

FCC Test Report

FCC ID : 2AXXQMLBADA

Equipment: Location Bridge

Model No. : MLB-AD-A

Brand Name : MACHINEQ

Applicant : Humax Networks, INC.

Address : 216, Hwangsaeul-ro, Bundang-gu, Seongnam-si,

South Korea

Standard : 47 CFR FCC Part 15.247

Received Date : Dec. 28, 2020

Tested Date : Jan. 08 ~ Jan. 26, 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: Approved by:

Along Cheid/ Assistant Manager Gary Chang / Manager

Testing Laboratory

Page: 1 of 61

Report Version: Rev. 01

Report No.: FR0D2803-1AH



Table of Contents

1	GENERAL DESCRIPTION	5
1.1	Information	5
1.2	Local Support Equipment List	7
1.3	Test Setup Chart	8
1.4	The Equipment List	10
1.5	Test Standards	11
1.6	Reference Guidance	11
1.7	Deviation from Test Standard and Measurement Procedure	11
1.8	Measurement Uncertainty	11
2	TEST CONFIGURATION	12
2.1	Testing Facility	12
2.2	The Worst Test Modes and Channel Details	12
3	TRANSMITTER TEST RESULTS	13
3.1	Conducted Emissions	13
3.2	Unwanted Emissions into Restricted Frequency Bands	26
3.3	Unwanted Emissions into Non-Restricted Frequency Bands	46
3.4	Conducted Output Power	49
3.5	Number of Hopping Frequency	50
3.6	20dB and Occupied Bandwidth	52
3.7	Channel Separation	54
3.8	Number of Dwell Time	56
3.9	Power Spectral Density	59
4	TEST LABORATORY INFORMATION	61



Release Record

Report No.	Version	Description	Issued Date
FR0D2803-1AH	Rev. 01	Initial issue	Feb. 03, 2021

Report No.: FR0D2803-1AH Page: 3 of 61



Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 0.165MHz 61.95 (Margin -3.26dB) - QP	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 2706.90MHz 51.28 (Margin -2.72dB) - AV	Pass
15.247(d)	Band Edge	Meet the requirement of limit	Pass
15.247(b)(2)(3)	Conducted Output Power	Power [dBm]: 21.06	Pass
15.247(a)(1)(i)	Number of Hopping Channels	Meet the requirement of limit	Pass
15.247(a)(1)	Hopping Channel Separation	Meet the requirement of limit	Pass
15.247(f)	Dwell Time	Meet the requirement of limit	Pass
15.247(f)	Power spectral density	Meet the requirement of limit	Pass
15.203	Antenna Requirement	Meet the requirement of limit	Pass

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.

Report No.: FR0D2803-1AH Page: 4 of 61



1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information							
Frequency Range (MHz) Ch. Freq. (MHz) Channel Number Data Rate (bit/sec) Spread Factor Bandwidth (kHz)							
902 ~ 928	902.3 ~ 914.9	1-64 [64]	5470 ~ 980	SF7~10	125		

Note 1: RF output power specifies that Maximum Conducted (Average) Output Power.

Note 2: The device uses Lora modulation.

Note 3: The device supports hybrid mode.

1.1.2 Antenna Details

Ant. No.	Туре	Connector	Gain (dBi)
1	PIFA	NA	2.18

1.1.3 Power Supply Type of Equipment under Test (EUT)

I POWAR STINNIV I VNA	55Vdc from PoE 5Vdc from USB adapter

1.1.4 Accessories

N/A

Report No.: FR0D2803-1AH Page: 5 of 61



1.1.5 Channel List

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

1.1.6 Test Tool and Duty Cycle

Test Tool Tera Term, version: V4.80		
Duty cycle	100 %	

1.1.7 Power Index of Test Tool

Modulation Mode		Test Frequency (MHz)	
Wodulation Wode	902.3	908.5	914.9
LORA	22	22	22

Report No.: FR0D2803-1AH Page: 6 of 61



1.2 Local Support Equipment List

POE Mode

	Support Equipment List							
No.	Equipment	Brand	Model	FCC ID	Remarks			
1	RJ45	ICC	RJ45-10m					
2	RJ45	ICC	RJ45-1m					
3	RJ45				Provided by applicant.			
4	Notebook	DELL	Latitude E5470	DoC				
5	USB cable				Provided by applicant.			
6	Fixture		HLCB_V00		Provided by applicant.			
7	POE	Microsemi	PD-9001GR/AC		Provided by applicant.			

Adapter Mode

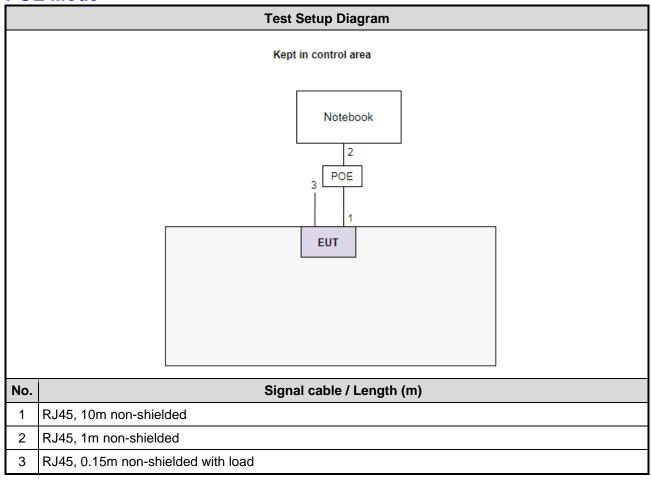
7 10101	tauptor mode							
Support Equipment List								
No. Equipment Brand Model FCC ID Remarks								
1	RJ45	ICC	RJ45-10m					
2	RJ45				Provided by applicant.			
3	Notebook	DELL	Latitude E5470	DoC				
4	USB Cable	I-Gota	micro to A					
5	Adapter	Samsung	ETA-U90JWS					
6	USB cable				Provided by applicant.			
7	Fixture		HLCB_V00		Provided by applicant.			

Report No.: FR0D2803-1AH Page: 7 of 61



1.3 Test Setup Chart

POE Mode

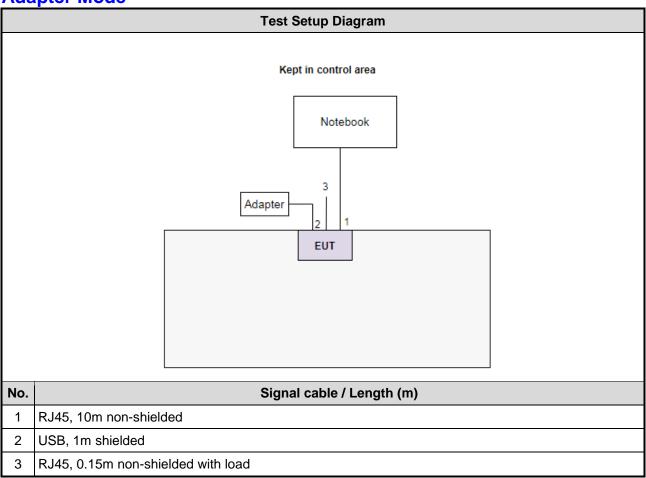


Note: The USB cable and fixture are disconnected from EUT and removed from test table when EUT is set to transmit continuously.

Report No.: FR0D2803-1AH Page: 8 of 61



Adapter Mode



Note: The USB cable and fixture are disconnected from EUT and removed from test table when EUT is set to transmit continuously.

Report No.: FR0D2803-1AH Page: 9 of 61



1.4 The Equipment List

Test Item	Conducted Emission								
Test Site	Conduction room 1 / (Conduction room 1 / (CO01-WS)							
Instrument	nt Brand Model No. Serial No. Calibration Date Calibration Until								
Receiver	R&S	ESR3	101657	Feb. 14, 2020	Feb. 13, 2021				
LISN	R&S	ENV216	101579	Mar. 12, 2020	Mar. 11, 2021				
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 21, 2020	Oct. 20, 2021				
Measurement Software AUDIX e3 6.120210k NA NA NA									
Note: Calibration Interval of instruments listed above is one year.									

Test Item	Radiated Emission				
Test Site	966 chamber1 / (03CH01-WS)				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101498	Dec. 04, 2020	Dec. 03, 2021
Receiver	R&S	ESR3	101657	Feb. 14, 2020	Feb. 13, 2021
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jul. 10, 2020	Jul. 09, 2021
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
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 17, 2020	Nov. 16, 2021
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 06, 2020	Oct. 05, 2021
Preamplifier	EMC	EMC02325	980225	Jul. 03, 2020	Jul. 02, 2021
Preamplifier	Agilent	83017A	MY39501308	Sep. 26, 2020	Sep. 25, 2021
Preamplifier	EMC	EMC184045B	980192	Jul. 21, 2020	Jul. 20, 2021
RF Cable	EMC	EMC104-SM-SM-80 00	181106	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
LF cable 1M	EMC	EMCCFD400-NM-N M-1000	160502	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
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Report No.: FR0D2803-1AH Page: 10 of 61



Test Item	RF Conducted				
Test Site	(TH01-WS)				
Instrument	Brand	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	Nov. 04, 2020	Nov. 03, 2021
Power Sensor	Anritsu	MA2411B	1207366	Nov. 04, 2020	Nov. 03, 2021
AC POWER SOURCE	APC	AFC-500W	F312060012	Dec. 04, 2020	Dec. 03, 2021
Measurement Software		SENSE-15247_DTS	V5.10.7	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			
Radiated emission ≤ 1GHz	±3.96 dB			
Radiated emission > 1GHz	±4.51 dB			

Report No.: FR0D2803-1AH Page: 11 of 61



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.: TW2732FCC site registration No.: 181692

➤ ISED#: 10807A

➤ CAB identifier: TW2732

2.2 The Worst Test Modes and Channel Details

Test item	Test Frequency (MHz)	Channel Bandwidth (kHz)	Modulation / SF	Test Configuration
Conducted Emissions	902.3 / 908.5 / 914.9	125	Lora / 10	1, 2
Radiated Emissions ≤ 1GHz	902.3 / 908.5 / 914.9	125	Lora / 10	1, 2
Conducted Output Power Hopping Channel Separation 20dB and Occupied bandwidth Power Spectral Density	902.3 / 908.5 / 914.9	125	Lora / 10	1
Radiated Emissions >1GHz	902.3 / 908.5 / 914.9	125	Lora / 10	1
Number of Hopping Channels	902.3 ~ 914.9	125	Lora / 10	1
Dwell Time	902.3	125	Lora / 10	1

NOTE:

2. The test configurations are listed as follows:

Configuration 1: POE Mode Configuration 2: Adapter Mode

Report No.: FR0D2803-1AH Page: 12 of 61

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



3 Transmitter Test Results

3.1 Conducted Emissions

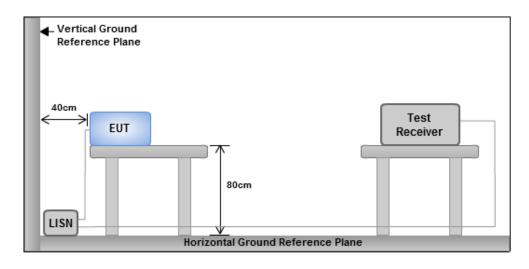
3.1.1 Limit of Conducted Emissions

Conducted Emissions Limit				
Frequency Emission (MHz)	Quasi-Peak	Average		
0.15-0.5	66 - 56 *	56 - 46 *		
0.5-5	56	46		
5-30	60	50		
Note 1: * Decreases with the logarithm of the frequency.				

3.1.2 Test Procedures

- 1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
- 2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels of AC power line conducted emission are across the 50 Ω LISN port.
- 3. AC conducted emission measurements is made over frequency range from 150 kHz to 30 MHz.
- 4. This measurement was performed with AC 120V/60Hz

3.1.3 Test Setup



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

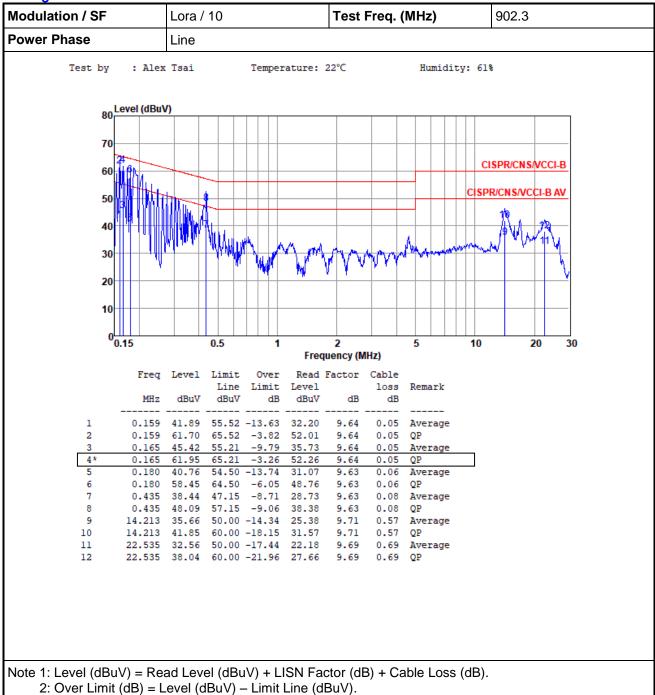
Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

Report No.: FR0D2803-1AH Page: 13 of 61



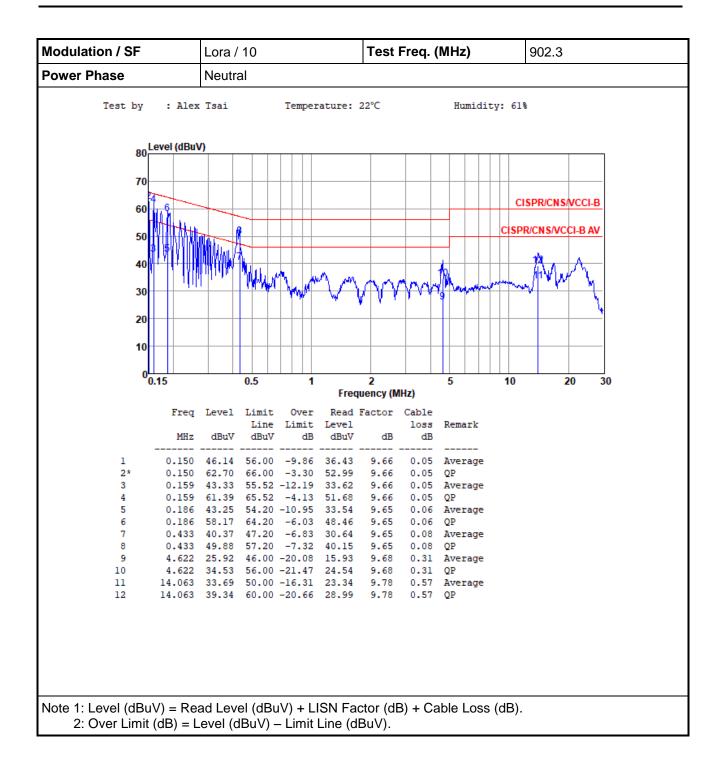
3.1.4 Test Result of Conducted Emissions

Configuration 1: POE Mode



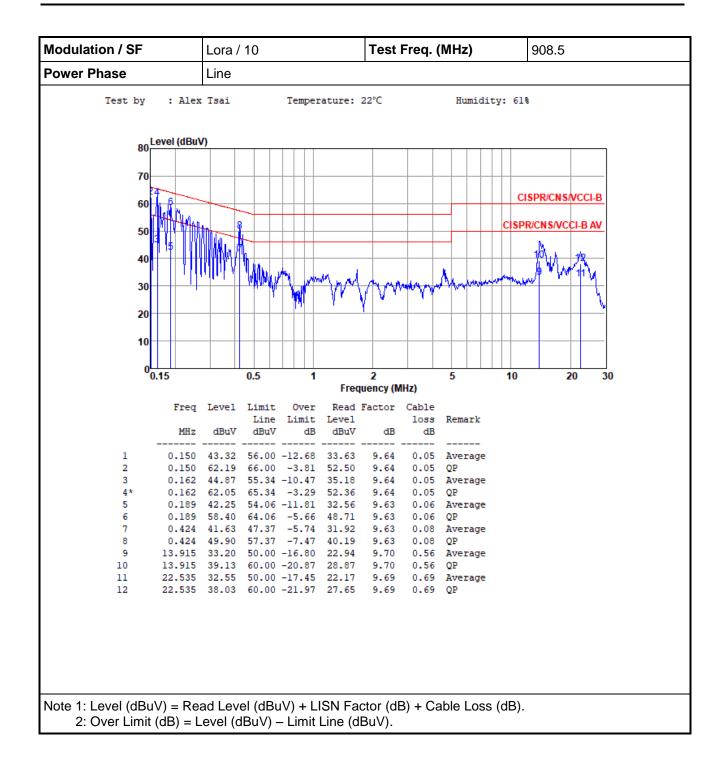
Report No.: FR0D2803-1AH Page: 14 of 61





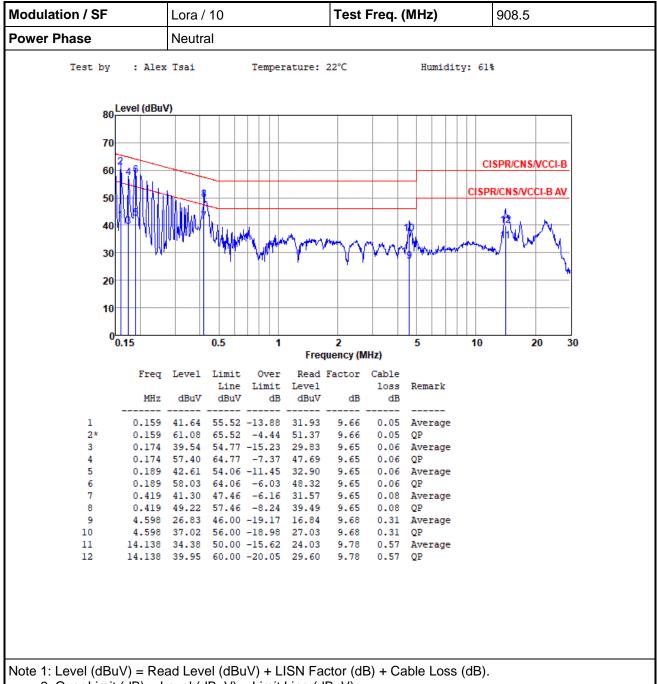
Report No.: FR0D2803-1AH Page: 15 of 61





Report No.: FR0D2803-1AH Page: 16 of 61

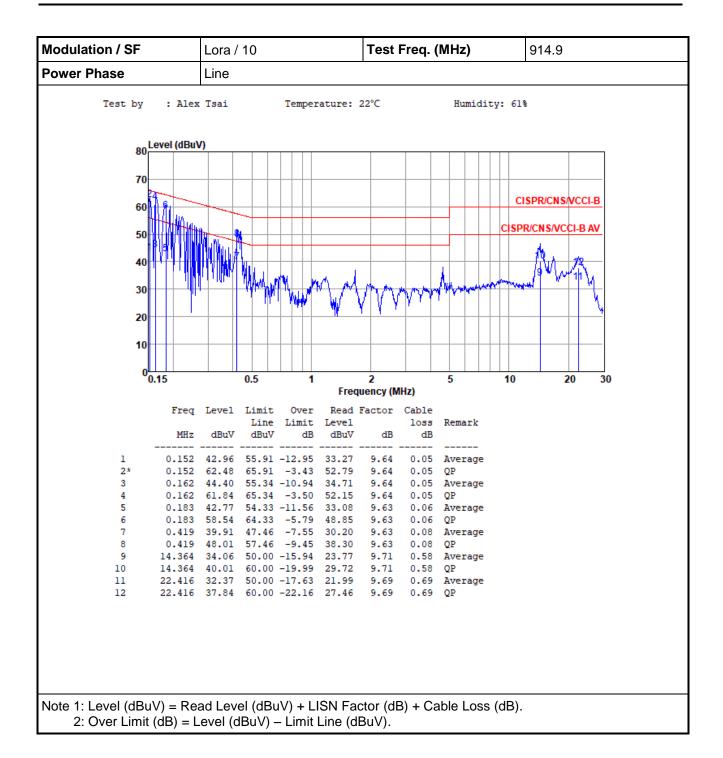




2: Over Limit (dB) = Level (dBuV) - Limit Line (dBuV).

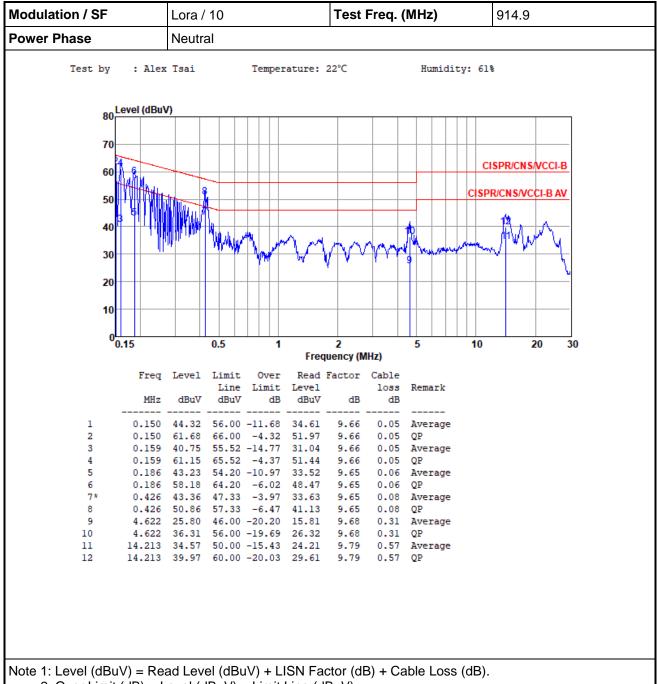
Report No.: FR0D2803-1AH Page: 17 of 61





Report No.: FR0D2803-1AH Page: 18 of 61



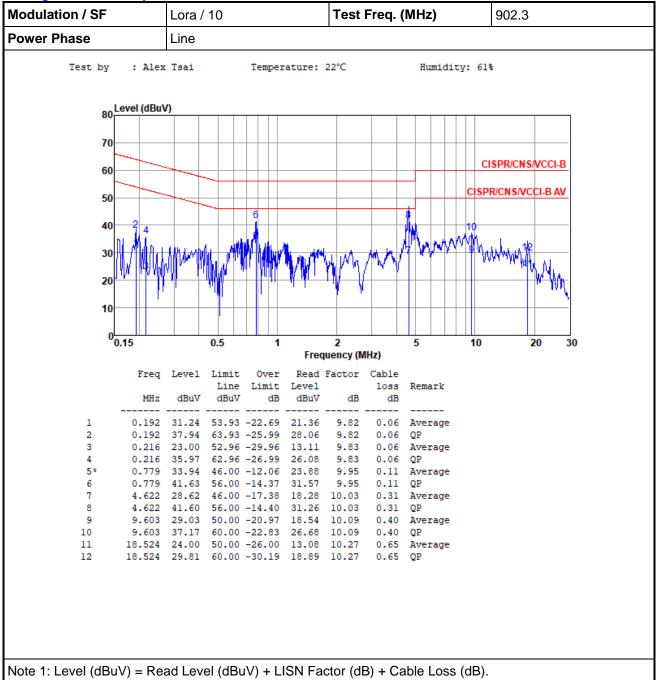


2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

Report No.: FR0D2803-1AH Page: 19 of 61



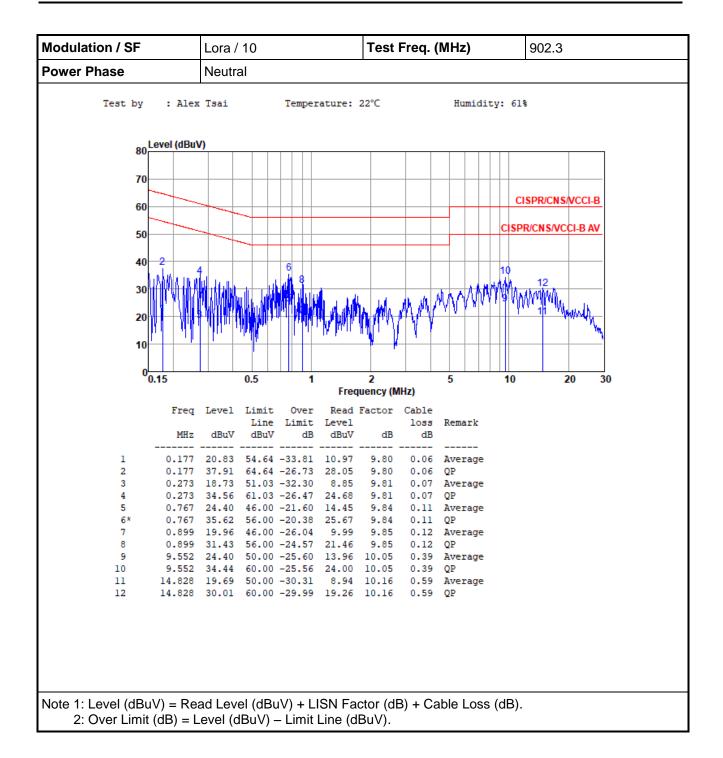
Configuration 2 : Adapter Mode



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

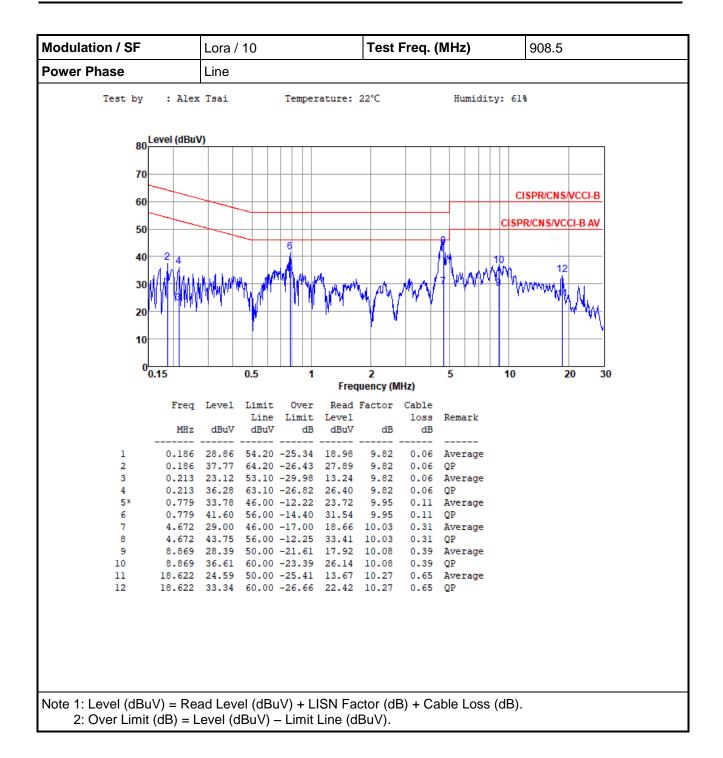
Report No.: FR0D2803-1AH Page: 20 of 61





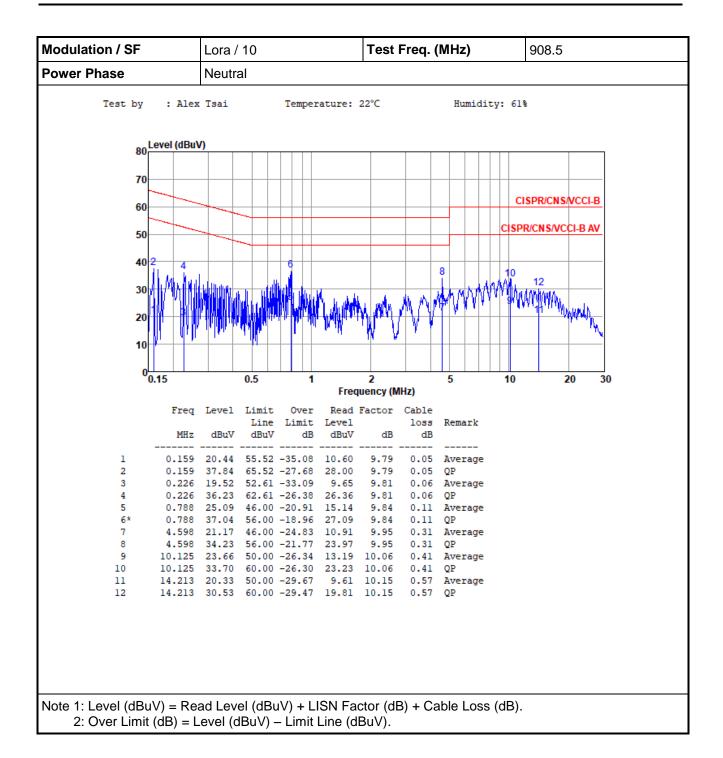
Report No.: FR0D2803-1AH Page: 21 of 61





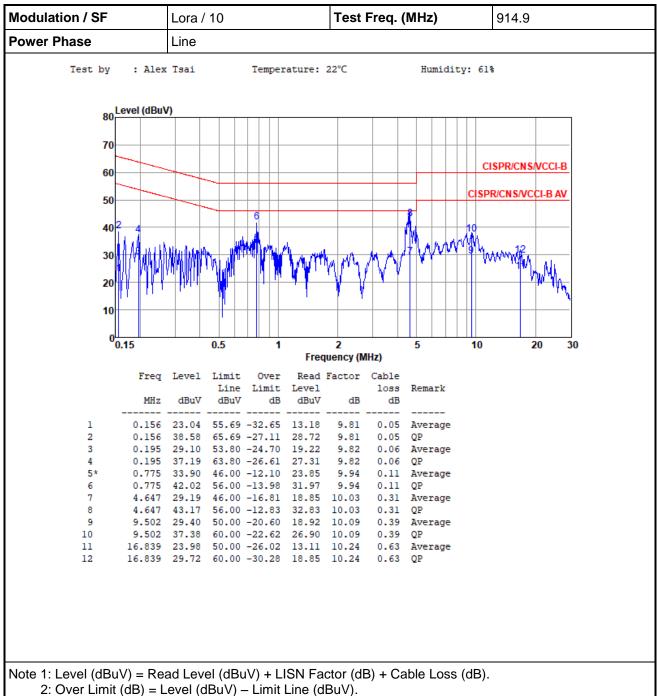
Report No.: FR0D2803-1AH Page: 22 of 61





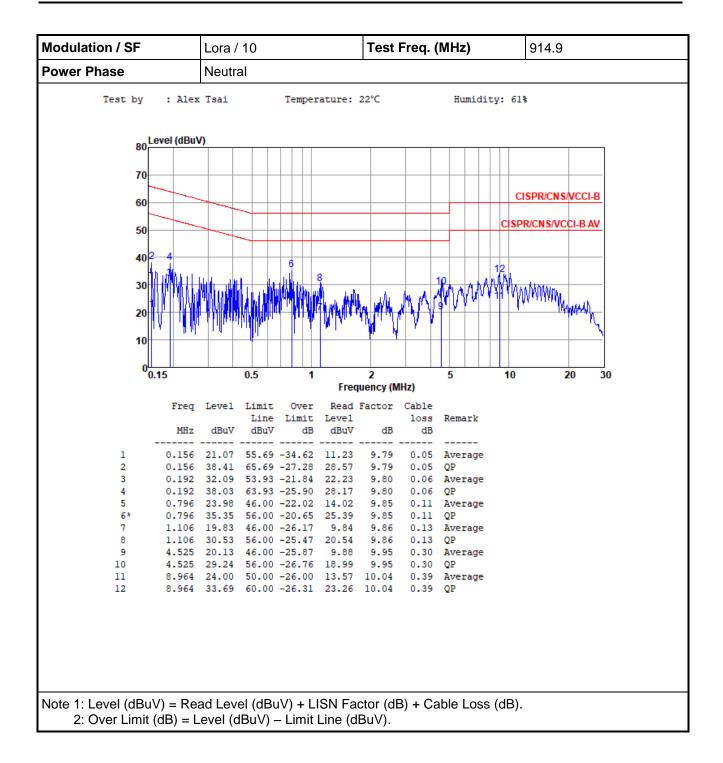
Report No.: FR0D2803-1AH Page: 23 of 61





Report No.: FR0D2803-1AH Page: 24 of 61





Report No.: FR0D2803-1AH Page: 25 of 61



3.2 Unwanted Emissions into Restricted Frequency Bands

3.2.1 Limit of Unwanted Emissions into Restricted Frequency Bands

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

Note 1:

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.

3.2.2 Test Procedures

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

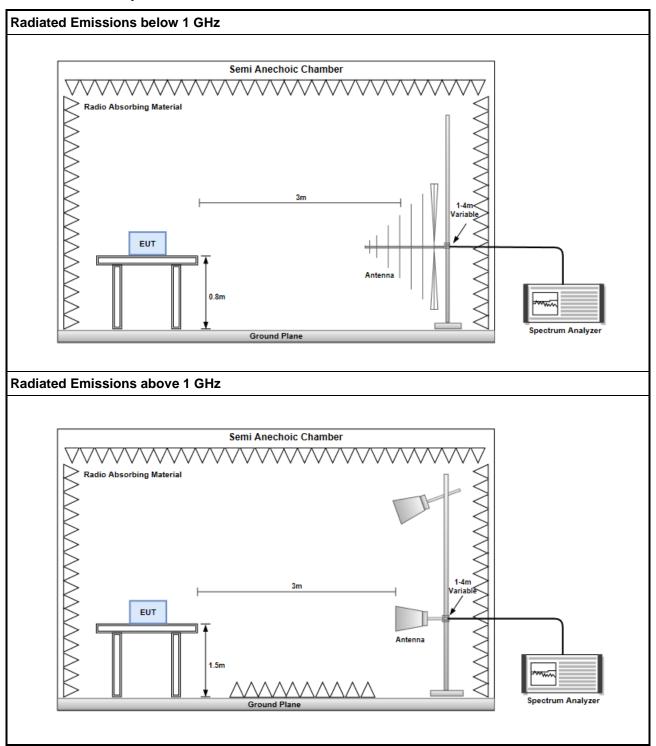
Note:

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

Report No.: FR0D2803-1AH Page: 26 of 61



3.2.3 Test Setup

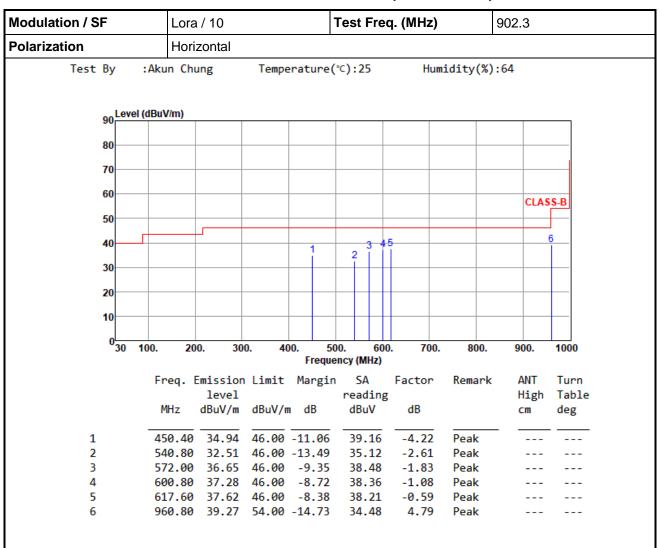


Report No.: FR0D2803-1AH Page: 27 of 61



Configuration 1: POE Mode

3.2.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)



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

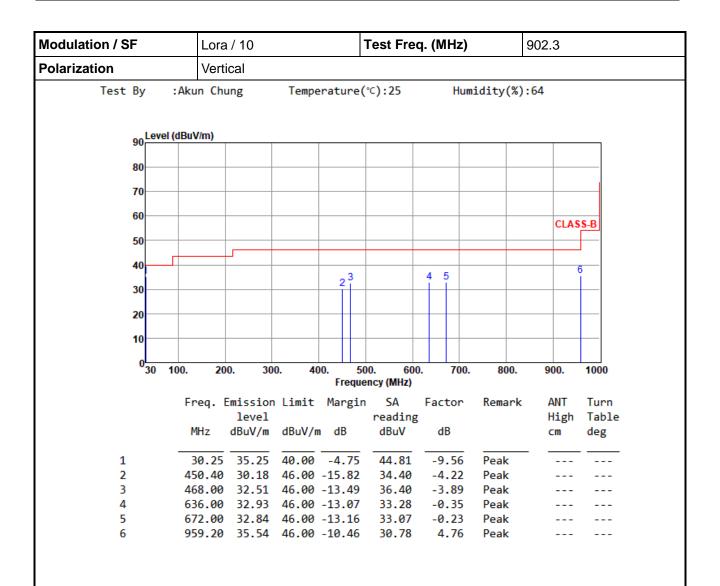
*Factor includes antenna factor, cable loss and amplifier gain

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

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

Report No.: FR0D2803-1AH Page: 28 of 61





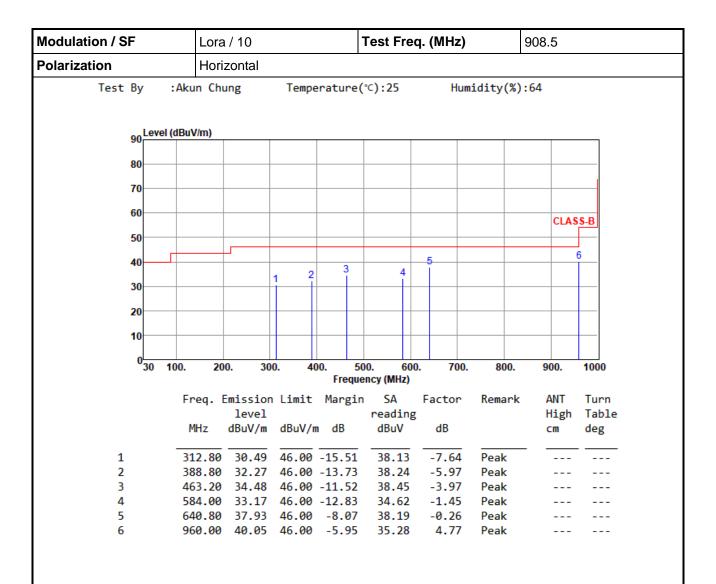
*Factor includes antenna factor, cable loss and amplifier gain

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

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

Report No.: FR0D2803-1AH Page: 29 of 61





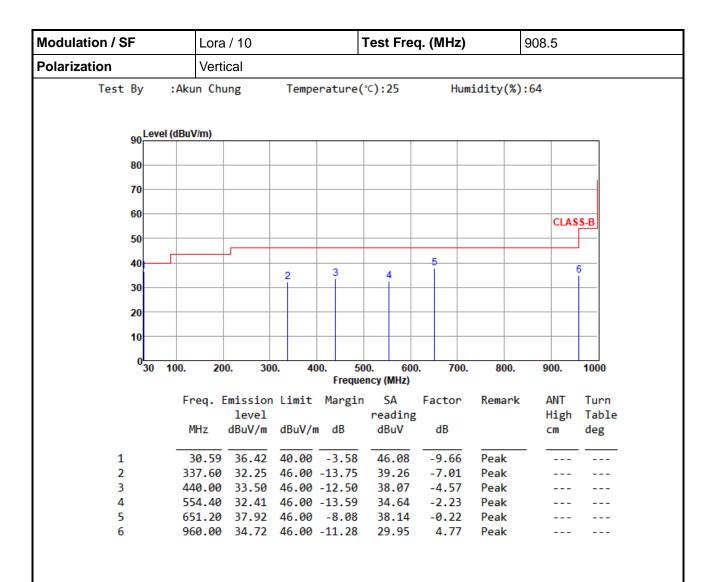
*Factor includes antenna factor, cable loss and amplifier gain

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

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

Report No.: FR0D2803-1AH Page: 30 of 61





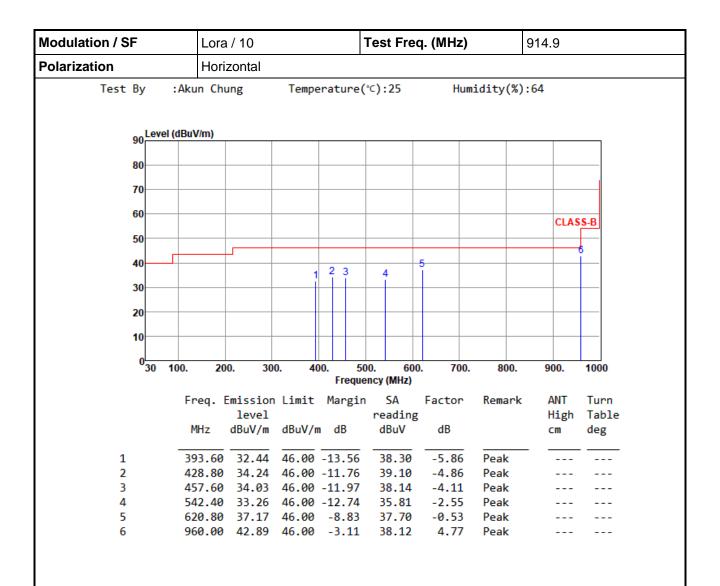
*Factor includes antenna factor, cable loss and amplifier gain

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

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

Report No.: FR0D2803-1AH Page: 31 of 61





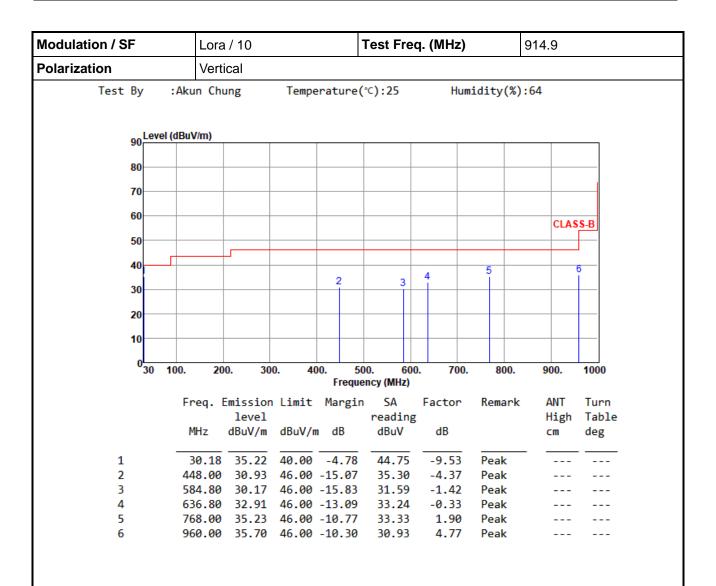
*Factor includes antenna factor, cable loss and amplifier gain

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

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

Report No.: FR0D2803-1AH Page: 32 of 61





*Factor includes antenna factor, cable loss and amplifier gain

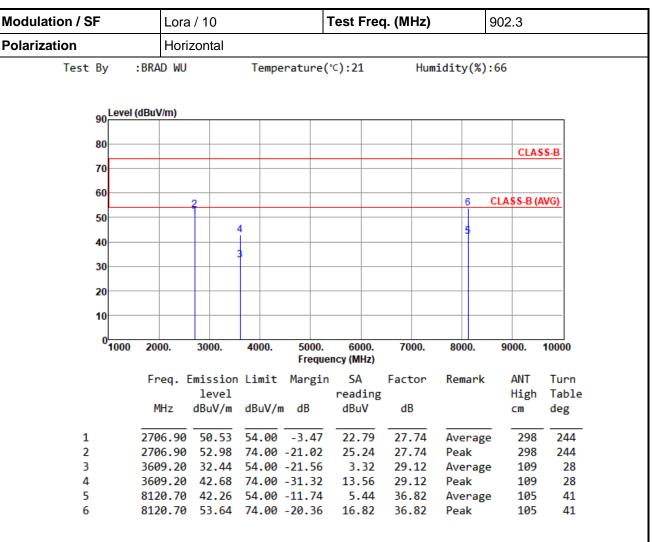
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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

Report No.: FR0D2803-1AH Page: 33 of 61



3.2.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)



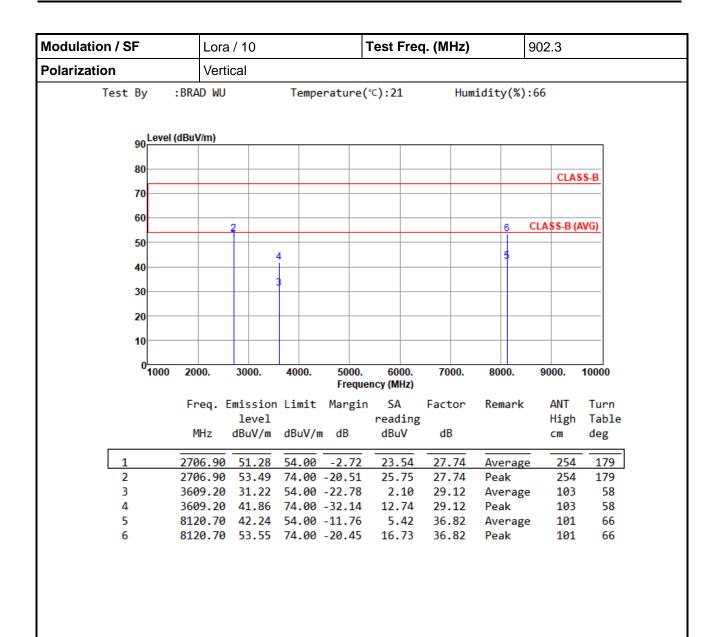
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor, cable loss and amplifier gain

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

Report No.: FR0D2803-1AH Page: 34 of 61



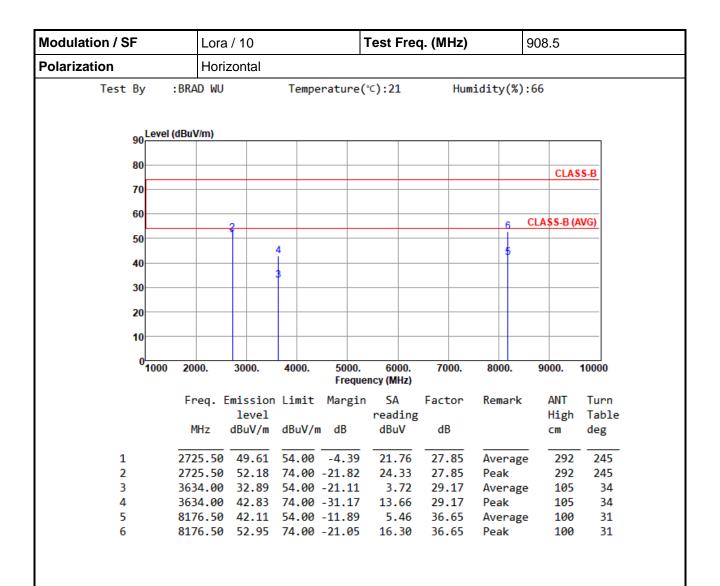


*Factor includes antenna factor, cable loss and amplifier gain

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

Report No.: FR0D2803-1AH Page: 35 of 61



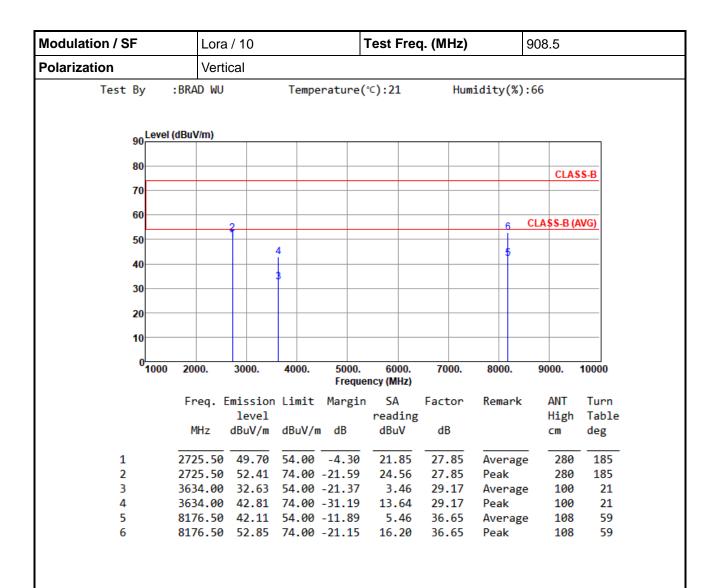


*Factor includes antenna factor, cable loss and amplifier gain

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

Report No.: FR0D2803-1AH Page: 36 of 61



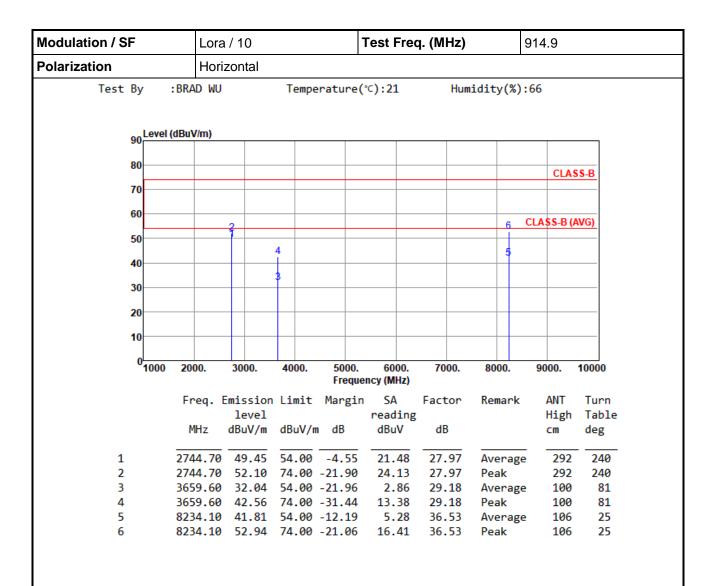


*Factor includes antenna factor, cable loss and amplifier gain

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

Report No.: FR0D2803-1AH Page: 37 of 61



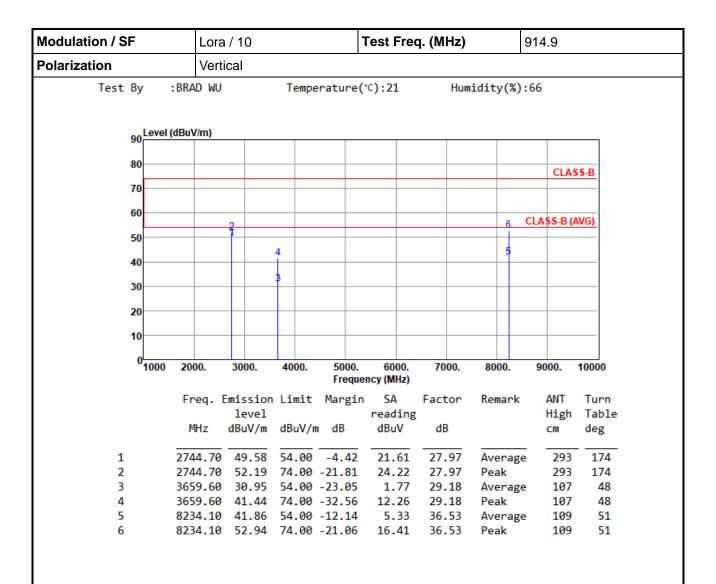


*Factor includes antenna factor, cable loss and amplifier gain

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

Report No.: FR0D2803-1AH Page: 38 of 61





*Factor includes antenna factor, cable loss and amplifier gain

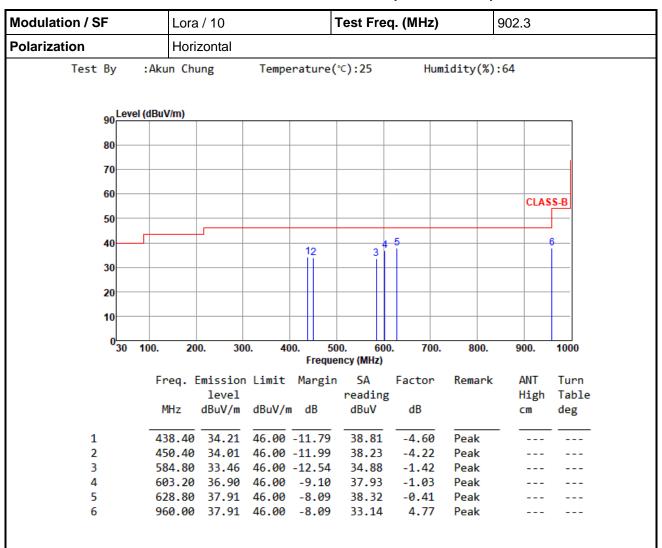
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Report No.: FR0D2803-1AH Page: 39 of 61



Configuration 2 : Adapter Mode

3.2.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)



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

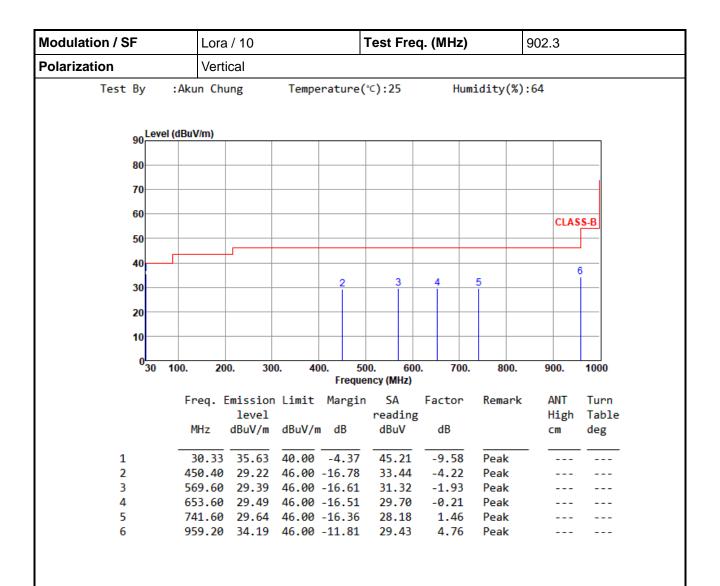
*Factor includes antenna factor, cable loss and amplifier gain

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

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

Report No.: FR0D2803-1AH Page: 40 of 61





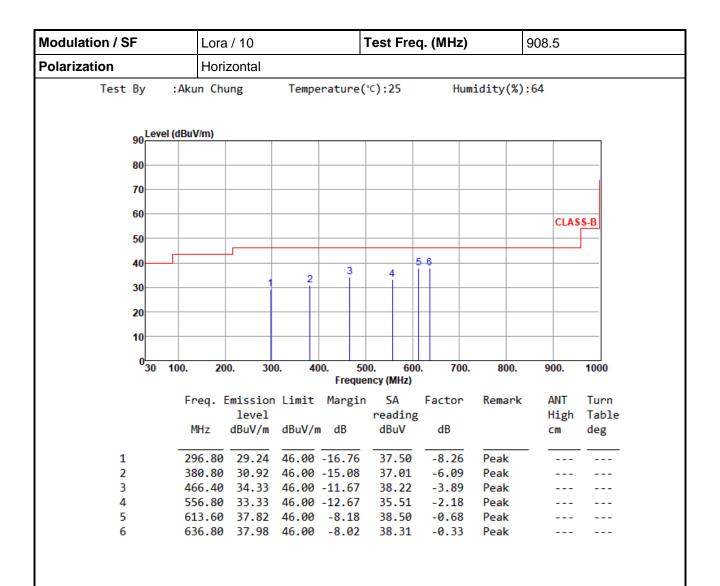
*Factor includes antenna factor, cable loss and amplifier gain

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

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

Report No.: FR0D2803-1AH Page: 41 of 61





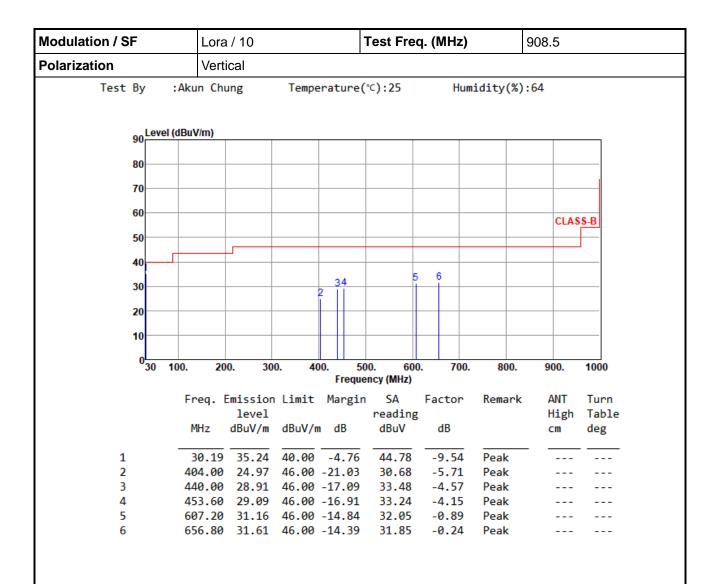
*Factor includes antenna factor, cable loss and amplifier gain

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

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

Report No.: FR0D2803-1AH Page: 42 of 61





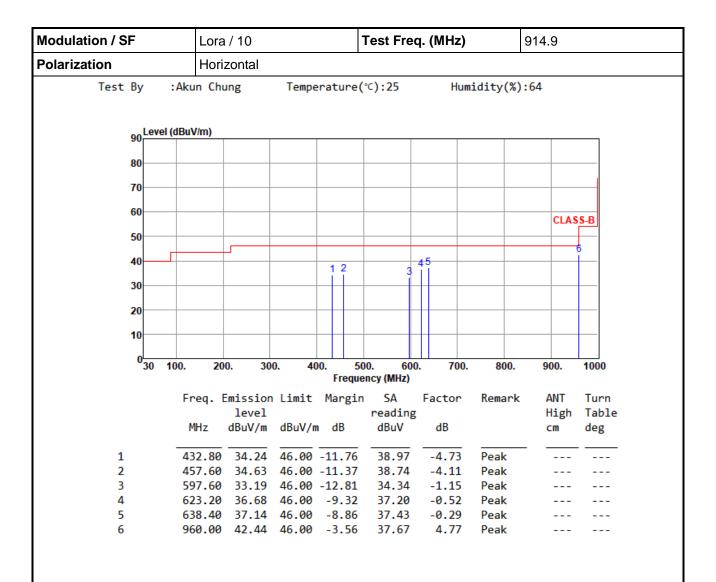
*Factor includes antenna factor, cable loss and amplifier gain

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

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

Report No.: FR0D2803-1AH Page: 43 of 61





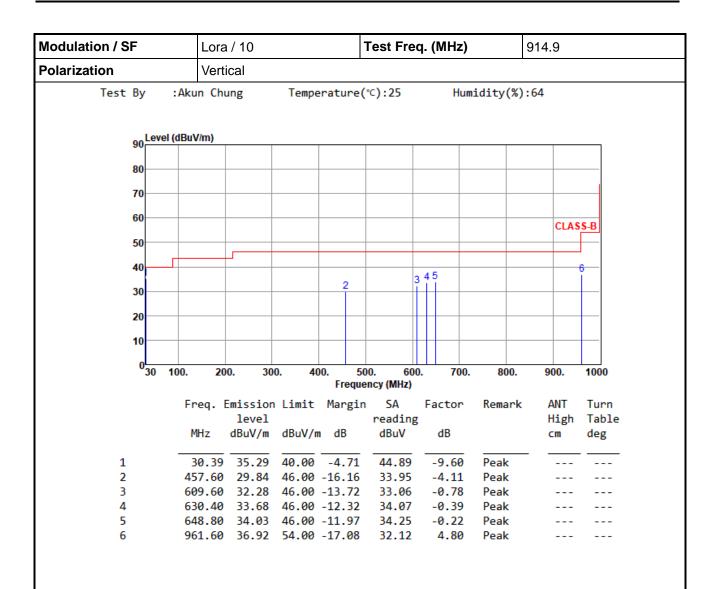
*Factor includes antenna factor, cable loss and amplifier gain

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

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

Report No.: FR0D2803-1AH Page: 44 of 61





*Factor includes antenna factor, cable loss and amplifier gain

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

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

Report No.: FR0D2803-1AH Page: 45 of 61



3.3 Unwanted Emissions into Non-Restricted Frequency Bands

3.3.1 Limit of Unwanted Emissions into Non-Restricted Frequency Bands

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

3.3.2 Test Procedures

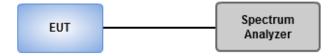
Reference Level Measurement

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

Unwanted Emissions Level Measurement

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

3.3.3 Test Setup

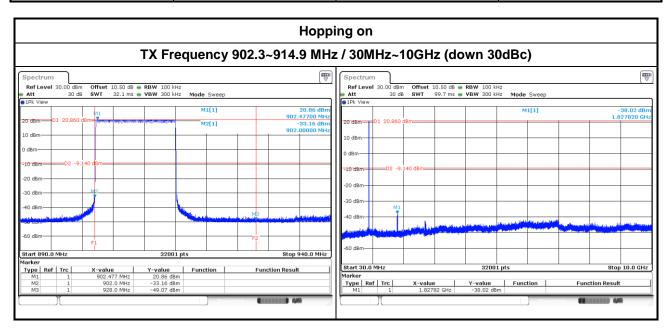


Report No.: FR0D2803-1AH Page: 46 of 61



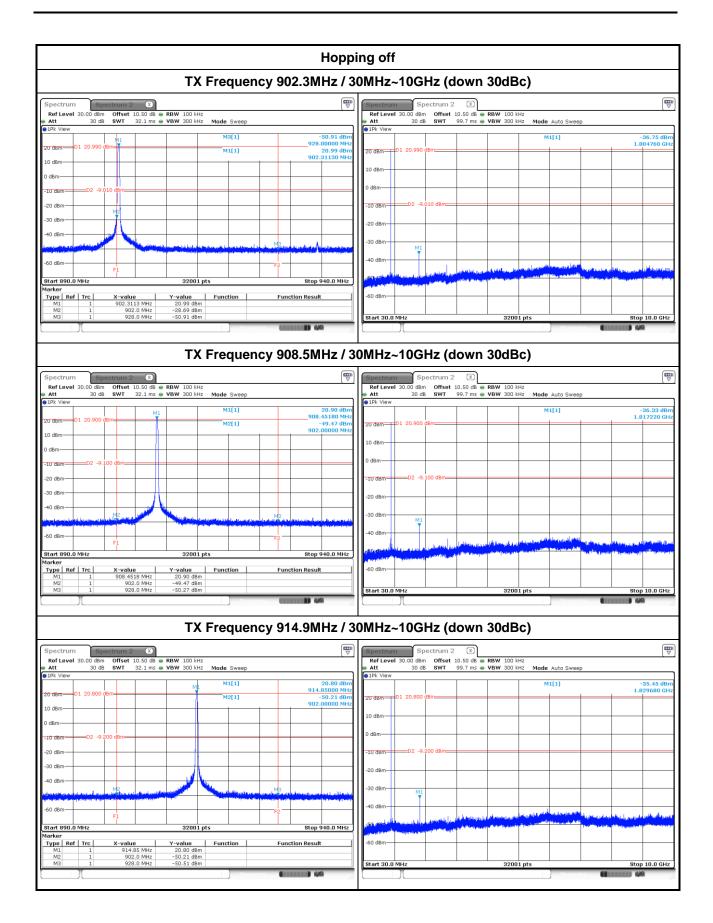
3.3.4 Unwanted Emissions into Non-Restricted Frequency Bands

Ambient Condition21°C / 65%Tested ByAska Huang



Report No.: FR0D2803-1AH Page: 47 of 61





Report No.: FR0D2803-1AH Page: 48 of 61



3.4 Conducted Output Power

3.4.1 Limit of Conducted Output Power

□ 1 Watt, systems employing at least 50 hopping channels;

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

3.4.2 Test Procedures

- A wideband power meter is used for power measurement. Bandwidth of power senor and meter is 50MHz
- If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power

3.4.3 Test Setup



3.4.4 Test Result of Conducted Output Power

Ambient Condition 21°C / 65% Tested By Aska Huang

Modulation / SF	Freq. (MHz)	Output Power (mW)	Output Power (dBm)	Limit (W)
Lora / 10	902.3	127.64	21.06	1
Lora / 10	908.5	125.31	20.98	1
Lora / 10	914.9	122.74	20.89	1

Report No.: FR0D2803-1AH Page: 49 of 61



3.5 Number of Hopping Frequency

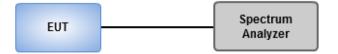
3.5.1 Limit of Number of Hopping Frequency

	Number of Hopping Frequencies Limit for Frequency Hopping Systems				
\boxtimes	902-928 MHz Band:				
	N ≥ 50, 20 dB bandwidth of the hopping channel is less than 250 kHz				
	N ≥ 25, 20 dB bandwidth of the hopping channel is 250 kHz or greater				
N : N	lumber of Hopping Frequencies				

3.5.2 Test Procedures

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

3.5.3 Test Setup

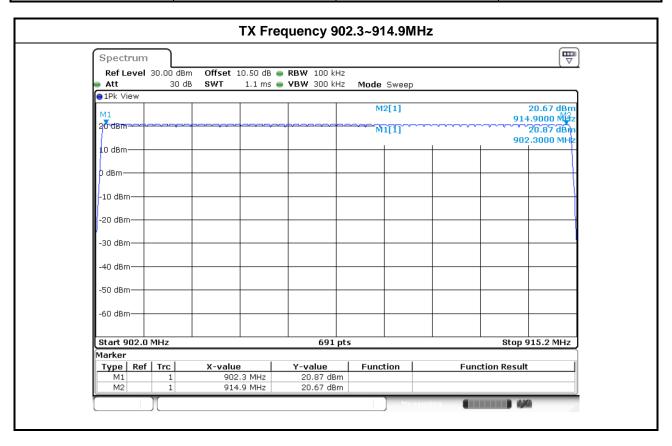


Report No.: FR0D2803-1AH Page: 50 of 61



3.5.4 Test Result of Number of Hopping Frequency

Ambient Condition	21°C / 65%	Tested By	Aska Huang
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Report No.: FR0D2803-1AH Page: 51 of 61



3.6 20dB and Occupied Bandwidth

3.6.1 Test Procedures

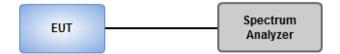
20dB Bandwidth

- 1. Set RBW=3kHz, VBW=10kHz, Sweep time=Auto, Detector=Peak Trace max hold.
- 2 Allow trace to stabilize.
- 3 Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

Occupied Bandwidth

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

3.6.2 Test Setup



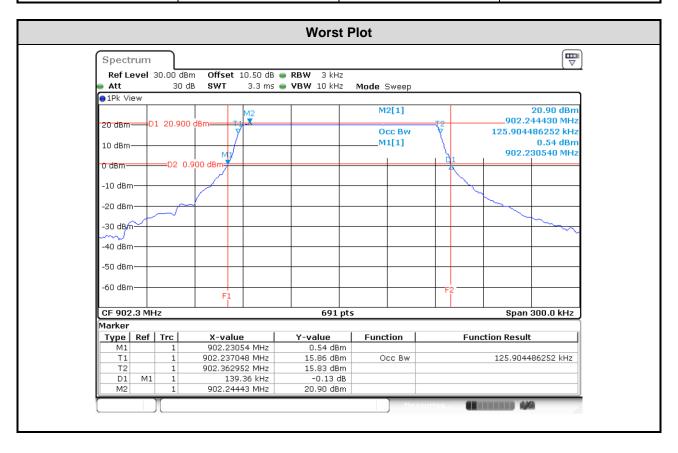
Report No.: FR0D2803-1AH Page: 52 of 61



3.6.3 Test result of 20dB and Occupied Bandwidth

Ambient Condition	21°C / 65%	Tested By	Aska Huang
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Modulation / SF	Freq. (MHz)	20dB Bandwidth (kHz)	Occupied Bandwidth (kHz)
Lora / 10	902.3	139.36	125.90
Lora / 10	908.5	138.49	125.90
Lora / 10	914.9	139.36	125.90



Report No.: FR0D2803-1AH Page: 53 of 61



3.7 Channel Separation

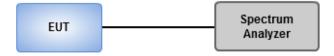
3.7.1 Limit of Channel Separation

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

3.7.2 Test Procedures

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

3.7.3 Test Setup



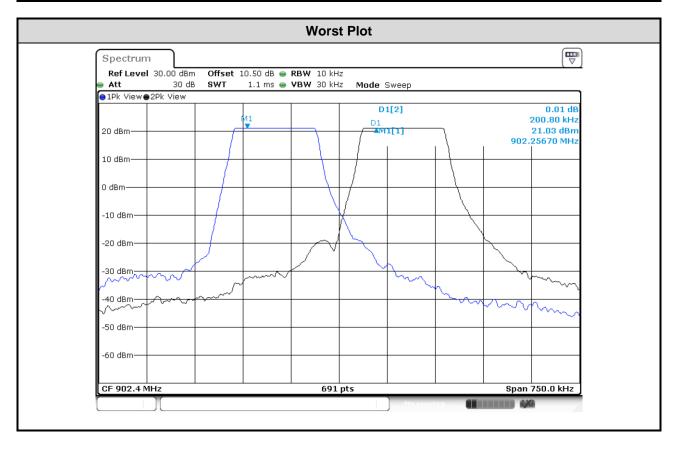
Report No.: FR0D2803-1AH Page: 54 of 61



3.7.4 Test result of Channel Separation

Ambient Condition	21°C / 65%	Tested By	Aska Huang
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Modulation / SF	Freq. (MHz)	Adjacent Channel Separation (kHz)	20dB Bandwidth (kHz)	Pass/Fail
Lora / 10	902.3	200.80	139.36	Pass
Lora / 10	908.5	200.80	138.49	Pass
Lora / 10	914.9	200.80	139.36	Pass



Report No.: FR0D2803-1AH Page: 55 of 61



3.8 Number of Dwell Time

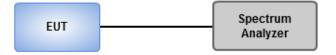
3.8.1 Limit of Dwell time

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

3.8.2 Test Procedures

- Set RBW=200kHz, VBW=1000kHz, Sweep time=25.6s / 500ms, Detector=Peak, Span=0Hz, Trace max hold.
- 2. Measure and record the burst on time.

3.8.3 Test Setup



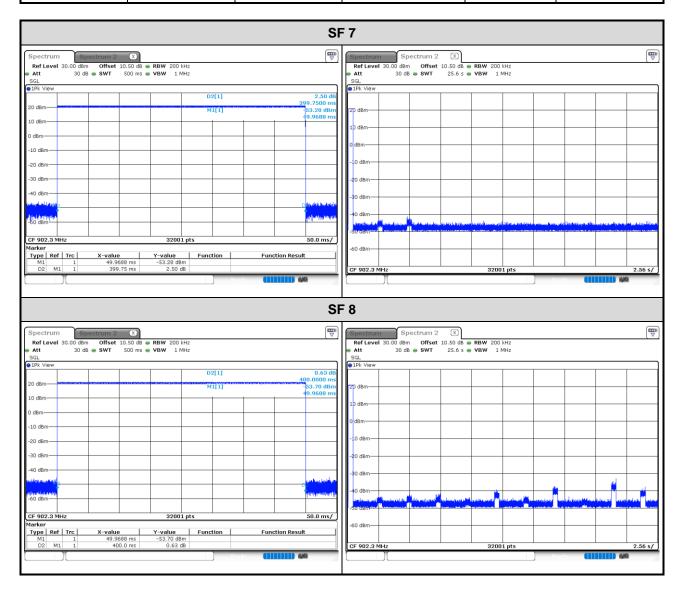
Report No.: FR0D2803-1AH Page: 56 of 61



3.8.4 Test Result of Dwell Time

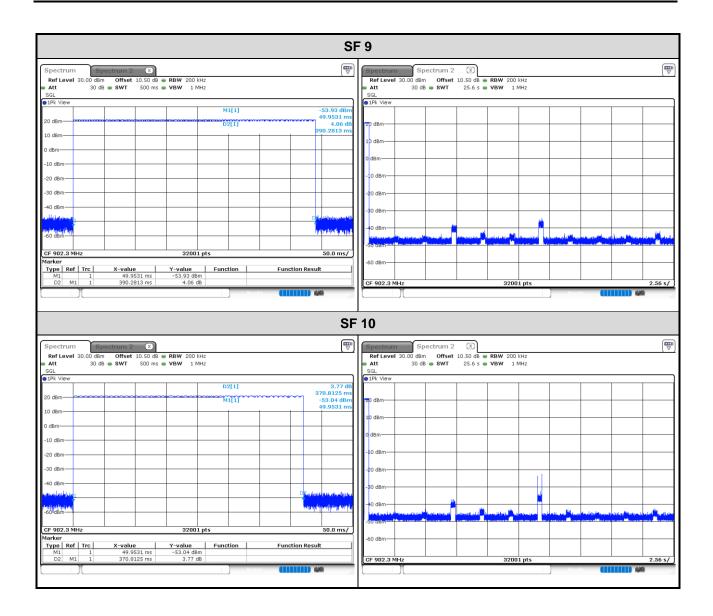
Ambient Condition	21°C / 65%	Tested By	Aska Huang
		,	3

Modulation / SF	Freq. (MHz)	Length of Transmission Time (sec)	Number of Transmission in a 25.6 s (64 Hopping*0.4s)	Result (s)	Limit (s)
Lora / 7	902.3	0.399750	1	0.399750	0.4
Lora / 8	902.3	0.400000	1	0.400000	0.4
Lora / 9	902.3	0.390281	1	0.390281	0.4
Lora / 10	902.3	0.370813	1	0.370813	0.4



Report No.: FR0D2803-1AH Page: 57 of 61





Report No.: FR0D2803-1AH Page: 58 of 61



3.9 Power Spectral Density

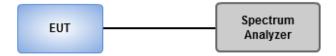
3.9.1 Limit of Power Spectral Density

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

3.9.2 Test Procedures

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

3.9.3 Test Setup



Report No.: FR0D2803-1AH Page: 59 of 61



3.9.4 Test Result of Power Spectral Density

Ambient Condition	21°C / 65%	Tested By	Aska Huang
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Modulation / SF	Freq. (MHz)	Total Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
Lora / 10	902.3	6.62	8.00
Lora / 10	908.5	6.62	8.00
Lora / 10	914.9	6.41	8.00



Report No.: FR0D2803-1AH Page: 60 of 61



4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website http://www.icertifi.com.tw.

Linkou

Tel: 886-2-2601-1640 No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City,

Taiwan, R.O.C.

Kwei Shan

Tel: 886-3-271-8666 No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

Kwei Shan Site II

Tel: 886-3-271-8640

No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information.

Tel: 886-3-271-8666 Fax: 886-3-318-0155

Email: ICC_Service@icertifi.com.tw

==END==

Report No.: FR0D2803-1AH Page: 61 of 61