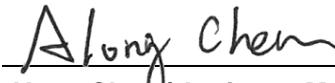


# FCC Test Report

**FCC ID** : MXF-WMDD209  
**Equipment** : Lora module  
**Model No.** : WMDD-209  
**Brand Name** : Gemtek  
**Applicant** : Gemtek Technology Co., Ltd.  
**Address** : No.15-1 Zhoughua 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



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## Table of Contents

<b>1</b>	<b>GENERAL DESCRIPTION .....</b>	<b>5</b>
1.1	Information.....	5
1.2	Local Support Equipment List .....	7
1.3	Test Setup Chart .....	7
1.4	The Equipment List .....	8
1.5	Test Standards .....	9
1.6	Measurement Uncertainty .....	9
<b>2</b>	<b>TEST CONFIGURATION .....</b>	<b>10</b>
2.1	Testing Condition .....	10
2.2	The Worst Test Modes and Channel Details .....	10
<b>3</b>	<b>TRANSMITTER TEST RESULTS.....</b>	<b>11</b>
3.1	Conducted Emissions.....	11
3.2	Unwanted Emissions into Restricted Frequency Bands .....	18
3.3	Unwanted Emissions into Non-Restricted Frequency Bands .....	32
3.4	Conducted Output Power .....	35
3.5	Number of Hopping Frequency .....	36
3.6	20dB and Occupied Bandwidth .....	37
3.7	Channel Separation.....	39
3.8	Number of Dwell Time.....	41
3.9	Power Spectral Density .....	48
<b>4</b>	<b>TEST LABORATORY INFORMATION .....</b>	<b>50</b>

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## Release Record

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

## Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 21.486MHz 39.02 (Margin -10.98dB) - AV	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 732.28MHz 40.53 (Margin -5.47dB) - PK	Pass
15.247(d)	Band Edge	Meet the requirement of limit	Pass
15.247(b)(2)(3)	Conducted Output Power	Power [dBm]: 19.02	Pass
15.247(a)(1)(i)	Number of Hopping Channels	Meet the requirement of limit	Pass
15.247(a)(1)	Hopping Channel Separation	Meet the requirement of limit	Pass
15.247(f)	Dwell Time	Meet the requirement of limit	Pass
15.247(f)	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	902.3 ~ 914.9	1-64 [64]	977 ~ 5469	10 ~ 7	125
Note 1: RF output power specifies that Maximum Conducted (Average) Output Power. Note 2: The device uses CSS modulation. Note 3: The device supports hybrid mode.					

### 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)

<b>Power Supply Type</b>	5Vdc from host
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### 1.1.4 Accessories

N/A

### 1.1.5 Channel List

Channel	Frequency (MHz)						
1	902.3	17	905.5	33	908.7	49	911.9
2	902.5	18	905.7	34	908.9	50	912.1
3	902.7	19	905.9	35	909.1	51	912.3
4	902.9	20	906.1	36	909.3	52	912.5
5	903.1	21	906.3	37	909.5	53	912.7
6	903.3	22	906.5	38	909.7	54	912.9
7	903.5	23	906.7	39	909.9	55	913.1
8	903.7	24	906.9	40	910.1	56	913.3
9	903.9	25	907.1	41	910.3	57	913.5
10	904.1	26	907.3	42	910.5	58	913.7
11	904.3	27	907.5	43	910.7	59	913.9
12	904.5	28	907.7	44	910.9	60	914.1
13	904.7	29	907.9	45	911.1	61	914.3
14	904.9	30	908.1	46	911.3	62	914.5
15	905.1	31	908.3	47	911.5	63	914.7
16	905.3	32	908.5	48	911.7	64	914.9

### 1.1.6 Test Tool and Duty Cycle

<b>Test Tool</b>	HyperTerminal, version: 5.1.2600.0
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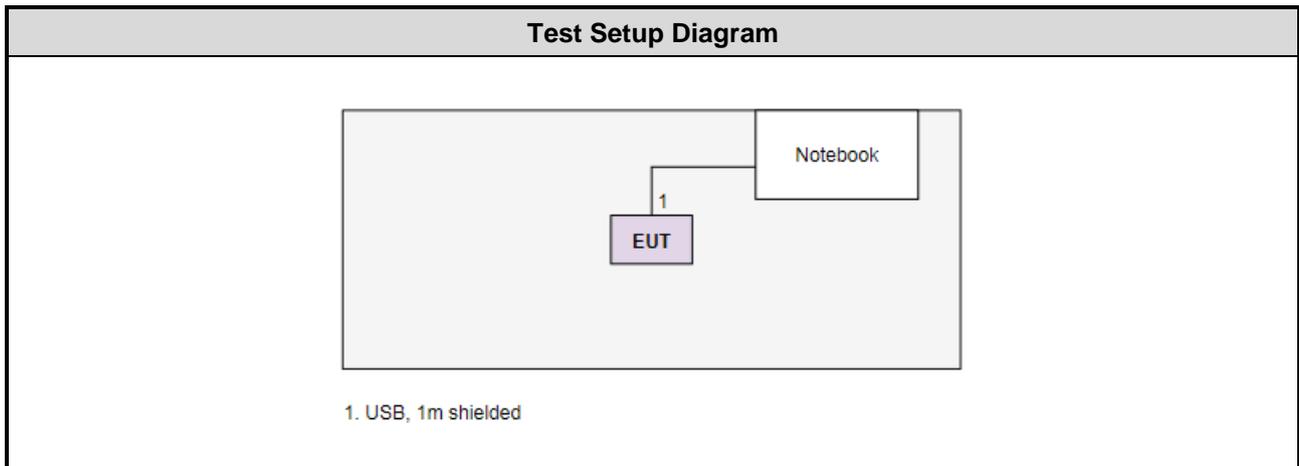
### 1.1.7 Power Setting

Modulation Mode	Test Frequency (MHz)		
	902.3	908.5	914.9
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.

<b>Test Item</b>	RF Conducted				
<b>Test Site</b>	(TH01-WS)				
<b>Instrument</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Calibration Date</b>	<b>Calibration Until</b>
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

FCC KDB 453039

## 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	$\pm 3.72$ dB
Radiated emission $> 1$ GHz	$\pm 5.65$ 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 Conducted Output Power Hopping Channel Separation 20dB and Occupied bandwidth Power Spectral Density	902.3 / 908.5 / 914.9	125	CSS / 10
Number of Hopping Channels	902.3 ~ 914.9	125	CSS / 10
Dwell Time	902.3	125	CSS: 10 / 9 / 8 / 7
<b>NOTE:</b>			
1. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The <b>Z-plane</b> results were found as the worst case and were shown in this report.			
2. Hopping channels supports 3 operation modes as below:			
1) 8 channels			
2) 16 channels			
3) 64 channels			

## 3 Transmitter Test Results

### 3.1 Conducted Emissions

#### 3.1.1 Limit of Conducted Emissions

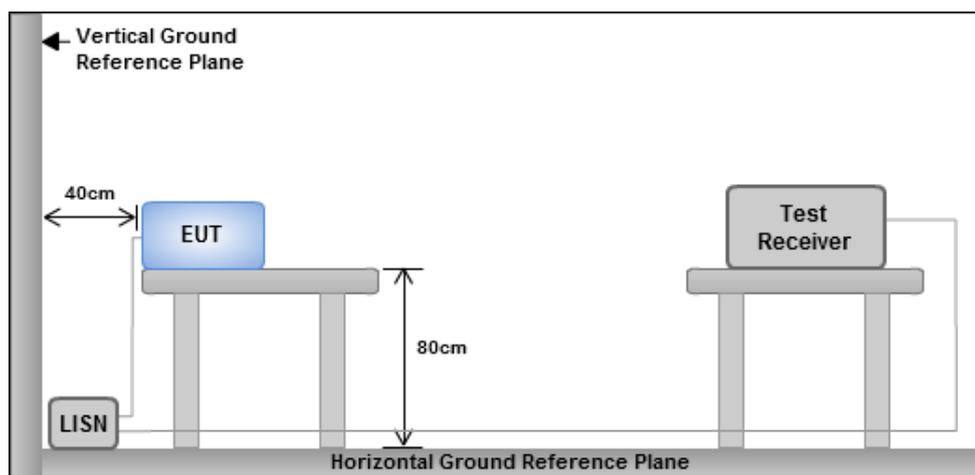
Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

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

#### 3.1.2 Test Procedures

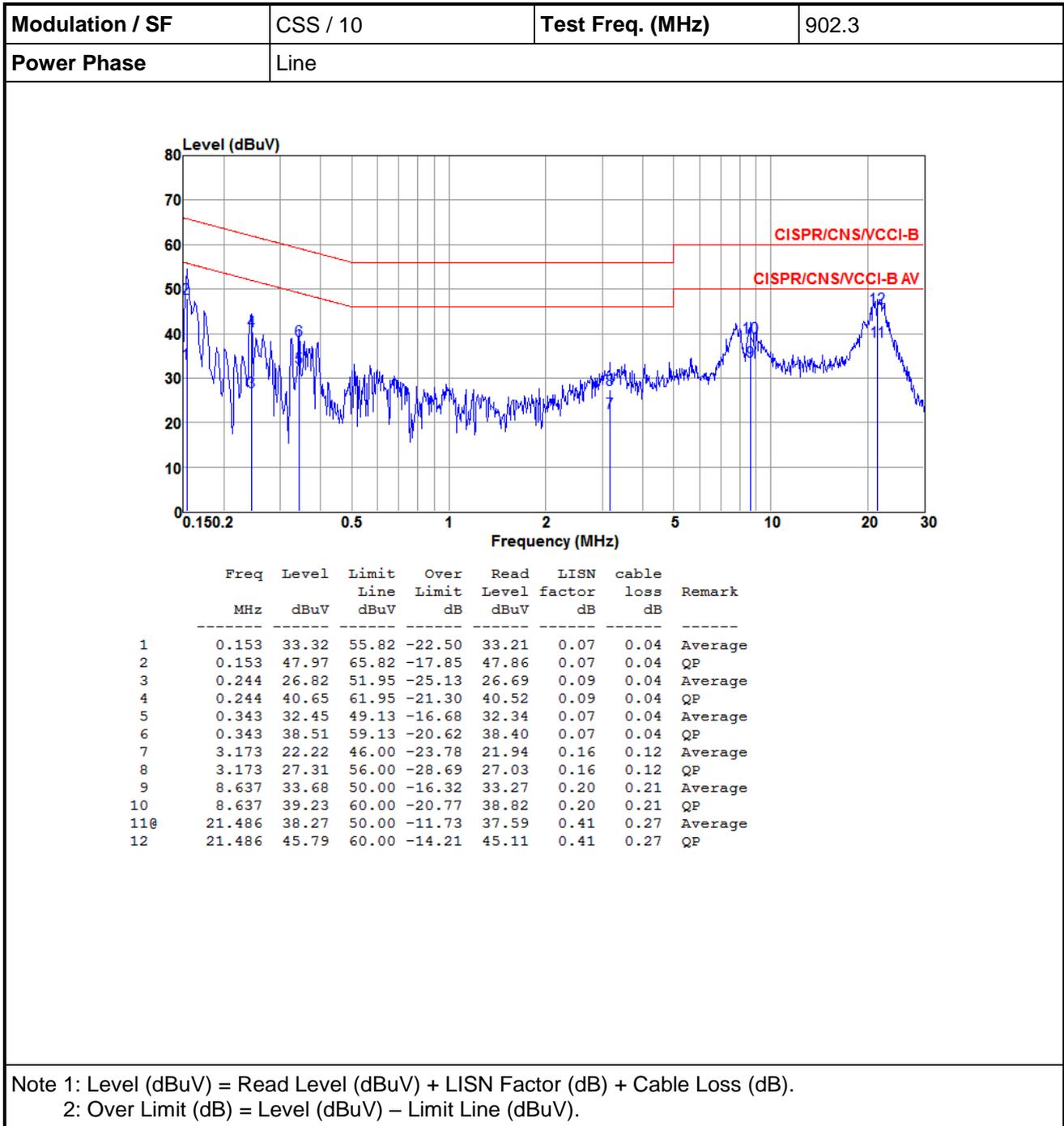
1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels 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

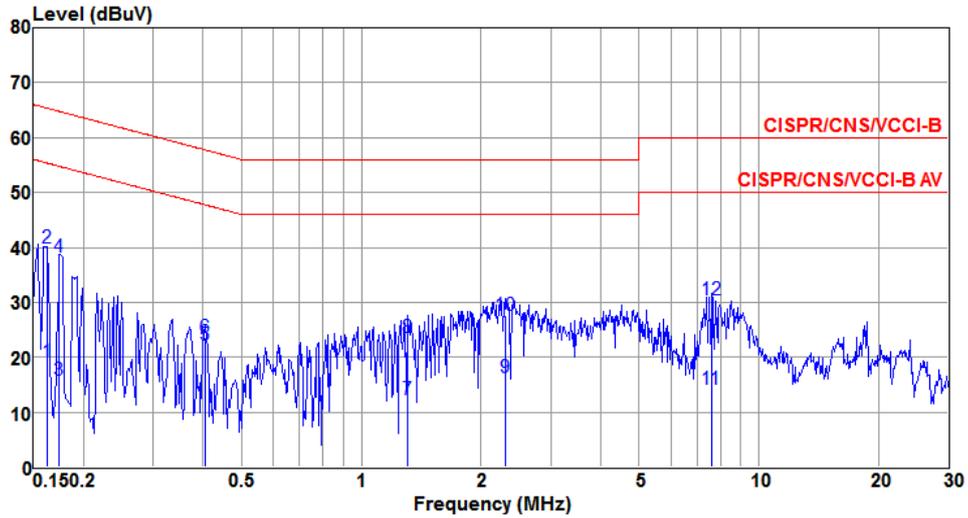


- Note: 1. Support units were connected to second LISN.  
 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

### 3.1.4 Test Result of Conducted Emissions



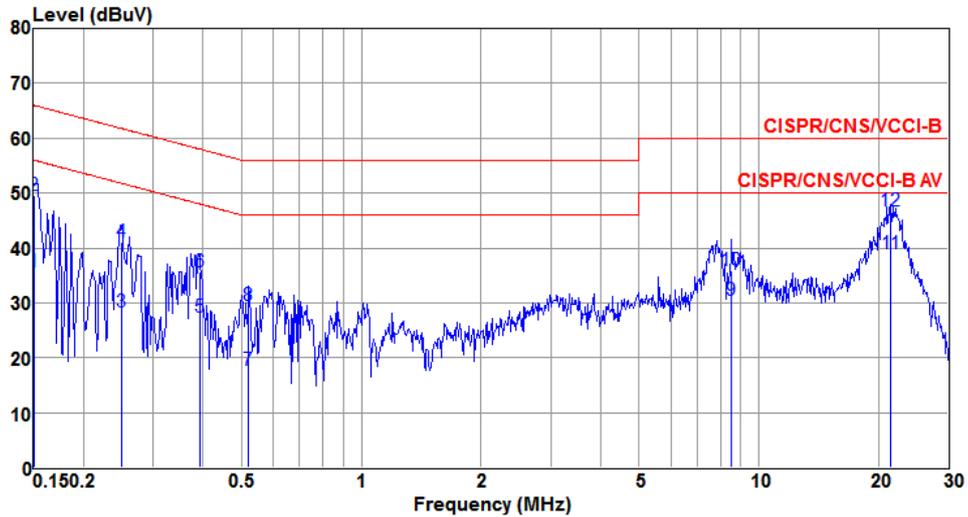
<b>Modulation / SF</b>	CSS / 10	<b>Test Freq. (MHz)</b>	902.3
<b>Power Phase</b>	Neutral		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.162	19.15	55.34	-36.19	19.01	0.10	0.04	Average
2	0.162	39.79	65.34	-25.55	39.65	0.10	0.04	QP
3	0.174	15.91	54.77	-38.86	15.78	0.09	0.04	Average
4	0.174	38.25	64.77	-26.52	38.12	0.09	0.04	QP
5	0.404	22.08	47.77	-25.69	21.91	0.13	0.04	Average
6	0.404	23.72	57.77	-34.05	23.55	0.13	0.04	QP
7	1.303	12.38	46.00	-33.62	12.22	0.12	0.04	Average
8	1.303	23.65	56.00	-32.35	23.49	0.12	0.04	QP
9	2.297	16.41	46.00	-29.59	16.19	0.16	0.06	Average
10	2.297	27.73	56.00	-28.27	27.51	0.16	0.06	QP
11	7.606	14.17	50.00	-35.83	13.71	0.26	0.20	Average
12	7.606	30.52	60.00	-29.48	30.06	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).

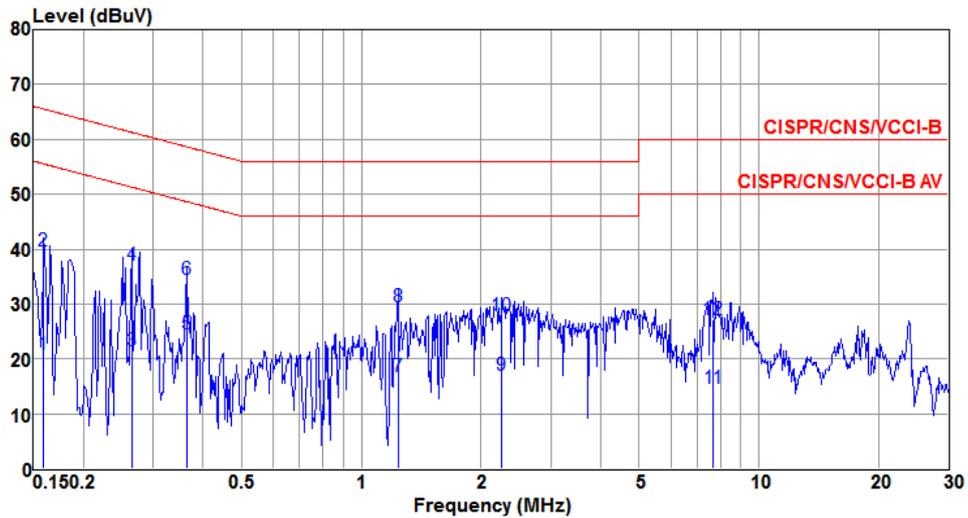
<b>Modulation / SF</b>	CSS / 10	<b>Test Freq. (MHz)</b>	908.5
<b>Power Phase</b>	Line		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.150	35.54	56.00	-20.46	35.43	0.07	0.04	Average
2	0.150	49.47	66.00	-16.53	49.36	0.07	0.04	QP
3	0.249	28.26	51.78	-23.52	28.13	0.09	0.04	Average
4	0.249	41.15	61.78	-20.63	41.02	0.09	0.04	QP
5	0.391	27.47	48.03	-20.56	27.37	0.06	0.04	Average
6	0.391	35.61	58.03	-22.42	35.51	0.06	0.04	QP
7	0.521	17.82	46.00	-28.18	17.72	0.06	0.04	Average
8	0.521	29.58	56.00	-26.42	29.48	0.06	0.04	QP
9	8.546	30.55	50.00	-19.45	30.15	0.19	0.21	Average
10	8.546	35.76	60.00	-24.24	35.36	0.19	0.21	QP
11@	21.486	39.02	50.00	-10.98	38.34	0.41	0.27	Average
12	21.486	46.65	60.00	-13.35	45.97	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).

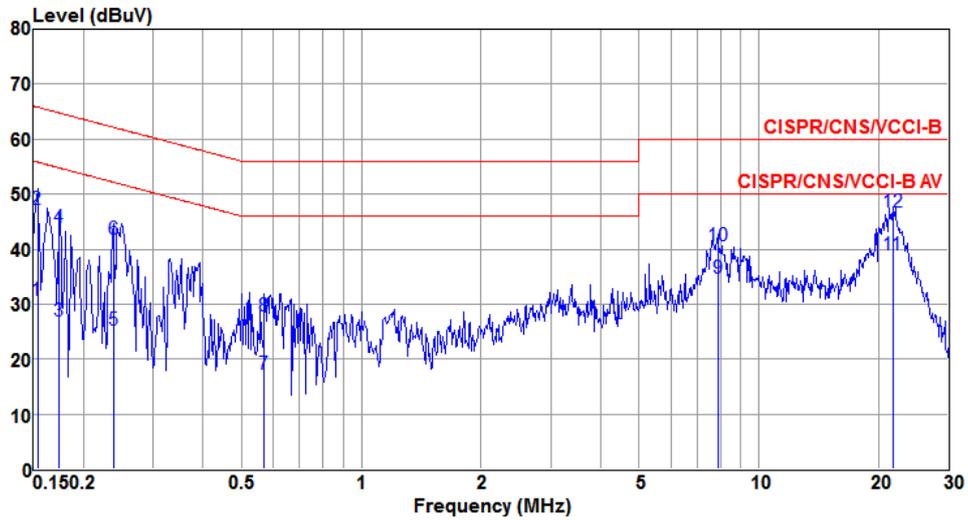
Modulation / SF	CSS / 10	Test Freq. (MHz)	908.5
Power Phase	Neutral		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.159	20.89	55.52	-34.63	20.75	0.10	0.04	Average
2	0.159	39.62	65.52	-25.90	39.48	0.10	0.04	QP
3	0.264	21.40	51.29	-29.89	21.25	0.11	0.04	Average
4	0.264	36.97	61.29	-24.32	36.82	0.11	0.04	QP
5@	0.363	24.57	48.65	-24.08	24.41	0.12	0.04	Average
6	0.363	34.45	58.65	-24.20	34.29	0.12	0.04	QP
7	1.236	16.70	46.00	-29.30	16.55	0.11	0.04	Average
8	1.236	29.41	56.00	-26.59	29.26	0.11	0.04	QP
9	2.261	17.12	46.00	-28.88	16.90	0.16	0.06	Average
10	2.261	27.82	56.00	-28.18	27.60	0.16	0.06	QP
11	7.687	14.61	50.00	-35.39	14.15	0.26	0.20	Average
12	7.687	27.26	60.00	-32.74	26.80	0.26	0.20	QP

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

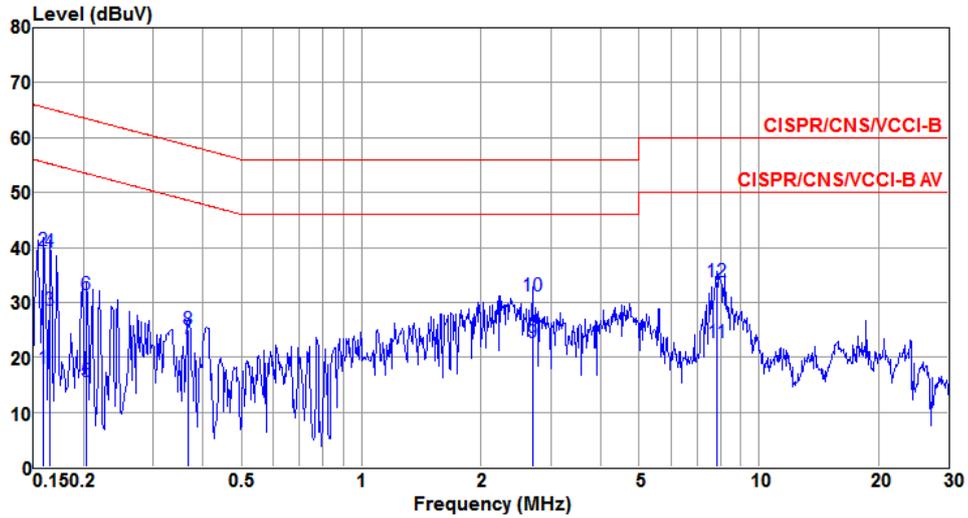
Modulation / SF	CSS / 10	Test Freq. (MHz)	914.9
Power Phase	Line		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.153	30.68	55.82	-25.14	30.57	0.07	0.04	Average
2	0.153	47.13	65.82	-18.69	47.02	0.07	0.04	QP
3	0.174	26.90	54.77	-27.87	26.77	0.09	0.04	Average
4	0.174	43.97	64.77	-20.80	43.84	0.09	0.04	QP
5	0.238	25.20	52.17	-26.97	25.07	0.09	0.04	Average
6	0.238	41.73	62.17	-20.44	41.60	0.09	0.04	QP
7	0.570	17.15	46.00	-28.85	17.05	0.06	0.04	Average
8	0.570	27.74	56.00	-28.26	27.64	0.06	0.04	QP
9	7.893	34.79	50.00	-15.21	34.40	0.19	0.20	Average
10	7.893	40.57	60.00	-19.43	40.18	0.19	0.20	QP
11@	21.715	38.99	50.00	-11.01	38.31	0.41	0.27	Average
12	21.715	46.62	60.00	-13.38	45.94	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).

<b>Modulation / SF</b>	CSS / 10	<b>Test Freq. (MHz)</b>	914.9
<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	0.159	17.92	55.52	-37.60	17.78	0.10	0.04	Average
2	0.159	39.35	65.52	-26.17	39.21	0.10	0.04	QP
3	0.165	28.46	55.21	-26.75	28.32	0.10	0.04	Average
4	0.165	39.25	65.21	-25.96	39.11	0.10	0.04	QP
5	0.204	15.54	53.45	-37.91	15.41	0.09	0.04	Average
6	0.204	31.49	63.45	-31.96	31.36	0.09	0.04	QP
7	0.367	23.39	48.56	-25.17	23.23	0.12	0.04	Average
8	0.367	25.02	58.56	-33.54	24.86	0.12	0.04	QP
9@	2.692	22.58	46.00	-23.42	22.34	0.15	0.09	Average
10	2.692	31.13	56.00	-24.87	30.89	0.15	0.09	QP
11	7.852	22.57	50.00	-27.43	22.11	0.26	0.20	Average
12	7.852	33.71	60.00	-26.29	33.25	0.26	0.20	QP

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

## 3.2 Unwanted Emissions into Restricted Frequency Bands

### 3.2.1 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.

### 3.2.2 Test Procedures

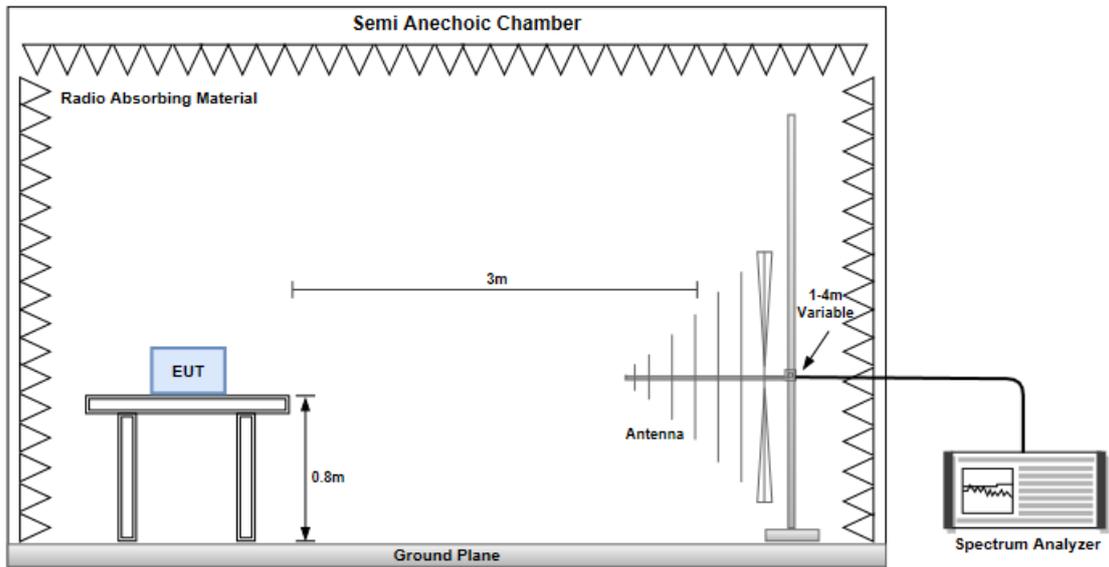
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission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

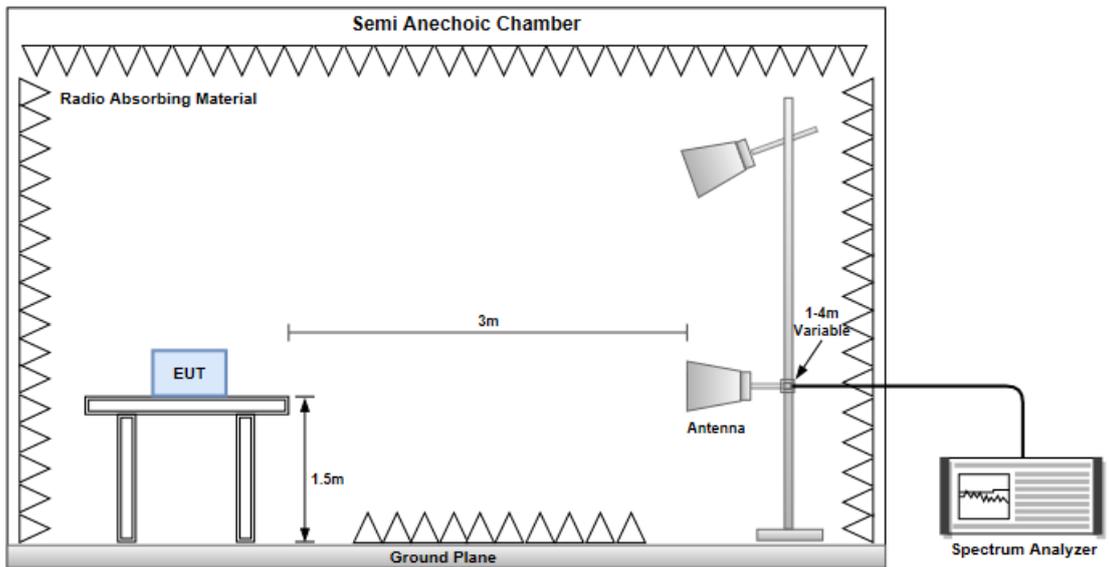
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

### 3.2.3 Test Setup

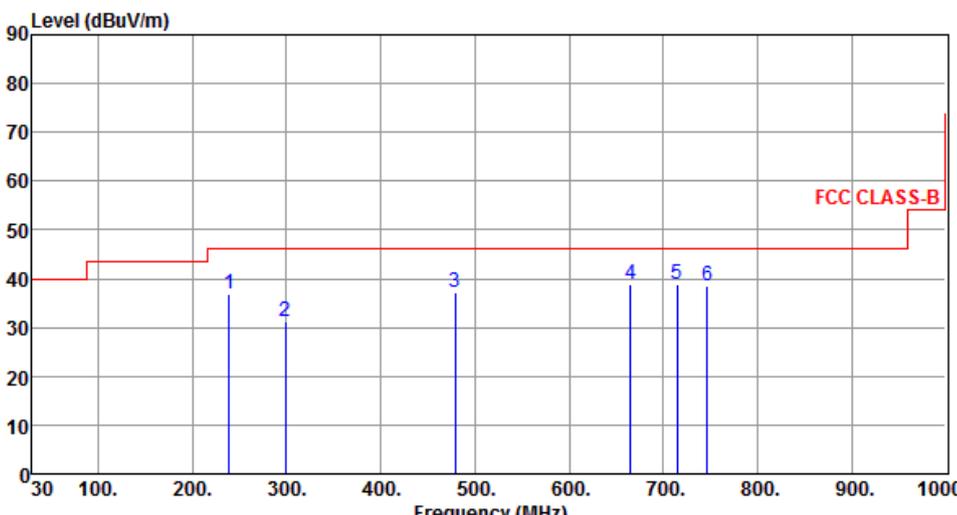
#### Radiated Emissions below 1 GHz



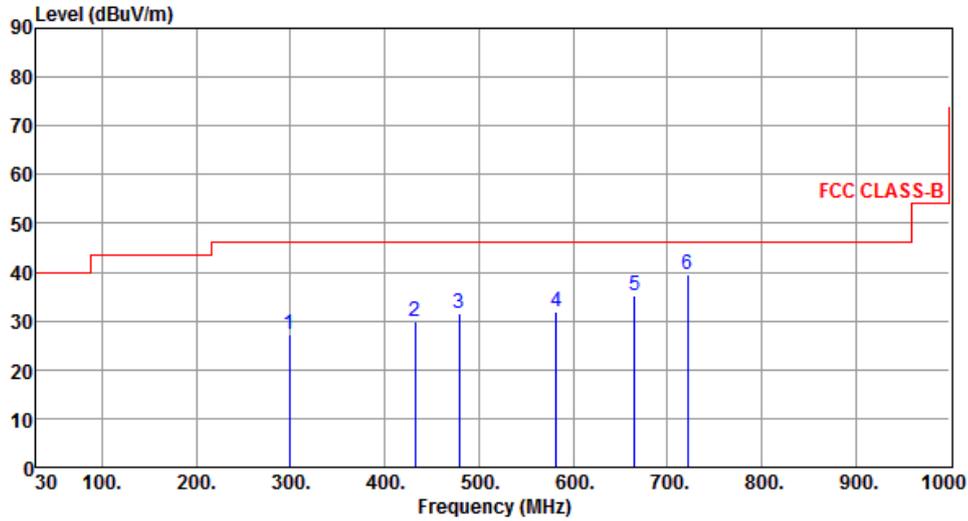
#### Radiated Emissions above 1 GHz



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

Modulation / SF	CSS / 10	Test Freq. (MHz)	902.3																																																													
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>239.52</td> <td>36.87</td> <td>46.00</td> <td>-9.13</td> <td>46.31</td> <td>-9.44</td> <td>Peak</td> <td>---</td> </tr> <tr> <td>2</td> <td>298.69</td> <td>31.23</td> <td>46.00</td> <td>-14.77</td> <td>38.77</td> <td>-7.54</td> <td>Peak</td> <td>---</td> </tr> <tr> <td>3</td> <td>479.11</td> <td>37.25</td> <td>46.00</td> <td>-8.75</td> <td>40.44</td> <td>-3.19</td> <td>Peak</td> <td>---</td> </tr> <tr> <td>4</td> <td>665.35</td> <td>38.90</td> <td>46.00</td> <td>-7.10</td> <td>38.69</td> <td>0.21</td> <td>Peak</td> <td>---</td> </tr> <tr> <td>5</td> <td>714.82</td> <td>38.91</td> <td>46.00</td> <td>-7.09</td> <td>37.81</td> <td>1.10</td> <td>Peak</td> <td>---</td> </tr> <tr> <td>6</td> <td>746.83</td> <td>38.52</td> <td>46.00</td> <td>-7.48</td> <td>36.77</td> <td>1.75</td> <td>Peak</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	239.52	36.87	46.00	-9.13	46.31	-9.44	Peak	---	2	298.69	31.23	46.00	-14.77	38.77	-7.54	Peak	---	3	479.11	37.25	46.00	-8.75	40.44	-3.19	Peak	---	4	665.35	38.90	46.00	-7.10	38.69	0.21	Peak	---	5	714.82	38.91	46.00	-7.09	37.81	1.10	Peak	---	6	746.83	38.52	46.00	-7.48	36.77	1.75	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	239.52	36.87	46.00	-9.13	46.31	-9.44	Peak	---																																																								
2	298.69	31.23	46.00	-14.77	38.77	-7.54	Peak	---																																																								
3	479.11	37.25	46.00	-8.75	40.44	-3.19	Peak	---																																																								
4	665.35	38.90	46.00	-7.10	38.69	0.21	Peak	---																																																								
5	714.82	38.91	46.00	-7.09	37.81	1.10	Peak	---																																																								
6	746.83	38.52	46.00	-7.48	36.77	1.75	Peak	---																																																								
<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 / 10	<b>Test Freq. (MHz)</b>	902.3
<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	298.69	27.37	46.00	-18.63	34.91	-7.54	Peak	---	---
2	432.55	29.94	46.00	-16.06	34.11	-4.17	Peak	---	---
3	479.11	31.61	46.00	-14.39	34.80	-3.19	Peak	---	---
4	581.93	31.98	46.00	-14.02	33.07	-1.09	Peak	---	---
5	665.35	35.14	46.00	-10.86	34.93	0.21	Peak	---	---
6	721.61	39.37	46.00	-6.63	38.12	1.25	Peak	---	---

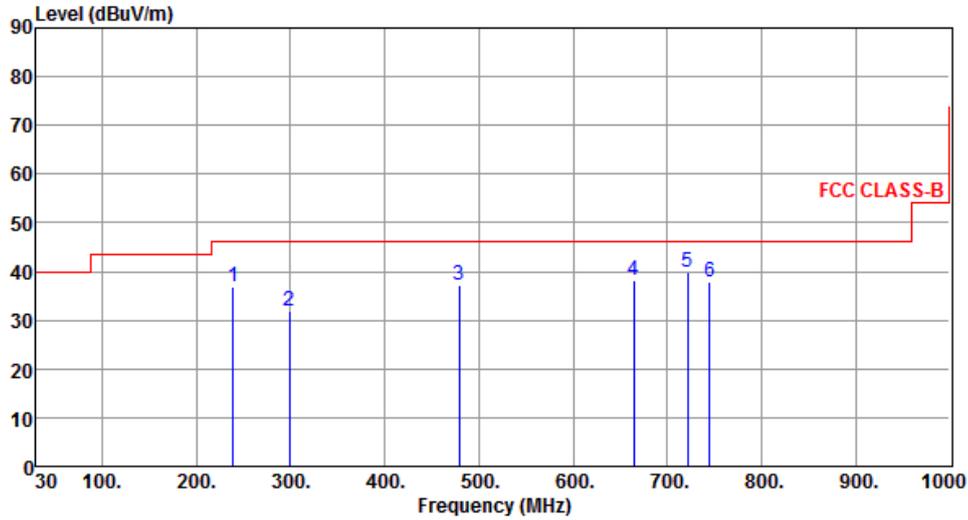
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*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.

<b>Modulation / SF</b>	CSS / 10	<b>Test Freq. (MHz)</b>	908.5
<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	239.52	36.88	46.00	-9.12	46.32	-9.44	Peak	---	---
2	298.69	31.83	46.00	-14.17	39.37	-7.54	Peak	---	---
3	479.11	37.25	46.00	-8.75	40.44	-3.19	Peak	---	---
4	664.38	38.15	46.00	-7.85	37.95	0.20	Peak	---	---
5	721.61	39.89	46.00	-6.11	38.64	1.25	Peak	---	---
6	744.89	37.94	46.00	-8.06	36.22	1.72	Peak	---	---

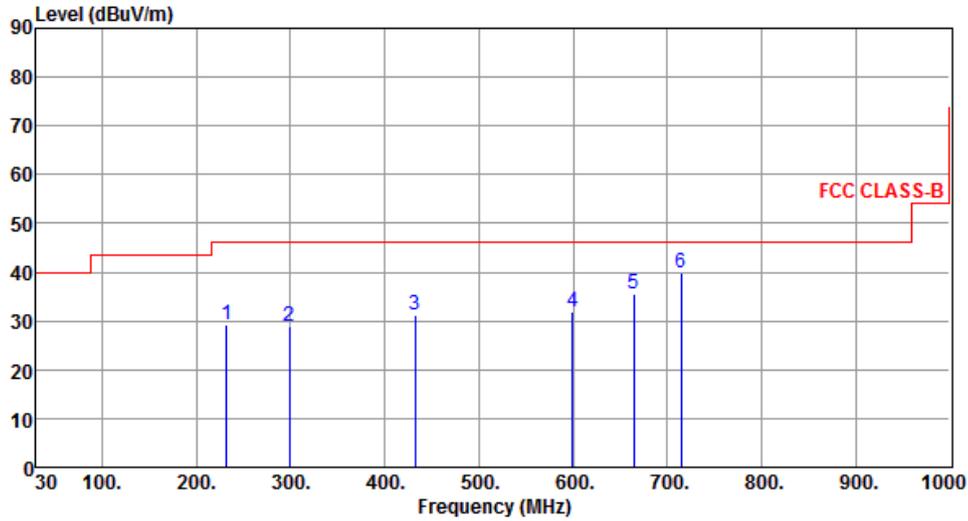
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*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.

<b>Modulation / SF</b>	CSS / 10	<b>Test Freq. (MHz)</b>	908.5
<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	231.76	29.21	46.00	-16.79	38.59	-9.38	Peak	---	---
2	298.69	28.96	46.00	-17.04	36.50	-7.54	Peak	---	---
3	432.55	31.08	46.00	-14.92	35.25	-4.17	Peak	---	---
4	599.39	32.00	46.00	-14.00	32.66	-0.66	Peak	---	---
5	664.38	35.48	46.00	-10.52	35.28	0.20	Peak	---	---
6	714.82	39.92	46.00	-6.08	38.82	1.10	Peak	---	---

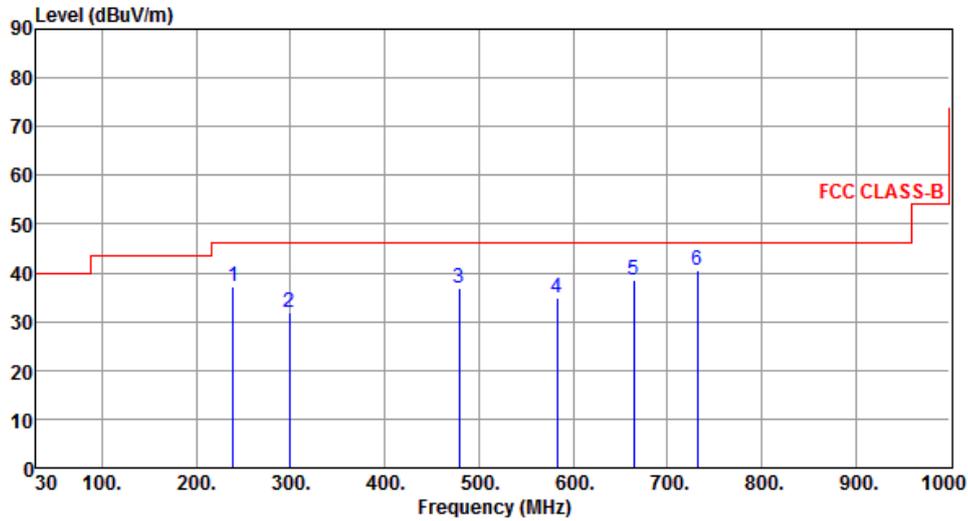
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*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.

<b>Modulation / SF</b>	CSS / 10	<b>Test Freq. (MHz)</b>	914.9
<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	239.52	37.23	46.00	-8.77	46.67	-9.44	Peak	---	---
2	298.69	31.82	46.00	-14.18	39.36	-7.54	Peak	---	---
3	479.11	36.95	46.00	-9.05	40.14	-3.19	Peak	---	---
4	582.90	34.89	46.00	-11.11	35.96	-1.07	Peak	---	---
5	664.38	38.62	46.00	-7.38	38.42	0.20	Peak	---	---
6	732.28	40.53	46.00	-5.47	39.07	1.46	Peak	---	---

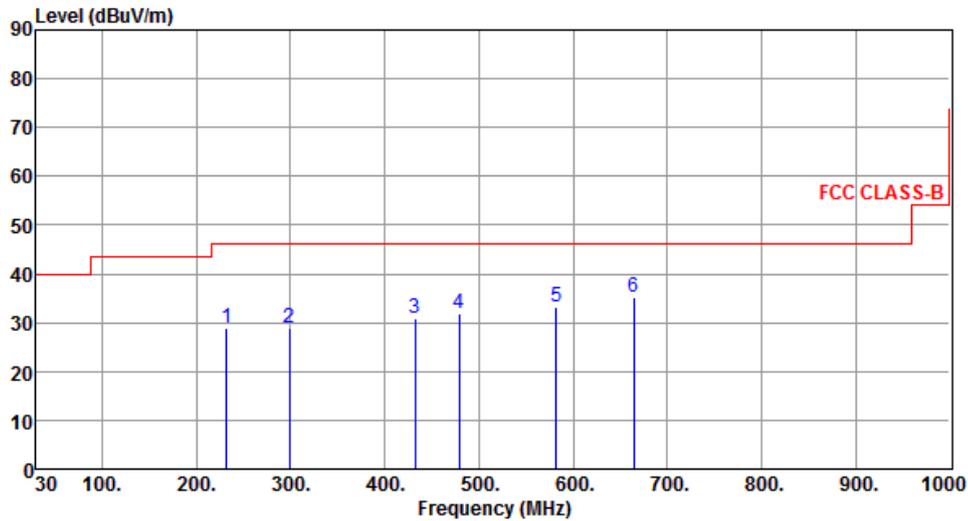
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*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 / 10	<b>Test Freq. (MHz)</b>	914.9
<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	231.76	29.04	46.00	-16.96	38.42	-9.38	Peak	---	---
2	298.69	28.81	46.00	-17.19	36.35	-7.54	Peak	---	---
3	432.55	30.95	46.00	-15.05	35.12	-4.17	Peak	---	---
4	479.11	32.00	46.00	-14.00	35.19	-3.19	Peak	---	---
5	581.93	33.06	46.00	-12.94	34.15	-1.09	Peak	---	---
6	664.38	35.13	46.00	-10.87	34.93	0.20	Peak	---	---

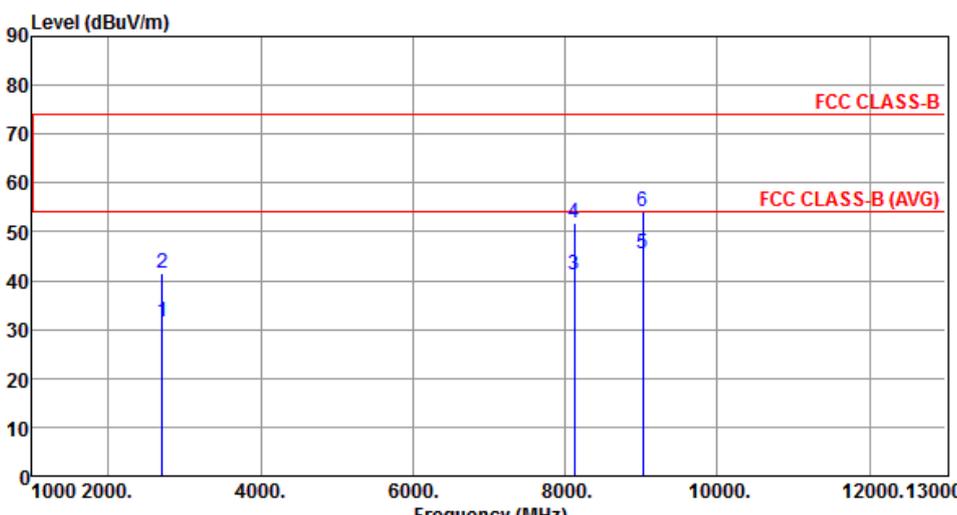
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

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

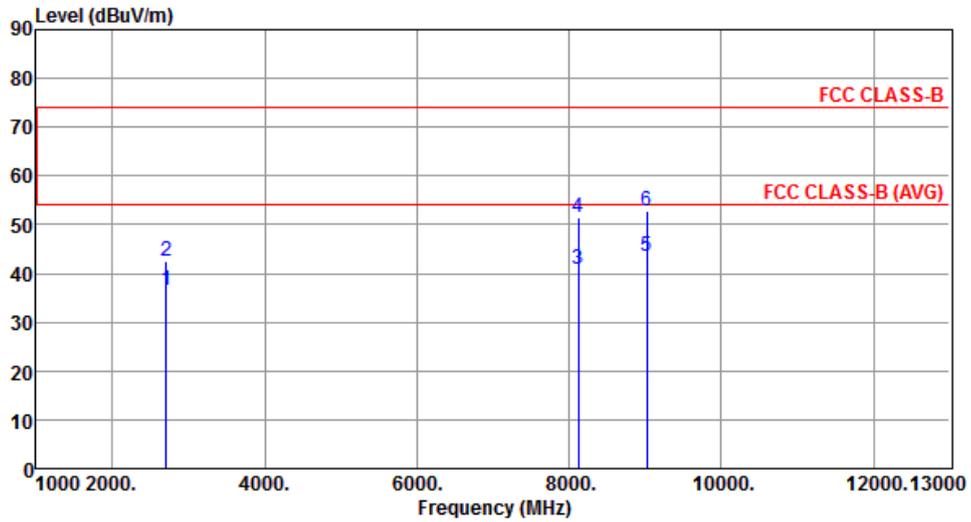
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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

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

<b>Modulation / SF</b>	CSS / 10	<b>Test Freq. (MHz)</b>	902.3						
<b>Polarization</b>	Horizontal								
									
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2706.90	31.66	54.00	-22.34	33.69	-2.03	Average	100	166
2	2706.90	41.51	74.00	-32.49	43.54	-2.03	Peak	100	166
3	8120.70	41.12	54.00	-12.88	31.74	9.38	Average	220	143
4	8120.70	51.83	74.00	-22.17	42.45	9.38	Peak	220	143
5	9023.00	45.42	54.00	-8.58	34.31	11.11	Average	191	150
6	9023.00	54.08	74.00	-19.92	42.97	11.11	Peak	191	150
<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).</p>									

<b>Modulation / SF</b>	CSS / 10	<b>Test Freq. (MHz)</b>	902.3
<b>Polarization</b>	Vertical		



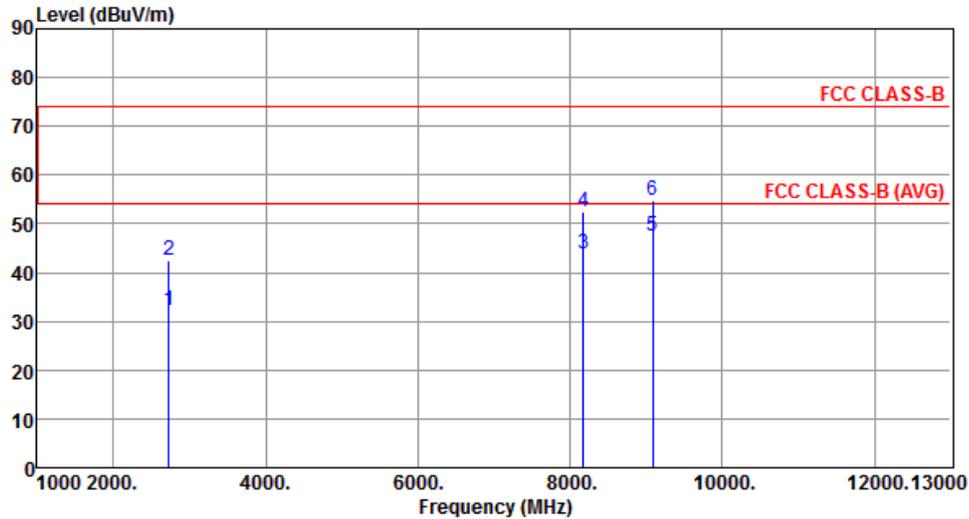
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2706.90	36.68	54.00	-17.32	38.71	-2.03	Average	170	183
2	2706.90	42.58	74.00	-31.42	44.61	-2.03	Peak	170	183
3	8120.70	40.79	54.00	-13.21	31.41	9.38	Average	100	223
4	8120.70	51.52	74.00	-22.48	42.14	9.38	Peak	100	223
5	9023.00	43.39	54.00	-10.61	32.28	11.11	Average	100	215
6	9023.00	52.87	74.00	-21.13	41.76	11.11	Peak	100	215

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 / 10	<b>Test Freq. (MHz)</b>	908.5
<b>Polarization</b>	Horizontal		



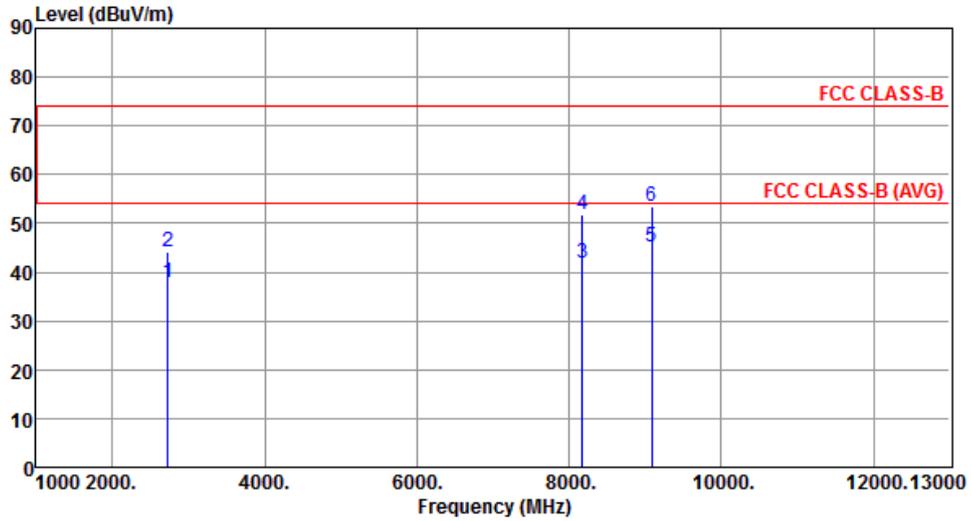
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2725.50	32.16	54.00	-21.84	34.14	-1.98	Average	111	169
2	2725.50	42.38	74.00	-31.62	44.36	-1.98	Peak	111	169
3	8176.50	43.85	54.00	-10.15	34.35	9.50	Average	213	12
4	8176.50	52.58	74.00	-21.42	43.08	9.50	Peak	213	12
5	9085.00	47.34	54.00	-6.66	36.02	11.32	Average	201	11
6	9085.00	54.72	74.00	-19.28	43.40	11.32	Peak	201	11

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 / 10	<b>Test Freq. (MHz)</b>	908.5
<b>Polarization</b>	Vertical		



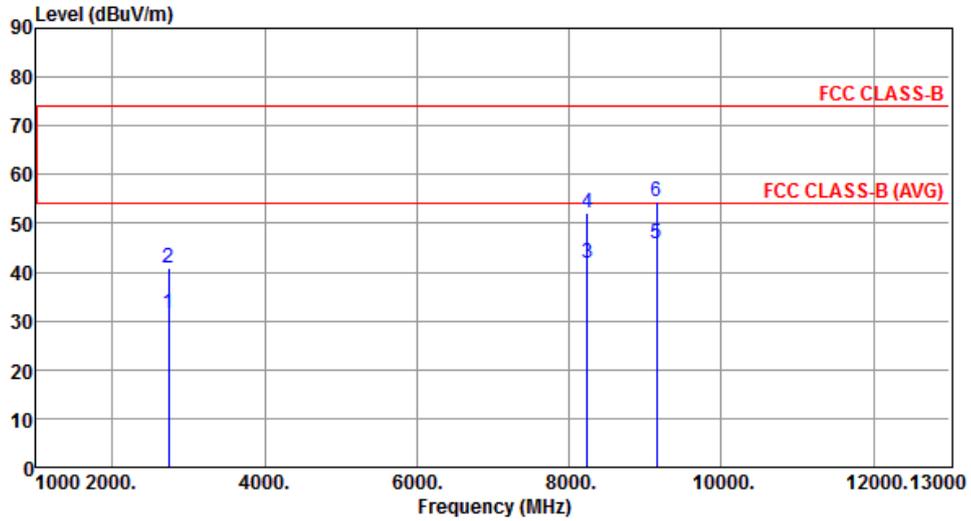
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2725.50	37.98	54.00	-16.02	39.96	-1.98	Average	165	198
2	2725.50	44.29	74.00	-29.71	46.27	-1.98	Peak	165	198
3	8176.50	41.89	54.00	-12.11	32.39	9.50	Average	182	279
4	8176.50	51.91	74.00	-22.09	42.41	9.50	Peak	182	279
5	9085.00	45.16	54.00	-8.84	33.84	11.32	Average	125	336
6	9085.00	53.40	74.00	-20.60	42.08	11.32	Peak	125	336

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 / 10	<b>Test Freq. (MHz)</b>	914.9
<b>Polarization</b>	Horizontal		



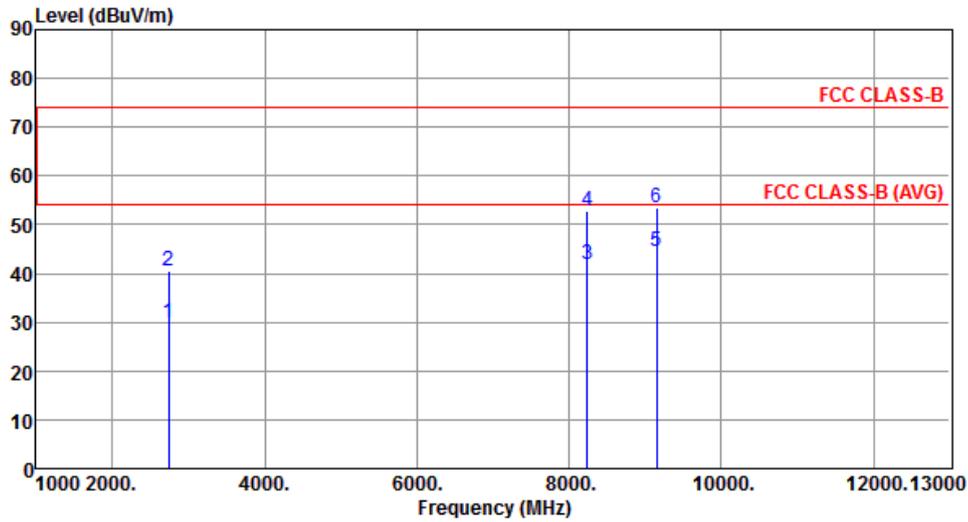
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2744.70	31.50	54.00	-22.50	33.41	-1.91	Average	100	15
2	2744.70	40.76	74.00	-33.24	42.67	-1.91	Peak	100	15
3	8234.10	41.81	54.00	-12.19	32.26	9.55	Average	257	214
4	8234.10	52.20	74.00	-21.80	42.65	9.55	Peak	257	214
5	9149.00	45.99	54.00	-8.01	34.47	11.52	Average	200	311
6	9149.00	54.57	74.00	-19.43	43.05	11.52	Peak	200	311

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 / 10	<b>Test Freq. (MHz)</b>	914.9
<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	2744.70	29.95	54.00	-24.05	31.86	-1.91	Average	134	116
2	2744.70	40.54	74.00	-33.46	42.45	-1.91	Peak	134	116
3	8234.10	41.90	54.00	-12.10	32.35	9.55	Average	143	129
4	8234.10	52.95	74.00	-21.05	43.40	9.55	Peak	143	129
5	9149.00	44.43	54.00	-9.57	32.91	11.52	Average	130	9
6	9149.00	53.35	74.00	-20.65	41.83	11.52	Peak	130	9

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).

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

#### 3.3.1 Limit of Unwanted Emissions into Non-Restricted Frequency Bands

The peak output power measured 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.

#### 3.3.2 Test Procedures

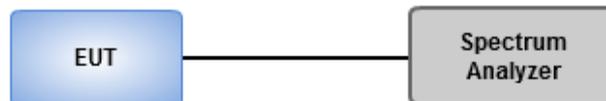
##### Reference Level Measurement

1. Set the RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
2. Set Sweep time = auto couple, Trace mode = max hold.
3. Allow trace to fully stabilize.
4. Use the peak marker function to determine the maximum amplitude level.

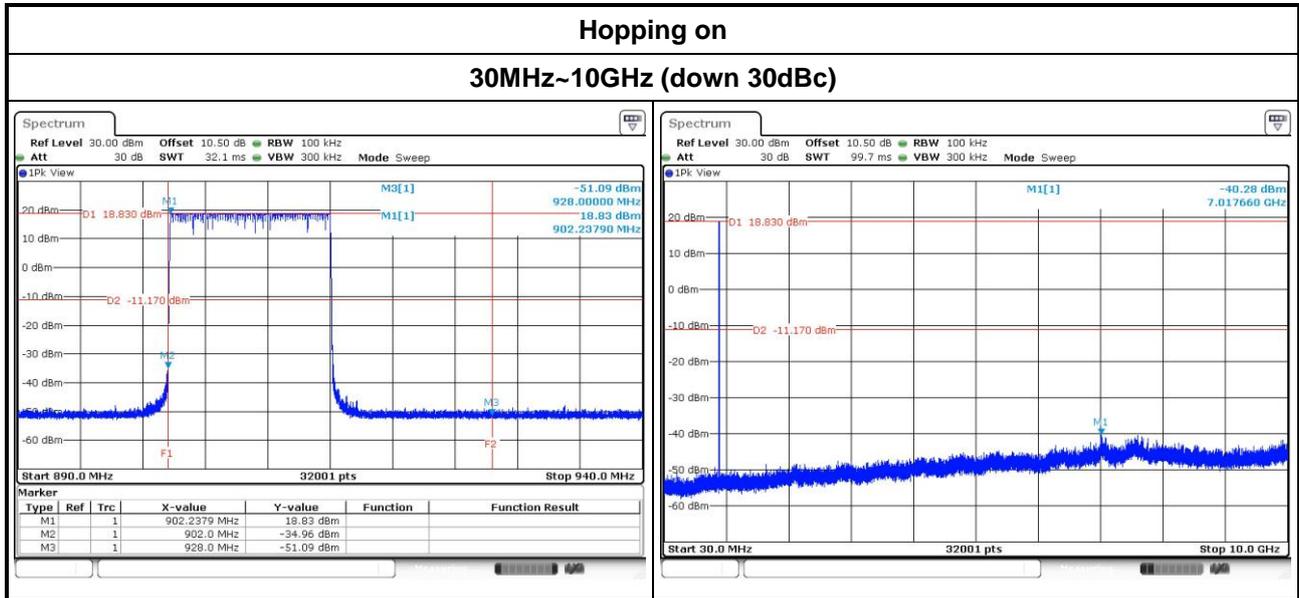
##### Unwanted Emissions Level Measurement

1. Set RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
2. Trace Mode = max hold, Sweep = auto couple.
3. Allow the trace to stabilize.
4. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

#### 3.3.3 Test Setup

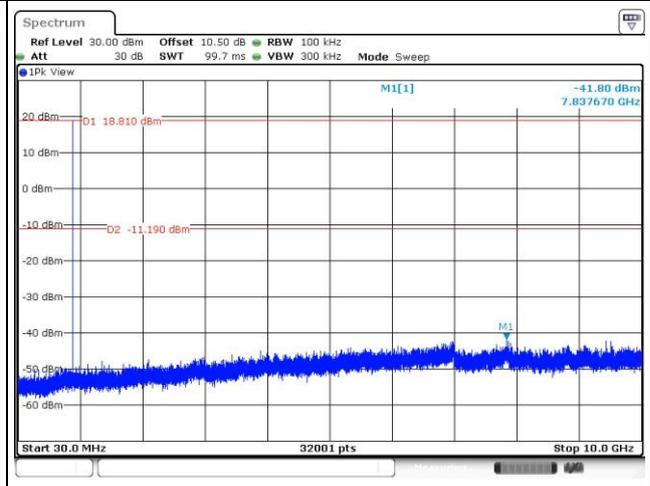
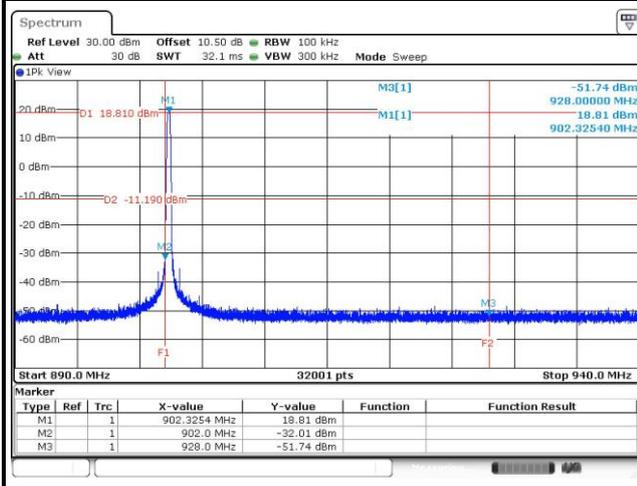


### 3.3.4 Unwanted Emissions into Non-Restricted Frequency Bands

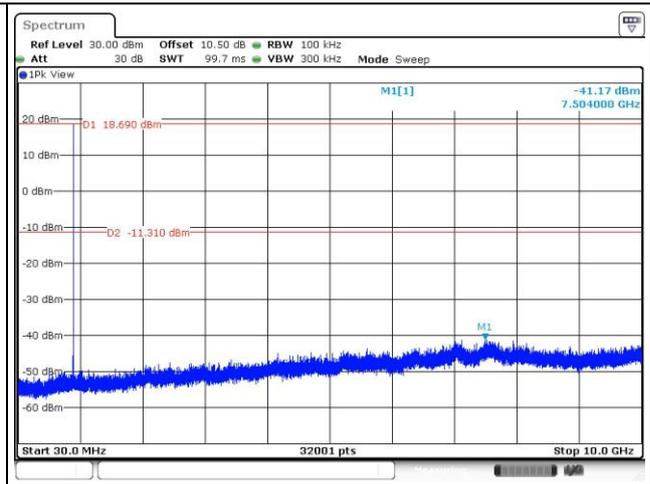
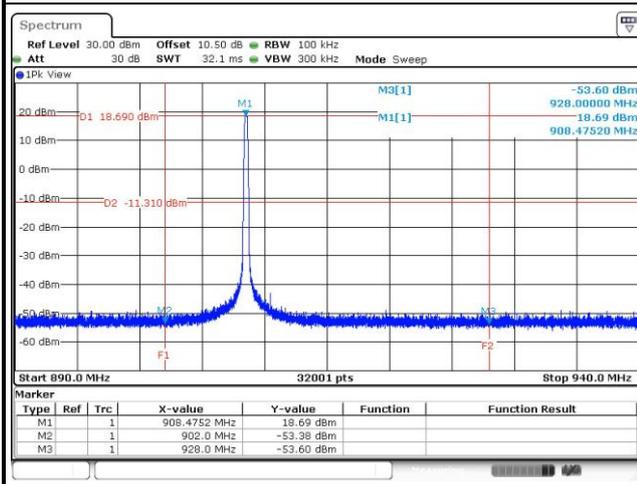


### Hopping off

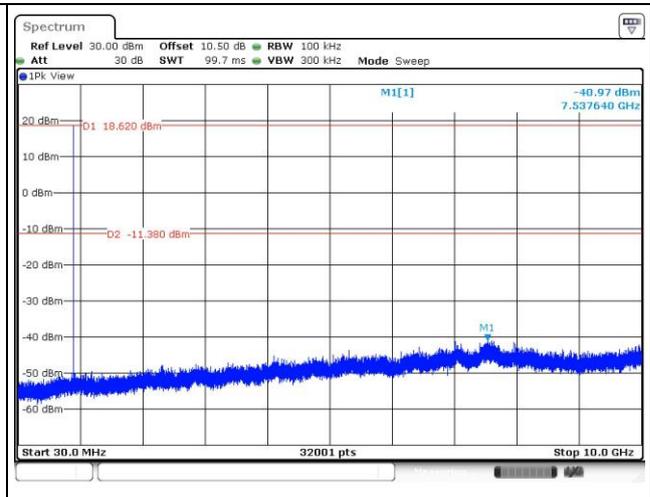
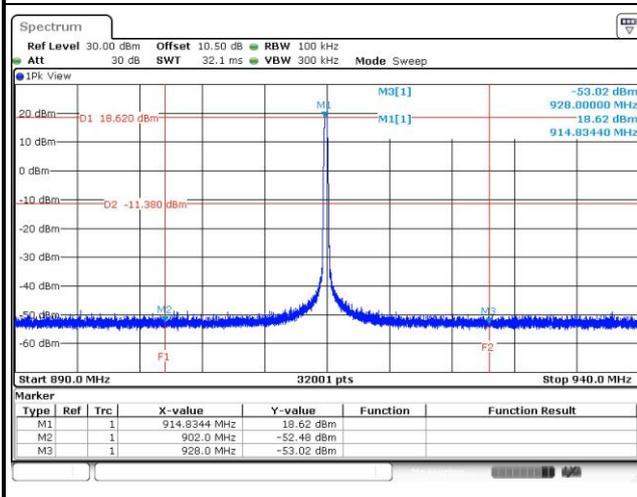
#### TX Frequency 902.3MHz / 30MHz~10GHz (down 30dBc)



#### TX Frequency 908.5MHz / 30MHz~10GHz (down 30dBc)



#### TX Frequency 914.9MHz / 30MHz~10GHz (down 30dBc)



### 3.4 Conducted Output Power

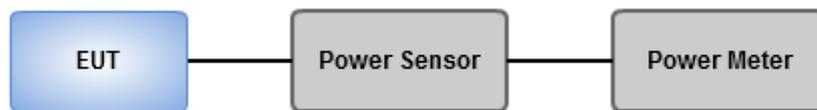
#### 3.4.1 Limit of Conducted Output Power

- 1 Watt, systems employing at least 50 hopping channels;
- 0.25 Watt, for systems employing less than 50 hopping channels, but at least 25 hopping channels,

#### 3.4.2 Test Procedures

1. A wideband power meter is used for power measurement. Bandwidth of power sensor and meter is 50MHz
2. 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

#### 3.4.3 Test Setup



#### 3.4.4 Test Result of Conducted Output Power

Modulation / SF	Freq. (MHz)	Output Power (mW)	Output Power (dBm)	Limit (W)
CSS / 10	902.3	79.80	19.02	1
CSS / 10	908.5	79.25	18.99	1
CSS / 10	914.9	78.89	18.97	1

### 3.5 Number of Hopping Frequency

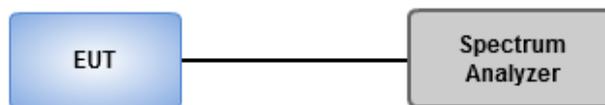
#### 3.5.1 Limit of Number of Hopping Frequency

Number of Hopping Frequencies Limit for Frequency Hopping Systems	
<input checked="" type="checkbox"/>	902-928 MHz Band:
<input type="checkbox"/>	$N \geq 50$ , 20 dB bandwidth of the hopping channel is less than 250 kHz
<input type="checkbox"/>	$N \geq 25$ , 20 dB bandwidth of the hopping channel is 250 kHz or greater
<input checked="" type="checkbox"/>	Hybrid mode, No minimum number of hopping channels associated with hybrid system.
<b>N:</b> Number of Hopping Frequencies	

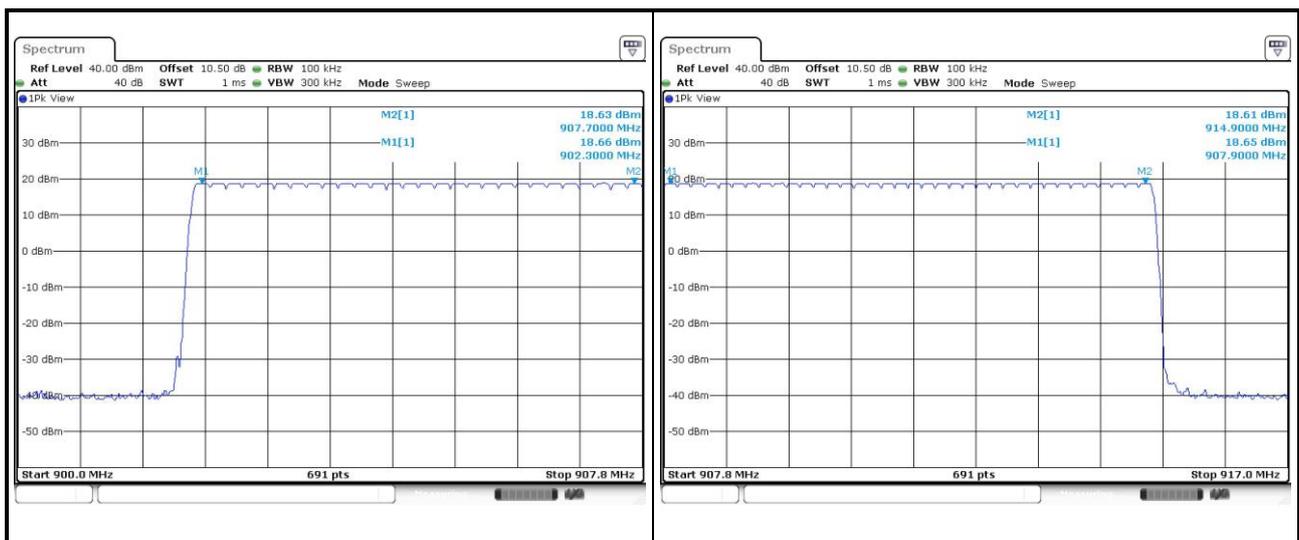
#### 3.5.2 Test Procedures

1. Set RBW = 100kHz, VBW = 300kHz, Sweep time = Auto, Detector = Peak Trace max hold.
2. Allow trace to stabilize.

#### 3.5.3 Test Setup



#### 3.5.4 Test Result of Number of Hopping Frequency



## 3.6 20dB and Occupied Bandwidth

### 3.6.1 Test Procedures

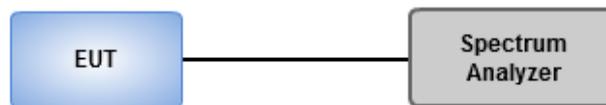
#### 20dB Bandwidth

1. Set RBW=3kHz, VBW=10kHz, Sweep time=Auto, Detector=Peak Trace max hold.
2. Allow trace to stabilize.
3. 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 20 dB relative to the maximum level measured in the fundamental emission.

#### Occupied Bandwidth

1. Set RBW=3kHz, VBW=10kHz, Sweep time = Auto, Detector=Sample, Trace max hold
2. Allow trace to stabilize
3. Use Occupied bandwidth function of spectrum analyzer to measuring 99% occupied bandwidth

### 3.6.2 Test Setup



### 3.6.3 Test result of 20dB and Occupied Bandwidth

Modulation / SF	Freq. (MHz)	20dB Bandwidth (kHz)	Occupied Bandwidth (kHz)
CSS / 10	902.3	138.70	125.40
CSS / 10	908.5	138.70	125.70
CSS / 10	914.9	137.83	125.80



## 3.7 Channel Separation

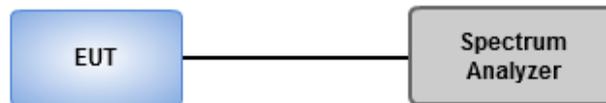
### 3.7.1 Limit of Channel Separation

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

### 3.7.2 Test Procedures

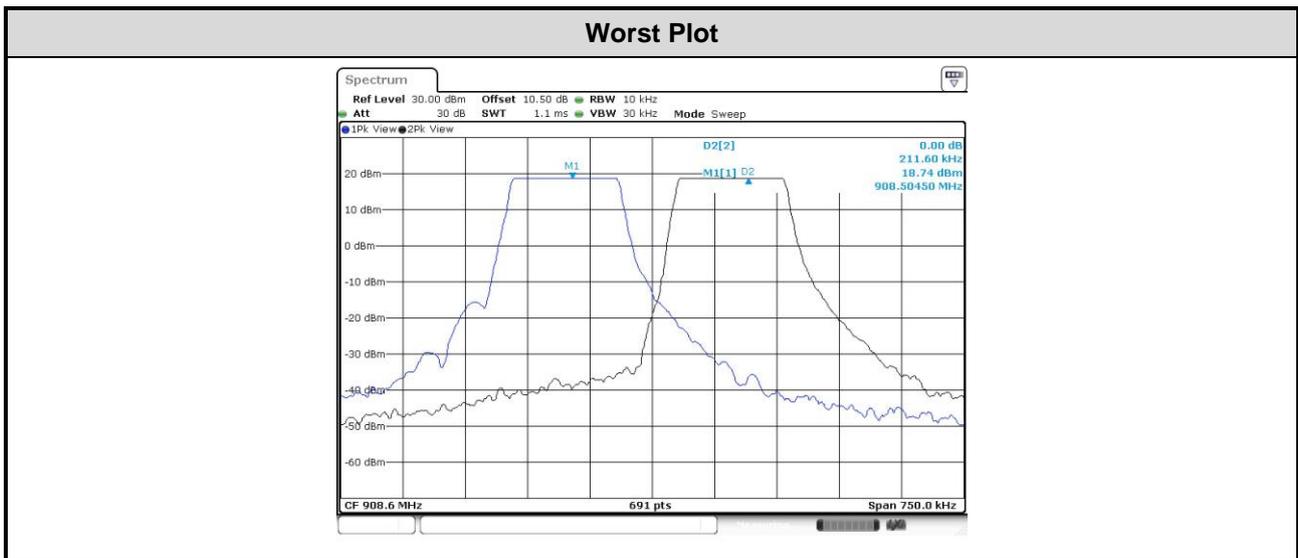
1. Set RBW=10kHz, VBW=30kHz, Sweep time=Auto, Detector=Peak Trace max hold.
2. Allow trace to stabilize.
3. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The EUT shall show compliance with the appropriate regulatory limit

### 3.7.3 Test Setup



### 3.7.4 Test result of Channel Separation

Modulation / SF	Freq. (MHz)	Adjacent Channel Separation (kHz)	20dB Bandwidth (kHz)	Pass/Fail
CSS / 10	902.3	145.40	138.70	Pass
CSS / 10	908.5	211.60	138.70	Pass
CSS / 10	914.9	196.50	137.83	Pass



## 3.8 Number of Dwell Time

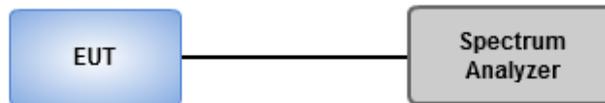
### 3.8.1 Limit of Dwell time

Time of Occupancy (Dwell Time) Limit for Frequency Hopping Systems	
<input checked="" type="checkbox"/>	902-928 MHz Band:
<input type="checkbox"/>	$\leq 0.4$ second within a 20 second period, 20 dB bandwidth of the hopping channel is less than 250 kHz
<input type="checkbox"/>	$\leq 0.4$ second within a 10 second period, 20 dB bandwidth of the hopping channel is 250 kHz or greater
<input checked="" type="checkbox"/>	Hybrid mode ,an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4

### 3.8.2 Test Procedures

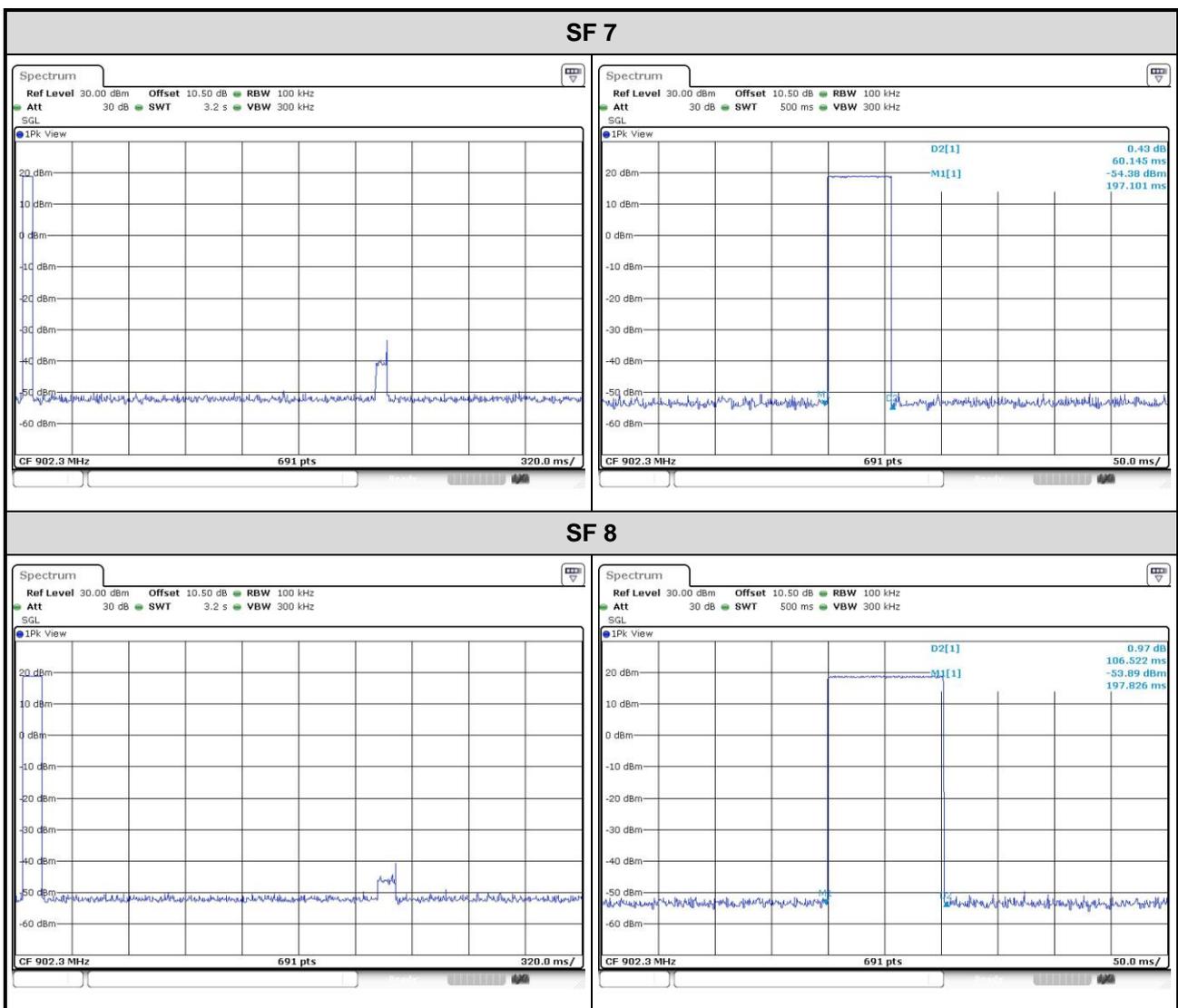
1. Set RBW=100kHz, VBW=300kHz, Sweep time=6.4s / 500ms, Detector=Peak, Span=0Hz, Trace max hold.
2. Measure and record the burst on time.

### 3.8.3 Test Setup

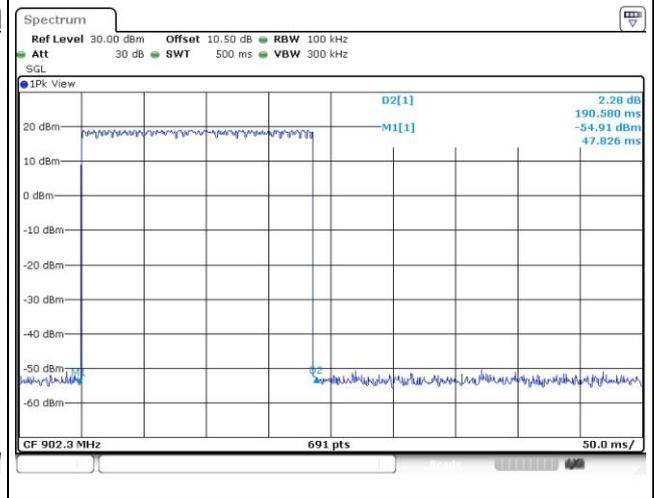
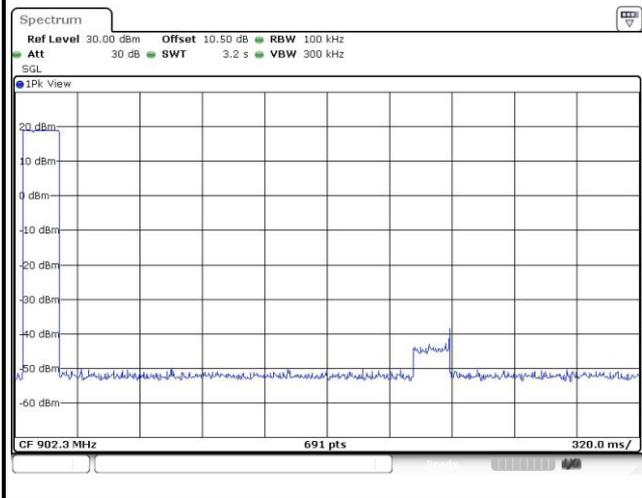


### 3.8.4 Test Result of Dwell Time

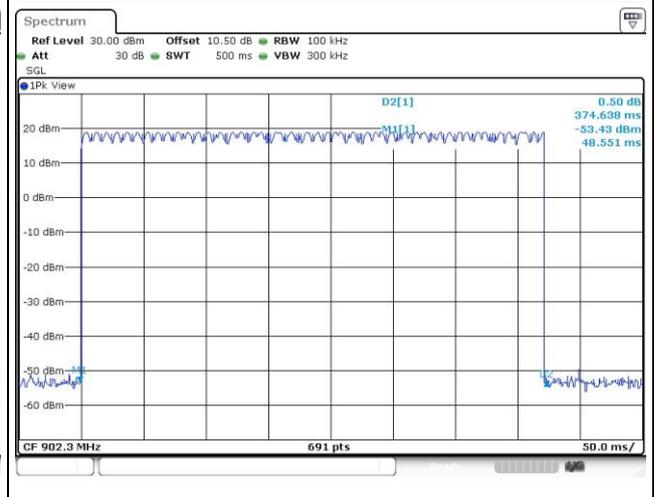
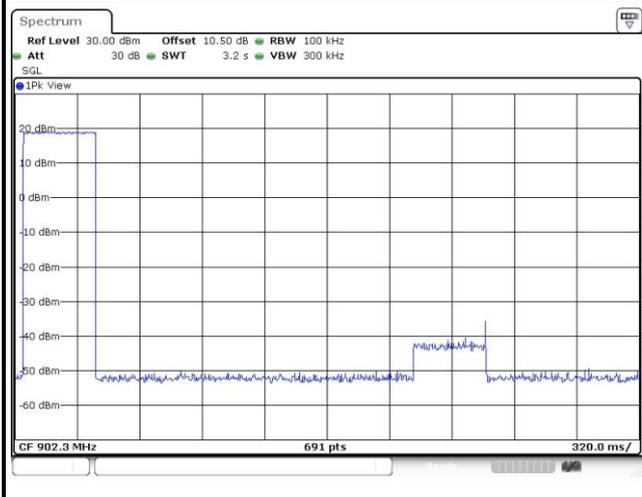
Modulation / SF	Freq. (MHz)	Length of Transmission Time (sec)	Number of Transmission in a 3.2 s (8 Hopping*0.4s)	Result (s)	Limit (s)
CSS / 7	902.3	0.060145	1	0.060145	0.4
CSS / 8	902.3	0.106522	1	0.106522	0.4
CSS / 9	902.3	0.190580	1	0.190580	0.4
CSS / 10	902.3	0.374638	1	0.374638	0.4



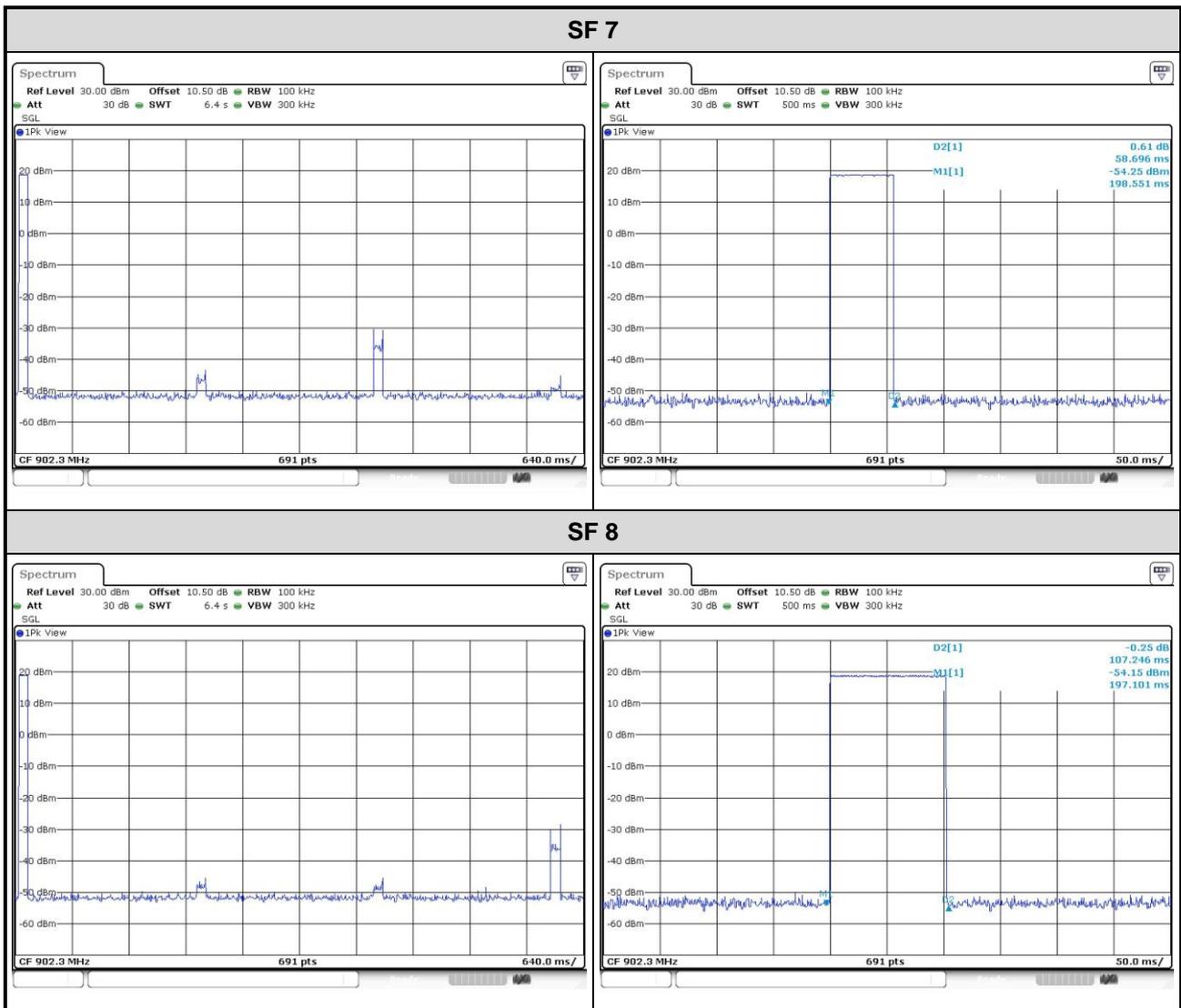
### SF 9

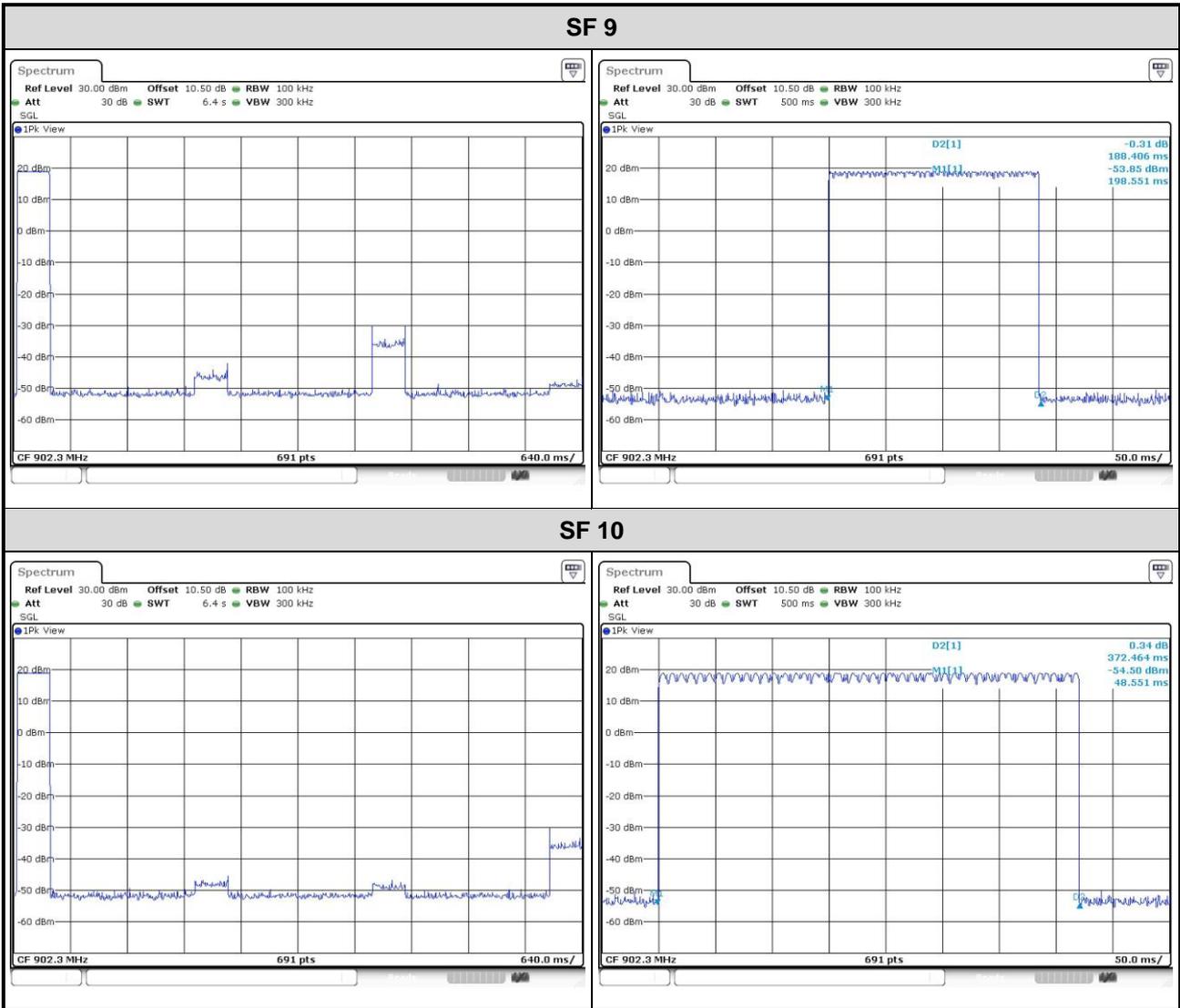


### SF 10

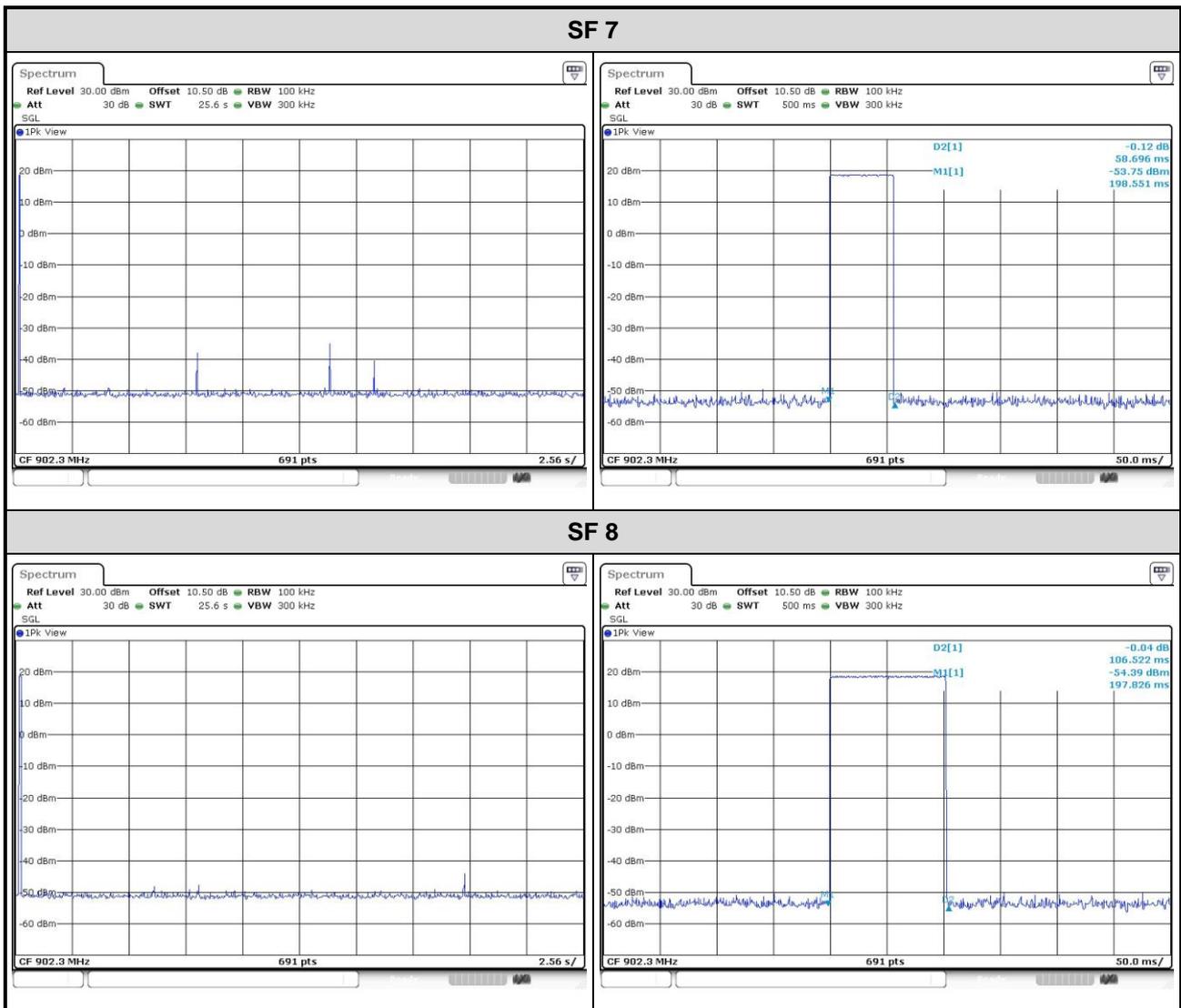


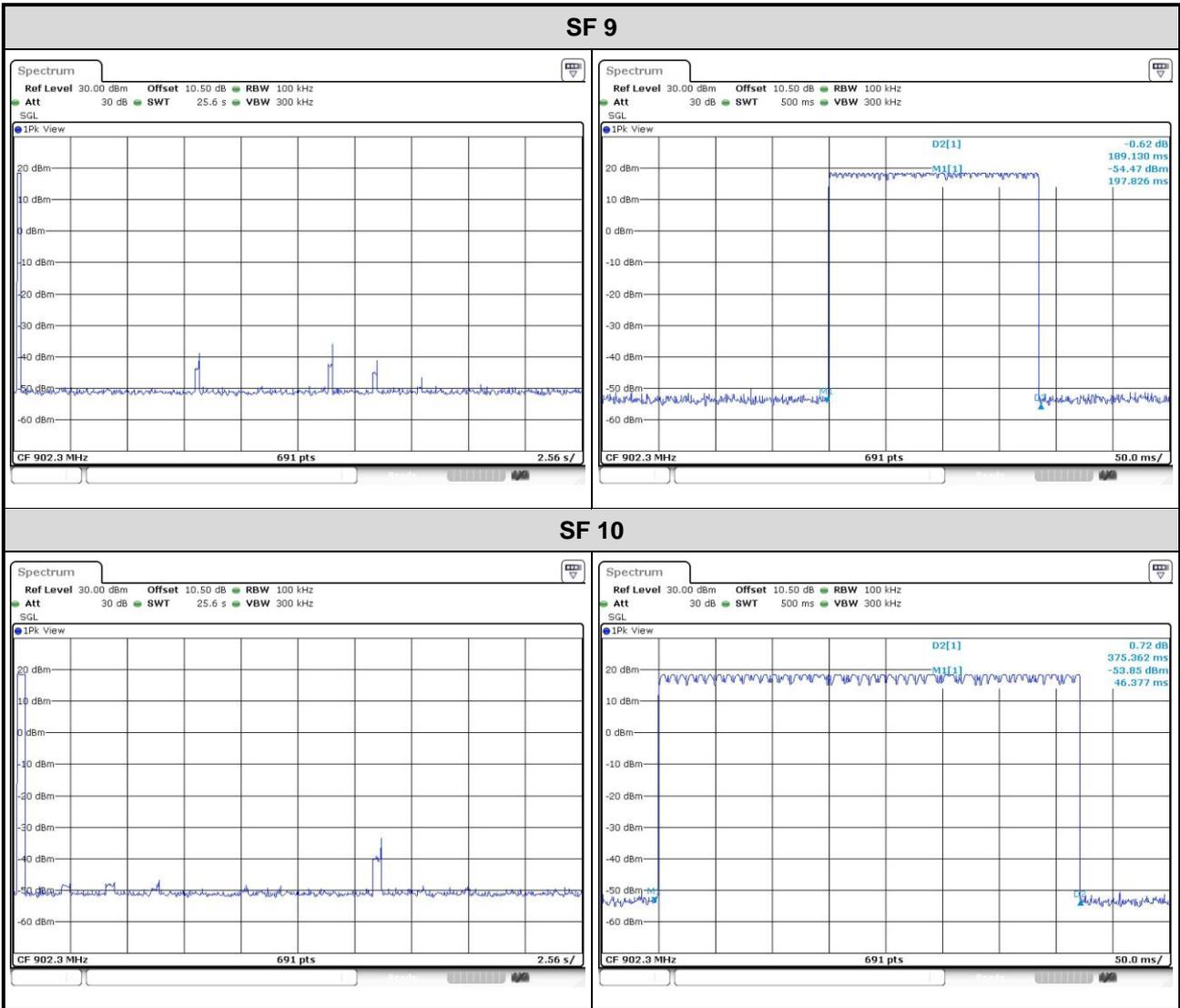
Modulation / SF	Freq. (MHz)	Length of Transmission Time (sec)	Number of Transmission in a 6.4 s (16 Hopping*0.4s)	Result (s)	Limit (s)
CSS / 7	902.3	0.058696	1	0.058696	0.4
CSS / 8	902.3	0.107246	1	0.107246	0.4
CSS / 9	902.3	0.188406	1	0.188406	0.4
CSS / 10	902.3	0.372464	1	0.372464	0.4





Modulation / SF	Freq. (MHz)	Length of Transmission Time (sec)	Number of Transmission in a 25.6 s (64 Hopping*0.4s)	Result (s)	Limit (s)
CSS / 7	902.3	0.058696	1	0.058696	0.4
CSS / 8	902.3	0.106522	1	0.106522	0.4
CSS / 9	902.3	0.189130	1	0.189130	0.4
CSS / 10	902.3	0.375362	1	0.375362	0.4





## 3.9 Power Spectral Density

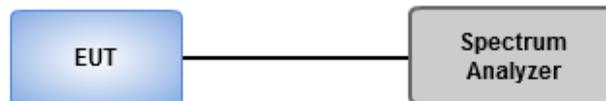
### 3.9.1 Limit of Power Spectral Density

Power spectral density shall not be greater than 8 dBm in any 3 kHz band. This item is for Hybrid mode.

### 3.9.2 Test Procedures

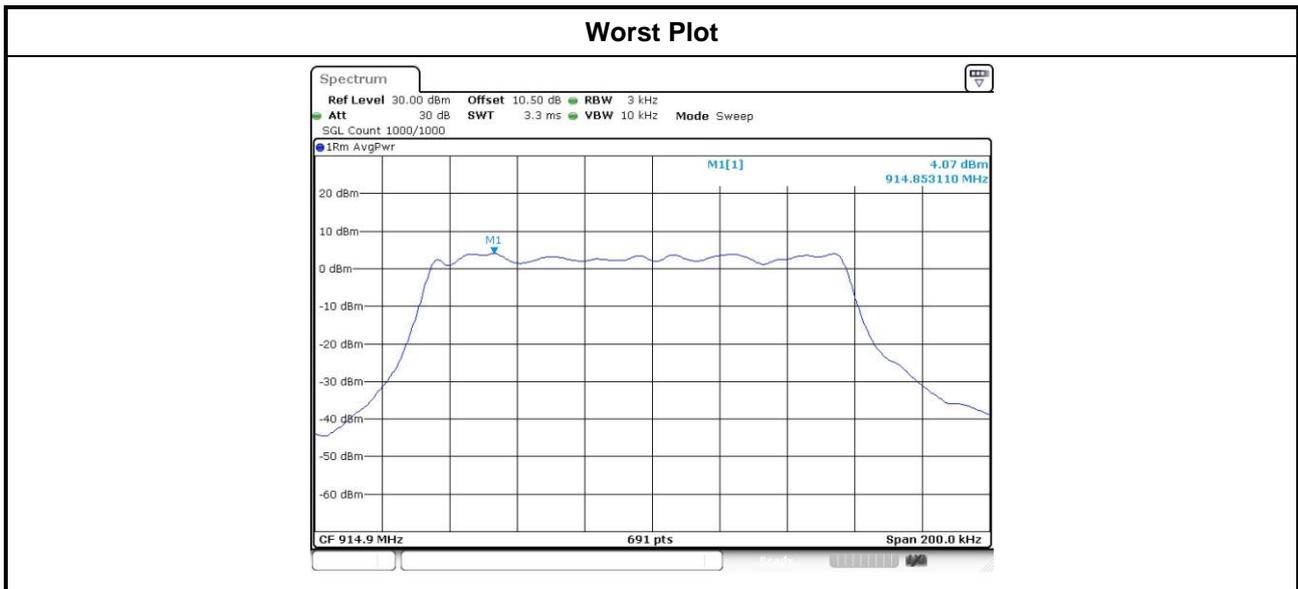
- Maximum peak conducted output power was used to demonstrate compliance to the fundamental output power limit.
  1. Set the RBW = 3kHz, VBW = 10kHz.
  2. Detector = Peak, Sweep time = auto couple.
  3. Trace mode = max hold, allow trace to fully stabilize.
  4. Use the peak marker function to determine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

### 3.9.3 Test Setup



### 3.9.4 Test Result of Power Spectral Density

Modulation / SF	Freq. (MHz)	Total Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
CSS / 10	902.3	3.91	8.00
CSS / 10	908.5	3.97	8.00
CSS / 10	914.9	4.07	8.00



## 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>.

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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.

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==END==