

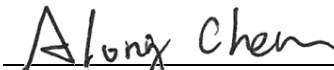
FCC Test Report

FCC ID : 2AAS9-TBMH120
Equipment : MiniHub Pro V2
Model No. : TBMH120
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 : Oct. 05, 2023
Tested Date : Oct. 18 ~ Oct. 20, 2023

We, International Certification Corporation, 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 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

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Appendix A. 6dB and Occupied Bandwidth

Appendix B. Conducted Output Power

Appendix C. Power Spectral Density

Appendix D. Unwanted Emissions into Restricted Frequency Bands

Appendix E. Emissions in Non-Restricted Frequency Bands

Appendix F. AC Power Line Conducted Emissions

Release Record

Report No.	Version	Description	Issued Date
FR070702-01	Rev. 01	Initial issue	Nov. 24, 2023

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	AC Power Line Conducted Emission	[dBuV]: 0.641MHz 49.92 (Margin -6.08dB) - QP	Pass
15.247(d) 15.209	Unwanted Emissions	[dBuV/m at 3m]: 170.59MHz 38.95 (Margin -4.55dB) - PK	Pass
15.247(b)(3)	Conducted Output Power	Max Power [dBm]: 26.03	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	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 LoRa modulation.					

1.1.2 Antenna Details

Ant. No.	Type	Connector	Gain (dBi)
1	PIFA	IPEX	0.25

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	100-240Vac
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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

1.1.6 Test Tool and Duty Cycle

Test Tool	Tera Term, V4.80	
Duty Cycle and Duty Factor	Duty Cycle (%)	Duty Factor (dB)
	36.87%	4.33

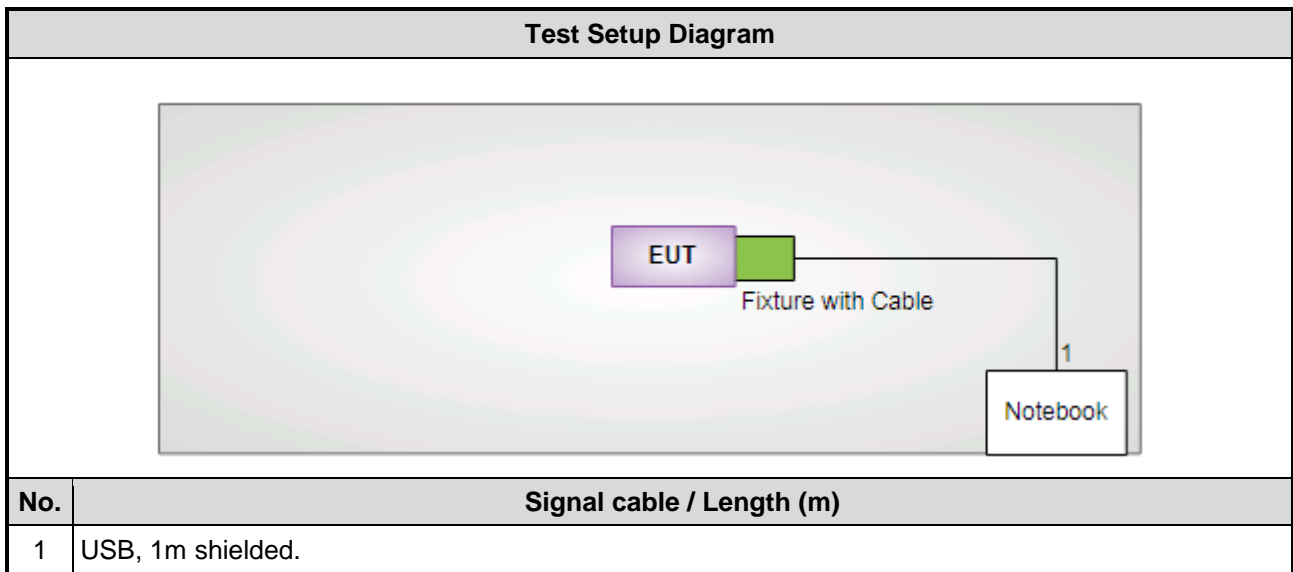
1.1.7 Power Index of Test Tool

Modulation Mode	923.3 MHz	927.5 MHz
LoRa	pa 1 pwid 20	pa 1 pwid 20

1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Remarks
1	Notebook	DELL	Latitude E5470	DoC	---
2	Fixture with Cable	---	---	---	Provided by applicant.

1.3 Test Setup Chart



1.4 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Tested Date	Oct. 20, 2023				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101658	Feb. 17, 2023	Feb. 16, 2024
LISN	R&S	ENV216	101579	May 09, 2023	May 08, 2024
LISN (Support Unit)	SCHWARZBECK	Schwarzbeck 8127	8127667	Jan .03, 2023	Jan .02, 2024
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 11, 2023	Oct. 10, 2024
50 ohm terminal (Support Unit)	NA	50	01	Jun. 14, 2023	Jun. 13, 2024
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	Oct. 18, 2023				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101657	Mar. 03, 2023	Mar. 02, 2024
Spectrum Analyzer	R&S	FSV40	101498	Nov. 21, 2022	Nov. 20, 2023
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 01, 2022	Oct. 31, 2023
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jul. 31, 2023	Jul. 30, 2024
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Nov. 25, 2022	Nov. 24, 2023
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Oct. 27, 2022	Oct. 26, 2023
Preamplifier	EMC	EMC02325	980225	Jun. 28, 2023	Jun. 27, 2024
Preamplifier	EMC	EMC118A45SE	980898	Jul. 14, 2023	Jul. 13, 2024
Preamplifier	EMC	EMC184045SE	980903	Jul. 17, 2023	Jul. 16, 2024
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 03, 2023	Oct. 02, 2024
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Oct. 03, 2023	Oct. 02, 2024
LF cable 11M	EMC	EMCCFD400-NW-N W-11000	200801	Oct. 03, 2023	Oct. 02, 2024
LF cable 1M	EMC	EMCCFD400-NM-N M-1000	160502	Oct. 03, 2023	Oct. 02, 2024
RF Cable	EMC	EMC104-35M-35M-8000	210920	Oct. 03, 2023	Oct. 02, 2024
RF Cable	EMC	EMC104-35M-35M-3000	210922	Oct. 03, 2023	Oct. 02, 2024
HIGHPASS FILTER 1.5-15G	WHK	WHK1.5/15G-10ST	21	Oct. 05, 2023	Oct. 04, 2024
Attenuator	Pasternack	PE7005-10	10-1	Oct. 05, 2023	Oct. 04, 2024
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	Oct. 19, 2023				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101910	Apr. 14, 2023	Apr. 13, 2024
Power Meter	Anritsu	ML2495A	1241002	Nov. 23, 2022	Nov. 22, 2023
Power Sensor	Anritsu	MA2411B	1207366	Nov. 23, 2022	Nov. 22, 2023
Attenuator	Pasternack	PE7005-10	10-2	Oct. 05, 2023	Oct. 04, 2024
Measurement Software	Sporton	SENSE-15247_FS	V5.10.8	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 ≤ 1 GHz	± 3.41 dB
Radiated emission > 1 GHz	± 4.59 dB

2 Test Configuration

2.1 Testing Facility

Test Laboratory	International Certification Corporation
Test Site	CO01-WS, 03CH01-WS, TH01-WS
Address of Test Site	No.3-1, Lane 6, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 33381, 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	Channel Bandwidth (kHz)	Test Frequency (MHz)	Modulation	SF	Test Configuration
AC Power Line Conducted Emission Conducted Output Power 6dB bandwidth Power spectral density Unwanted Emissions	500	923.3 / 927.5	500	12	--
NOTE: The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The Z-plane results were found as the worst case and were shown in this report.					

3 Transmitter Test Results

3.1 6dB and Occupied Bandwidth

3.1.1 Limit of 6dB Bandwidth

The minimum 6dB bandwidth shall be at least 500 kHz.

3.1.2 Test Procedures

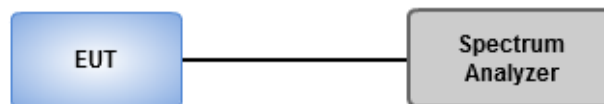
6dB Bandwidth

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.

3.1.3 Test Setup



3.1.4 Test Results

Ambient Condition	23°C / 66%	Tested By	Akun Chung
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Refer to Appendix A.

3.2 RF Output Power

3.2.1 Limit of RF Output Power

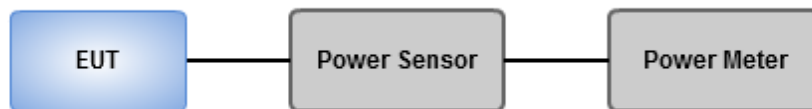
Conducted power shall not exceed 1Watt.

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

3.2.2 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.

3.2.3 Test Setup



3.2.4 Test Results

Ambient Condition	23°C / 66%	Tested By	Akun Chung
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Refer to Appendix B.

3.3 Power Spectral Density

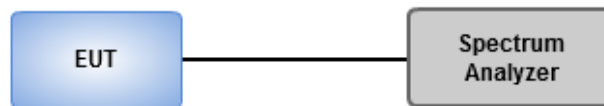
3.3.1 Limit of Power Spectral Density

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

3.3.2 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.

3.3.3 Test Setup



3.3.4 Test Results

Ambient Condition	23°C / 66%	Tested By	Akun Chung
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Refer to Appendix C.

3.4 Unwanted Emissions into Restricted Frequency Bands

3.4.1 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.

3.4.2 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:

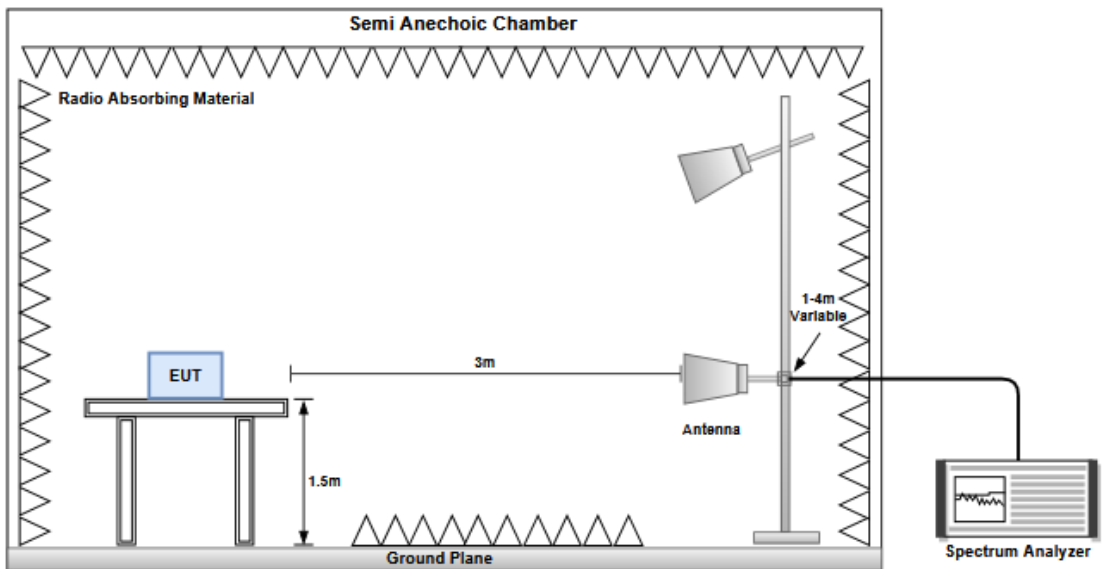
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

3.4.3 Test Setup

Radiated Emissions below 1 GHz



Radiated Emissions above 1 GHz



3.4.4 Test Results

Refer to Appendix D.

3.5 Emissions in Non-Restricted Frequency Bands

3.5.1 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.

3.5.2 Test Procedures

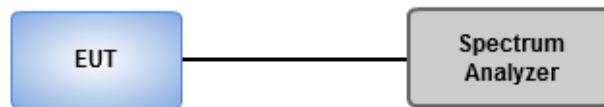
Reference level measurement

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

3.5.3 Test Setup



3.5.4 Test Results

Ambient Condition	23°C / 66%	Tested By	Akun Chung
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Refer to Appendix E.

3.6 AC Power Line Conducted Emissions

3.6.1 Limit of AC Power Line Conducted Emissions

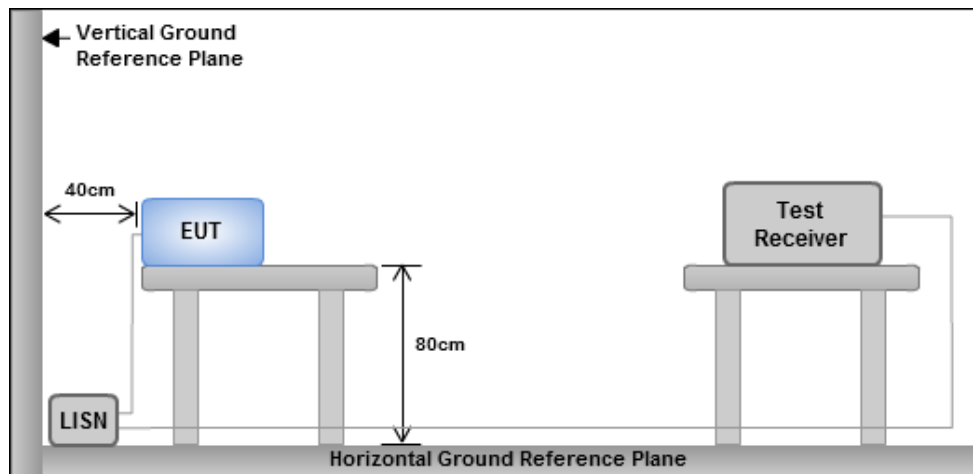
Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

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

3.6.2 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.

3.6.3 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

3.6.4 Test Results

Refer to Appendix F.

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 Corporation (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 33381, 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

==END==



Summary

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
902-928MHz	-	-	-	-	-
LoRa (500kHz)	629.375k	490.38k	490KF1D	626.25k	486.632k

Max-N dB = Maximum 6dB down bandwidth; Max-OBW = Maximum 99% occupied bandwidth;
Min-N dB = Minimum 6dB down bandwidth; Min-OBW = Minimum 99% occupied bandwidth

Result

Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
LoRa (500kHz)	-	-	-	-
923.3MHz	Pass	500k	629.375k	490.38k
927.5MHz	Pass	500k	626.25k	486.632k

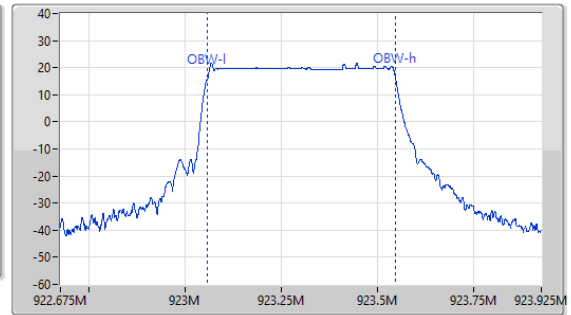
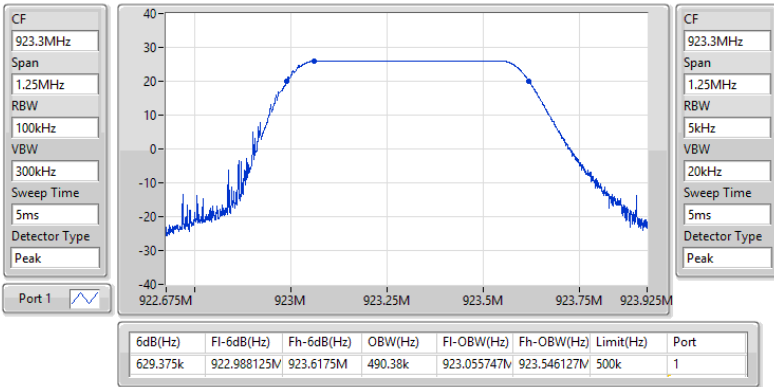
Port X-N dB = Port X 6dB down bandwidth;
Port X-OBW = Port X 99% occupied bandwidth



902-928MHz_LoRa (500kHz)

EBW-DTS

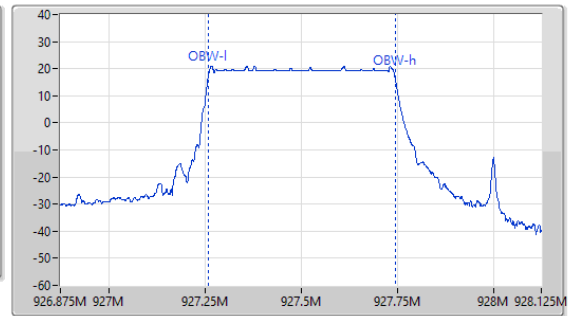
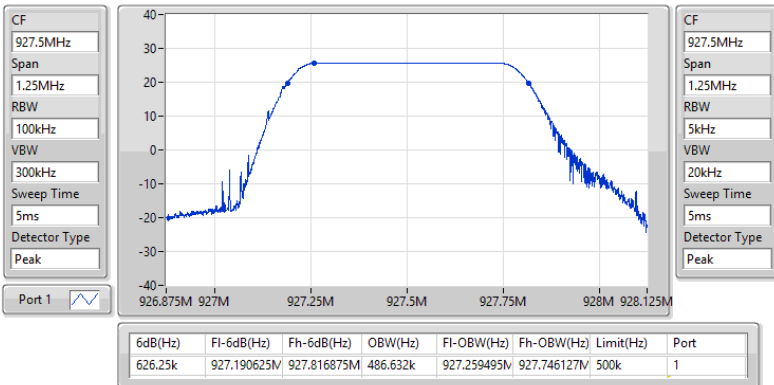
923.3MHz



902-928MHz_LoRa (500kHz)

EBW-DTS

927.5MHz





Summary

Mode	Total Power (dBm)	Power (W)
902-928MHz	-	-
LoRa (500kHz)	26.03	0.40087

Result

Mode	Result	Antenna Gain (dBi)	Total Power (dBm)	Power Limit (dBm)	EIRP (dBm)	EIRP Limit (dBm)
LoRa (500kHz)	-	-	-	-	-	-
923.3MHz	Pass	0.25	26.03	30.00	26.28	36.00
927.5MHz	Pass	0.25	25.62	30.00	25.87	36.00

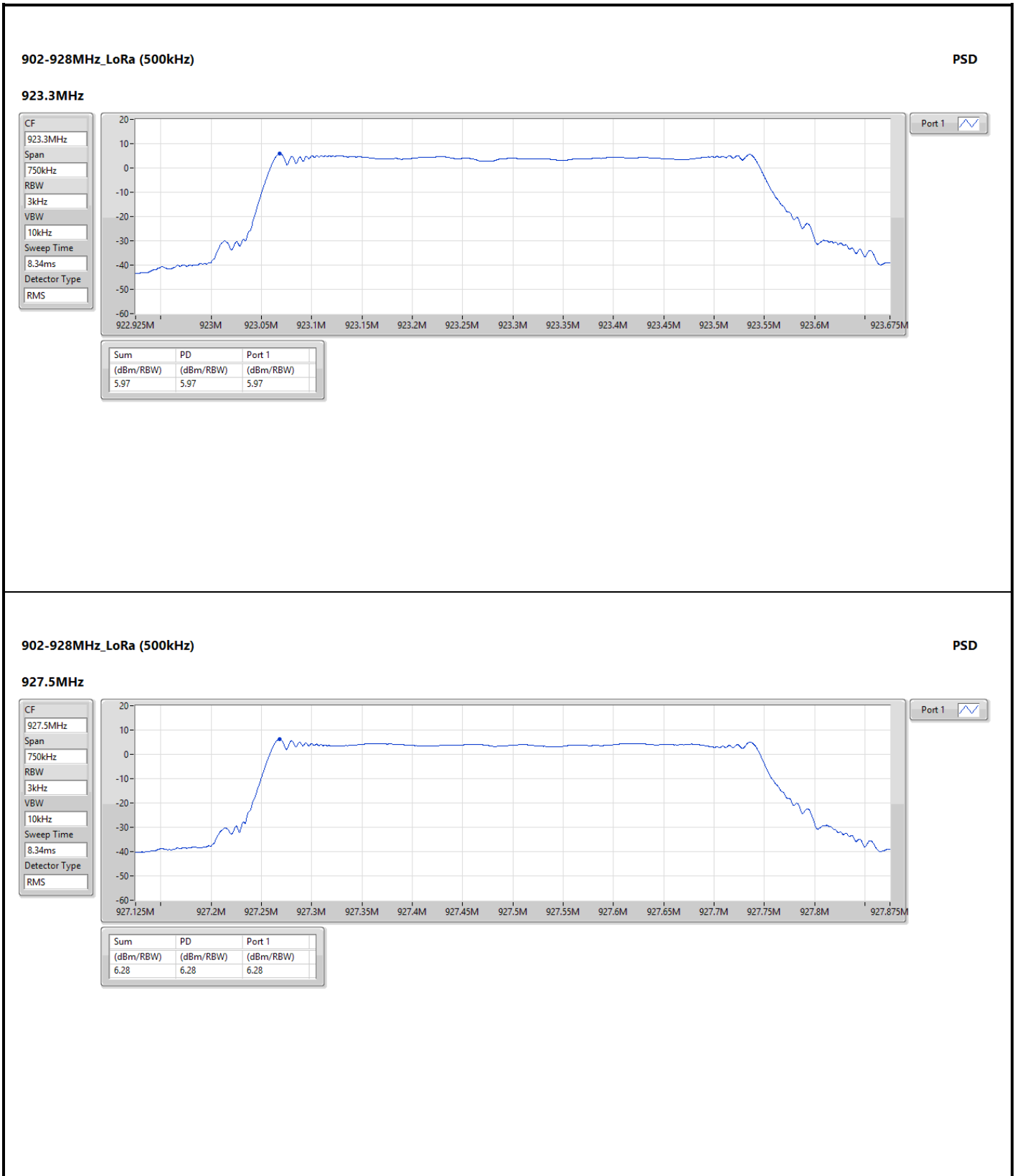


Summary

Mode	PD (dBm/3kHz)
902-928MHz	-
LoRa (500kHz)	6.28

Result

Mode	Result	Antenna Gain (dBi)	Power Density (dBm/3kHz)	Power Density Limit (dBm/3kHz)
LoRa (500kHz)	-	-	-	-
923.3MHz	Pass	0.25	5.97	8.00
927.5MHz	Pass	0.25	6.28	8.00





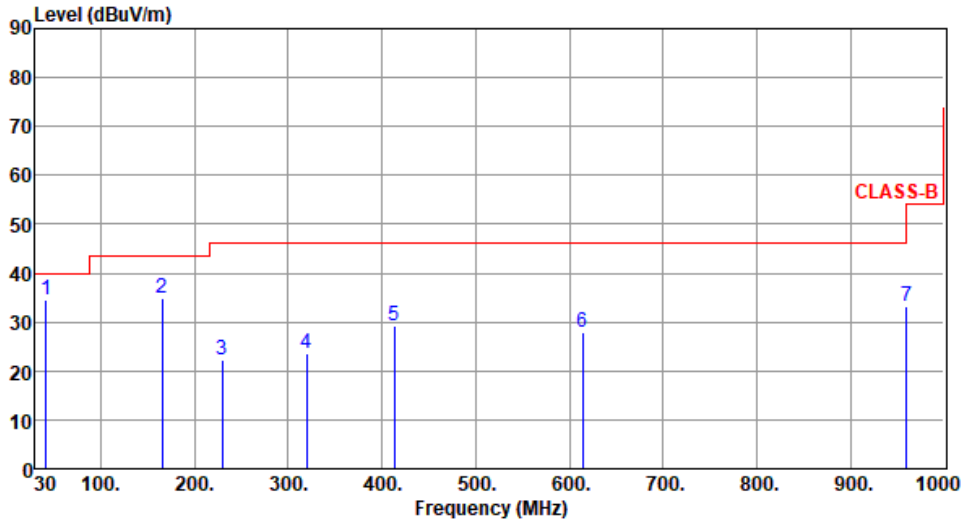
Unwanted Emissions (Below 1GHz)

Mode	LoRa (500kHz)	Test Freq. (MHz)	923.3																																																																																
Polarization	Horizontal																																																																																		
<p>Test By :Paul Lin Temperature(°C):24 Humidity(%):66</p>																																																																																			
<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 constant at 46 dBuV/m from 30 MHz to 960 MHz, then rises to 73 dBuV/m at 1000 MHz. Seven blue vertical lines indicate emission peaks at the following frequencies: 1 (59.41 MHz), 2 (170.59 MHz), 3 (226.40 MHz), 4 (240.00 MHz), 5 (304.00 MHz), 6 (614.00 MHz), and 7 (960.00 MHz).</p>																																																																																			
<table border="1"> <thead> <tr> <th></th> <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>1</td> <td>59.41</td> <td>33.46</td> <td>40.00</td> <td>-6.54</td> <td>42.19</td> <td>-8.73</td> <td>Peak</td> <td>---</td> <td>---</td> </tr> <tr> <td>2</td> <td>170.59</td> <td>38.95</td> <td>43.50</td> <td>-4.55</td> <td>48.28</td> <td>-9.33</td> <td>Peak</td> <td>---</td> <td>---</td> </tr> <tr> <td>3</td> <td>226.40</td> <td>28.89</td> <td>46.00</td> <td>-17.11</td> <td>40.77</td> <td>-11.88</td> <td>Peak</td> <td>---</td> <td>---</td> </tr> <tr> <td>4</td> <td>240.00</td> <td>31.64</td> <td>46.00</td> <td>-14.36</td> <td>41.92</td> <td>-10.28</td> <td>Peak</td> <td>---</td> <td>---</td> </tr> <tr> <td>5</td> <td>304.00</td> <td>29.32</td> <td>46.00</td> <td>-16.68</td> <td>37.29</td> <td>-7.97</td> <td>Peak</td> <td>---</td> <td>---</td> </tr> <tr> <td>6</td> <td>614.00</td> <td>27.54</td> <td>46.00</td> <td>-18.46</td> <td>27.78</td> <td>-0.24</td> <td>Peak</td> <td>---</td> <td>---</td> </tr> <tr> <td>7</td> <td>960.00</td> <td>33.30</td> <td>46.00</td> <td>-12.70</td> <td>28.00</td> <td>5.30</td> <td>Peak</td> <td>---</td> <td>---</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	1	59.41	33.46	40.00	-6.54	42.19	-8.73	Peak	---	---	2	170.59	38.95	43.50	-4.55	48.28	-9.33	Peak	---	---	3	226.40	28.89	46.00	-17.11	40.77	-11.88	Peak	---	---	4	240.00	31.64	46.00	-14.36	41.92	-10.28	Peak	---	---	5	304.00	29.32	46.00	-16.68	37.29	-7.97	Peak	---	---	6	614.00	27.54	46.00	-18.46	27.78	-0.24	Peak	---	---	7	960.00	33.30	46.00	-12.70	28.00	5.30	Peak	---	---
	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	59.41	33.46	40.00	-6.54	42.19	-8.73	Peak	---	---																																																																										
2	170.59	38.95	43.50	-4.55	48.28	-9.33	Peak	---	---																																																																										
3	226.40	28.89	46.00	-17.11	40.77	-11.88	Peak	---	---																																																																										
4	240.00	31.64	46.00	-14.36	41.92	-10.28	Peak	---	---																																																																										
5	304.00	29.32	46.00	-16.68	37.29	-7.97	Peak	---	---																																																																										
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<p>Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).</p>																																																																																			



Mode	LoRa (500kHz)	Test Freq. (MHz)	923.3
Polarization	Vertical		

Test By :Paul Lin Temperature(°C):24 Humidity(%):66



	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	41.22	34.67	40.00	-5.33	43.35	-8.68	Peak	---	---
2	165.83	34.73	43.50	-8.77	43.74	-9.01	Peak	---	---
3	229.60	22.36	46.00	-23.64	33.91	-11.55	Peak	---	---
4	320.00	23.64	46.00	-22.36	31.04	-7.40	Peak	---	---
5	413.60	29.20	46.00	-16.80	34.16	-4.96	Peak	---	---
6	614.00	28.01	46.00	-17.99	28.25	-0.24	Peak	---	---
7	960.00	33.35	46.00	-12.65	28.05	5.30	Peak	---	---

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

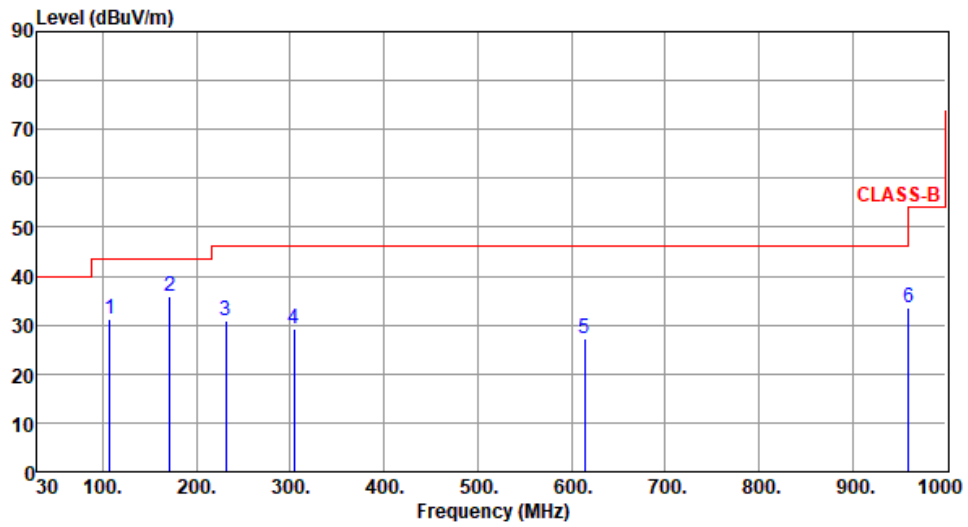
*Factor includes antenna factor , cable loss and amplifier gain

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



Mode	LoRa (500kHz)	Test Freq. (MHz)	927.5
Polarization	Horizontal		

Test By : Paul Lin Temperature(°C): 24 Humidity(%): 66



	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	107.35	31.38	43.50	-12.12	43.48	-12.10	Peak	---	---
2	171.10	35.99	43.50	-7.51	45.29	-9.30	Peak	---	---
3	231.20	30.86	46.00	-15.14	42.20	-11.34	Peak	---	---
4	304.00	29.32	46.00	-16.68	37.29	-7.97	Peak	---	---
5	614.00	27.29	46.00	-18.71	27.53	-0.24	Peak	---	---
6	960.00	33.45	46.00	-12.55	28.15	5.30	Peak	---	---

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

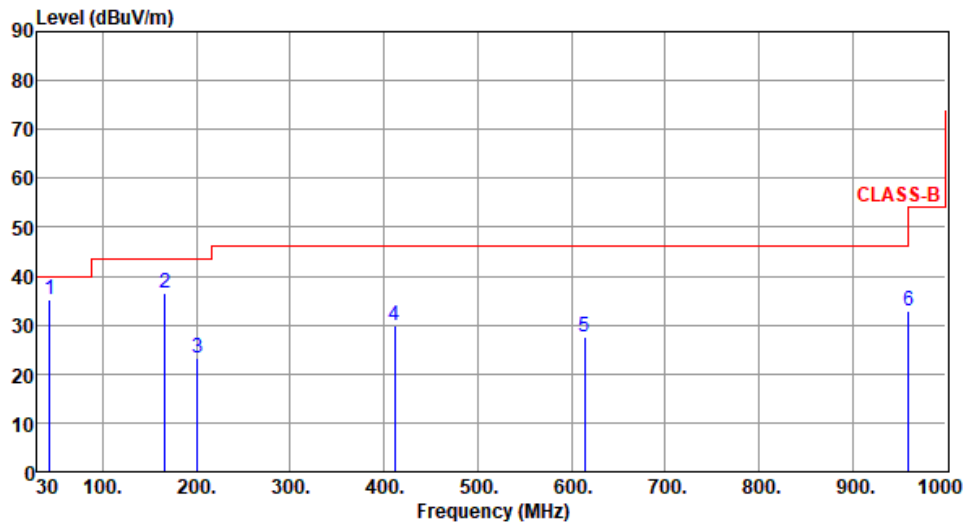
*Factor includes antenna factor , cable loss and amplifier gain

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



Mode	LoRa (500kHz)	Test Freq. (MHz)	927.5
Polarization	Vertical		

Test By :Paul Lin Temperature(°C):24 Humidity(%):66



	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	43.09	35.24	40.00	-4.76	43.60	-8.36	Peak	---	---
2	166.17	36.62	43.50	-6.88	45.65	-9.03	Peak	---	---
3	200.80	23.23	43.50	-20.27	35.06	-11.83	Peak	---	---
4	411.20	29.85	46.00	-16.15	34.87	-5.02	Peak	---	---
5	614.00	27.65	46.00	-18.35	27.89	-0.24	Peak	---	---
6	960.00	32.85	46.00	-13.15	27.55	5.30	Peak	---	---

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

*Factor includes antenna factor , cable loss and amplifier gain

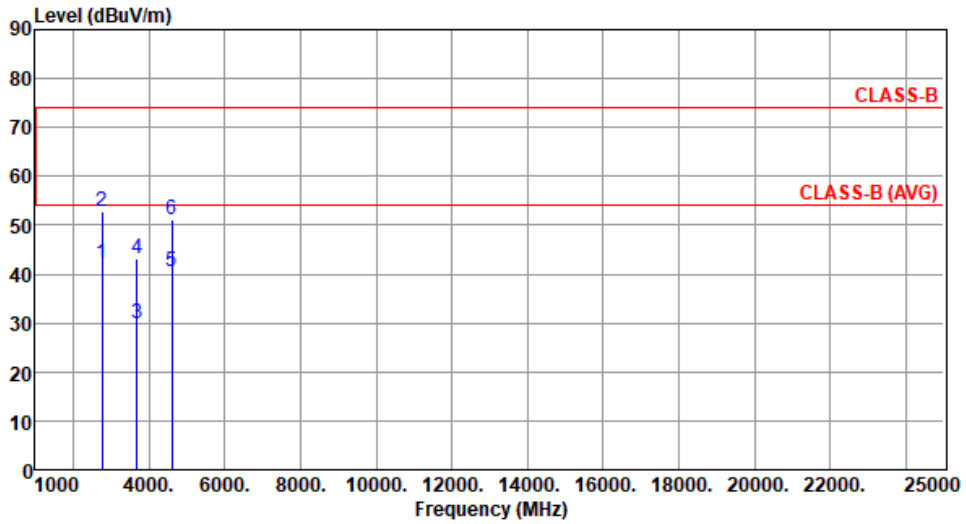
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).



Unwanted Emissions (Above 1GHz)

Mode	LoRa (500kHz)	Test Freq. (MHz)	923.3
Polarization	Horizontal		

Test By : Paul Lin Temperature(°C): 25 Humidity(%): 62



	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	42.30	54.00	-11.70	45.57	-3.27	Average	100	40
2	2769.90	52.91	74.00	-21.09	56.18	-3.27	Peak	100	40
3	3693.20	29.91	54.00	-24.09	32.04	-2.13	Average	100	51
4	3693.20	43.20	74.00	-30.80	45.33	-2.13	Peak	100	51
5	4616.50	40.38	54.00	-13.62	40.88	-0.50	Average	183	7
6	4616.50	51.09	74.00	-22.91	51.59	-0.50	Peak	183	7

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

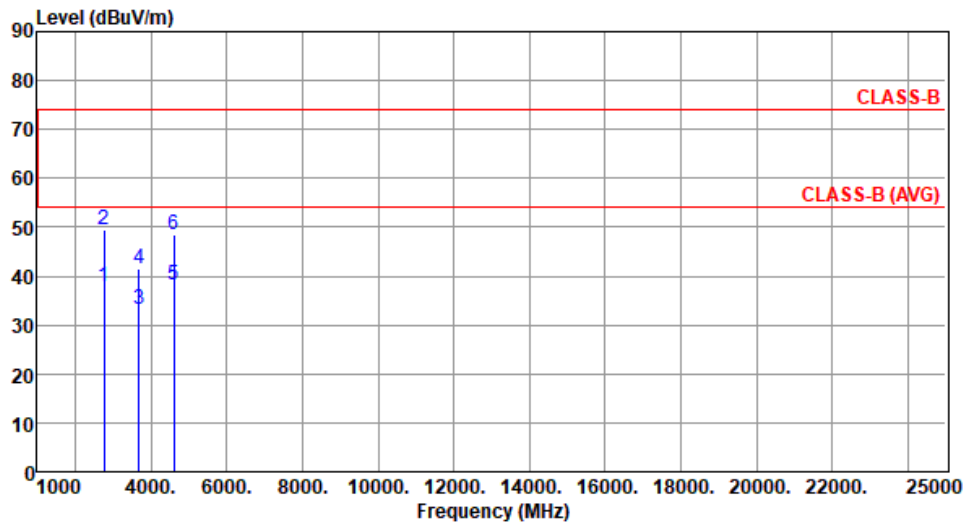
*Factor includes antenna factor , cable loss and amplifier gain

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



Mode	LoRa (500kHz)	Test Freq. (MHz)	923.3
Polarization	Vertical		

Test By : Paul Lin Temperature(°C): 25 Humidity(%): 62



	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	38.01	54.00	-15.99	41.28	-3.27	Average	252	280
2	2769.90	49.50	74.00	-24.50	52.77	-3.27	Peak	252	280
3	3693.20	33.11	54.00	-20.89	35.24	-2.13	Average	110	82
4	3693.20	41.51	74.00	-32.49	43.64	-2.13	Peak	110	82
5	4616.50	38.30	54.00	-15.70	38.80	-0.50	Average	134	104
6	4616.50	48.35	74.00	-25.65	48.85	-0.50	Peak	134	104

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

*Factor includes antenna factor , cable loss and amplifier gain

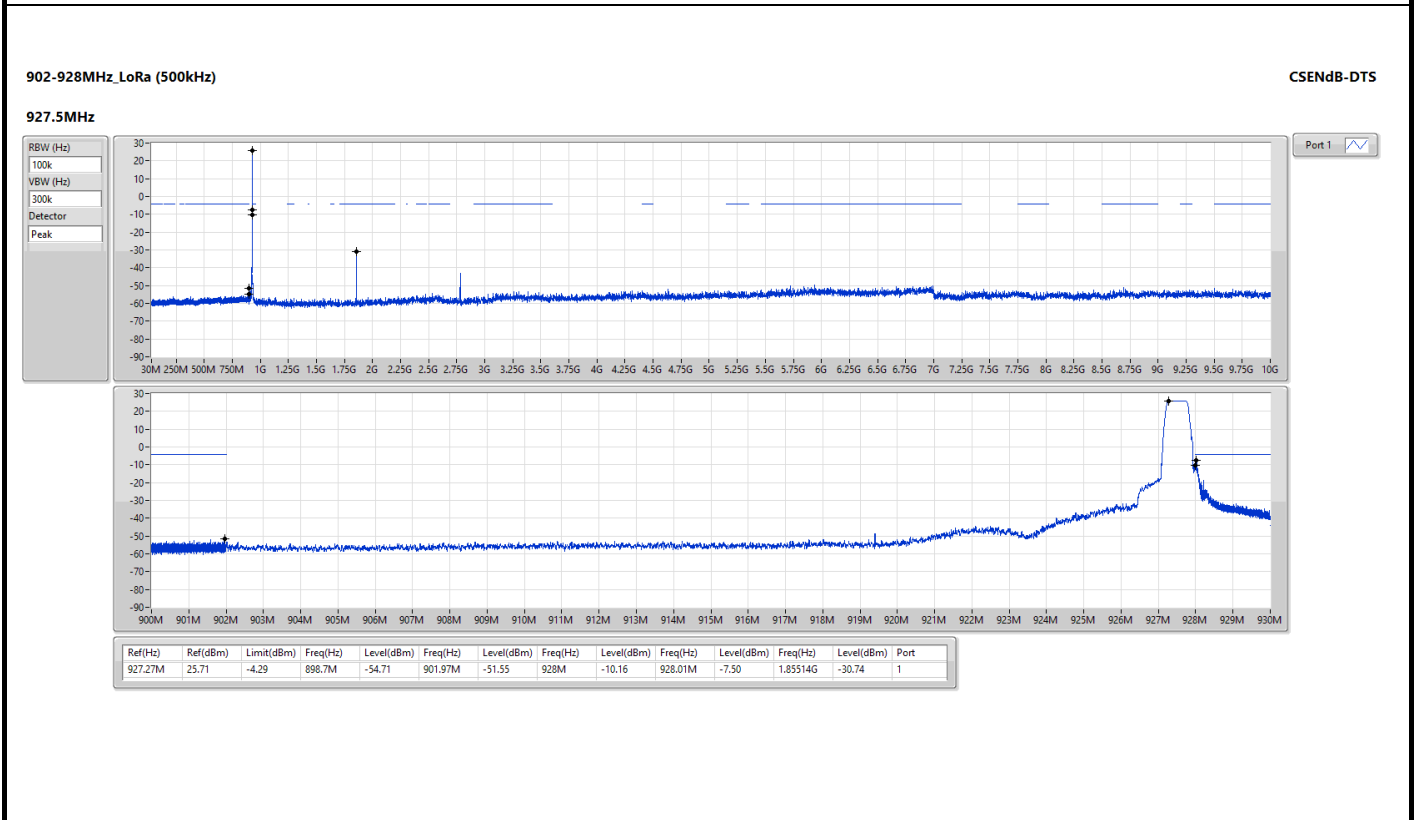
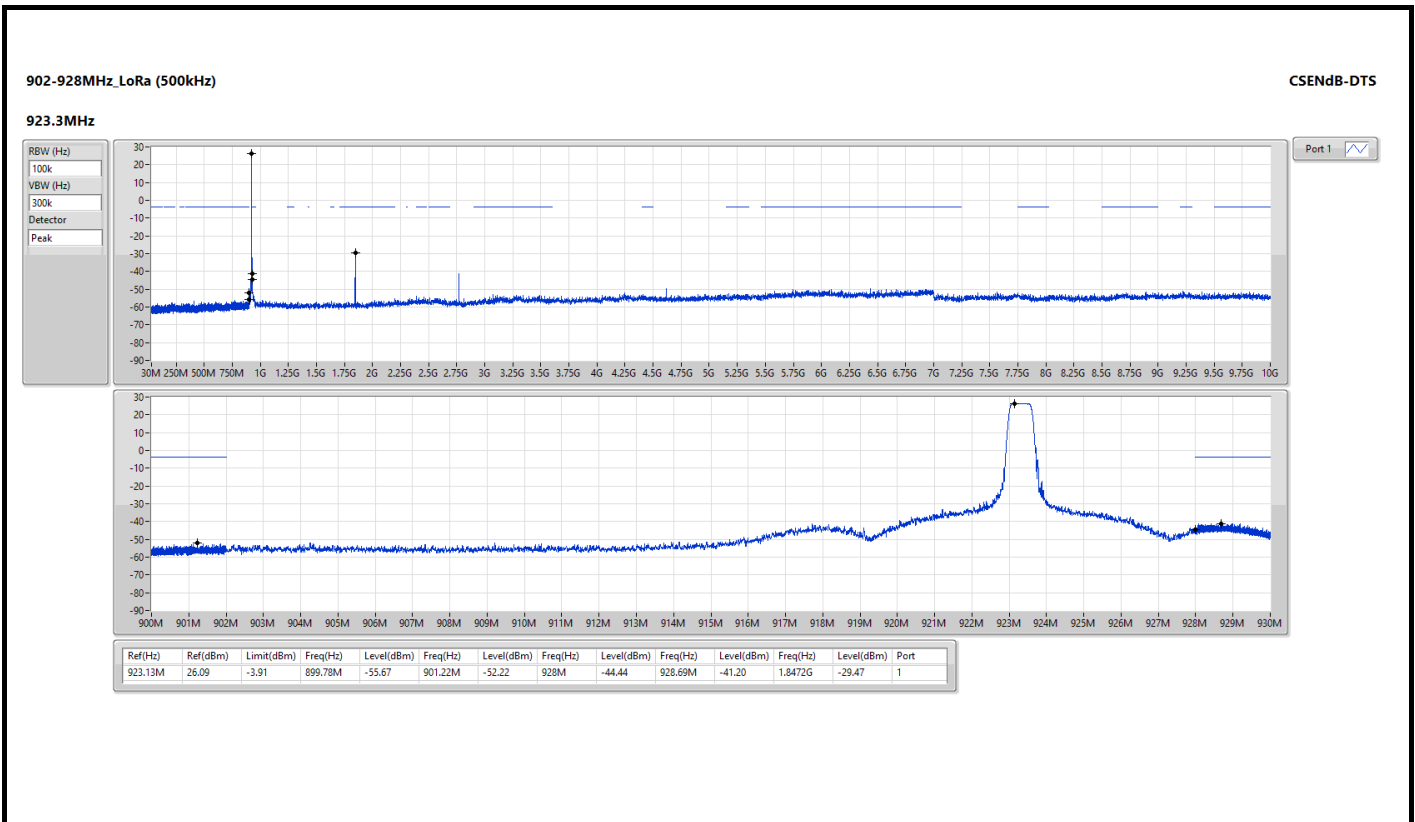
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).



Mode	LoRa (500kHz)	Test Freq. (MHz)	927.5						
Polarization	Horizontal								
Test By : Paul Lin		Temperature(°C): 25			Humidity(%): 62				
<p>The graph plots Level (dBuV/m) on the y-axis (0 to 90) against Frequency (MHz) on the x-axis (1000 to 25000). Two horizontal red lines represent limits: CLASS-B at approximately 74 dBuV/m and CLASS-B (AVG) at approximately 54 dBuV/m. Six vertical blue lines represent emission peaks labeled 1 through 6, with their corresponding data values listed in the 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	2782.50	42.83	54.00	-11.17	46.03	-3.20	Average	100	34
2	2782.50	52.21	74.00	-21.79	55.41	-3.20	Peak	100	34
3	3710.00	29.30	54.00	-24.70	31.41	-2.11	Average	100	265
4	3710.00	43.16	74.00	-30.84	45.27	-2.11	Peak	100	265
5	4637.50	40.55	54.00	-13.45	40.95	-0.40	Average	160	2
6	4637.50	47.43	74.00	-26.57	47.83	-0.40	Peak	160	2
<p>Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).</p>									



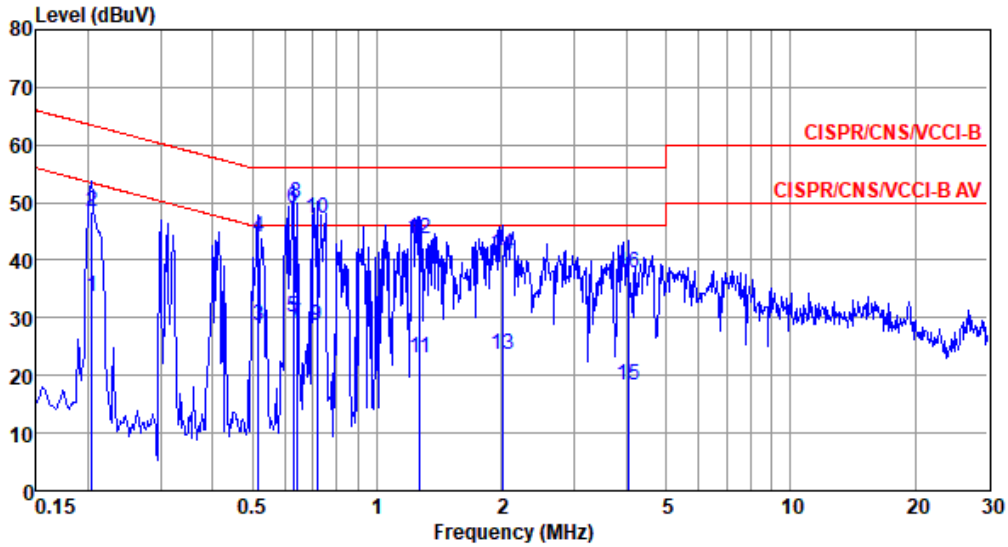
Mode	LoRa (500kHz)	Test Freq. (MHz)	927.5						
Polarization	Vertical								
<p>Test By : Paul Lin Temperature(°C): 25 Humidity(%): 62</p>									
<p>The graph plots Level (dBuV/m) on the y-axis (0 to 90) against Frequency (MHz) on the x-axis (1000 to 25000). Two horizontal red lines represent limits: CLASS-B at approximately 75 dBuV/m and CLASS-B (AVG) at approximately 55 dBuV/m. Six vertical blue lines represent emission peaks labeled 1 through 6, with their corresponding data values listed in the 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	2782.50	41.66	54.00	-12.34	44.86	-3.20	Average	233	227
2	2782.50	52.17	74.00	-21.83	55.37	-3.20	Peak	233	227
3	3710.00	31.42	54.00	-22.58	33.53	-2.11	Average	100	237
4	3710.00	41.44	74.00	-32.56	43.55	-2.11	Peak	100	237
5	4637.50	39.83	54.00	-14.17	40.23	-0.40	Average	226	244
6	4637.50	47.92	74.00	-26.08	48.32	-0.40	Peak	226	244
<p>Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).</p>									





Power Phase	Line	Test Freq. (MHz)	923.3
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Test by : Joe Liao Temperature: 25°C Humidity: 67%



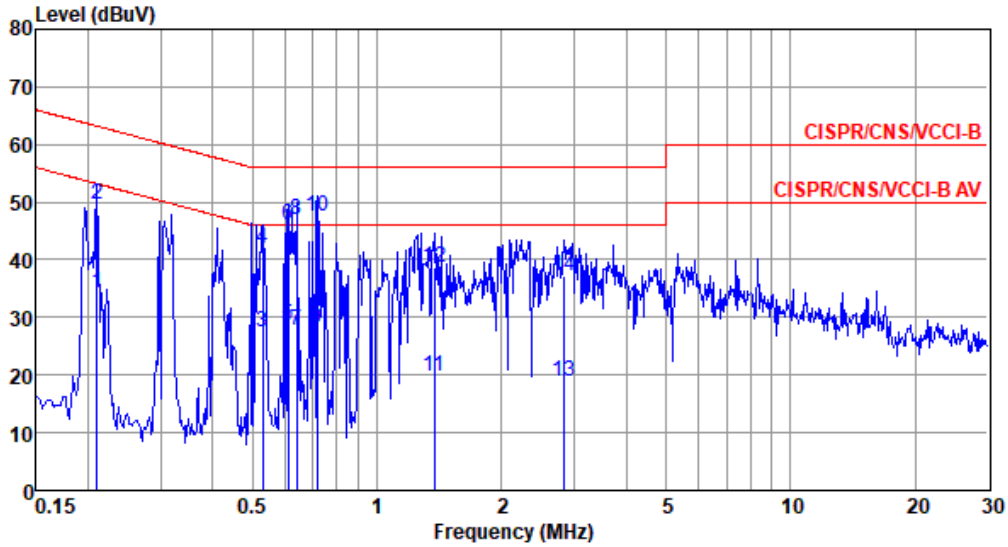
	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	Factor dB	Cable loss dB	Aux dB	Remark
1	0.204	33.75	53.45	-19.70	23.82	9.62	0.06	0.25	Average
2	0.204	48.49	63.45	-14.96	38.56	9.62	0.06	0.25	QP
3	0.516	28.53	46.00	-17.47	18.49	9.62	0.08	0.34	Average
4	0.516	44.08	56.00	-11.92	34.04	9.62	0.08	0.34	QP
5	0.627	30.26	46.00	-15.74	20.22	9.62	0.08	0.34	Average
6	0.627	49.13	56.00	-6.87	39.09	9.62	0.08	0.34	QP
7	0.641	28.92	46.00	-17.08	18.85	9.63	0.09	0.35	Average
8*	0.641	49.92	56.00	-6.08	39.85	9.63	0.09	0.35	QP
9	0.716	28.57	46.00	-17.43	18.50	9.63	0.09	0.35	Average
10	0.716	47.12	56.00	-8.88	37.05	9.63	0.09	0.35	QP
11	1.269	23.07	46.00	-22.93	12.97	9.63	0.10	0.37	Average
12	1.269	43.79	56.00	-12.21	33.69	9.63	0.10	0.37	QP
13	2.012	23.62	46.00	-22.38	13.50	9.63	0.11	0.38	Average
14	2.012	40.95	56.00	-15.05	30.83	9.63	0.11	0.38	QP
15	4.049	18.34	46.00	-27.66	8.10	9.65	0.18	0.41	Average
16	4.049	37.65	56.00	-18.35	27.41	9.65	0.18	0.41	QP

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



Power Phase	Neutral	Test Freq. (MHz)	923.3
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Test by : Joe Liao Temperature: 25°C Humidity: 67%



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	Factor dB	Cable loss dB	Aux dB	Remark
1	0.211	34.10	53.18	-19.08	24.23	9.63	0.06	0.18	Average
2	0.211	49.59	63.18	-13.59	39.72	9.63	0.06	0.18	QP
3	0.529	27.48	46.00	-18.52	17.51	9.62	0.08	0.27	Average
4	0.529	41.98	56.00	-14.02	32.01	9.62	0.08	0.27	QP
5	0.611	28.71	46.00	-17.29	18.74	9.62	0.08	0.27	Average
6	0.611	46.07	56.00	-9.93	36.10	9.62	0.08	0.27	QP
7	0.641	27.66	46.00	-18.34	17.66	9.63	0.09	0.28	Average
8	0.641	47.04	56.00	-8.96	37.04	9.63	0.09	0.28	QP
9	0.716	27.98	46.00	-18.02	17.98	9.63	0.09	0.28	Average
10*	0.716	47.48	56.00	-8.52	37.48	9.63	0.09	0.28	QP
11	1.374	19.87	46.00	-26.13	9.82	9.63	0.10	0.32	Average
12	1.374	38.80	56.00	-17.20	28.75	9.63	0.10	0.32	QP
13	2.839	18.89	46.00	-27.11	8.72	9.65	0.15	0.37	Average
14	2.839	37.23	56.00	-18.77	27.06	9.65	0.15	0.37	QP

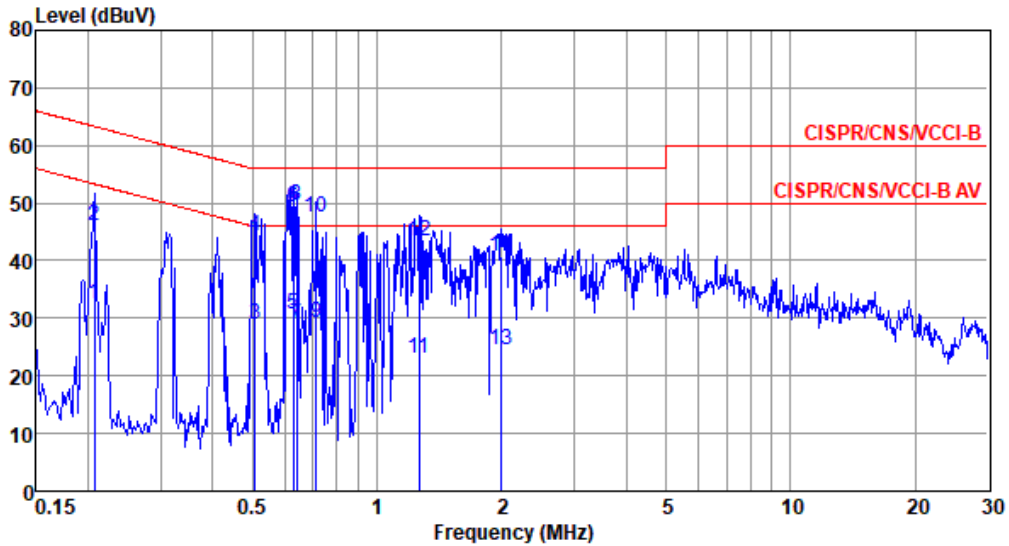
Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB) + Aux (dB).

2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).



Power Phase	Line	Test Freq. (MHz)	927.5
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Test by : Joe Liao Temperature: 25°C Humidity: 67%



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	Factor dB	Cable loss dB	Aux dB	Remark
1	0.207	32.42	53.32	-20.90	22.49	9.62	0.06	0.25	Average
2	0.207	46.01	63.32	-17.31	36.08	9.62	0.06	0.25	QP
3	0.507	28.89	46.00	-17.11	18.85	9.62	0.08	0.34	Average
4	0.507	44.39	56.00	-11.61	34.35	9.62	0.08	0.34	QP
5	0.627	30.57	46.00	-15.43	20.53	9.62	0.08	0.34	Average
6	0.627	49.31	56.00	-6.69	39.27	9.62	0.08	0.34	QP
7	0.641	28.99	46.00	-17.01	18.92	9.63	0.09	0.35	Average
8*	0.641	49.57	56.00	-6.43	39.50	9.63	0.09	0.35	QP
9	0.712	29.32	46.00	-16.68	19.25	9.63	0.09	0.35	Average
10	0.712	47.47	56.00	-8.53	37.40	9.63	0.09	0.35	QP
11	1.262	23.06	46.00	-22.94	12.96	9.63	0.10	0.37	Average
12	1.262	43.48	56.00	-12.52	33.38	9.63	0.10	0.37	QP
13	2.001	24.37	46.00	-21.63	14.25	9.63	0.11	0.38	Average
14	2.001	40.86	56.00	-15.14	30.74	9.63	0.11	0.38	QP

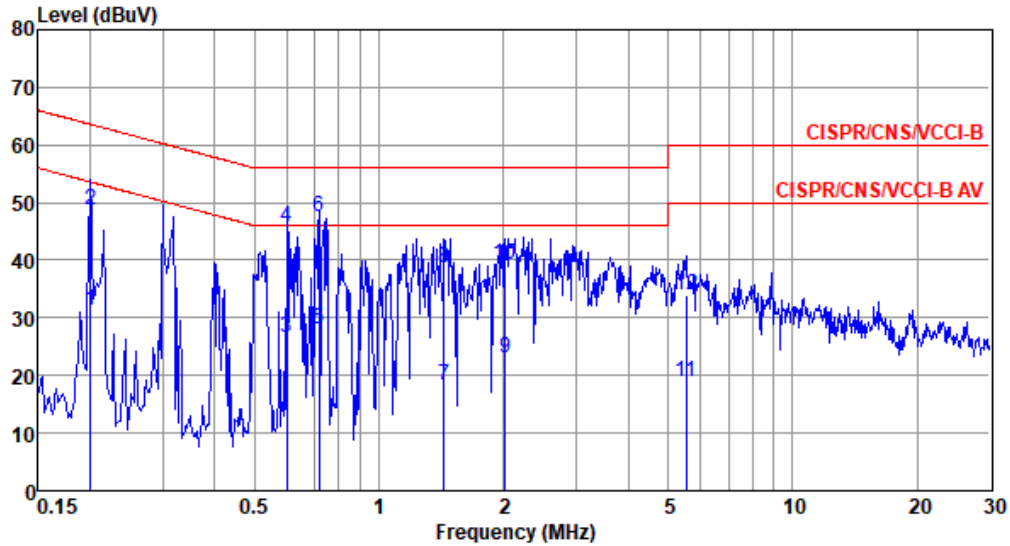
Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB) + Aux (dB).

Note 2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).



Power Phase	Neutral	Test Freq. (MHz)	927.5
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Test by : Joe Liao Temperature: 25°C Humidity: 67%



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	Factor dB	Cable loss dB	Aux dB	Remark
1	0.201	31.38	53.58	-22.20	21.52	9.63	0.06	0.17	Average
2	0.201	48.73	63.58	-14.85	38.87	9.63	0.06	0.17	QP
3	0.598	26.56	46.00	-19.44	16.59	9.62	0.08	0.27	Average
4	0.598	45.68	56.00	-10.32	35.71	9.62	0.08	0.27	QP
5	0.718	27.96	46.00	-18.04	17.96	9.63	0.09	0.28	Average
6*	0.718	47.46	56.00	-8.54	37.46	9.63	0.09	0.28	QP
7	1.433	18.41	46.00	-27.59	8.35	9.64	0.10	0.32	Average
8	1.433	38.57	56.00	-17.43	28.51	9.64	0.10	0.32	QP
9	2.023	23.04	46.00	-22.96	12.95	9.64	0.11	0.34	Average
10	2.023	39.24	56.00	-16.76	29.15	9.64	0.11	0.34	QP
11	5.535	18.76	50.00	-31.24	8.44	9.67	0.24	0.41	Average
12	5.535	33.91	60.00	-26.09	23.59	9.67	0.24	0.41	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB) + Aux (dB).

Note 2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).