

FCC Test Report

FCC ID : 2ALXW-LCM001915010

Equipment : Gateway Lora

Model No. : LCM001

Brand Name : Liyatech

Applicant : Liyatech Corporation

Address : 20F-8, No.7, Sec. 3, New Taipei Blvd.,

Xinzhuang Dist., New Taipei City, Taiwan

24250

Standard : 47 CFR FCC Part 15.247

Received Date : Jan. 10, 2018

Tested Date : Apr. 12 ~ Apr. 19, 2018

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

Report No.: FR811003 Page: 1 of 41



Table of Contents

1	GENERAL DESCRIPTION	5
1.1	Information	5
1.2	Local Support Equipment List	
1.3	Test Setup Chart	
1.4	The Equipment List	
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	
3.3	RF Output Power	
3.4	Power Spectral Density	19
3.5	Unwanted Emissions into Restricted Frequency Bands	21
3.6	Emissions in Non-Restricted Frequency Bands	39
4	TEST LABORATORY INFORMATION	41



Release Record

Report No.	Version	Description	Issued Date
FR811003	Rev. 01	Initial issue	Jun. 29, 2018

Report No.: FR811003 Page : 3 of 41



Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 0.285MHz 40.96 (Margin -9.70dB) - AV	Pass
15.247(d)	Radiated Emissions	[dBuV/m at 3m]: 2782.50MHz	Pass
15.209	INdulated Lillissions	53.83 (Margin -0.17dB) - AV	r ass
15.247(b)(3)	Maximum Output Power	Max Power [dBm]: 16.23	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

Report No.: FR811003 Page : 4 of 41



1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

	RF General Information						
Frequency Range (MHz)							
902 ~ 928	923.3 ~ 927.5	1-8[8]	980 ~ 21900	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.	Туре	Connector Gain (dBi)		Remark
1	Monopole	SMA Male	2	
2	Dipole	SMA Male	0.41	

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	24Vdc from adapter (Support unit only)
-------------------	---

1.1.4 Accessories

N/A

1.1.5 Channel List

Channel	Frequency(MHz)
1	923.3
2	923.9
3	924.5
4	925.1
5	925.7
6	926.3
7	926.9
8	927.5

Report No.: FR811003 Page : 5 of 41



1.1.6 Test Tool and Duty Cycle

Test Tool	Terminal, version: 3.18.3			
Duty Cycle and Duty Factor	Duty Cycle (%)	Duty Factor (dB)		
Duty Cycle and Duty Factor	100%	0		

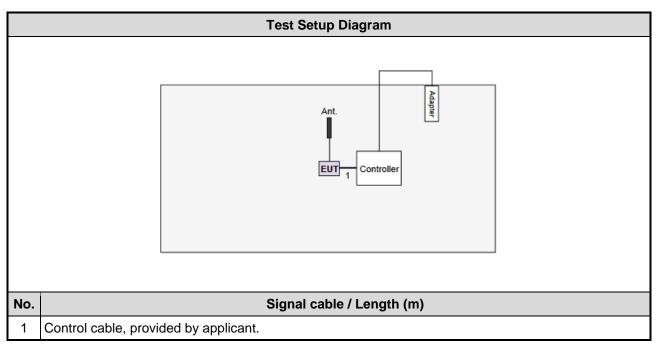
1.1.7 Power Setting

Modulation Mode	Test Frequency (MHz)			
Wodulation Wode	923.3	927.5		
CSS	"pa 3dig 0mix 11	"pa 3dig 0mix 11		

1.2 Local Support Equipment List

	Support Equipment List							
No.	Equipment	FCC ID	Remarks					
1	Adapter	MEAN WELL	GST40A24	DoC	I/P: 100-240Vac, 50/60Hz, 1.0A O/P: 24Vdc, 1.67A, 40W MAX Provided by applicant.			
2	Controller	Matrix	MXE-202i-MI3		Provided by applicant.			

1.3 Test Setup Chart



Report No.: FR811003 Page: 6 of 41



1.4 The Equipment List

Test Item	Conducted Emission							
Test Site	Conduction room 1 /	Conduction room 1 / (CO01-WS)						
Instrument	Manufacturer Model No. Serial No. Calibration Date Calibration Until							
Receiver	R&S	ESR3	101657	Jan. 05, 2018	Jan. 04, 2019			
LISN	SCHWARZBECK	Schwarzbeck 8127	8127-667	Nov. 13, 2017	Nov. 12, 2018			
RF Cable-CON	EMC	EMCCFD300-BM-BM-6000	50821	Dec. 18, 2017	Dec. 17, 2018			
Measurement Software AUDIX e3 6.120210k NA NA NA								
Note: Calibration Interval of instruments listed above is one year.								

Test Item	Radiated Emission						
Test Site	966 chamber1 / (03CH01-WS)						
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until		
Spectrum Analyzer	R&S	FSV40	101498	Dec. 04, 2017	Dec. 03, 2018		
Receiver	R&S	ESR3	101658	Nov. 20, 2017	Nov. 19, 2018		
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. 20, 2017	Dec. 19, 2018		
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 23, 2017	Nov. 22, 2018		
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 13, 2017	Nov. 12, 2018		
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Dec. 07, 2017	Dec. 06, 2018		
Preamplifier	EMC	EMC02325	980225	Jul. 28, 2017	Jul. 27, 2018		
Preamplifier	Agilent	83017A	MY39501308	Oct. 06, 2017	Oct. 05, 2018		
Preamplifier	EMC	EMC184045B	980192	Aug. 22, 2017	Aug. 21, 2018		
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Dec. 07, 2017	Dec. 06, 2018		
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Dec. 07, 2017	Dec. 06, 2018		
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16139/4	Dec. 07, 2017	Dec. 06, 2018		
LF cable 1M	EMC	EMCCFD400-NM-N M-1000	16052	Dec. 07, 2017	Dec. 06, 2018		
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Dec. 07, 2017	Dec. 06, 2018		
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Dec. 07, 2017	Dec. 06, 2018		
Measurement Software	AUDIX	e3	6.120210g	NA	NA		
Note: Calibration Inter	rval of instruments liste	d above is one year.					

Report No.: FR811003 Page: 7 of 41



Test Item	RF Conducted				
Test Site	(TH01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101486	Nov. 21, 2017	Nov. 20, 2018
Power Meter	Anritsu	ML2495A	1241002	Oct. 16, 2017	Oct. 15, 2018
Power Sensor	Anritsu	MA2411B	1207366	Oct. 16, 2017	Oct. 15, 2018
AC POWER SOURCE	APC	AFC-500W	F312060012	Dec. 01, 2017	Nov. 30, 2018
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA
Note: Calibration Inte	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	±3.66 dB			
Radiated emission > 1GHz	±5.63 dB			

Report No.: FR811003 Page: 8 of 41



2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	22°C / 59%	Alex Tsai
Radiated Emissions	03CH01-WS	22-25°C / 62%	Akun Chung
RF Conducted	TH01-WS	22°C / 64%	Brad Wu

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	Test Configuration
Conducted Emissions Maximum Output Power 6dB Bandwidth Power Spectral Density	923.3 / 927.5	500	CSS / 12	1
Radiated Emissions ≤1GHz Radiated Emissions >1GHz	923.3 / 927.5	500	CSS / 12	1, 2

Note:

Test Configuration 1: with Monopole ANT Test Configuration 2: with Dipole ANT

Report No.: FR811003 Page: 9 of 41

^{1.} The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The **Y-plane** results were found as the worst case and were shown in this report.

^{2.} Two types antenna was selected to perform radiated emission test that listed as below configuration.



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



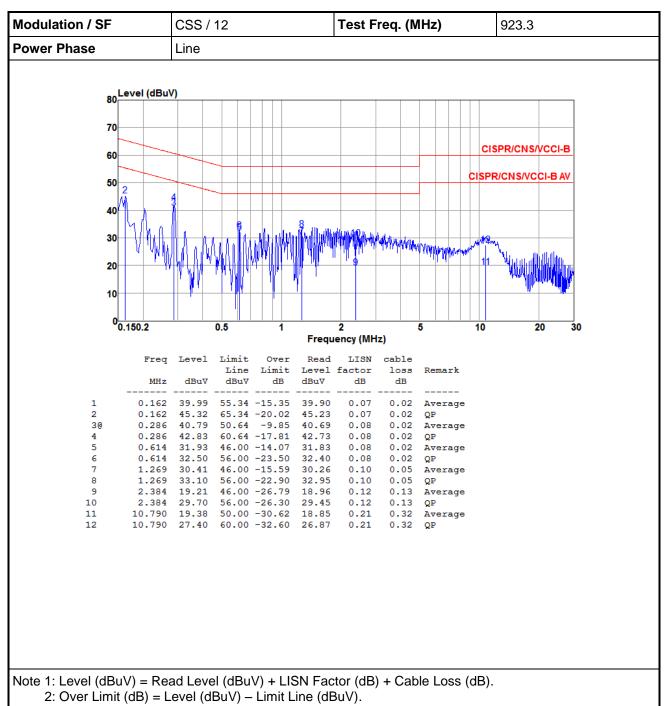
Note: 1. Support units were connected to second LISN.

Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

Report No.: FR811003 Page: 10 of 41

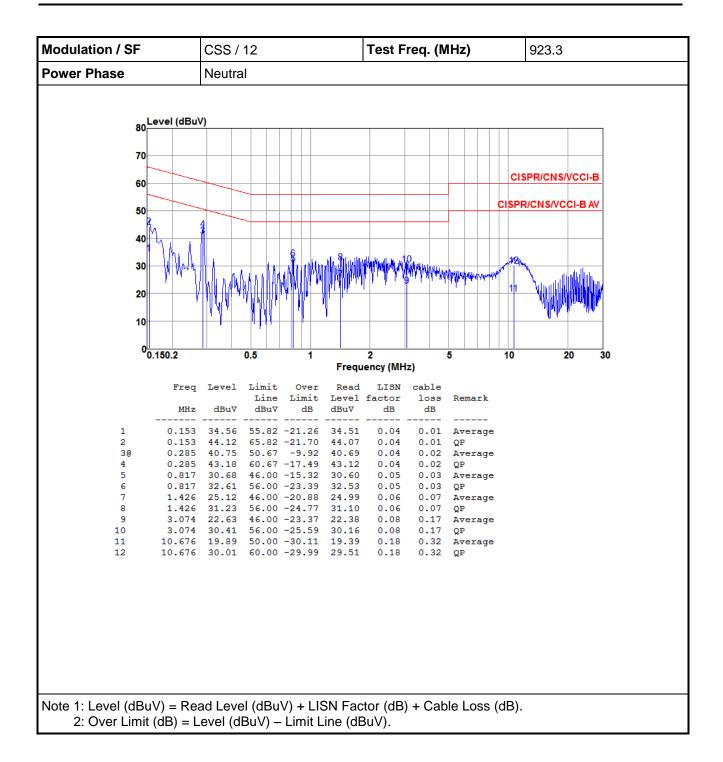


3.1.4 Test Result of Conducted Emissions



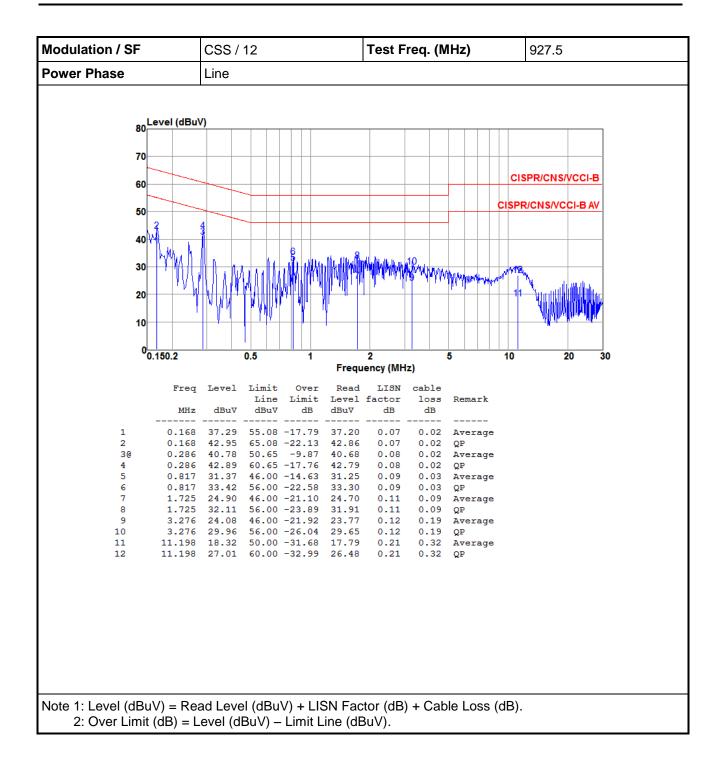
Report No.: FR811003 Page: 11 of 41





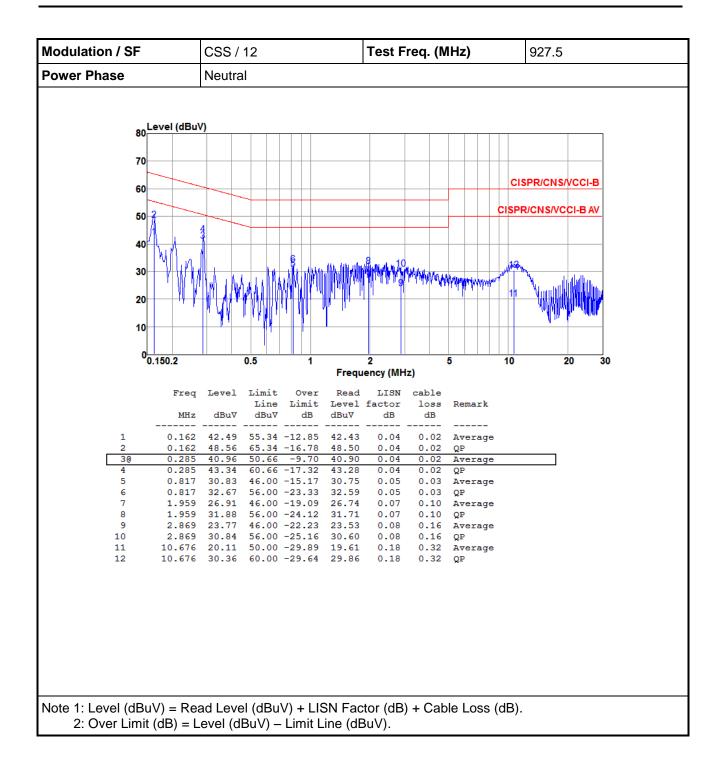
Report No.: FR811003 Page: 12 of 41





Report No.: FR811003 Page: 13 of 41





Report No.: FR811003 Page: 14 of 41



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

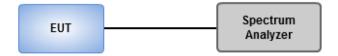
6dB Bandwidth

- 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

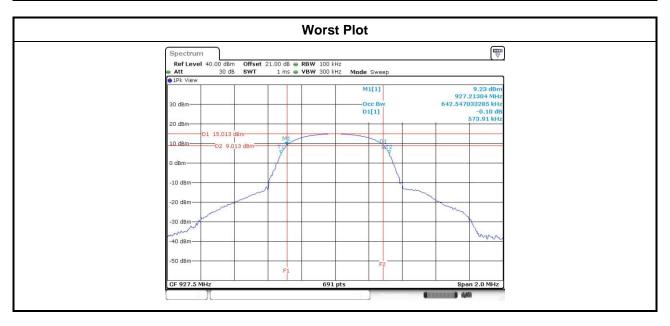


Report No.: FR811003 Page: 15 of 41



3.2.4 Test Result of 6dB and Occupied Bandwidth

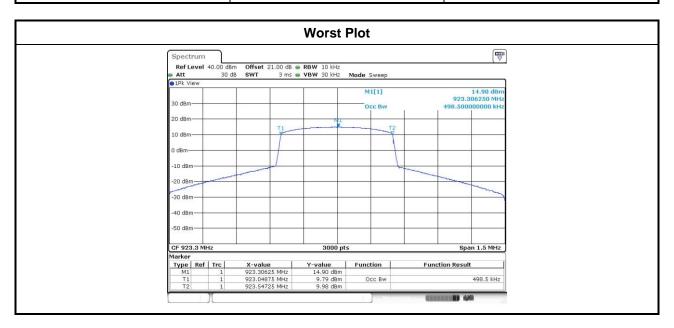
Modulation / SF	Freq. (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
CSS / 12	923.3	0.577	0.5
CSS / 12	927.5	0.574	0.5



Report No.: FR811003 Page: 16 of 41



Modulation / SF	Freq. (MHz)	99% Occupied Bandwidth (MHz)
CSS / 12	923.3	0.499
CSS / 12	927.5	0.499



Report No.: FR811003 Page: 17 of 41



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

A broadband 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	923.3	41.976	16.23	30
CSS / 12	927.5	40.551	16.08	30

Report No.: FR811003 Page: 18 of 41



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

Peak PSD

- 1. Set the RBW = 3 kHz, VBW = 10 kHz.
- 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.

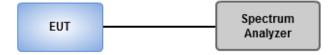
Average PSD, duty cycle ≥ 98%

- 1. Set the RBW = 3 kHz, VBW = 10 kHz.
- 2. Detector = RMS, Sweep time = auto couple.
- 3. Sweep time = auto couple.
- 4. Employ trace averaging (RMS) mode over a minimum of 100 traces.
- 5. Use the peak marker function to determine the maximum amplitude level.

Average PSD, duty cycle < 98%

- 1 Set the RBW = 3 kHz, VBW = 10 kHz. Detector = RMS.
- Set the sweep time to: \geq 10 (number of measurement points in sweep) x (total on/off period of the transmitted signal).
- 3 Perform the measurement over a single sweep.
- 4 Use the peak marker function to determine the maximum amplitude level.
- 5 Add 10 log (1/x), where x is the duty cycle.

3.4.3 Test Setup

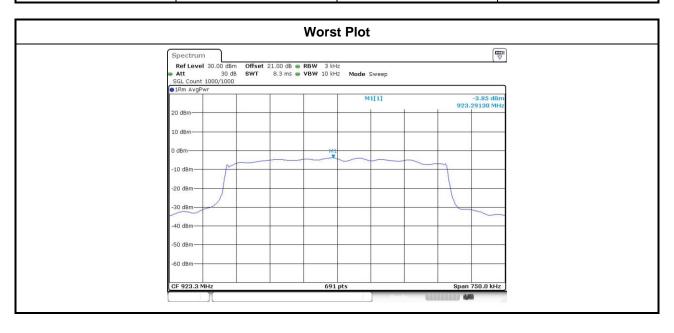


Report No.: FR811003 Page: 19 of 41



3.4.4 Test Result of Power Spectral Density

Modulation / SF	Freq. (MHz)	Total Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
CSS / 12	923.3	-3.85	8.00
CSS / 12	927.5	-4.56	8.00



Report No.: FR811003 Page: 20 of 41



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.

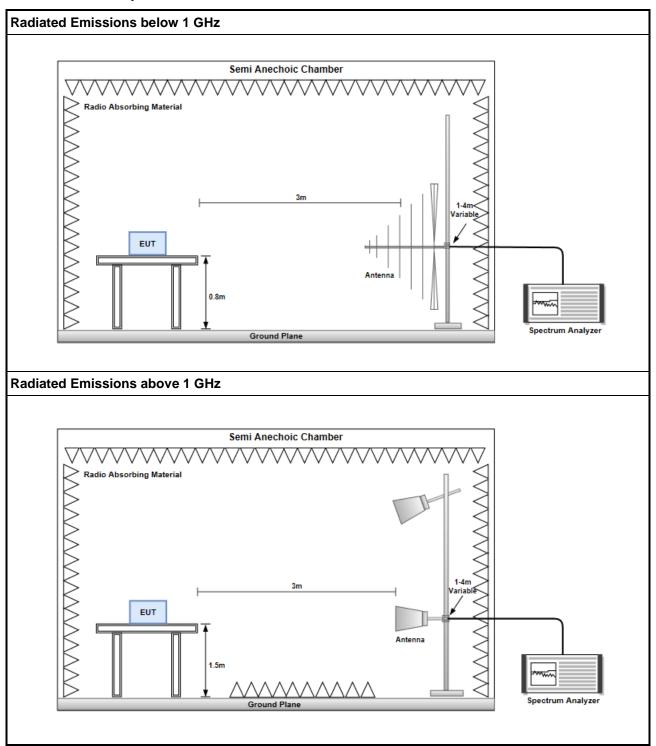
Note:

- 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.
- RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above 1GHz.

Report No.: FR811003 Page: 21 of 41



3.5.3 Test Setup

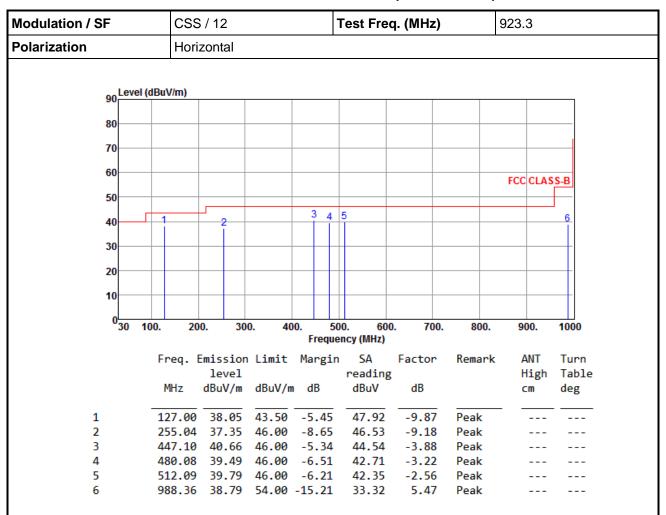


Report No.: FR811003 Page: 22 of 41



Configuration 1: with Monopole ANT

3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)



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

*Factor includes antenna factor, cable loss and amplifier gain

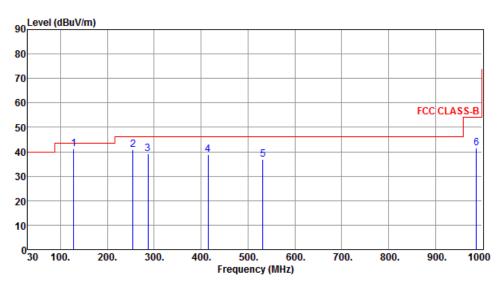
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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

Report No.: FR811003 Page: 23 of 41



Modulation / SF	CSS / 12	Test Freq. (MHz)	923.3
Polarization	Vertical		



	Freq.	Emission level	Limit	Margin	SA reading		Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	120 01	41 14	42 50	2.26	- O1	0.77	<u></u>	100	127
1	120.01	41.14	43.50	-2.30	50.91	-9.77	QP	100	127
2	255.04	40.85	46.00	-5.15	50.03	-9.18	Peak		
3	287.05	39.25	46.00	-6.75	47.17	-7.92	Peak		
4	415.09	38.72	46.00	-7.28	43.32	-4.60	Peak		
5	531.49	36.78	46.00	-9.22	38.92	-2.14	Peak		
6	987.39	41.57	54.00	-12.43	36.11	5.46	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.

Report No.: FR811003 Page: 24 of 41



Modulation / SF			CSS	/ 12					T	est Fre	q. (MH	z)		927.	5	
Polarization			Hori	zonta	l									•		
-	Leve	el (dBu\	V/m)													
90)	Ì														
80	—				_				+			-				
7/																
70	,								\top							
60) <u> </u>				+				+			-		ECC	CLAS	e D
50	_													100	CLAS	3-6
30	1				_			3 4	. !	5						اړا
40	—			- 2	+			T	+	Ĭ						-
30	<u> </u>				_				4			_				
20)				\top				\dagger							
10	—				+				+			-				
'	30	100.	20	0.	300). 40			50(0. 60 ncy (MHz)	0. 7	00.	800.	90	00.	1000
		E.		micc	ion	limi+				SA	Facto		Remark		NT	Turn
			eq. ı	leve		CIMIT	rid	. gı		reading			Kellidi'i		ligh	Table
		M	ИHz			dBuV/m	d	В		dBuV	dB				:m	deg
					_							_				
1						43.50					-28.3		Peak			
2						46.00		.31		66.09			Peak			
4						46.00 46.00					-28.2 -28.2		Peak Peak			
-						46.00					20.2		DI-			

512.37 40.14 46.00 -5.86 68.35 -28.21 988.35 38.89 54.00 -15.11 66.37 -27.48

Peak

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.

Report No.: FR811003 Page: 25 of 41

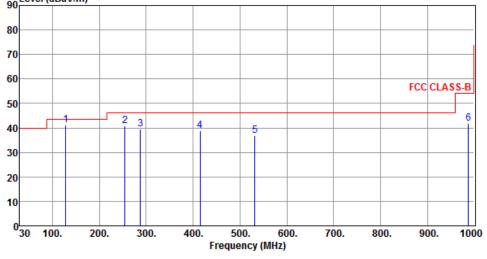
Report Version: Rev. 01

5

6



Modulation / SF	CSS / 12	•	Test Fre	eq. (MHz	z)	927.	5	
Polarization	Vertical							
	·							
oo Lev	el (dBuV/m)							
80								



	Freq.	Emission level	Limit	Margin	SA reading		Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	127.89	41.23	43.50	-2.27	69.56	-28.33	QP	100	129
2	254.92	40.94	46.00	-5.06	69.34	-28.40	Peak		
3	287.54	39.53	46.00	-6.47	67.94	-28.41	Peak		
4	415.29	38.89	46.00	-7.11	67.19	-28.30	Peak		
5	531.78	36.89	46.00	-9.11	65.09	-28.20	Peak		
6	987.58	42.00	54.00	-12.00	69.48	-27.48	Peak		

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

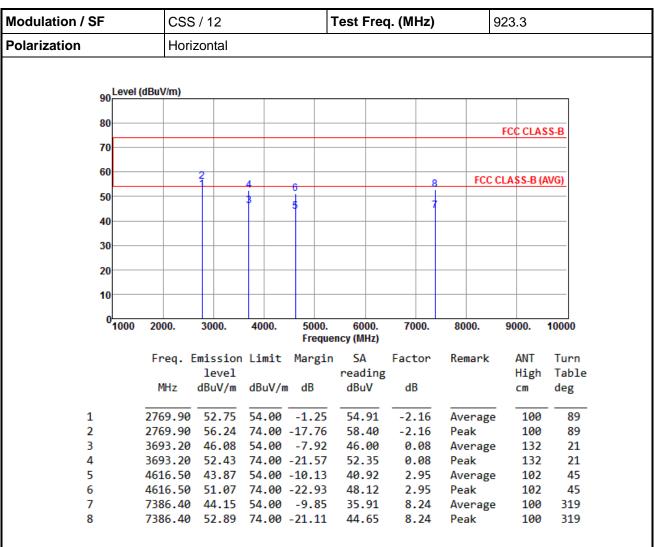
*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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

Report No.: FR811003 Page: 26 of 41



3.5.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)



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).

Report No.: FR811003 Page: 27 of 41



Modulation / SF	CSS	5/12		7	Test Free	q. (MHz)		923.3	
Polarization	Verti	ical							
	•								
90 Level ((BuV/m)								
90									
80									
								FCC CLAS	SS-B
70									
60		2							
		1	4	6		8	FCC	CLASS-B (AVG)
50			3	Ĭ					
40				3					
30									
20									
10									
0 <mark></mark>	2000.	3000.	4000.	5000.	6000.	7000.	8000.	9000.	10000
				Freque	ncy (MHz)				
	Freq. E	Emission	Limit	Margin	SA	Factor	Remark	ANT	Turn
		level			reading			High	
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2769.90	52.64	54.00	-1.36	54.80	-2.16	Average	262	213
2	2769.90				58.18	-2.16	Peak	262	
3	3693.20	43.62	54.00	-10.38	43.54	0.08	Average	107	297
4	3693.20				50.07	0.08	Peak	107	
	4616.50				39.05	2.95	Average		
6	4616.50			-24.17	46.88	2.95	Peak	100	

42.65

45.68

Average

Peak

261

261

177

177

8.24

8.24

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

7386.40 50.89 54.00 -3.11

7386.40 53.92 74.00 -20.08

*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

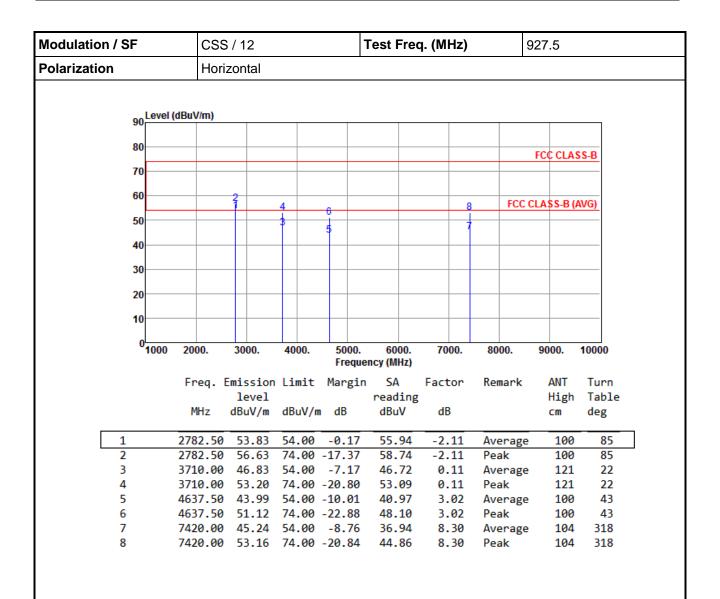
Report No.: FR811003 Page: 28 of 41

Report Version: Rev. 01

7

8





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).

Report No.: FR811003 Page: 29 of 41



Modulation / SF	=	CSS	/ 12		-	Test Fred	q. (MHz)		927.5	
Polarization		Verti	cal		•			•		
!	90 Level	(dBuV/m)								
	80									
									FCC CLAS	S-B
	70									
1	60		2				8	ECC	CLASS-B (A	WG
	50			4	6			100	CLA33-D (A	
				3	5		1			
•	40									
:	30									
	20									
	10									
	0 1000	2000.	3000.	4000.	5000.	6000.	7000.	8000.	9000.	10000
					Freque	ncy (MHz)				
		Freq. E	mission	Limit	Margin		Factor	Remark	ANT	Turn
		MHz	level dBuV/m	dRuV/r	n dB	reading dBuV	dB		High cm	Table deg
		1112	ubuv/III	ubuv/i	ıı ub	abav	ub		CIII	ueg
1		2782.50			-0.94	55.17	-2.11	Average		214
2		2782.50			-17.54	58.57	-2.11	Peak	250	214
3		3710.00			-11.01	42.88	0.11	Average		295
4 5		3710.00 4637.50			-24.27 -10.66	49.62 40.32	0.11 3.02	Peak Average	103	295 9
6		4637.50			-22.91	48.07	3.02	Peak	100	9
7		7420.00			-7.92	37.78	8.30	Average		175
,										

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

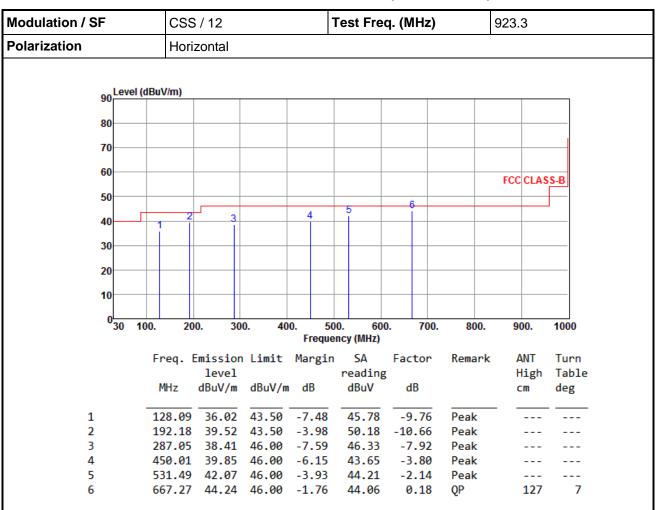
*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Report No.: FR811003 Page: 30 of 41



Configuration 2: with Dipole ANT

3.5.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)



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.

Report No.: FR811003 Page: 31 of 41



	CSS / 12	Test Freq. (MHz)	923.3
Polarization	Vertical	•	•
90 Level	l (dBuV/m)		
80			
70			
60			FCC CLASS-B
50			
40	1 2 3 4	5 6	
30			
20			
10			
030	100. 200. 300. 400.	500. 600. 700. 8	00. 900. 1000
30	100. 200. 300. 400.	Frequency (MHz)	00. 000. 1000
	Freq. Emission Limit M		
	level MHz dBuV/m dBuV/m	reading dB dBuV dB	High Tabl cm deg

49.40

47.25

50.78

48.06

42.47

41.80

-9.76

-8.20

-10.66

-7.92

-3.22

0.20

QP

QP

Peak

Peak

Peak

Peak

100

100

170

156

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).

128.09

160.05

2

3

4

5

6

39.64 43.50 -3.86

39.05 43.50 -4.45

192.18 40.12 43.50 -3.38

287.05 40.14 46.00 -5.86

480.08 39.25 46.00 -6.75

668.26 42.00 46.00 -4.00

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

Report No.: FR811003 Page: 32 of 41



Modulation /	SF		CSS	/ 12				Те	st Fre	q. (M	Hz)		927.	5	
Polarization			Horiz	zonta	al								•		
			•												
	90 Lev	vel (dBu	ıV/m)												
	80							+							
	70							_							
	60												FCC	CLAS	S-B
	50				\rightarrow			+		-					
	40		1		, 3		4		5						
	40			2	ĭ										
	30				+			+							
	20														
	10														
	030	100.	20	0.	30	0. 40	00.	500.	60	0.	700.	800.	9	00.	1000
							Freq	uenc	y (MHz)						
		F	req. E	miss	ion	Limit	Margi	n	SA	Fac	tor	Remark	c /	ANT	Turn
				lev					eading					ligh	Table
			MHz	dBu\	//m	dBuV/n	n dB		dBuV	dl	В		(_m	deg
	1	1	92.96	39	48	43.50	-4 03		50.15	-10	67	Peak			
	2		56.01	35.		46.00			44.80		.15	Peak			
	3		88.02	37.		46.00	-8.93		44.97		.90	Peak			
4	4	4	79.20	40.	86	46.00	-5.14	ļ	44.09	-3	. 23	Peak			
	5		31.20		.93	46.00	-4.07		44.08		.15	Peak			
•	6	6	71.36	44.	65	46.00	-1.35	5	44.39	0	. 26	QP		128	358

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.

Report No.: FR811003 Page: 33 of 41



Modulation / SF	CSS	/ 12		-	Test Fre	q. (MHz)		927.5	
Polarization	Verti	cal		•					
90 Leve	el (dBuV/m)								
80									
70									
60									
00								FCC CLA	SS-B
50									
40	1 2 3	4		5		6			
30									
30									
20									
10									
0									
030	100. 200	0. 30	0. 40		00. 600 ency (MHz)	0. 700.	800.	900.	1000
	Freq. E	mission	Limit	Margin	SA	Factor	Remark	ANT	Turn
		level			reading	;		High	Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	128.09	39 77	43 50	-3 73	49.53	-9.76	OP	100	166
2	160.05		43.50	-4.55	47.15	-8.20	үг Peak		
3	192.18				50.76		QP	100	163
4	288.00			-5.41	48.49		Peak		
5	449.60	38.55	46.00	-7.45	42.37	-3.82	Peak		

0.27

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).

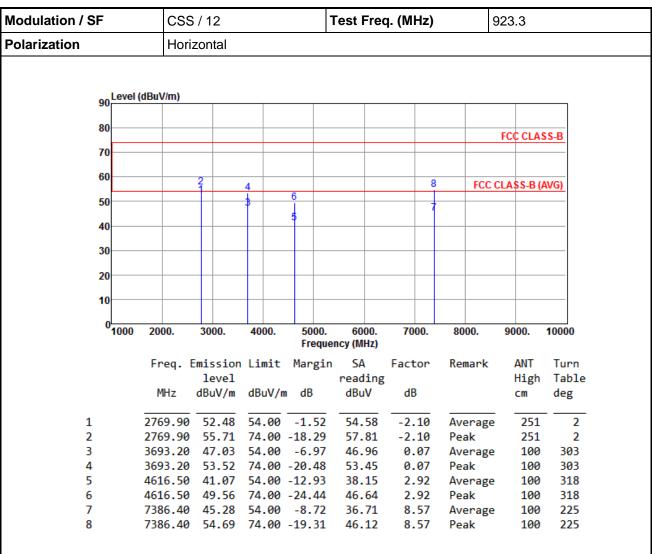
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

672.00 42.31 46.00 -3.69 42.04

Report No.: FR811003 Page: 34 of 41



3.5.7 Transmitter Radiated Unwanted Emissions (Above 1GHz)



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

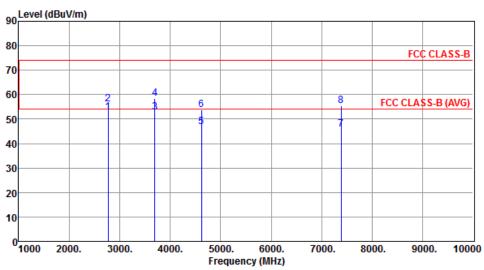
*Factor includes antenna factor, cable loss and amplifier gain

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

Report No.: FR811003 Page: 35 of 41



Modulation / SF	CSS / 12	Test Freq. (MHz)	923.3
Polarization	Vertical		



				rreque	icy (miliz)				
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2769.90	52.88	54.00	-1.12	54.98	-2.10	Average	375	86
2	2769.90	55.97	74.00	-18.03	58.07	-2.10	Peak	375	86
3	3693.20	52.73	54.00	-1.27	52.66	0.07	Average	328	89
4	3693.20	58.31	74.00	-15.69	58.24	0.07	Peak	328	89
5	4616.50	46.89	54.00	-7.11	43.97	2.92	Average	258	98
6	4616.50	53.94	74.00	-20.06	51.02	2.92	Peak	258	98
7	7386.40	45.87	54.00	-8.13	37.30	8.57	Average	253	119
8	7386.40	55.49	74.00	-18.51	46.92	8.57	Peak	253	119

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).

Report No.: FR811003 Page: 36 of 41



Modulation /	SF	CSS	/ 12		-	Test Fred	q. (MHz)		927.5	
Polarization		Hori	zontal							
	90 Level	(dBuV/m)								
	80								FCC CLAS	SS-B
	70									
	60		_							
			7	4	6		8	FCC	CLASS-B (A	AVG)
	50			3	Ĭ		7			
	40				5					
	30									
	30									
	20									
	10									
	⁰ 1000	2000.	3000.	4000.	5000. Freque	6000. ncy (MHz)	7000.	8000.	9000.	10000
		Freg. F	mission	limit	Margin		Factor	Remark	ANT	Tur
			level	Limit	riai gan	reading		ricinal it	High	Tab
		MHz	dBuV/m	dBuV/r	n dB	dBuV	dB		cm	deg
	1	2782.50	52.14	54.00	-1.86	54.19	-2.05	Average	218	
	2	2782.50			-18.76	57.29	-2.05	Peak	218	
	3	3710.00		54.00	-6.87	47.02	0.11	Average	100	30
	4	3710.00	52.51	74.00	-21.49	52.40	0.11	Peak	100	30
	5	4637.50	40.78		-13.22	37.79	2.99	Average	100	31
	6	4637.50			-24.28	46.73	2.99	Peak	100	31
	7	7420.00	45.74	54.00	-8.26	37.11	8.63	Average	100	22

45.39

Peak

100

222

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

7420.00 54.02 74.00 -19.98

*Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Report No.: FR811003 Page: 37 of 41

Report Version: Rev. 01

8



Modulation / SF	CSS / 12		Test Freq	. (MHz)	92	27.5	
Polarization	Vertical						
90 Level (dE	BuV/m)						
90							
80						CC CL A	
70						CC CLAS	22-B
70							
60	2	4		8	FCC CL	ASS-B (AVG)
50		3 1					
40		5		1			
40							
30							
20							
10							
0 1000	2000. 3000.	4000. 5000	. 6000.	7000.	8000.	9000.	10000
1000	2000. 3000.		uency (MHz)	7000.	0000.	3000.	10000
	Freq. Emission	Limit Margi	in SA	Factor	Remark	ANT	Turn
	level		reading			High	Table
	MHz dBuV/m	dBuV/m dB	dBuV	dB		cm	deg
1 2	782.50 53.18	54.00 -0.82	55.23	-2.05	Average	368	94
	782.50 56.60	74.00 -17.40		-2.05	Peak	368	94
	710.00 51.20	54.00 -2.80		0.11	Average	345	63
4 3	710.00 56.95	74.00 -17.05	56.84	0.11	Peak	345	63
5 4	637.50 44.31	54.00 -9.69	41.32	2.99	Average	246	112
6 4	637.50 52.18	74.00 -21.82	49.19	2.99	Peak	246	112
7 7	420.00 46.20	54.00 -7.86	37.57	8.63	Average	261	105
8 7	420.00 55.44	74.00 -18.56		8.63	Peak	261	105

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).

Report No.: FR811003 Page: 38 of 41



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 Test Procedures

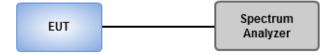
Reference level measurement

- 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 25GHz
- 4. Use the peak marker function to determine the maximum amplitude level

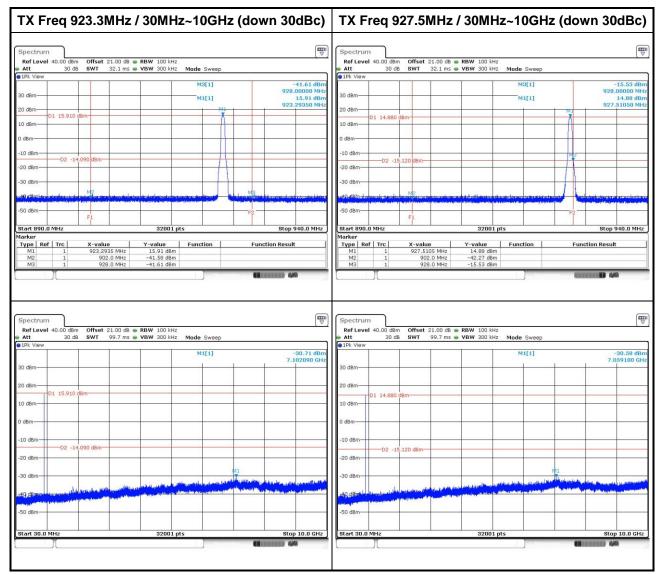
3.6.3 Test Setup



Report No.: FR811003 Page: 39 of 41



3.6.4 Unwanted Emissions into Non-Restricted Frequency Bands



Report No.: FR811003 Page: 40 of 41



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==

Report No.: FR811003 Page: 41 of 41