FCC Test Report

FCC ID	:	**2AIHD1041**
Equipment	:	**HW-IG41**
Model No.	:	**010-1041**
Brand Name	:	**Samsara**
Applicant	:	**Samsara Networks Inc.**
Address	:	**1990 Alameda Street, San Francisco, CA 94103, United States**
Standard	:	**47 CFR FCC Part 15.247**
Received Date	:	**Sep. 01, 2020**
Tested Date	:	**Sep. 24 ~ Sep. 30, 2020**

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

Release Record

Report No.	Version	Description	Issued Date
FR090103	Rev. 01	Initial issue	Oct. 20, 2020

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 0.853MHz 37.93 (Margin -8.07dB) - AV	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 125.16MHz 42.13 (Margin -1.37dB) - QP	Pass
15.247(b)(3)	Maximum Output Power	Max Power [dBm]: 23.75	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

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information					
Frequency Range (MHz)	**Ch. Frequency (MHz)**	**Channel Number**	**Physical bit rate (bit/sec)**	**Spread Factor**	**Channel Spacing (kHz)**
902 ~ 928	923.3 ~ 927.5	0 ~ 7 [8]	980 ~ 21900	12 ~ 7	500
Note 1: RF output power specifies thatMaximum Conducted (Average) Output Power. Note 2: The device uses CSS modulation.					

1.1.2 Antenna Details

Ant. No.	Model	Type	Connector	Ant. gain with cable loss (dBi)	Ant. gain (dBi)	Cable loss (dB)
1	Individual antenna (OA-LR-05-01-C5-SE)	Dipole	SMA PLUG	0.7	0.7	-
2	Array antenna (OS-PENTA-014-01-SA	PIFA	SMA PLUG	2.3	3.5	1.2

Note: The antenna assembly includes Array antenna and Individual antenna.

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	24Vdc from DC power

Note: The above power supply is not bundled in market.

1.1.4 Accessories

N/A

1.1.5 Channel List

Frequency Band (MHz)		902 ~928	
Channel	**Frequency(MHz)**	**Channel**	**Frequency(MHz)**
0	923.3	4	925.7
1	923.9	5	926.3
2	924.5	6	926.9
3	925.1	7	927.5

1.1.6 Test Tool and Duty Cycle

Test Tool	Putty command, V0.6	
Duty Cycle and Duty Factor	**Duty Cycle (%)**	**Duty Factor (dB)**
	100.00%	0.00

1.1.7 Power Index of Test Tool

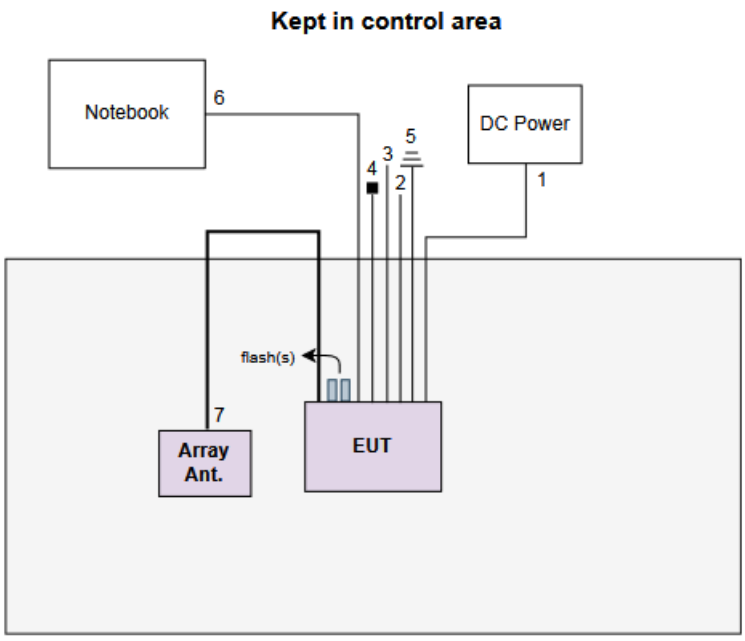
Modulation Mode	Test Frequency (MHz)	Power Index
CSS	923.3	pa 1 --pwid 22
CSS	927.5	pa 1 --pwid 22

1.2 Local Support Equipment List

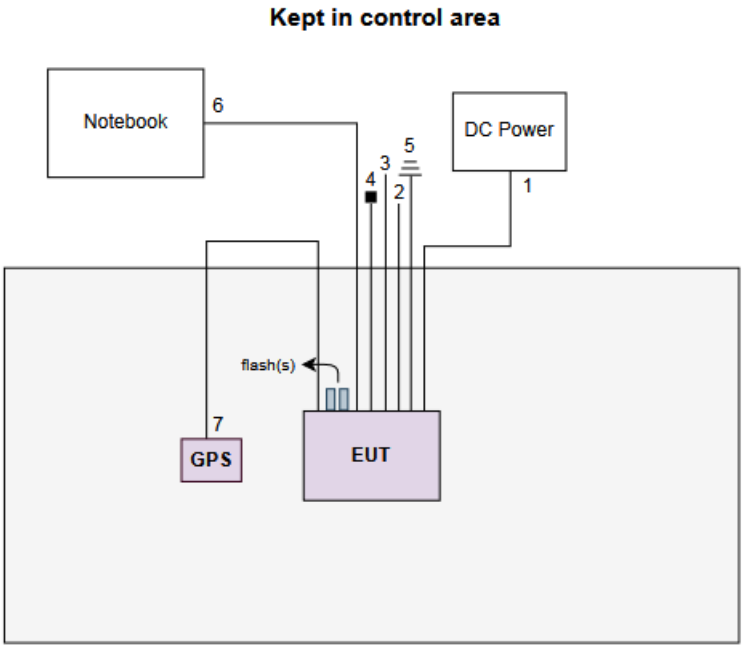
Support Equipment List					
No.	**Equipment**	**Brand**	**Model**	**FCC ID**	**Remarks**
1	Notebook	DELL	Latitude E5400	DoC	---
2	USB Flash	Kingston	DTSE9	---	---
3	USB Flash	Kingston	DTSE9	---	---
4	RJ45 Load	ICC	---	---	---
5	DC power	MEAN WELL	SDR-75-24	---	Provided by applicant.

1.3 Test Setup Chart

Test Setup Diagram (Array antenna)



No.	Signal cable / Length (m)
1	DC cable, 10m(x2) non-shielded.
2	Data cable, 1.55m, unterminated. (Provided by applicant.)
3	Console cable, 1.75m shielded, unterminated. (Provided by applicant.)
4	RJ45, 1.3m non-shielded with load.
5	Ground cable, 2.3m non-shielded.
6	RJ45, 10m non-shielded.
7	RF cable, 1.5m(x5) shielded.

Test Setup Diagram (Individual antenna)


No.	Signal cable / Length (m)
1	DC cable, 10m(x2) non-shielded.
2	Data cable, 1.55m, unterminated. (Provided by applicant.)
3	Console cable, 1.75m shielded, unterminated. (Provided by applicant.)
4	RJ45, 1.3m non-shielded with load.
5	Ground cable, 2.3m non-shielded.
6	RJ45, 10m non-shielded.
7	RF cable, 1.5m shielded.

1.4 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Tested Date	Sep. 30, 2020				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Receiver	R&S	ESR3	101658	Dec. 12, 2019	Dec. 11, 2020
LISN	R&S	ENV216	101579	Mar. 12, 2020	Mar. 11, 2021
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 22, 2019	Oct. 21, 2020
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)				
Tested Date	Sep. 24 ~ Sep. 25, 2020				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	R&S	FSV40	101499	Jan. 09, 2020	Jan. 08, 2021
Receiver	R&S	ESR3	101657	Feb. 14, 2020	Feb. 13, 2021
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-685	Apr. 29, 2020	Apr. 28, 2021
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1206	Dec. 27, 2019	Dec. 26, 2020
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 15, 2019	Nov. 14, 2020
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 13, 2019	Nov. 12, 2020
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 07, 2019	Oct. 06, 2020
Preamplifier	EMC	EMC02325	980187	Aug. 05, 2020	Aug. 04, 2021
Preamplifier	Agilent	83017A	MY39501309	Sep. 02, 2020	Sep. 01, 2021
Preamplifier	EMC	EMC184045B	980192	Jul. 21, 2020	Jul. 20, 2021
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22620/4	Sep. 27, 2019	Sep. 26, 2020
RF cable-8M	EMC	EMC104-SM-SM-8000	181107	Sep. 27, 2019	Sep. 26, 2020
RF cable-1M	HUBER+SUHNER	SUCOFLEX104	MY22624/4	Sep. 27, 2019	Sep. 26, 2020
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800 -001	Sep. 27, 2019	Sep. 26, 2020
LF cable-3M	EMC	EMC8D-NM-NM-3000	131103	Sep. 27, 2019	Sep. 26, 2020
LF cable-13M	EMC	EMC8D-NM-NM-13000	131104	Sep. 27, 2019	Sep. 26, 2020
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)				
Tested Date	Sep. 29, 2020				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	R&S	FSV40	101063	Apr. 30, 2020	Apr. 29, 2021
Power Meter	Anritsu	ML2495A	1241002	Oct. 23, 2019	Oct. 22, 2020
Power Sensor	Anritsu	MA2411B	1207366	Oct. 23, 2019	Oct. 22, 2020
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

1.5 Test Standards

47 CFR FCC Part 15.247
ANSI C63.10-2013

1.6 Reference Guidance

FCC KDB 558074 D01 15.247 Meas Guidance v05r02

1.7 Deviation from Test Standard and Measurement Procedure

None

1.8 Measurement Uncertainty

The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)).

Measurement Uncertainty	
Parameters	**Uncertainty**
Bandwidth	±34.130 Hz
Conducted power	±0.808 dB
Power density	±0.583 dB
Conducted emission	±2.715 dB
AC conducted emission	±2.92 dB
Radiated emission ≤ 1GHz	±3.96 dB
Radiated emission > 1GHz	±4.51 dB

2 Test Configuration

2.1 Testing Facility

Test Laboratory	International Certification Corp.
Test Site	CO01-WS, TH01-WS
Address of Test Site	No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.
Test Site	03CH03-WS
Address of Test Site	No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

- FCC Designation No.: TW0009
- FCC site registration No.: 207696
- ISED#: 10807A
- CAB identifier: TW2732

2.2 The Worst Test Modes and Channel Details

Test item	Modulation Mode	Test Frequency (MHz)	Separating Factor	Test Configuration
Conducted Emissions Maximum Output Power 6dB bandwidth Power spectral density	CSS	923.3 / 927.5	SF12	1
Radiated Emissions ≤1GHz Radiated Emissions >1GHz	CSS	923.3 / 927.5	SF12	1, 2

NOTE:

1. The antenna assembly includes Array antenna and Individual antenna.
   - Individual antenna without antenna cable.
   - Array antenna with antenna cable and need to be assessed 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.
2. Test configurations are listed as below:
   1) Configuration 1: Array antenna with antenna cable, Z-plane
   2) Configuration 2: Individual antenna

3 Transmitter Test Results

3.1 Conducted Emissions

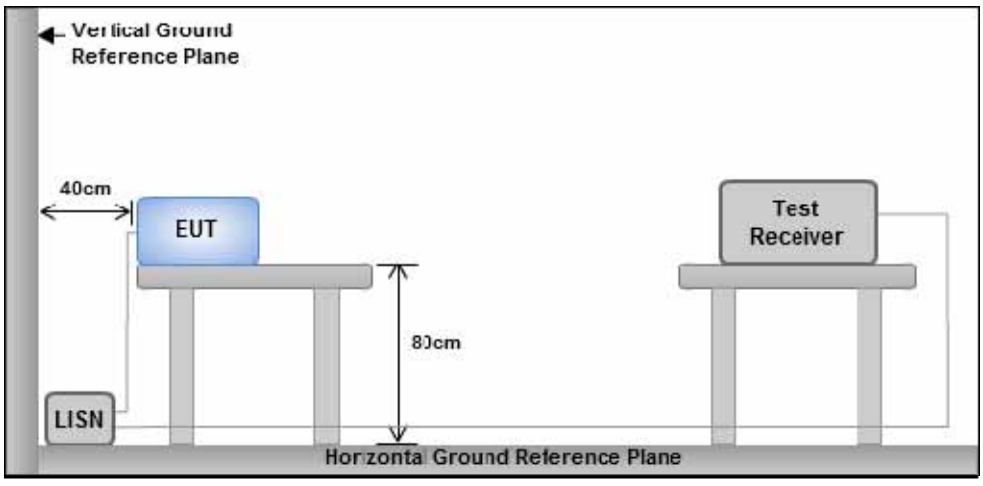
3.1.1 Limit of Conducted Emissions

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



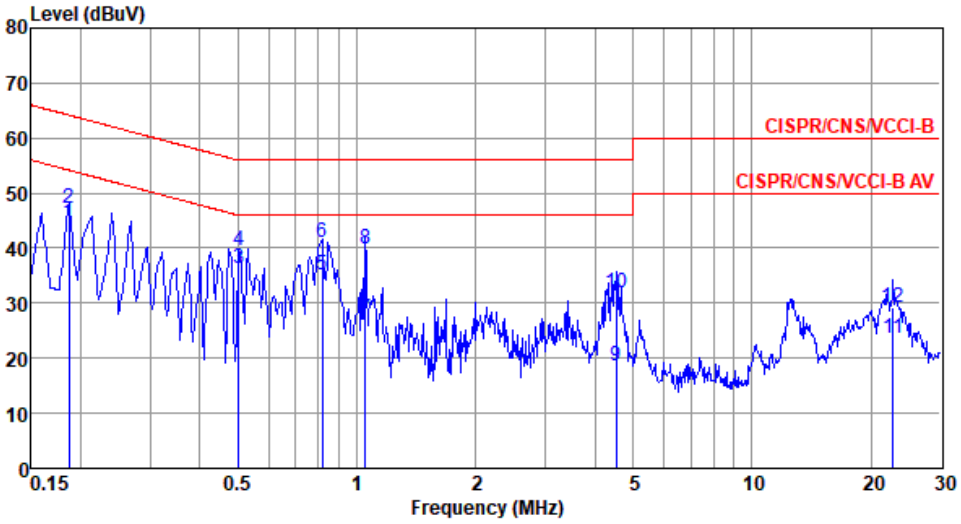
Note: 1. Support units were connected to second LISN.

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	CSS	Test Freq. (MHz)	923.3
Power Phase	Line		

Test by : Alex Tsai Temperature: 22°C Humidity: 56%

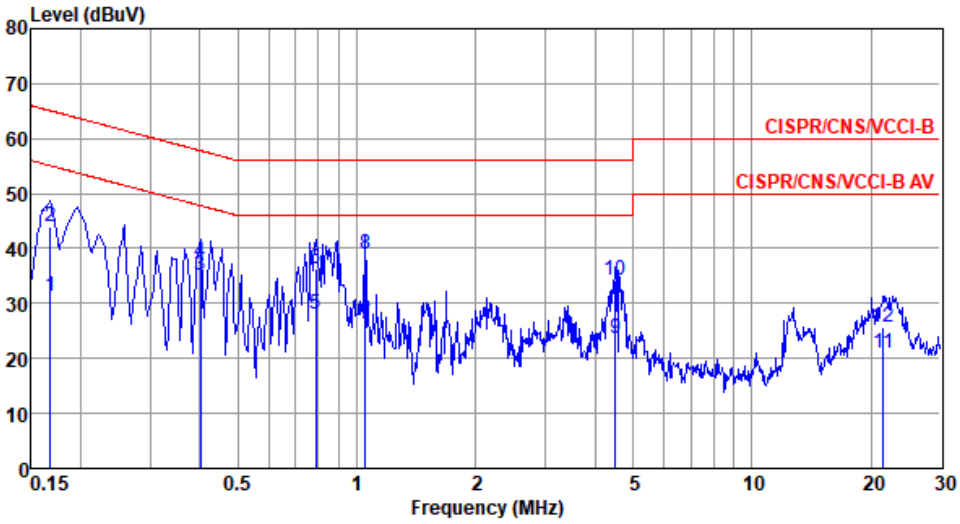


	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.186	44.54	54.20	-9.66	34.67	9.63	0.06	Average
2	0.186	47.25	64.20	-16.95	37.38	9.63	0.06	QP
3*	0.502	36.39	46.00	-9.61	26.40	9.63	0.09	Average
4	0.502	39.47	56.00	-16.53	29.48	9.63	0.09	QP
5	0.817	35.03	46.00	-10.97	24.99	9.63	0.11	Average
6	0.817	41.08	56.00	-14.92	31.04	9.63	0.11	QP
7	1.049	27.11	46.00	-18.89	17.04	9.63	0.12	Average
8	1.049	39.92	56.00	-16.08	29.85	9.63	0.12	QP
9	4.525	18.58	46.00	-27.42	8.25	9.66	0.30	Average
10	4.525	31.92	56.00	-24.08	21.59	9.66	0.30	QP
11	22.775	23.74	50.00	-26.26	12.70	9.69	0.69	Average
12	22.775	29.15	60.00	-30.85	18.11	9.69	0.69	QP

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

Modulation	CSS	Test Freq. (MHz)	923.3
Power Phase	Neutral		

Test by : Alex Tsai Temperature: 22°C Humidity: 56%

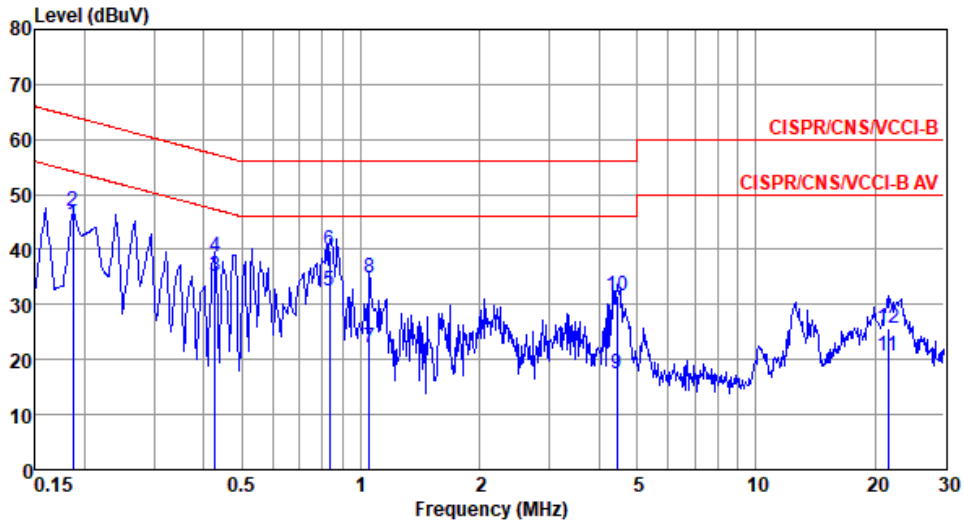


	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.168	31.40	55.08	-23.68	21.56	9.66	0.05	Average
2	0.168	43.94	65.08	-21.14	34.10	9.66	0.05	QP
3*	0.402	35.23	47.81	-12.58	25.33	9.65	0.08	Average
4	0.402	37.51	57.81	-20.30	27.61	9.65	0.08	QP
5	0.788	28.17	46.00	-17.83	18.22	9.65	0.11	Average
6	0.788	36.16	56.00	-19.84	26.21	9.65	0.11	QP
7	1.049	26.14	46.00	-19.86	16.17	9.65	0.12	Average
8	1.049	39.00	56.00	-17.00	29.03	9.65	0.12	QP
9	4.501	23.55	46.00	-22.45	13.30	9.68	0.30	Average
10	4.501	34.10	56.00	-21.90	23.85	9.68	0.30	QP
11	21.486	20.91	50.00	-29.09	9.83	9.83	0.68	Average
12	21.486	25.71	60.00	-34.29	14.63	9.83	0.68	QP

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

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

Test by : Alex Tsai Temperature: 22°C Humidity: 56%

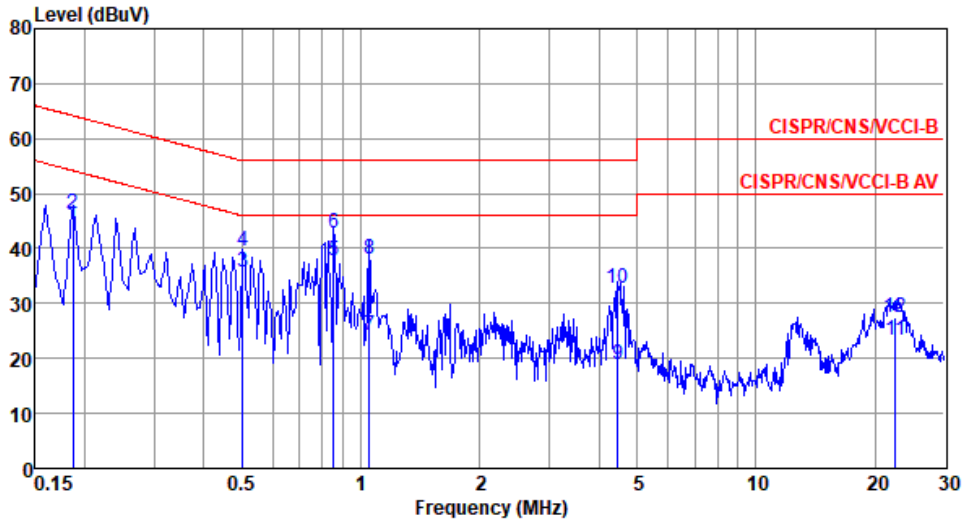


	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1*	0.186	44.61	54.20	-9.59	34.74	9.63	0.06	Average
2	0.186	46.80	64.20	-17.40	36.93	9.63	0.06	QP
3	0.428	35.03	47.29	-12.26	25.06	9.63	0.08	Average
4	0.428	38.76	57.29	-18.53	28.79	9.63	0.08	QP
5	0.835	32.47	46.00	-13.53	22.42	9.63	0.11	Average
6	0.835	39.82	56.00	-16.18	29.77	9.63	0.11	QP
7	1.049	22.00	46.00	-24.00	11.93	9.63	0.12	Average
8	1.049	34.86	56.00	-21.14	24.79	9.63	0.12	QP
9	4.454	17.48	46.00	-28.52	7.16	9.65	0.30	Average
10	4.454	31.54	56.00	-24.46	21.22	9.65	0.30	QP
11	21.600	20.77	50.00	-29.23	9.75	9.70	0.68	Average
12	21.600	25.68	60.00	-34.32	14.66	9.70	0.68	QP

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

Modulation	CSS	Test Freq. (MHz)	927.5
Power Phase	Neutral		

Test by : Alex Tsai Temperature: 22°C Humidity: 56%



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.186	44.37	54.20	-9.83	34.52	9.65	0.06	Average
2	0.186	46.28	64.20	-17.92	36.43	9.65	0.06	QP
3	0.502	35.57	46.00	-10.43	25.65	9.65	0.09	Average
4	0.502	39.51	56.00	-16.49	29.59	9.65	0.09	QP
5*	0.853	37.93	46.00	-8.07	27.98	9.65	0.11	Average
6	0.853	42.91	56.00	-13.09	32.96	9.65	0.11	QP
7	1.049	24.31	46.00	-21.69	14.34	9.65	0.12	Average
8	1.049	38.03	56.00	-17.97	28.06	9.65	0.12	QP
9	4.478	18.79	46.00	-27.21	8.54	9.68	0.30	Average
10	4.478	32.83	56.00	-23.17	22.58	9.68	0.30	QP
11	22.535	23.18	50.00	-26.82	12.06	9.82	0.69	Average
12	22.535	27.54	60.00	-32.46	16.42	9.82	0.69	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

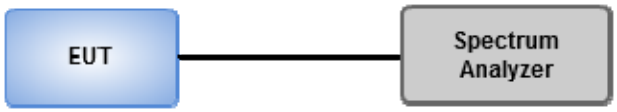
6dB Bandwidth

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) = 1% ~ 5 % of OBW, Video bandwidth = 3 x RBW
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.

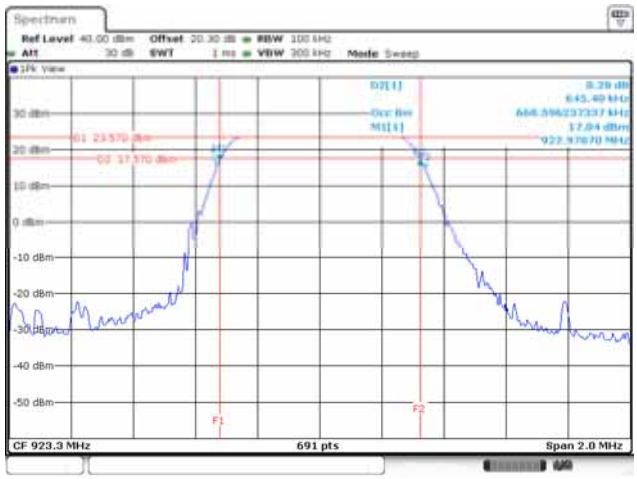
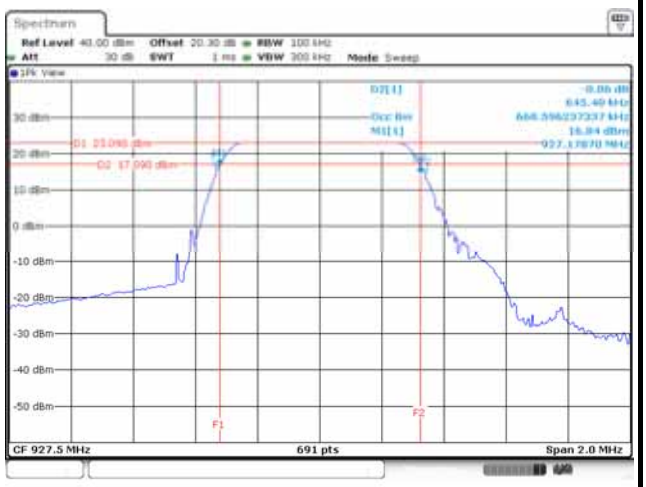
3.2.3 Test Setup



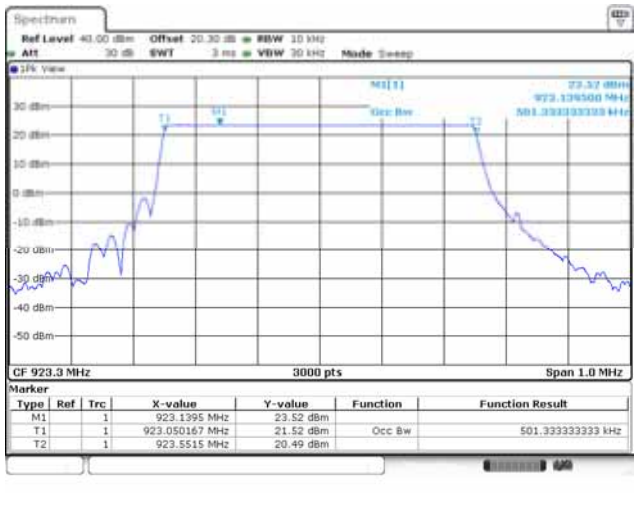
3.2.4 Test Result of 6dB and Occupied Bandwidth

Ambient Condition	22°C / 67%	Tested By	Brad Wu

Modulation / SF	Freq. (MHz)	6dB Bandwidth (MHz)	Limit (kHz)
CSS / 12	923.3	0.645	500
CSS / 12	927.5	0.645	500

923.3 MHz	927.5 MHz
	

Modulation / SF	Freq. (MHz)	Occupied Bandwidth (MHz)
CSS / 12	923.3	0.501
CSS / 12	927.5	0.502

923.3 MHz	927.5 MHz
	

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.

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

Ambient Condition	22°C / 67%	Tested By	Brad Wu

Modulation / SF	Freq. (MHz)	AV Power (mW)	AV Power (dBm)	Limit (dBm)
CSS / 12	923.3	237.1374	23.75	30
CSS / 12	927.5	214.2891	23.31	30

3.4 Power Spectral Density

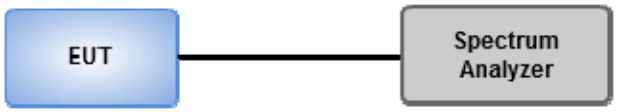
3.4.1 Limit of Power Spectral Density

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

3.4.2 Test Procedures

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.

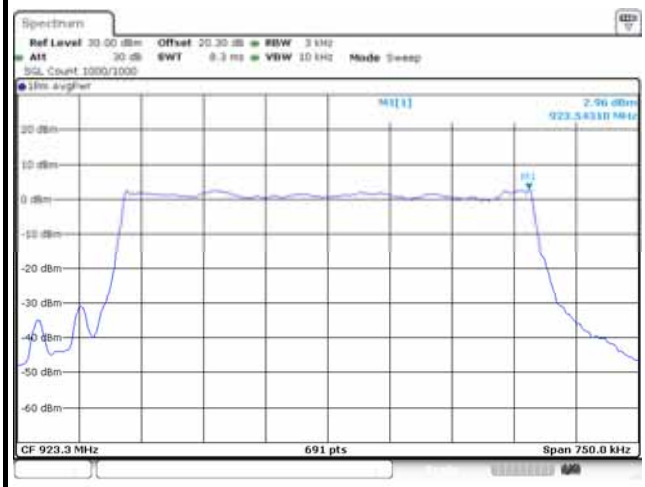
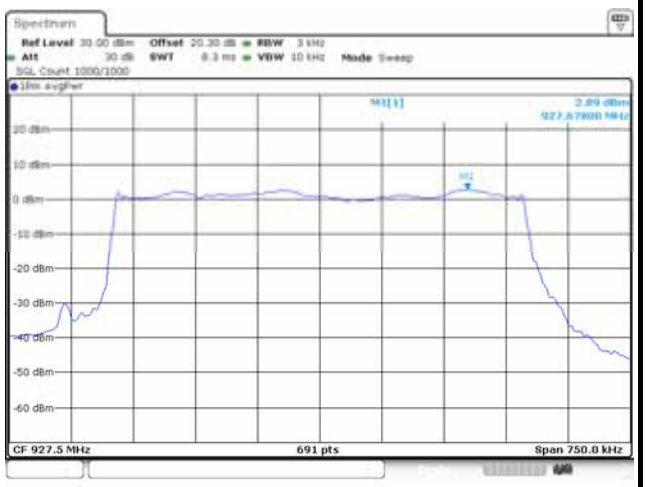
3.4.3 Test Setup



3.4.4 Test Result of Power Spectral Density

Ambient Condition	22°C / 67%	Tested By	Brad Wu

Modulation / SF	Freq. (MHz)	PSD (mW)	PSD (dBm)	Limit (dBm)
CSS / 12	923.3	2.0	2.96	8
CSS / 12	927.5	1.9	2.89	8

923.3 MHz	927.5 MHz
	

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

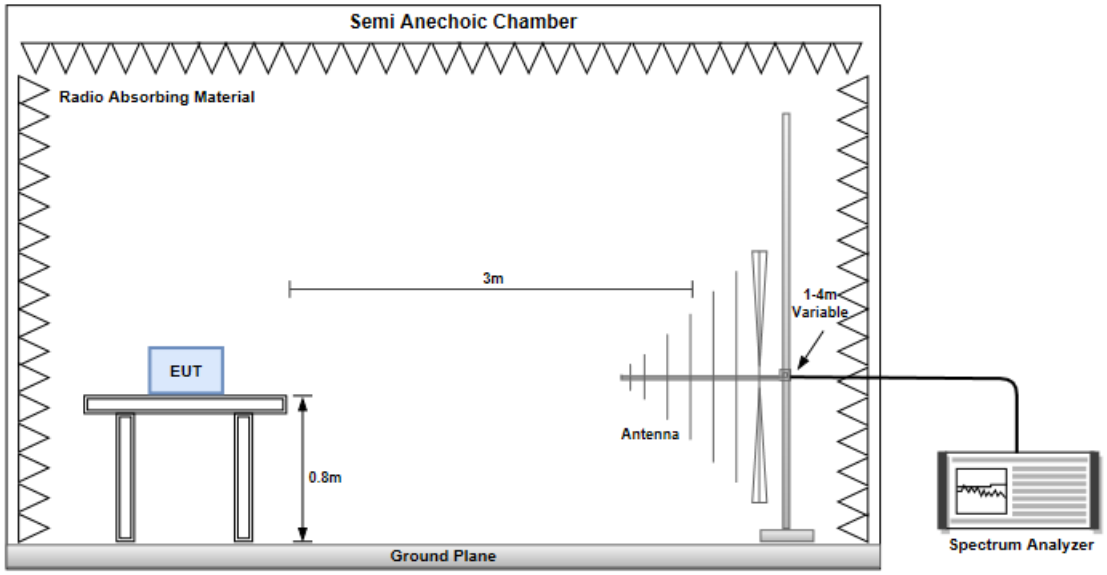
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission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

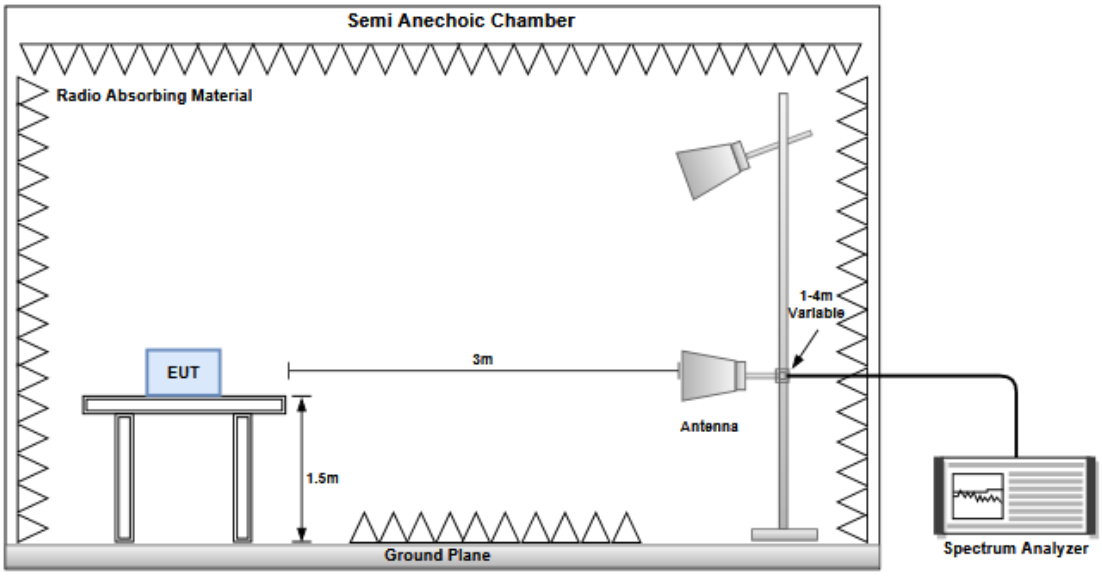
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

3.5.3 Test Setup

Radiated Emissions below 1 GHz



Radiated Emissions above 1 GHz

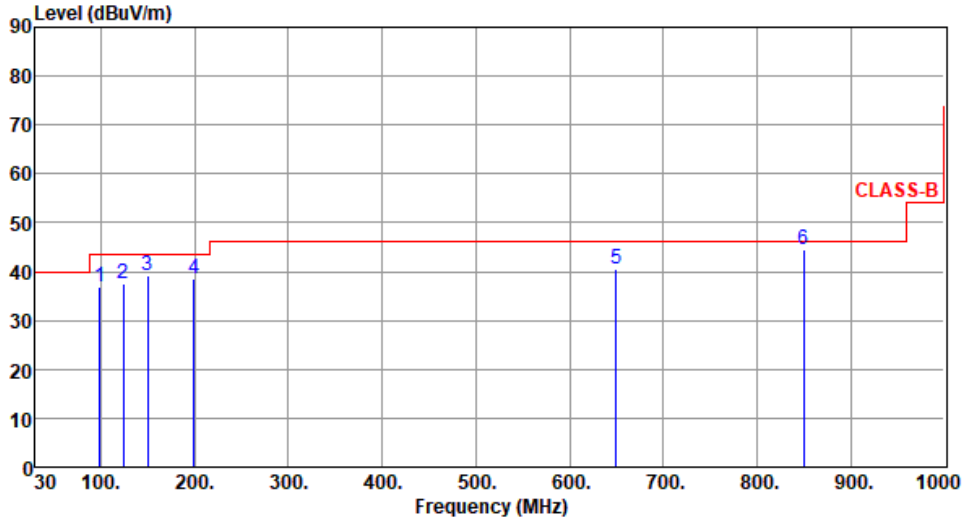


Configuration 1: Array antenna with antenna cable, Z-plane

3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	CSS	**Test Freq. (MHz)**	923.3
Polarization	Horizontal		

Test By :BRAD WU Temperature(℃):22 Humidity(%):64

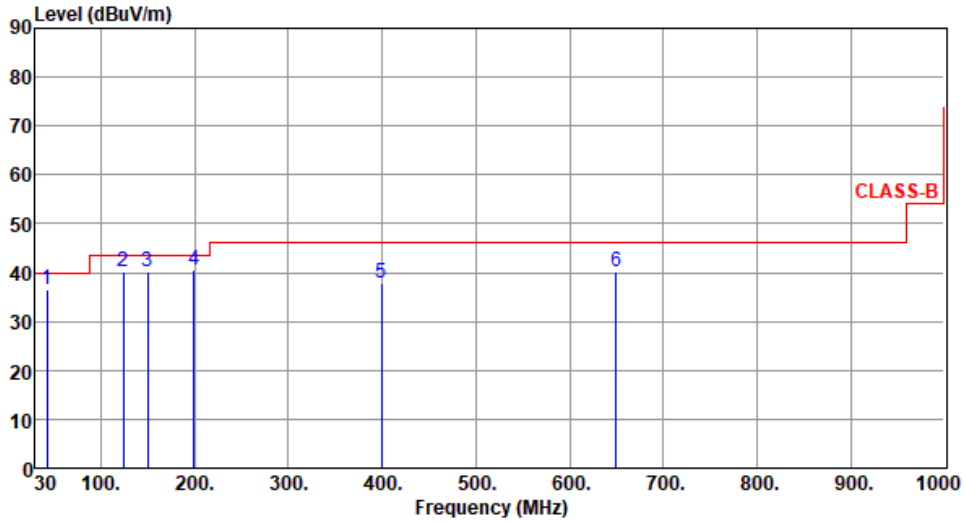


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	98.56	36.75	43.50	-6.75	50.95	-14.20	Peak	---	---
2	124.15	37.68	43.50	-5.82	48.64	-10.96	Peak	---	---
3	149.59	39.25	43.50	-4.25	48.36	-9.11	Peak	---	---
4	199.66	38.64	43.50	-4.86	51.01	-12.37	Peak	---	---
5	649.53	40.38	46.00	-5.62	39.95	0.43	Peak	---	---
6	850.11	44.55	46.00	-1.45	41.17	3.38	QP	100	146

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	CSS	Test Freq. (MHz)	923.3
Polarization	Vertical		

Test By :BRAD WU Temperature(℃):22 Humidity(%):64

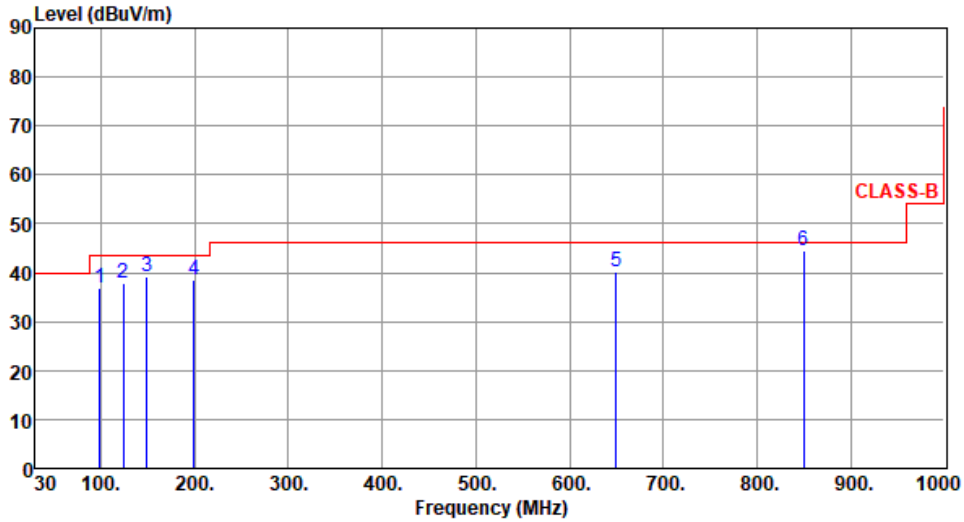


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	42.58	36.65	40.00	-3.35	45.49	-8.84	Peak	---	---
2	124.15	40.25	43.50	-3.25	51.21	-10.96	Peak	---	---
3	149.46	40.03	43.50	-3.47	49.13	-9.10	Peak	---	---
4	199.66	40.59	43.50	-2.91	52.96	-12.37	QP	100	116
5	399.66	37.84	46.00	-8.16	43.71	-5.87	Peak	---	---
6	649.46	40.03	46.00	-5.97	39.60	0.43	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	CSS	Test Freq. (MHz)	927.5
Polarization	Horizontal		

Test By :BRAD WU Temperature(℃):22 Humidity(%):64

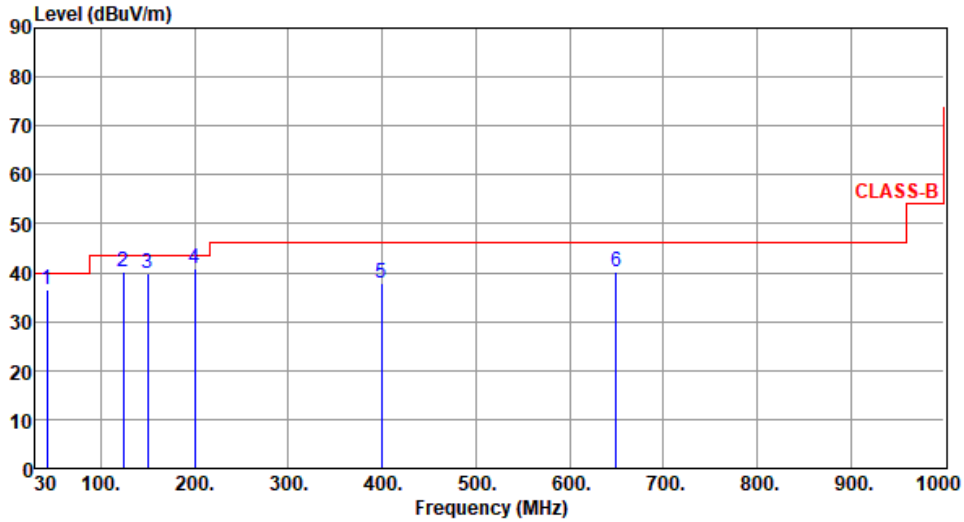


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	98.79	36.75	43.50	-6.75	50.95	-14.20	Peak	---	---
2	124.11	37.96	43.50	-5.54	48.92	-10.96	Peak	---	---
3	149.25	39.16	43.50	-4.34	48.23	-9.07	Peak	---	---
4	199.66	38.64	43.50	-4.86	51.01	-12.37	Peak	---	---
5	649.48	40.35	46.00	-5.65	39.92	0.43	Peak	---	---
6	850.15	44.52	46.00	-1.48	41.13	3.39	QP	100	149

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	CSS	Test Freq. (MHz)	927.5
Polarization	Vertical		

Test By :BRAD WU Temperature(℃):22 Humidity(%):64



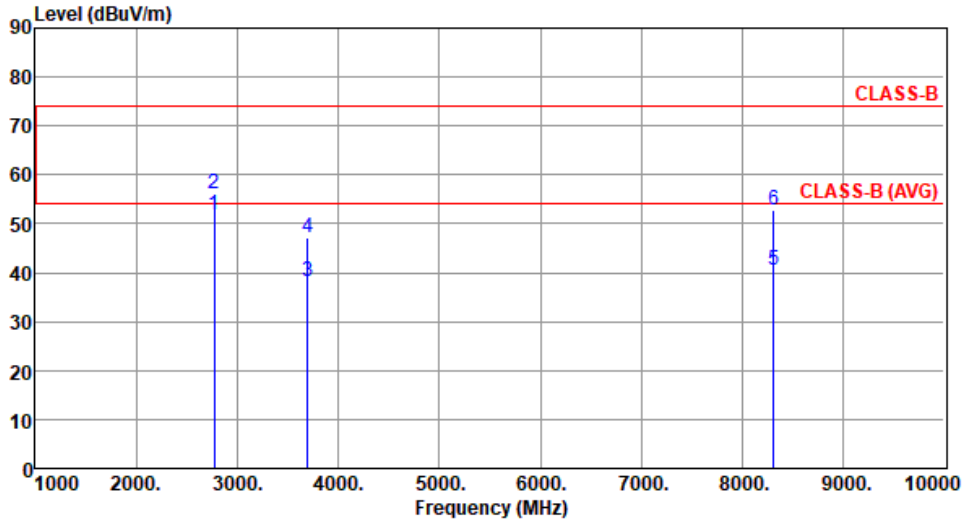
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	42.66	36.64	40.00	-3.36	45.47	-8.83	Peak	---	---
2	124.12	40.24	43.50	-3.26	51.20	-10.96	Peak	---	---
3	149.46	39.88	43.50	-3.62	48.98	-9.10	Peak	---	---
4	199.76	40.75	43.50	-2.75	53.11	-12.36	QP	100	119
5	399.61	37.84	46.00	-8.16	43.72	-5.88	Peak	---	---
6	649.46	40.13	46.00	-5.87	39.70	0.43	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	CSS	Test Freq. (MHz)	923.3
Polarization	Horizontal		

Test By :Roger Lu Temperature(℃):25 Humidity(%):68

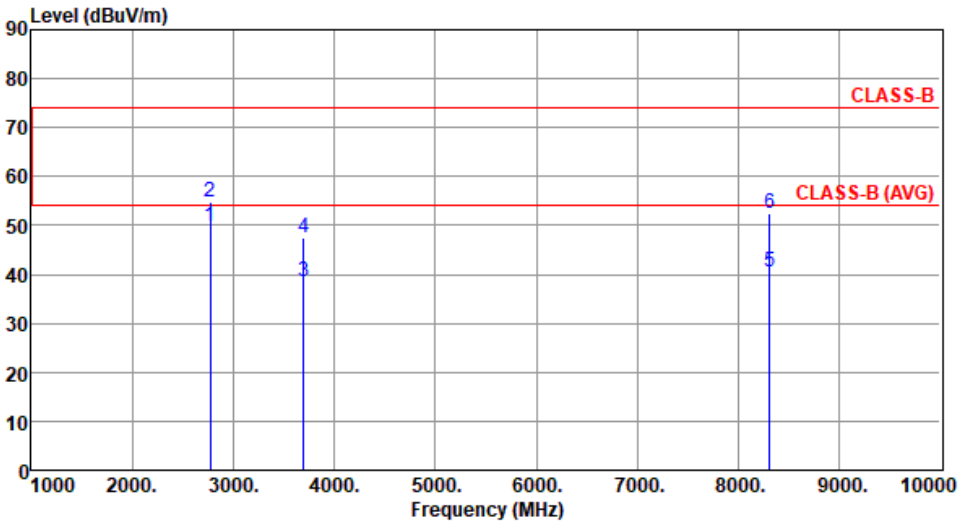


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2769.90	51.80	54.00	-2.20	53.25	-1.45	Average	152	318
2	2769.90	56.17	74.00	-17.83	57.62	-1.45	Peak	152	318
3	3693.20	38.30	54.00	-15.70	37.10	1.20	Average	102	297
4	3693.20	47.13	74.00	-26.87	45.93	1.20	Peak	102	297
5	8309.70	40.60	54.00	-13.40	30.80	9.80	Average	100	60
6	8309.70	52.81	74.00	-21.19	43.01	9.80	Peak	100	60

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	CSS	Test Freq. (MHz)	923.3
Polarization	Vertical		

Test By :Roger Lu Temperature(℃):25 Humidity(%):68

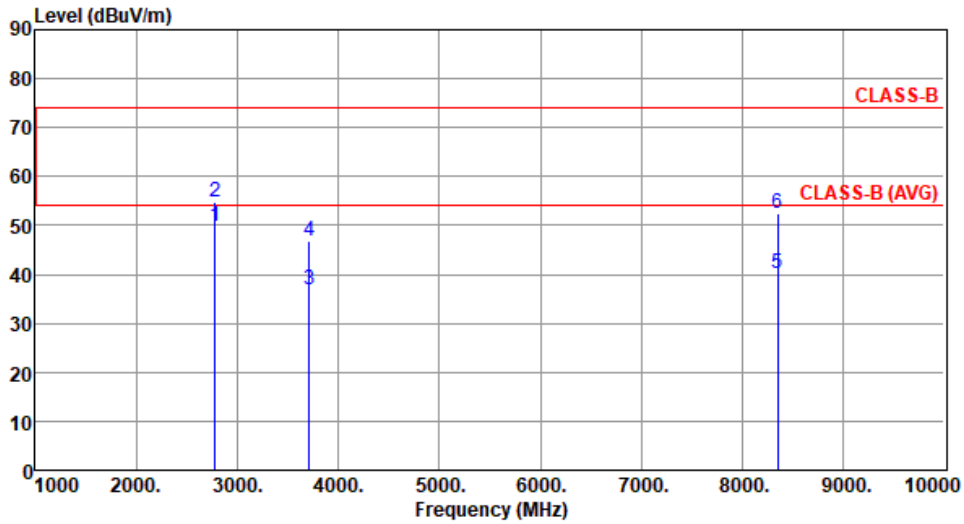


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2769.90	49.66	54.00	-4.34	51.11	-1.45	Average	317	32
2	2769.90	54.73	74.00	-19.27	56.18	-1.45	Peak	317	32
3	3693.20	38.57	54.00	-15.43	37.37	1.20	Average	100	3
4	3693.20	47.40	74.00	-26.60	46.20	1.20	Peak	100	3
5	8309.70	40.45	54.00	-13.55	30.65	9.80	Average	100	200
6	8309.70	52.38	74.00	-21.62	42.58	9.80	Peak	100	200

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	CSS	Test Freq. (MHz)	927.5
Polarization	Horizontal		

Test By :Roger Lu Temperature(℃):25 Humidity(%):68

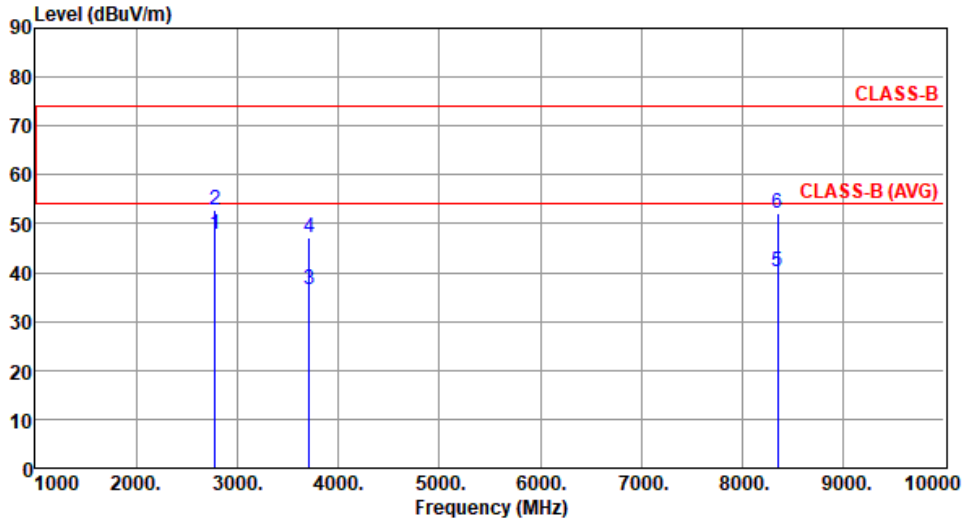


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2782.50	49.87	54.00	-4.13	51.23	-1.36	Average	160	318
2	2782.50	54.74	74.00	-19.26	56.10	-1.36	Peak	160	318
3	3710.00	36.80	54.00	-17.20	35.56	1.24	Average	105	295
4	3710.00	46.70	74.00	-27.30	45.46	1.24	Peak	105	295
5	8347.50	40.33	54.00	-13.67	30.56	9.77	Average	100	55
6	8347.50	52.41	74.00	-21.59	42.64	9.77	Peak	100	55

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	CSS	Test Freq. (MHz)	927.5
Polarization	Vertical		

Test By :Roger Lu Temperature(℃):25 Humidity(%):68



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2782.50	47.75	54.00	-6.25	49.11	-1.36	Average	315	35
2	2782.50	52.90	74.00	-21.10	54.26	-1.36	Peak	315	35
3	3710.00	36.69	54.00	-17.31	35.45	1.24	Average	100	5
4	3710.00	47.00	74.00	-27.00	45.76	1.24	Peak	100	5
5	8347.50	40.22	54.00	-13.78	30.45	9.77	Average	100	20
6	8347.50	52.31	74.00	-21.69	42.54	9.77	Peak	100	20

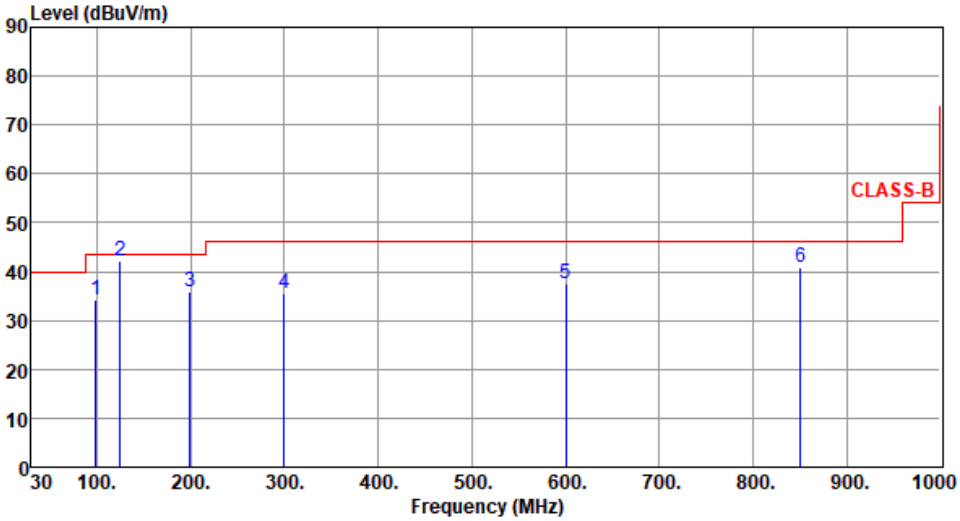
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Configuration 2: Individual antenna

3.5.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	CSS	Test Freq. (MHz)	923.3
Polarization	Horizontal		

Test By :BRAD WU Temperature(℃):22 Humidity(%):64

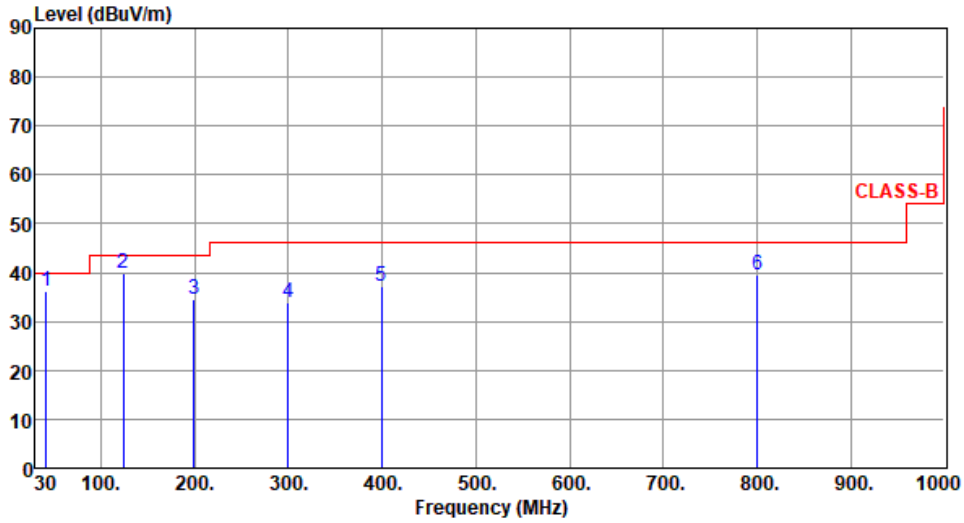


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	98.74	34.26	43.50	-9.24	48.46	-14.20	Peak	---	---
2	125.16	42.13	43.50	-1.37	52.99	-10.86	QP	153	268
3	199.64	35.84	43.50	-7.66	48.22	-12.38	Peak	---	---
4	299.59	35.63	46.00	-10.37	44.28	-8.65	Peak	---	---
5	600.49	37.54	46.00	-8.46	38.41	-0.87	Peak	---	---
6	850.49	40.85	46.00	-5.15	37.45	3.40	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	CSS	Test Freq. (MHz)	923.3
Polarization	Vertical		

Test By :BRAD WU Temperature(℃):22 Humidity(%):64

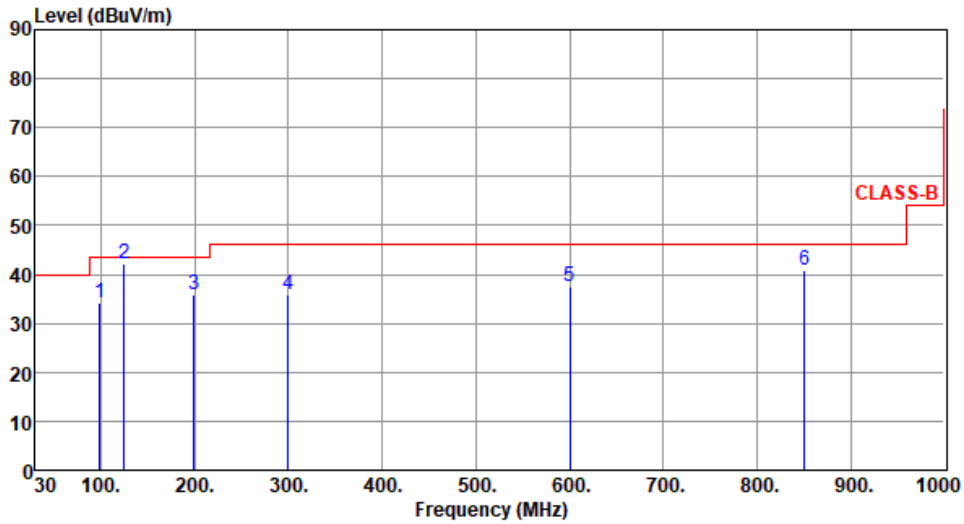


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	41.55	36.21	40.00	-3.79	45.17	-8.96	Peak	---	---
2	124.18	39.78	43.50	-3.72	50.73	-10.95	Peak	---	---
3	199.61	34.43	43.50	-9.07	46.81	-12.38	Peak	---	---
4	299.58	34.03	46.00	-11.97	42.68	-8.65	Peak	---	---
5	399.61	37.21	46.00	-8.79	43.09	-5.88	Peak	---	---
6	800.22	39.48	46.00	-6.52	36.68	2.80	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	CSS	Test Freq. (MHz)	927.5
Polarization	Horizontal		

Test By :BRAD WU Temperature(℃):22 Humidity(%):64

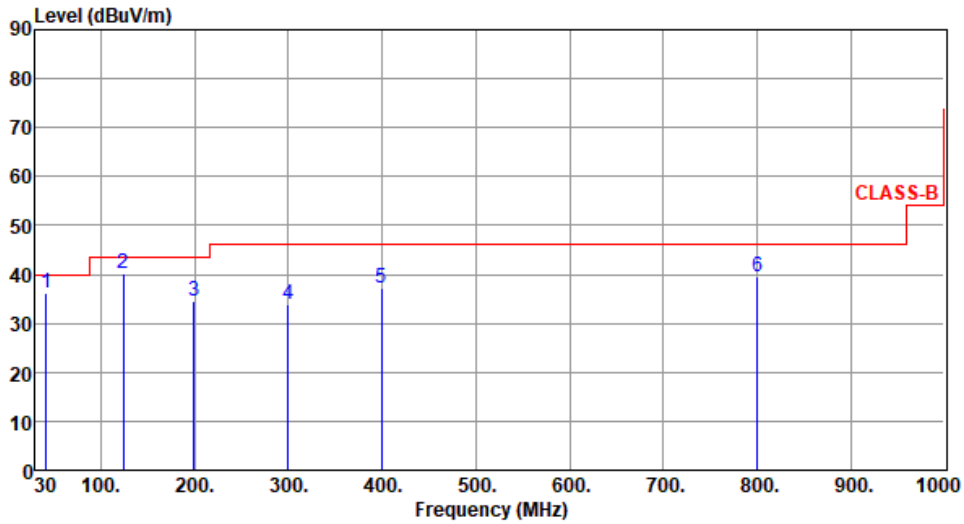


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	98.49	34.21	43.50	-9.29	48.41	-14.20	Peak	---	---
2	125.17	42.02	43.50	-1.48	52.88	-10.86	QP	161	262
3	199.66	35.84	43.50	-7.66	48.21	-12.37	Peak	---	---
4	299.59	35.82	46.00	-10.18	44.47	-8.65	Peak	---	---
5	600.40	37.54	46.00	-8.46	38.42	-0.88	Peak	---	---
6	850.59	40.86	46.00	-5.14	37.46	3.40	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	CSS	Test Freq. (MHz)	927.5
Polarization	Vertical		

Test By :BRAD WU Temperature(℃):22 Humidity(%):64



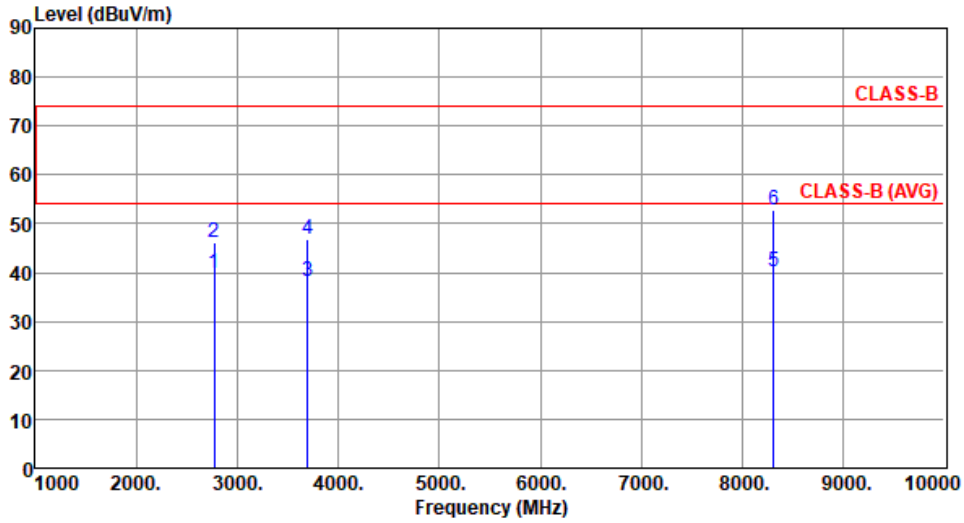
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	41.51	36.28	40.00	-3.72	45.24	-8.96	Peak	---	---
2	124.15	40.15	43.50	-3.35	51.11	-10.96	Peak	---	---
3	199.64	34.43	43.50	-9.07	46.81	-12.38	Peak	---	---
4	299.55	34.02	46.00	-11.98	42.67	-8.65	Peak	---	---
5	399.61	37.17	46.00	-8.83	43.05	-5.88	Peak	---	---
6	800.22	39.45	46.00	-6.55	36.65	2.80	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.

3.5.7 Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation	CSS	Test Freq. (MHz)	923.3
Polarization	Horizontal		

Test By :Roger Lu Temperature(℃):25 Humidity(%):68

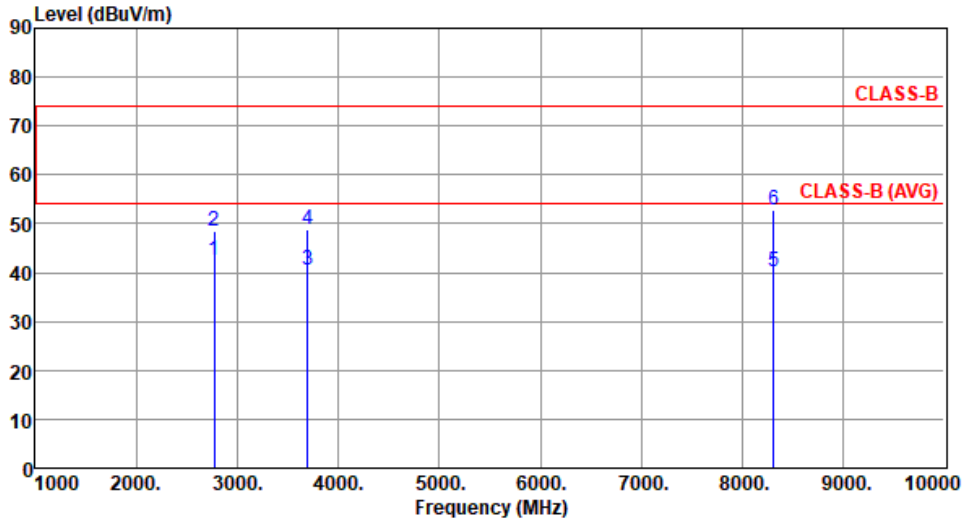


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2769.90	39.91	54.00	-14.09	41.36	-1.45	Average	112	39
2	2769.90	46.20	74.00	-27.80	47.65	-1.45	Peak	112	39
3	3693.20	38.30	54.00	-15.70	37.10	1.20	Average	100	162
4	3693.20	46.96	74.00	-27.04	45.76	1.20	Peak	100	162
5	8309.70	40.25	54.00	-13.75	30.45	9.80	Average	100	50
6	8309.70	52.85	74.00	-21.15	43.05	9.80	Peak	100	50

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	CSS	Test Freq. (MHz)	923.3
Polarization	Vertical		

Test By :Roger Lu Temperature(℃):25 Humidity(%):68

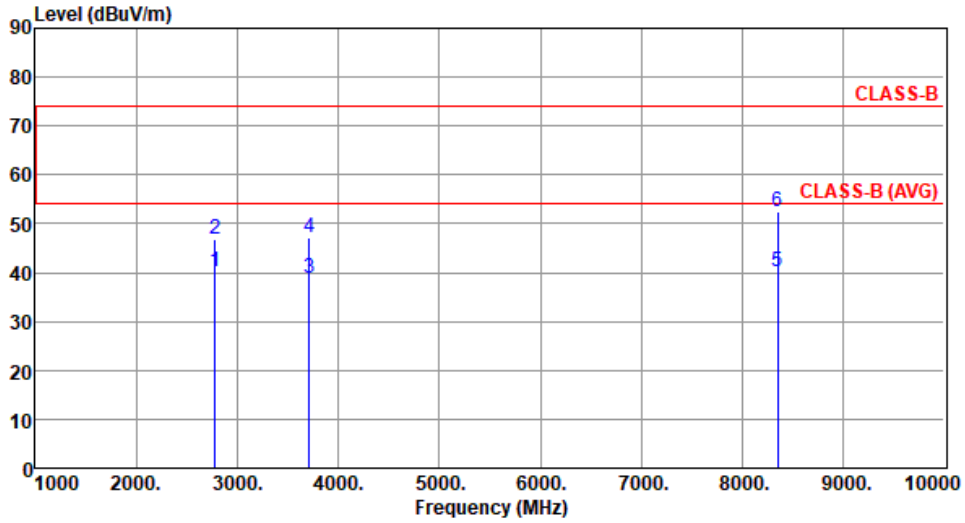


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2769.90	42.60	54.00	-11.40	44.05	-1.45	Average	125	91
2	2769.90	48.57	74.00	-25.43	50.02	-1.45	Peak	125	91
3	3693.20	40.65	54.00	-13.35	39.45	1.20	Average	100	35
4	3693.20	48.86	74.00	-25.14	47.66	1.20	Peak	100	35
5	8309.70	40.05	54.00	-13.95	30.25	9.80	Average	100	40
6	8309.70	52.66	74.00	-21.34	42.86	9.80	Peak	100	40

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	CSS	Test Freq. (MHz)	927.5
Polarization	Horizontal		

Test By :Roger Lu Temperature(℃):25 Humidity(%):68

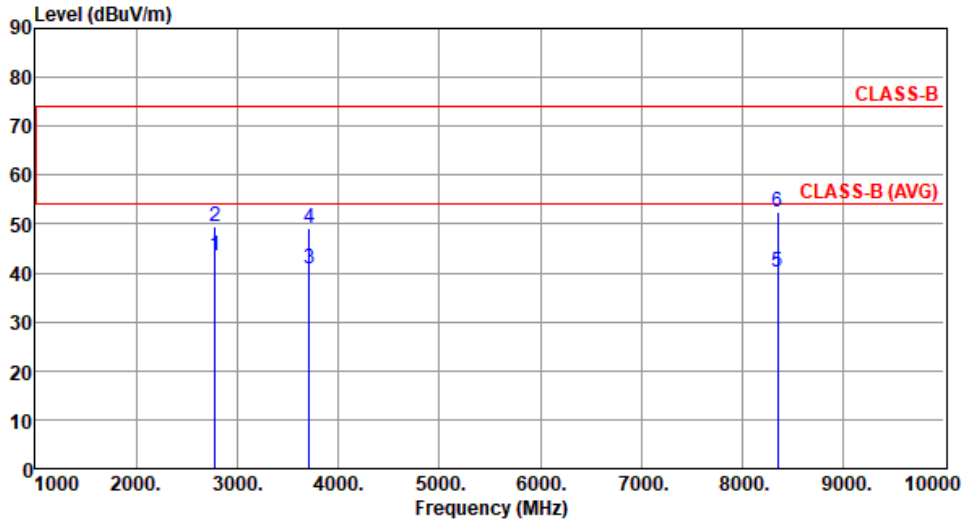


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2782.50	40.32	54.00	-13.68	41.68	-1.36	Average	115	42
2	2782.50	46.69	74.00	-27.31	48.05	-1.36	Peak	115	42
3	3710.00	38.69	54.00	-15.31	37.45	1.24	Average	100	165
4	3710.00	47.21	74.00	-26.79	45.97	1.24	Peak	100	165
5	8347.50	40.13	54.00	-13.87	30.36	9.77	Average	100	40
6	8347.50	52.44	74.00	-21.56	42.67	9.77	Peak	100	40

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	CSS	Test Freq. (MHz)	927.5
Polarization	Vertical		

Test By :Roger Lu Temperature(℃):25 Humidity(%):68



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2782.50	43.41	54.00	-10.59	44.77	-1.36	Average	118	181
2	2782.50	49.48	74.00	-24.52	50.84	-1.36	Peak	118	181
3	3710.00	40.92	54.00	-13.08	39.68	1.24	Average	100	40
4	3710.00	49.13	74.00	-24.87	47.89	1.24	Peak	100	40
5	8347.50	40.22	54.00	-13.78	30.45	9.77	Average	100	20
6	8347.50	52.56	74.00	-21.44	42.79	9.77	Peak	100	20

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 20 dB relative to the maximum in-band peak PSD level in 100 kHz.

3.6.2 Test Procedures

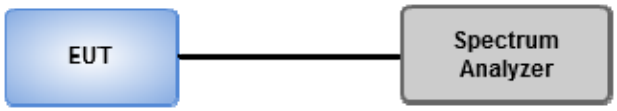
Reference level measurement

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

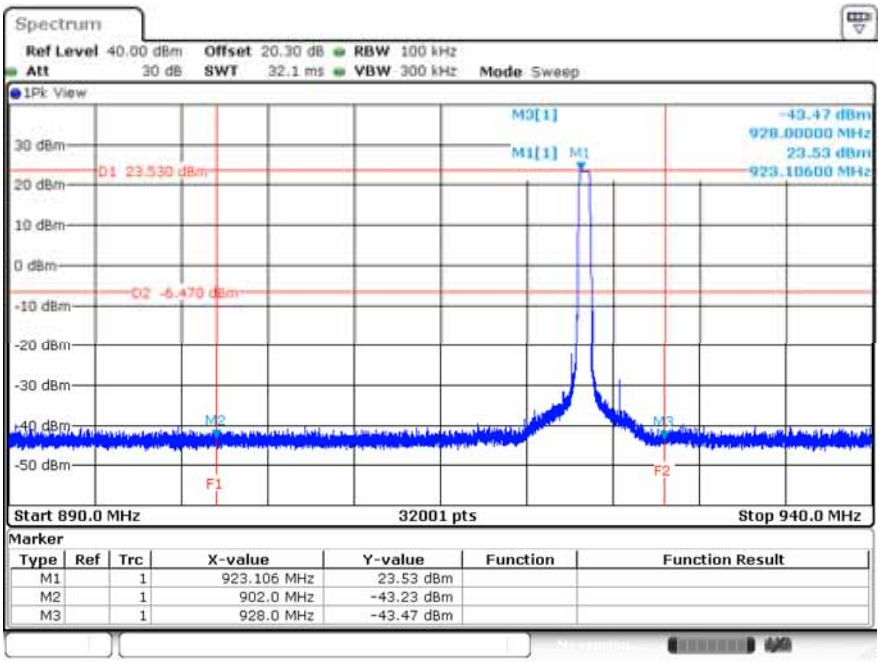
3.6.3 Test Setup

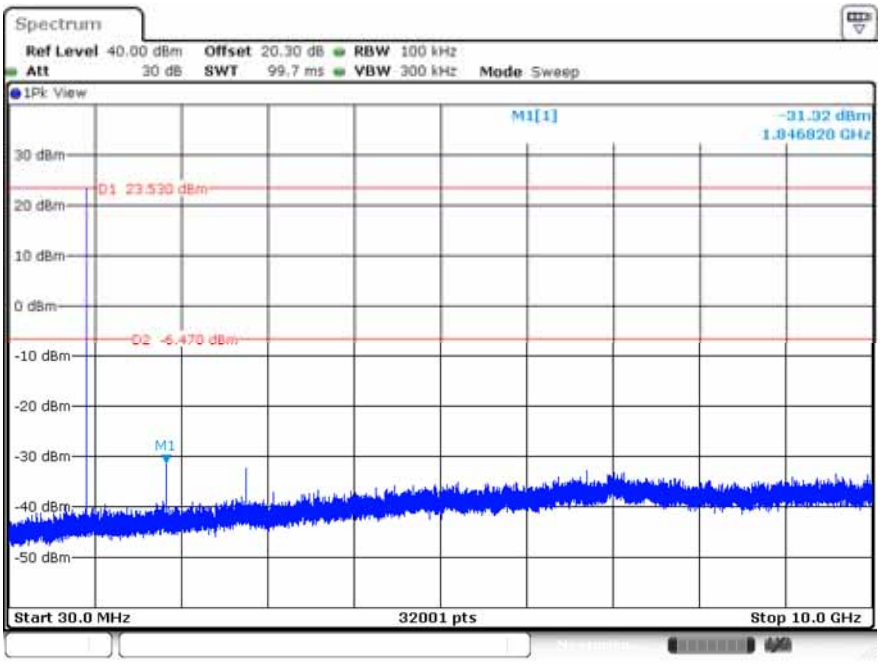


3.6.4 Unwanted Emissions into Non-Restricted Frequency Bands

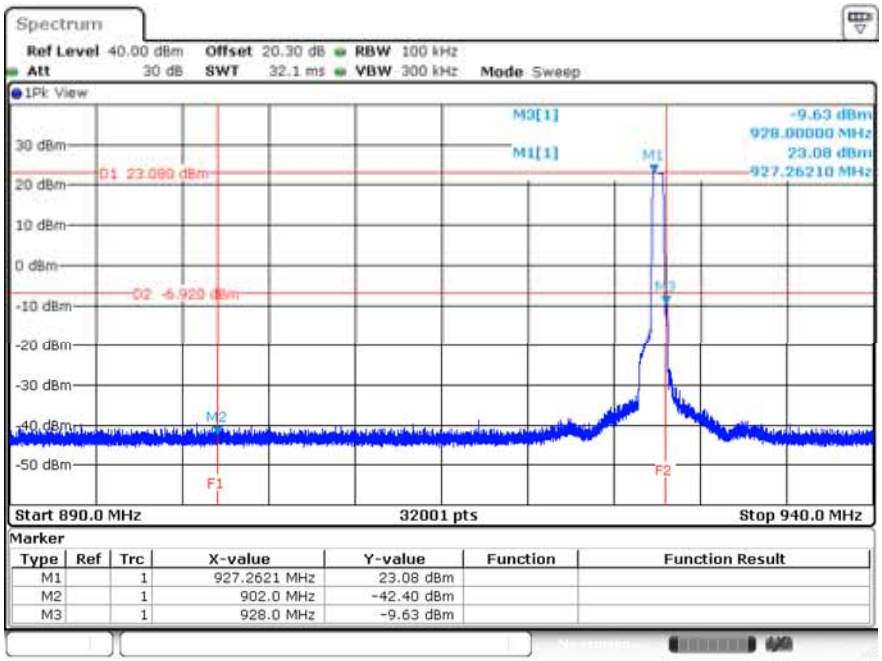
Ambient Condition	22°C / 67%	Tested By	Brad Wu

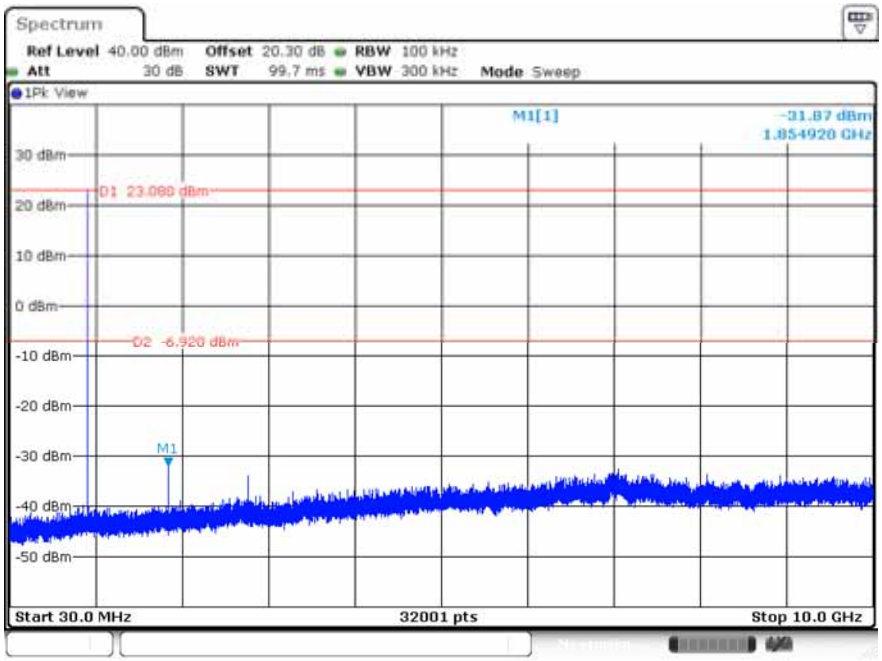
923.3 MHz





927.5 MHz


Spectrum
Ref Level 40.00 dBm Offset 20.30 dB RBW 100 kHz
Att 30 dB SWT 32.1 ms VBW 300 kHz Mode Sweep
1Pk View
M3[1] -9.63 dBm
928.00000 MHz
M1[1] 23.08 dBm
927.26210 MHz
D1 23.080 dBm
D2 -6.920 dBm
Start 890.0 MHz 32001 pts Stop 940.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 927.2621 MHz 23.08 dBm
M2 1 902.0 MHz -42.40 dBm
M3 1 928.0 MHz -9.63 dBm


Spectrum
Ref Level 40.00 dBm Offset 20.30 dB RBW 100 kHz
Att 30 dB SWT 99.7 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -31.87 dBm
1.854920 GHz
D1 23.080 dBm
D2 -6.920 dBm
Start 30.0 MHz 32001 pts Stop 10.0 GHz

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.

Tel: 886-3-271-8666
Fax: 886-3-318-0155
Email: ICC_Service@icertifi.com.tw

==END==