power Spectral Density

Refer to original report for other test categories. Test report number: 22050020 -TRFCC02-A.



## 2. Test Configuration of Equipment under Test

### 2.1 Feature of Equipment under Test

Operation Frequency Range	902-928MHz
Center Frequency Range	Lora 500K: 923.3~ 927.5 MHz
Modulation Type	Hybrid
Modulation Technology	DTS
Data Rate	500kbps
Antenna Type	Dipole Antenna
Max Antenna Gain	8 dBi
Cable (ipex cable)	Brand: Tengxiang Model: SMAFN8-3B0150-00X-P
Cable (N-Type to ipex)	Brand: TSKY Model: A8-A004-00189
Cable (N-Type to SMA)	Brand: KWANG HWA ELECT MATERIAL CO., LTD. Model: SL-NM-SMF-1M
Antenna 1	Brand: GSC Model: OMA-G01 Antenna Gain:8 dBi
Antenna 2	Brand: GSC Model: OMA-G03A Antenna Gain:5 dBi
Antenna 3	Brand: GSC Model: OMA-G04A Antenna Gain:3 dBi
Antenna 4	Brand: ASUS Model: A8-A003-00108 Antenna Gain:1.2 dBi
Antenna 5	Brand: Tengxiang Model: AB0915-4602RS-1P5M Antenna Gain: 0.61 dBi

Note: For more details, please refer to the User’s manual of the EUT.



## 2.2 Carrier Frequency of Channes

Lora 500K

Channel	Frequency (MHz)
<b>*0</b>	<b>923.3</b>
1	923.9
2	924.5
3	925.1
4	925.7
5	926.3
6	926.9
<b>*7</b>	<b>927.5</b>

Note: Channels remarked \* are selected to perform test.



### 2.3 Test Mode & Test Software

- a. During testing, the interface cables and equipment positions were varied according to ANSI C63.10
- b. The complete test system included Notebook and EUT for RF test.
- c. An executive program, "command" under Windows OS system was executed to transmit and receive data via Lora 500K.
- d. The following test modes were performed for the test:

Conducted Emissions from the AC mains power ports	
Test Mode	Operating Description
1	Lora 500K From Adapter
caused "Test Mode 1" generated the worst case, it was reported as the final data.	
Radiation Emissions (30MHz ~ 1GHz)	
Test Mode	Operating Description
1	Lora 500K From Adapter
caused "Test Mode 1" generated the worst case, it was reported as the final data.	
Radiation Emissions (1GHz ~ 25GHz)	
Test Mode	Operating Description
1	Lora 500K From Adapter
caused "Test Mode 1" generated the worst case, they were reported as the final data.	

Note:

- 1. There are two kinds of test voltage: AC 120V / 60Hz and AC 240V / 60Hz.  
 For AC Power Line Conducted Emission, AC 120V / 60Hz is worst case.  
 For Radiated Spurious Emission(30MHz ~ 1GHz), AC 240V / 60Hz is worst case.  
 For Radiated Spurious Emission(1GHz ~ 25GHz), AC 120V / 60Hz is worst case.





## 2.4 Description of Test System

For 22050020 -TRFCC02-A

RF Conducted				
Equipment	Brand	Model	Length/Type	Power cord/Length/Type
Notebook	lenovo	S1GL2W	N/A	N/A
RJ45 Cable	TE CONNECTIVITY	CAT5E	1.2m / NS	N/A
adapter	Frecom	F18L16-120150SPAU	1m/NS	N/A
Radiated Emissions				
Equipment	Brand	Model	Length/Type	Power cord/Length/Type
Notebook	ASUS	P2430U	N/A	Adapter / 1.8m / NS
RJ45 Cable	TE CONNECTIVITY	CAT5E	1.2m / NS	N/A
adapter	Frecom	F18L16-120150SPAU	1m/NS	N/A
AC Power Line Conducted Emission				
Equipment	Brand	Model	Length/Type	Power cord/Length/Type
Notebook	ASUS	P2430U	N/A	Adapter / 1.8m / NS
RJ45 Cable	TE CONNECTIVITY	CAT5E	1.2m / NS	N/A
adapter	Frecom	F18L16-120150SPAU	1m/NS	N/A

For Retest

RF Conducted				
Equipment	Brand	Model	Length/Type	Power cord/Length/Type
Notebook	lenovo	S1GL2W	N/A	N/A
RJ45 Cable	TE CONNECTIVITY	CAT5E	1.2m / NS	N/A
Radiated Emissions				
Equipment	Brand	Model	Length/Type	Power cord/Length/Type
Notebook	ASUS	P2430U	N/A	Adapter / 1.8m / NS
RJ45 Cable	TE CONNECTIVITY	CAT5E	1.2m / NS	N/A
adapter	Frecom	F18L16-120150SPAU	1m/NS	N/A

**2.5 General Information of Test**

Test Site	<b>Cerpass Technology Corporation Test Laboratory</b> Address: No.10, Ln. 2, Lianfu St., Luzhu Dist., Taoyuan City 33848, Taiwan (R.O.C.) Tel:+886-3-3226-888 Fax:+886-3-3226-881	
	FCC	TW1439, TW1079
	IC	4934E-1, 4934E-2
	VCCI	T-2205 for Telecommunication test C-4663 for Conducted emission test R-4218 for Radiated emission test G-10812, G-10813 for radiated disturbance above 1GHz
Frequency Range Investigated:	Conducted: from 150kHz to 30 MHz Radiation: from 30 MHz to 40,000MHz	
Test Distance:	The test distance of radiated emission from antenna to EUT is 3 M.	

For 22050020 -TRFCC02-A

Test Item	Test Site	Test period	Environmental Conditions	Tested By
RF Conducted	RFCON01-NK	2022/6/8 ~2022/07/19	24.4~29.3°C / 44~57%	Dian Chen
Radiated Emissions	3M03-NK	2022/07/19 ~2022/07/20	22~25°C / 42~44%	Dian Chen
AC Power Line Conducted Emission	CON01-NK	2022/07/20	26°C / 60%	Dian Chen

For Retest

Test Item	Test Site	Test period	Environmental Conditions	Tested By
RF Conducted	RFCON01-NK	2023/05/29	26°C / 48%	Leon Huang
RF Conducted	RFCON01-NK	2023/06/13	28°C / 47%	Leon Huang
RF Conducted	RFCON01-NK	2023/06/15	25.5°C / 47%	Leon Huang
Radiated Emissions	3M03-NK	2023/05/30 ~2023/06/06	23~25°C / 50~56%	Leon Huang



## 2.6 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

Before 2023/05/30

Measurement Item	Uncertainty
AC Power Line Conduction(150K~30MHz)	±3.12dB
Radiated Spurious Emission(9KHz~30MHz)	±3.4dB
Radiated Spurious Emission(30MHz~1GHz)	±5.7dB
Radiated Spurious Emission(1GHz~25GHz)	±6.8dB
Conducted Spurious Emission	±1.8dB
6dB Bandwidth	±4.4%
20dB Bandwidth	±4.4%
Occupied Bandwidth	±4.4%
Peak Output Power(Conducted Power Meter)	±1.1dB
Dwell Time / Deactivation Time	±1.2%
Power Spectral Density	±1.8dB
Duty Cycle	±1.2%

After 2023/05/30

Measurement Item	Uncertainty
Radiated Spurious Emission(9KHz~30MHz)	±3.5dB
Radiated Spurious Emission(30MHz~1GHz)	±5.1dB
Conducted Spurious Emission	±2.1dB
20dB Bandwidth	±4.4%
Occupied Bandwidth	±4.5%
Peak Output Power(Conducted Power Meter)	±1.1dB



### 3. Test Equipment and Ancillaries Used for Tests

For 22050020 -TRFCC02-A

Test Item	Radiated Emissions				
Test Site	Semi Anechoic Room(3M03-NK)				
Bilog Antenna	Sunol	JB1	A020514-2	2022/6/2	2023/6/1
Active Loop Antenna	EMCO	6507	40855	2022/5/25	2023/5/24
Double Ridged Guide Horn Antenna	RF SPAN	DRH18-E	210309A18-ES	2021/11/9	2022/11/8
Horn Antenna	EMCO	3116	31974	2021/10/4	2022/10/3
EMI Receiver	ROHDE & SCHWARZ	ESCI	100821	2021/9/17	2022/9/16
Spectrum Analyzer	ROHDE & SCHWARZ	FSP 40	100219	2021/8/6	2022/8/5
Preamplifier	EM Electronics corp.	EM01G18G	60701	2022/5/12	2023/5/11
Preamplifier	EMC INSTRUMENTS	EMC184045	980065	2021/11/16	2022/11/15
Preamplifier	EM Electronics corp.	EM01M06G	60686	2021/10/28	2022/10/27
Cable-6m(9k~300M)	NA	EMC5D-BM-BM-6	130606	2022/3/21	2023/3/20
Cable-10m(30M-1G)	HUBER SUHNER	RG-214	01126M	2022/4/22	2023/4/21
Cable-4m(30M-1G)	HUBER SUHNER	RG-214	02953M	2022/4/22	2023/4/21
Cable-1m(30M-1G)	HUBER SUHNER	RG-214	01099M	2022/4/22	2023/4/21
Cable-6m(1G-26.5G)	HUBER SUHNER	SUCOFLEX 102	28417/2	2022/3/17	2023/3/16
Cable-0.5m(1G-18G)	EMEC	EM104-SMSM-0.5M	CCE1354	2022/5/26	2023/5/25
Cable-3m(1G-18G)	EMEC	EM104-SMSM-3M	CCE1355	2022/5/26	2023/5/25
Cable-0.5m(1G-40G)	HUBER SUHNER	SUCOFLEX 102	MY4569/2	2021/9/3	2022/9/2
Cable-1m(1G-40G)	HUBER SUHNER	SUCOFLEX 102	MY5739/2	2021/9/3	2022/9/2
Cable-6m(1G-40G)	HUBER SUHNER	SUCOFLEX 102	MY5740/2	2021/9/3	2022/9/2
E3	AUDIX	v8.2014-8-6	RK-000529	NA	NA

Test Item	RF Conducted				
Test Site	RFCON01-NK				
Instrument	Manufacturer	Model No	Serial No	Calibration Date	Valid Date
Spectrum Analyzer	ROHDE & SCHWARZ	FSP 40	100047	2022/03/04	2023/03/03
Attenuator	KEYSIGHT	8491B	MY39250703	2022/04/12	2023/04/11
Cable-0.5m(1G-26.5G)	HUBER SUHNER	SUCOFLEX 102	28422/2	2022/04/09	2023/04/08
Power Meter	Anritsu	ML2495A	1224005	2022/04/12	2023/04/11
Power Sensor	Anritsu	MA2411B	1207295	2022/04/12	2023/04/11
Switch Box	Theda	1-4	TW5451159	NA	NA



Test Item	AC Power Line Conducted Emission				
Test Site	CON01-NK				
Instrument	Manufacturer	Model No	Serial No	Calibration Date	Valid Date
EMI Receiver	ROHDE & SCHWARZ	ESCI	101200	2021/08/30	2022/08/29
Line Impedance Stabilization Network	Schwarzbeck	NSLK 8127	8127-516	2021/10/05	2022/10/04
Pulse Limiter	ROHDE & SCHWARZ	ESH3-Z2	101933	2021/09/15	2022/09/14
Cable-6m(9k~300M)	NA	EMC5D-BM-BM-6	130605	2021/09/22	2022/09/21
E3	AUDIX	v8.2014-8-6	RK-000531	NA	NA

## For Retest

Test Item	Radiated Emissions				
Test Site	Semi Anechoic Room(3M03-NK)				
Bilog Antenna	Sunol	JB1	A051717	2022/07/22	2023/07/21
Active Loop Antenna	Schwarzbeck	FMZB 1513	414	2023/02/03	2024/02/02
Double Ridged Guide Horn Antenna	RF SPAN	DRH18-E	210309A18-ES	2022/08/24	2023/08/23
Horn Antenna	EMCO	3116	31970	2023/03/03	2024/03/02
EMI Receiver	ROHDE & SCHWARZ	ESCI	101402	2023/03/02	2024/03/01
Spectrum Analyzer	ROHDE & SCHWARZ	FSP 40	100219	2022/08/16	2023/08/15
Preamplifier	EM Electronics corp.	EM01G18G	60700	2022/09/05	2023/09/04
Preamplifier	EMC INSTRUMENTS	EMC184045	980065	2022/11/11	2023/11/10
Amplifier	EM Electronics corp.	EM330	60644	2022/09/05	2023/09/04
Cable-1m(30M-1G)	HUBER SUHNER	RG-214	05094M	2022/09/06	2023/09/05
Cable-1.5m(30M-1G)	HUBER SUHNER	RG-214	00420M	2022/06/21	2023/06/20
Cable-9m(30M-1G)	HUBER SUHNER	RG-214	00402M	2022/09/06	2023/09/05
Cable-6m(9k~300M)	NA	EMC5D-BM-BM-6	130605	2022/09/06	2023/09/05
Cable-1m(1G-26.5G)	HUBER SUHNER	SF126E	589849/126E	2022/11/09	2023/11/08
Cable-3m(10M-26.5G)	HUBER SUHNER	SF126E	587398/126E	2022/10/07	2023/10/06
Cable-0.5m(30M-40G)	HUBER SUHNER	SUCOFLEX 102	28420/2	2023/03/07	2024/03/06
Cable-3m(30M-40G)	HUBER SUHNER	SUCOFLEX 102	MY2608/2	2023/03/07	2024/03/06
E3	AUDIX	v8.2014-8-6	RK-000529	NA	NA



Test Item	RF Conducted				
Test Site	RFCON01-NK				
Instrument	Manufacturer	Model No	Serial No	Calibration Date	Valid Date
Spectrum Analyzer	ROHDE & SCHWARZ	FSP 40	100047	2023/02/24	2024/02/23
Attenuator	KEYSIGHT	8491B	MY39250703	2023/03/07	2024/03/06
Cable-0.5m(1G-26.5G)	HUBER SUHNER	SUCOFLEX 102	28422/2	2023/03/07	2024/03/06
Power Meter	Anritsu	ML2495A	1224005	2023/03/07	2024/03/06
Power Sensor	Anritsu	MA2411B	1207295	2023/03/07	2024/03/06
Switch Box	Theda	1-4	TW5451159	NA	NA



## 4. Antenna Requirements

### 4.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 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.

And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

### 4.2 Antenna Construction and Directional Gain

Antenna Type		Antenna Gain
Antenna A	Dipole Antenna	8 dBi

Directional gain greater than 6dBi are used, the power limit shall be reduced by 1 dB.



## 5. Test of AC Power Line Conducted Emission

### 5.1 Test Limit

Conducted Emissions were measured from 150 kHz to 30 MHz with a bandwidth of 9 KHz, according to the methods defined in ANSI C63.10-2013. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

Frequency (MHz)	Quasi Peak (dB $\mu$ V)	Average (dB $\mu$ V)
0.15 – 0.5	66-56*	56-46*
0.5 – 5.0	56	46
5.0 – 30.0	60	50

\*Decreases with the logarithm of the frequency.

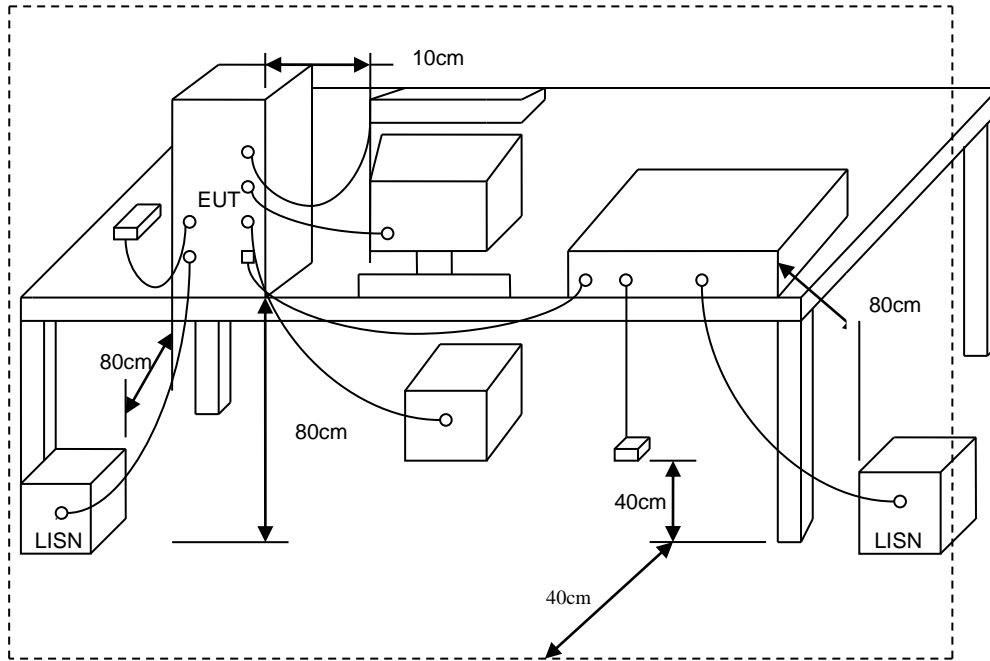
### 5.2 Test Procedures

- a. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- b. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- c. All the support units are connecting to the other LISN.
- d. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- e. The FCC states that a 50 ohm, 50 micro-Henry LISN should be used.
- f. Both sides of AC line were checked for maximum conducted interference.
- g. The frequency range from 150 kHz to 30 MHz was searched.
- h. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.





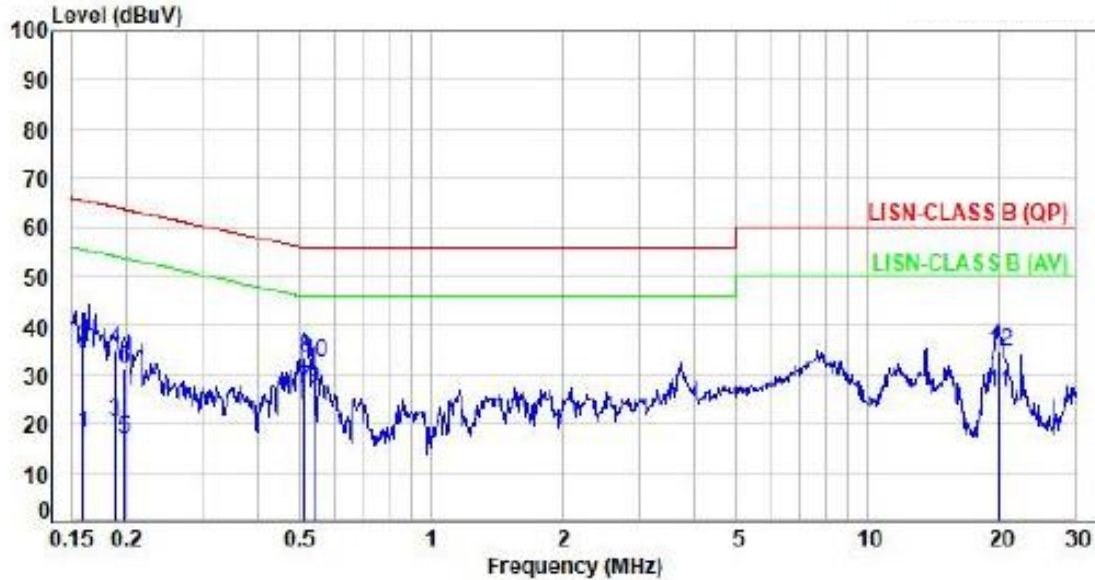
### 5.3 Typical Test Setup





### 5.4 Test Result and Data

Power	: AC 120V / 60Hz	Pol/Phase	: LINE
Test Mode	: Mode 1		:

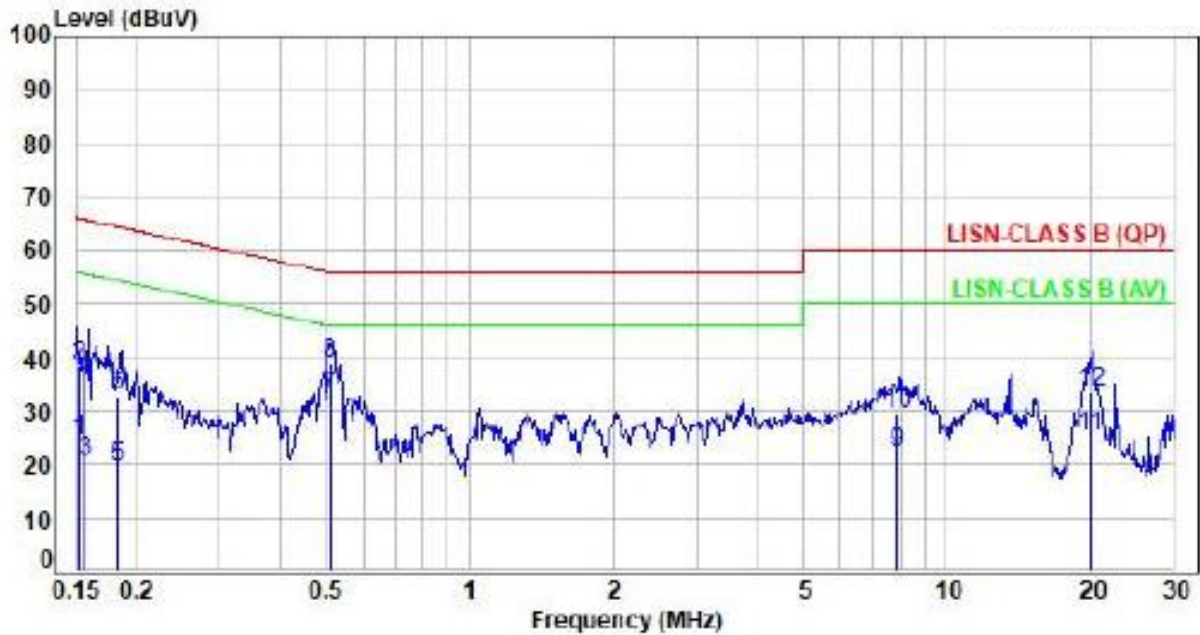


No.	Frequency (MHz)	Factor (dB)	Reading (dBUV)	Level (dBUV)	Limit (dBUV)	Margin (dB)	Detector	P/F
1	0.16	9.96	7.77	17.73	55.46	-37.73	Average	P
2	0.16	9.96	25.42	35.38	65.46	-30.08	QP	P
3	0.19	9.95	10.22	20.17	54.13	-33.96	Average	P
4	0.19	9.95	25.11	35.06	64.13	-29.07	QP	P
5	0.20	9.95	6.66	16.61	53.74	-37.13	Average	P
6	0.20	9.95	21.24	31.19	63.74	-32.55	QP	P
7	0.51	9.97	16.96	26.93	46.00	-19.07	Average	P
8	0.51	9.97	23.41	33.38	56.00	-22.62	QP	P
9	0.54	9.97	17.15	27.12	46.00	-18.88	Average	P
10	0.54	9.97	22.34	32.31	56.00	-23.69	QP	P
11	19.97	10.71	15.57	26.28	50.00	-23.72	Average	P
12	19.97	10.71	23.85	34.56	60.00	-25.44	QP	P

Note: Level=Reading+Factor  
 Margin=Level-Limit  
 Factor=(LISN or ISN or Current Probe)Factor + Cable Loss



Power	: AC 120V / 60Hz	Pol/Phase	: NEUTRAL
Test Mode	: Mode 1		:



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.15	9.94	14.28	24.22	55.93	-31.71	Average	P
2	0.15	9.94	28.55	38.49	65.93	-27.44	QP	P
3	0.16	9.94	10.59	20.53	55.63	-35.10	Average	P
4	0.16	9.94	25.96	35.90	65.63	-29.73	QP	P
5	0.18	9.93	9.55	19.48	54.36	-34.88	Average	P
6	0.18	9.93	22.86	32.79	64.36	-31.57	QP	P
7	0.51	9.94	22.87	32.81	46.00	-13.19	Average	P
8	0.51	9.94	28.87	38.81	56.00	-17.19	QP	P
9	7.90	10.28	11.59	21.87	50.00	-28.13	Average	P
10	7.90	10.28	18.81	29.09	60.00	-30.91	QP	P
11	19.96	10.60	14.64	25.24	50.00	-24.76	Average	P
12	19.96	10.60	22.70	33.30	60.00	-26.70	QP	P

Note: Level=Reading+Factor  
 Margin=Level-Limit  
 Factor=(LISN or ISN or Current Probe)Factor + Cable Loss



## 6. Test of Radiated Spurious Emission

### 6.1 Test Limit

In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. If the transmitter measurement is based on the maximum conducted output power, the attenuation required under this paragraph shall be 30dB instead of 20dB. In addition, radiated emissions which fall in section 15.205(a) the restricted bands must also comply with the radiated emission limit specified in section 15.209(a).

Frequency (MHz)	Field Strength (microvolt/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
Above 960	500	3

### 6.2 Test Procedures

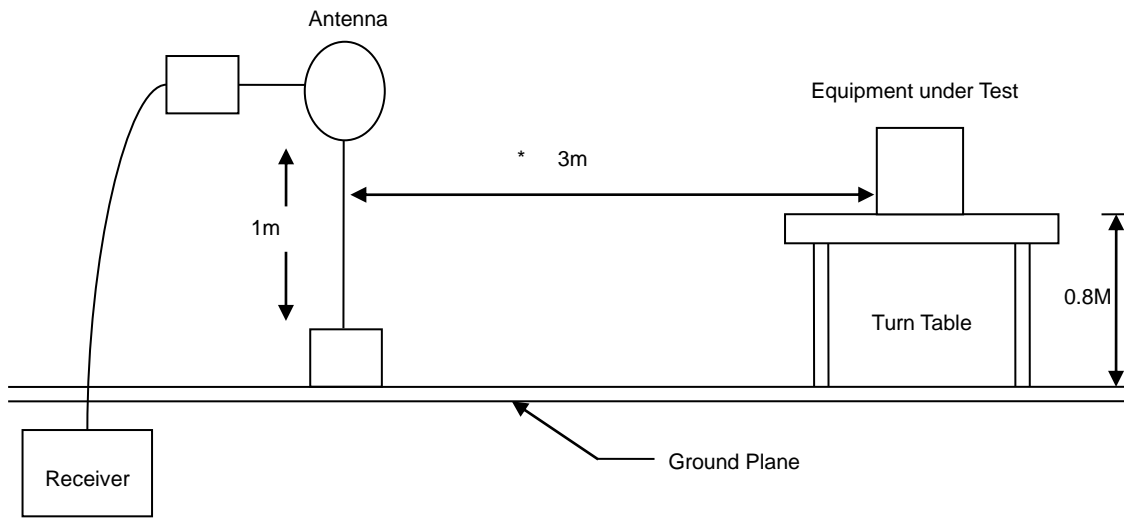
- The EUT was placed on a rotatable table top 0.8 meter above ground.
- The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
- The table was rotated 360 degrees to determine the position of the highest radiation.
- The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
- For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
- Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
- For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

Note: The supporting fixture shall permit orientation of the EUT in each of three orthogonal axis positions such that emissions from the EUT are maximized.  
(Z-AXIS is the worst.)

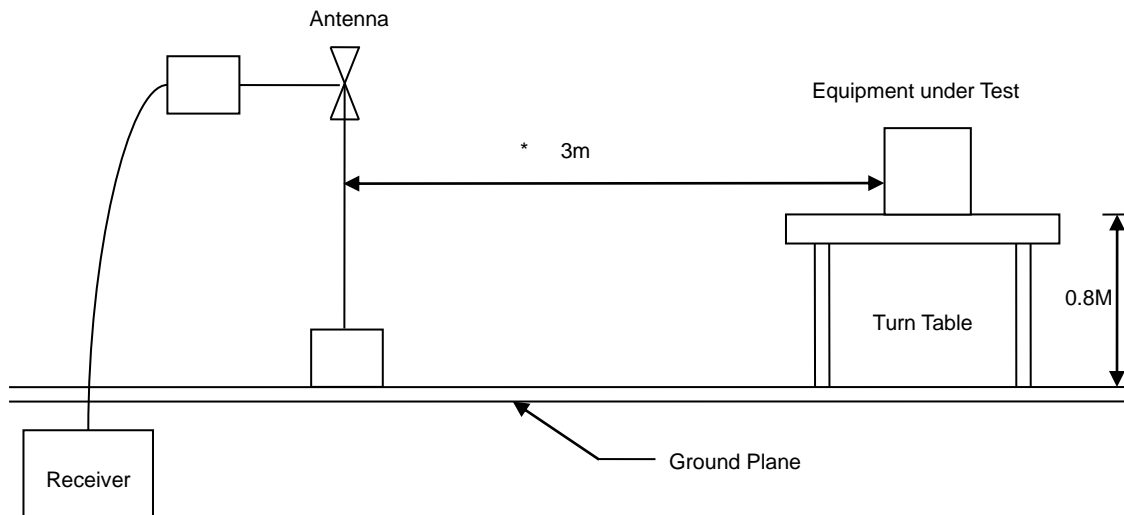


### 6.3 Typical Test Setup

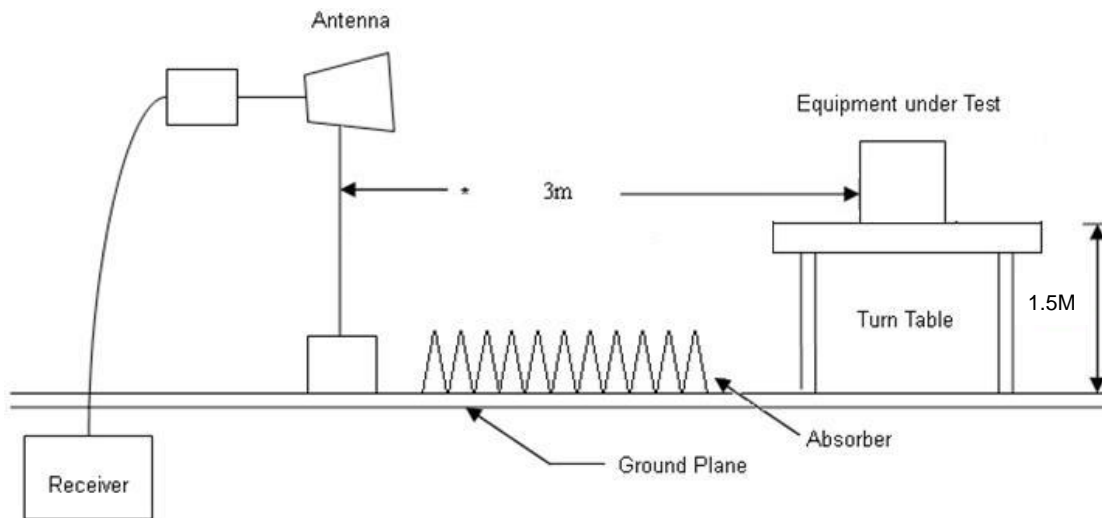
Below 30MHz test setup



30MHz- 1GHz Test Setup



Above 1GHz Test Setup



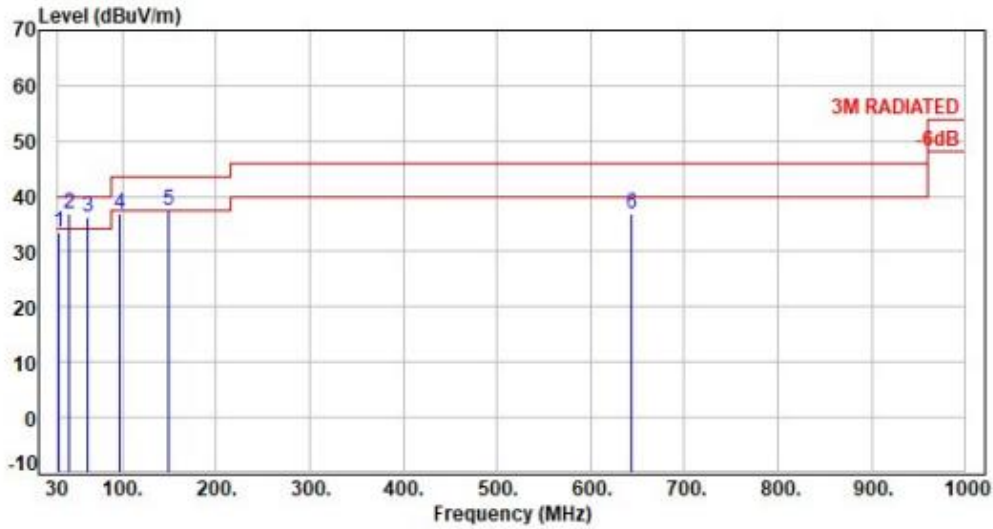


### 6.4 Test Result and Data (9kHz ~ 30MHz)

The 9kHz-30MHz spurious emission is under limit 20dB more.

### 6.5 Test Result and Data (30MHz ~ 1GHz)

Power	: AC 240V / 60Hz	Pol/Phase	: VERTICAL
Test Mode	: Mode 1, CH00 923.3 (MHz)		



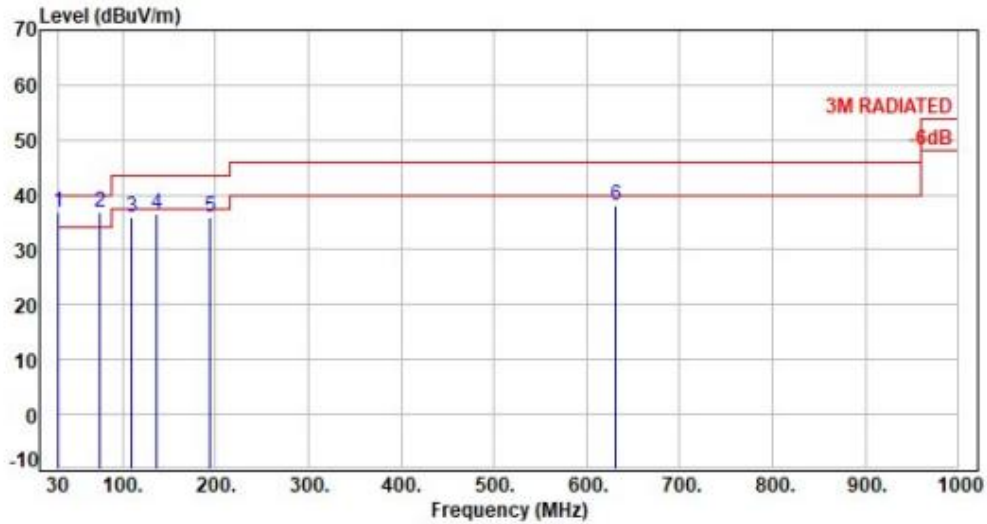
No.	Frequency (MHz)	Factor (dB)	Reading (dBUV)	Level (dBUV/m)	Limit (dBUV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	31.45	-3.41	36.96	33.55	40.00	-6.45	Peak	400	0	P
2	43.28	-12.23	49.06	36.83	40.00	-3.17	QP	100	220	P
3	62.39	-16.28	52.66	36.38	40.00	-3.62	Peak	400	0	P
4	97.65	-14.60	51.32	36.72	43.50	-6.78	Peak	400	0	P
5	148.55	-10.83	48.32	37.49	43.50	-6.01	Peak	400	0	P
6	643.11	-1.57	38.54	36.97	46.00	-9.03	Peak	400	0	P

Note: Level=Reading+Factor  
Margin=Level-Limit  
Factor=Antenna Factor + cable loss - Amplifier Factor





Power	: AC 240V / 60Hz	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1, CH00 923.3 (MHz)		:

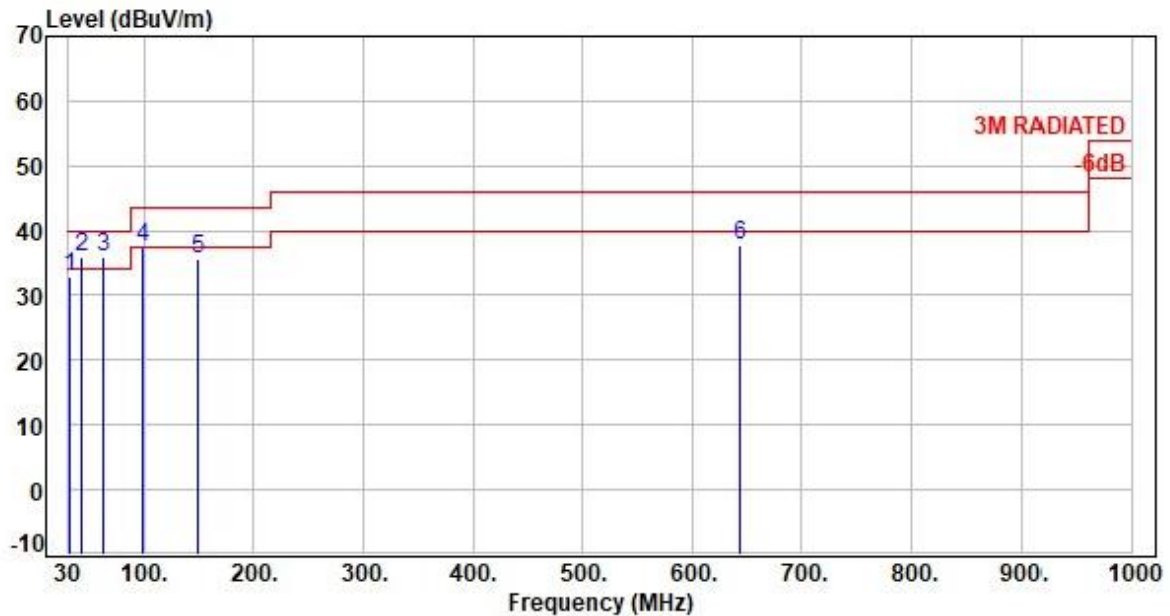


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	30.00	-2.44	39.22	36.78	40.00	-3.22	Peak	400	0	P
2	74.99	-16.02	52.88	36.86	40.00	-3.14	Peak	400	0	P
3	109.23	-11.36	47.27	35.91	43.50	-7.59	Peak	400	0	P
4	136.42	-10.11	46.77	36.66	43.50	-6.84	Peak	400	0	P
5	194.79	-10.95	46.95	36.00	43.50	-7.50	Peak	400	0	P
6	631.26	-2.05	40.14	38.09	46.00	-7.91	Peak	400	0	P

Note: Level=Reading+Factor  
Margin=Level-Limit  
Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: AC 240V / 60Hz	Pol/Phase	: VERTICAL
Test Mode	: Mode 1, CH07 927.5 (MHz)		:



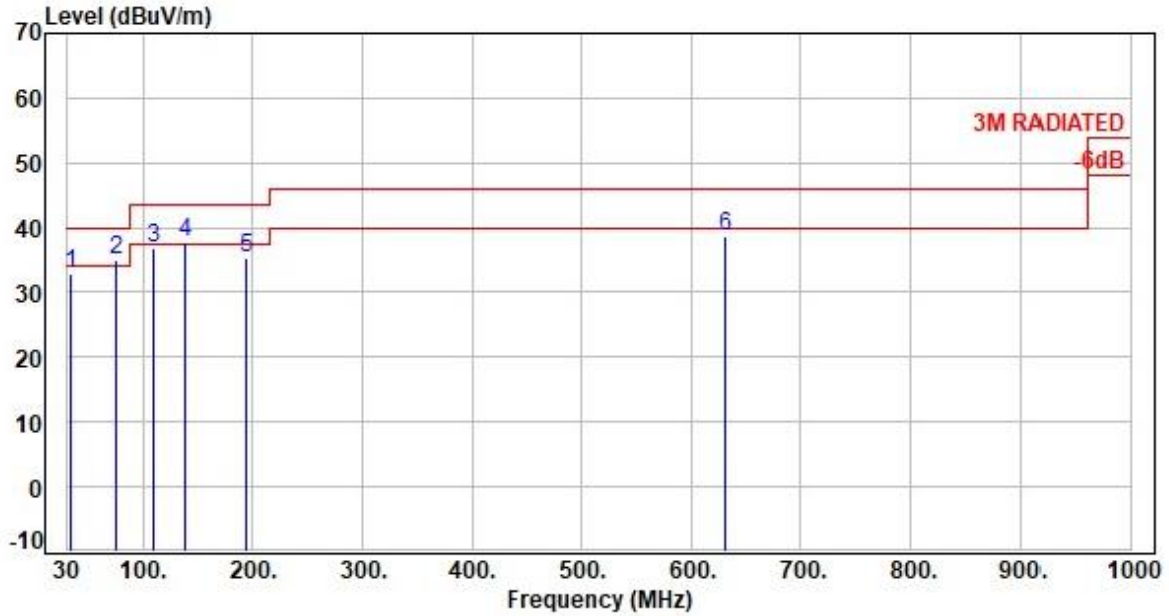
No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	32.36	-4.11	37.03	32.92	40.00	-7.08	Peak	400	0	P
2	43.28	-12.23	48.17	35.94	40.00	-4.06	QP	100	231	P
3	62.39	-16.28	52.10	35.82	40.00	-4.18	Peak	400	0	P
4	98.66	-14.23	51.62	37.39	43.50	-6.11	Peak	400	0	P
5	148.55	-10.83	46.52	35.69	43.50	-7.81	Peak	400	0	P
6	643.11	-1.57	39.23	37.66	46.00	-8.34	Peak	400	0	P

Note: Level=Reading+Factor  
Margin=Level-Limit  
Factor=Antenna Factor + cable loss - Amplifier Factor





Power	: AC 240V / 60Hz	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1, CH07 927.5 (MHz)		



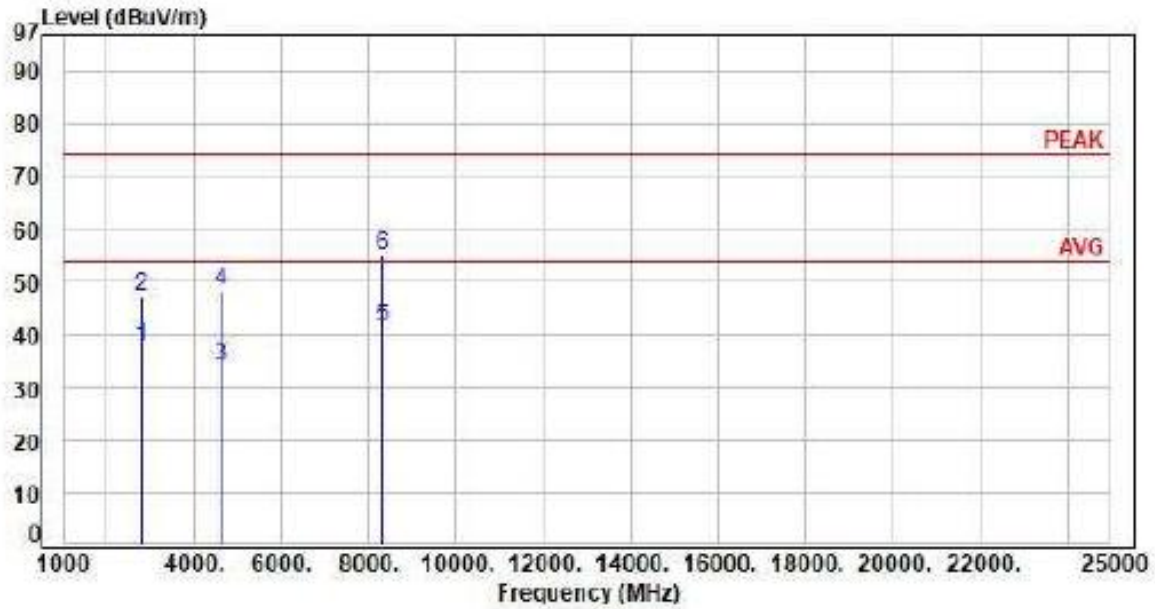
No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	33.42	-5.10	38.12	33.02	40.00	-6.98	Peak	400	0	P
2	75.02	-16.03	50.97	34.94	40.00	-5.06	Peak	400	0	P
3	109.23	-11.36	48.15	36.79	43.50	-6.71	Peak	400	0	P
4	139.00	-10.22	48.02	37.80	43.50	-5.70	Peak	400	0	P
5	194.79	-10.95	46.35	35.40	43.50	-8.10	Peak	400	0	P
6	631.26	-2.05	40.66	38.61	46.00	-7.39	Peak	400	0	P

Note: Level=Reading+Factor  
Margin=Level-Limit  
Factor=Antenna Factor + cable loss - Amplifier Factor



### 6.6 Test Result and Data (1GHz ~ 25GHz)

Power	: AC 120V / 60Hz	Pol/Phase	: VERTICAL
Test Mode	: Mode 1, CH00 923.3 (MHz)		

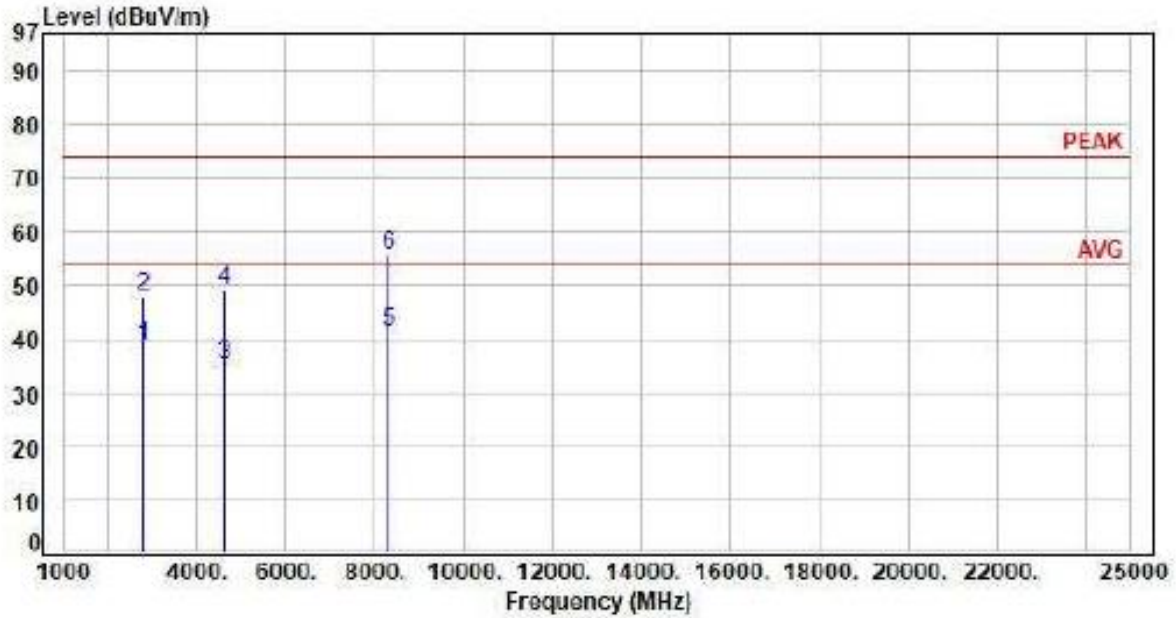


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2769.90	-28.26	65.89	37.63	54.00	-16.37	Average	251	360	P
2	2769.90	-28.26	75.32	47.86	74.00	-26.94	Peak	251	360	P
3	4616.50	-22.31	56.22	33.91	54.00	-20.09	Average	100	171	P
4	4616.50	-22.31	70.52	48.21	74.00	-25.79	Peak	100	171	P
5	8309.70	-14.24	55.50	41.26	54.00	-12.74	Average	100	308	P
6	8309.70	-14.24	69.38	55.14	74.00	-18.86	Peak	100	308	P

Note: Level-Reading+Factor  
Margin-Level-Limit  
Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: AC 120V / 60Hz	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1, CH00 923.3 (MHz)		:

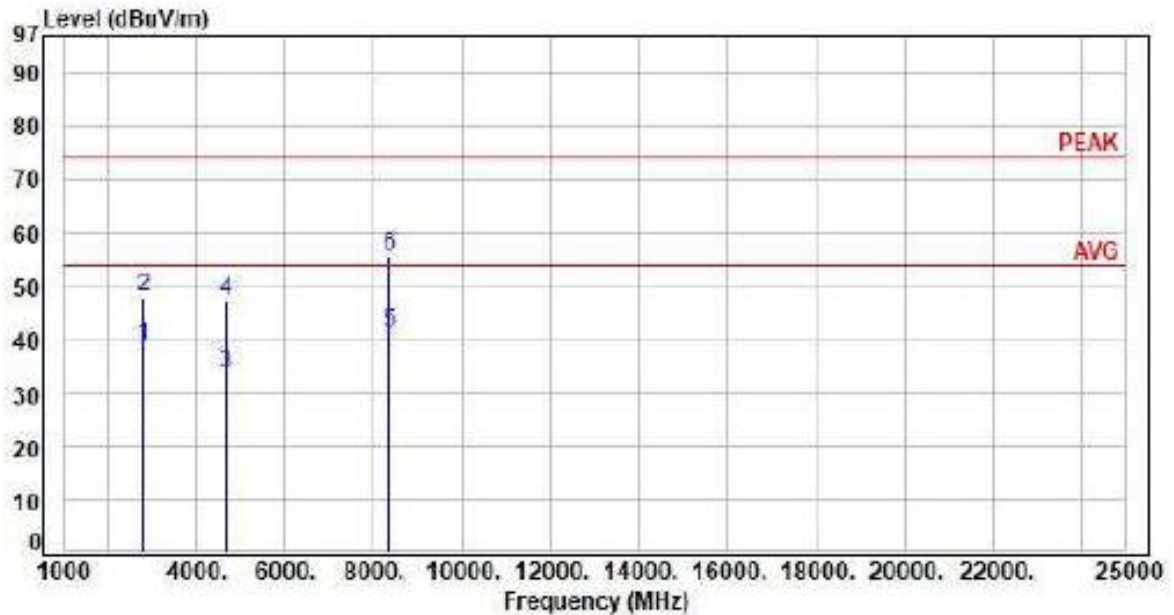


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2769.90	-28.26	67.16	38.90	54.00	-15.10	Average	100	65	P
2	2769.90	-28.26	76.21	47.95	74.00	-26.05	Peak	100	65	P
3	4616.50	-22.31	57.52	35.21	54.00	-18.79	Average	343	324	P
4	4616.50	-22.31	71.45	49.14	74.00	-24.86	Peak	343	324	P
5	8309.70	-14.24	55.48	41.24	54.00	-12.76	Average	100	244	P
6	8309.70	-14.24	69.87	55.63	74.00	-18.37	Peak	100	244	P

Note: Level=Reading+Factor  
Margin=Level-Limit  
Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: AC 120V / 60Hz	Pol/Phase	: VERTICAL
Test Mode	: Mode 1, CH07 927.5 (MHz)		

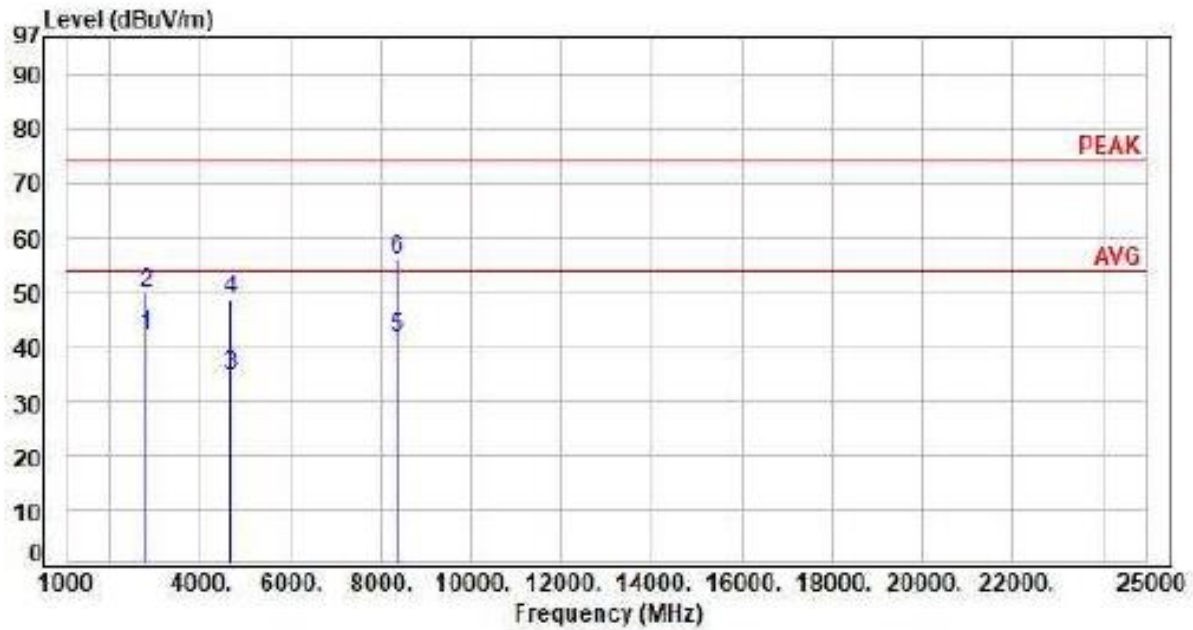


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2782.50	-28.17	66.90	38.73	54.00	-15.27	Average	259	360	P
2	2782.50	-28.17	75.99	47.82	74.00	-26.18	Peak	259	360	P
3	4637.50	-22.23	55.90	33.67	54.00	-20.33	Average	100	169	P
4	4637.50	-22.23	69.57	47.34	74.00	-26.66	Peak	100	169	P
5	8347.50	-14.13	55.36	41.23	54.00	-12.77	Average	100	321	P
6	8347.50	-14.13	69.87	55.74	74.00	-18.26	Peak	100	321	P

Note: Level=Reading+Factor  
 Margin=Level-Limit  
 Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: AC 120V / 60Hz	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1, CH07 927.5 (MHz)		:



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2782.50	-28.17	70.09	41.92	54.00	-12.08	Average	100	66	P
2	2782.50	-28.17	78.05	49.88	74.00	-24.12	Peak	100	66	P
3	4637.50	-22.23	57.01	34.78	54.00	-19.22	Average	100	37	P
4	4637.50	-22.23	70.99	48.76	74.00	-25.24	Peak	100	37	P
5	8347.50	-14.13	55.67	41.54	54.00	-12.46	Average	100	228	P
6	8347.50	-14.13	70.10	55.97	74.00	-18.03	Peak	100	228	P

Note: Level=Reading+Factor  
 Margin=Level-Limit  
 Factor=Antenna Factor + cable loss - Amplifier Factor





### 6.7 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.09000 – 0.11000	16.42000 – 16.42300	399.9 – 410.0	4.500 – 5.250
0.49500 – 0.505**	16.69475 – 16.69525	608.0 – 614.0	5.350 – 5.460
2.17350 – 2.19050	16.80425 – 16.80475	960.0 – 1240.0	7.250 – 7.750
4.12500 – 4.12800	25.50000 – 25.67000	1300.0 – 1427.0	8.025 – 8.500
4.17725 – 4.17775	37.50000 – 38.25000	1435.0 – 1626.5	9.000 – 9.200
4.20725 – 4.20775	73.00000 – 74.60000	1645.5 – 1646.5	9.300 – 9.500
6.21500 – 6.21800	74.80000 – 75.20000	1660.0 – 1710.0	10.600 – 12.700
6.26775 – 6.26825	108.00000 – 121.94000	1718.8 – 1722.2	13.250 – 13.400
6.31175 – 6.31225	123.00000 – 138.00000	2200.0 – 2300.0	14.470 – 14.500
8.29100 – 8.29400	149.90000 – 150.05000	2310.0 – 2390.0	15.350 – 16.200
8.36200 – 8.36600	156.52475 – 156.52525	2483.5 – 2500.0	17.700 – 21.400
8.37625 – 8.38675	156.70000 – 156.90000	2655.0 – 2900.0	22.010 – 23.120
8.41425 – 8.41475	162.01250 – 167.17000	3260.0 – 3267.0	23.600 – 24.000
12.29000 – 12.29300	167.72000 – 173.20000	3332.0 – 3339.0	31.200 – 31.800
12.51975 – 12.52025	240.00000 – 285.00000	3345.8 – 3358.0	36.430 – 36.500
12.57675 – 12.57725	322.00000 – 335.40000	3600.0 – 4400.0	Above 38.6
13.36000 – 13.41000			

\*\* : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz



## 7. Test of Conducted Spurious Emission

### 7.1 Test Limit

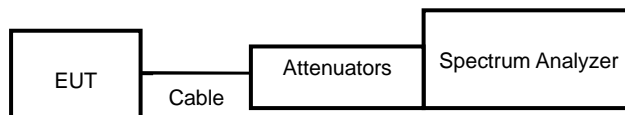
According to the methods defined in ANSI C63.10-2013 Section 11.11.1  
Below  $-20\text{dB}$  of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

### 7.2 Test Procedure

According to the methods defined in ANSI C63.10-2013 Section 11.11.2 & 11.11.3

- a. The transmitter output was connected to the spectrum analyzer via a low loss cable.
- b. Set both RBW and VBW of spectrum analyzer to 100 KHz with convenient frequency span including 100 KHz bandwidth from band edge.
- c. The band edges was measured and recorded.

### 7.3 Test Setup Layout

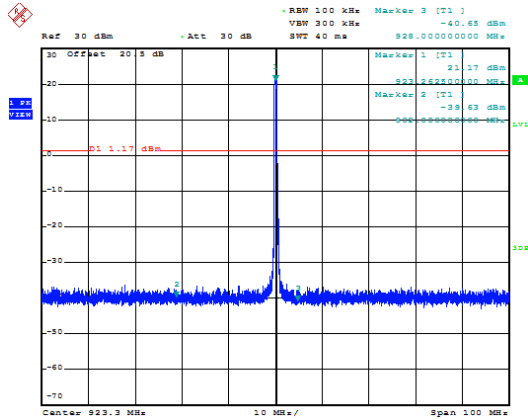


### 7.4 Test Result and Data

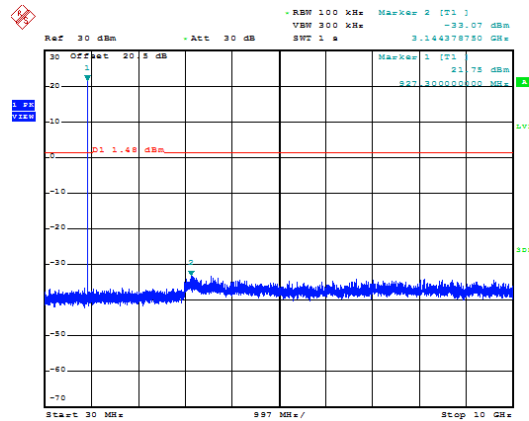
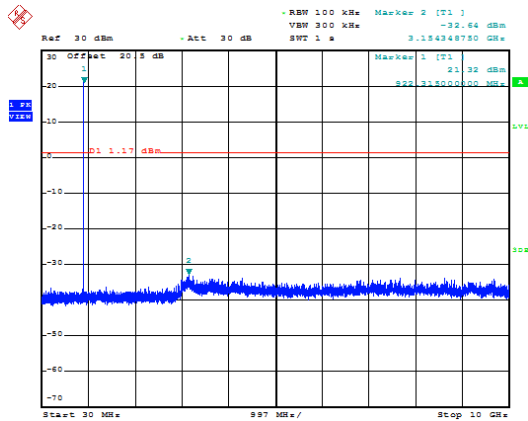
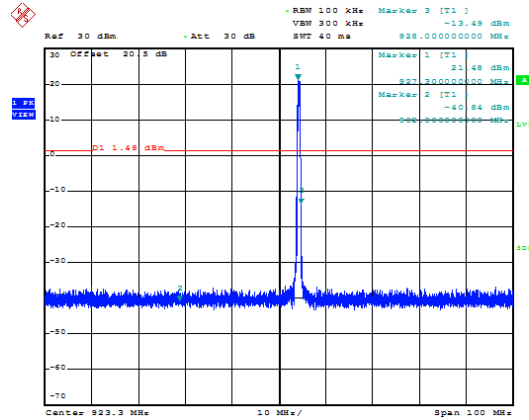
Note: Test plots refer to the following pages.



Modulation Type: Lora 500K  
CH00



Modulation Type: Lora 500K  
CH07







## 8. On Time, Duty Cycle and Measurement methods

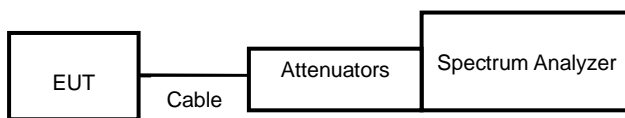
### 8.1 Test Limit

None; for reporting purposes only.

### 8.2 Test Procedure

According to the methods defined in ANSI C63.10-2013 Section 11.6 Zero-Span Spectrum Analyzer Method.

### 8.3 Test Setup Layout

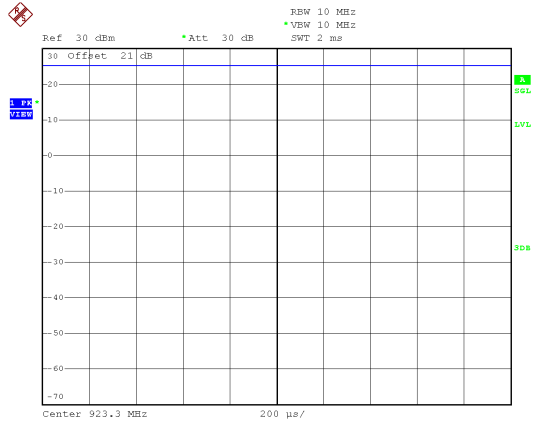


### 8.4 Test Result and Data

Modulation Mode	On Time (ms)	Period Time (ms)	Duty Cycle (%)
500 KHz	100.00	100.00	100.00%



Modulation Type: Lora 500K





## 9. 6dB Bandwidth Measurement Data

### 9.1 Test Limit

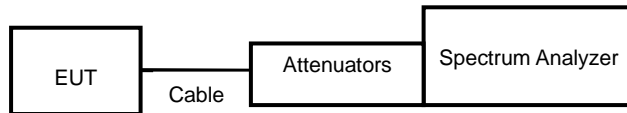
The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz..

### 9.2 Test Procedures

According to the methods defined in ANSI C63.10-2013 Section 11.8

- a. The transmitter output was connected to the spectrum analyzer.
- b. Set RBW of spectrum analyzer to 100 KHz and VBW to 300 KHz.
- c. The 6 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6 dB.
- d. The 6dB Bandwidth was measured and recorded.

### 9.3 Test Setup Layout

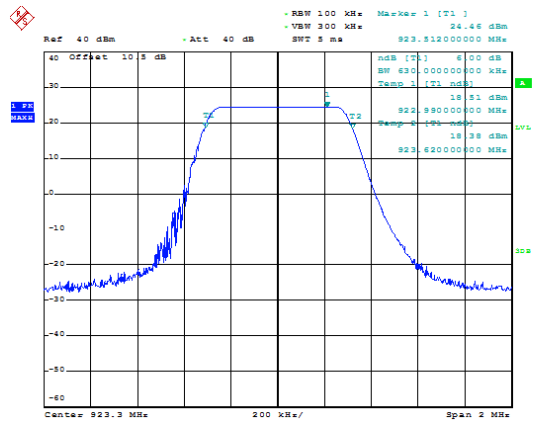


### 9.4 Test Result and Data

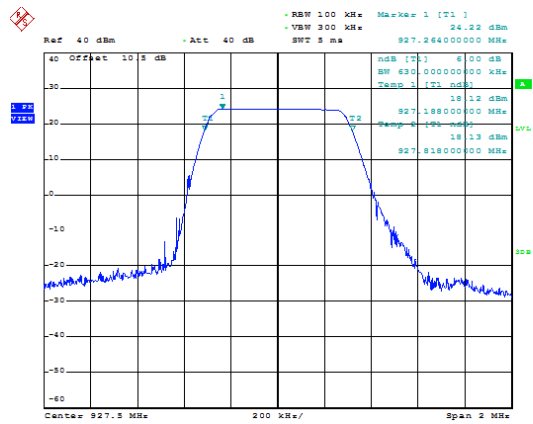
Modulation Type	Channel	Frequency (MHz)	6dB Bandwidth (KHz)	Limit (KHz)
500KHz	0	923.3	630.00	500
	7	927.5	630.00	500



Modulation Type: 500K  
CH00



Modulation Type: 500K  
CH07





### 10. Maximum Peak Output Power

#### 10.1 Test Limit

The Maximum Peak Output Power Measurement is 30dBm.

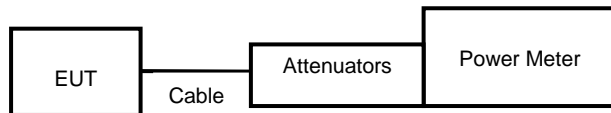
#### 10.2 Test Procedures

According to the methods defined in ANSI C63.10-2013 Section 7.8.5

The antenna port( RF output )of the EUT was connected to the input( RF input )of a power meter.

Power was read directly from the meter and cable loss connection was added to the reading to obtain power at the EUT antenna terminal. The EUT Output Power was set to maximum to produce the worse case test result.

#### 10.3 Test Setup Layout



#### 10.4 Test Result and Data

Lora 500K

Power Set	Modulation Type	Channel	Frequency (MHz)	Power Output (dBm)		Power Output (mW)		Powe Limit (dBm)	
				Peak	Average	Peak	Average	Peak	Average
12	500KHz	0	923.3	25.62	25.55	364.754	358.922	28.000	NA
12		7	927.5	25.34	25.17	341.979	328.852	28.000	NA

\*Average Power is for reference only



## 11. Power Spectral Density

### 11.1 Test Limit

The Maximum of Power Spectral Density Measurement is 8dBm.

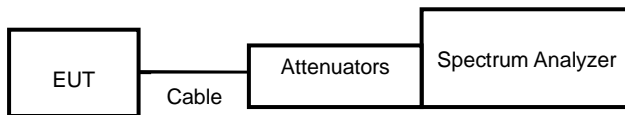
If transmitting antennas of directional gain greater than 6 dBi are used, the power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi

### 11.2 Test Procedures

According to the methods defined in ANSI C63.10-2013 Section 11.10.1

- a. The transmitter output was connected to spectrum analyzer.
- b. The spectrum analyzer's resolution bandwidth were set at 3KHz RBW and 10KHz VBW as that of the fundamental frequency. Set the sweep time=auto couple.
- c. The power spectral density was measured and recorded.

### 11.3 Test Setup Layout

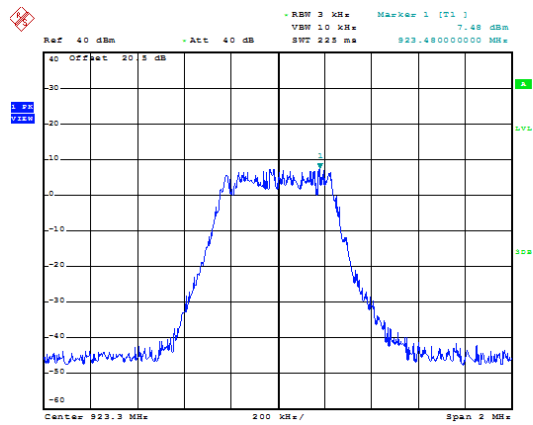


### 11.4 Test Result and Data

Modulation Type	Channel	Frequency (MHz)	Maximum Power Density of 3KHz Bandwidth(dBm)	Limit
500KHz	0	923.3	7.48	8.00
	7	927.5	7.49	8.00



Modulation Type: 500K  
CH00



Modulation Type: 500K  
CH07

