

FCC Test Report

FCC ID : 2AAS9-WLRRTES106
Equipment : Femto Lite IoT Gateway
(Refer to item 1.1.1 for more details)
Model No. : WLRRTES-106
Brand Name : BROWAN
Applicant : Browan Communications Incorporation.
Address : No.15-1 Zhonghua Road, Hsinchu Industrial
Park, Hukou, Hsinchu, Taiwan (R.O.C.) , 30352.
Standard : 47 CFR FCC Part 15.247
Received Date : Jul. 02, 2021
Tested Date : Jul. 05, 2021 ~ Jul. 21, 2021

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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Release Record

Report No.	Version	Description	Issued Date
FR0D2402-01	Rev. 01	Initial issue	Aug. 18, 2021

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 0.529MHz 37.26 (Margin -8.74dB) - AV	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 30.55MHz 37.59 (Margin -2.41dB) - QP	Pass
15.247(b)(3)	Maximum Output Power	Max Power [dBm]: 27.16	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

The EUT has two housing options. Refers to EUT photo for detail information of housing.

1.1.1 Product Details

The following models are provided to this EUT.

Brand Name	Model Name	Product Name	Description
BROWAN	WLRRTES-106	Femto Lite IoT Gateway	For marketing purpose
		MerryIoT Hub	

1.1.2 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 Bandwidth (kHz)
902 ~ 928	923.3 ~ 927.5	73 ~ 80 [8]	980 ~ 21900	12 ~ 7	500
Note 1: RF output power specifies that Maximum Conducted (Average) Output Power.					
Note 2: The device uses LORA modulation.					

1.1.3 Antenna Details

Ant. No.	Type	Gain (dBi)	Connector	Remark
1	PIFA	1.47	UFL	---

1.1.4 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	5Vdc from AC adapter
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1.1.5 Accessories

Accessories		
No.	Equipment	Description
1	AC adapter	Brand: PHIHONG Model: PSAF10A-050Q I/P: 100-240Vac, 50/60Hz, 0.28A O/P: 5.0Vdc=2.0A Power Line: 1.10m non-shielded without core
2	AC adapter	Brand: Ktec Model: KSC-10A-050200HU I/P: 100-240Vac, 50/60Hz, 0.3A O/P: 5.0Vdc=2.0A Power Line: 1.10m non-shielded without core
3	Ethernet cable	0.95m non-shielded without core

1.1.6 Channel List

Frequency Band (MHz)		902 ~928	
Channel	Frequency(MHz)	Channel	Frequency(MHz)
73	923.3	77	925.7
74	923.9	78	926.3
75	924.5	79	926.9
76	925.1	80	927.5

1.1.7 Test Tool and Duty Cycle

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

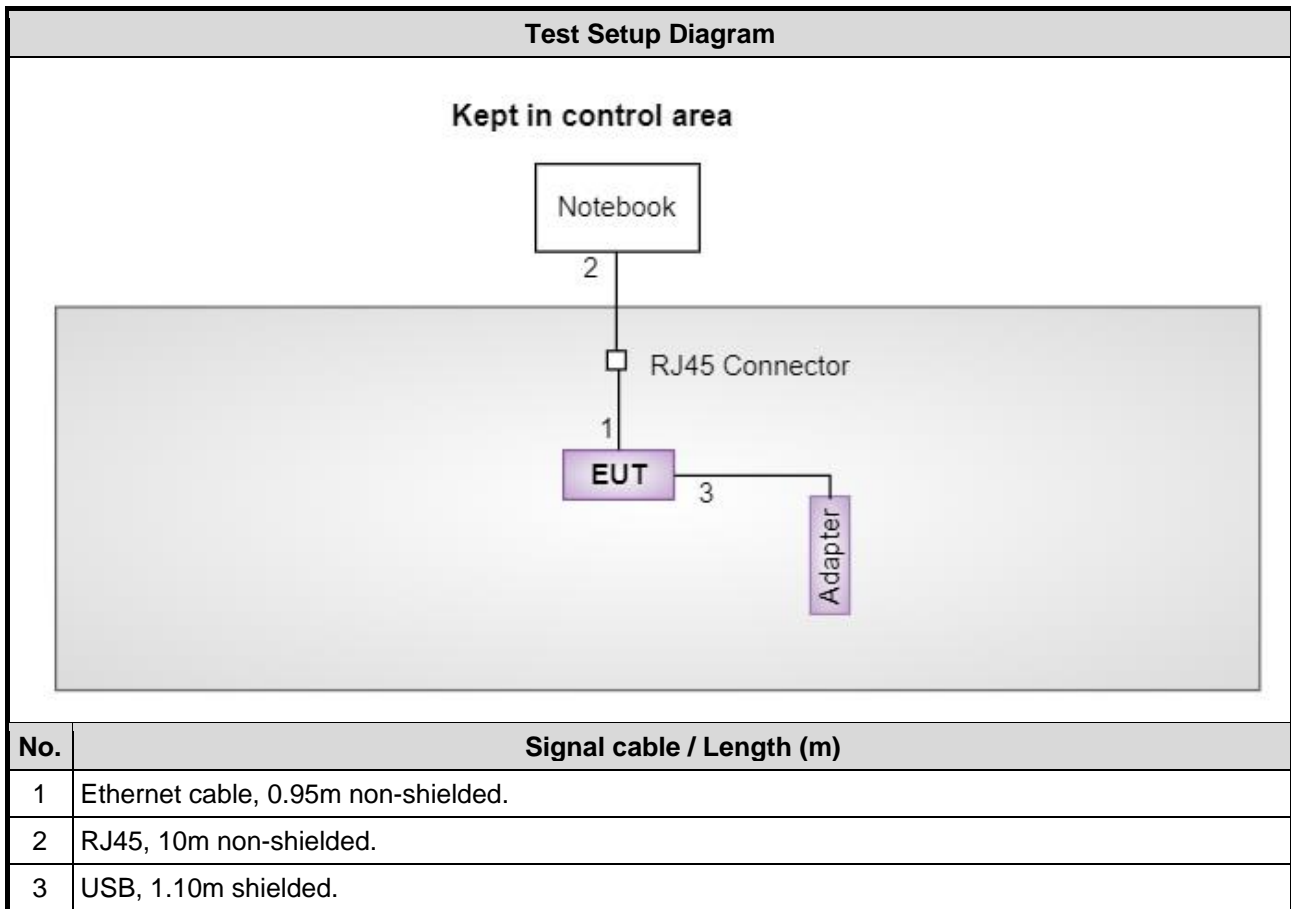
1.1.8 Power Index of Test Tool

Modulation Mode	Test Frequency (MHz)	Power Index
LORA	923.3	--pa 3 --mix 15 --dig 0
LORA	927.5	--pa 3 --mix 15 --dig 0

1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Remarks
1	Notebook	DELL	Latitude E5470	DoC	---
2	RJ45 Connector	ICC	---	---	---

1.3 Test Setup Chart



1.4 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Tested Date	Jul. 21, 2021				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101658	Feb. 08, 2021	Feb. 07, 2022
LISN	R&S	ENV216	101579	Mar. 17, 2021	Mar. 16, 2022
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 21, 2020	Oct. 20, 2021
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 chamber1 / (03CH01-WS)				
Tested Date	Jul. 05, 2021				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101657	Mar. 12, 2021	Mar. 11, 2022
Spectrum Analyzer	R&S	FSV40	101498	Dec. 04, 2020	Dec. 03, 2021
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 17, 2020	Nov. 16, 2021
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jun. 30, 2021	Jun. 29, 2022
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 11, 2020	Dec. 10, 2021
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 06, 2020	Nov. 05, 2021
Preamplifier	EMC	EMC02325	980225	Jun. 29, 2021	Jun. 28, 2022
Preamplifier	Agilent	83017A	MY39501308	Sep. 26, 2020	Sep. 25, 2021
Preamplifier	EMC	EMC184045B	980192	Jul. 21, 2020	Jul. 20, 2021
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 06, 2020	Oct. 05, 2021
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Oct. 06, 2020	Oct. 05, 2021
LF cable 11M	EMC	EMCCFD400-NW-N W-11000	200801	Oct. 06, 2020	Oct. 05, 2021
LF cable 1M	EMC	EMCCFD400-NM-N M-1000	160502	Oct. 06, 2020	Oct. 05, 2021
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Oct. 06, 2020	Oct. 05, 2021
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Oct. 06, 2020	Oct. 05, 2021
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	Jul. 21, 2021				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101063	Apr. 19, 2021	Apr. 18, 2022
Power Meter	Anritsu	ML2495A	1241002	Nov. 04, 2020	Nov. 03, 2021
Power Sensor	Anritsu	MA2411B	1207366	Nov. 04, 2020	Nov. 03, 2021
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 ≤ 1 GHz	± 4.32 dB
Radiated emission > 1 GHz	± 4.90 dB

2 Test Configuration

2.1 Testing Facility

Test Laboratory	International Certification Corp.
Test Site	CO01-WS, 03CH01-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.

- FCC Designation No.: TW2732
- FCC site registration No.: 181692
- 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	LORA	923.3 / 927.5	SF12	2
Radiated Emissions ≤1GHz Radiated Emissions >1GHz	LORA	923.3 / 927.5	SF12	1
Maximum Output Power 6dB bandwidth Power spectral density	LORA	923.3 / 927.5	SF12	1
<p>Note: The EUT had been tested by following test configurations.</p> <ol style="list-style-type: none"> 1) Configuration 1: PHIHONG adapter with housing 2 2) Configuration 2: Ktec adapter with housing 2 				

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



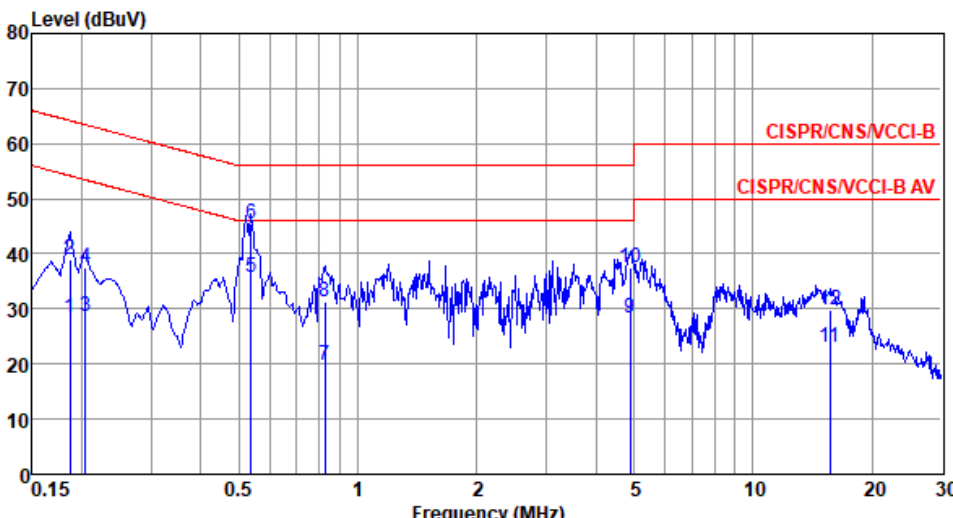
Note: 1. Support units were connected to second LISN.

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	LORA	Test Freq. (MHz)	923.3
Power Phase	Line		

Test by : Alex Tsai Temperature: 22°C Humidity: 61%

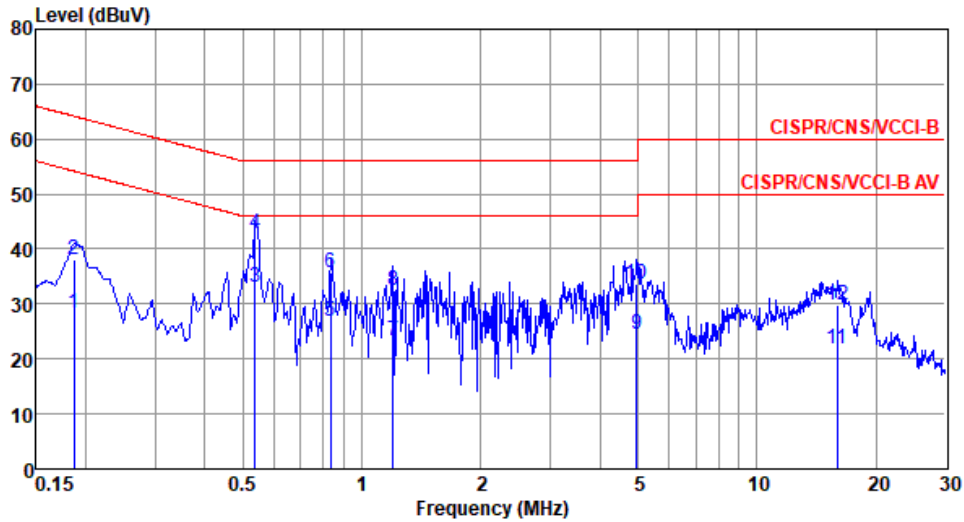


	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	Factor dB	Cable loss dB	Remark
1	0.186	28.30	54.20	-25.90	18.40	9.84	0.06	Average
2	0.186	38.88	64.20	-25.32	28.98	9.84	0.06	QP
3	0.204	28.58	53.45	-24.87	18.68	9.84	0.06	Average
4	0.204	37.45	63.45	-26.00	27.55	9.84	0.06	QP
5*	0.538	35.65	46.00	-10.35	25.64	9.92	0.09	Average
6	0.538	45.43	56.00	-10.57	35.42	9.92	0.09	QP
7	0.826	19.84	46.00	-26.16	9.76	9.97	0.11	Average
8	0.826	31.25	56.00	-24.75	21.17	9.97	0.11	QP
9	4.900	28.22	46.00	-17.78	17.85	10.06	0.31	Average
10	4.900	37.36	56.00	-18.64	26.99	10.06	0.31	QP
11	15.635	23.01	50.00	-26.99	12.19	10.21	0.61	Average
12	15.635	29.75	60.00	-30.25	18.93	10.21	0.61	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	LORA	Test Freq. (MHz)	923.3
Power Phase	Neutral		

Test by : Alex Tsai Temperature: 22°C Humidity: 61%

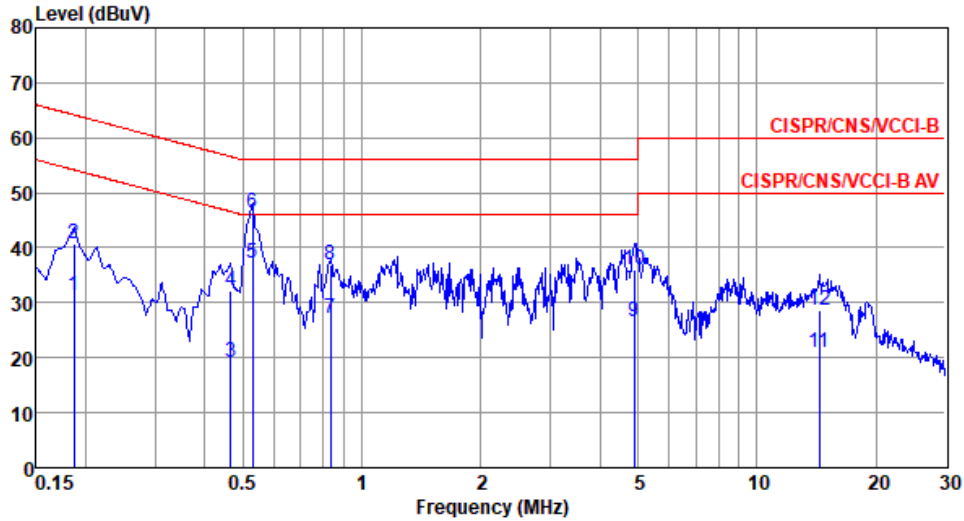


	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	Factor dB	Cable loss dB	Remark
1	0.186	28.28	54.20	-25.92	18.39	9.83	0.06	Average
2	0.186	38.19	64.20	-26.01	28.30	9.83	0.06	QP
3*	0.538	33.14	46.00	-12.86	23.19	9.86	0.09	Average
4	0.538	42.70	56.00	-13.30	32.75	9.86	0.09	QP
5	0.835	26.72	46.00	-19.28	16.74	9.87	0.11	Average
6	0.835	35.60	56.00	-20.40	25.62	9.87	0.11	QP
7	1.197	23.46	46.00	-22.54	13.42	9.90	0.14	Average
8	1.197	32.56	56.00	-23.44	22.52	9.90	0.14	QP
9	4.952	24.47	46.00	-21.53	14.16	9.99	0.32	Average
10	4.952	33.69	56.00	-22.31	23.38	9.99	0.32	QP
11	15.970	21.88	50.00	-28.12	11.01	10.25	0.62	Average
12	15.970	29.67	60.00	-30.33	18.80	10.25	0.62	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	LORA	Test Freq. (MHz)	927.5
Power Phase	Line		

Test by : Alex Tsai Temperature: 22°C Humidity: 61%

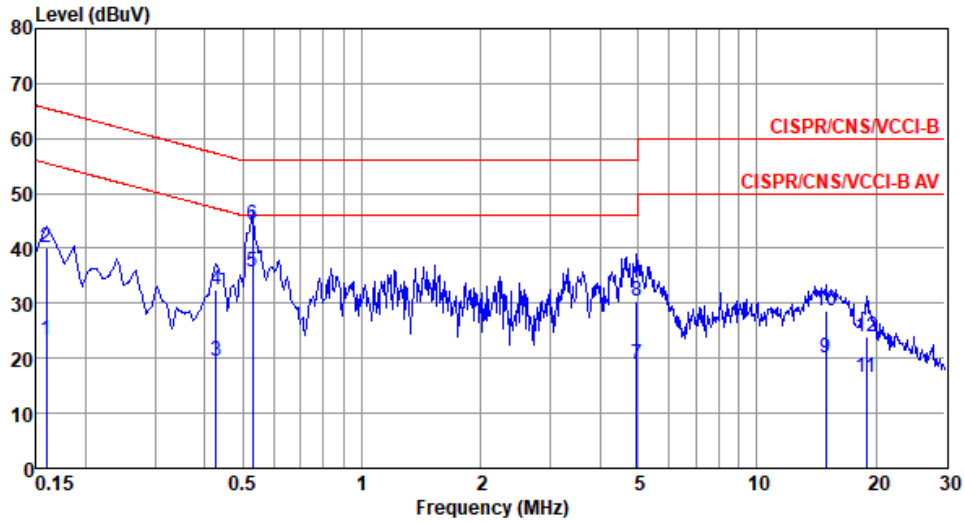


	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	Factor dB	Cable loss dB	Remark
1	0.186	31.44	54.20	-22.76	21.54	9.84	0.06	Average
2	0.186	40.76	64.20	-23.44	30.86	9.84	0.06	QP
3	0.466	19.09	46.58	-27.49	9.09	9.91	0.09	Average
4	0.466	32.11	56.58	-24.47	22.11	9.91	0.09	QP
5*	0.529	37.26	46.00	-8.74	27.25	9.92	0.09	Average
6	0.529	46.22	56.00	-9.78	36.21	9.92	0.09	QP
7	0.835	27.26	46.00	-18.74	17.18	9.97	0.11	Average
8	0.835	36.88	56.00	-19.12	26.80	9.97	0.11	QP
9	4.900	26.45	46.00	-19.55	16.08	10.06	0.31	Average
10	4.900	36.05	56.00	-19.95	25.68	10.06	0.31	QP
11	14.364	20.83	50.00	-29.17	10.06	10.19	0.58	Average
12	14.364	28.61	60.00	-31.39	17.84	10.19	0.58	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	LORA	Test Freq. (MHz)	927.5
Power Phase	Neutral		

Test by : Alex Tsai Temperature: 22°C Humidity: 61%



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	Factor dB	Cable loss dB	Remark
1	0.159	23.40	55.52	-32.12	13.53	9.82	0.05	Average
2	0.159	40.17	65.52	-25.35	30.30	9.82	0.05	QP
3	0.428	19.40	47.29	-27.89	9.47	9.85	0.08	Average
4	0.428	32.41	57.29	-24.88	22.48	9.85	0.08	QP
5*	0.529	35.74	46.00	-10.26	25.79	9.86	0.09	Average
6	0.529	44.27	56.00	-11.73	34.32	9.86	0.09	QP
7	4.952	18.76	46.00	-27.24	8.45	9.99	0.32	Average
8	4.952	30.42	56.00	-25.58	20.11	9.99	0.32	QP
9	14.907	20.10	50.00	-29.90	9.28	10.22	0.60	Average
10	14.907	28.65	60.00	-31.35	17.83	10.22	0.60	QP
11	18.920	16.54	50.00	-33.46	5.58	10.30	0.66	Average
12	18.920	23.80	60.00	-36.20	12.84	10.30	0.66	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 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

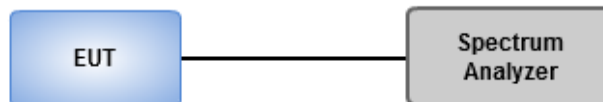
6dB Bandwidth

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.

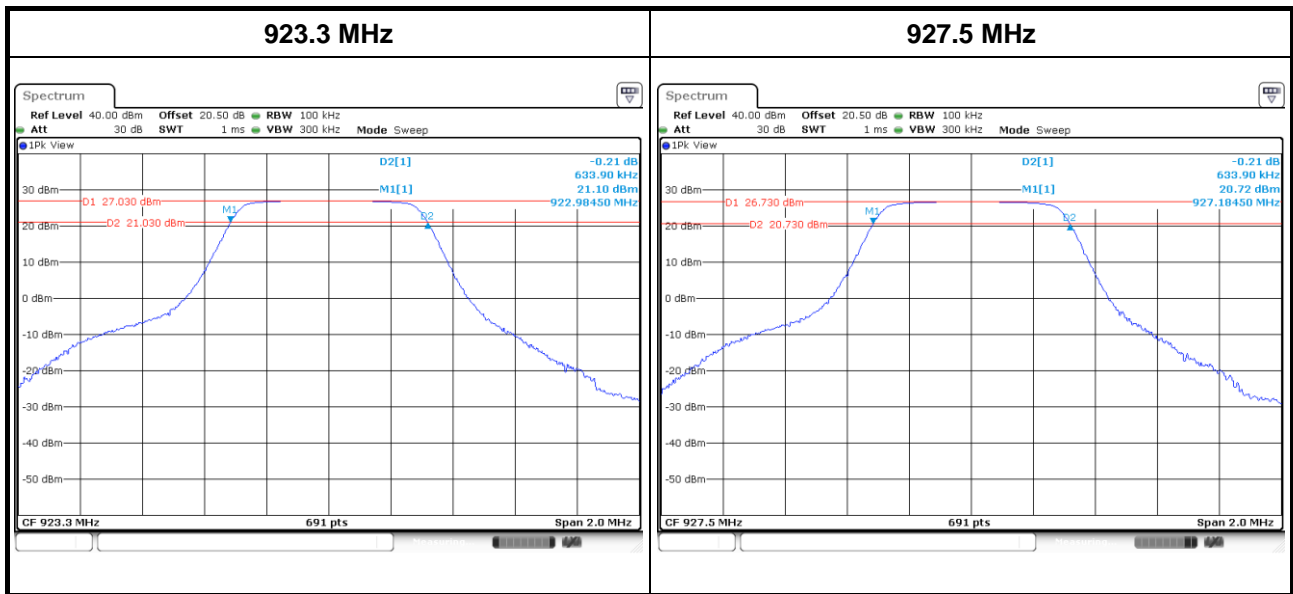
3.2.3 Test Setup



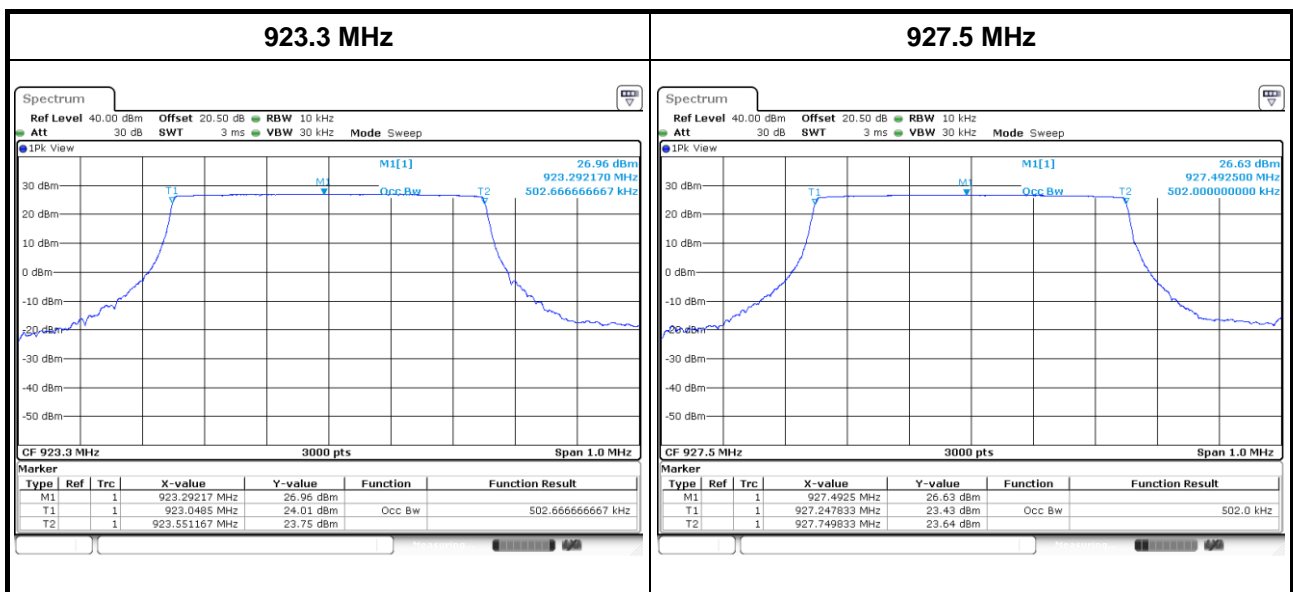
3.2.4 Test Result of 6dB and Occupied Bandwidth

Ambient Condition	24°C / 62%	Tested By	Roger Lu
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Modulation / SF	Freq. (MHz)	6dB Bandwidth (kHz)	Limit (kHz)
LORA / 12	923.3	639.9	500
LORA / 12	927.5	639.9	500



Modulation / SF	Freq. (MHz)	Occupied Bandwidth (MHz)
LORA / 12	923.3	0.503
LORA / 12	927.5	0.502



3.3 RF Output Power

3.3.1 Limit of RF Output Power

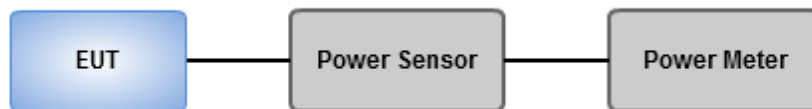
Conducted power shall not exceed 1Watt.

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

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	24°C / 62%	Tested By	Roger Lu
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Modulation / SF	Freq. (MHz)	AV Power (mW)	AV Power (dBm)	Limit (dBm)
LORA / 12	923.3	519.996	27.16	30
LORA / 12	927.5	490.9079	26.91	30

3.4 Power Spectral Density

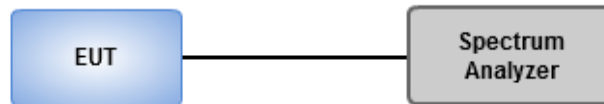
3.4.1 Limit of Power Spectral Density

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.

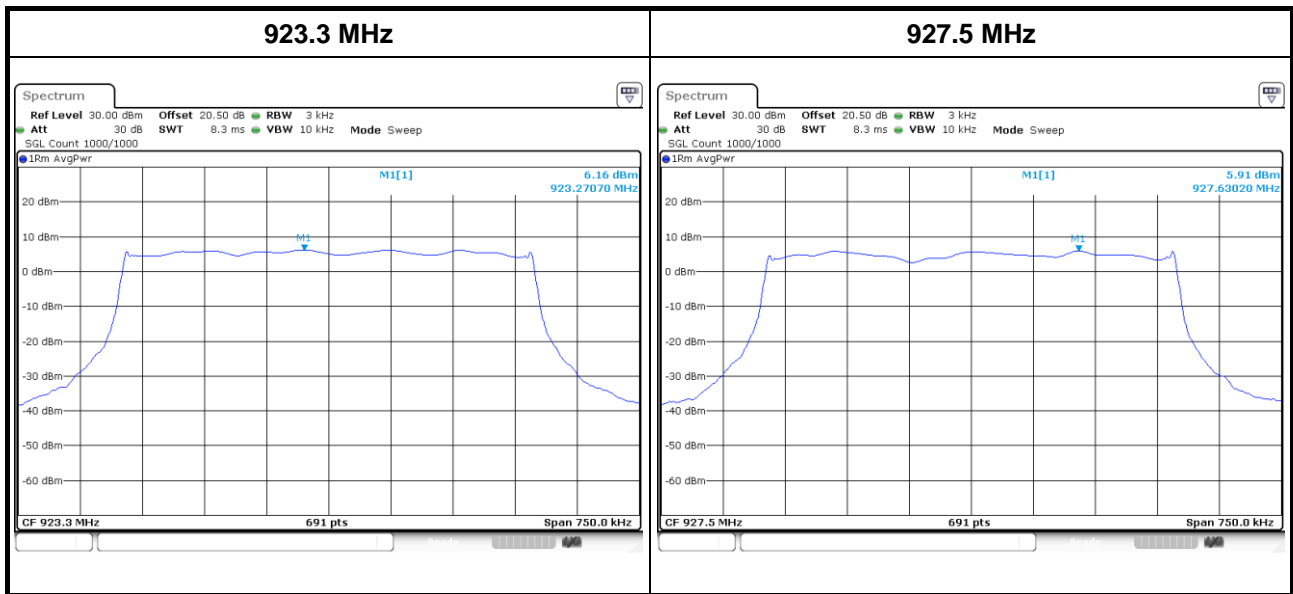
3.4.3 Test Setup



3.4.4 Test Result of Power Spectral Density

Ambient Condition	24°C / 62%	Tested By	Roger Lu
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Modulation / SF	Freq. (MHz)	PSD (mW)	PSD (dBm)	Limit (dBm)
LORA / 12	923.3	4.1	6.16	8
LORA / 12	927.5	3.9	5.91	8



3.5 Unwanted Emissions into Restricted Frequency Bands

3.5.1 Limit of Unwanted Emissions into Restricted Frequency Bands

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1:
Quasi-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit

Note 2:
Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

3.5.2 Test Procedures

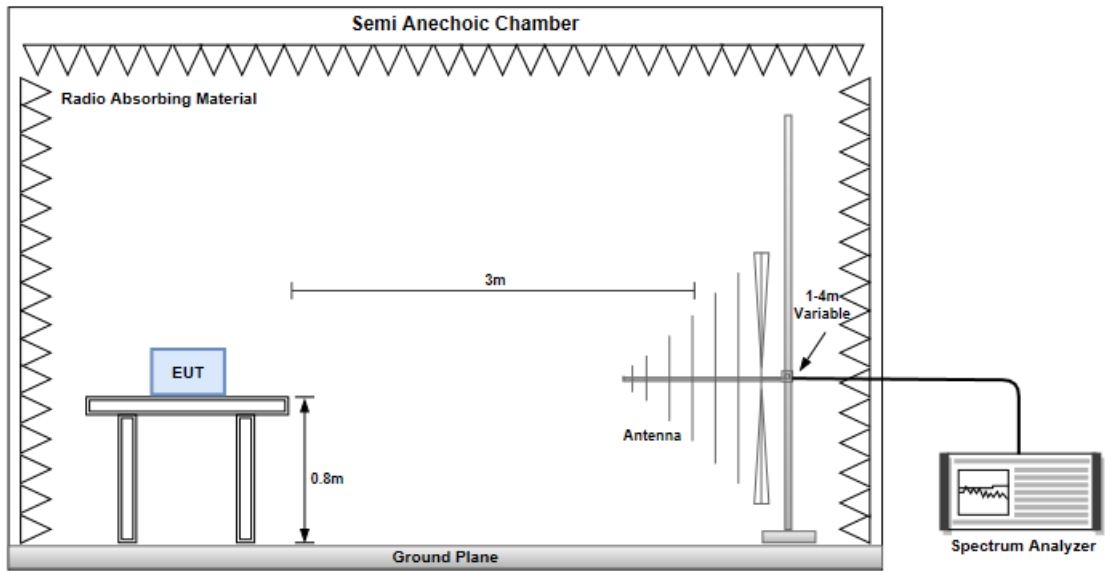
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m
2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Note:

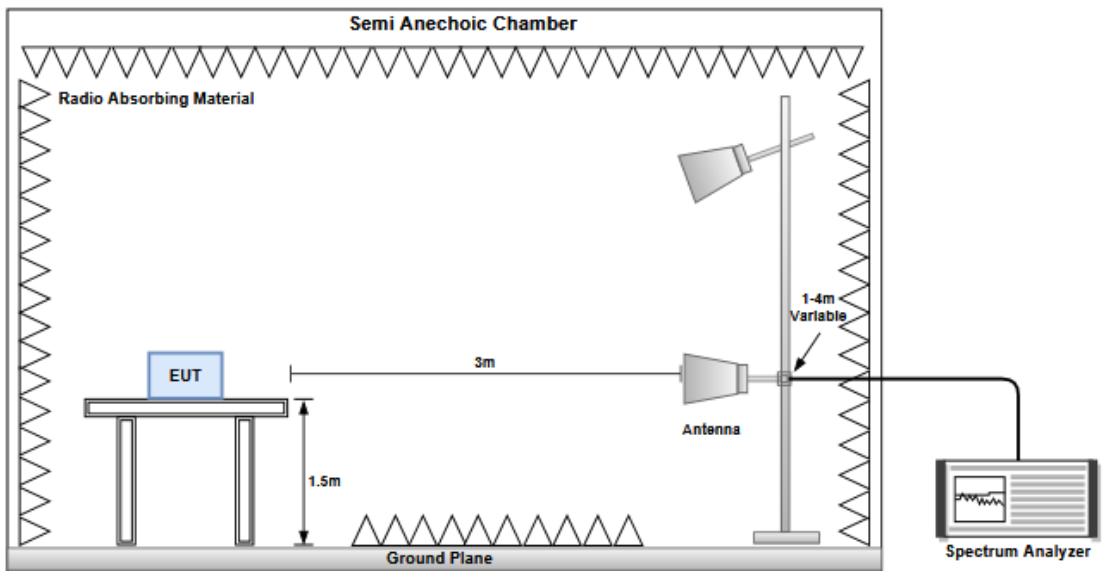
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

3.5.3 Test Setup

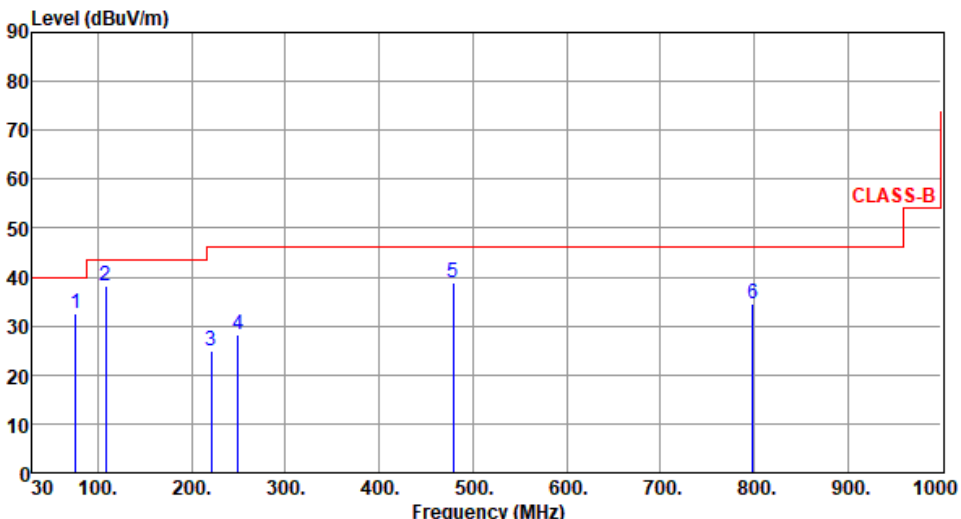
Radiated Emissions below 1 GHz



Radiated Emissions above 1 GHz



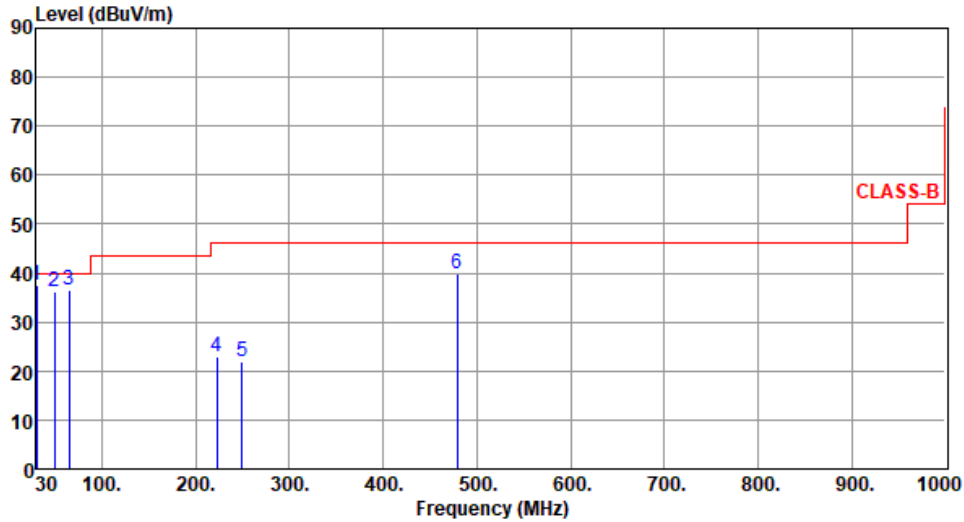
3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	LORA	Test Freq. (MHz)	923.3						
Polarization	Horizontal								
Test By : Roger Lu		Temperature(°C): 25	Humidity(%): 61						
 <p>The graph plots Level (dBuV/m) on the y-axis (0 to 90) against Frequency (MHz) on the x-axis (30 to 1000). A red line represents the CLASS-B limit, which is 40 dBuV/m from 30 to 100 MHz, 45 dBuV/m from 100 to 200 MHz, and 55 dBuV/m from 200 to 1000 MHz. Six peaks are labeled with blue numbers 1 through 6, corresponding to the data table below.</p>									
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		cm	deg
1	76.59	32.56	40.00	-7.44	45.07	-12.51	Peak	---	---
2	108.46	38.15	43.50	-5.35	50.22	-12.07	Peak	---	---
3	220.80	24.90	46.00	-21.10	36.92	-12.02	Peak	---	---
4	249.60	28.37	46.00	-17.63	38.52	-10.15	Peak	---	---
5	479.20	38.90	46.00	-7.10	42.74	-3.84	Peak	---	---
6	798.40	34.47	46.00	-11.53	32.60	1.87	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	LORA	Test Freq. (MHz)	923.3
Polarization	Vertical		

Test By :Roger Lu Temperature(°C):25 Humidity(%):61



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	30.55	37.59	40.00	-2.41	47.60	-10.01	QP	100	255
2	49.51	36.22	40.00	-3.78	44.79	-8.57	Peak	---	---
3	65.05	36.48	40.00	-3.52	46.40	-9.92	Peak	---	---
4	222.40	22.97	46.00	-23.03	35.02	-12.05	Peak	---	---
5	249.60	21.86	46.00	-24.14	32.01	-10.15	Peak	---	---
6	479.20	39.73	46.00	-6.27	43.57	-3.84	Peak	---	---

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

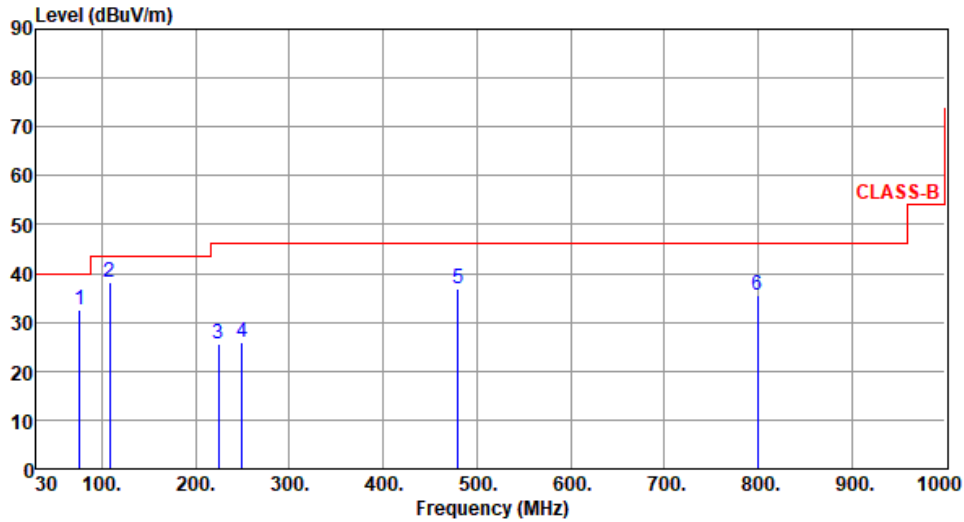
*Factor includes antenna factor , cable loss and amplifier gain

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	LORA	Test Freq. (MHz)	927.5
Polarization	Horizontal		

Test By :Roger Lu Temperature(°C):25 Humidity(%):61



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	76.48	32.39	40.00	-7.61	44.85	-12.46	Peak	---	---
2	108.46	38.12	43.50	-5.38	50.19	-12.07	Peak	---	---
3	224.00	25.41	46.00	-20.59	37.48	-12.07	Peak	---	---
4	249.22	26.05	46.00	-19.95	36.21	-10.16	Peak	---	---
5	480.08	36.74	46.00	-9.26	40.55	-3.81	Peak	---	---
6	799.21	35.48	46.00	-10.52	33.61	1.87	Peak	---	---

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

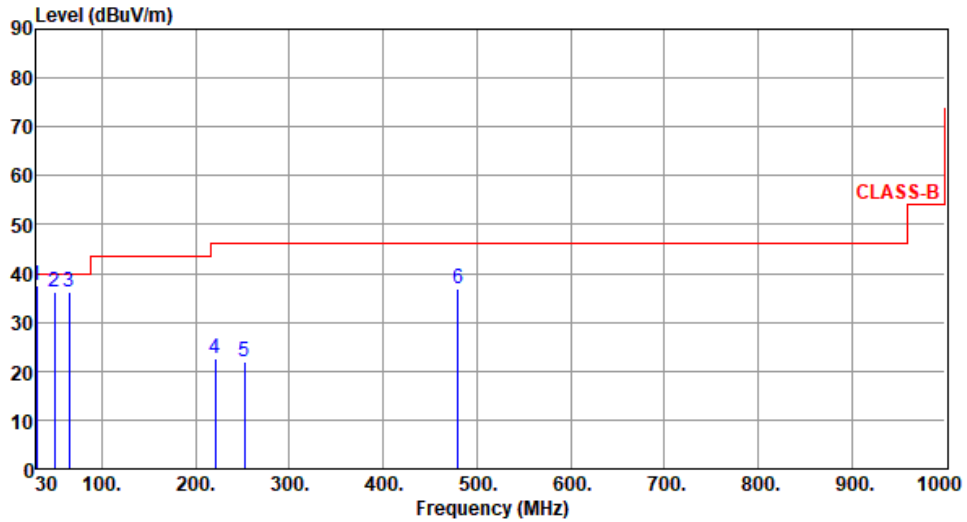
*Factor includes antenna factor , cable loss and amplifier gain

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	LORA	Test Freq. (MHz)	927.5
Polarization	Vertical		

Test By :Roger Lu Temperature(°C):25 Humidity(%):61



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	30.58	37.52	40.00	-2.48	47.53	-10.01	QP	100	261
2	49.53	36.16	40.00	-3.84	44.73	-8.57	Peak	---	---
3	64.86	36.19	40.00	-3.81	46.07	-9.88	Peak	---	---
4	221.09	22.60	46.00	-23.40	34.62	-12.02	Peak	---	---
5	252.13	21.95	46.00	-24.05	32.00	-10.05	Peak	---	---
6	480.08	36.92	46.00	-9.08	40.73	-3.81	Peak	---	---

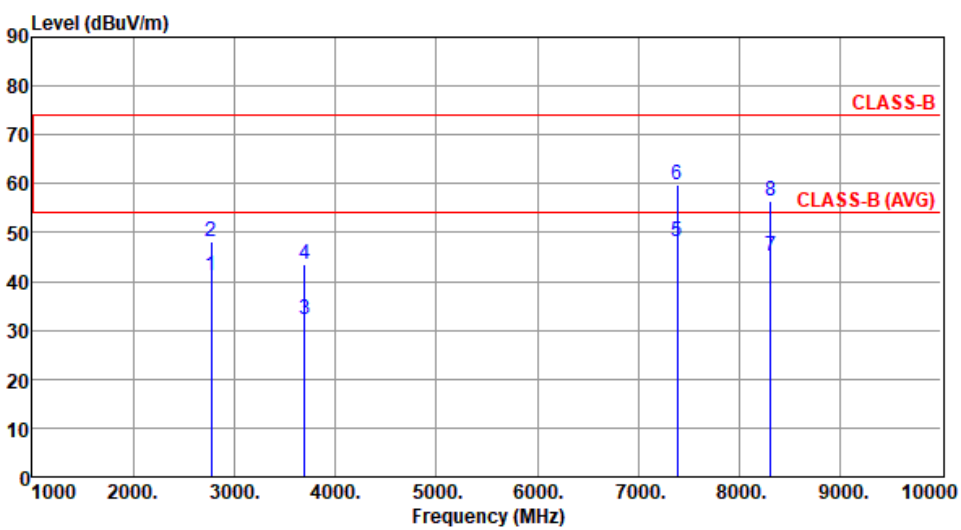
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

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

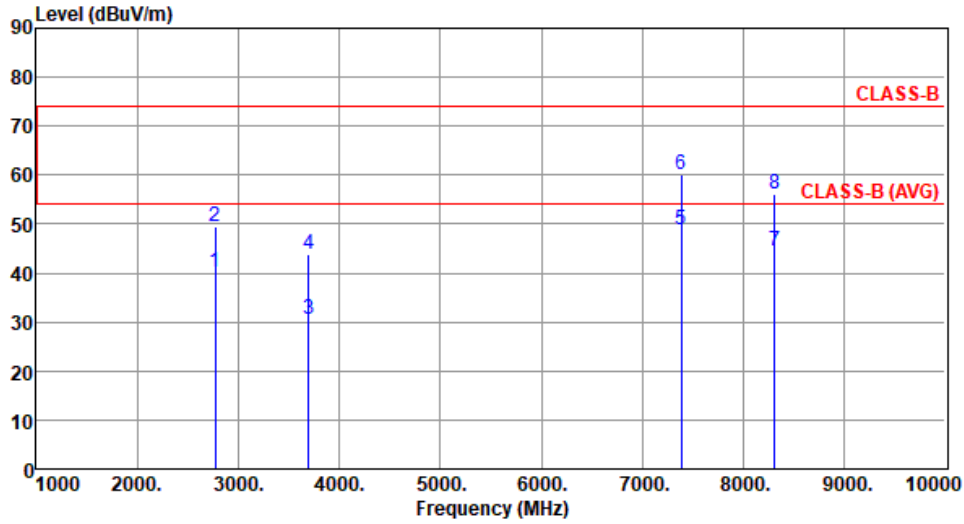
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

3.5.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation	LORA	Test Freq. (MHz)	923.3																																																																																																																																																																
Polarization	Horizontal																																																																																																																																																																		
Test By : Roger Lu Temperature(°C):25 Humidity(%):61																																																																																																																																																																			
																																																																																																																																																																			
	<table border="1"> <thead> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> <th>8</th> </tr> </thead> <tbody> <tr> <td>2769.90</td> <td>2769.90</td> <td>3693.20</td> <td>3693.20</td> <td>7386.40</td> <td>7386.40</td> <td>8309.70</td> <td>8309.70</td> </tr> <tr> <td>41.34</td> <td>48.25</td> <td>32.21</td> <td>43.49</td> <td>48.18</td> <td>59.91</td> <td>45.11</td> <td>56.58</td> </tr> <tr> <td>54.00</td> <td>74.00</td> <td>54.00</td> <td>74.00</td> <td>54.00</td> <td>74.00</td> <td>54.00</td> <td>74.00</td> </tr> <tr> <td>-12.66</td> <td>-25.75</td> <td>-21.79</td> <td>-30.51</td> <td>-5.82</td> <td>-14.09</td> <td>-8.89</td> <td>-17.42</td> </tr> <tr> <td>43.13</td> <td>50.04</td> <td>31.93</td> <td>43.21</td> <td>39.21</td> <td>50.94</td> <td>35.76</td> <td>47.23</td> </tr> <tr> <td>-1.79</td> <td>-1.79</td> <td>0.28</td> <td>0.28</td> <td>8.97</td> <td>8.97</td> <td>9.35</td> <td>9.35</td> </tr> <tr> <td>Average</td> <td>Peak</td> <td>Average</td> <td>Peak</td> <td>Average</td> <td>Peak</td> <td>Average</td> <td>Peak</td> </tr> <tr> <td>100</td> <td>100</td> <td>153</td> <td>153</td> <td>319</td> <td>319</td> <td>100</td> <td>100</td> </tr> <tr> <td>177</td> <td>177</td> <td>340</td> <td>340</td> <td>30</td> <td>30</td> <td>20</td> <td>20</td> </tr> </tbody> </table>	1	2	3	4	5	6	7	8	2769.90	2769.90	3693.20	3693.20	7386.40	7386.40	8309.70	8309.70	41.34	48.25	32.21	43.49	48.18	59.91	45.11	56.58	54.00	74.00	54.00	74.00	54.00	74.00	54.00	74.00	-12.66	-25.75	-21.79	-30.51	-5.82	-14.09	-8.89	-17.42	43.13	50.04	31.93	43.21	39.21	50.94	35.76	47.23	-1.79	-1.79	0.28	0.28	8.97	8.97	9.35	9.35	Average	Peak	Average	Peak	Average	Peak	Average	Peak	100	100	153	153	319	319	100	100	177	177	340	340	30	30	20	20	<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/m</th> <th>Remark</th> <th>ANT High cm</th> <th>Turn Table deg</th> </tr> </thead> <tbody> <tr> <td>2769.90</td> <td>41.34</td> <td>54.00</td> <td>-12.66</td> <td>43.13</td> <td>-1.79</td> <td>Average</td> <td>100</td> <td>177</td> </tr> <tr> <td>2769.90</td> <td>48.25</td> <td>74.00</td> <td>-25.75</td> <td>50.04</td> <td>-1.79</td> <td>Peak</td> <td>100</td> <td>177</td> </tr> <tr> <td>3693.20</td> <td>32.21</td> <td>54.00</td> <td>-21.79</td> <td>31.93</td> <td>0.28</td> <td>Average</td> <td>153</td> <td>340</td> </tr> <tr> <td>3693.20</td> <td>43.49</td> <td>74.00</td> <td>-30.51</td> <td>43.21</td> <td>0.28</td> <td>Peak</td> <td>153</td> <td>340</td> </tr> <tr> <td>7386.40</td> <td>48.18</td> <td>54.00</td> <td>-5.82</td> <td>39.21</td> <td>8.97</td> <td>Average</td> <td>319</td> <td>30</td> </tr> <tr> <td>7386.40</td> <td>59.91</td> <td>74.00</td> <td>-14.09</td> <td>50.94</td> <td>8.97</td> <td>Peak</td> <td>319</td> <td>30</td> </tr> <tr> <td>8309.70</td> <td>45.11</td> <td>54.00</td> <td>-8.89</td> <td>35.76</td> <td>9.35</td> <td>Average</td> <td>100</td> <td>20</td> </tr> <tr> <td>8309.70</td> <td>56.58</td> <td>74.00</td> <td>-17.42</td> <td>47.23</td> <td>9.35</td> <td>Peak</td> <td>100</td> <td>20</td> </tr> </tbody> </table>	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg	2769.90	41.34	54.00	-12.66	43.13	-1.79	Average	100	177	2769.90	48.25	74.00	-25.75	50.04	-1.79	Peak	100	177	3693.20	32.21	54.00	-21.79	31.93	0.28	Average	153	340	3693.20	43.49	74.00	-30.51	43.21	0.28	Peak	153	340	7386.40	48.18	54.00	-5.82	39.21	8.97	Average	319	30	7386.40	59.91	74.00	-14.09	50.94	8.97	Peak	319	30	8309.70	45.11	54.00	-8.89	35.76	9.35	Average	100	20	8309.70	56.58	74.00	-17.42	47.23	9.35	Peak	100	20
1	2	3	4	5	6	7	8																																																																																																																																																												
2769.90	2769.90	3693.20	3693.20	7386.40	7386.40	8309.70	8309.70																																																																																																																																																												
41.34	48.25	32.21	43.49	48.18	59.91	45.11	56.58																																																																																																																																																												
54.00	74.00	54.00	74.00	54.00	74.00	54.00	74.00																																																																																																																																																												
-12.66	-25.75	-21.79	-30.51	-5.82	-14.09	-8.89	-17.42																																																																																																																																																												
43.13	50.04	31.93	43.21	39.21	50.94	35.76	47.23																																																																																																																																																												
-1.79	-1.79	0.28	0.28	8.97	8.97	9.35	9.35																																																																																																																																																												
Average	Peak	Average	Peak	Average	Peak	Average	Peak																																																																																																																																																												
100	100	153	153	319	319	100	100																																																																																																																																																												
177	177	340	340	30	30	20	20																																																																																																																																																												
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3693.20	43.49	74.00	-30.51	43.21	0.28	Peak	153	340																																																																																																																																																											
7386.40	48.18	54.00	-5.82	39.21	8.97	Average	319	30																																																																																																																																																											
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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	LORA	Test Freq. (MHz)	923.3
Polarization	Vertical		

Test By :Roger Lu Temperature(°C):25 Humidity(%):61



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	2769.90	40.12	54.00	-13.88	41.91	-1.79	Average	126	347
2	2769.90	49.60	74.00	-24.40	51.39	-1.79	Peak	126	347
3	3693.20	30.46	54.00	-23.54	30.18	0.28	Average	100	50
4	3693.20	43.80	74.00	-30.20	43.52	0.28	Peak	100	50
5	7386.40	48.88	54.00	-5.12	39.91	8.97	Average	100	246
6	7386.40	59.99	74.00	-14.01	51.02	8.97	Peak	100	246
7	8309.70	44.41	54.00	-9.59	35.06	9.35	Average	100	17
8	8309.70	56.05	74.00	-17.95	46.70	9.35	Peak	100	17

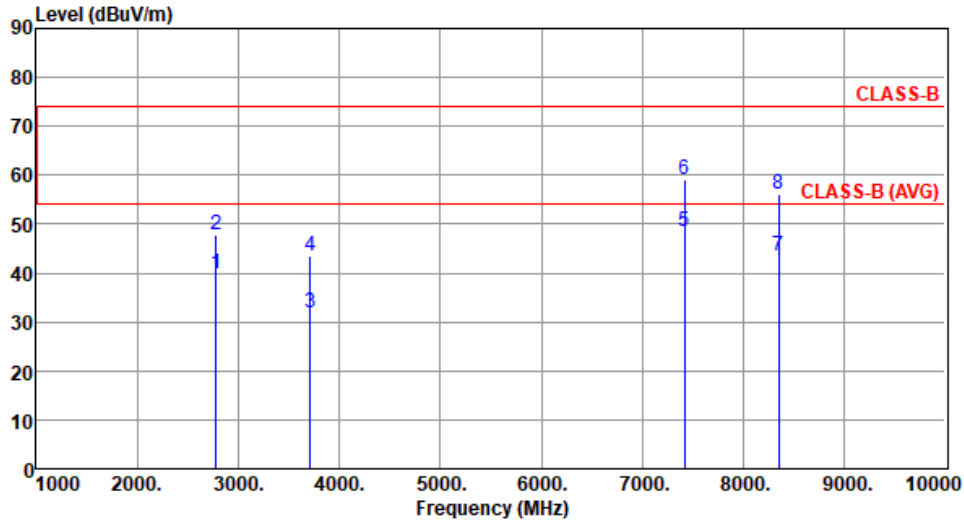
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

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

Modulation	LORA	Test Freq. (MHz)	927.5
Polarization	Horizontal		

Test By :Roger Lu Temperature(°C):25 Humidity(%):61



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	2782.50	39.84	54.00	-14.16	41.56	-1.72	Average	100	178
2	2782.50	47.71	74.00	-26.29	49.43	-1.72	Peak	100	178
3	3710.00	31.86	54.00	-22.14	31.56	0.30	Average	149	345
4	3710.00	43.36	74.00	-30.64	43.06	0.30	Peak	149	345
5	7420.00	48.55	54.00	-5.45	39.59	8.96	Average	320	26
6	7420.00	59.25	74.00	-14.75	50.29	8.96	Peak	320	26
7	8347.50	43.46	54.00	-10.54	34.14	9.32	Average	119	16
8	8347.50	56.05	74.00	-17.95	46.73	9.32	Peak	119	16

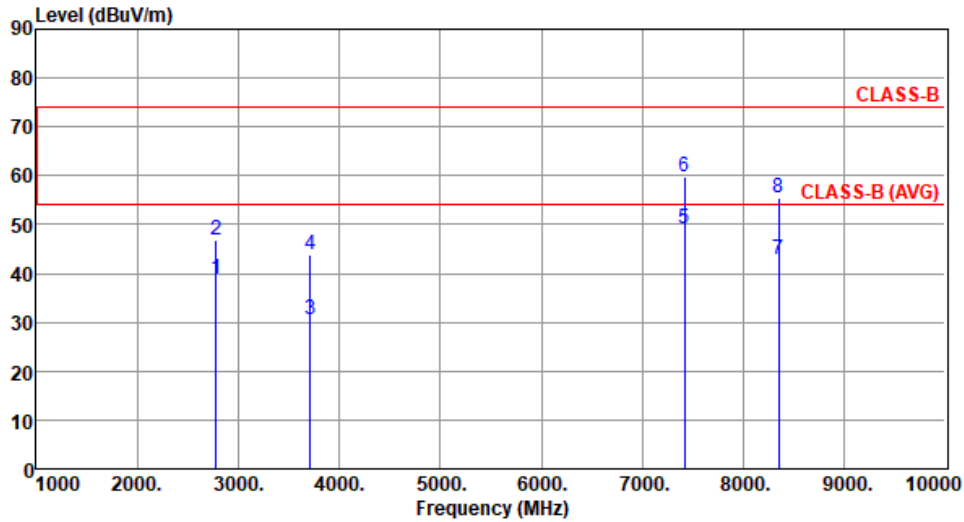
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

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

Modulation	LORA	Test Freq. (MHz)	927.5
Polarization	Vertical		

Test By :Roger Lu Temperature(°C):25 Humidity(%):61



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	2782.50	38.74	54.00	-15.26	40.46	-1.72	Average	125	349
2	2782.50	46.87	74.00	-27.13	48.59	-1.72	Peak	125	349
3	3710.00	30.56	54.00	-23.44	30.26	0.30	Average	100	40
4	3710.00	43.76	74.00	-30.24	43.46	0.30	Peak	100	40
5	7420.00	49.12	54.00	-4.88	40.16	8.96	Average	100	245
6	7420.00	59.65	74.00	-14.35	50.69	8.96	Peak	100	245
7	8347.50	42.87	54.00	-11.13	33.55	9.32	Average	100	18
8	8347.50	55.47	74.00	-18.53	46.15	9.32	Peak	100	18

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

*Factor includes antenna factor , cable loss and amplifier gain

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

3.6 Emissions in Non-Restricted Frequency Bands

3.6.1 Emissions in Non-Restricted Frequency Bands Limit

Peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz.

3.6.2 Test Procedures

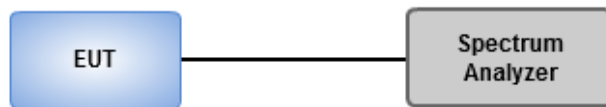
Reference level measurement

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

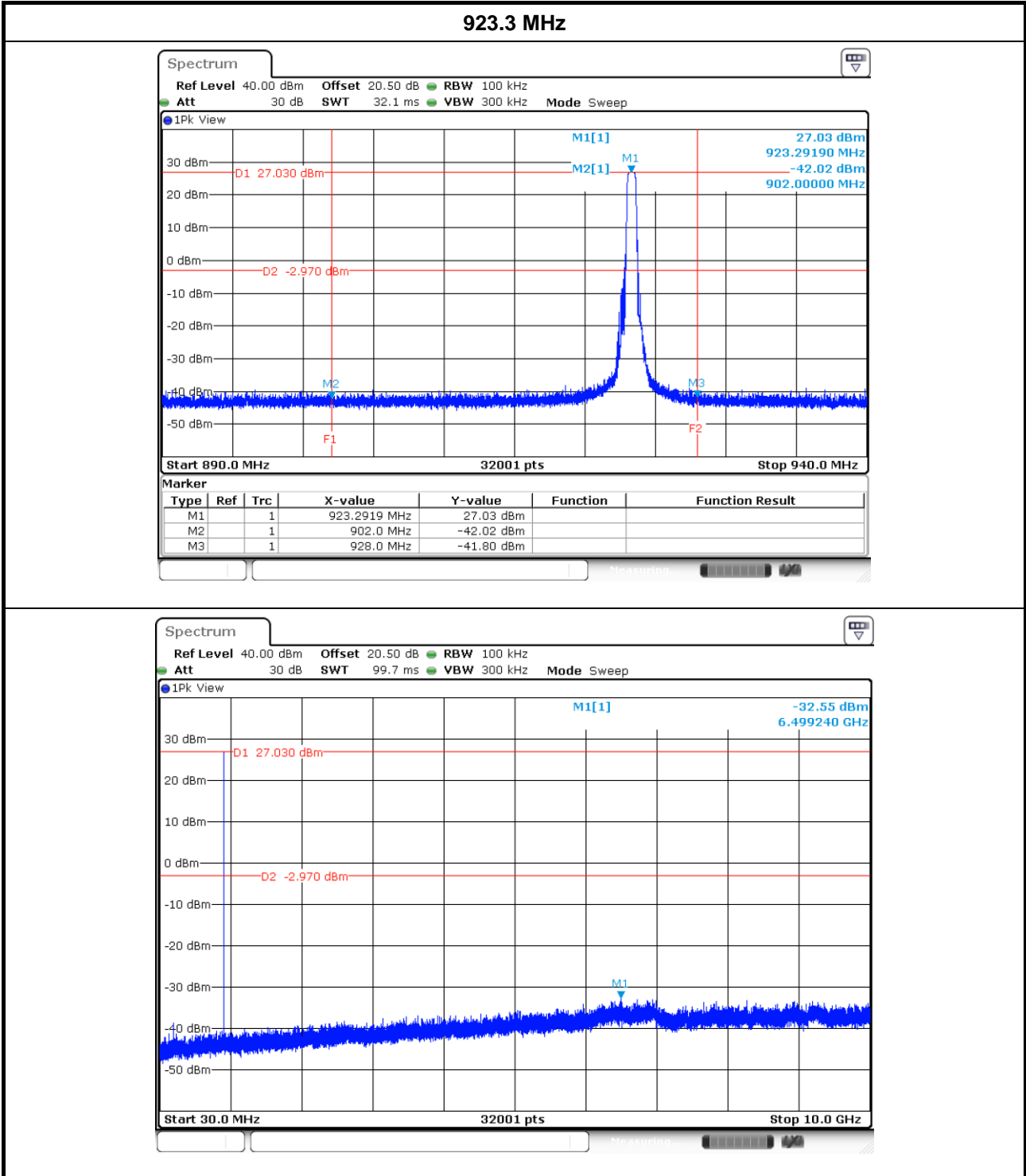
1. Set RBW=100kHz, VBW = 300kHz , Detector = Peak, Sweep time = Auto
2. Trace = max hold , Allow Trace to fully stabilize
3. Scan Frequency range is up to 25GHz
4. Use the peak marker function to determine the maximum amplitude level

3.6.3 Test Setup

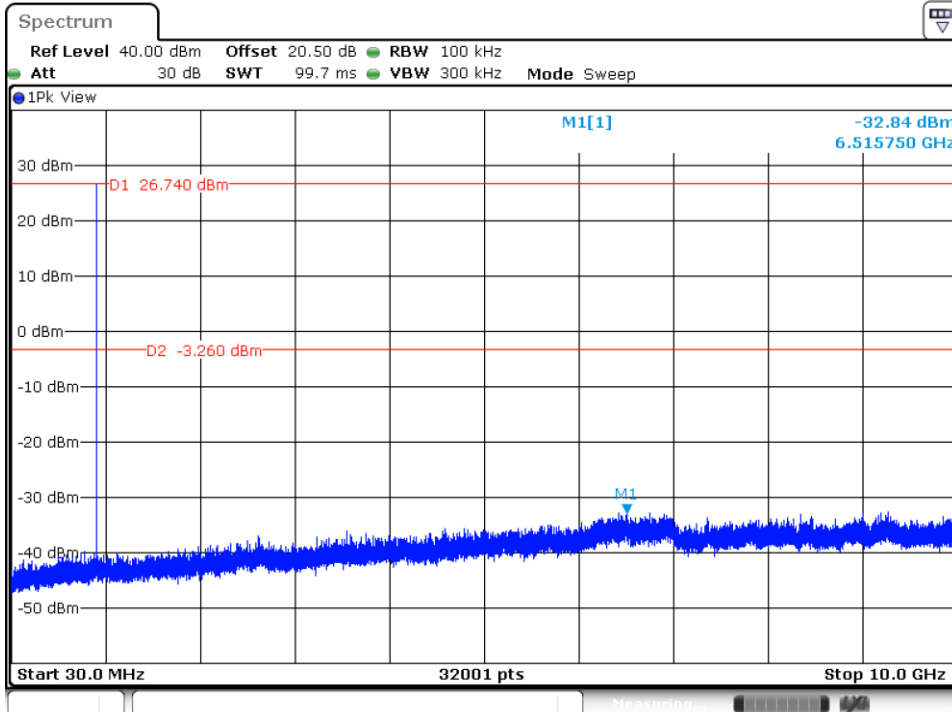
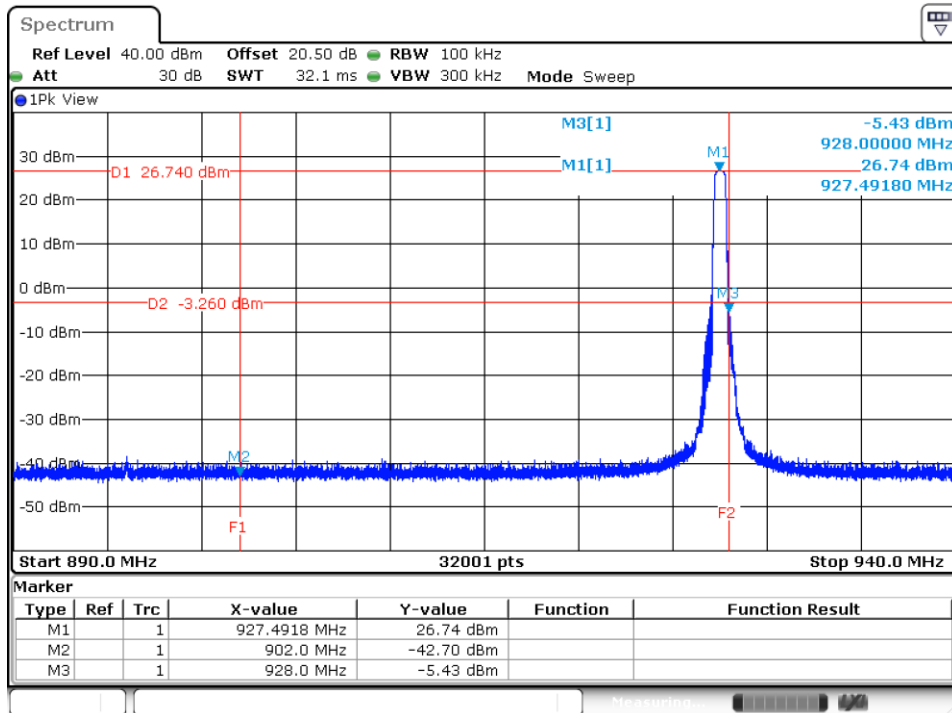


3.6.4 Unwanted Emissions into Non-Restricted Frequency Bands

Ambient Condition	24°C / 62%	Tested By	Roger Lu
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927.5 MHz



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 Dist., Tao Yuan
City 33381, Taiwan (R.O.C.)

No.2-1, Lane 6, Wen San 3rd
St., Kwei Shan Dist., Tao Yuan
City 33381, Taiwan (R.O.C.)

Kwei Shan Site II

Tel: 886-3-271-8640

No.14-1, Lane 19, Wen San 3rd
St., Kwei Shan Dist., 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: 886-3-318-0345

Email: ICC_Service@icertifi.com.tw

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