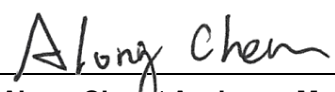


FCC Test Report

FCC ID : MXF-WMDD209
Equipment : Lora module
Model No. : WMDD-209
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 : Mar. 09, 2017
Tested Date : Mar. 23 ~ Apr. 06, 2017

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.

Reviewed by:


Along Chen / Assistant Manager

Approved by:

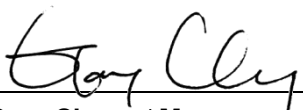

Gary Chang / Manager



Table of Contents

1	GENERAL DESCRIPTION	5
1.1	Information.....	5
1.2	Local Support Equipment List	6
1.3	Test Setup Chart	6
1.4	The Equipment List	7
1.5	Test Standards	8
1.6	Measurement Uncertainty	8
2	TEST CONFIGURATION	9
2.1	Testing Condition	9
2.2	The Worst Test Modes and Channel Details	9
3	TRANSMITTER TEST RESULTS.....	10
3.1	Conducted Emissions.....	10
3.2	6dB and Occupied Bandwidth	17
3.3	RF Output Power	20
3.4	Power Spectral Density	22
3.5	Unwanted Emissions into Restricted Frequency Bands	24
3.6	Emissions in Non-Restricted Frequency Bands	38
4	TEST LABORATORY INFORMATION	41

Release Record

Report No.	Version	Description	Issued Date
FR730901-1	Rev. 01	Initial issue	Apr. 24, 2017

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 21.600MHz 38.58 (Margin -11.42dB) - AV	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 684.29MHz 42.75 (Margin -3.25dB) - PK	Pass
15.247(b)(3)	Maximum Output Power	Max Power [dBm]: 18.88	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	Data Rate (bit/sec)	Spread Factor	Channel Bandwidth (kHz)
902 ~ 928	903 ~ 914.2	65 ~ 72 [8]	293 ~ 5469	12 ~ 7	500
Note 1: RF output power specifies thatMaximum Conducted (Average) Output Power. Note 2: The device uses CSS modulation.					

1.1.2 Antenna Details

Ant. No.	Type	Connector	Gain (dBi)	Remark
1	Dipole	IPEX	0	---

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	5Vdc from host
-------------------	----------------

1.1.4 Accessories

N/A

1.1.5 Channel List

Channel	Frequency(MHz)
65	903
66	904.6
67	906.2
68	907.8
69	909.4
70	911
71	912.6
72	914.2

1.1.6 Test Tool and Duty Cycle

Test Tool	HyperTerminal, version: 5.1.2600.0	
Duty Cycle and Duty Factor	Duty Cycle (%)	Duty Factor (dB)
	100%	0

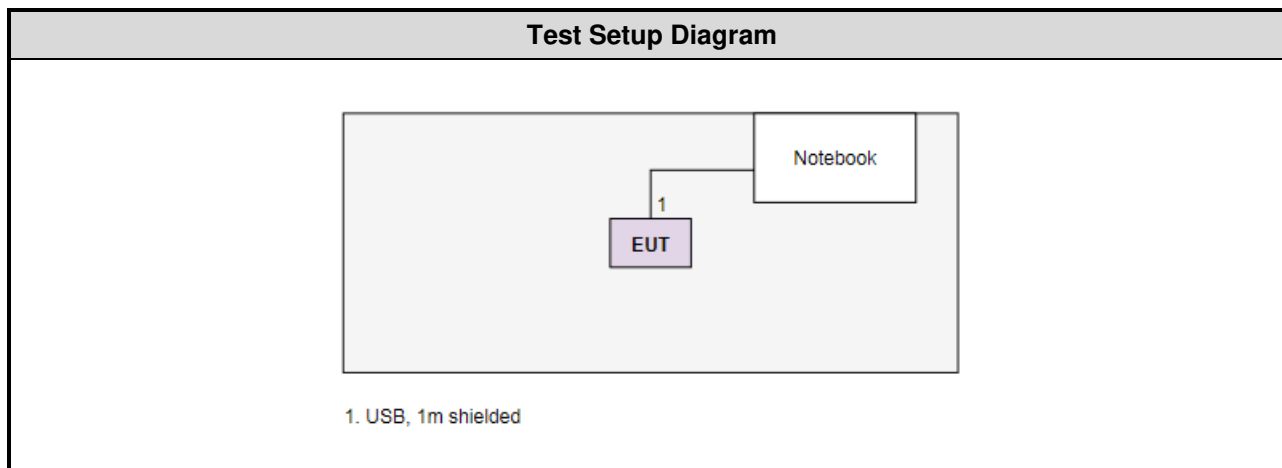
1.1.7 Power Setting

Modulation Mode	Test Frequency (MHz)		
	903	907.8	914.2
CSS	20	20	20

1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Signal cable / Length (m)
1	Notebook	DELL	Latitude E6430	DoC	USB, 1m shielded.

1.3 Test Setup Chart



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
Receiver	R&S	ESR3	101657	Dec. 21, 2016	Dec. 20, 2017
LISN	SCHWARZBECK	Schwarzbeck 8127	8127-667	Nov. 08, 2016	Nov. 07, 2017
RF Cable-CON	EMC	EMCCFD300-BM-BM-6000	50821	Dec. 20, 2016	Dec. 19, 2017
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. 09, 2016	Sep. 08, 2017
Receiver	Agilent	N9038A	MY53290044	Oct. 06, 2016	Oct. 05, 2017
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-685	Apr. 26, 2016	Apr. 25, 2017
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1206	Feb. 09, 2017	Feb. 08, 2018
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 10, 2016	Nov. 09, 2017
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Dec. 09, 2016	Dec. 08, 2017
Preamplifier	EMC	EMC02325	980187	Sep. 08, 2016	Sep. 07, 2017
Preamplifier	Agilent	83017A	MY53270014	Aug. 22, 2016	Aug. 21, 2017
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22620/4	Feb. 04, 2017	Feb. 03, 2018
RF cable-8M	HUBER+SUHNER	SUCOFLEX104	MY22600/4	Feb. 04, 2017	Feb. 03, 2018
RF cable-1M	HUBER+SUHNER	SUCOFLEX104	MY22624/4	Feb. 04, 2017	Feb. 03, 2018
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800-001	Feb. 04, 2017	Feb. 03, 2018
LF cable-3M	EMC	EMC8D-NM-NM-3000	131103	Feb. 04, 2017	Feb. 03, 2018
LF cable-13M	EMC	EMC8D-NM-NM-13000	131104	Feb. 04, 2017	Feb. 03, 2018
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	Mar. 15, 2017	Mar. 14, 2018
Power Meter	Anritsu	ML2495A	1241002	Oct. 06, 2016	Oct. 05, 2017
Power Sensor	Anritsu	MA2411B	1207366	Oct. 06, 2016	Oct. 05, 2017
DC POWER SOURCE	GW INSTEK	GPC-6030D	EM892433	Oct. 20, 2016	Oct. 19, 2017
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 v04

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	±34.134 Hz
Conducted power	±0.808 dB
Power density	±0.463 dB
Conducted emission	±2.670 dB
AC conducted emission	±2.90 dB
Radiated emission ≤ 1GHz	±3.72 dB
Radiated emission > 1GHz	±5.65 dB

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	20°C / 58%	Howard Huang
Radiated Emissions	03CH03-WS	24°C / 62%	Kevin Lee Vincent Yeh
RF Conducted	TH01-WS	22°C / 63%	Brad Wu

- FCC Designation No.: TW0009
- 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)	Channel Bandwidth (kHz)	Modulation / SF
Conducted Emissions Radiated Emissions ≤1GHz Radiated Emissions >1GHz Maximum Output Power 6dB Bandwidth Power Spectral Density	903 / 907.8 / 914.2	500	CSS / 12
NOTE: 1. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The Z-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

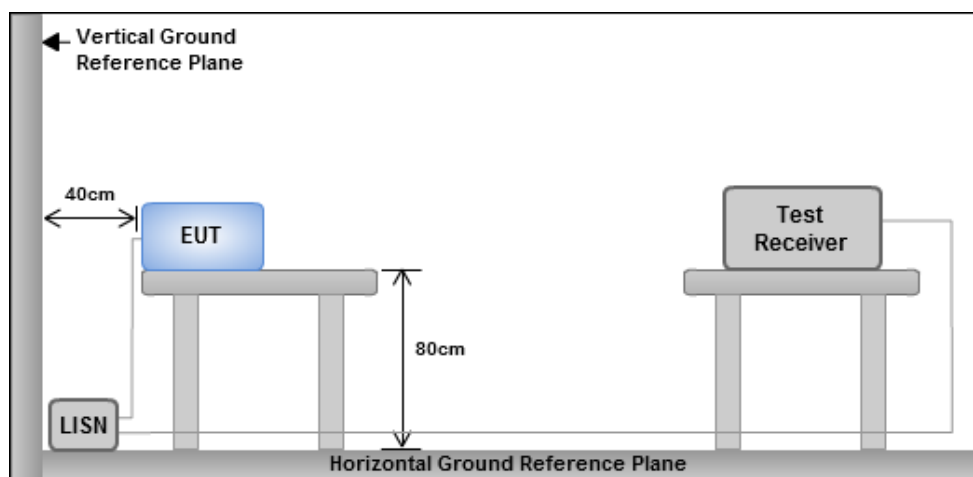
Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

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 Ω 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.

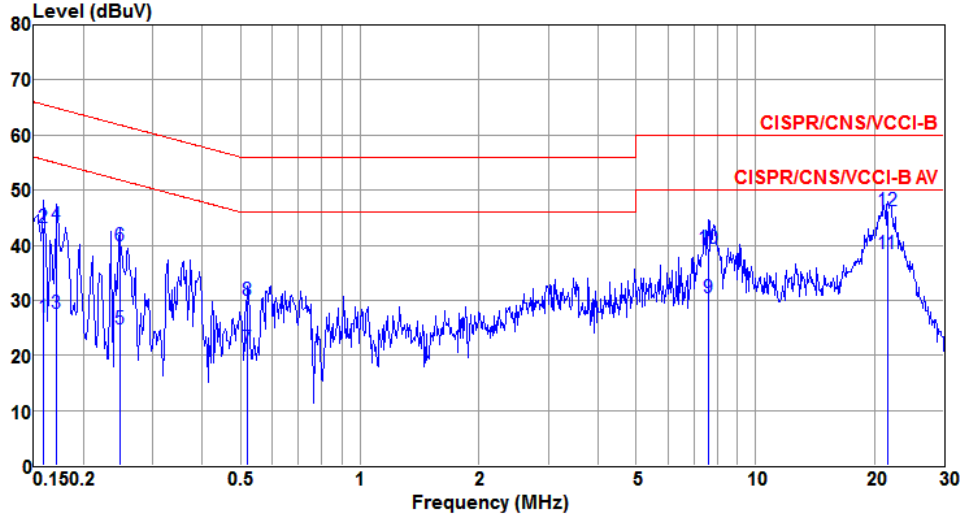
3.1.3 Test Setup



- 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

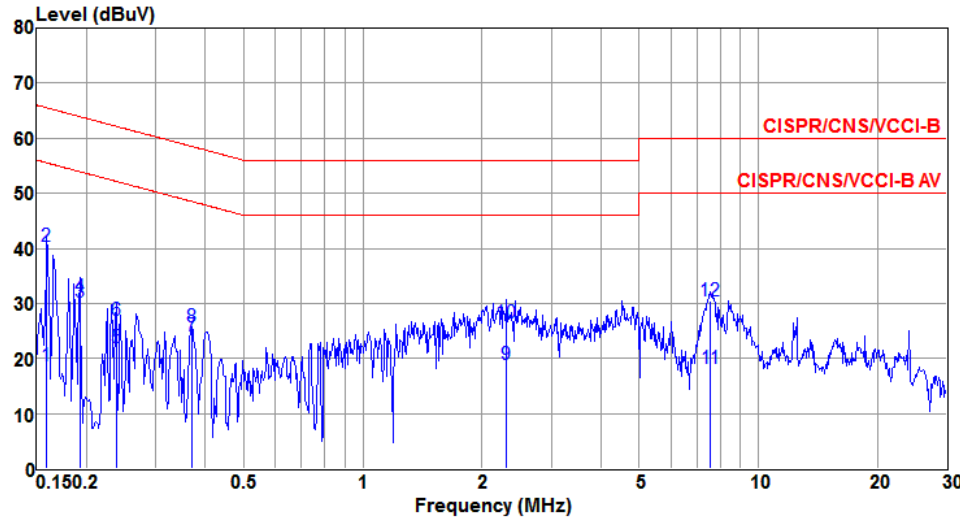
3.1.4 Test Result of Conducted Emissions

Modulation / SF	CSS / 12	Test Freq. (MHz)	903
Power Phase	Line		

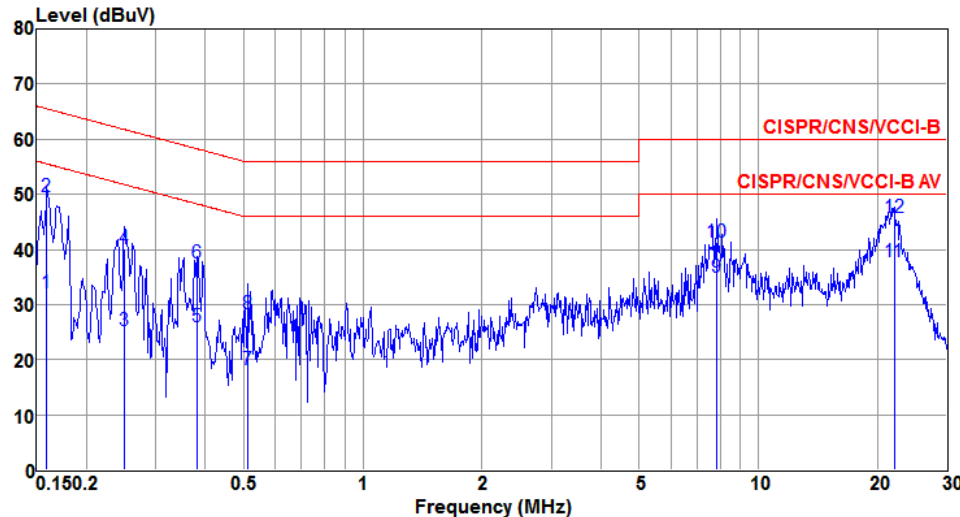


	Freq MHz	Level dBUV	Limit Line dBUV	Over Limit dB	Read Level dBUV	LISN factor dB	cable loss dB	Remark
1	0.159	26.95	55.52	-28.57	26.83	0.08	0.04	Average
2	0.159	43.30	65.52	-22.22	43.18	0.08	0.04	QP
3	0.171	27.54	54.90	-27.36	27.42	0.08	0.04	Average
4	0.171	43.77	64.90	-21.13	43.65	0.08	0.04	QP
5	0.247	24.75	51.86	-27.11	24.62	0.09	0.04	Average
6	0.247	39.96	61.86	-21.90	39.83	0.09	0.04	QP
7	0.521	21.22	46.00	-24.78	21.12	0.06	0.04	Average
8	0.521	30.01	56.00	-25.99	29.91	0.06	0.04	QP
9	7.606	30.43	50.00	-19.57	30.04	0.19	0.20	Average
10	7.606	39.51	60.00	-20.49	39.12	0.19	0.20	QP
11@	21.600	38.58	50.00	-11.42	37.90	0.41	0.27	Average
12	21.600	46.37	60.00	-13.63	45.69	0.41	0.27	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 / 12	Test Freq. (MHz)	903																																																																																																																					
Power Phase	Neutral																																																																																																																							
Level (dBuV)  Frequency (MHz) <table><tr><th></th><th>Freq MHz</th><th>Level dBuV</th><th>Limit Line dBuV</th><th>Over Limit dB</th><th>Read Level dBuV</th><th>LISN factor dB</th><th>cable loss dB</th><th>Remark</th></tr><tr><td>1</td><td>0.159</td><td>18.72</td><td>55.52</td><td>-36.80</td><td>18.58</td><td>0.10</td><td>0.04</td><td>Average</td></tr><tr><td>2</td><td>0.159</td><td>40.30</td><td>65.52</td><td>-25.22</td><td>40.16</td><td>0.10</td><td>0.04</td><td>QP</td></tr><tr><td>3@</td><td>0.192</td><td>30.21</td><td>53.93</td><td>-23.72</td><td>30.08</td><td>0.09</td><td>0.04</td><td>Average</td></tr><tr><td>4</td><td>0.192</td><td>31.17</td><td>63.93</td><td>-32.76</td><td>31.04</td><td>0.09</td><td>0.04</td><td>QP</td></tr><tr><td>5</td><td>0.238</td><td>21.88</td><td>52.17</td><td>-30.29</td><td>21.74</td><td>0.10</td><td>0.04</td><td>Average</td></tr><tr><td>6</td><td>0.238</td><td>26.86</td><td>62.17</td><td>-35.31</td><td>26.72</td><td>0.10</td><td>0.04</td><td>QP</td></tr><tr><td>7</td><td>0.369</td><td>23.97</td><td>48.52</td><td>-24.55</td><td>23.80</td><td>0.13</td><td>0.04</td><td>Average</td></tr><tr><td>8</td><td>0.369</td><td>25.68</td><td>58.52</td><td>-32.84</td><td>25.51</td><td>0.13</td><td>0.04</td><td>QP</td></tr><tr><td>9</td><td>2.309</td><td>18.97</td><td>46.00</td><td>-27.03</td><td>18.74</td><td>0.16</td><td>0.07</td><td>Average</td></tr><tr><td>10</td><td>2.309</td><td>26.33</td><td>56.00</td><td>-29.67</td><td>26.10</td><td>0.16</td><td>0.07</td><td>QP</td></tr><tr><td>11</td><td>7.566</td><td>18.16</td><td>50.00</td><td>-31.84</td><td>17.70</td><td>0.26</td><td>0.20</td><td>Average</td></tr><tr><td>12</td><td>7.566</td><td>30.48</td><td>60.00</td><td>-29.52</td><td>30.02</td><td>0.26</td><td>0.20</td><td>QP</td></tr></table> Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB). 2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).					Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark	1	0.159	18.72	55.52	-36.80	18.58	0.10	0.04	Average	2	0.159	40.30	65.52	-25.22	40.16	0.10	0.04	QP	3@	0.192	30.21	53.93	-23.72	30.08	0.09	0.04	Average	4	0.192	31.17	63.93	-32.76	31.04	0.09	0.04	QP	5	0.238	21.88	52.17	-30.29	21.74	0.10	0.04	Average	6	0.238	26.86	62.17	-35.31	26.72	0.10	0.04	QP	7	0.369	23.97	48.52	-24.55	23.80	0.13	0.04	Average	8	0.369	25.68	58.52	-32.84	25.51	0.13	0.04	QP	9	2.309	18.97	46.00	-27.03	18.74	0.16	0.07	Average	10	2.309	26.33	56.00	-29.67	26.10	0.16	0.07	QP	11	7.566	18.16	50.00	-31.84	17.70	0.26	0.20	Average	12	7.566	30.48	60.00	-29.52	30.02	0.26	0.20	QP
	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark																																																																																																																
1	0.159	18.72	55.52	-36.80	18.58	0.10	0.04	Average																																																																																																																
2	0.159	40.30	65.52	-25.22	40.16	0.10	0.04	QP																																																																																																																
3@	0.192	30.21	53.93	-23.72	30.08	0.09	0.04	Average																																																																																																																
4	0.192	31.17	63.93	-32.76	31.04	0.09	0.04	QP																																																																																																																
5	0.238	21.88	52.17	-30.29	21.74	0.10	0.04	Average																																																																																																																
6	0.238	26.86	62.17	-35.31	26.72	0.10	0.04	QP																																																																																																																
7	0.369	23.97	48.52	-24.55	23.80	0.13	0.04	Average																																																																																																																
8	0.369	25.68	58.52	-32.84	25.51	0.13	0.04	QP																																																																																																																
9	2.309	18.97	46.00	-27.03	18.74	0.16	0.07	Average																																																																																																																
10	2.309	26.33	56.00	-29.67	26.10	0.16	0.07	QP																																																																																																																
11	7.566	18.16	50.00	-31.84	17.70	0.26	0.20	Average																																																																																																																
12	7.566	30.48	60.00	-29.52	30.02	0.26	0.20	QP																																																																																																																

Modulation / SF	CSS / 12	Test Freq. (MHz)	907.8
Power Phase	Line		



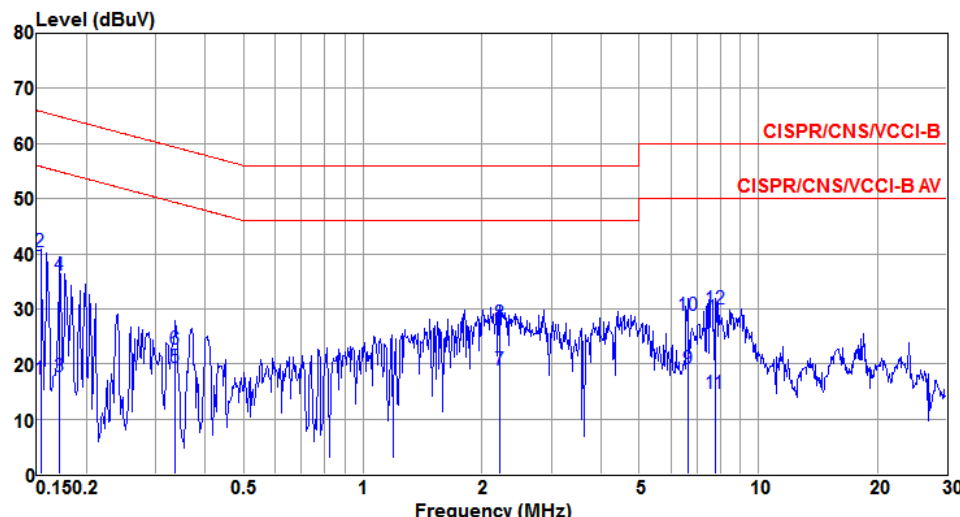
The graph displays the measured level in dBUV across a frequency range from 0.15 to 30 MHz. Two red limit lines are shown: CISPR/CNS/VCCI-B (upper) and CISPR/CNS/VCCI-B AV (lower). The measured signal is plotted in blue. Several peaks are labeled with numbers 1 through 12, corresponding to the data table below.

	Freq	Level	Limit	Over	Read	LISN	cable	
	MHz	dBuV	Line	Limit	Level	factor	loss	Remark
			dBuV	dB	dBuV	dB	dB	
1	0.159	32.14	55.52	-23.38	32.02	0.08	0.04	Average
2	0.159	49.60	65.52	-15.92	49.48	0.08	0.04	QP
3	0.249	25.28	51.78	-26.50	25.15	0.09	0.04	Average
4	0.249	40.07	61.78	-21.71	39.94	0.09	0.04	QP
5	0.381	26.07	48.25	-22.18	25.97	0.06	0.04	Average
6	0.381	37.63	58.25	-20.62	37.53	0.06	0.04	QP
7	0.513	18.13	46.00	-27.87	18.03	0.06	0.04	Average
8	0.513	28.36	56.00	-27.64	28.26	0.06	0.04	QP
9	7.852	34.98	50.00	-15.02	34.59	0.19	0.20	Average
10	7.852	41.20	60.00	-18.80	40.81	0.19	0.20	QP
11@	22.063	37.67	50.00	-12.33	36.99	0.41	0.27	Average
12	22.063	45.73	60.00	-14.27	45.05	0.41	0.27	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 / 12	Test Freq. (MHz)	907.8
Power Phase	Neutral		

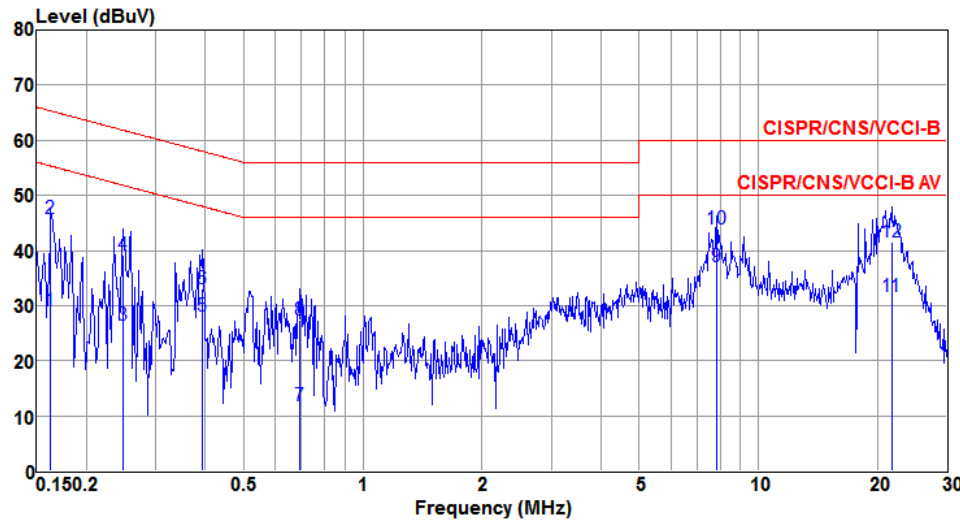


	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.153	17.21	55.82	-38.61	17.07	0.10	0.04	Average
2@	0.153	40.28	65.82	-25.54	40.14	0.10	0.04	QP
3	0.171	17.64	54.90	-37.26	17.50	0.10	0.04	Average
4	0.171	36.01	64.90	-28.89	35.87	0.10	0.04	QP
5	0.336	19.32	49.31	-29.99	19.16	0.12	0.04	Average
6	0.336	22.62	59.31	-36.69	22.46	0.12	0.04	QP
7	2.213	18.91	46.00	-27.09	18.69	0.16	0.06	Average
8	2.213	27.47	56.00	-28.53	27.25	0.16	0.06	QP
9	6.627	19.08	50.00	-30.92	18.66	0.23	0.19	Average
10	6.627	28.69	60.00	-31.31	28.27	0.23	0.19	QP
11	7.769	14.70	50.00	-35.30	14.24	0.26	0.20	Average
12	7.769	30.01	60.00	-29.99	29.55	0.26	0.20	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 / 12	Test Freq. (MHz)	914.2
Power Phase	Line		



The graph displays the measured electromagnetic interference level in dBuV across a frequency range from 0.150 to 30 MHz. Two red lines represent the CISPR/CNS/VCCI-B and CISPR/CNS/VCCI-B AV limits. The blue line shows the measured level, with several peaks labeled with numbers 2, 7, 10, and 11. The measured level is generally below the limits, with some peaks exceeding the limits at higher frequencies.

	Freq	Level	Limit	Over	Read	LISN	cable	
	MHz	dBuV	Line	Limit	Level	factor	loss	Remark
			dBuV	dB	dBuV	dB	dB	
1	0.162	29.13	55.34	-26.21	29.01	0.08	0.04	Average
2	0.162	45.88	65.34	-19.46	45.76	0.08	0.04	QP
3	0.247	26.34	51.86	-25.52	26.21	0.09	0.04	Average
4	0.247	39.27	61.86	-22.59	39.14	0.09	0.04	QP
5	0.393	27.98	47.99	-20.01	27.88	0.06	0.04	Average
6	0.393	32.93	57.99	-25.06	32.83	0.06	0.04	QP
7	0.694	11.78	46.00	-34.22	11.67	0.07	0.04	Average
8	0.694	27.41	56.00	-28.59	27.30	0.07	0.04	QP
9@	7.852	37.10	50.00	-12.90	36.71	0.19	0.20	Average
10	7.852	43.87	60.00	-16.13	43.48	0.19	0.20	QP
11	21.715	31.64	50.00	-18.36	30.96	0.41	0.27	Average
12	21.715	41.56	60.00	-18.44	40.88	0.41	0.27	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 / 12	Test Freq. (MHz)	914.2
Power Phase	Neutral		

The graph displays the radio frequency interference (RFI) level in dBuV across a frequency range from 0.150 MHz to 30 MHz. Two red lines represent the CISPR/CNS/VCCI-B and CISPR/CNS/VCCI-B AV limits. The blue line shows the measured RFI level, which is generally below the limits, with some peaks around 0.150 MHz, 0.330 MHz, 1.527 MHz, 2.448 MHz, and 7.566 MHz. The measured level is approximately 30 dBuV at 7.566 MHz, which is below the 60 dBuV limit.

	Freq	Level	Limit	Over	Read	LISN	cable	
	MHz	dBuV	Line	Limit	Level	factor	loss	Remark
			dBuV	dB	dBuV	dB	dB	
1	0.150	16.60	56.00	-39.40	16.46	0.10	0.04	Average
2	0.150	38.56	66.00	-27.44	38.42	0.10	0.04	QP
3	0.156	28.93	55.65	-26.72	28.79	0.10	0.04	Average
4	0.156	37.90	65.65	-27.75	37.76	0.10	0.04	QP
5	0.330	23.39	49.44	-26.05	23.23	0.12	0.04	Average
6	0.330	27.88	59.44	-31.56	27.72	0.12	0.04	QP
7@	1.527	21.79	46.00	-24.21	21.62	0.13	0.04	Average
8	1.527	28.00	56.00	-28.00	27.83	0.13	0.04	QP
9	2.448	18.27	46.00	-27.73	18.05	0.15	0.07	Average
10	2.448	27.36	56.00	-28.64	27.14	0.15	0.07	QP
11	7.566	15.37	50.00	-34.63	14.91	0.26	0.20	Average
12	7.566	30.64	60.00	-29.36	30.18	0.26	0.20	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

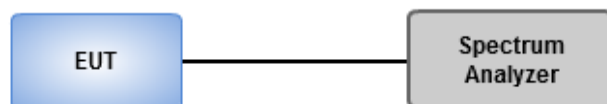
6dB Bandwidth

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

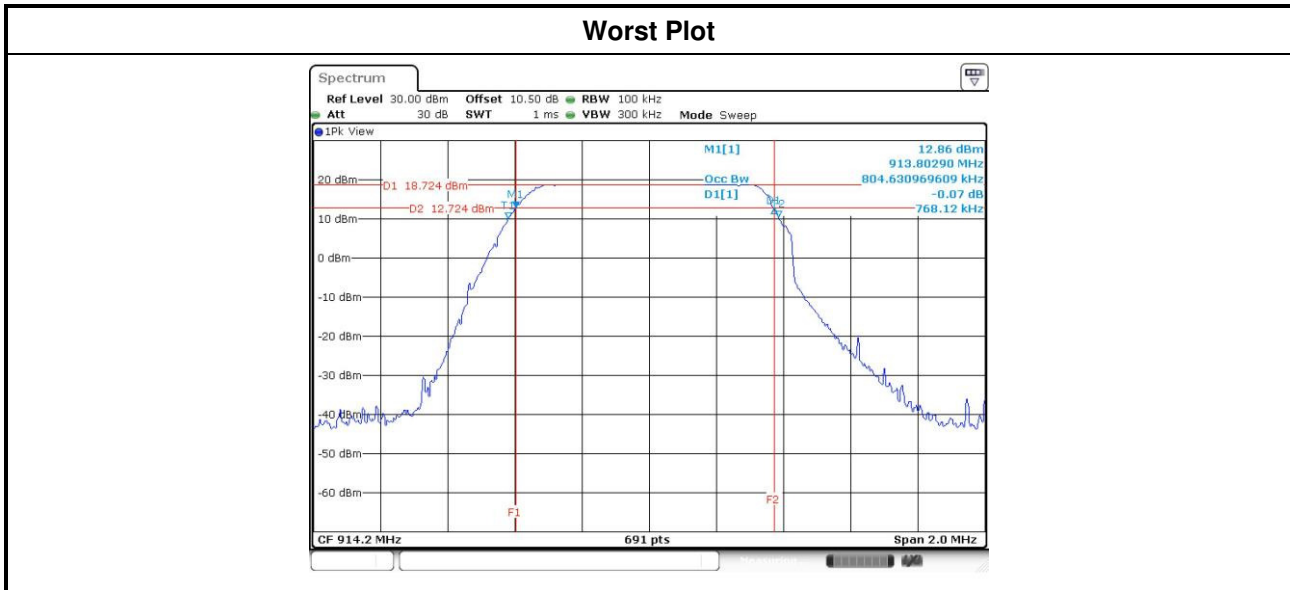
1. Set resolution bandwidth (RBW) = 10kHz, Video bandwidth = 30kHz.
2. Detector = Sample, Trace mode = max hold.
3. Sweep = auto couple, Allow the trace to stabilize.
4. Use the OBW measurement function of spectrum analyzer to measure the occupied bandwidth.

3.2.3 Test Setup



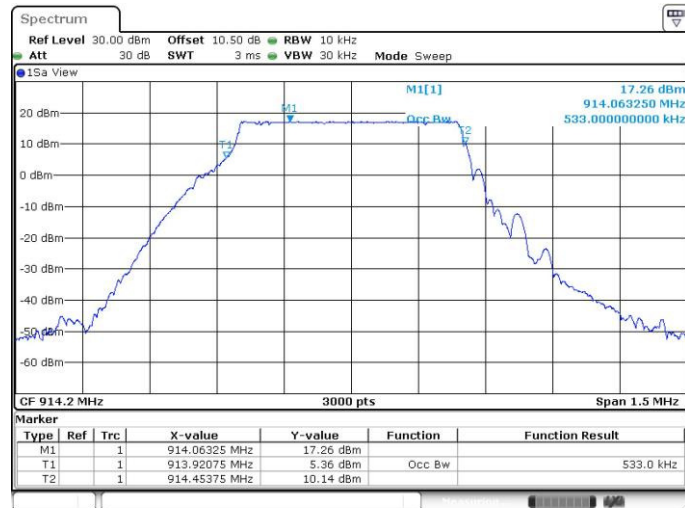
3.2.4 Test Result of 6dB and Occupied Bandwidth

Modulation / SF	Freq. (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
CSS / 12	903	0.786	0.5
CSS / 12	907.8	0.780	0.5
CSS / 12	914.2	0.768	0.5



Modulation / SF	Freq. (MHz)	99% Occupied Bandwidth (MHz)
CSS / 12	903	0.531
CSS / 12	907.8	0.531
CSS / 12	914.2	0.533

Worst Plot



3.3 RF Output Power

3.3.1 Limit of RF Output Power

Conducted power shall not exceed 1Watt.

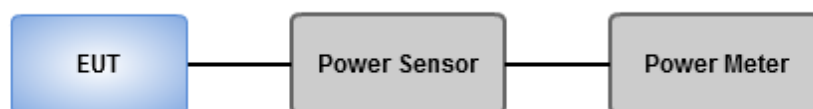
- ☒ Antenna gain $\leq 6\text{dBi}$, no any corresponding reduction is in output power limit.
- ☐ Antenna gain $> 6\text{dBi}$

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 / 12	903	77.26806	18.88	30
CSS / 12	907.8	76.38358	18.83	30
CSS / 12	914.2	76.55966	18.84	30

3.4 Power Spectral Density

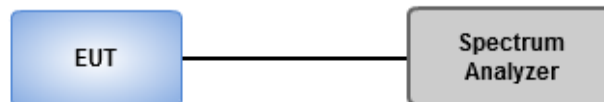
3.4.1 Limit of Power Spectral Density

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

3.4.2 Test Procedures

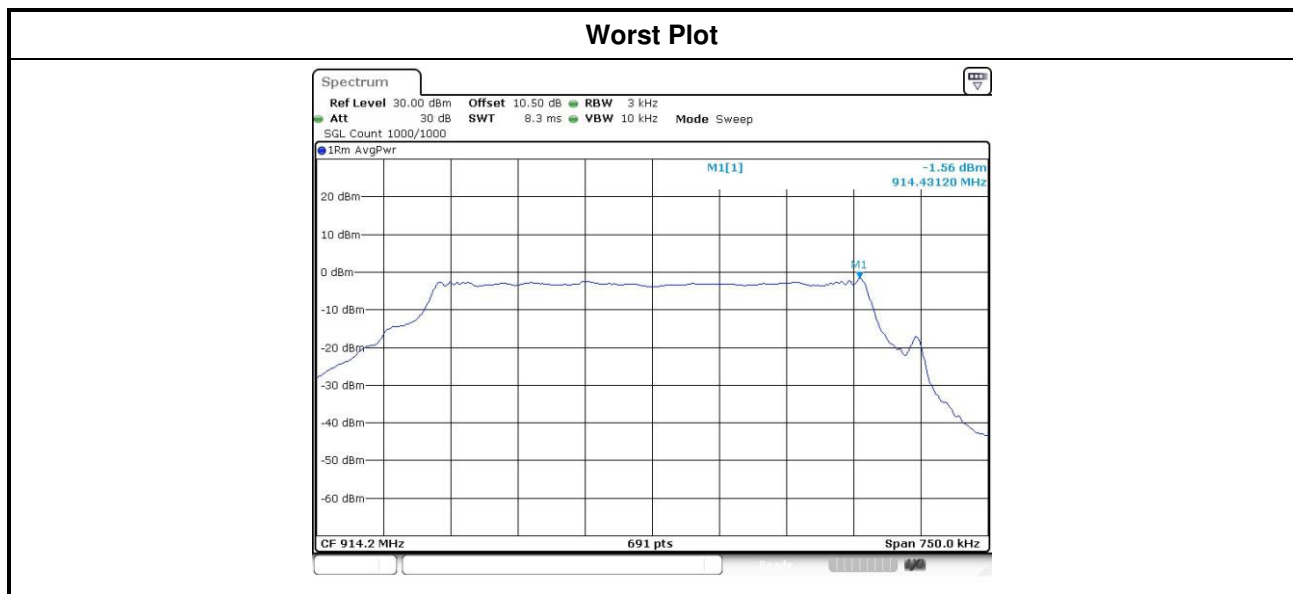
- ☐ Maximum peak conducted output power was used to demonstrate compliance to the fundamental output power limit.
 1. Set the RBW = 3kHz, VBW = 10kHz.
 2. Detector = Peak, Sweep time = auto couple.
 3. Trace mode = max hold, allow trace to fully stabilize.
 4. Use the peak marker function to determine 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 / 12	903	-1.95	8.00
CSS / 12	907.8	-2.04	8.00
CSS / 12	914.2	-1.56	8.00



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

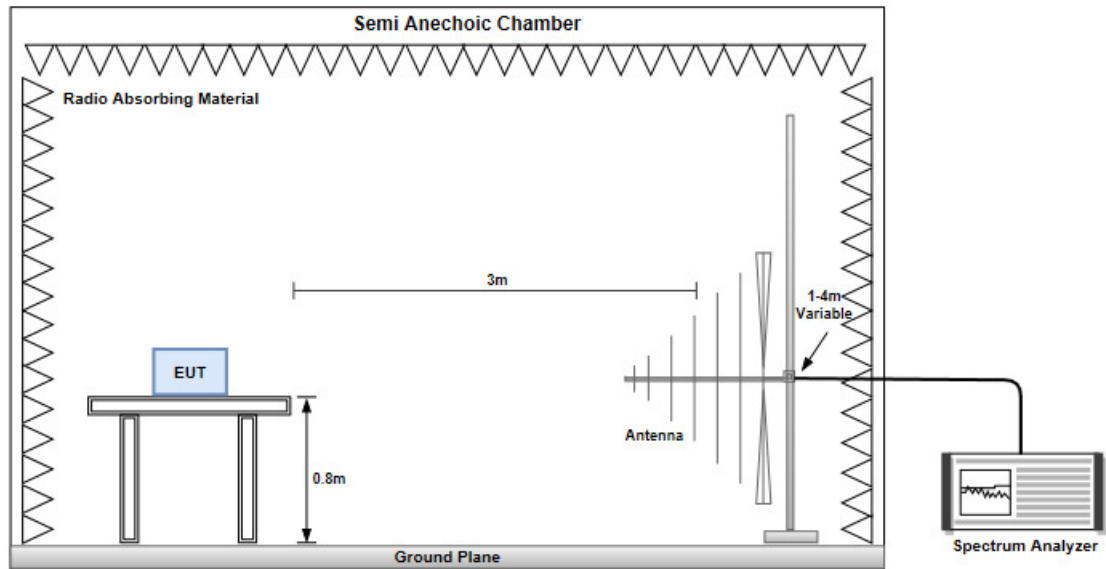
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission 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:

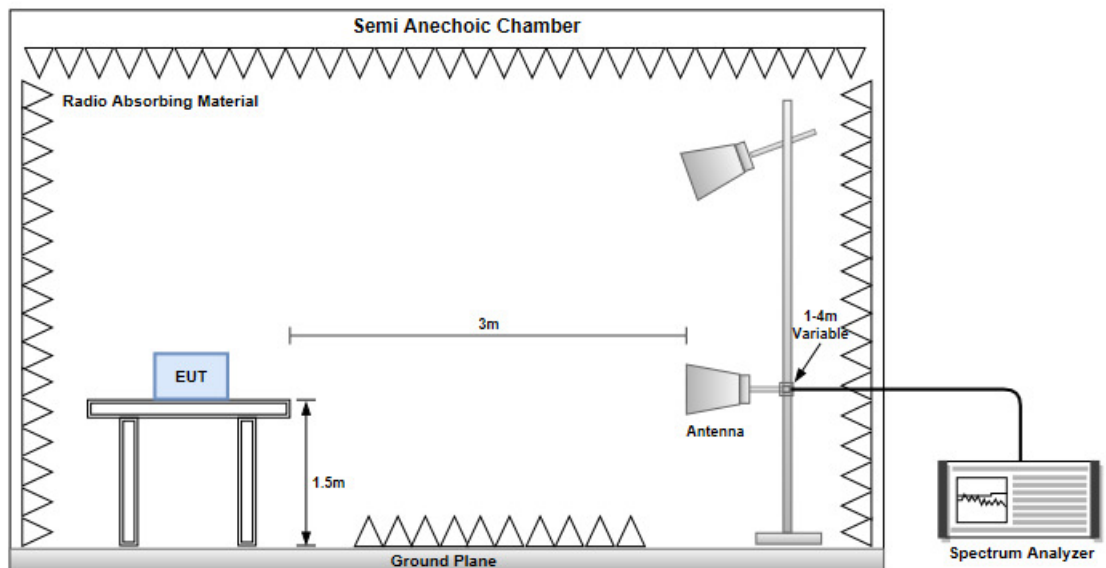
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

3.5.3 Test Setup

Radiated Emissions below 1 GHz



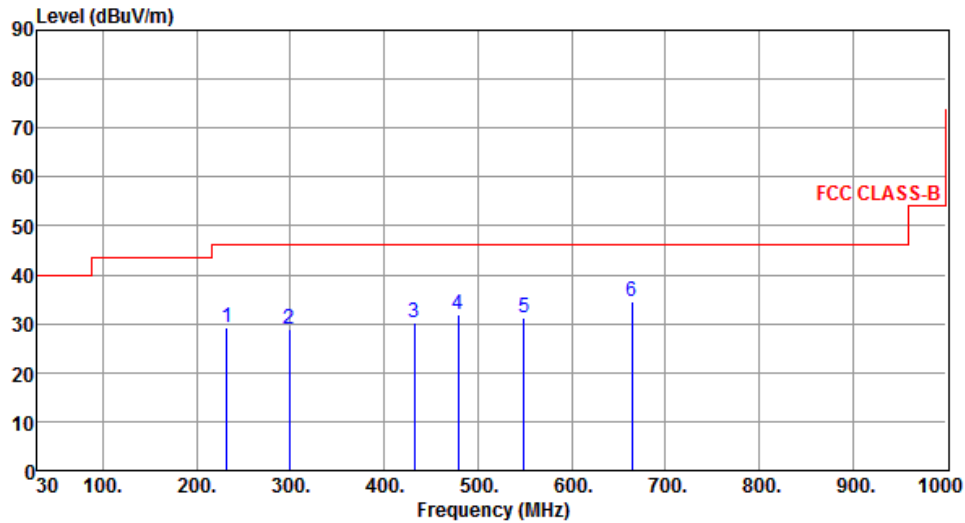
Radiated Emissions above 1 GHz



3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation / SF	CSS / 12	Test Freq. (MHz)	903
Polarization	Horizontal		
Level (dBuV/m) </			

Modulation / SF	CSS / 12	Test Freq. (MHz)	903
Polarization	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	231.76	29.38	46.00	-16.62	38.76	-9.38	Peak	---	---
2	298.69	29.04	46.00	-16.96	36.58	-7.54	Peak	---	---
3	432.55	30.37	46.00	-15.63	34.54	-4.17	Peak	---	---
4	479.11	31.77	46.00	-14.23	34.96	-3.19	Peak	---	---
5	548.95	31.10	46.00	-14.90	32.98	-1.88	Peak	---	---
6	664.38	34.68	46.00	-11.32	34.48	0.20	Peak	---	---

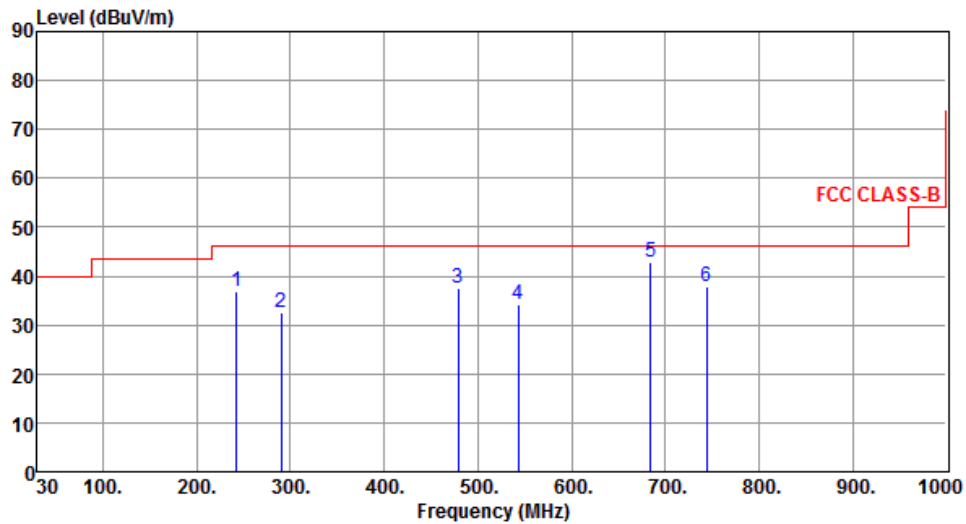
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*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.

Modulation / SF	CSS / 12	Test Freq. (MHz)	907.8
Polarization	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	242.41	37.03	46.00	-8.97	46.41	-9.38	Peak	---	---
2	289.83	32.51	46.00	-13.49	40.24	-7.73	Peak	---	---
3	478.69	37.62	46.00	-8.38	40.82	-3.20	Peak	---	---
4	543.57	34.30	46.00	-11.70	36.29	-1.99	Peak	---	---
5	684.29	42.75	46.00	-3.25	42.21	0.54	Peak	---	---
6	743.86	37.93	46.00	-8.07	36.23	1.70	Peak	---	---

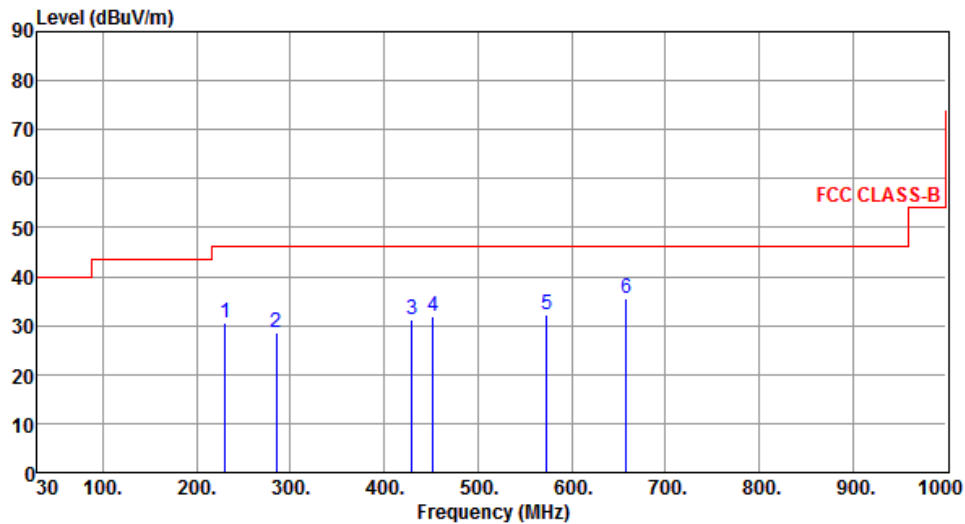
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*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.

Modulation / SF	CSS / 12	Test Freq. (MHz)	907.8
Polarization	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	230.41	30.48	46.00	-15.52	39.84	-9.36	Peak	---	---
2	284.83	28.42	46.00	-17.58	36.27	-7.85	Peak	---	---
3	429.58	31.08	46.00	-14.92	35.33	-4.25	Peak	---	---
4	451.84	31.92	46.00	-14.08	35.63	-3.71	Peak	---	---
5	573.28	32.18	46.00	-13.82	33.48	-1.30	Peak	---	---
6	658.42	35.46	46.00	-10.54	35.35	0.11	Peak	---	---

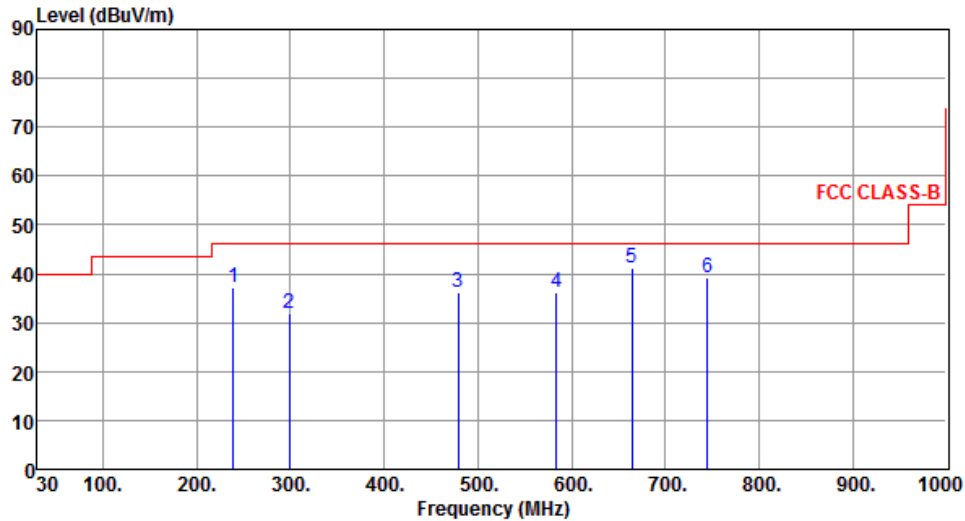
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*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.

Modulation / SF	CSS / 12	Test Freq. (MHz)	914.2
Polarization	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	239.52	37.12	46.00	-8.88	46.56	-9.44	Peak	---	---
2	298.69	31.84	46.00	-14.16	39.38	-7.54	Peak	---	---
3	479.11	36.32	46.00	-9.68	39.51	-3.19	Peak	---	---
4	583.87	36.20	46.00	-9.80	37.24	-1.04	Peak	---	---
5	664.38	41.23	46.00	-4.77	41.03	0.20	Peak	---	---
6	744.89	39.28	46.00	-6.72	37.56	1.72	Peak	---	---

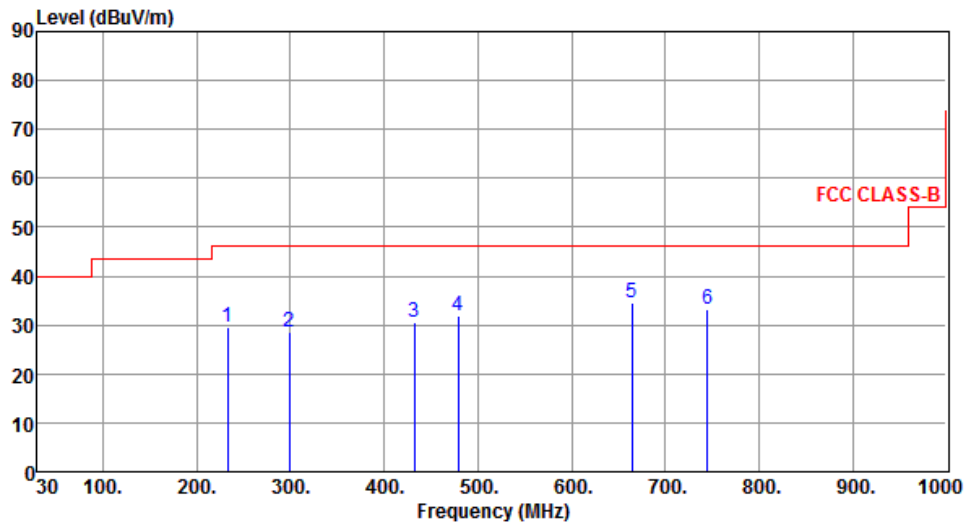
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*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.

Modulation / SF	CSS / 12	Test Freq. (MHz)	914.2
Polarization	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	232.73	29.57	46.00	-16.43	38.95	-9.38	Peak	---	---
2	298.69	28.51	46.00	-17.49	36.05	-7.54	Peak	---	---
3	432.55	30.45	46.00	-15.55	34.62	-4.17	Peak	---	---
4	479.11	31.93	46.00	-14.07	35.12	-3.19	Peak	---	---
5	664.38	34.49	46.00	-11.51	34.29	0.20	Peak	---	---
6	744.89	33.25	46.00	-12.75	31.53	1.72	Peak	---	---

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

*Factor includes antenna factor , cable loss and amplifier gain

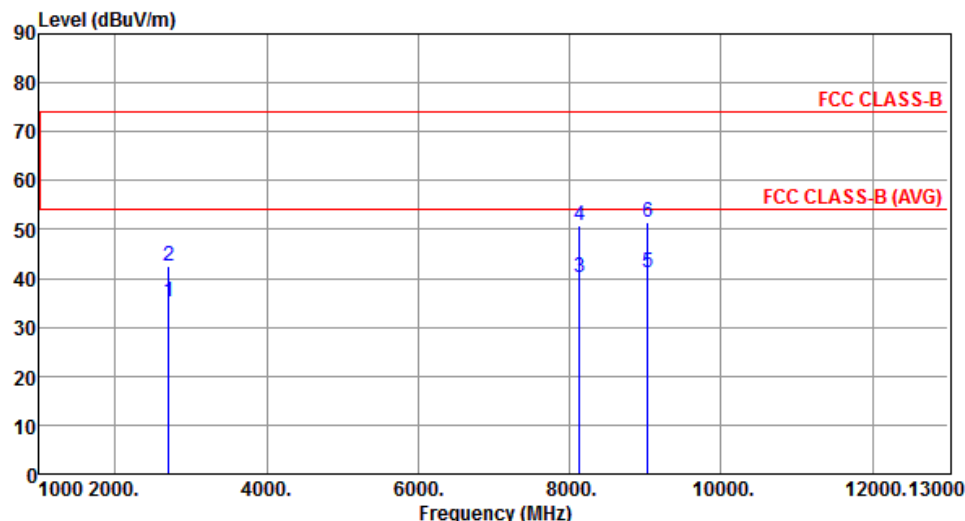
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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 / 12	Test Freq. (MHz)	903
Polarization	Horizontal		
Level (dBuV/m) <			

Modulation / SF	CSS / 12	Test Freq. (MHz)	903
Polarization	Vertical		



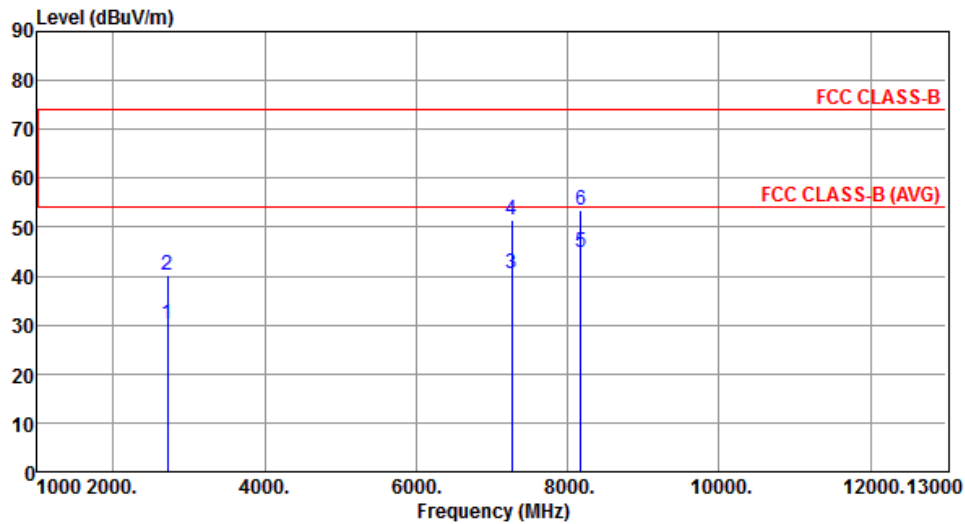
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2709.00	35.05	54.00	-18.95	37.08	-2.03	Average	181	123
2	2709.00	42.62	74.00	-31.38	44.65	-2.03	Peak	181	123
3	8127.00	40.16	54.00	-13.84	30.76	9.40	Average	100	222
4	8127.00	50.66	74.00	-23.34	41.26	9.40	Peak	100	222
5	9030.00	41.34	54.00	-12.66	30.20	11.14	Average	217	122
6	9030.00	51.57	74.00	-22.43	40.43	11.14	Peak	217	122

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).

Modulation / SF	CSS / 12	Test Freq. (MHz)	907.8
Polarization	Horizontal		



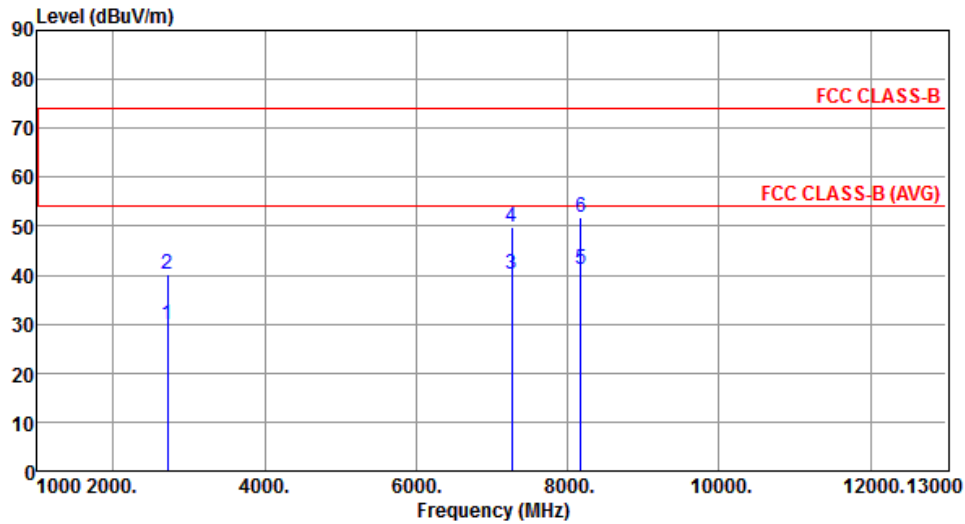
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2723.40	30.33	54.00	-23.67	32.31	-1.98	Average	158	134
2	2723.40	40.08	74.00	-33.92	42.06	-1.98	Peak	158	134
3	7262.40	40.63	54.00	-13.37	32.25	8.38	Average	212	230
4	7262.40	51.32	74.00	-22.68	42.94	8.38	Peak	212	230
5	8170.20	44.90	54.00	-9.10	35.42	9.48	Average	211	148
6	8170.20	53.41	74.00	-20.59	43.93	9.48	Peak	211	148

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).

Modulation / SF	CSS / 12	Test Freq. (MHz)	907.8
Polarization	Vertical		



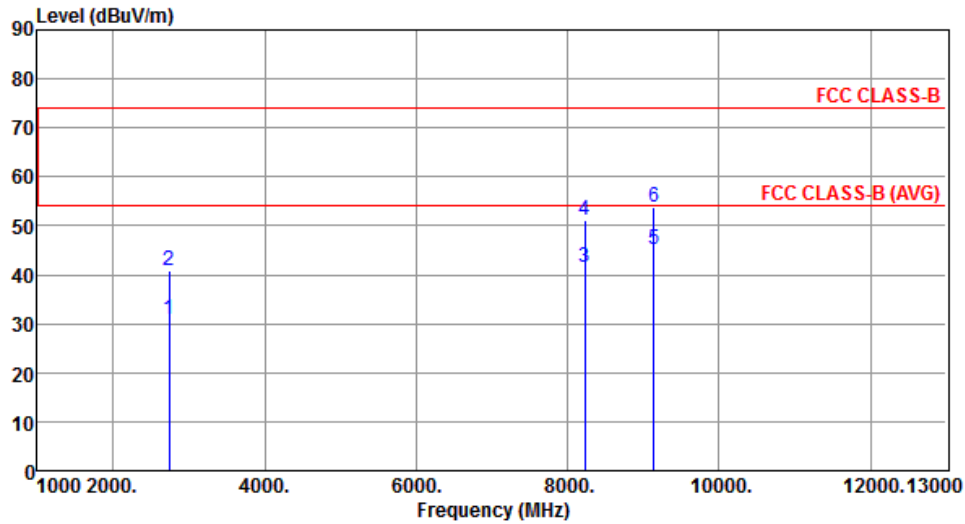
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2723.40	29.76	54.00	-24.24	31.74	-1.98	Average	153	182
2	2723.40	40.34	74.00	-33.66	42.32	-1.98	Peak	153	182
3	7262.40	40.28	54.00	-13.72	31.90	8.38	Average	243	218
4	7262.40	49.87	74.00	-24.13	41.49	8.38	Peak	243	218
5	8170.20	41.32	54.00	-12.68	31.84	9.48	Average	115	247
6	8170.20	51.70	74.00	-22.30	42.22	9.48	Peak	115	247

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).

Modulation / SF	CSS / 12	Test Freq. (MHz)	914.2
Polarization	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	30.83	54.00	-23.17	32.75	-1.92	Average	112	164
2	2742.60	40.72	74.00	-33.28	42.64	-1.92	Peak	112	164
3	8227.80	41.60	54.00	-12.40	32.06	9.54	Average	197	152
4	8227.80	51.01	74.00	-22.99	41.47	9.54	Peak	197	152
5	9142.00	45.32	54.00	-8.68	33.82	11.50	Average	182	152
6	9142.00	53.80	74.00	-20.20	42.30	11.50	Peak	182	152

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).

Modulation / SF	CSS / 12	Test Freq. (MHz)	914.2
Polarization	Vertical		
Level (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

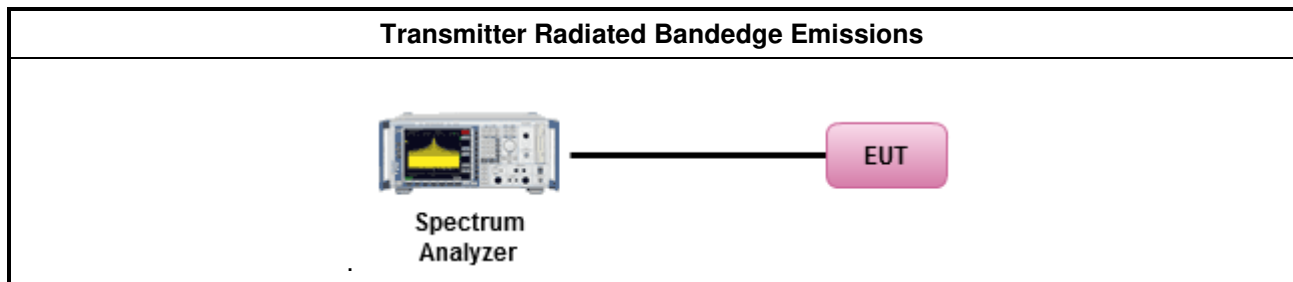
Reference level measurement

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

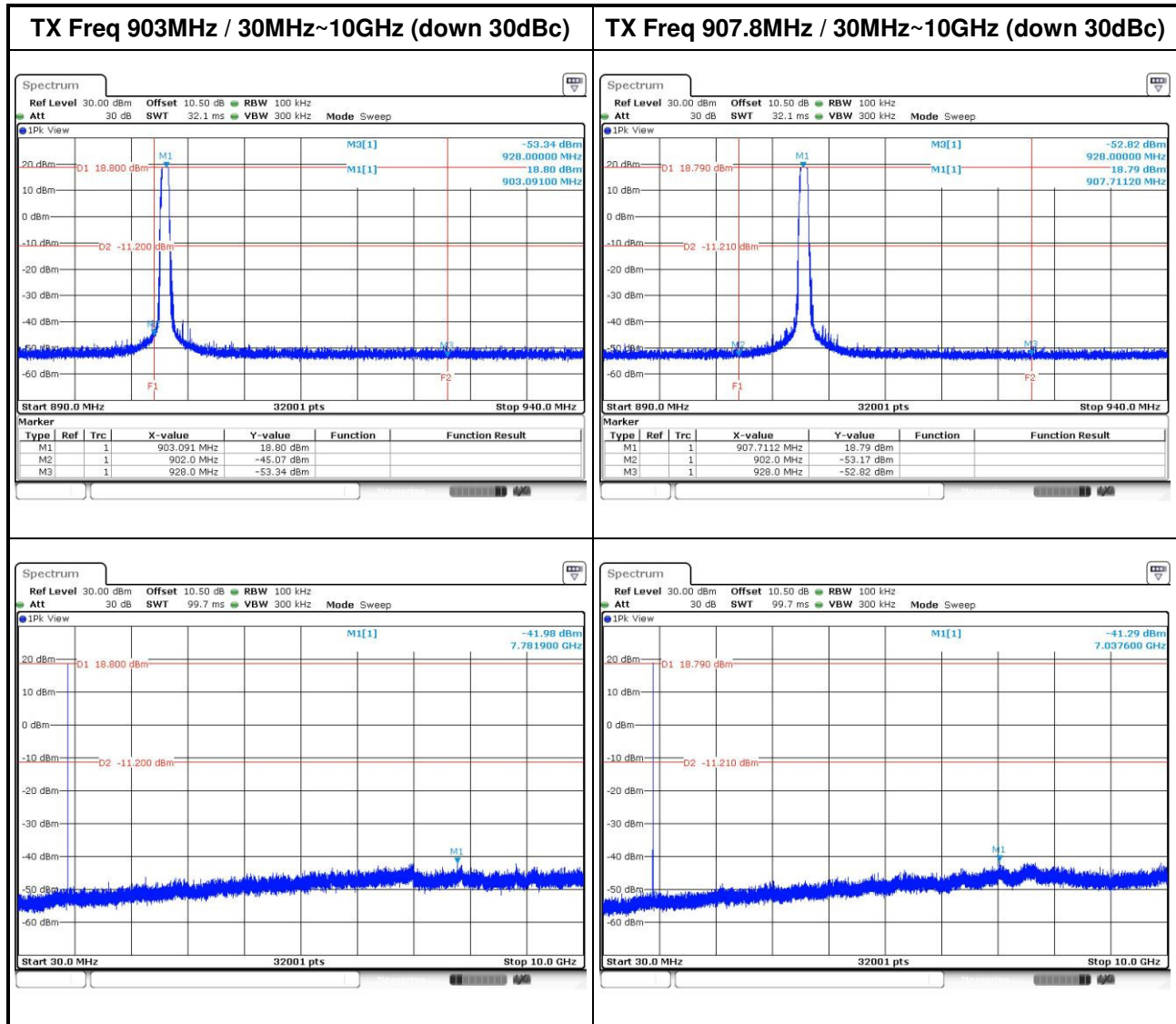
Emission level measurement

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

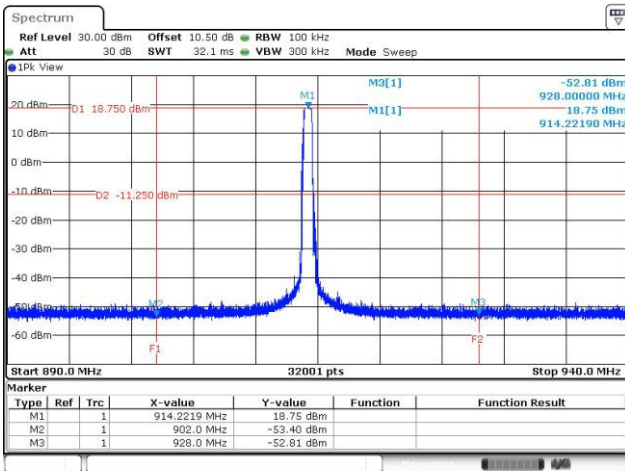
3.6.4 Test Setup

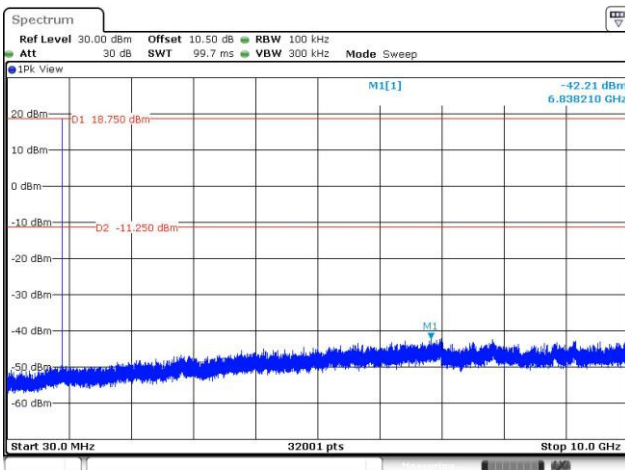


3.6.5 Unwanted Emissions into Non-Restricted Frequency Bands



TX Freq 914.2MHz / 30MHz~10GHz (down 30dBc)





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 (EMC and Wireless Communication Laboratory), 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 District. 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 District, Tao Yuan City
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 District, Tao Yuan
City 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

==END==