FCC Test Report

FCC ID	:	**MXF-WMDD209A**
Equipment	:	**Lora module**
Model No.	:	**WMDD-209A**
Brand Name	:	**Gemtek**
Applicant	:	**Gemtek Technology Co., Ltd.**
Address	:	**No. 15-1 Zhonghua Road, Hsinchu Industrial Park, Hukou, Hsinchu, Taiwan, 30352.**
Standard	:	**47 CFR FCC Part 15.247**
Received Date	:	**Aug. 23, 2017**
Tested Date	:	**Aug. 23 ~ Sep. 01, 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: **Approved by:**

Along Chen / Assistant Manager **Gary Chang / Manager**

Testing Laboratory 2732

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
FR782804-1	Rev. 01	Initial issue	Oct. 13, 2017

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 0.471MHz 33.94 (Margin -12.55dB) - AV	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 799.21MHz 41.93 (Margin -4.07dB) - PK	Pass
15.247(b)(3)	Maximum Output Power	Max Power [dBm]: 18.87	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 that Maximum 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

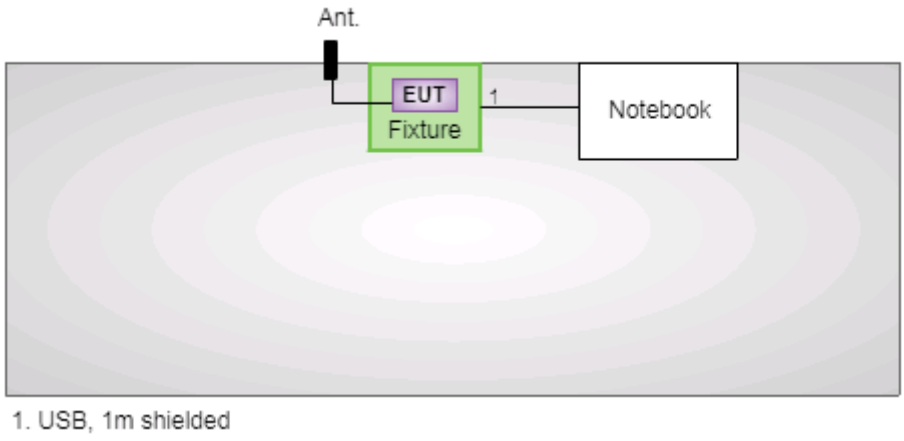
1.2 Local Support Equipment List

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

Note: No. 2 was supplied by applicant.

1.3 Test Setup Chart

Test Setup Diagram



1. USB, 1m shielded

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 1 / (03CH01-WS)				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	R&S	FSV40	101498	Nov. 25, 2016	Nov. 24, 2017
Receiver	R&S	ESR3	101658	Nov. 24, 2016	Nov. 23, 2017
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jul. 25, 2017	Jul. 24, 2018
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 21, 2016	Dec. 20, 2017
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Oct. 25, 2016	Oct. 24, 2017
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	980225	Jul. 28, 2017	Jul. 27, 2018
Preamplifier	Agilent	83017A	MY39501308	Oct. 06, 2016	Oct. 05, 2017
Preamplifier	EMC	EMC184045B	980192	Aug. 22, 2017	Aug. 21, 2018
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Dec. 09, 2016	Dec. 08, 2017
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Dec. 09, 2016	Dec. 08, 2017
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16139/4	Dec. 09, 2016	Dec. 08, 2017
LF cable 1M	EMC	EMCCFD400-NM-NM-1000	16052	Dec. 09, 2016	Dec. 08, 2017
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Dec. 09, 2016	Dec. 08, 2017
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Dec. 09, 2016	Dec. 08, 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	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	23°C / 57%	Alex Tsai
Radiated Emissions	03CH01-WS	24°C / 62%	Aska Huang Vincent Yeh
RF Conducted	TH01-WS	23°C / 62%	Felix Sung

- FCC Designation No.: TW2732
- FCC site registration No.: 181692
- IC site registration No.: 10807A-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

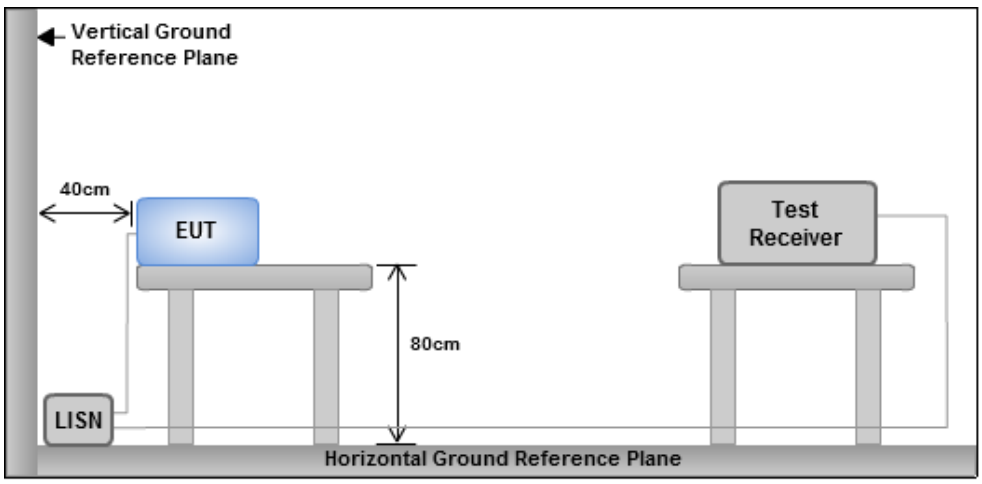
3.1.1 Limit of Conducted Emissions

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

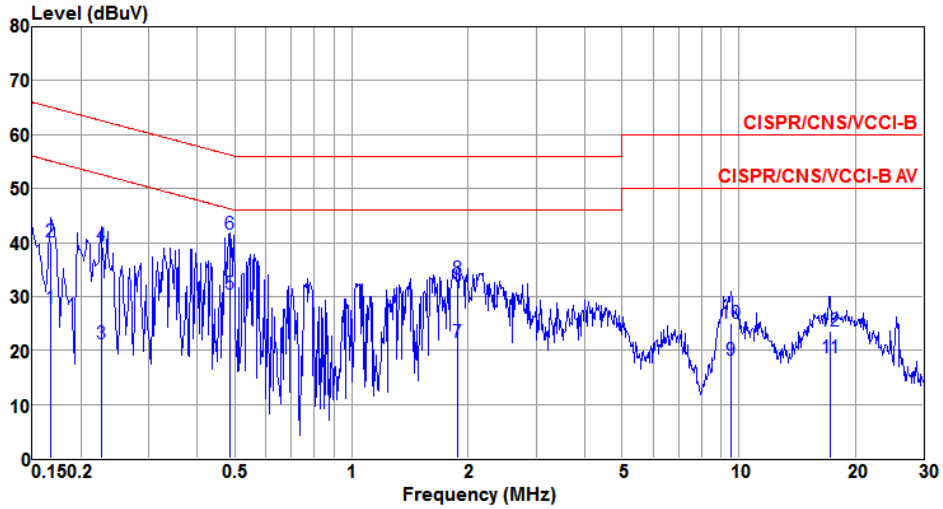


Note: 1. Support units were connected to second LISN.

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

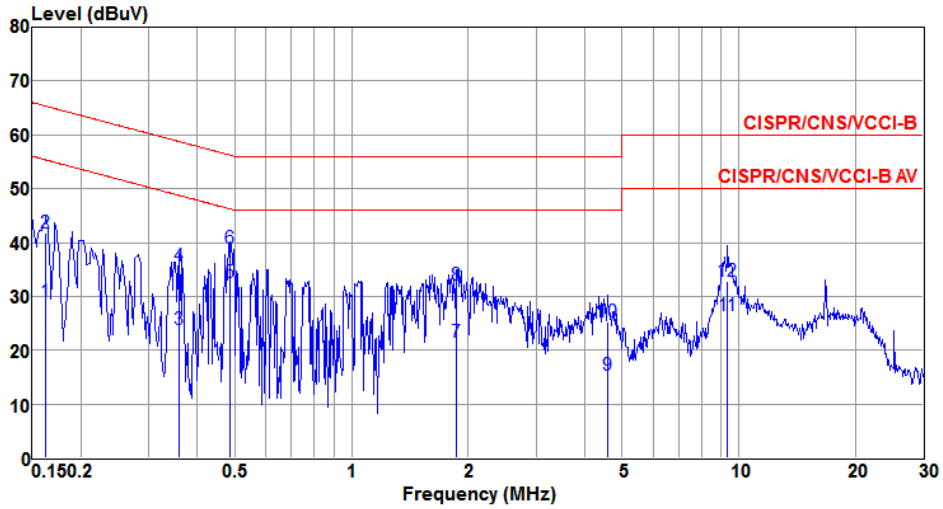
Modulation / SF	CSS / 12	Test Freq. (MHz)	903
Power Phase	Line		



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.168	27.76	55.08	-27.32	27.64	0.08	0.04	Average
2	0.168	40.17	65.08	-24.91	40.05	0.08	0.04	QP
3	0.226	21.13	52.61	-31.48	21.00	0.09	0.04	Average
4	0.226	39.35	62.61	-23.26	39.22	0.09	0.04	QP
5	0.484	30.50	46.27	-15.77	30.40	0.06	0.04	Average
6@	0.484	41.52	56.27	-14.75	41.42	0.06	0.04	QP
7	1.878	21.53	46.00	-24.47	21.37	0.12	0.04	Average
8	1.878	33.23	56.00	-22.77	33.07	0.12	0.04	QP
9	9.552	18.15	50.00	-31.85	17.73	0.20	0.22	Average
10	9.552	25.04	60.00	-34.96	24.62	0.20	0.22	QP
11	17.291	18.60	50.00	-31.40	18.00	0.36	0.24	Average
12	17.291	23.69	60.00	-36.31	23.09	0.36	0.24	QP

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

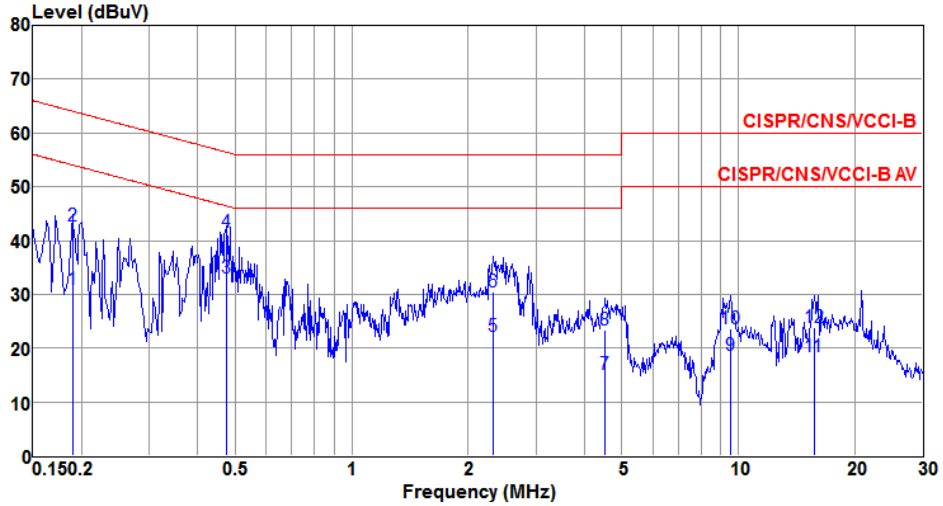
Modulation / SF	CSS / 12	Test Freq. (MHz)	903
Power Phase	Neutral		



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.162	28.97	55.34	-26.37	28.83	0.10	0.04	Average
2	0.162	41.89	65.34	-23.45	41.75	0.10	0.04	QP
3	0.358	23.81	48.78	-24.97	23.65	0.12	0.04	Average
4	0.358	35.53	58.78	-23.25	35.37	0.12	0.04	QP
5@	0.484	32.54	46.27	-13.73	32.38	0.12	0.04	Average
6	0.484	38.91	56.27	-17.36	38.75	0.12	0.04	QP
7	1.858	21.57	46.00	-24.43	21.38	0.15	0.04	Average
8	1.858	32.15	56.00	-23.85	31.96	0.15	0.04	QP
9	4.574	15.34	46.00	-30.66	15.01	0.16	0.17	Average
10	4.574	25.29	56.00	-30.71	24.96	0.16	0.17	QP
11	9.352	26.47	50.00	-23.53	25.95	0.30	0.22	Average
12	9.352	32.79	60.00	-27.21	32.27	0.30	0.22	QP

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

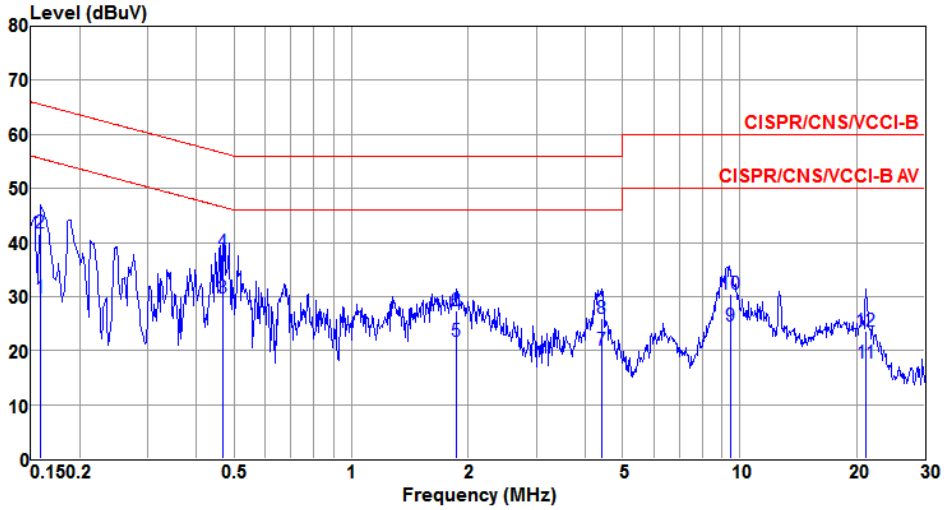
Modulation / SF	CSS / 12	Test Freq. (MHz)	907.8
Power Phase	Line		



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.189	30.99	54.06	-23.07	30.86	0.09	0.04	Average
2	0.189	42.81	64.06	-21.25	42.68	0.09	0.04	QP
3@	0.476	33.01	46.41	-13.40	32.91	0.06	0.04	Average
4	0.476	41.44	56.41	-14.97	41.34	0.06	0.04	QP
5	2.321	22.24	46.00	-23.76	22.03	0.14	0.07	Average
6	2.321	30.51	56.00	-25.49	30.30	0.14	0.07	QP
7	4.525	15.09	46.00	-30.91	14.75	0.17	0.17	Average
8	4.525	23.38	56.00	-32.62	23.04	0.17	0.17	QP
9	9.552	18.59	50.00	-31.41	18.17	0.20	0.22	Average
10	9.552	23.59	60.00	-36.41	23.17	0.20	0.22	QP
11	15.706	18.49	50.00	-31.51	17.93	0.33	0.23	Average
12	15.706	23.75	60.00	-36.25	23.19	0.33	0.23	QP

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

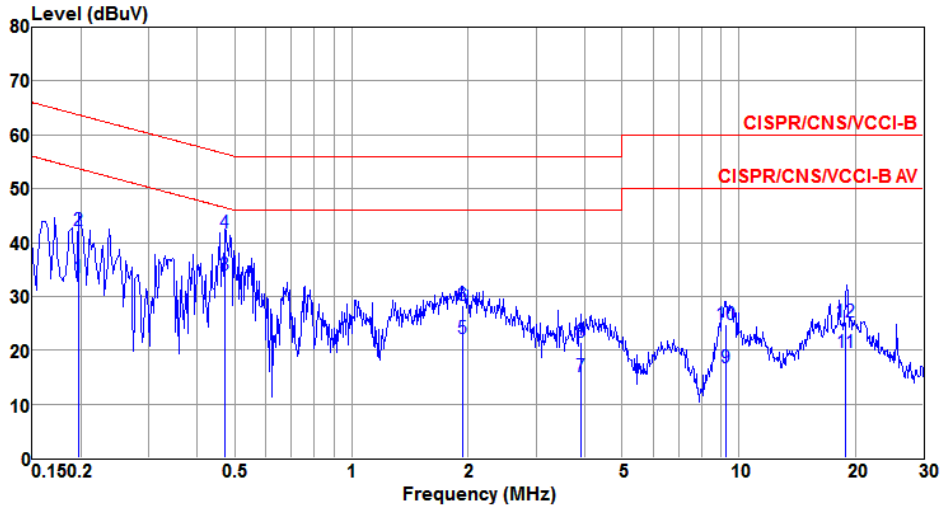
Modulation / SF	CSS / 12	Test Freq. (MHz)	907.8
Power Phase	Neutral		



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.159	29.81	55.52	-25.71	29.67	0.10	0.04	Average
2	0.159	41.71	65.52	-23.81	41.57	0.10	0.04	QP
3@	0.466	29.69	46.58	-16.89	29.53	0.12	0.04	Average
4	0.466	38.24	56.58	-18.34	38.08	0.12	0.04	QP
5	1.858	21.68	46.00	-24.32	21.49	0.15	0.04	Average
6	1.858	27.46	56.00	-28.54	27.27	0.15	0.04	QP
7	4.407	20.03	46.00	-25.97	19.70	0.16	0.17	Average
8	4.407	26.03	56.00	-29.97	25.70	0.16	0.17	QP
9	9.501	24.51	50.00	-25.49	23.99	0.30	0.22	Average
10	9.501	30.56	60.00	-29.44	30.04	0.30	0.22	QP
11	21.147	17.61	50.00	-32.39	16.92	0.42	0.27	Average
12	21.147	23.57	60.00	-36.43	22.88	0.42	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).

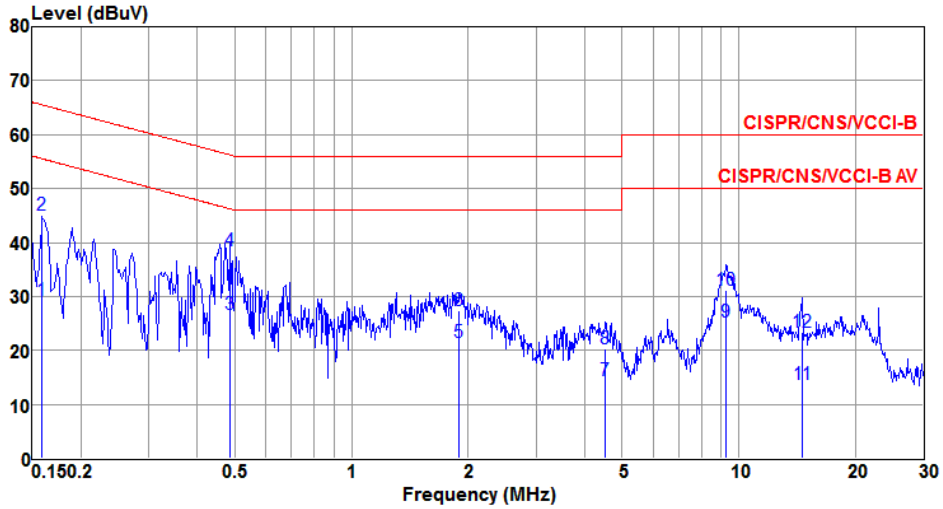
Modulation / SF	CSS / 12	Test Freq. (MHz)	914.2
Power Phase	Line		



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.198	33.63	53.71	-20.08	33.49	0.10	0.04	Average
2	0.198	42.34	63.71	-21.37	42.20	0.10	0.04	QP
3@	0.471	33.94	46.49	-12.55	33.84	0.06	0.04	Average
4	0.471	41.70	56.49	-14.79	41.60	0.06	0.04	QP
5	1.939	22.30	46.00	-23.70	22.13	0.13	0.04	Average
6	1.939	28.35	56.00	-27.65	28.18	0.13	0.04	QP
7	3.922	15.19	46.00	-30.81	14.86	0.17	0.16	Average
8	3.922	21.43	56.00	-34.57	21.10	0.17	0.16	QP
9	9.234	16.78	50.00	-33.22	16.37	0.20	0.21	Average
10	9.234	24.90	60.00	-35.10	24.49	0.20	0.21	QP
11	18.927	19.49	50.00	-30.51	18.86	0.38	0.25	Average
12	18.927	25.18	60.00	-34.82	24.55	0.38	0.25	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		



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.159	29.34	55.52	-26.18	29.20	0.10	0.04	Average
2	0.159	45.05	65.52	-20.47	44.91	0.10	0.04	QP
3	0.486	26.57	46.23	-19.66	26.41	0.12	0.04	Average
4@	0.486	38.39	56.23	-17.84	38.23	0.12	0.04	QP
5	1.898	21.53	46.00	-24.47	21.33	0.16	0.04	Average
6	1.898	27.40	56.00	-28.60	27.20	0.16	0.04	QP
7	4.525	14.48	46.00	-31.52	14.15	0.16	0.17	Average
8	4.525	20.31	56.00	-35.69	19.98	0.16	0.17	QP
9	9.253	25.34	50.00	-24.66	24.84	0.29	0.21	Average
10	9.253	31.26	60.00	-28.74	30.76	0.29	0.21	QP
11	14.594	13.65	50.00	-36.35	13.06	0.36	0.23	Average
12	14.594	23.32	60.00	-36.68	22.73	0.36	0.23	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

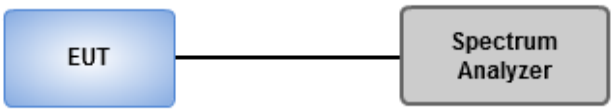
6dB Bandwidth

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.

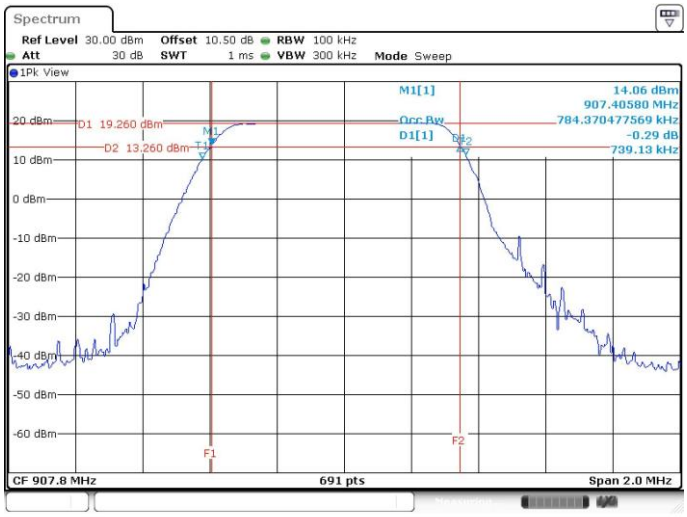
3.2.3 Test Setup



3.2.4 Test Result of 6dB and Occupied Bandwidth

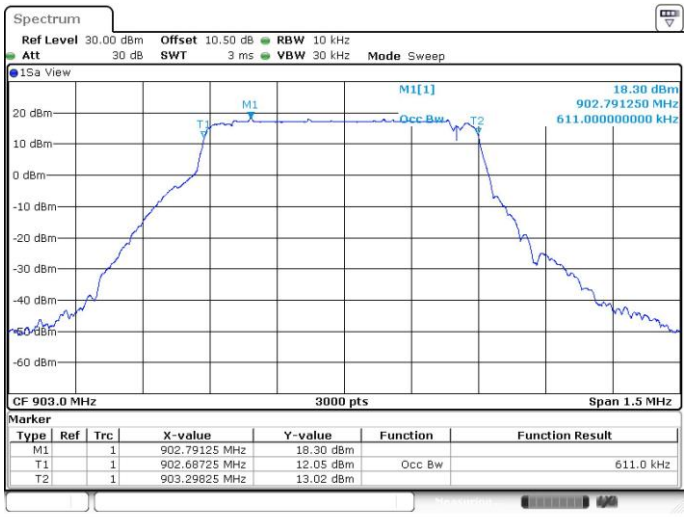
Modulation / SF	Freq. (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
CSS / 12	903	0.754	0.5
CSS / 12	907.8	0.739	0.5
CSS / 12	914.2	0.777	0.5

Worst Plot



Modulation / SF	Freq. (MHz)	99% Occupied Bandwidth (MHz)
CSS / 12	903	0.611
CSS / 12	907.8	0.574
CSS / 12	914.2	0.557

Worst Plot



3.3 RF Output Power

3.3.1 Limit of RF Output Power

Conducted power shall not exceed 1Watt.

☒ Antenna gain <= 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 / 12	903	77.09035	18.87	30
CSS / 12	907.8	76.03263	18.81	30
CSS / 12	914.2	75.85776	18.80	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

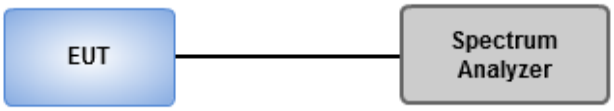
☐ Maximum peak conducted output power was used to demonstrate compliance to the fundamental output power limit.

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.

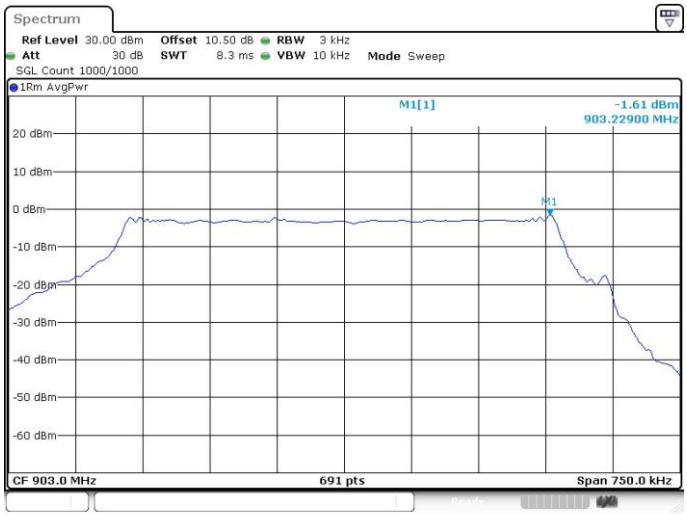
3.4.3 Test Setup



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	-1.61	8.00
CSS / 12	907.8	-1.78	8.00
CSS / 12	914.2	-1.85	8.00

Worst Plot



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:
Qusai-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

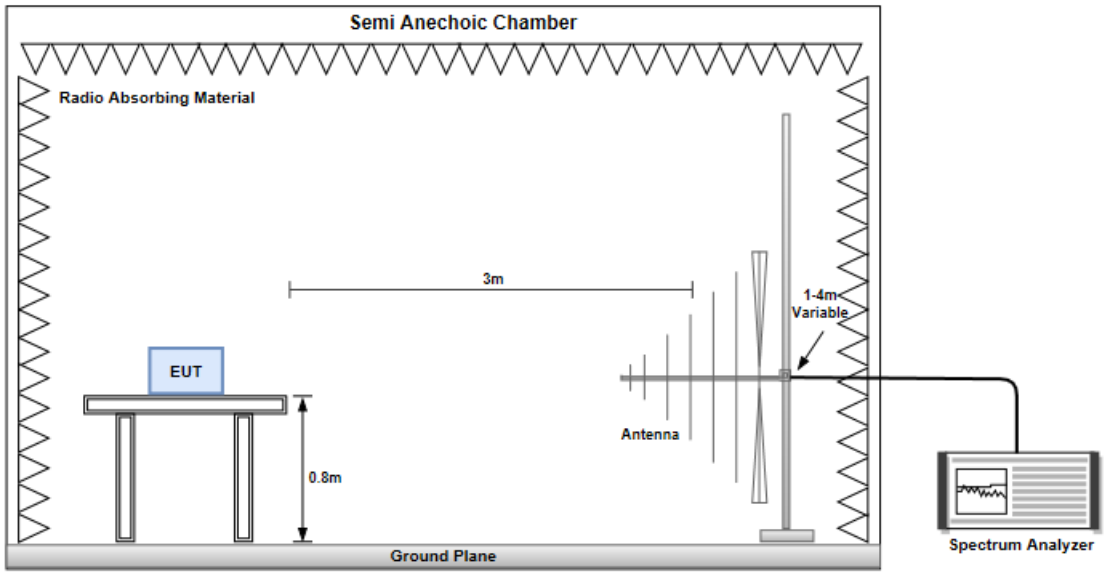
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission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

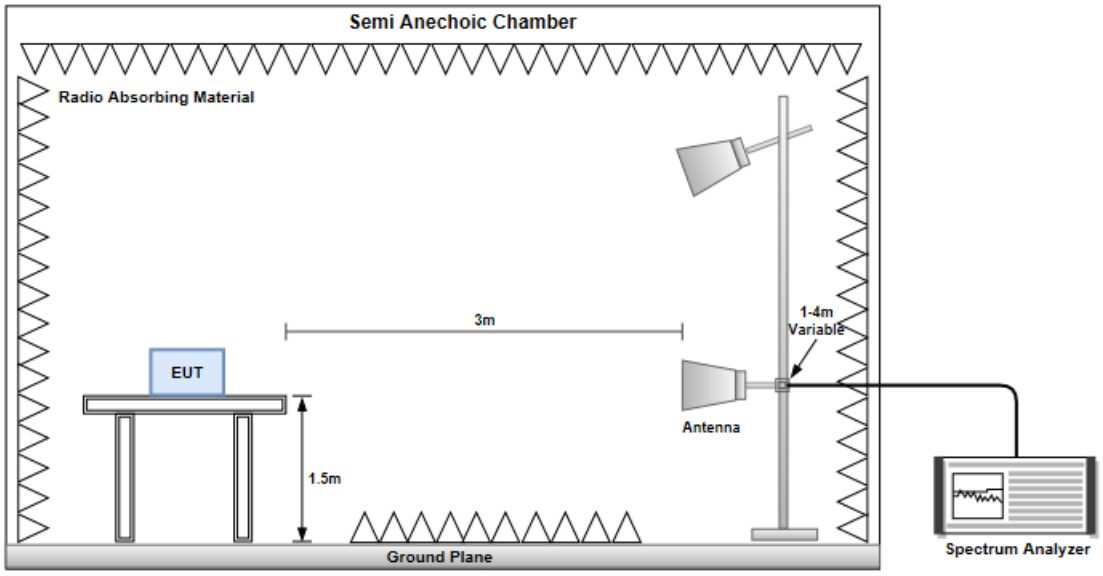
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

3.5.3 Test Setup

Radiated Emissions below 1 GHz

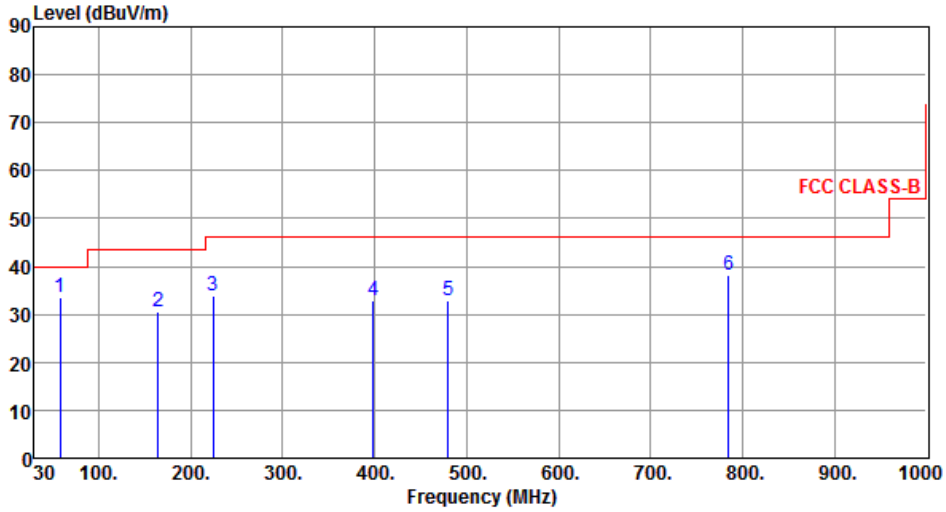


Radiated Emissions above 1 GHz



3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

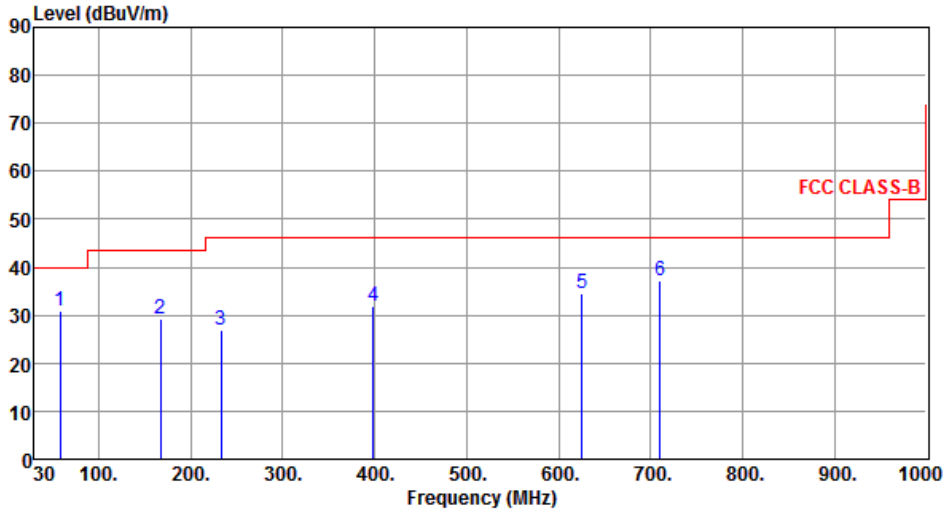
Modulation / SF	CSS / 12	Test Freq. (MHz)	903
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	58.13	33.51	40.00	-6.49	41.86	-8.35	Peak	---	---
2	164.83	30.62	43.50	-12.88	39.03	-8.41	Peak	---	---
3	224.00	33.79	46.00	-12.21	44.41	-10.62	Peak	---	---
4	398.60	33.04	46.00	-12.96	38.03	-4.99	Peak	---	---
5	480.08	32.84	46.00	-13.16	36.06	-3.22	Peak	---	---
6	784.66	38.10	46.00	-7.90	36.00	2.10	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.

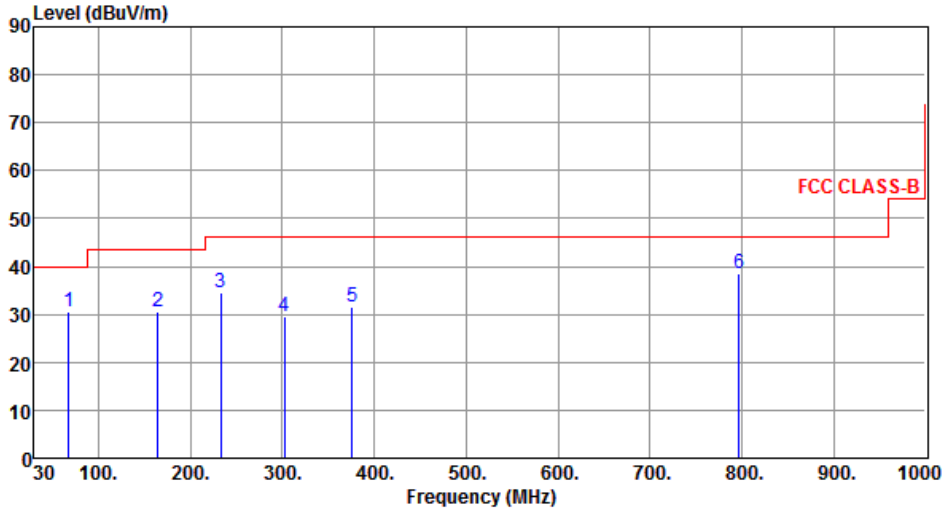
Modulation / SF	CSS / 12	Test Freq. (MHz)	903
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	58.13	30.94	40.00	-9.06	39.29	-8.35	Peak	---	---
2	166.77	29.32	43.50	-14.18	37.80	-8.48	Peak	---	---
3	232.73	26.82	46.00	-19.18	36.96	-10.14	Peak	---	---
4	398.60	31.84	46.00	-14.16	36.83	-4.99	Peak	---	---
5	625.58	34.42	46.00	-11.58	34.85	-0.43	Peak	---	---
6	709.97	37.09	46.00	-8.91	36.24	0.85	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.

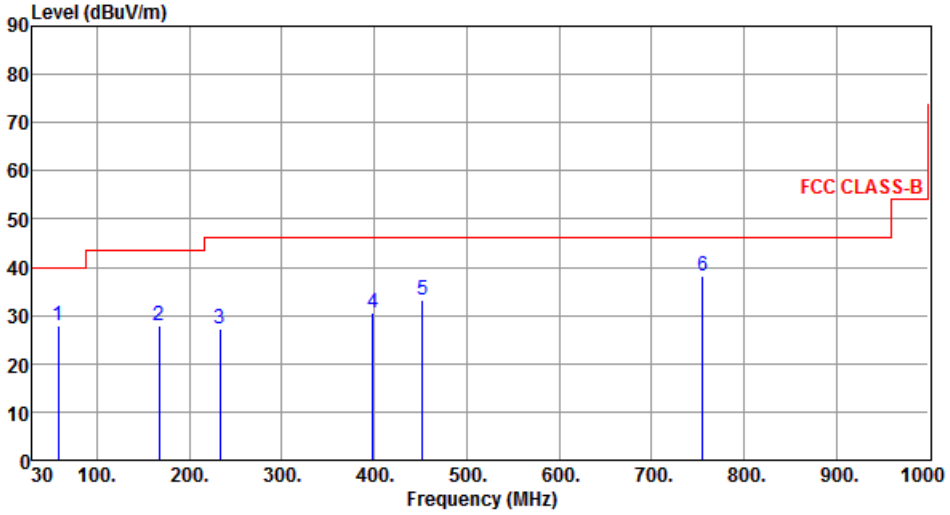
Modulation / SF	CSS / 12	Test Freq. (MHz)	907.8
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	67.83	30.43	40.00	-9.57	40.71	-10.28	Peak	---	---
2	164.83	30.60	43.50	-12.90	39.01	-8.41	Peak	---	---
3	232.73	34.53	46.00	-11.47	44.67	-10.14	Peak	---	---
4	302.57	29.50	46.00	-16.50	37.10	-7.60	Peak	---	---
5	376.29	31.46	46.00	-14.54	37.11	-5.65	Peak	---	---
6	797.27	38.59	46.00	-7.41	36.37	2.22	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.

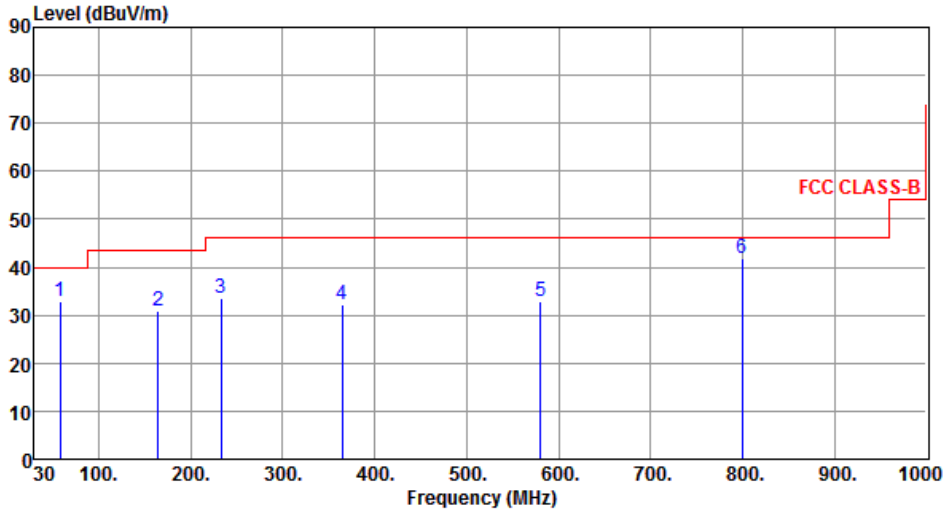
Modulation / SF	CSS / 12	Test Freq. (MHz)	907.8
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	58.13	28.01	40.00	-11.99	36.36	-8.35	Peak	---	---
2	166.77	27.74	43.50	-15.76	36.22	-8.48	Peak	---	---
3	232.73	27.17	46.00	-18.83	37.31	-10.14	Peak	---	---
4	398.60	30.47	46.00	-15.53	35.46	-4.99	Peak	---	---
5	451.95	33.07	46.00	-12.93	36.82	-3.75	Peak	---	---
6	755.56	38.05	46.00	-7.95	36.24	1.81	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.

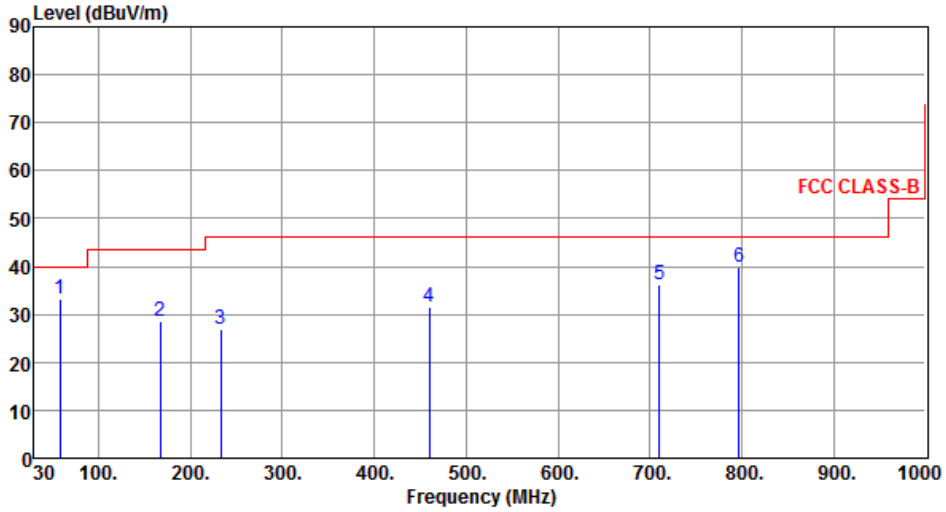
Modulation / SF	CSS / 12	Test Freq. (MHz)	914.2
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	58.13	32.81	40.00	-7.19	41.16	-8.35	Peak	---	---
2	164.83	30.95	43.50	-12.55	39.36	-8.41	Peak	---	---
3	232.73	33.61	46.00	-12.39	43.75	-10.14	Peak	---	---
4	364.65	32.07	46.00	-13.93	38.05	-5.98	Peak	---	---
5	579.99	32.94	46.00	-13.06	34.07	-1.13	Peak	---	---
6	799.21	41.93	46.00	-4.07	39.68	2.25	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		

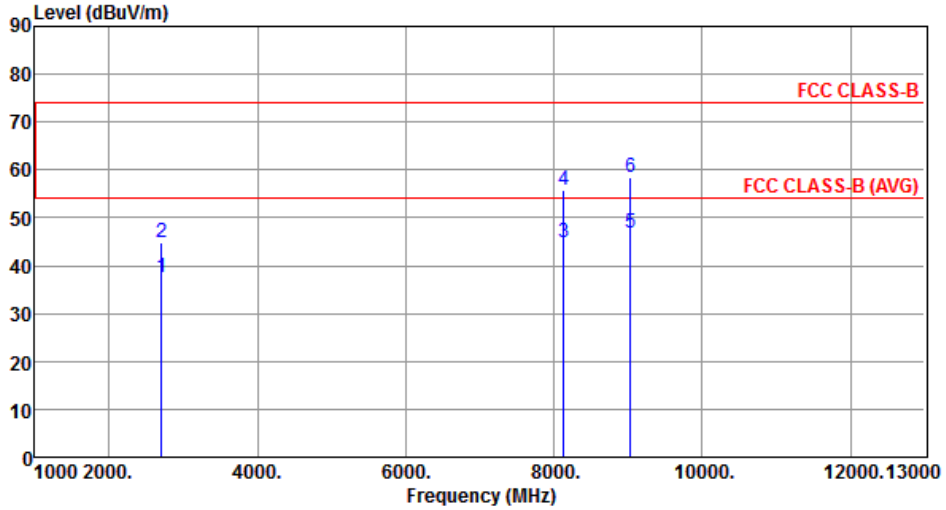


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	58.13	33.22	40.00	-6.78	41.57	-8.35	Peak	---	---
2	166.77	28.69	43.50	-14.81	37.17	-8.48	Peak	---	---
3	232.73	27.01	46.00	-18.99	37.15	-10.14	Peak	---	---
4	459.71	31.46	46.00	-14.54	35.06	-3.60	Peak	---	---
5	709.97	36.35	46.00	-9.65	35.50	0.85	Peak	---	---
6	797.27	39.97	46.00	-6.03	37.75	2.22	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)

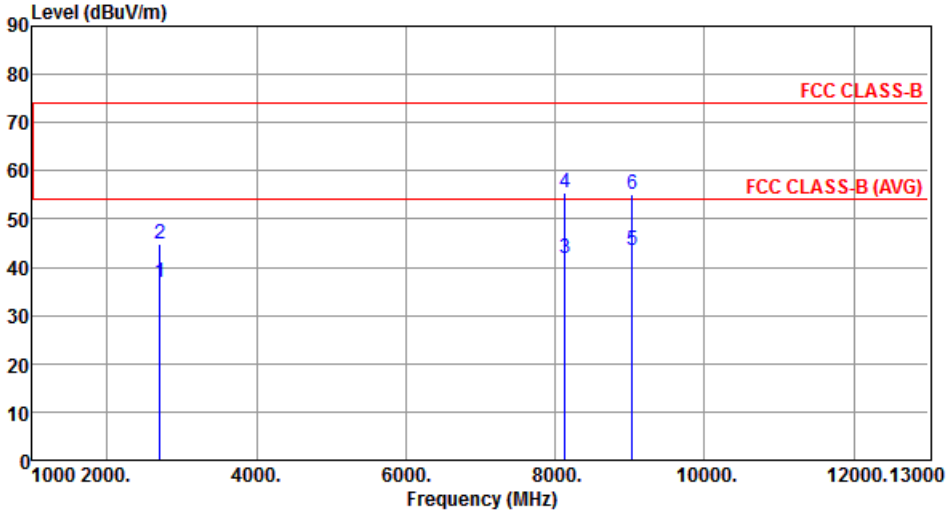
Modulation / SF	CSS / 12	Test Freq. (MHz)	903
Polarization	Horizontal		



	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	37.50	54.00	-16.50	39.53	-2.03	Average	100	320
2	2709.00	44.86	74.00	-29.14	46.89	-2.03	Peak	100	320
3	8127.00	44.78	54.00	-9.22	35.38	9.40	Average	234	33
4	8127.00	55.88	74.00	-18.12	46.48	9.40	Peak	234	33
5	9030.00	46.80	54.00	-7.20	35.66	11.14	Average	202	317
6	9030.00	58.59	74.00	-15.41	47.45	11.14	Peak	202	317

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).

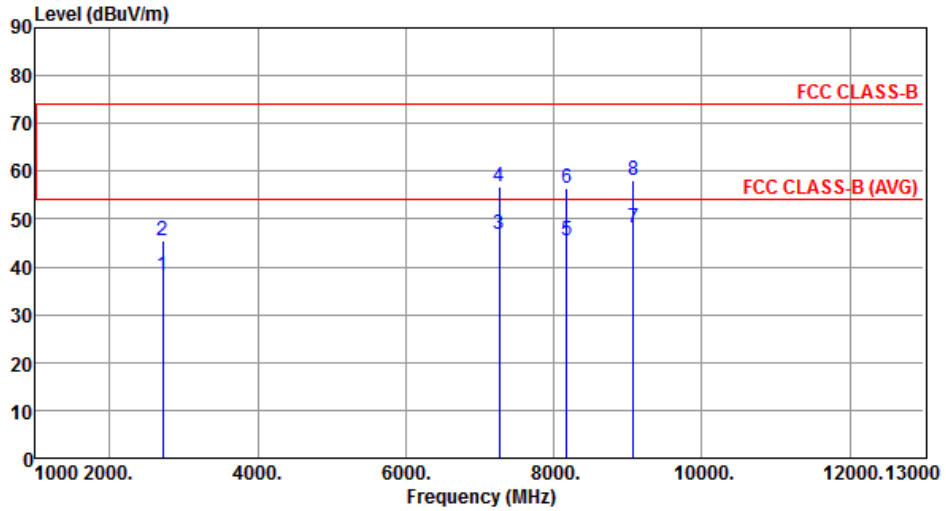
Modulation / SF	CSS / 12	Test Freq. (MHz)	903
Polarization	Vertical		



	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	36.79	54.00	-17.21	38.82	-2.03	Average	135	28
2	2709.00	44.86	74.00	-29.14	46.89	-2.03	Peak	135	28
3	8127.00	41.73	54.00	-12.27	32.33	9.40	Average	230	45
4	8127.00	55.42	74.00	-18.58	46.02	9.40	Peak	230	45
5	9030.00	43.56	54.00	-10.44	32.42	11.14	Average	100	347
6	9030.00	55.05	74.00	-18.95	43.91	11.14	Peak	100	347

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).

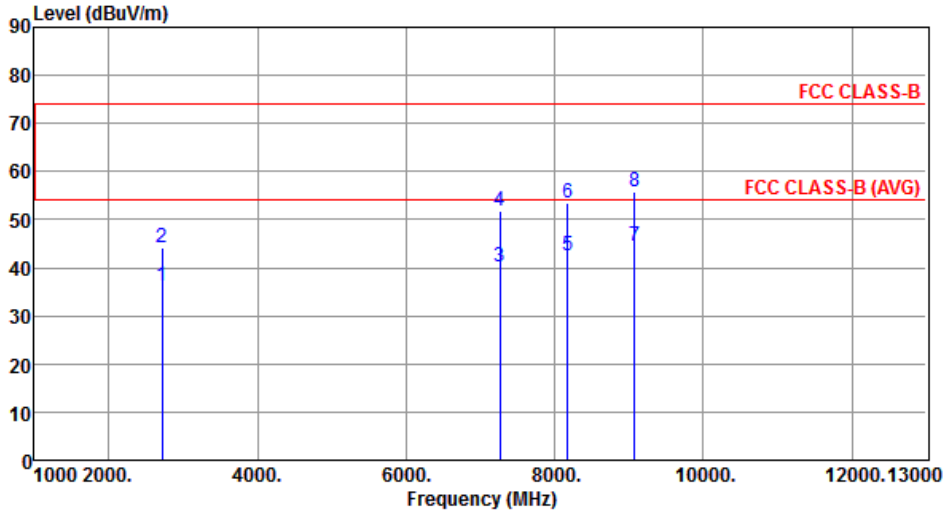
Modulation / SF	CSS / 12	Test Freq. (MHz)	907.8
Polarization	Horizontal		



	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	38.04	54.00	-15.96	40.02	-1.98	Average	100	322
2	2723.40	45.50	74.00	-28.50	47.48	-1.98	Peak	100	322
3	7262.40	46.92	54.00	-7.08	38.54	8.38	Average	225	38
4	7262.40	56.69	74.00	-17.31	48.31	8.38	Peak	225	38
5	8170.20	45.56	54.00	-8.44	36.08	9.48	Average	236	33
6	8170.20	56.60	74.00	-17.40	47.12	9.48	Peak	236	33
7	9078.00	48.20	54.00	-5.80	36.91	11.29	Average	208	310
8	9078.00	58.16	74.00	-15.84	46.87	11.29	Peak	208	310

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).

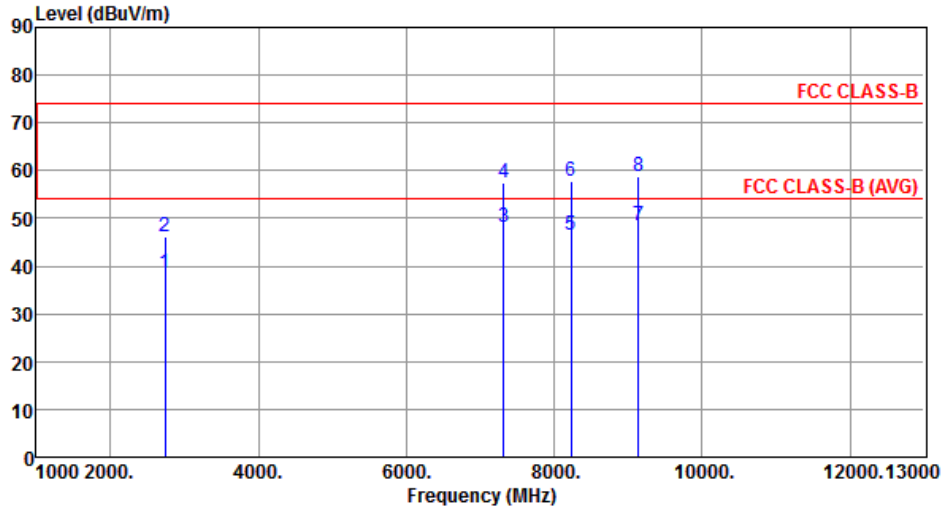
Modulation / SF	CSS / 12	Test Freq. (MHz)	907.8
Polarization	Vertical		



	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	36.32	54.00	-17.68	38.30	-1.98	Average	154	26
2	2723.40	44.18	74.00	-29.82	46.16	-1.98	Peak	154	26
3	7262.40	40.14	54.00	-13.86	31.76	8.38	Average	122	293
4	7262.40	51.82	74.00	-22.18	43.44	8.38	Peak	122	293
5	8170.20	42.59	54.00	-11.41	33.11	9.48	Average	208	45
6	8170.20	53.51	74.00	-20.49	44.03	9.48	Peak	208	45
7	9078.00	44.55	54.00	-9.45	33.26	11.29	Average	100	349
8	9078.00	55.77	74.00	-18.23	44.48	11.29	Peak	100	349

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).

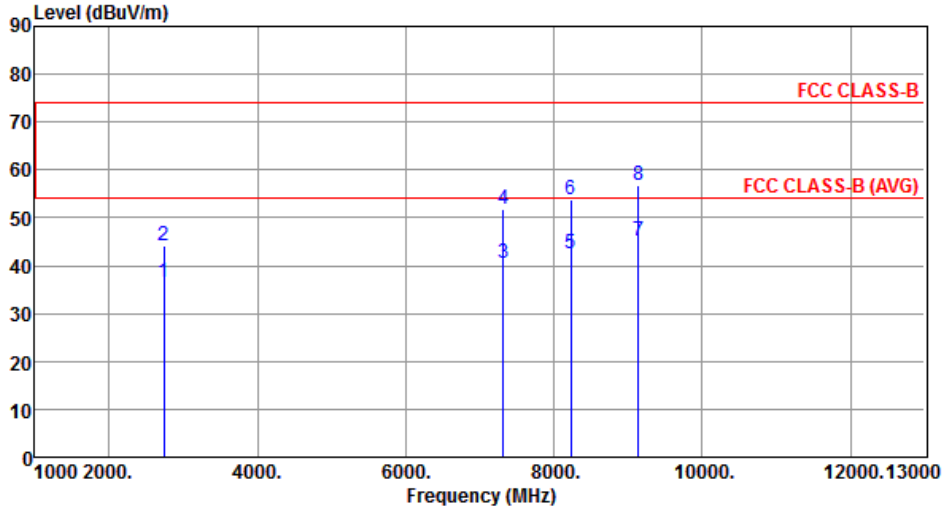
Modulation / SF	CSS / 12	Test Freq. (MHz)	914.2
Polarization	Horizontal		



	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	38.55	54.00	-15.45	40.47	-1.92	Average	117	319
2	2742.60	46.18	74.00	-27.82	48.10	-1.92	Peak	117	319
3	7313.60	48.06	54.00	-5.94	39.64	8.42	Average	224	35
4	7313.60	57.37	74.00	-16.63	48.95	8.42	Peak	224	35
5	8227.80	46.39	54.00	-7.61	36.85	9.54	Average	231	31
6	8227.80	57.62	74.00	-16.38	48.08	9.54	Peak	231	31
7	9142.00	48.53	54.00	-5.47	37.03	11.50	Average	216	312
8	9142.00	58.80	74.00	-15.20	47.30	11.50	Peak	216	312

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		



	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	36.46	54.00	-17.54	38.38	-1.92	Average	145	18
2	2742.60	44.19	74.00	-29.81	46.11	-1.92	Peak	145	18
3	7313.60	40.51	54.00	-13.49	32.09	8.42	Average	100	304
4	7313.60	51.71	74.00	-22.29	43.29	8.42	Peak	100	304
5	8227.80	42.50	54.00	-11.50	32.96	9.54	Average	225	49
6	8227.80	53.90	74.00	-20.10	44.36	9.54	Peak	225	49
7	9142.00	45.10	54.00	-8.90	33.60	11.50	Average	100	346
8	9142.00	56.85	74.00	-17.15	45.35	11.50	Peak	100	346

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

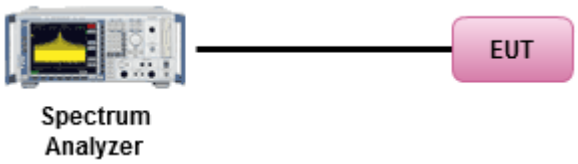
Reference level measurement

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

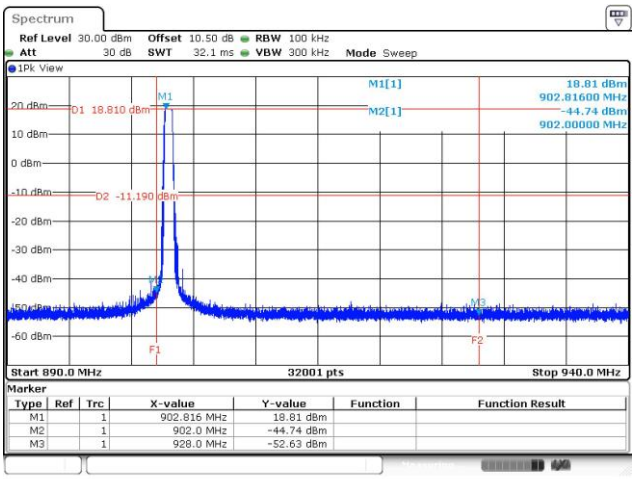
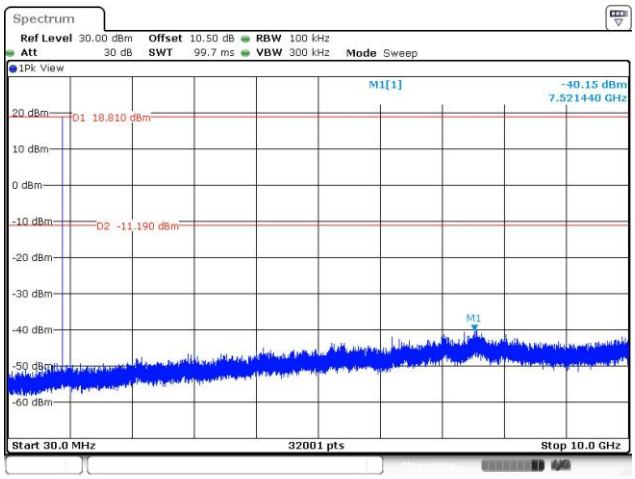
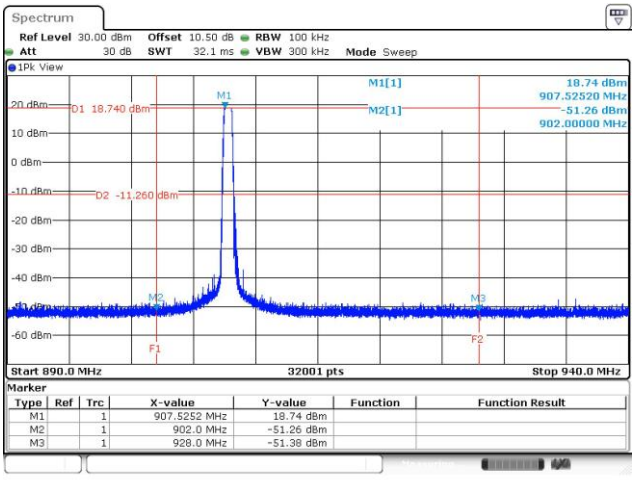
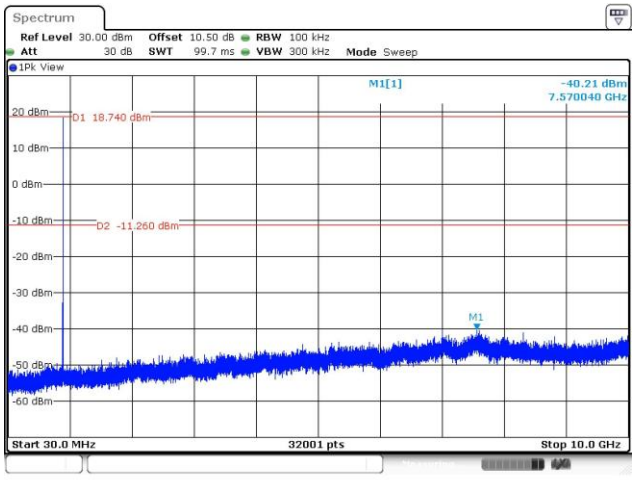
Emission level measurement

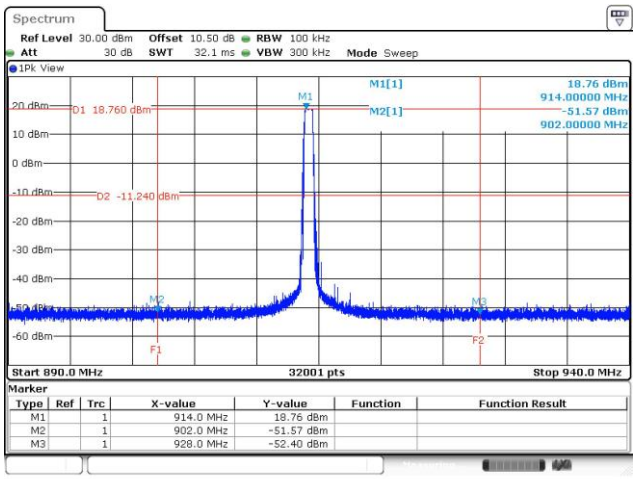
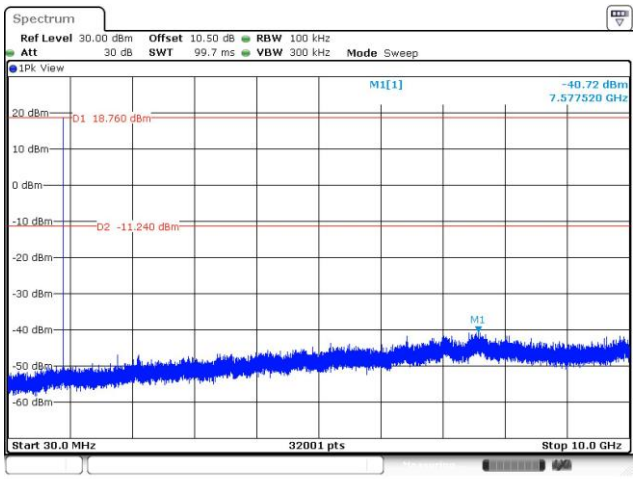
1. Set RBW=100kHz, VBW = 300kHz , Detector = Peak, Sweep time = Auto
2. Trace = max hold , Allow Trace to fully stabilize
3. Scan Frequency range is up to 10GHz
4. Use the peak marker function to determine the maximum amplitude level

3.6.4 Test Setup

Transmitter Radiated Bandedge Emissions


3.6.5 Unwanted Emissions into Non-Restricted Frequency Bands

TX Freq 903MHz / 30MHz~10GHz (down 30dBc)	TX Freq 907.8MHz / 30MHz~10GHz (down 30dBc)
	
	

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	**Kwei Shan**	**Kwei Shan Site II**
Tel: 886-2-2601-1640	Tel: 886-3-271-8666	Tel: 886-3-271-8640
No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan, R.O.C.	No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.	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.

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Email: ICC_Service@icertifi.com.tw

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