

# FCC Test Report

**FCC ID** : MXF-WMDS-203  
**Equipment** : LPWAN Module  
**Model No.** : GL6509  
**Brand Name** : Gemtek  
**Applicant** : Gemtek Technology Co., Ltd.  
**Address** : No.15-1 Zhonghua Rd, Hsinchu Industrial  
Park, Hukou, Hsinchu, Taiwan, R.O.C  
**Standard** : 47 CFR FCC Part 15.247  
**Received Date** : Apr. 15, 2016  
**Tested Date** : Apr. 15 ~ May 19, 2016

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Approved & Reviewed by:

  
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Gary Chang / Manager



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## Release Record

Report No.	Version	Description	Issued Date
FR641901-1	Rev. 01	Initial issue	Jun. 03, 2016

## Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 17.755MHz 38.92 (Margin -21.08dB) - QP	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 9142.00MHz 46.57 (Margin -7.43dB) - AV	Pass
15.247(b)(3)	Maximum Output Power	Max Power [dBm]: 18.95	Pass
15.247(a)(2)	6dB Bandwidth	Meet the requirement of limit	Pass
15.247(e)	Power Spectral Density	Meet the requirement of limit	Pass
15.203	Antenna Requirement	Meet the requirement of limit	Pass

# 1 General Description

## 1.1 Information

### 1.1.1 Specification of the Equipment under Test (EUT)

RF General Information				
Frequency Range (MHz)	Ch. Freq. (MHz)	Channel Number	Channel Bandwidth (kHz)	Spread Factor
902 ~ 928	903 ~ 927.5	65 ~ 98 [18]	500	7 ~ 10
Note 1: RF output power specifies that Maximum Conducted (Average) Output Power. Note 2: The device uses CSS modulation.				

### 1.1.2 Antenna Details

Ant. No.	Brand	Model	Type	Connector	Gain (dBi)
1	GSC-Tech	OMA-G01	Fiberglass Omni Antenna	N-style Jack	8

### 1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	3.3Vdc from host
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### 1.1.4 Accessories

N/A

### 1.1.5 Channel List

Frequency band (MHz)		902 ~ 928	
Channel	Frequency(MHz)	Channel	Frequency(MHz)
65	903	98	924
66	904.6	73	923.3
67	906.2	74	923.9
68	907.8	75	924.5
69	909.4	76	925.1
70	911	77	925.7
71	912.6	78	926.3
72	914.2	79	926.9
97	922	80	927.5

### 1.1.6 Test Tool and Duty Cycle

Test Tool	Putty, Ver. 0.60.0.0	
Duty Cycle and Duty Factor	Duty cycle (%)	Duty factor (dB)
	100%	0

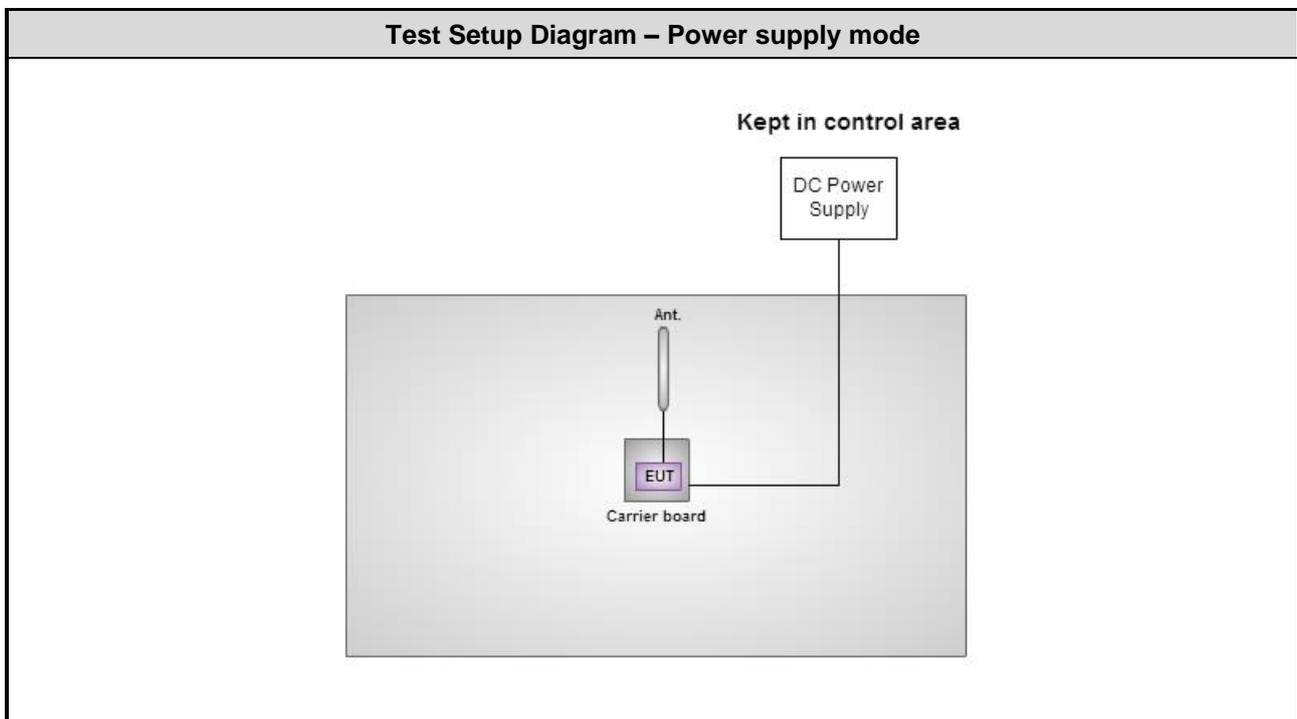
### 1.1.7 Power Setting

Modulation Mode	Test Frequency (MHz)		
	903	914.2	927.5
CSS	20	20	20

## 1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	S/N	Signal cable / Length (m)
1	DC Power Supply	GWINSTEK	GPC-60300	EM884797	---
2	Notebook	DELL	Latitude E6430	F2JB4X1	---
3	Carrier board	---	---	---	---

## 1.3 Test Setup Chart



Note: The notebook is disconnected from EUT and removed from test table when EUT is set to transmit continuously.

## 1.4 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
EMC Receiver	R&S	ESCS 30	100169	Oct. 21, 2015	Oct. 20, 2016
LISN	SCHWARZBECK	Schwarzbeck 8127	8127-667	Nov. 13, 2015	Nov. 12, 2016
RF Cable-CON	EMC	EMCCFD300-BM-BM-6000	50821	Dec. 21, 2015	Dec. 20, 2016
Measurement Software	AUDIX	e3	6.120210k	NA	NA

Note: Calibration Interval of instruments listed above is one year.

Test Item	Radiated Emission				
Test Site	966 chamber 3 / (03CH03-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	Agilent	N9010A	MY53400091	Sep. 14, 2015	Sep. 13, 2016
Receiver	Agilent	N9038A	MY53290044	Oct. 14, 2015	Oct. 13, 2016
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-563	Dec. 29, 2015	Dec. 28, 2016
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1206	Feb. 24, 2016	Feb. 23, 2017
Preamplifier	EMC	EMC02325	980187	Sep. 21, 2015	Sep. 20, 2016
Preamplifier	Agilent	83017A	MY53270014	Sep. 07, 2015	Sep. 06, 2016
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22620/4	Feb. 05, 2016	Feb. 04, 2017
RF cable-8M	HUBER+SUHNER	SUCOFLEX104	MY22600/4	Feb. 05, 2016	Feb. 04, 2017
RF cable-1M	HUBER+SUHNER	SUCOFLEX104	MY22624/4	Feb. 05, 2016	Feb. 04, 2017
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800-001	Feb. 05, 2016	Feb. 04, 2017
LF cable-3M	EMC	EMC8D-NM-NM-3000	131103	Feb. 05, 2016	Feb. 04, 2017
LF cable-13M	EMC	EMC8D-NM-NM-13000	131104	Feb. 05, 2016	Feb. 04, 2017
Measurement Software	AUDIX	e3	6.120210g	NA	NA

Note: Calibration Interval of instruments listed above is one year.

Test Item	RF Conducted				
Test Site	(TH01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101063	Feb. 17, 2016	Feb. 16, 2017
Power Meter	Anritsu	ML2495A	1241002	Sep. 21, 2015	Sep. 20, 2016
Power Sensor	Anritsu	MA2411B	1207366	Sep. 21, 2015	Sep. 20, 2016
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA

Note: Calibration Interval of instruments listed above is one year.

## 1.5 Test Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.247

ANSI C63.10-2013

FCC KDB 558074 D01 DTS Meas Guidance v03r05

## 1.6 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 ( $k=2$ ))

Measurement Uncertainty	
Parameters	Uncertainty
Bandwidth	$\pm 34.134$ Hz
Conducted power	$\pm 0.808$ dB
Power density	$\pm 0.463$ dB
Conducted emission	$\pm 2.670$ dB
AC conducted emission	$\pm 2.90$ dB
Radiated emission $\leq 1$ GHz	$\pm 3.66$ dB
Radiated emission $> 1$ GHz	$\pm 5.37$ dB

## 2 Test Configuration

### 2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	20°C / 60%	Howard Huang
Radiated Emissions	03CH03-WS	21°C / 69%	Warren Lee
RF Conducted	TH01-WS	23°C / 65%	Felix Sung

- FCC site registration No.: 207696
- IC site registration No.: 10807C-1

### 2.2 The Worst Test Modes and Channel Details

Test item	Test Frequency (MHz)	Modulation / SF	Test Configuration
Conducted Emissions	903 / 914.2 / 927.5	CSS / 9	---
Radiated Emissions ≤1GHz	903 / 914.2 / 927.5	CSS / 9	---
Radiated Emissions >1GHz Maximum Output Power 6dB bandwidth Power spectral density	903 / 914.2 / 927.5	CSS / 9	---

**NOTE:**

- The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The **Y-plane** results were found as the worst case and were shown in this report.

## 3 Transmitter Test Results

### 3.1 Conducted Emissions

#### 3.1.1 Limit of Conducted Emissions

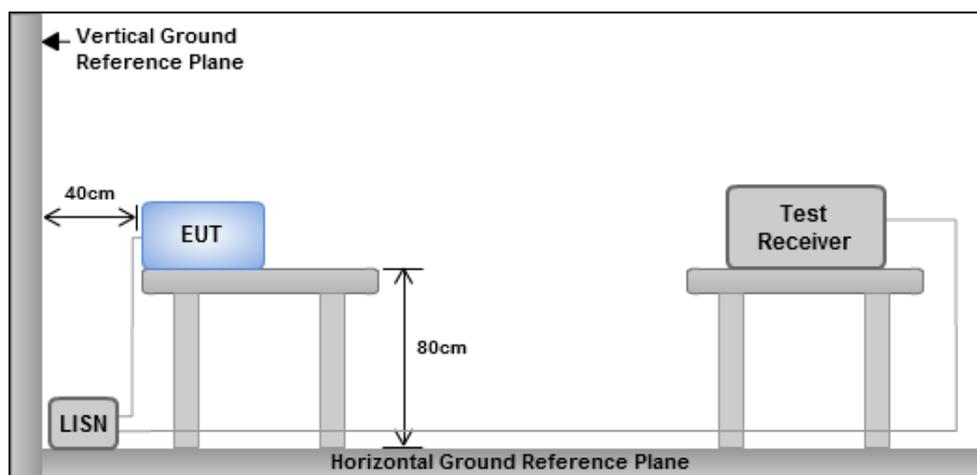
Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

Note 1: \* Decreases with the logarithm of the frequency.

#### 3.1.2 Test Procedures

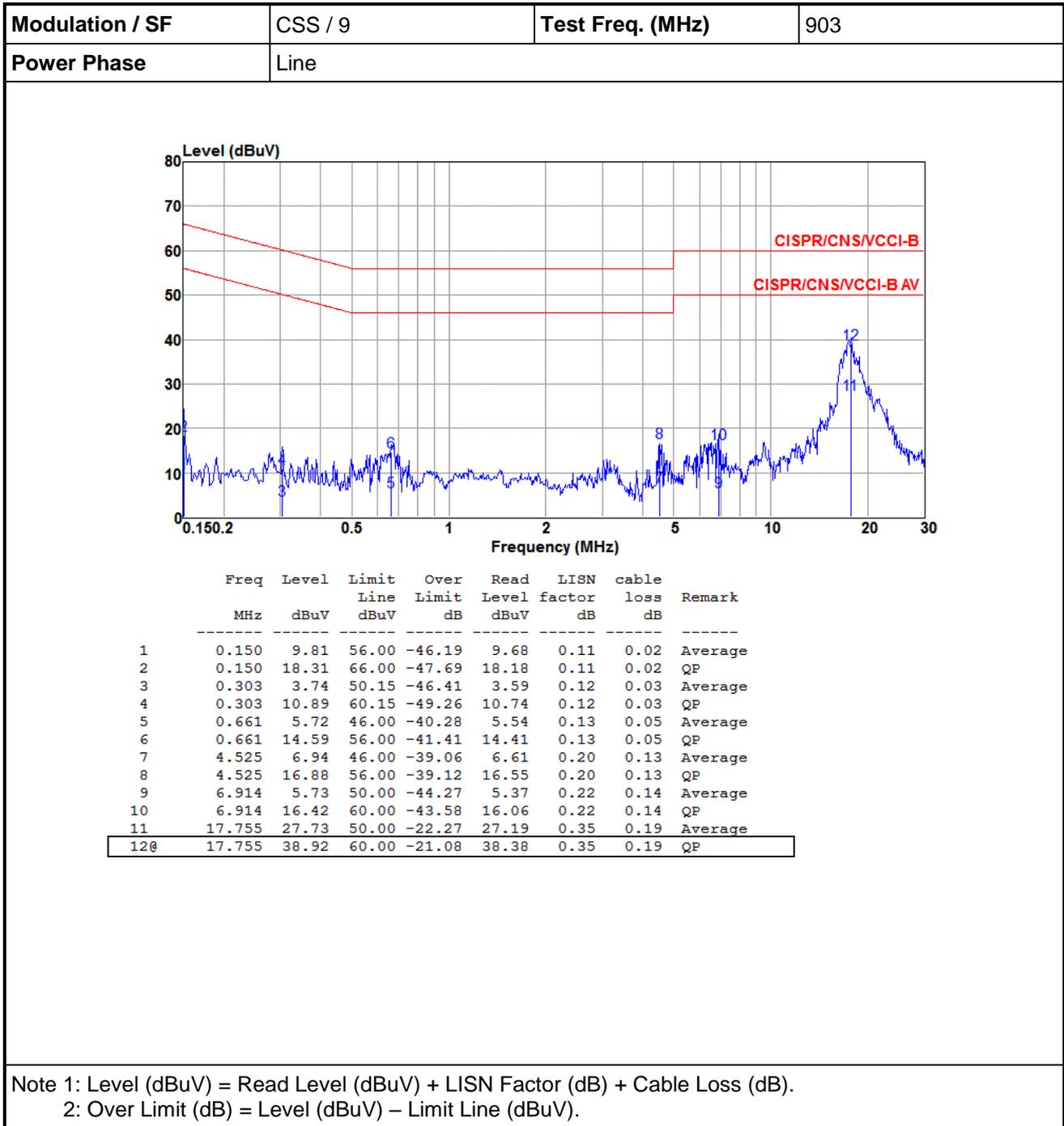
1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels of AC power line conducted emission are across the 50  $\Omega$  LISN port.
3. AC conducted emission measurements is made over frequency range from 150 kHz to 30 MHz.
4. This measurement was performed with AC 120V / 60Hz.

#### 3.1.3 Test Setup

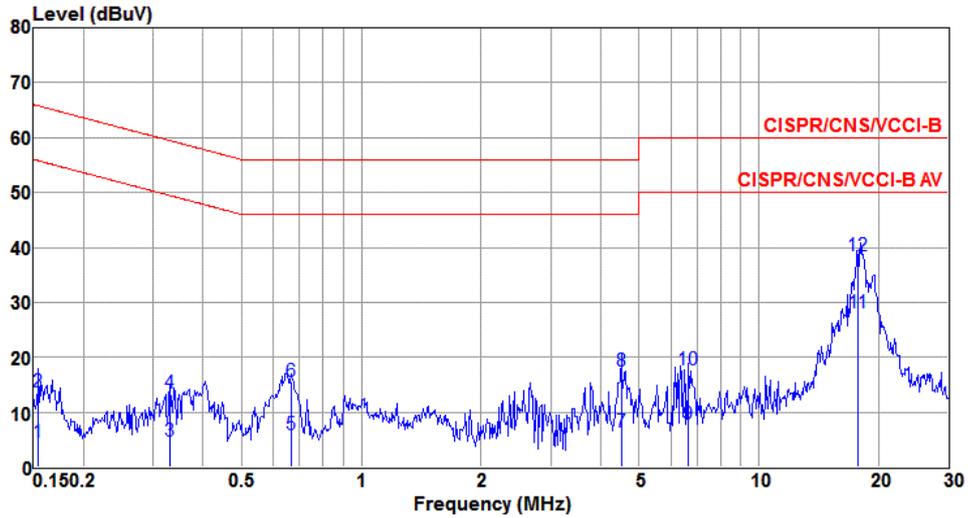


- Note: 1. Support units were connected to second LISN.  
 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

### 3.1.4 Test Result of Conducted Emissions



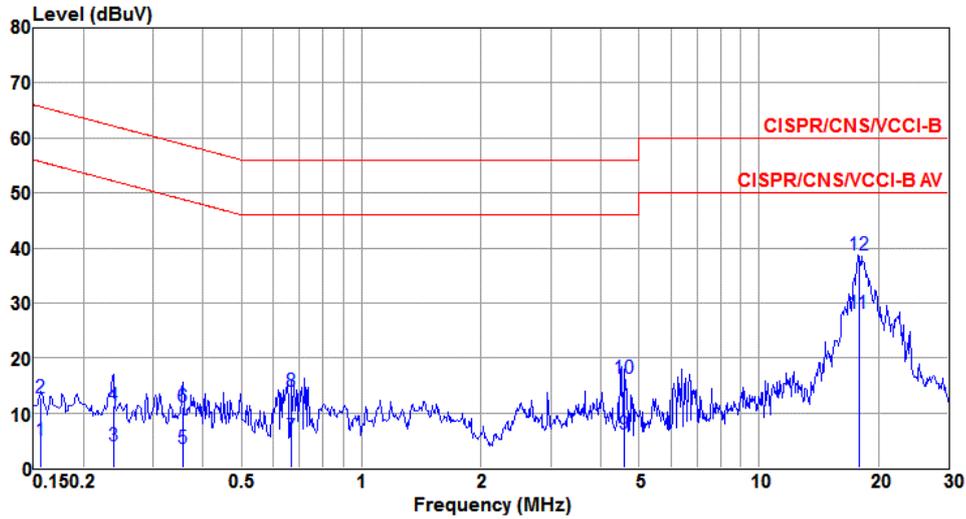
<b>Modulation / SF</b>	CSS / 9	<b>Test Freq. (MHz)</b>	903
<b>Power Phase</b>	Neutral		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.154	4.60	55.78	-51.18	4.45	0.13	0.02	Average
2	0.154	13.67	65.78	-52.11	13.52	0.13	0.02	QP
3	0.330	4.76	49.44	-44.68	4.60	0.13	0.03	Average
4	0.330	13.36	59.44	-46.08	13.20	0.13	0.03	QP
5	0.665	5.91	46.00	-40.09	5.73	0.13	0.05	Average
6	0.665	15.69	56.00	-40.31	15.51	0.13	0.05	QP
7	4.501	6.39	46.00	-39.61	6.09	0.18	0.12	Average
8	4.501	17.40	56.00	-38.60	17.10	0.18	0.12	QP
9	6.662	7.80	50.00	-42.20	7.43	0.23	0.14	Average
10	6.662	17.62	60.00	-42.38	17.25	0.23	0.14	QP
11	17.820	28.02	50.00	-21.98	27.45	0.38	0.19	Average
12	17.820	38.42	60.00	-21.58	37.85	0.38	0.19	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).  
 2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

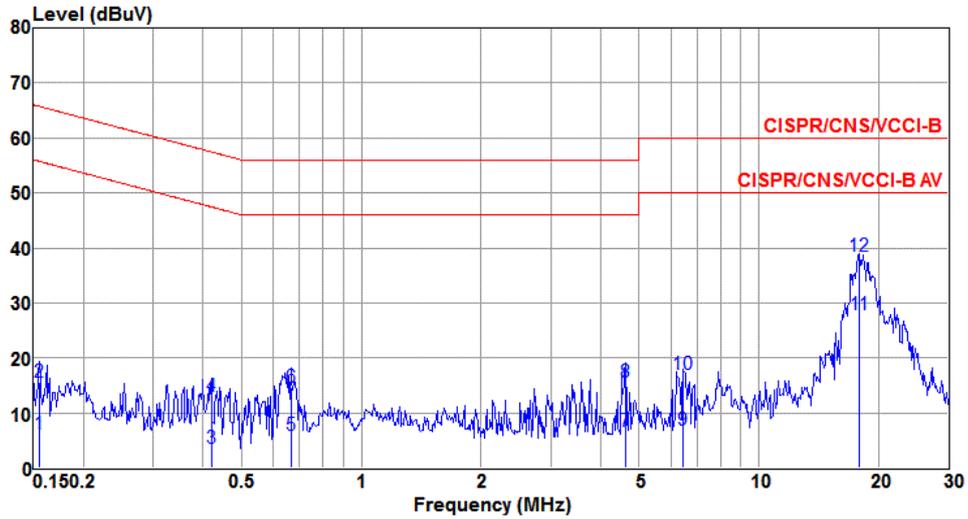
Modulation / SF	CSS / 9	Test Freq. (MHz)	914.2
Power Phase	Line		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.156	4.99	55.65	-50.66	4.86	0.11	0.02	Average
2	0.156	12.78	65.65	-52.87	12.65	0.11	0.02	QP
3	0.238	3.92	52.17	-48.25	3.78	0.12	0.02	Average
4	0.238	11.31	62.17	-50.86	11.17	0.12	0.02	QP
5	0.356	3.47	48.83	-45.36	3.31	0.13	0.03	Average
6	0.356	11.11	58.83	-47.72	10.95	0.13	0.03	QP
7	0.668	5.59	46.00	-40.41	5.41	0.13	0.05	Average
8	0.668	13.93	56.00	-42.07	13.75	0.13	0.05	QP
9	4.574	6.03	46.00	-39.97	5.70	0.20	0.13	Average
10	4.574	16.19	56.00	-39.81	15.86	0.20	0.13	QP
11	17.850	27.98	50.00	-22.02	27.44	0.35	0.19	Average
12@	17.850	38.73	60.00	-21.27	38.19	0.35	0.19	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).  
 2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

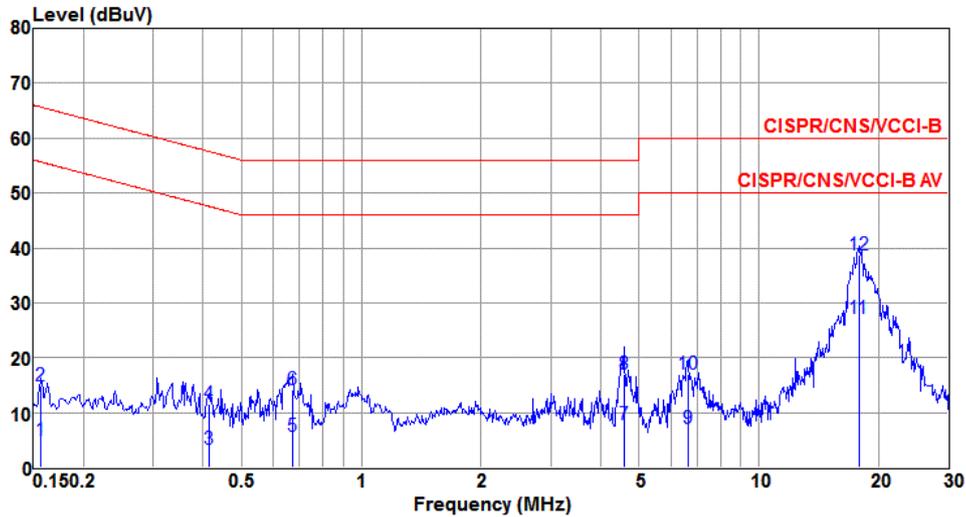
<b>Modulation / SF</b>	CSS / 9	<b>Test Freq. (MHz)</b>	914.2
<b>Power Phase</b>	Neutral		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.155	6.10	55.74	-49.64	5.95	0.13	0.02	Average
2	0.155	15.63	65.74	-50.11	15.48	0.13	0.02	QP
3	0.419	3.49	47.46	-43.97	3.32	0.14	0.03	Average
4	0.419	13.01	57.46	-44.45	12.84	0.14	0.03	QP
5	0.665	5.97	46.00	-40.03	5.79	0.13	0.05	Average
6	0.665	14.57	56.00	-41.43	14.39	0.13	0.05	QP
7	4.622	6.58	46.00	-39.42	6.26	0.19	0.13	Average
8	4.622	15.48	56.00	-40.52	15.16	0.19	0.13	QP
9	6.454	6.90	50.00	-43.10	6.54	0.22	0.14	Average
10	6.454	17.02	60.00	-42.98	16.66	0.22	0.14	QP
11	17.944	27.80	50.00	-22.20	27.24	0.38	0.18	Average
12@	17.944	38.36	60.00	-21.64	37.80	0.38	0.18	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).  
 2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

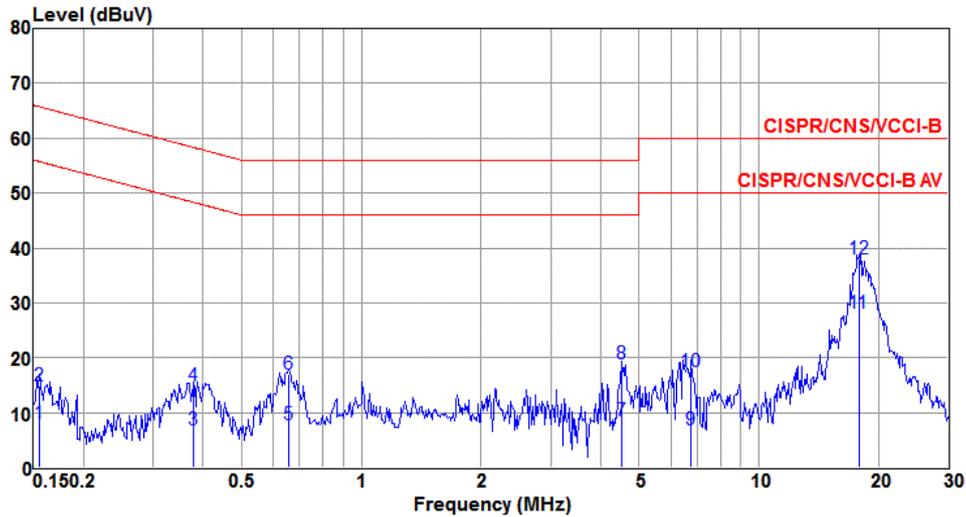
Modulation / SF	CSS / 9	Test Freq. (MHz)	927.5
Power Phase	Line		



	Freq	Level	Limit	Over	Read	LISN	cable	
	MHz	dBuV	Line	Limit	Level	factor	loss	Remark
			dBuV	dB	dBuV	dB	dB	
1	0.156	4.99	55.65	-50.66	4.86	0.11	0.02	Average
2	0.156	14.82	65.65	-50.83	14.69	0.11	0.02	QP
3	0.413	3.30	47.59	-44.29	3.14	0.13	0.03	Average
4	0.413	11.56	57.59	-46.03	11.40	0.13	0.03	QP
5	0.672	5.78	46.00	-40.22	5.60	0.13	0.05	Average
6	0.672	14.17	56.00	-41.83	13.99	0.13	0.05	QP
7	4.574	7.71	46.00	-38.29	7.38	0.20	0.13	Average
8	4.574	17.07	56.00	-38.93	16.74	0.20	0.13	QP
9	6.627	7.18	50.00	-42.82	6.82	0.22	0.14	Average
10	6.627	16.91	60.00	-43.09	16.55	0.22	0.14	QP
11	17.849	27.23	50.00	-22.77	26.69	0.35	0.19	Average
12@	17.849	38.63	60.00	-21.37	38.09	0.35	0.19	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).  
 2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

<b>Modulation / SF</b>	CSS / 9	<b>Test Freq. (MHz)</b>	927.5
<b>Power Phase</b>	Neutral		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.155	8.11	55.74	-47.63	7.96	0.13	0.02	Average
2	0.155	14.84	65.74	-50.90	14.69	0.13	0.02	QP
3	0.377	6.83	48.34	-41.51	6.66	0.14	0.03	Average
4	0.377	14.96	58.34	-43.38	14.79	0.14	0.03	QP
5	0.654	7.86	46.00	-38.14	7.68	0.13	0.05	Average
6	0.654	16.89	56.00	-39.11	16.71	0.13	0.05	QP
7	4.501	8.46	46.00	-37.54	8.16	0.18	0.12	Average
8	4.501	18.80	56.00	-37.20	18.50	0.18	0.12	QP
9	6.769	6.89	50.00	-43.11	6.52	0.23	0.14	Average
10	6.769	17.51	60.00	-42.49	17.14	0.23	0.14	QP
11	17.870	28.00	50.00	-22.00	27.43	0.38	0.19	Average
12	17.870	38.11	60.00	-21.89	37.54	0.38	0.19	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).  
 2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

## 3.2 6dB and Occupied Bandwidth

### 3.2.1 Limit of 6dB Bandwidth

The minimum 6dB bandwidth shall be at least 500 kHz.

### 3.2.2 Test Procedures

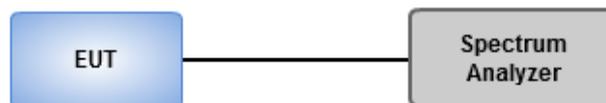
#### 6dB Bandwidth

1. Set resolution bandwidth (RBW) = 100 kHz, Video bandwidth = 300 kHz.
2. Detector = Peak, Trace mode = max hold.
3. Sweep = auto couple, Allow the trace to stabilize.
4. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6dB relative to the maximum level measured in the fundamental emission.

#### Occupied Bandwidth

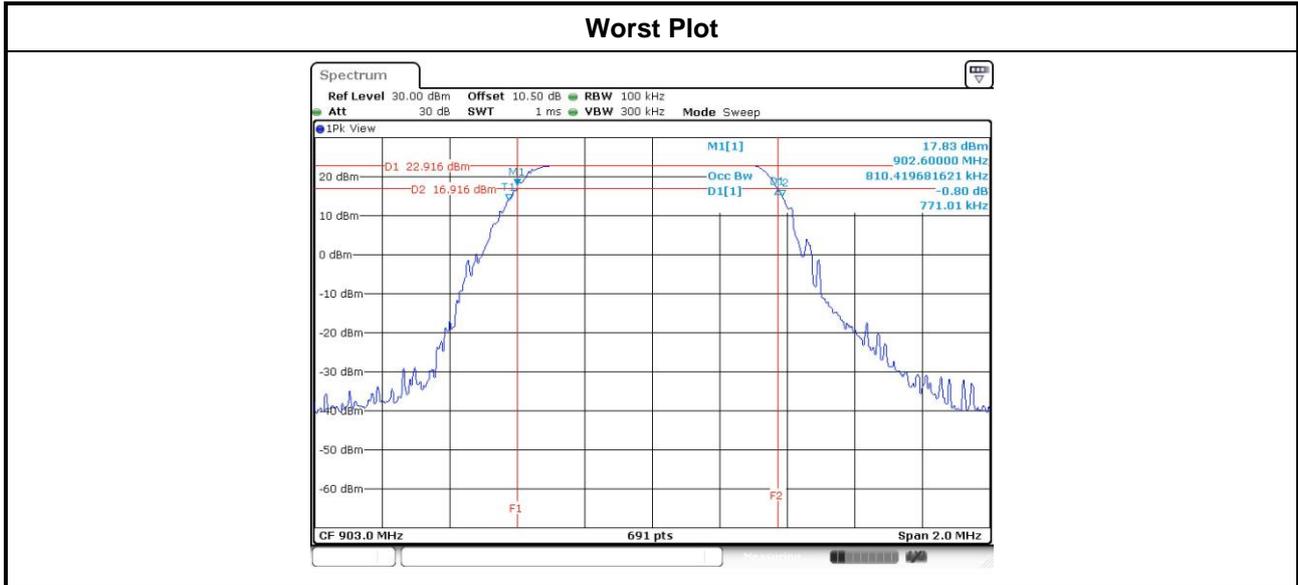
1. Set resolution bandwidth (RBW) = 10kHz, Video bandwidth = 30kHz.
2. Detector = Sample, Trace mode = max hold.
3. Sweep = auto couple, Allow the trace to stabilize.
4. Use the OBW measurement function of spectrum analyzer to measure the occupied bandwidth.

### 3.2.3 Test Setup

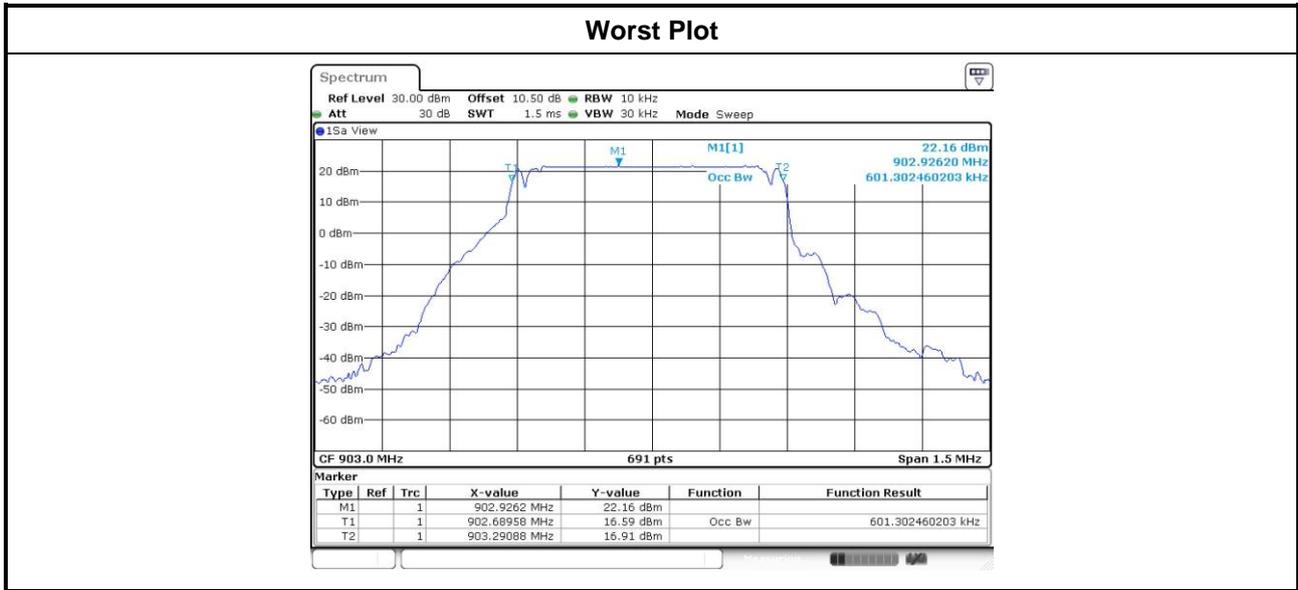


### 3.2.4 Test Result of 6dB and Occupied Bandwidth

Modulation / SF	Freq. (MHz)	6dB Bandwidth (MHz)	Limit (kHz)
CSS / 9	903	771.01	500
CSS / 9	914.2	771.01	500
CSS / 9	927.5	773.91	500



Modulation / SF	Freq. (MHz)	99% Occupied Bandwidth (MHz)
CSS / 9	903	0.601
CSS / 9	914.2	0.590
CSS / 9	927.5	0.567



## 3.3 RF Output Power

### 3.3.1 Limit of RF Output Power

Conducted power shall not exceed 1Watt.

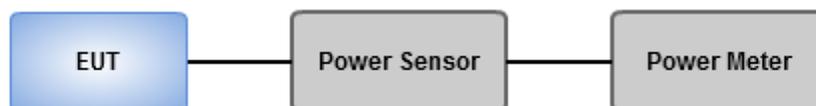
- Antenna gain  $\leq$  6dBi, no any corresponding reduction is in output power limit.
- Antenna gain  $>$  6dBi

Transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi

### 3.3.2 Test Procedures

- Maximum Peak Conducted Output Power
  - Spectrum analyzer**
    1. Set RBW = 1MHz, VBW = 3MHz, Detector = Peak.
    2. Sweep time = auto, Trace mode = max hold, Allow trace to fully stabilize.
    3. Use the spectrum analyzer channel power measurement function with the band limits set equal to the DTS bandwidth edges.
  - Power meter**
    1. A broadband Peak RF power meter is used for output power measurement. The video bandwidth of power meter is greater than DTS bandwidth of EUT. If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power.
- Maximum Conducted Output Power
  - Power meter**
    1. A broadband Average RF power meter is used for output power measurement. The video bandwidth of power meter is greater than DTS bandwidth of EUT. If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power.

### 3.3.3 Test Setup



### 3.3.4 Test Result of Maximum Output Power

Modulation / SF	Freq. (MHz)	Output Power (mW)	Output Power (dBm)	Limit (dBm)
CSS / 9	903	78.52356	18.95	28
CSS / 9	914.2	78.34296	18.94	28
CSS / 9	927.5	77.26806	18.88	28

**Note:** The maximum antenna gain 8dBi is higher than 6dBi, so the limit shall be reduced to 30 dBm - (8dBi - 6dBi) = 28 dBm.

### 3.4 Power Spectral Density

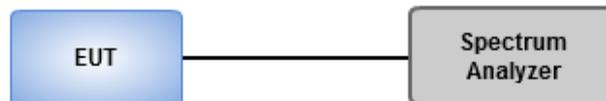
#### 3.4.1 Limit of Power Spectral Density

Power spectral density shall not be greater than 8 dBm in any 3 kHz band.

#### 3.4.2 Test Procedures

- Maximum peak conducted output power was used to demonstrate compliance to the fundamental output power limit.
  1. Set the RBW = 3kHz, VBW = 10kHz.
  2. Detector = Peak, Sweep time = auto couple.
  3. Trace mode = max hold, allow trace to fully stabilize.
  4. Use the peak marker function to determine the maximum amplitude level.
- Maximum (average) conducted output power was used to demonstrate compliance to the fundamental output power limit.
  1. Set the RBW = 3kHz, VBW = 10 kHz.
  2. Detector = RMS, Sweep time = auto couple.
  3. Employ trace averaging (RMS) mode over a minimum of 100 traces
  4. Use the peak marker function to determine the maximum amplitude level.

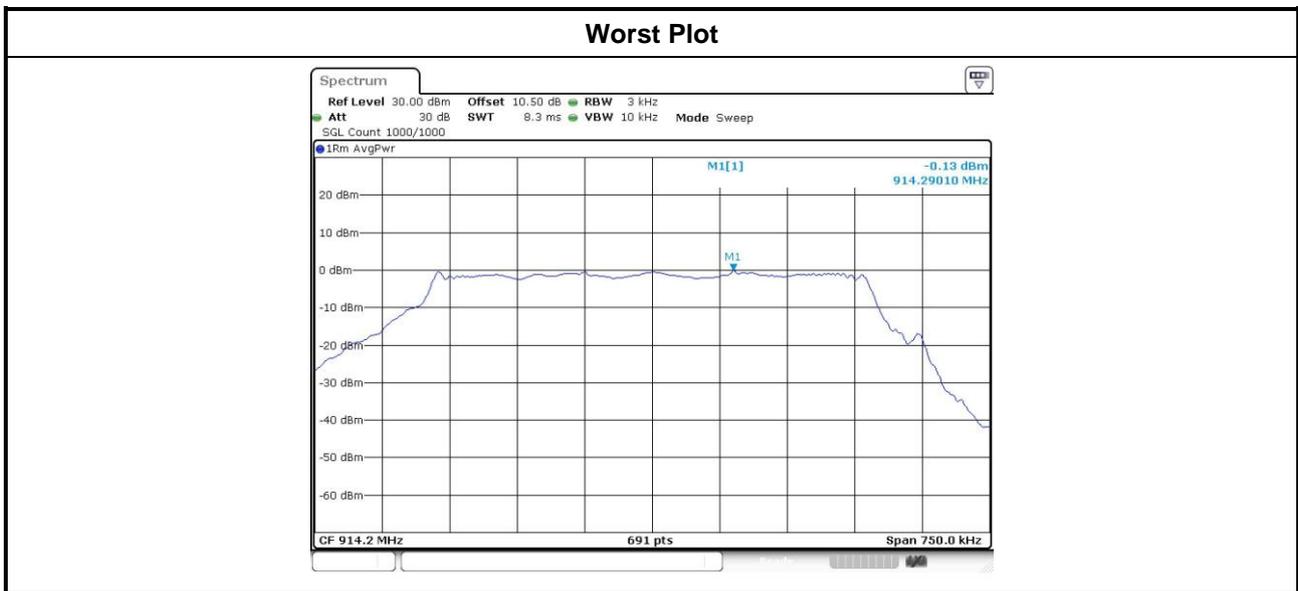
#### 3.4.3 Test Setup



### 3.4.4 Test Result of Power Spectral Density

Modulation / SF	Freq. (MHz)	Total Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
CSS / 9	903	-0.30	6
CSS / 9	914.2	-0.13	6
CSS / 9	927.5	-0.41	6

**Note:** The maximum antenna gain 8dBi is higher than 6dBi, so the limit shall be reduced to 8 dBm - (8dBi - 6dBi) = 6 dBm.



## 3.5 Unwanted Emissions into Restricted Frequency Bands

### 3.5.1 Limit of Unwanted Emissions into Restricted Frequency Bands

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

**Note 1:**  
Quasi-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit

**Note 2:**  
Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

### 3.5.2 Test Procedures

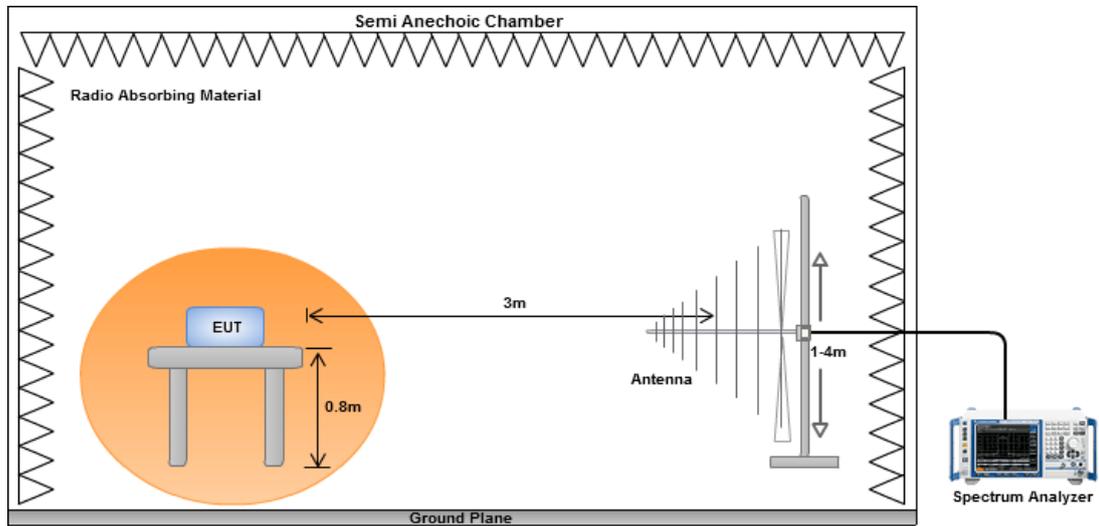
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m
2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Note:

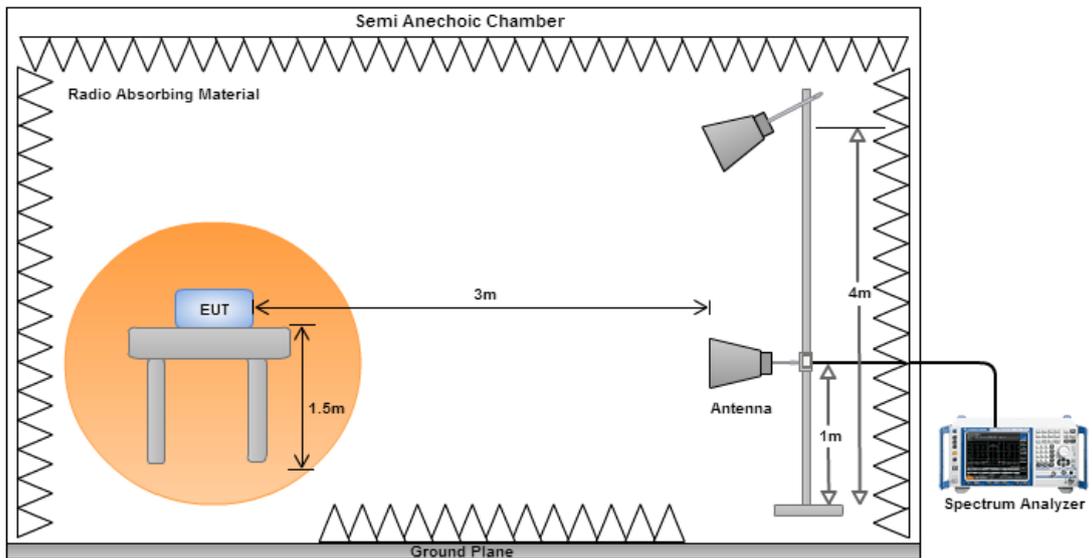
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above 1GHz.

### 3.5.3 Test Setup

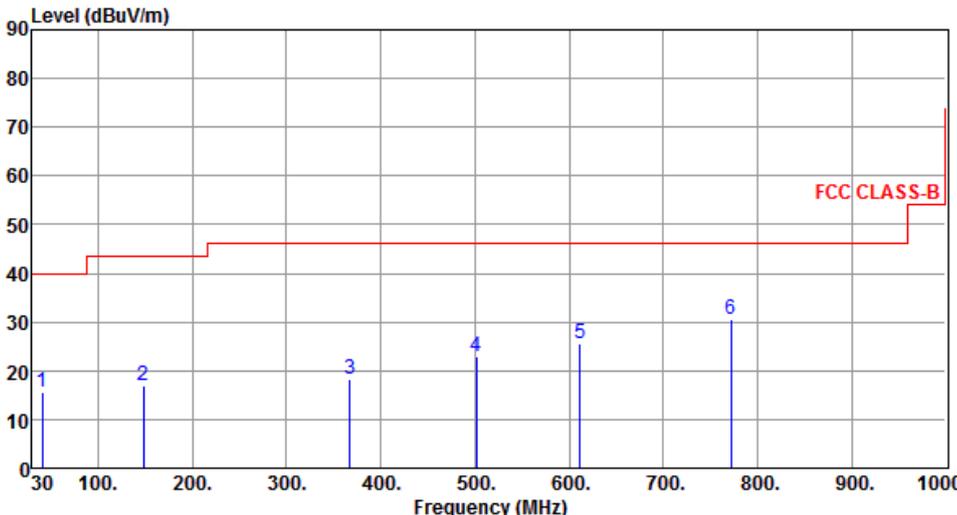
#### Radiated Emissions below 1 GHz



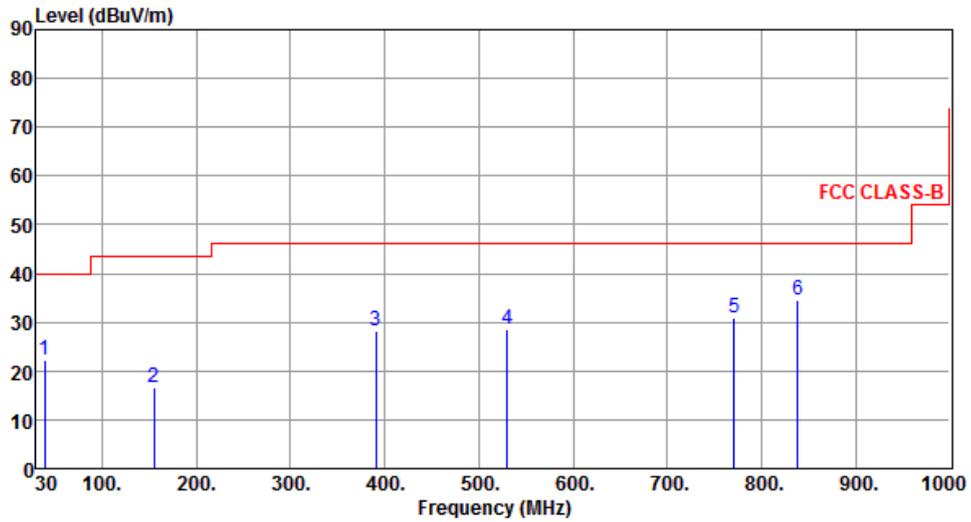
#### Radiated Emissions above 1 GHz



### 3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation / SF	CSS / 9	Test Freq. (MHz)	903																																																																
Polarization	Horizontal																																																																		
																																																																			
	<table border="1"> <thead> <tr> <th>Freq. MHz</th> <th>Emission level dBuV/m</th> <th>Limit dBuV/m</th> <th>Margin dB</th> <th>SA reading dBuV</th> <th>Factor dB</th> <th>Remark</th> <th>ANT High cm</th> <th>Turn Table deg</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>40.67</td> <td>40.00</td> <td>-24.54</td> <td>28.73</td> <td>-13.27</td> <td>Peak</td> <td>---</td> <td>---</td> </tr> <tr> <td>2</td> <td>148.34</td> <td>43.50</td> <td>-26.46</td> <td>30.50</td> <td>-13.46</td> <td>Peak</td> <td>---</td> <td>---</td> </tr> <tr> <td>3</td> <td>367.56</td> <td>46.00</td> <td>-27.82</td> <td>29.19</td> <td>-11.01</td> <td>Peak</td> <td>---</td> <td>---</td> </tr> <tr> <td>4</td> <td>501.42</td> <td>46.00</td> <td>-23.05</td> <td>30.82</td> <td>-7.87</td> <td>Peak</td> <td>---</td> <td>---</td> </tr> <tr> <td>5</td> <td>612.00</td> <td>46.00</td> <td>-20.57</td> <td>31.01</td> <td>-5.58</td> <td>Peak</td> <td>---</td> <td>---</td> </tr> <tr> <td>6</td> <td>772.05</td> <td>46.00</td> <td>-15.55</td> <td>33.46</td> <td>-3.01</td> <td>Peak</td> <td>---</td> <td>---</td> </tr> </tbody> </table>	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg	1	40.67	40.00	-24.54	28.73	-13.27	Peak	---	---	2	148.34	43.50	-26.46	30.50	-13.46	Peak	---	---	3	367.56	46.00	-27.82	29.19	-11.01	Peak	---	---	4	501.42	46.00	-23.05	30.82	-7.87	Peak	---	---	5	612.00	46.00	-20.57	31.01	-5.58	Peak	---	---	6	772.05	46.00	-15.55	33.46	-3.01	Peak	---	---			
Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg																																																											
1	40.67	40.00	-24.54	28.73	-13.27	Peak	---	---																																																											
2	148.34	43.50	-26.46	30.50	-13.46	Peak	---	---																																																											
3	367.56	46.00	-27.82	29.19	-11.01	Peak	---	---																																																											
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<p>Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)            *Factor includes antenna factor , cable loss and amplifier gain            Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).            Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.</p>																																																																			

<b>Modulation / SF</b>	CSS / 9	<b>Test Freq. (MHz)</b>	903
<b>Polarization</b>	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	38.73	22.25	40.00	-17.75	35.71	-13.46	Peak	---	---
2	155.13	16.69	43.50	-26.81	30.05	-13.36	Peak	---	---
3	390.84	28.26	46.00	-17.74	38.67	-10.41	Peak	---	---
4	530.52	28.43	46.00	-17.57	35.72	-7.29	Peak	---	---
5	771.08	30.90	46.00	-15.10	33.92	-3.02	Peak	---	---
6	838.98	34.45	46.00	-11.55	36.31	-1.86	Peak	---	---

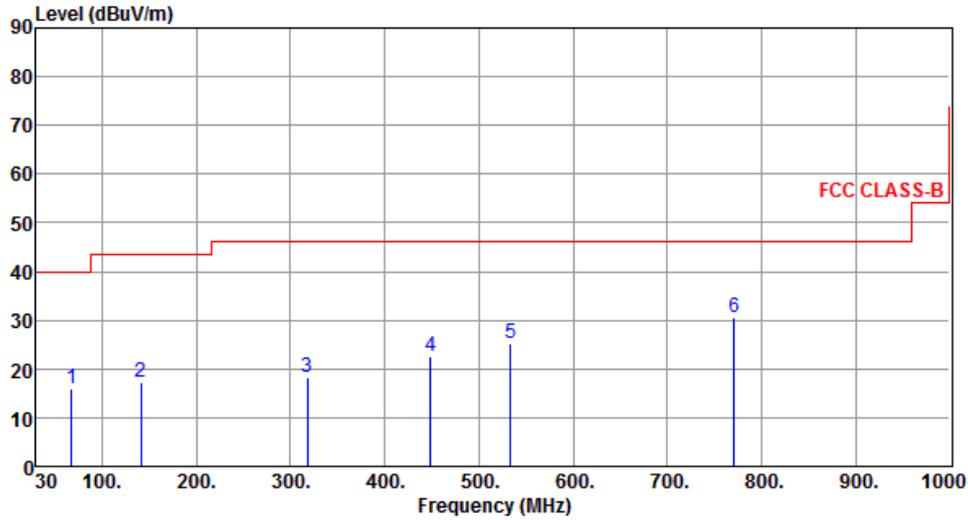
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

<b>Modulation / SF</b>	CSS / 9	<b>Test Freq. (MHz)</b>	914.2
<b>Polarization</b>	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	67.83	15.98	40.00	-24.02	31.26	-15.28	Peak	---	---
2	141.55	17.32	43.50	-26.18	30.95	-13.63	Peak	---	---
3	318.09	18.13	46.00	-27.87	30.47	-12.34	Peak	---	---
4	449.04	22.59	46.00	-23.41	31.42	-8.83	Peak	---	---
5	533.43	25.11	46.00	-20.89	32.35	-7.24	Peak	---	---
6	771.08	30.60	46.00	-15.40	33.62	-3.02	Peak	---	---

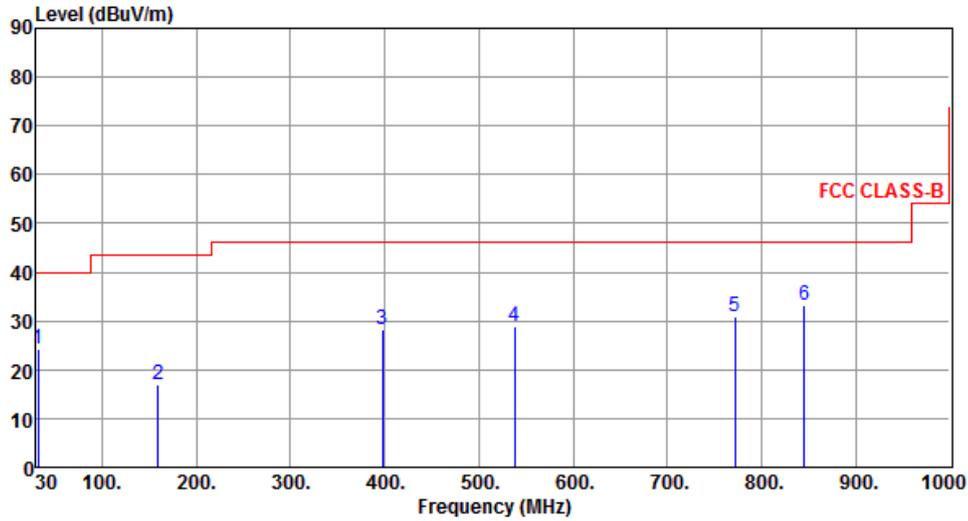
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

<b>Modulation / SF</b>	CSS / 9	<b>Test Freq. (MHz)</b>	914.2
<b>Polarization</b>	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	31.94	24.29	40.00	-15.71	38.30	-14.01	Peak	---	---
2	159.01	16.95	43.50	-26.55	30.25	-13.30	Peak	---	---
3	397.63	28.24	46.00	-17.76	38.48	-10.24	Peak	---	---
4	538.28	28.88	46.00	-17.12	36.01	-7.13	Peak	---	---
5	772.05	30.80	46.00	-15.20	33.81	-3.01	Peak	---	---
6	845.77	33.14	46.00	-12.86	34.87	-1.73	Peak	---	---

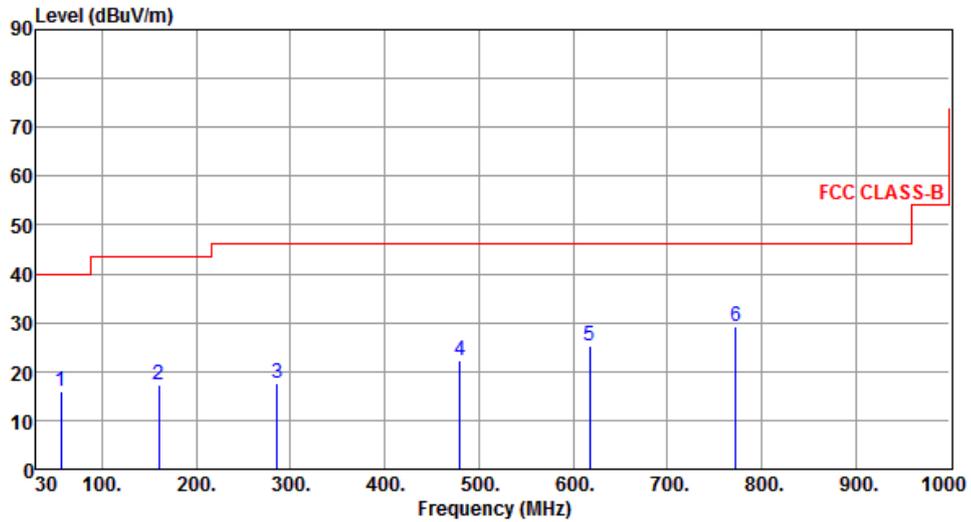
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

<b>Modulation / SF</b>	CSS / 9	<b>Test Freq. (MHz)</b>	927.5
<b>Polarization</b>	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	56.19	15.95	40.00	-24.05	29.62	-13.67	Peak	---	---
2	159.98	17.40	43.50	-26.10	30.69	-13.29	Peak	---	---
3	286.08	17.72	46.00	-28.28	30.86	-13.14	Peak	---	---
4	480.08	22.11	46.00	-23.89	30.38	-8.27	Peak	---	---
5	617.82	25.20	46.00	-20.80	30.73	-5.53	Peak	---	---
6	773.02	29.09	46.00	-16.91	32.09	-3.00	Peak	---	---

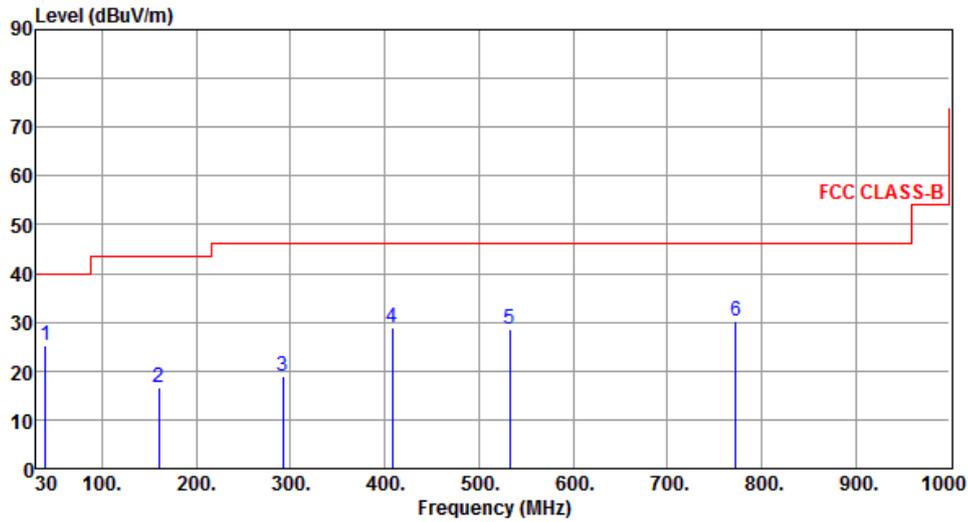
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

<b>Modulation / SF</b>	CSS / 9	<b>Test Freq. (MHz)</b>	927.5
<b>Polarization</b>	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	39.70	25.31	40.00	-14.69	38.66	-13.35	Peak	---	---
2	159.98	16.61	43.50	-26.89	29.90	-13.29	Peak	---	---
3	291.90	18.85	46.00	-27.15	31.86	-13.01	Peak	---	---
4	408.30	28.75	46.00	-17.25	38.70	-9.95	Peak	---	---
5	532.46	28.72	46.00	-17.28	35.98	-7.26	Peak	---	---
6	773.02	30.22	46.00	-15.78	33.22	-3.00	Peak	---	---

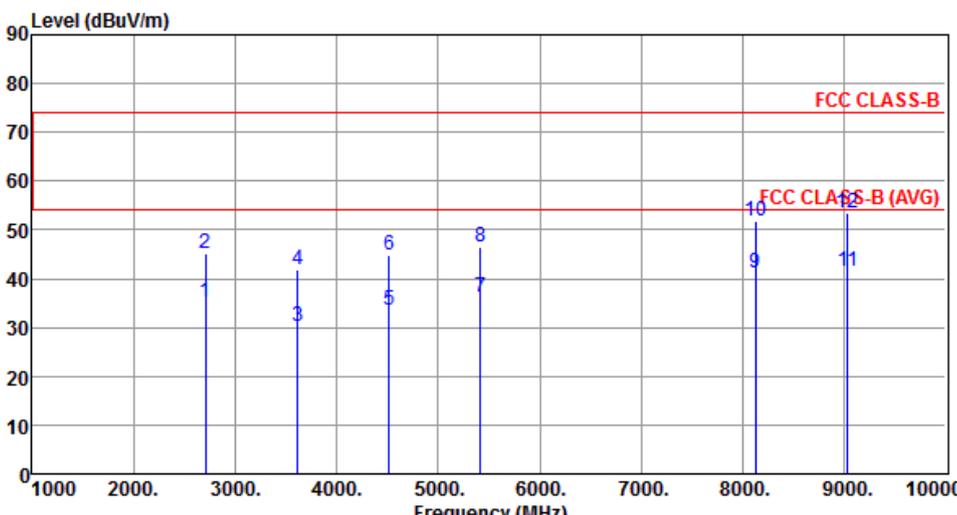
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*Factor includes antenna factor , cable loss and amplifier gain

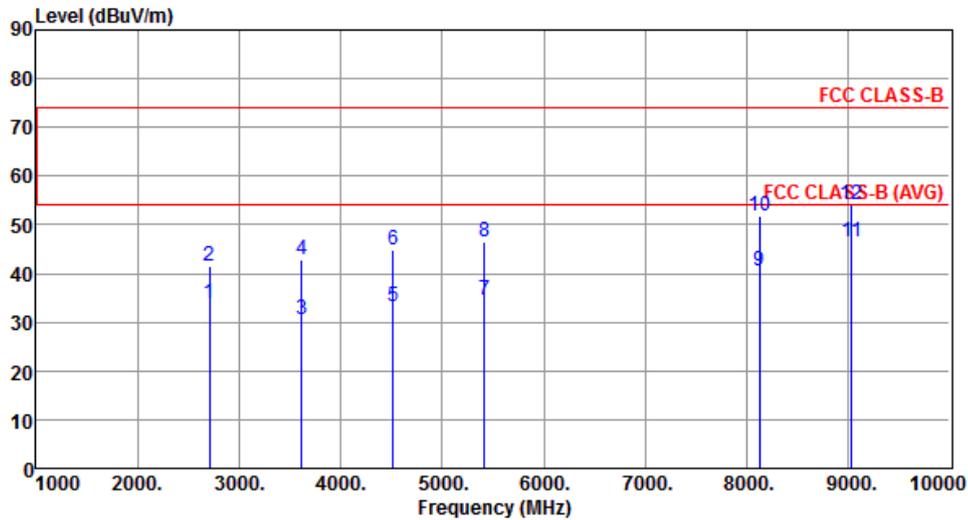
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

### 3.5.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation / SF	CSS / 9	Test Freq. (MHz)	903																																																																																																																																		
Polarization	Horizontal																																																																																																																																				
																																																																																																																																					
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Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg																																																																																																																													
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5	4515.00	33.58	54.00	-20.42	28.99	4.59	Average	335	157																																																																																																																												
6	4515.00	44.88	74.00	-29.12	40.29	4.59	Peak	335	157																																																																																																																												
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<b>Modulation / SF</b>	CSS / 9	<b>Test Freq. (MHz)</b>	903
<b>Polarization</b>	Vertical		



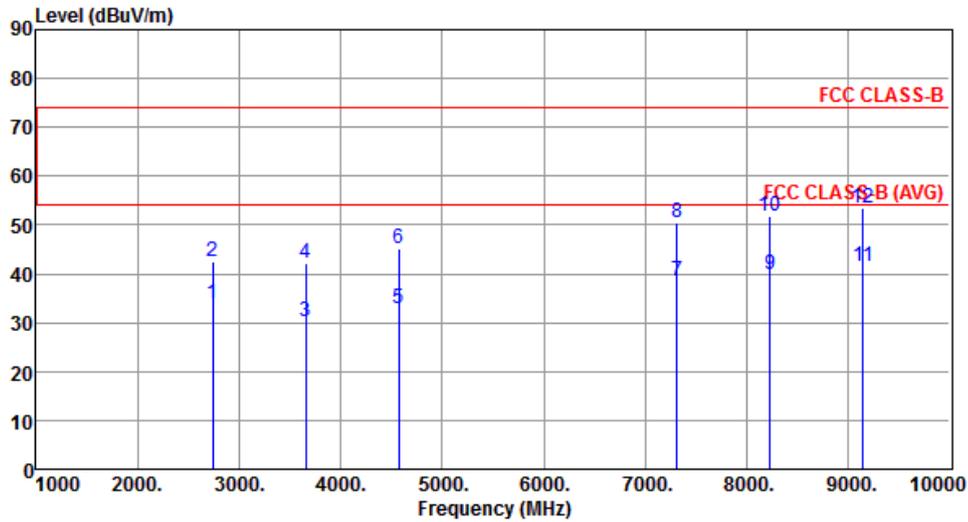
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2709.00	33.77	54.00	-20.23	33.71	0.06	Average	374	326
2	2709.00	41.64	74.00	-32.36	41.58	0.06	Peak	374	326
3	3612.00	30.70	54.00	-23.30	28.90	1.80	Average	264	171
4	3612.00	42.70	74.00	-31.30	40.90	1.80	Peak	264	171
5	4515.00	33.11	54.00	-20.89	28.52	4.59	Average	307	157
6	4515.00	44.88	74.00	-29.12	40.29	4.59	Peak	307	157
7	5418.00	34.63	54.00	-19.37	28.30	6.33	Average	366	195
8	5418.00	46.60	74.00	-27.40	40.27	6.33	Peak	366	195
9	8127.00	40.38	54.00	-13.62	28.88	11.50	Average	215	117
10	8127.00	51.70	74.00	-22.30	40.20	11.50	Peak	215	117
11	9030.00	46.37	54.00	-7.63	33.29	13.08	Average	298	35
12	9030.00	54.23	74.00	-19.77	41.15	13.08	Peak	298	35

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

<b>Modulation / SF</b>	CSS / 9	<b>Test Freq. (MHz)</b>	914.2
<b>Polarization</b>	Horizontal		



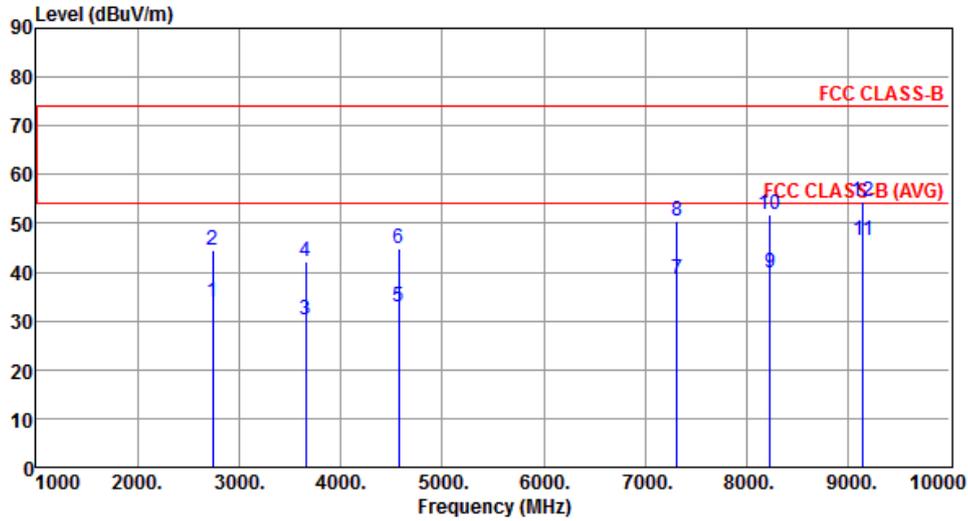
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2742.60	33.78	54.00	-20.22	33.67	0.11	Average	126	50
2	2742.60	42.36	74.00	-31.64	42.25	0.11	Peak	126	50
3	3656.80	30.32	54.00	-23.68	28.36	1.96	Average	157	27
4	3656.80	42.29	74.00	-31.71	40.33	1.96	Peak	157	27
5	4571.00	32.95	54.00	-21.05	28.26	4.69	Average	305	187
6	4571.00	45.25	74.00	-28.75	40.56	4.69	Peak	305	187
7	7313.60	38.48	54.00	-15.52	28.21	10.27	Average	157	1571
8	7313.60	50.46	74.00	-23.54	40.19	10.27	Peak	157	1571
9	8227.80	39.95	54.00	-14.05	28.35	11.60	Average	165	271
10	8227.80	51.85	74.00	-22.15	40.25	11.60	Peak	165	271
11	9142.00	41.60	54.00	-12.40	28.12	13.48	Average	305	24
12	9142.00	53.57	74.00	-20.43	40.09	13.48	Peak	305	24

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

<b>Modulation / SF</b>	CSS / 9	<b>Test Freq. (MHz)</b>	914.2
<b>Polarization</b>	Vertical		



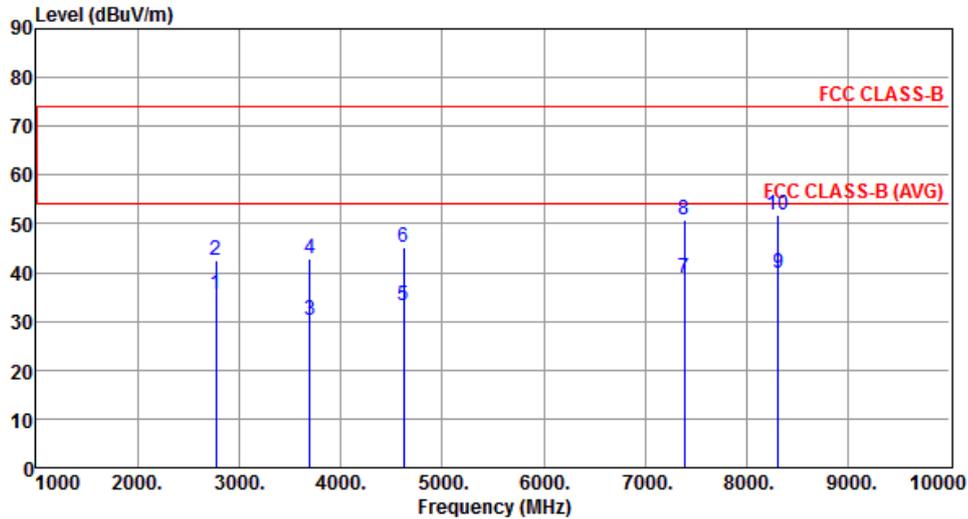
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2742.60	33.76	54.00	-20.24	33.65	0.11	Average	265	45
2	2742.60	44.34	74.00	-29.66	44.23	0.11	Peak	265	45
3	3656.80	30.15	54.00	-23.85	28.19	1.96	Average	267	156
4	3656.80	42.15	74.00	-31.85	40.19	1.96	Peak	267	156
5	4571.00	32.91	54.00	-21.09	28.22	4.69	Average	180	267
6	4571.00	44.91	74.00	-29.09	40.22	4.69	Peak	180	267
7	7313.60	38.45	54.00	-15.55	28.18	10.27	Average	265	157
8	7313.60	50.52	74.00	-23.48	40.25	10.27	Peak	265	157
9	8227.80	39.85	54.00	-14.15	28.25	11.60	Average	165	157
10	8227.80	51.77	74.00	-22.23	40.17	11.60	Peak	165	157
11	9142.00	46.57	54.00	-7.43	33.09	13.48	Average	235	0
12	9142.00	54.57	74.00	-19.43	41.09	13.48	Peak	235	0

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

<b>Modulation / SF</b>	CSS / 9	<b>Test Freq. (MHz)</b>	927.5
<b>Polarization</b>	Horizontal		



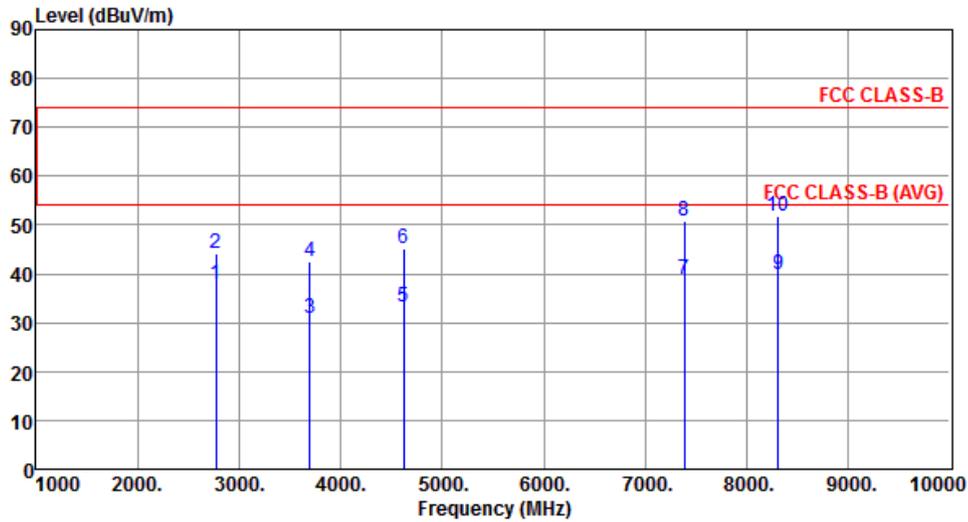
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2769.90	35.41	54.00	-18.59	35.26	0.15	Average	390	1
2	2769.90	42.41	74.00	-31.59	42.26	0.15	Peak	390	1
3	3693.20	30.37	54.00	-23.63	28.25	2.12	Average	265	235
4	3693.20	42.71	74.00	-31.29	40.59	2.12	Peak	265	235
5	4616.50	33.15	54.00	-20.85	28.37	4.78	Average	157	47
6	4616.50	45.05	74.00	-28.95	40.27	4.78	Peak	157	47
7	7386.40	38.73	54.00	-15.27	28.33	10.40	Average	168	271
8	7386.40	50.79	74.00	-23.21	40.39	10.40	Peak	168	271
9	8309.70	39.96	54.00	-14.04	28.37	11.59	Average	319	195
10	8309.70	51.86	74.00	-22.14	40.27	11.59	Peak	319	195

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

<b>Modulation / SF</b>	CSS / 9	<b>Test Freq. (MHz)</b>	927.5
<b>Polarization</b>	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2769.90	37.74	54.00	-16.26	37.59	0.15	Average	112	33
2	2769.90	44.15	74.00	-29.85	44.00	0.15	Peak	112	33
3	3693.20	30.77	54.00	-23.23	28.65	2.12	Average	235	320
4	3693.20	42.49	74.00	-31.51	40.37	2.12	Peak	235	320
5	4616.50	33.05	54.00	-20.95	28.27	4.78	Average	275	280
6	4616.50	45.16	74.00	-28.84	40.38	4.78	Peak	275	280
7	7386.40	38.78	54.00	-15.22	28.38	10.40	Average	298	82
8	7386.40	50.68	74.00	-23.32	40.28	10.40	Peak	298	82
9	8309.70	39.97	54.00	-14.03	28.38	11.59	Average	167	127
10	8309.70	51.88	74.00	-22.12	40.29	11.59	Peak	167	127

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

## 3.6 Emissions in Non-Restricted Frequency Bands

### 3.6.1 Emissions in Non-Restricted Frequency Bands Limit

Peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz

### 3.6.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

### 3.6.3 Test Procedures

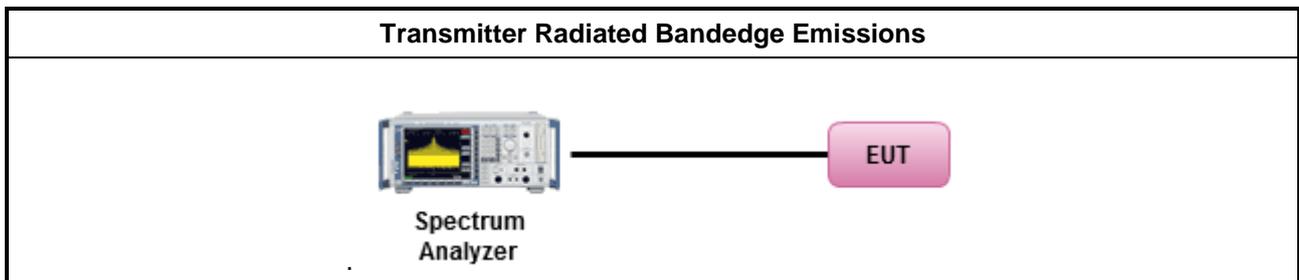
#### Reference level measurement

1. Set RBW=100kHz, VBW = 300kHz , Detector = Peak, Sweep time = Auto
2. Trace = max hold , Allow Trace to fully stabilize
3. Use the peak marker function to determine the maximum PSD level

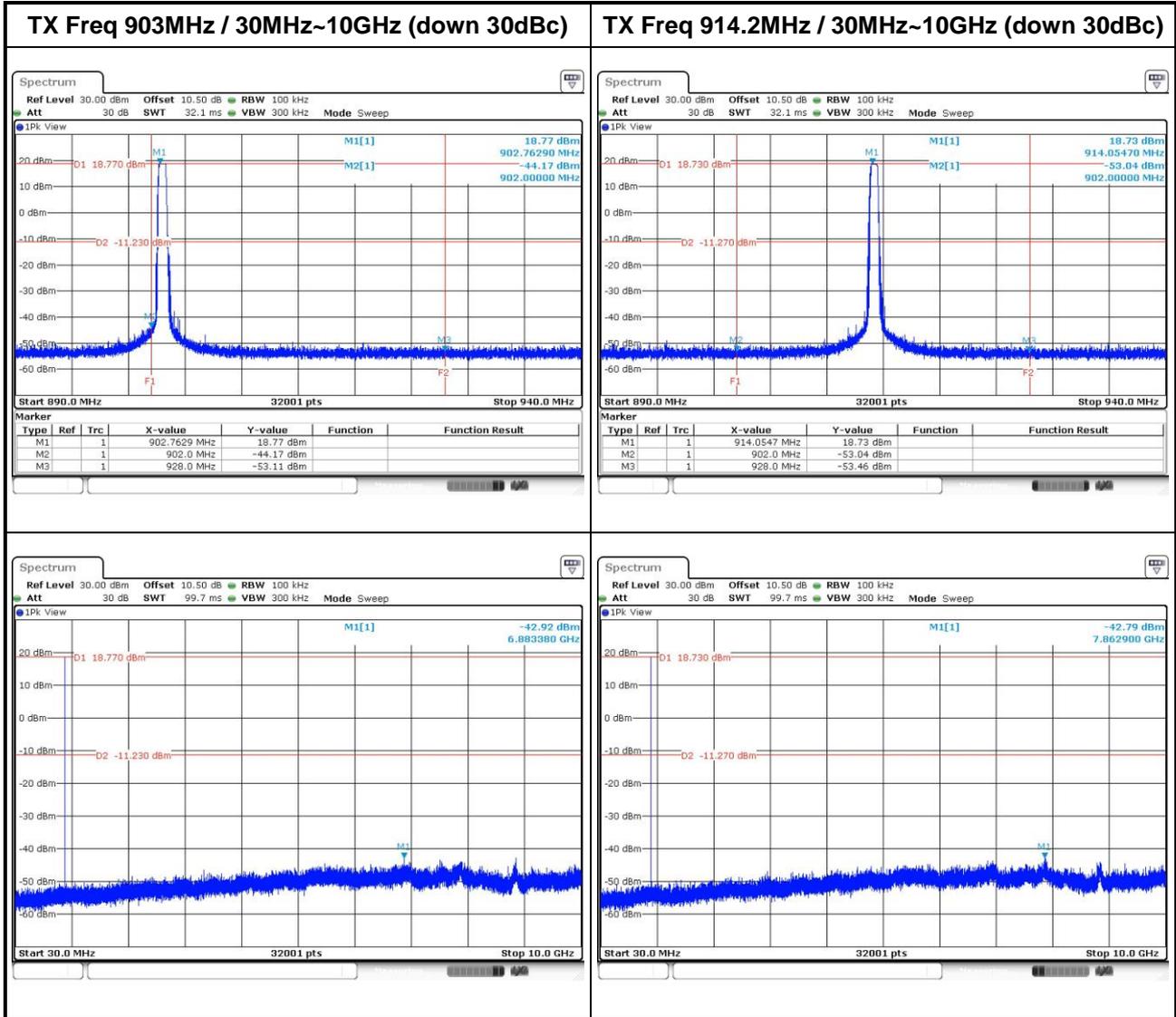
#### Emission level measurement

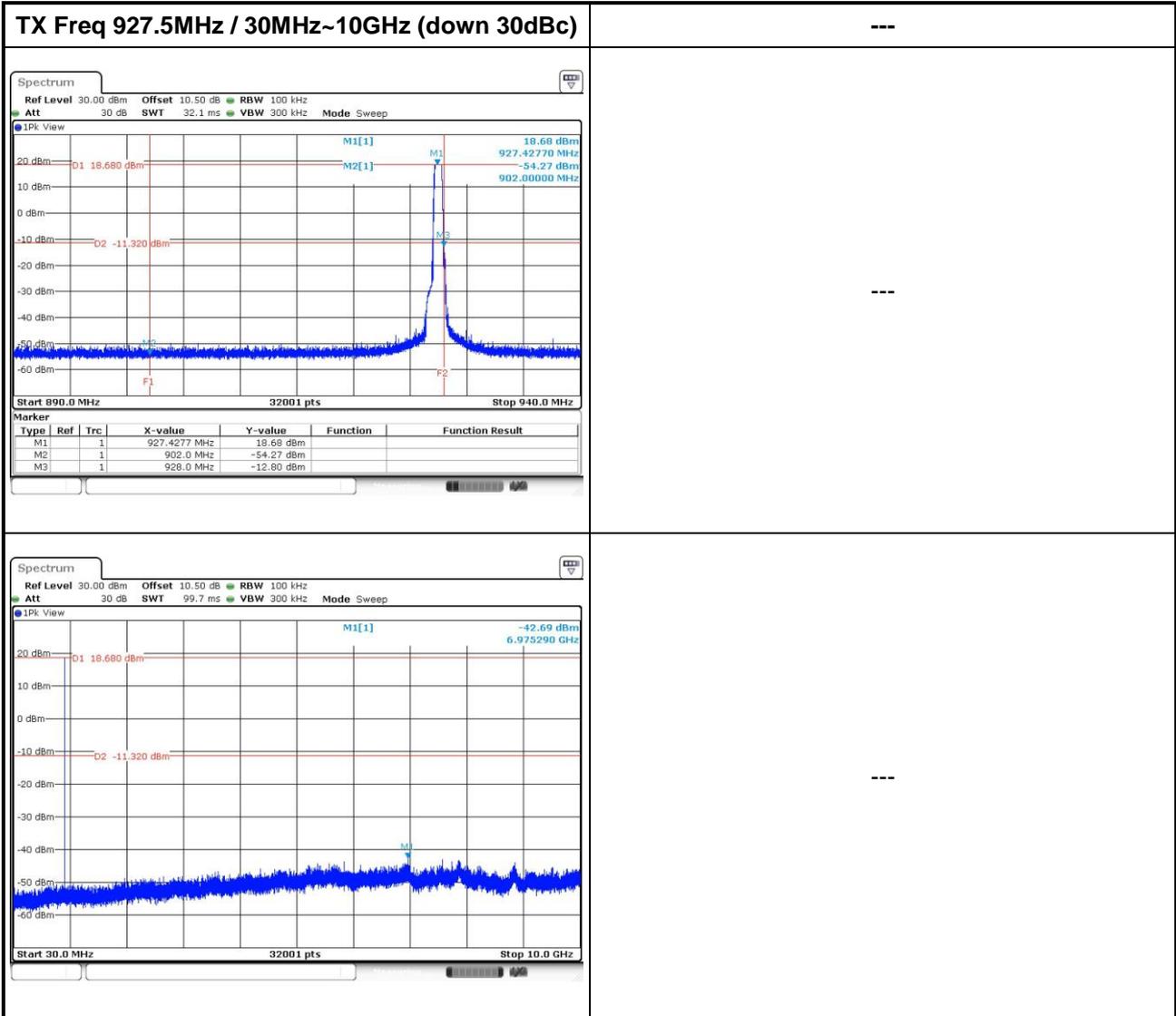
1. Set RBW=100kHz, VBW = 300kHz , Detector = Peak, Sweep time = Auto
2. Trace = max hold , Allow Trace to fully stabilize
3. Scan Frequency range is up to 10GHz
4. Use the peak marker function to determine the maximum amplitude level

### 3.6.4 Test Setup



### 3.6.5 Unwanted Emissions into Non-Restricted Frequency Bands





## 4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp, it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan Hsiang. Location map can be found on our website <http://www.icertifi.com.tw>.

### **Linkou**

Tel: 886-2-2601-1640

No. 30-2, Ding Fwu Tsuen, Lin Kou  
District, New Taipei City, Taiwan,  
R.O.C.

### **Kwei Shan**

Tel: 886-3-271-8666

No. 3-1, Lane 6, Wen San 3rd  
St., Kwei Shan Hsiang, Tao Yuan  
Hsien 333, Taiwan, R.O.C.

### **Kwei Shan Site II**

Tel: 886-3-271-8640

No. 14-1, Lane 19, Wen San 3rd  
St., Kwei Shan Hsiang, Tao Yuan  
Hsien 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information

Tel: 886-3-271-8666

Fax: 886-3-318-0155

Email: ICC\_Service@icertifi.com.tw

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